The Development and Evaluation of *ExerciseGuide* – A Web-Based Exercise and Behaviour Change Intervention to Support Individuals with Metastatic Prostate Cancer

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Thesis Abstract

Prostate cancer is the second most commonly diagnosed cancer in Australian men. One-third of these individuals will progress to the locally advanced or metastatic stage. Emerging evidence suggests that exercise can play a supportive care role in the management of metastatic prostate cancer, and recently, the safety of individualised face-to-face exercise has been demonstrated. Despite this, many individuals do not engage in sufficient exercise to gain the benefits. Many barriers limit the uptake of face-to-face exercise in this population, including lack of suitable facilities, access to experts, significant fatigue, and motivation. Technological advances and adoption make it possible to deliver web-based individualised exercise prescription economically and automatically using algorithms. However, acceptability and safety has not been ascertained in this population. The overarching aim of this thesis by publication is to systematically develop and pilot a web-based computer-tailored exercise and behavioural change tool (*ExerciseGuide*) designed for individuals with metastatic prostate cancer.

Consideration of users' needs and preferences is essential for enhancing web-based intervention effectiveness and adherence. Semi-structured interviews with individuals with metastatic prostate cancer (Chapter 3) explored individuals' lifestyle, understanding of their disease, exercise levels, exercise advice received from health care providers, and acceptability of and suggested content for the web-based exercise tool. Results indicated that individuals had a limited understanding of the benefits of prostate cancer-specific exercise but viewed a potential web-based computer-tailored intervention as an acceptable vehicle for exercise prescription and education due to accessibility and convenience.

Web-based intervention development should involve a patient-centred process of intervention evaluation and modification to ensure acceptability and usability in the target population. A mixed-methods approach (Chapter 4) was used to examine and iteratively refine *ExerciseGuide*, the web-based computer-tailored exercise intervention for men with metastatic prostate cancer. After the first iteration, testing found the program acceptable, usable and resistance training algorithms were shown to provide individualised content safely.

An eight-week pilot two-armed randomised controlled trial was used to evaluate a web-based computer-tailored exercise and behavioural change tool (*ExerciseGuide*) in individuals with metastatic prostate cancer. Publication of the protocol aimed to ensure transparency around pre-specified criteria for success (chapter 5). Study findings (chapter 6) indicated that the *ExerciseGuide* intervention is acceptable, improves meaningful participation in moderate to vigorous physical exercise (MVPA) and is safe (no grade three or more adverse events). However, website usability was just below the cut-point for success. The recruitment goal was not met, but behavioural change and physical functioning data were collected in greater than 75% of suitable participants indicating the feasibility of conducting a larger-scale evaluation if recruitment concerns can be addressed.

Collectively, the results of this thesis add important knowledge to the literature about enhancing the engagement and efficacy of web-based exercise interventions for people with metastatic prostate cancer. In particular, the findings suggest that web-based individualised exercise prescription and behaviour change support facilitated by technology provides a safe, acceptable, and potentially efficacious scalable alternative to face-to-face exercise programs. Future research is needed to examine efficacy further, and if warranted, optimise implementation in clinical practice.

Originality and Publication Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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Holly Elizabeth Louise Evans		12 November 2021
Name	*Signature*	*Date*

Contribution to Discipline

Publications

Thesis publications

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Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Girard D, Brook N, Short CE. Usability, acceptability, and safety analysis of a computer-tailored web-based exercise intervention (*ExerciseGuide*) for individuals with metastatic prostate cancer: multi-methods laboratory-based study. JMIR Cancer. 2021;7(3):e28370. DOI: 10.2196/28370.

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D, Short CE. Evaluating a web-and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial. Pilot and feasibility studies. 2021;7(1):1-6. DOI:10.1186/s40814-020-00763-2.

Evans HE, Galvão DA, Forbes CC, Girard D, Vandelanotte C, Newton RU, Vincent AD, Wittert G, Kichenadasse G, Chambers S, Brook N. Acceptability and preliminary efficacy of a web-and telephone-based personalised exercise intervention for individuals with metastatic prostate cancer: the *ExerciseGuide* pilot randomised controlled trial. Cancers. 2021;13(23):5925. DOI: 10.3390/cancers13235925.

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McIntosh M, Opozda MJ, Evans H, Finlay A, Galvão DA, Chambers SK, Short CE. A systematic review of the unmet supportive care needs of men on active surveillance for prostate cancer. Psycho-Oncology. 2019;28(12):2307-22. DOI: 10.1002/pon.5262.

Finlay A, Evans H, Vincent A, Wittert G, Vandelanotte C, Short CE. Optimising web-based computer-tailored physical activity interventions for prostate cancer survivors: a randomised controlled trial examining the impact of website architecture on user engagement. International journal of environmental research and public health. 2020 Jan;17(21):7920. DOI: 10.3390/ijerph17217920

Conference Proceedings

Published conference abstracts

Asia Pacific Prostate Cancer Conference, Brisbane, Australia.

Evans H, Forbes CC, Galvão D, Newton R, Jones L, Vandelanotte C, Chambers S, Wittert G, Brook N, Kichenadasse G, Jayasinghe H, Short CE. Development of 'Exercise Guide': A tailored eHealth guidance and exercise prescription tool for men with metastatic prostate cancer. BJU International. 2018;122:16-17.

Evans H, Forbes CC, Galvão D, Newton R, Jones L, Vandelanotte C, Chambers S, Wittert G, Brook N, Kichenadasse G, Jayasinghe H, Short CE. A tailored eHealth guidance and exercise prescription tool for men with metastatic prostate cancer: a protocol for feasibility, safety and usability testing. BJU International. 2018;122:19-19.

Accepted conference abstracts (posters)

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Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D. A tailored eHealth guidance and exercise prescription tool for men with metastatic prostate cancer: a protocol for feasibility, safety and usability testing. 2019.

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D. Needs and preferences for web-based exercise prescription and education tool for men living with metastatic prostate cancer: A qualitative study. 2019.

Exercise and Sports Science Australia Research to Practice, Online, Australia

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D. *ExerciseGuide* study protocol: A pilot randomised controlled trial of an e-Health exercise and lifestyle intervention for men living with metastatic prostate cancer. 2021.

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D. Assessing the safety of unsupervised, digitally-prescribed resistance exercise in men with metastatic prostate cancer: A lab-based movement assessment study. 2021.

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Lastly, to the participants. This thesis is dedicated to you. You have consistently humbled me with your strength and resolve in the face of an enormous personal challenge. Thank you.

List of Terminology: Abbreviations and Units

1RM	One Repetition Maximum
ACSM	American College of Sports Medicine
ADT	Androgen Deprivation Therapy
COREQ	Consolidated criteria for reporting qualitative research
CSQ-8	Client satisfaction questionnaire
CTCAE	Common Terminology Criteria for Adverse Events
EORTC QLC-30	European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire-30 items
EP	Exercise physiologist
ESSA	Exercise and Sports Science Australia
FACIT-F	Functional Assessment of Chronic Illness Therapy-fatigue subscale
FACT-P	Functional Assessment of Cancer Therapy – Prostate questionnaire
GLTEQ	Godin Leisure-Time Exercise Questionnaire.
GAP4 INTERVAL	INTense ExeRcise for surviVAL Among Men With Metastatic Prostate Cancer
HADS	Hospital Anxiety and Depression Scale
HR	Hazard Ratio
IQR	Interquartile Range
IT	Information Technology
MCS-12	Mental Component Score.
MET	Metabolic Equivalent
MVPA	Moderate to Vigorous Physical Activity
N	Number
NWB	Non-weight bearing
PCFA	Prostate Cancer Foundation of Australia
PCS-12	Physical Component Score.
PSA	Prostatic-Specific Antigen.
PSQI	Pittsburgh Sleep Quality Index

RCT	Randomised Controlled Trial
RPE	Rate of Perceived Exertion
SCT	Social Cognitive Theory
SD	Standard Deviation
SDT	Self-Determination Theory
SF-12	12-Item Short Form Survey
SMS	Short message service
SPIRIT	Standard Protocol Items: Recommendations for Interventional Trials
SUS	System Usability Scale
TUG	Timed up and go
TPB	Theory of Planned Behaviour
WB	Weight bearing

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Chapter One

Introduction

1.1 Background

Prostate cancer is the most commonly diagnosed cancer in Australian males (excluding non-melanoma skin cancer) (1). It has been estimated that in 2021, 18,110 new cases will be diagnosed in Australia, with approximately 4% found to be metastatic (1). Despite enhancements in treatment efficacy, up to 20% of individuals originally diagnosed with localised disease may go on to develop metastatic prostate cancer within ten years (2). Once prostate cancer becomes metastatic, the estimated 5-year survival rate in individuals drops to 30-46% (1,2). For many individuals with metastatic prostate cancer, treatment goals shift from curative intent toward reductions in disease progression and preservation of quality of life (3).

Prostate cancer and its treatment have a significant detrimental impact on quality of life, with 42500 disability-adjusted life years lost to prostate cancer each year (4). Sarcopenia, functional impairments, sexual dysfunction, increased adiposity, increased fracture rates, osteoporosis are associated with treatment, as well as an increase in comorbidities including diabetes and cardiovascular disease (5,6). The disease itself can also lead to significant morbidity.

Skeletal-related events caused by bone metastases are experienced by approximately 40% of individuals and result in bone pain, reduced mobility, hypercalcemia, pathological fractures and spinal cord compression (7). In addition, psychological issues are also very common, including depression, anxiety and post-traumatic stress (8). Even when equated to individuals with localised prostate cancer, those with metastatic prostate cancer have higher levels of distress, reduced quality of life and lower functional well-being and have a higher risk of suicide (3). As such, it is evident that this population needs to be given increased supportive care.

Exercise-based interventions have the potential to moderate the sequelae resulting from metastatic prostate cancer (9,10). While patients with bone metastases were deemed unsuitable for exercise programs because of the possible risk of increased skeletal-related complications, preliminary evidence now demonstrates the safety and tolerance of exercise for these men (9,11–13). Multi-modal interventions completed by Cormie et al. and Galvão et al. have led to improvements in physical activity levels, physical functioning and lower body muscle strength (9,12). Cormie et al. also showed small improvements in submaximal aerobic capacity and lean mass in their pilot study (12). In combination, exercise may provide a protective effect to alleviate or reduce the progression of distress, depression, and anxiety (14). Based on this evidence, as well as evidence from numerous randomised controlled trials demonstrating significant benefits of exercise for cancer patients with other diagnoses (including those with localised prostate cancer) (15,16), exercise is a recommended intervention to support patients with metastatic prostate cancer (10,15,16).

The crucial challenge for exercise interventions within this population is implementation. It is evident that exercise interventions need to be evidence-based, safe and tailored to the individual. However, they also need to be easily accessible and affordable for all (6,15). While survey research suggests that metastatic prostate cancer patients are interested in exercise, the majority report low levels of exercise with only 29% of responders meeting national guidelines (14,17). Qualitative research has shown that not only are patients unsure of what exercise they can safely complete, but many are not educated in the disease-specific health and quality of life benefits (14). Furthermore, many reported a myriad of barriers to physical activity, which are related to supervised exercise (14). Embarrassment around urinary incontinence and hot flushes, lack of suitable facilities (rural living), limited finances, high level of hospital/doctors commitments are all linked to reduced physical activity (14,18). Whilst targeted supervised exercise is the gold standard, it is clear that other approaches to exercise prescription and support may be necessary to increase participation.

Using tailored and interactive web-based interventions may be a promising method to increase the acceptability and feasibility of exercise interventions (19–21). As the prescription, education, and behavioural modification strategies can be completed independently of a supervised location, it may circumvent many barriers to exercise in this population (22). Also, compared with other distance-based approaches (e.g., print materials, DVDs, telephone calls), modern interactive websites can provide not only high-quality information but highly personalised information paired with opportunities to interact with others (including other men and health professionals) and tools designed to support self-management and decision making (23). Given these benefits, it is not surprising that cancer survivors are interested in receiving lifestyle advice via the Internet (19,22).

However, there is no evidence-based web-based exercise interventions specifically designed and tailored to the needs of individuals with metastatic prostate cancer. Currently, only a handful of research trials have utilised web-based physical activity interventions to help men with prostate cancer (all stages), and no studies have specifically prescribed both aerobic and resistance training within the interventions (24–27). Furthermore, Short et al. reviewed publicly available web-based physical activity advice and found that most sites were of poor quality, lacked specificity, and did not offer comprehensive behaviour change support (28). This needs to be addressed, especially given recent evidence that cancer survivors want to receive lifestyle advice via this modality, and importantly are already seeking exercise advice online, despite a lack of evidence-based and appropriately tailored services (29,30).

1.2 Thesis aims and hypotheses

Overall, this thesis aims to develop and evaluate an evidence-based computer-tailored website designed to support individuals with metastatic prostate cancer to participate in a distance-based exercise program. The first three thesis aims relate to the evidence-based development of the intervention. The final two aims relate to the preliminary evaluation of the intervention and determination of whether progression to a larger scale evaluation is warranted.

Evidence-based development aims of this thesis were, therefore, to:

1. Use a qualitative investigation to explore the priorities, needs and preferences of individuals with metastatic prostate cancer in designing a tailored web-based exercise intervention.
2. Examine and refine the acceptability and usability of a tailored web-based exercise intervention (*ExerciseGuide*) for individuals with metastatic prostate cancer in a safe lab-based setting.
3. Investigate the safety of video-guided resistance exercises used within the *ExerciseGuide* intervention in a safe lab-based setting.

Preliminary evaluation aims of this thesis were, therefore, to:

1. Assess the acceptability, safety and preliminary efficacy of a computer-tailored web-based exercise intervention (*ExerciseGuide*) in individuals with metastatic prostate cancer compared to a waitlist control group.
2. Determine the feasibility of conducting a definitive *ExerciseGuide* trial.

We hypothesise that individuals randomised into the ExerciseGuide intervention group will find the tool acceptable and safe as defined by a pre-specified criteria for success. We expect that the *ExerciseGuide* intervention group will experience significantly greater improvements in all physical activity outcomes (including aerobic, resistance and sedentary behaviours) at the postintervention follow-up than individuals randomised into the waitlist control groups. Overall, we hypothesise that the *ExerciseGuide* trial will prove feasible and that a definitive *ExerciseGuide* trial will be warranted.

1.3 References

1. Australian Institute of Health and Welfare. Australian Cancer Incidence and Mortality. In: AIHW, editor. Canberra; 2021. Available from: https://www.aihw.gov.au/reports/cancer/cancer-data-in-australia.
2. Luo Q, Yu XQ, Smith DP, O'Connell DL. A population-based study of progression to metastatic prostate cancer in Australia. Cancer Epidemiol. 2015;39:617–22. DOI: 10.1016/j.canep.2015.04.013.
3. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8:e019917. DOI: 10.1136/bmjopen-2017-019917.
4. Earnest A, Evans SM, Sampurno F, Millar J. Forecasting annual incidence and mortality rate for prostate cancer in Australia until 2022 using autoregressive integrated moving average (ARIMA) models. BMJ Open. 2019;9(8):e031331. DOI: 10.1136/bmjopen-2019-031331.
5. Sheill G, Guinan EM, Peat N, Hussey J. Considerations for exercise prescription in patients with bone metastases: a comprehensive narrative review. PM&R. 2018;10(8):843–864 . DOI: 10.1016/j.pmrj.2018.02.006.
6. Bennett C, Davis ID, Hamid AA. Nursing implications of recent changes in management practices for metastatic prostate cancer. Seminars in Oncology 2020;36(4):151047. DOI: 10.1016/j.soncn.2020.151047.
7. Coleman RE. Clinical features of metastatic bone disease and risk of skeletal morbidity. Clin Cancer Res. 2006;12(20) :6243s-6249s. DOI: 10.1158/1078-0432.CCR-06-0931.
8. Mundle R, Afenya E, Agarwal N. The effectiveness of psychological intervention for depression, anxiety, and distress in prostate cancer: a systematic review of literature. Prostate Cancer Prostatic Dis. 2021;24(3):674–87. DOI: 10.1038/s41391-021-00342-3.
9. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393–399. DOI: 10.1249/MSS.0000000000001454.

10. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11(3):247–57. DOI: 10.1097/SPC.0000000000000276.
11. Galvão D, Taaffe D, Cormie P, Spry N, Chambers S, Peddle-McIntyre C, et al. Efficacy and safety of a modular multi-modal exercise program in prostate cancer patients with bone metastases: a randomized controlled trial. BMC Cancer. 2011; 11(1):1-7. DOI: 10.1186/1471-2407-11-517.
12. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16(4):328–35. DOI: 10.1038/pcan.2013.22.
13. Rief H, Bruckner T, Schlampp I, Bostel T, Welzel T, Debus J, et al. Resistance training concomitant to radiotherapy of spinal bone metastases - survival and prognostic factors of a randomized trial. Radiat Oncol. 2016;11(97):1–7. DOI: 10.1186/s13014-016-0675-x.
14. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: a qualitative exploration. Support Care Cancer. 2018; 26(6):1747-1754. DOI: 10.1007/s00520-017-4008-x.
15. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: exercise medicine in cancer management. J Sci Med Sport. 2019; 22(11):1175-1199. DOI: 10.1016/j.jsams.2019.05.003.
16. Campbell KL, Winters-stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, et al. Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable. Med Sci Sport Exerc. 2019;51(11):2375–90. DOI: 10.1249/MSS.0000000000002116.
17. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care. 2017;26(6). DOI: 10.1111/ecc.12575.
18. Forbes CC, Finlay A, McIntosh M, Siddiquee S, Short CE. A systematic review of the feasibility, acceptability, and efficacy of online supportive care interventions

targeting men with a history of prostate cancer. J Cancer Surviv. 2019;13:75–96. DOI: 10.1007/s11764-018-0729-1.

19. Roberts AL, Fisher A, Smith L, Heinrich M, Potts HWW. Digital health behaviour change interventions targeting physical activity and diet in cancer survivors: a systematic review and meta-analysis. J Cancer Surviv. 2017;11:704–19. DOI: 10.1007/s11764-017-0632-1.
20. Muntaner A, Vidal-Conti J, Palou P. Increasing physical activity through mobile device interventions: a systematic review. Health Informatics J. 2016;22(3):451–69. DOI: 10.1177/1460458214567004.
21. Haberlin C, O'Dwyer T, Mockler D, Moran J, O'Donnell DM, Broderick J. The use of eHealth to promote physical activity in cancer survivors: a systematic review. Support Care Cancer. 2018;26:3323–36. DOI: 10.1007/s00520-018-4305-z.
22. Finlay A, Wittert G, Short CE. A systematic review of physical activity-based behaviour change interventions reaching men with prostate cancer. Journal of Cancer Survivorship. 2018;12(4):571-591. DOI: 10.1007/s11764-018-0694-8.
23. Vandelanotte C, Müller AM, Short CE, Hingle M, Nathan N, Williams SL, et al. Past, present, and future of eHealth and mHealth research to improve physical activity and dietary behaviors. J Nutr Educ Behav. 2016;48:219-228. DOI: 10.1016/j.jneb.2015.12.006.
24. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: Testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49. DOI: 10.1186/s12966-018-0686-0.
25. Chan JM, van Blarigan EL, Langlais CS, Zhao S, Ramsdill JW, Daniel K, et al. Feasibility and acceptability of a remotely delivered, web-based behavioral intervention for men with prostate cancer: four-arm randomized controlled pilot trial. J Med Internet Res. 2020;22(12):e19238. DOI: 10.2196/19238.
26. Kenfield SA, Van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (Prostate 8): a pilot randomized controlled trial in

men with prostate cancer. Eur Urol. 2019;75(6):950–8. DOI: 10.1016/j.eururo.2018.12.040.

27. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Short-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: a randomized controlled trial. Int J Behav Nutr Phys Act. 2018;15(1):106. DOI: 10.1186/s12966-018-0734-9.

28. Short CE, Gelder C, Binnewerg L, McIntosh M, Turnbull D. Examining the accessibility of high-quality physical activity behaviour change support freely available online for men with prostate cancer. J Cancer Surviv. 2018;12(1):10–7. DOI: 10.1007/s11764-017-0638-8.

29. Martin EC, Basen-Engquist K, Cox MG, Lyons EJ, Carmack CL, Blalock JA, et al. Interest in health behavior intervention delivery modalities among cancer survivors: A cross-sectional study. JMIR Cancer. 2016;2(1):e1. DOI: 10.2196/cancer.5247.

Chapter Two

Literature review

2.1 Prostate cancer

Prostate cancer is a hormone-sensitive disease, in which malignant tumour cells of prostatic cell origin mutate, divide and grow in an uncontrolled and disordered fashion (1). It is highly prevalent globally, with the highest rates recorded in the United States of America, France, and Australia (2). In Australia, it is the most commonly diagnosed cancer in males, with the 2020 age-standardised incidence rate for prostate cancer estimated to be 110 cases per 100,000 males (3). This equates to an estimated 18,110 new cases diagnosed in 2021 (3). Of these individuals, the majority (67%) will be diagnosed over the age of 65, and relatively few (3%) will be diagnosed under the age of 49 (4). Despite the fact that individuals diagnosed with localised or locally advanced prostate cancer have a 95% chance of surviving for five years compared to their age-matched peers, prostate cancer is the fifth leading cause of cancer-related mortality globally and presents a substantial public health burden (3,4). A substantial amount of this burden is associated with metastatic prostate cancer.

2.1.1 Prostate cancer staging

Prostate cancer can either remain localised to the prostate (stage I and II), locally advanced (stage III) or metastasise and spread to distant locations to form secondary tumours (stage IV) (1). Typically, a prostate-specific antigen (PSA) blood test, transrectal ultrasound, and biopsies and magnetic resonance imagining are used to diagnose prostate cancer in Australia (5). Results provide staging information such as Gleason score, tumour size (T), as well as information on spread to lymph nodes (N) or other distant areas. The medical team can then make individualised treatment recommendations (1,6).

2.1.2 Metastatic prostate cancer

Metastatic prostate cancer, often called advanced or stage IV cancer, occurs when cancer proliferates from the original tumour site to other regions or organs of the body (Figure 1). Currently, only four percent of individuals diagnosed with prostate cancer in Australia are classed as metastatic (4). However, one in five individuals will progress from localised or locally advanced to metastatic prostate cancer within 6.8 years of initial diagnosis (7). Prostate cancer has a relatively extensive natural history when detected early; however, as the disease becomes advanced, the 5-year survival rate rapidly decreases to 36.4% (4). This progression is characterised by significant reductions in the individual’s physical, psychological, and social wellbeing (8–11). Due to the multi-faceted interactions between unclear causation, screening, vast treatment choices, and significant side effects; prostate cancer and its progression presents substantial challenges for the men, their families, and the healthcare team (9,11).

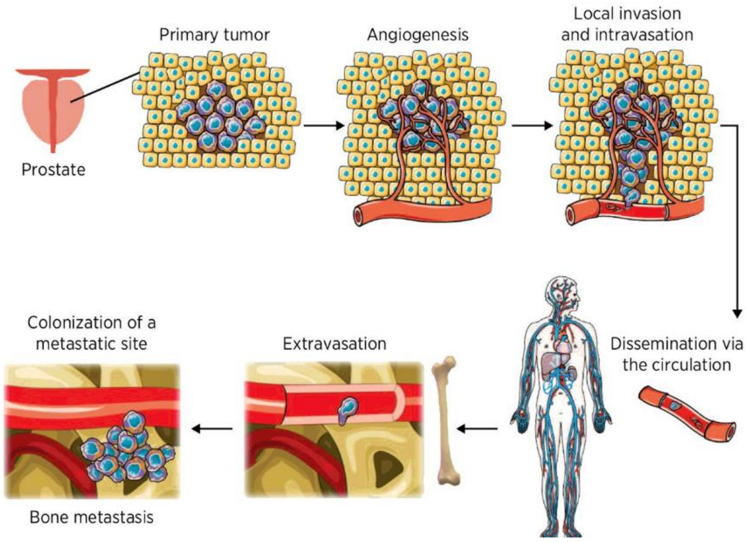

Figure 1. Steps of the metastatic process in prostate cancer.
Reproduced from De Groot et al with permission of the American Association for Cancer Research (12)

2.1.3 Metastatic sites in prostate cancer

The most frequent site of prostate cancer metastases are bone tissue (90%), but metastases are also typically found in the lungs (46%), liver (25%), pleura (21%), and adrenals (13%) (13). Metastases can also present in multiple sites, with 18.4% of patients presenting with two or more implicated sites (13). While individuals with non-metastatic prostate cancer report minimal non-treatment related symptoms, there is a significant disease-specific burden among those with advanced disease, especially as new therapies begin to lead to longer life expectancies (14). These symptoms include pain from skeletal-related events, hypercalcaemia, muscle deconditioning and fatigue (due to anaemia, uraemia and non-specific effects) (15). All of which can reduce quality and quantity of life in this population.

Skeletal-related events are a significant concern associated with bone metastases. Approximately 40% of men in this population experience one or more events through the disease course, resulting in loss of independence and health-related quality of life (16). Metastases permanently alter bone tissue and change cell metabolism, reducing the load-bearing capacity (17). This can result in local microfractures and fractures, which causes either chronic or breakthrough pain (17,18). Another clinical feature includes compression of the spinal cord, which usually requires immediate treatment for motor weakness (96%), pain (94%), sensory disturbance (79%), and sphincter disturbance (61%), as well as the risk of paralysis (19). Despite advances in treatment, individuals who have a skeletal-related event such as spinal compression have an increased risk of mortality compared to men who have not had an event (18).

2.2 Treatments and corresponding side effects for prostate cancer

There are various treatment options available to individuals diagnosed with prostate cancer. Treatment choices depend on stage, the extent of disease, age, and other comorbidities (Figure 2). Once cancer has advanced, treatment options shift from curative to ameliorating symptoms and extending survival time (20,21).

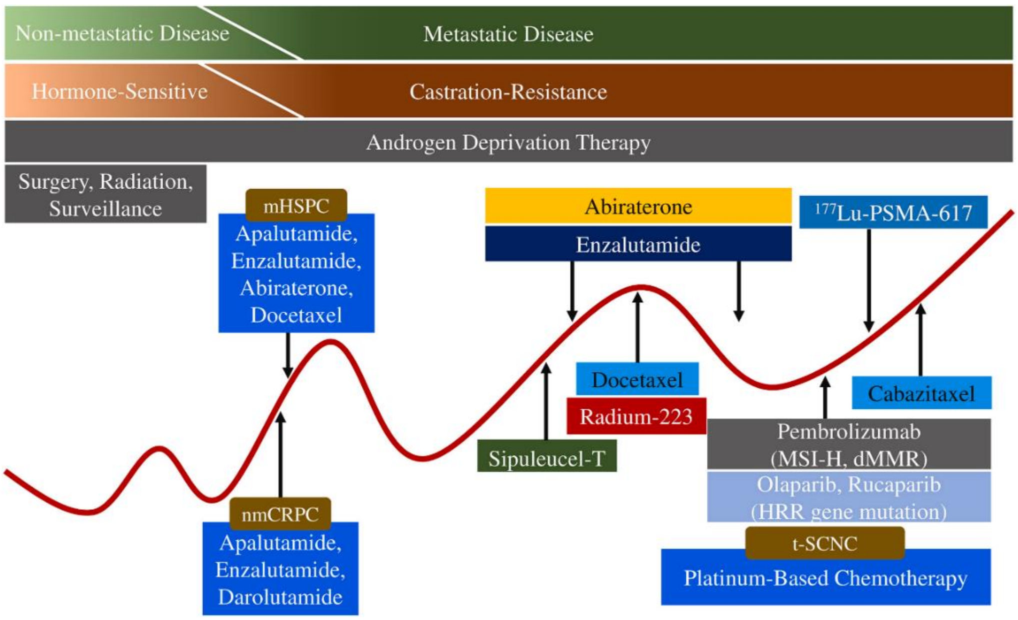

Figure 2. The current landscape of therapies in prostate cancer.
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2.2.1 Localised prostate cancer treatments

For individuals with intermediate or high risk localised prostate cancer, surgery and radiotherapy are the most well-established treatment options recommended (22). The surgical removal of the prostate is known as a radical prostatectomy (23). The aim of the procedure is the removal of the tumour with free surgical margins while maintaining neurological function where possible (24). However, urinary incontinence and erectile dysfunction are common complications which can have substantial implications on the individual' quality of life (24). Radiotherapy uses ionising radiation to target and damage the DNA in cancer cells, which slows cancer cell growth or leads to cell death (25). There are two main types of radiotherapy for prostate cancer: external beam radiation therapy or brachytherapy (internal) (24). External beam radiation therapy can be used in earlier stage cancers or to help relieve symptoms in more advanced stages (24). Furthermore, the addition of external radiation therapy to standard treatment can improve overall survival in individuals with prostate cancer with initial metastatic lesions (26). When administered externally, radiotherapy can lead to significant fatigue, erectile dysfunction, emotional sensitivity, urinary dysfunction, pain and bowel dysfunction (8,27). Whether surgery or radiotherapy is the most effective therapy for individuals with non-metastatic prostate cancer is debatable. However, the Surveillance, Epidemiology, and End Results (SEER) study (n=404,604) found a the radical prostatectomy was associated with a lower 10-year cancer-specific mortality in comparison to external beam radiation therapy [95% CI, 0.39-0.43; P<0.001] in individuals aged less than 80 years of age (28).

2.2.2 Treatments for metastatic prostate cancer

Androgen deprivation therapy (ADT) is a first-line treatment for metastatic prostate cancer but is also prescribed across much of the spectrum of disease (including high-risk localised and locally advanced prostate cancer) (29). The main goal of ADT is to reduce androgen levels to castrate levels (<50ng/dL) by suppressing the production of androgens, which are known to promote the growth of prostate cancer (25,30). The most commonly prescribed approaches to ADT include orchiectomy or gonadotropin-releasing hormone (GnRH) agonists and antagonists (30). The Medical Research Council trial found that in comparison of immediate ADT to deferred treatment for advanced prostate cancer, immediate ADT was associated with a reduction in distant metastases (P=0.04), improved disease-free survival (P=0.001), and overall survival (P=0.02) (31). Nevertheless, it has been recognised that ADT treatment has a high degree of toxicities that can affect quality of life and the overall health of individuals with prostate cancer. From a musculoskeletal perspective, androgen deprivation therapy contributes to an increased risk of osteoporosis and fractures by increasing bone turnover (29). Edmunds et al. found a mean percent lumbar spine bone loss of -3.6% [95% CI,6.72− -0.47, P=0.02] using a pooled analysis of four studies (n=483) (32). The study also reported significant changes to body composition and muscle strength with decreases in muscle mass [2.8%; 95% CI 3.6−12.0, P<0.00001], increased fat mass [7.7%; 95% CI 4.3, 11.2, P<0.00001] as well as reductions in muscular strength and endurance (32). There are also considerable metabolic complications (33). A cross-sectional study found that the prevalence of metabolic disease was higher in individuals undergoing ADT compared to individuals with prostate cancer not receiving ADT (P<0.01) or individuals without prostate cancer (P=0.03) (33). There is also a significant likelihood that individuals will experience an increased risk of hypertension, stroke, cardiovascular incidents, vasomotor flushing, sexual dysfunction, fatigue, physical function and falls (29,32).

Chemotherapy treatments such as docetaxel and cabazitaxel are prescribed to relieve symptoms and prolong life in individuals with metastatic prostate cancer (34). The taxane treatment protocol involves the intravenous administration of cytotoxic agents which are designed to cause apoptosis in tumour cells (34). A phase III study (TAX327) demonstrated that docetaxel led to increased median survival in patients with metastatic castrate resistance prostate cancer to 18.9 months (three-weekly dose) in comparison to mitoxantrone (16.5 months), and moreover, docetaxel also had a hazard ratio (HR) for death of 0.76 [95% CI, 0.62- 0.94; P=0.009] relative to mitoxantrone (35). Regardless of the small efficacy benefits achieved with docetaxel-based treatment, it has been well documented that over time prostate cancer can become resistant to taxane-based protocols (36). Cabazitaxel, which is a second-generation taxane, is then offered as an alternative chemotherapy treatment as it has been shown to elicit improved overall survival [HR; 0.70, 95% CI, 0.59–0.83; P<0.0001] when compared with mitoxantrone (TROPIC phase III study) (36). Notably, side effects from the taxane treatments can be significant and impair the patients quality of life (8). These side effects can include high levels of cancer-related fatigue, neuropathy, loss of appetite, nausea, neutropenia, and anaemia (8,36). Longer-term, individuals undergoing chemotherapy treatments also risk developing comorbidities such as metabolic syndrome, type 2 diabetes and cardiovascular disease compared to healthy age-matched peers (37,38).

There are also emerging pharmaceutical interventions like second-generation antiandrogens (including abiraterone and enzalutamide) and monoclonal antibodies (pembrolizumab and denosumab), which are typically used when individuals have a biochemical relapse or develop castrate resistance (21,34). Enzalutamide is designed to reduce tumour growth by preventing androgens from binding to androgen receptor proteins on the surface of the prostate cell (39). Whereas abiraterone impedes testosterone production and the ability of testosterone to encourage tumour growth (40). Separate phase III studies have shown that abiraterone (plus prednisone) and enzalutamide showed a longer survival duration than control groups and marked improvements in time to PSA progression, time to radiographic progression, and frequency of skeletal-related events, and quality of life (39–41). However, both enzalutamide and abiraterone acetate may increase fatigue and various aspects of cognitive impairment in some patients (42).

The role of radiation therapy in treating individuals with metastatic prostate cancer is evolving. Radium-223 is another form of radiotherapy prescribed to patients with multiple bone metastases and is used to suppress prostate cancer cells and reduce pain symptoms (21,43). Side effects from treatment can include fatigue, nausea, diarrhoea and peripheral oedema (44). Additionally, results from the STAMPEDE trial suggest that local radiotherapy in individuals with low volume metastatic disease may prevent further disease progression (21). However, additional trials are necessary to validate these findings (21).

While treatments that aim to prolong life in this population are constantly advancing, each has its own variable efficacy and side effect profile (8). Given that many individuals will undergo multiple treatment modalities over their disease course, it is important to recognise that individuals with metastatic prostate cancer experience a substantial physical and emotional quality of life burden resulting from these treatment modalities (8,21).

2.2.3 Quality of life for individuals with metastatic prostate cancer

Individuals with metastatic prostate cancer have specific physical and psychosocial concerns that affect their perceived quality of life. These issues need to be highlighted, investigated and managed to promote better outcomes for patients (9,20). One study by Sullivan et al. used the Functional Assessment of Cancer Therapy – Prostate questionnaire (FACT-P) and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ C30) to demonstrate declines in quality of life over time in individuals with hormone resistant metastatic prostate cancer (45). They specifically noted increases in pain, fatigue levels, nausea, vomiting, breathlessness and appetite loss between baseline testing and follow-up (9 months) (45). Recently, Zajdlewicz et al. reported that health-related quality of life can vary significantly over a period of five years using a prospective study of 81 men with locally advanced or advanced prostate cancer (46). For example, whilst the global quality of life and life satisfaction scores decreased over time, certain disease-specific quality of life domains (EPIC) subscales varied. Hormonal symptoms varied depending on treatment timelines, bowel symptoms improved after two months, and sexual health symptoms such as erectile dysfunction remained high throughout the entire five year period (46). Patient-related outcome monitoring is very important in this population as treatments tailored to meet prostate cancer patients' psychosocial and clinical needs could lead to better management of pain, functional capacity, and quality of life over the disease course.

In addition, individuals with metastatic prostate cancer often report considerable psychological distress, anxiety and depression (9). Zajdlewicz et al. (n=81) reported that 46.3% of participants with locally advanced or advanced prostate cancer had high levels of distress at diagnosis using a distress thermometer (0-10 scale) (46). While, these levels were found to decrease to 18.6% one-year post-diagnosis, they rose back to 38.9% after the three-year follow-up, and by five years, 33.0% remained distressed (46). In a global patient survey in metastatic prostate cancer, Drudge-Coates et al. found that 28-42% of individuals with metastatic prostate cancer reported having depression and or anxiety, 36-49% reported trouble sleeping, and 6-20% reported confusion (10). Likewise, a systematic review in individuals with advanced cancer reported that 30% of men are diagnosed with anxiety, and 25% are diagnosed with depression (47). This number could be even higher, given that individuals with prostate cancer may be less likely to report changes in mental health post-diagnosis (47). Chambers et al. completed a qualitative study investigating the experiences of Australian men with advanced prostate cancer (9).

It was found that the men tend to experience regret regarding treatment choices, fear of the future and a feeling of being discounted within the health system (9). Masculine values such as strength, independence and stoicism are also challenged due to changes in sexuality and their role within society (both within the workplace and in the family structure) (9). This distress can be very debilitating, and it has been reported in other studies (48). For example, using the Swedish Prostate Cancer Database that included 77,439 patients over ten years, suicide risk was twice as high in men with locally advanced or metastatic prostate cancer when compared with their age-matched controls (48).

Whilst supportive care is important across the entire prostate cancer continuum, it is evident that those with incurable cancer may have the greatest need for interventions that aim to improve physical functioning, reduce symptom and psychological distress and improve their overall quality of life (49). Furthermore, Chambers et al. reported that one area significantly affecting individuals with metastatic prostate cancer is the number of unmet needs and lack of supportive care options (9). Individuals reported mixed experiences when communicating with health professionals and preferred referrals to other information sources (9). They felt that they were left on their own to manage side effects (9). Regular coordinated and accessible care was important in this population, as well as peer support (9). A common theme found was that talking about their situation was devalued, especially with psychologists (9). Some men wanted to avoid embarrassment, self-pity or thinking about their condition, whilst others employed more action-orientated approaches (9). As such, it may be important to integrate psychological support with other interventions to help improve the quality of life in patients with advanced prostate cancer.

2.3 Exercise medicine in individuals with prostate cancer

Exercise has been proposed and endorsed by many professional organisations as an intervention strategy that can improve physical function, symptom control and quality of life in individuals with prostate cancer (50,51). Exercise is defined as a component of physical activity that is planned and structured with the intention to maintain or improve aspects of physical fitness (52). Intensity of the activity is one of the main elements that can determine whether the activity will provide physical fitness and health benefits.

Research has consistently shown that moderate-to-vigorous exercise will elicit the most efficient health responses (50,53). Typically, health-related physical exercise is divided into three main categories: aerobic (cardiorespiratory focus), strength (muscle mass and endurance) and flexibility (52).

Historically, clinicians have advised individuals with metastatic prostate cancer to rest and avoid exercise to circumvent the risk of loading bone lesions and increasing chances of skeletal complications (54). However, preliminary research has recently shown that individually tailored exercise is safe and can be prescribed to assist individuals with metastatic cancer to counteract treatment side effects and improve quality of life. Notably, this includes improvements in muscular strength and physical functioning (49,54–57). It should also be acknowledged that an appealing component of individualised exercise therapy is that it takes an action-orientated and person-centred approach, focusing on positive outcomes and is complementary to medical and psychological treatments (14,52,53,58).

2.3.1 Exercise as a potential therapeutic agent to delay disease progression

Recent evidence suggests that tailored exercise in this population may not only improve quality of life, but it may play a role in reducing tumour progression, thus attenuating both disease and possible skeletal-related events (54). Exercise may play a role in reducing the risk of prostate cancer-related mortality via multiple mechanisms. Modulation of immune function, reduction of systemic inflammation, improved tumour vascularisation and changes in epigenetics can all influence tumour development (54,59). In a recent review, Kim et al. highlighted the role muscle mass, termed the largest endocrine organ with the body, has on tumour cell biology using examples of several pre-clinical studies (60). When muscles are exercised, it releases cytokines (myokines) and other hormones systemically, directly reducing tumour cell growth and migration and impacting the tumour-promoting environment through adipocyte regulation (see Figure 3). In addition, pre-clinical studies suggest that the mechanical loading of bone through exercise may reduce the formation of metastatic tumours (61).

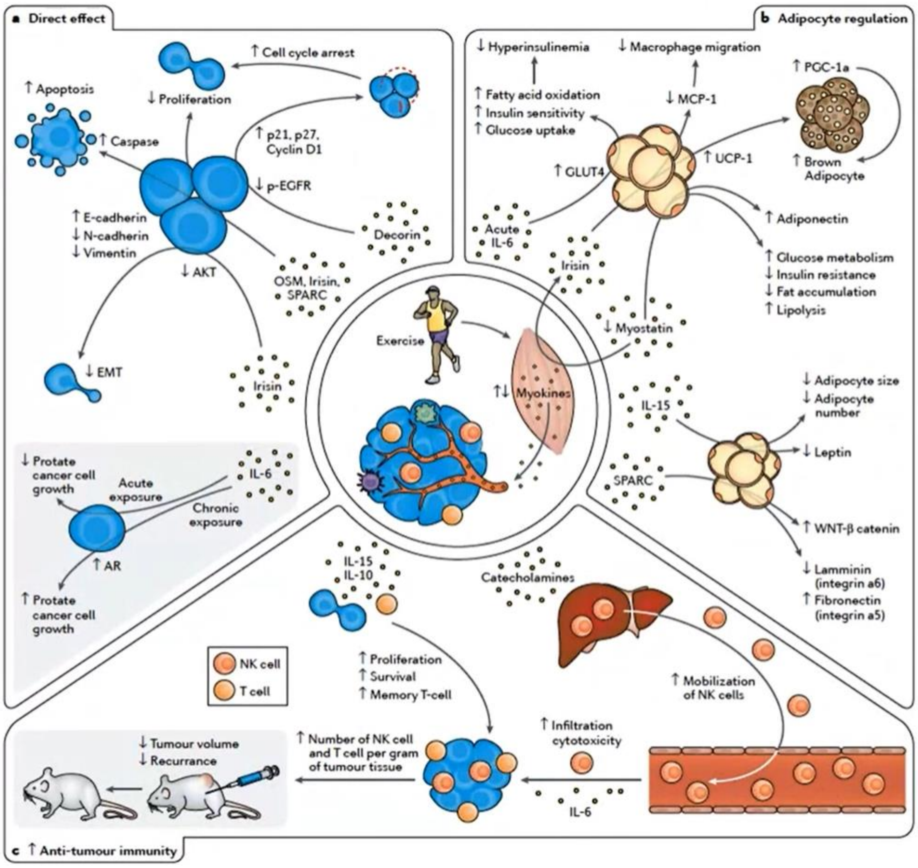

Figure 3. Potential mechanisms by which exercise impacts cancer progression. Reproduced from Kim et al. with permission of Springer Nature (60).

Currently, there is one human study with a published protocol investigating exercise as a potential therapeutic agent to delay disease progression in individuals with prostate cancer. A multi-national phase III clinical trial conducted by Newton et al. is investigating the use of high-intensity multi-modular exercise on individuals with metastatic castrate-resistant prostate cancer (n=866) on overall survival, time to disease progression, the occurrence of skeletal-related events, quality of life, and changes in metabolic biomarkers (62). It is hypothesised that targeted exercise prescription can reduce disease progression, which would indicate that exercise therapy could be an extremely important treatment in men with metastatic prostate cancer.

2.3.2 Exercise prescription for individuals with metastatic cancer

Exercise and Sports Science Australia (ESSA) (53) and the American College of Sports Medicine (ACSM) (50) have recently re-released guidelines for exercise therapy for individuals with cancer. Previous guidelines, which matched the apparently healthy population, recommended progression towards 150 minutes of moderate-intensity exercise or 75 minutes of vigorous-intensity exercise (or equivalent combinations), including 2-3 sessions of resistance training (63,64). However, both ESSA and the ACSM have avoided recommending similar targets in the recent guidelines (50,53). These targets may not be applicable for patients with metastatic cancer or those with confounding factors. Additionally, a systematic review and meta-analysis from Scott et al. have shown that exercise doses of less than 150 minutes may still produce desired physiological responses (65). However, both guidelines endorse the prescription of multi-modal exercise, the need to avoid inactivity, progression towards moderate to vigorous-intensity exercise, and the provision of individually tailored exercise prescription (50,53). Another concept that the Australian guidelines considered is the use of autoregulation. Individuals should be educated on how to subjectively assess their capabilities within each session, using tools such as the rate of perceived exertion scale (RPE) so they can adjust their prescription when necessary (43,54). Whilst this affects the reporting of exercise prescription within studies, it may be important to clarify how often participants need to modify programming. This may affect the outcome of the studies that undertake this approach and how often this concept is utilised in clinical practice.

Converging evidence suggests that to tailor an exercise program for individuals with metastatic prostate cancer, metastases location, bone fracture risk and current and prior treatment and side effects must be considered (43,53,66). Hart et al. and Sheill et al. recently completed comprehensive narrative reviews on the topics of exercise in advanced prostate cancers or bone metastases (43,54). Importantly, it was noted that exercise prescription in this population must be tailored and cannot take a one size fits all approach. Prescription should be individualised based on the extent and location of the lesion, treatment side effects, and co-morbid conditions (43,54).

2.3.3 Resistance-based exercise therapy

Over the last ten years, there has been a surge in resistance training research studies within prostate cancer populations and, more specifically, those with metastatic prostate cancer. One of the earliest studies was Cormie et al., who completed an initial two-armed pilot randomised controlled trial in 20 men with metastatic prostate cancer (57) with the exercise protocol based on a modular exercise prescription proposed earlier (67). The protocol involved twice-weekly resistance training for 12 weeks, with a progressive overload (2-4 sets of 12-8 repetition maximum) focus. To ensure safety, a novel approach was taken to ensure the prescription did not target regions affected by bone lesions, essentially minimising mechanical force (Table 1). Exercises were also prescribed with a set cadence of 1-2 seconds (eccentric and concentric actions) which was designed to reduce compressive and shear loading. Although the sample size was small, the trial resulted in improvements in lower limb muscular strength, muscle mass, ambulation, aerobic function (400m submaximal walk) and body composition. In addition, there were no adverse events or significant changes in bone pain, which indicates that this type of prescription was safe in this population (57).

Table 1. Multi-modal exercise prescription for individuals with bone metastases.

Metastasis Location	**Resistance**		**Aerobic**		**Flexibility**	
	Upper	**Trunk**	**Lower**	**WB**	**NWB**	**WB**
Proximal humerus		✓	✓	✓		✓ [c]
Cervical Spine	✓ [a]		✓	✓		✓ [b]
Thoracic spine/ribs	✓ [a]		✓	✓		✓ [d]
Lumbar spine	✓		✓		✓	✓ [d]
Pelvis	✓	✓	✓ [b]		✓	✓ [b]
Proximal femur	✓	✓			✓	✓ [e]

Target exercise region

[a] *Exclusion of shoulder flexion/extension/abduction/adduction – inclusion of elbow flexion/extension.*

[b] *Exclusion of hp extension/flexion – inclusion of knee extension/flexion.*

[c] *Exclusion of elbow flexion/extension.*

[d] *Exclusion of spinal flexion/extension/rotation.*

[e] *Exclusion of knee flexion/extension.*

WB = weight-bearing (walking); NWB= Non-weight bearing (water walking; cycling) (55)

In 2014, Cormie et al. reported on the follow-up date from the initial study (68). They demonstrated that functional benefits of the resistance training program were sustained six months post the original three-month study (68). Significant improvements in whole-body lean mass (2%) and quality of life (13%) persisted while leg strength (-3%) and aerobic capacity reduced (1%) in comparison to baseline. In addition, while physical activity levels remained higher than baseline (105 minutes per week), they declined by

55 minutes per week over the observational three-month period. This indicates that adherence to exercise must be focused on to ensure the greatest physical and psychological benefits (68).

Using a different exercise prescription approach, Rief and colleagues have presented multiple papers utilising a guided isometric spinal exercise (static contraction of muscle/s without any visible movement in the angle of the joint) program in individuals with stable spinal bone metastases (69–71). The advanced cancer cohort included individuals with metastatic prostate cancer (n=14), lung cancer (n=20), breast cancer (n=11), melanoma (n=2), renal cancer (n=3) and ten other cancers. The intervention group completed daily isometric spinal exercises for 30 minutes while undergoing concomitant radiotherapy. The control group undertook passive physiotherapy. After two weeks, the intervention group were instructed to complete the program three times per week at home, with the control group discontinuing physical therapy. Overall, the trial demonstrated safety and feasibility but did not affect overall survival (72). Results showed improvement (small to moderate effect sizes) in physical fatigue and some dimensions of the bone metastases subscale of the EORTC-QLQ, (painful sites, pain characteristics, functional interference, and psychosocial aspects) (70). Furthermore, bone turnover markers pyridinoline and beta-isomer of carboxy-terminal telopeptide of type I collagen significantly decreased after the three-month marker in the intervention arm in comparison to the control (73). Recently, attention turned to the safety and feasibility of isometric exercise in those individuals with unstable metastases (the DISPO-II training program). While the program required frequent modifications, it appeared feasible and safe (74).

Overall, while differing positive outcome measures were seen in Cormie et al. (lower limb strength, mass and physical function) and Rief et al. (physical fatigue and bone metastases related quality of life) (57,70). Both the modular and the isometric exercise approaches demonstrated safety and feasibility of resistance training in individuals with metastatic prostate cancer.

2.3.4 Aerobic-based exercise therapy

Two recent studies investigated aerobic exercise as a uni-modal intervention; however, they had different prescription methodologies. Uth et al. conducted a 32-week, randomised controlled trial of a football training program for men with prostate cancer (n=57) compared to a control group (75). The study included thirteen participants with nodal metastases and eleven with metastatic bone disease (75). The intervention group (n=29) undertook football twice per week for 45 minutes (including skills and small-sided games) for the first four weeks, progressed to 60 minutes in weeks 5-8 and increased to a frequency of three times per week in weeks 9-12 (75). Week 13 and onwards involved two sessions per week for 60 minutes (75). The control group (n=28) were instructed to maintain their baseline activity levels (75). Adherence was 76.5 ± 24.2% in weeks 1-12 and 46.2 ± 23.2% in weeks 13-32 (75). The intervention group exhibited favourable differences in total body bone mineral content (26.4; P=0.013) and leg bone mineral content (13.8; *P*=0.001) in comparison to the control group (75). The one-repetition maximum knee extensor strength in the intervention group showed a mean group difference of 6.7kg (*P*=0.001) (75). However, there were no significant differences between groups in aerobic fitness or body fat percentage (75). Notably, two participants sustained a fibula fracture, and three had muscle or tendon injuries resulting from the football training (75). As such, whilst football may be a more enjoyable form of exercise for some and useful in primary prevention settings; injuries and decreasing adherence over time indicate it may not be the best aerobic intervention for this population (76).

Conversely, in 2019, a 6-month moderate-to-vigorous structured aerobic exercise intervention was undertaken to assess the effect of aerobic exercise on platelet cloaking and circulating tumour cells in individuals with metastatic prostate cancer (n=61) (77,78). The intervention group consisted of one face-to-face clinic-based session and five home-based aerobic exercise sessions per week in an attempt to complete 180 minutes per week (77). The control group continued with standard care (77). Exercise intensity (percentage heart rate reserve) was determined by baseline fitness and ranged from 40-50% to 65-75% (77). Systolic blood pressure between groups significantly favoured the exercise group at three months (*P*=0.008) and six months (*P*=0.011) (77). However, no significant differences were observed in either group in physical activity levels or quality of life at three months or six months (77). No adverse events were reported, and adherence was recorded as 83% for the supervised exercise and 67%-72% for the unsupervised home exercise component (77). Brady et al. showed that there was no significant change in the number of circulating tumour cells (a subset of cancer cells that can travel to distant sites, forming metastatic lesions) over time between the two groups (*P*=0.2630) (78). However, over time there was a trend (*P*=0.1005) towards reduced platelet cloaking (platelet adhesion to tumour cells, which forms a protective cloak that helps cancer cells to avoid immune surveillance and cytolysis) in the exercise group in comparison to the control group (78). Overall, this trial provides further preliminary evidence of aerobic exercise tolerability in this population. However, further research is needed to understand the role of aerobic exercise in improving quality of life and modifying other disease factors such as circulating tumour cells.

2.3.5 Multi-modal exercise therapy

Given that each exercise mode exerts a different physiological response and exhibits its own beneficial effects, it is important to determine the impact of multi-modal prescriptions in individuals with metastatic prostate cancer. A 2018 study by Galvão et al. utilised a supervised modular multi-modal exercise protocol (resistance, aerobic and flexibility exercise) to investigate the efficacy and safety in this population (55). The study used a two-armed randomised controlled trial involving 57 men and is currently the largest published randomised control trial within the population. Men in the exercise arm undertook exercise three times per week based on their original 2011 study protocol, which informed subsequent resistance exercise prescription studies in the field (55,57,67). In addition, a 20–30-minute aerobic component was introduced at a target intensity of 60%–85% estimated maximal heart rate. Flexibility was trained using static stretching protocols (2–4 repetitions for 30–60 seconds for all joints considered important) (55). Notably, there was a significant improvement between groups in self-reported physical functioning (3.2 points; 95% CI, 0.4–6.0 *P*=0.028) and leg strength (6.6kg; 95% CI, 0.6–12.7; *P*=0.033) in the exercise group. However, fatigue, balance, lean mass, muscle mass, and objective physical function measures did not significantly change. This may be due to a conservative exercise program prescription where a modular exercise program was employed for training and testing (55). Importantly, adherence to the supervised intervention was 89%, with no adverse events resulting from the prescription reported (55). This study provided preliminary evidence that tailored exercise is safe and can improve objectively measured muscle strength and self-reported physical functioning in patients with metastatic prostate cancer with bone metastases.

Collectively, the research in this area indicates that both aerobic and resistance exercise is safe and efficacious for individuals with metastatic prostate cancer. To gain the best overall benefits, prescription of both aerobic and resistance training may be most effective. Notably, structured aerobic exercise might work better than sports participation in this population and there are two different approaches of resistance training prescriptions that both have merit. Despite the demonstrated benefits of regular exercise, available evidence suggests that exercise is underutilised as a support therapy for individuals with prostate cancer (79). There are few specialised programs available, and available evidence suggests most prostate cancer patients are not engaging in optimum levels of exercise to maximise health benefits (14,80,81). To better support patients, a deeper understanding of exercise barriers is needed.

2.4 Understanding current barriers and facilitators to effective and sustainable exercise in individuals with prostate cancer

Individuals with metastatic prostate cancer face an array of barriers to exercise initiation and adherence, with many reported barriers being universal to many cancer populations (82). Disease symptoms and corresponding treatment side effects have consistently been reported as common barriers to exercise (14,81–83). Most notably, cancer-related fatigue was found to be a considerable barrier to exercise as well as pain and muscular weakness (14,82,83). Low mood and motivation have also been reported as barriers, especially for those on ADT (82). Moreover, for individuals who have undergone a prostatectomy or radiation, urinary or bowel incontinence may limit activity for fear of leaking during exercise (82).

Sheill et al. and Fox et al. both found that a lack of cancer-specific exercise knowledge was a barrier to exercise (14,83). Individuals were uncertain of the most appropriate mode and duration (14). As such, education and support from exercise professionals and the clinical care team may be crucial for exercise adoption. Logistical barriers include the lack of suitable facilities and qualified exercise professionals (14). Presently, individually tailored face-to-face multi-modal exercise interventions delivered by trained exercise specialists are not extensively available, especially in rural areas (84). Furthermore, many individuals have time and financial pressures, leading to reluctance or inability to attend face-to-face exercise programs (9,14,85).

Lastly, the typically older age range of individuals with prostate cancer has also been cited as a barrier to exercise (86). Bøhn et al. (n=696) found that individuals over 70 years were statistically significantly less likely to complete two or more exercise sessions per week than younger individuals with prostate cancer (86). Aside from increased functional decline as individuals age, there is also an increased risk of comorbidities that may impact exercise initiation and adherence, such as osteoarthritis and cardiovascular disease (82).

On the contrary, there are facilitators of exercise that have shown to be beneficial in the prostate cancer population. Clinician referrals, family and peer support and socialisation, are all associated with exercise facilitation (82,83). There is also some evidence that understanding and accounting for patient preferences such as group exercise vs individual, location, and type of exercise facilitates the uptake of exercise (82). However, it is also important to consider that patient preference must be balanced with ensuring the exercise program is safe and provides clinical benefits (81).

By understanding the unique exercise barriers such as side effects, motivation and logistical constraints and facilitators including professional and social support, strategies can be implemented to maximise adoption and maintenance of exercise (83). However, to ensure the most appropriate and effective strategies are implemented within an intervention, behavioural science input is advantageous (87).

2.5 Using theory to improve exercise adoption and maintenance in individuals with prostate cancer

Increasing or maintaining physical activity and, more specifically, exercise habits, is complex and challenging in oncology settings. Health-focused behaviour change interventions have shown promise in many physical activity settings to modify individuals attitudes towards exercise and exercise behaviour (88). However, for these interventions to be effective in exercise oncology settings, it is important to understand the theoretical basis of physical activity behaviour change and focus on the most relevant mechanisms that will facilitate change in exercise behaviours (89–91).

2.5.1 Theories of physical activity behaviour change

Behavioural change theories from the field of psychology are commonly used to predict, explain, and underpin health intervention content in an effort to create effective tools for physical activity behaviour change (87). A considerable amount of research has demonstrated the effectiveness of theory-based interventions in targeting and modifying behavioural determinants (92). Whilst numerous different health-based behavioural change theories have been proposed, a review by Napolitano and colleagues found that the social cognitive theory (SCT), the theory of planned behaviour (TPB) and self-determination theory (SDT) were the theories that produced the most substantial changes to physical activity behaviour (93).

The SCT highlights the dynamic interaction between individuals' behaviour, personal factors, and the environment when looking to understand physical activity behaviours. (94,95). One of the main determinants within the SCT is the concept of self-efficacy, which refers to an individual's confidence in their capability to execute behaviours to succeed in a particular situation (i.e. when undergoing cancer treatments or experiencing inclement weather) (96). Self-efficacy is thought to directly impact behaviour, as well as creating an indirect influence through affecting other determinants, including outcome expectations, goals, perceived sociostructural facilitators and impediments (Figure 4) (94). Modifying these determinants may positively influence physical activity behaviour change and whether that change is maintained long term (94).

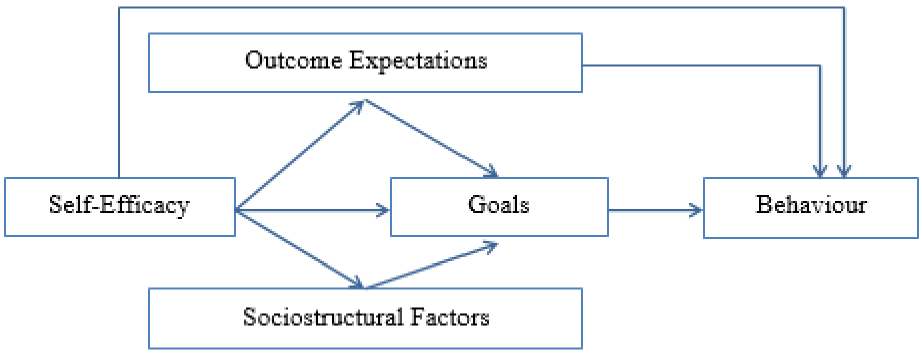

Figure 4. Social cognitive theory framework.

Reproduced from Bandura (94) with permission of SAGE Journals.

According to the TPB, an individual's physical activity behaviour is predicted by intention (the individual's motivational factors that influence a given behaviour) (97).

Intention is then, in turn, influenced by their attitude towards the activity, the subjective norms (perceived social pressure to execute the activity), and perceived control (perception of ability to perform the activity) (Figure 5) (97). To a degree, the TPB overlaps with the SCT because both are social cognitive approaches that generally posit that people will intend to do a behaviour (or have a goal) if they believe it is important and are capable of enacting the activity (87). Both theories have been widely used in physical activity research, with the social cognitive approach demonstrating utility in predicting and changing physical activity (87,93). However, it must be noted that some recognised limitations lead to the consideration of other theories when creating behavioural change interventions. For example, it has been shown that there is a clear intention behaviour gap with large changes in intentions leading to only small changes in behaviour (98). Also, whilst many interventions using these theories have demonstrated increased behaviour initiation, long term adherence to the behaviours has not been found as often (87). Other well-known theories such as the SDT and habit (dual process) theories are increasingly used to address these limitations.

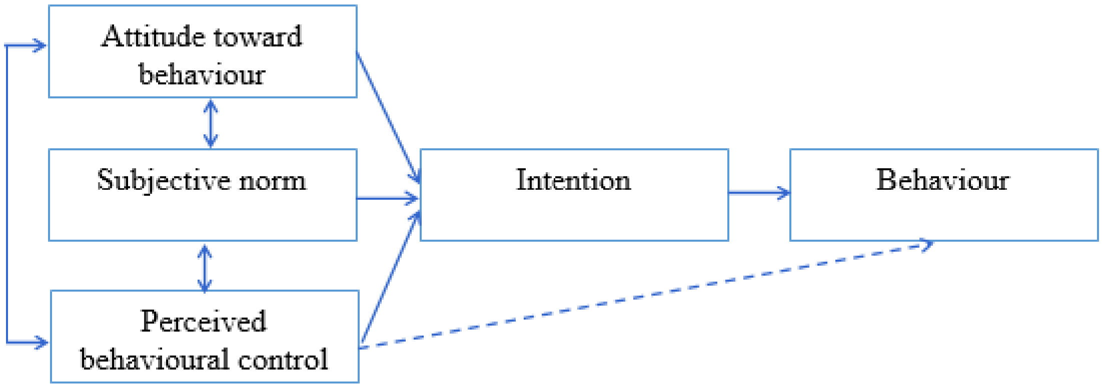

Figure 5. The theory of planned behaviour framework.
Adapted from Ajzen (97) with the permission from Elsevier

The SDT postulates that the motivation of an individual to participate in a behaviour is based on the satisfaction of their basic human needs of autonomy (having a sense of choice and control over one's behaviour), competence (feeling capable and effective when completing a task) and relatedness (experiencing meaningful connections with others) (Figure 6) (99). These factors are thought to govern the type of motivation experienced by an individual, which can range from amotivation on one end of the continuum to extrinsic motivation in the middle of the continuum to intrinsic motivation at the other end of the continuum (100). Amotivation is the absence of motivation, whereas extrinsic motivation involves engaging in an activity in order to obtain an outcome that is separate from the activity itself (e.g., weight loss), and intrinsic motivation is performing the activity for its own sake (e.g., for enjoyment) (100). Intrinsic motivation is achieved when an individual's needs for competence, autonomy and relatedness are met (100). Previous research has shown that extrinsic motivation predicts short-term adoption of exercise when the outcomes one wishes to obtain are personally valued by the individual (e.g., exercising to improve cancer symptoms), but intrinsic motivation (e.g., enjoyment) is more predictive of long-term exercise adherence (87,100). To improve adherence, it is important to consider promoting a sense of choice and control over one's behaviour (autonomy), increasing feelings of competence (similar to self-efficacy and perceive behavioural control in SCT and TPB, respectively) and encouraging meaningful connections with others (relatedness) when designing exercise programs.

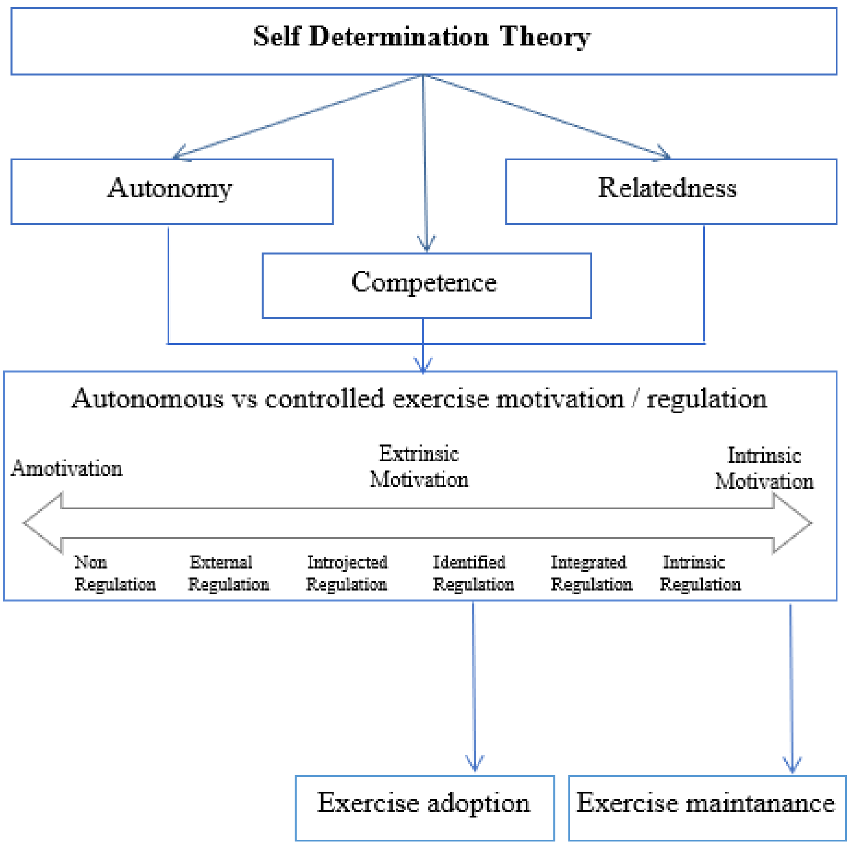

Figure 6. The self-determination theory framework.

Adapted from Deci and Ryan (101)

A typical underlying assumption of social cognitive theories is that behaviour change is regulated by conscious cognitive processes (87). However, evidence now suggests that these processes only predict a proportion of physical activity behaviours (87). The dual-process theories of behaviour change consider that behaviour is regulated by two different types of information-processing systems (102). The reflective processes (premeditated, effortful) include variables from the social-cognitive approach, such as intentions. In contrast, the non-conscious processes (spontaneous and more difficult to manage) comprise lesser understood physical activity determinants such as habits (103,104). Developing habits, which are a non-conscious instinct to complete a behaviour due to a learned relationship between a contextual cue and the behaviour, can be an important determinant of exercise behaviours because they reduce the need for conscious, motivation-dependent actions (104). There is a complex interplay between reflective and non-conscious systems, which indicate that interventions must account for both rather than focus on one system. For example, Rebar et al. found that habit strength was positively related to physical activity when intentions were lower than usual. However, habit strength did not influence daily physical activity when people had standard or stronger intentions than usual. Further research is needed to understand the role that non-conscious processes such as habits play in long term physical activity behaviours.

In a systematic review analysing physical activity-based behaviour change studies for individuals with prostate cancer, Finlay et al. reported on twelve (three prostate cancer and five mixed cancers) studies (91). Their results suggested that only eight of the studies used behaviour change theories, including the SCT and the TPB (91). These results align with a recent systematic review and meta-analysis (19 pooled randomised controlled trials) of maintenance of physical activity behaviour change in other cancer types. Twelve studies utilised theoretical models, including SCT, the TPB, the SDT or the transtheoretical model (88). Despite its potential, the dual process model was not reported in either review (88,91). It is important to note that neither review analysed the differences between interventions based on behavioural theories chosen or compared to interventions that did not report a theoretical basis (88,91).

It is highly likely that there cannot be a one-size-fits-all approach as no theory will be appropriate in every situation (105). As such, it appears that a range of theories may be useful when taking a theory-based approach within an intervention aimed at changing physical activity behaviour in patients with prostate cancer. Consequently, it will be important for future theory-driven research to develop logical intervention frameworks, which draw on multiple theories such as the SCT and the TPB to identify to identify suitable determinants and map how the key components may integrate together (106).

2.5.2 Behaviour change techniques used in physical activity interventions

A behavioural change technique is an active, replicable intervention component that helps change or adjust the determinants of behaviour. Michie et al. developed a taxonomy of 93 active components (Appendix 1) to create a reliable method for specifying, interpreting and implementing the active ingredients of interventions to change behaviours (107). To determine what specific techniques are chosen within a physical activity intervention, researchers need to understand what determinants should be targeted, based on suitable behavioural change theories, such as the SCT, the TPB, the SDT, and the dual-process theory (107).

It must be noted that because many behaviour change interventions are intricate and have interacting techniques and theories, reviewing the evidence to inform potential interventions is difficult (88). In a 2018 systematic review, Finlay et al., aimed to review the feasibility and efficacy of prostate cancer-specific physical activity behaviour change interventions. They found that the common behavioural change techniques found to increase physical activity included goal-setting (n=11), information on behaviour consequences (n=11), self-monitoring encouragement (n=10), and barrier identification (n=8) (91). More specifically, Hallward et al. reported on 15 studies investigating behaviour change techniques in physical activity interventions for individuals with prostate cancer (106). Behavioural practice/rehearsal (n=15), instruction to perform behaviours (n=11), self-monitoring encouragement (n=9), social support (n=8), generalisation of target behaviours (n=8), and graded tasks (n=7) were used frequently (106). While both studies presented commonly used behavioural change techniques, the Finlay et al. review only included RCT’s with behavioural change outcome measures, whereas Hallward et al. only included physical activity studies on prostate cancer, which included more exercise-specific interventions (91,106).

Interestingly, given that Sheill et al. and Fox et al. found the lack of prostate cancer-specific exercise knowledge was a barrier to exercise in individuals with metastatic prostate cancer, it is feasible that targeting determinants such as self-efficacy (SCT); competency (SDT) and perceived behavioural control (TPB) is of value for longer-term behavioural change. Therefore, behavioural change techniques that focus on instruction, rehearsal and self-monitoring may be more important than other techniques typically implemented (14,83). Additionally, disease symptoms and corresponding treatment side effects have been shown to be a barrier to exercise adoption and maintenance, so incorporating behaviour change techniques such as grading tasks, barrier identification (and problem-solving) are also likely to be important.

There is no hard and fast rule regarding the number of behavioural change techniques required in a physical activity intervention to ensure success. Hallward et al. found a mean of 7 behavioural change techniques per intervention (minimum of three and a maximum of ten) (106). Notably, the systematic review found that more techniques did not always result in a more successful intervention (106). This indicates that intervention development must consider users in order to determine the most suitable and efficient behavioural change techniques rather than focusing on quantity.

In summary, while it is suggested that physical activity interventions are more effective at changing behaviour when theoretically driven, there is still debate regarding what theories maybe most applicable. Current research indicates that interventions that utilise an integrated theory approach (as opposed to traditional social cognitive theory approaches) and thoughtfully select behaviour change techniques based on what is known about exercise barriers and facilitators among men with metastatic prostate cancer may be most effective for individuals with prostate cancer.

2.6 Physical activity behaviour change interventions designed for individuals with prostate cancer

Given the unique challenges individuals with prostate cancer face and the effectiveness of exercise therapy, developing specialised physical activity interventions with high-quality theory-based behavioural change support to aid the adoption and maintenance of physical activity is essential (106). The challenge in any targeted behavioural change intervention is to ensure the behaviour change support is relevant, comprehensive, evidence-based, and engaging while also being easily accessible, financially viable and sustainable to deliver (108).

In the last decade, there have been numerous trials of interventions for promoting physical activity in individuals with prostate cancer with varying degrees of success (91,106,108). Notably, there is large heterogeneity among these behaviour change interventions in terms of intervention design, modalities, outcome measures, the support provided, and individualisation of content (106). All of which can have a big impact on efficacy (106). For example, face-to-face and distance-based modalities have both been used as the delivery modality (91). While historically, face-to-face behaviour change counselling has been seen as the gold standard in methods for behavioural change in health, recent technological advances may enhance engagement whilst increasing accessibility.

2.6.1 Face-to-face physical activity behaviour change interventions for individuals with prostate cancer

In general, supervised face-to-face interventions involve a brick-and-mortar location, where participants come into contact with health professionals or individuals trained to run a physical activity behavioural change intervention. Supervised delivery can come in the form of individual training, group-based or a combination of the two. The in-person contact in face-to-face interventions is seen to provide support, accountability, real-time instruction and discussion, access to appropriate equipment and engagement (109–111). A recent systematic review by Finlay et al. reported positive physical activity outcomes in three of the four prostate cancer-specific studies that used supervised behavioural change interventions. Culos-Reed demonstrated a 71% mean increase in moderate-to-vigorous physical activity (MVPA) (as measured by the Godin leisure score index)

[F(1,60)=3.15, P=0.004] compared to the wait-list controlled group (112). Livingston et al. increased participants self-reported vigorous physical activity by 45 minutes [95% CI, 0.09-0.82; P=0.010] more than the control group, but did not see a significant change in MVPA, and Winters-Stone et al. demonstrated an increase in MVPA in comparison to individuals in the control group [303.6 kcal per day, 95% CI, 116.9-490.3, P<0.01] (113,114). Despite different behavioural change approaches (weekly group education, one individual coaching session and weekly check-ins, couples training together), all three studies reported prescribing individualised exercise programming alongside the behavioural change intervention rather than just supplying recommendations to meet the physical activity guidelines (112–114). Conversely, in the fourth study reported in Finlay et al., Carmack Taylor et al. did not prescribe exercise in their education, lifestyle or control groups and reported no significant physical activity differences between any groups (115). This may indicate that behavioural change information alone is not effective in changing behaviours, and some form of exercise or physical activity prescription is required to see a change in MVPA. It also signifies that it is difficult to currently infer what elements of the interventions are influencing behaviour in the prostate cancer population. To create effective interventions, further research comparing the value of different elements is required.

There are limitations with behaviour change interventions delivered in a face-to-face environment (116). In-person behavioural change programs can be expensive, lack flexibility, and may inhibit large-scale implementation (14,110,117). As noted earlier, individuals diagnosed with cancer face various barriers such as logistics (distance from exercise clinics), time and finances, as well as having different preferences (group vs individual services) (14,79,82). Therefore, insights into how intervention delivery can be modified or refined to produce interventions that best suit the range of individual needs would be valuable.

2.6.2 Distance-based physical activity behaviour change interventions for individuals with prostate cancer

To bypass conventional face-to-face physical activity counselling barriers, researchers began investigating distance-based behavioural change modalities (118). Typically delivered outside of clinical settings and involving minimal to no face-to-face supervision, distance-based methods can include print-based materials and video/DVD instruction. Furthermore, technological improvements over the last three decades have led to an ability to provide distance-based supervision using methods such as telehealth counselling, websites, smartphone apps, email, SMS communication/prompts, social media platforms and wearable activity trackers (119,120). These approaches offer increased accessibility and possibly cost-effectiveness to deliver the repeated contacts needed to encourage physical activity initiation and maintenance in individuals with cancer (120).

Improved accessibility to the Internet in recent years has exponentially increased the potential of online health interventions (116). For instance, in the last decade, over a thousand digital health behaviour change interventions for promoting physical activity in different populations have been developed and evaluated (121). The adoption of Internet use in older adults has seen a dramatic rise, with 93% of older Australians having access to the Internet at home in 2020 compared to 68% in 2017 (122). Given that older adults are becoming more IT literate and the Internet has become more accessible, it has become a source of lifestyle information for men with prostate cancer (123). Online interventions are a feasible method of disseminating high-quality, easily adaptable information to change physical activity behaviours (124). Moreover, online interventions may solve some of the barriers currently influencing uptake of physical activity in individuals with cancer, such as easy access to oncology trained exercise professionals and difficulties accessing services (e.g. physical decline, fatigue) (14,83).

One highlight of web-based interventions is the ability to use computer tailoring, which provides the capacity to increase the individualisation of a distance-based intervention on a large scale without a significant burden on practitioners. Computer-tailoring is defined as the practice of adjusting information presented to the individual’s particular characteristics, thus removing the one-size-fits-all approach utilised by many distance-based interventions (125). Computer-tailoring is akin to how health professionals tailor their education based on a patient’s requirements. The tailored component means that feedback can be mapped to an individual’s demographical, societal, or behavioural profile. According to the elaboration likelihood model, tailoring may improve information processing because the information is perceived as more relevant (125). The main method of tailoring is the use of “if-then” algorithms to provide customised feedback based on the participant’s responses to a survey (126). The feedback is drawn from a database incorporating feedback combinations tailored to the participant’s condition and responses to prompts for information on the website (126).

The application of digital physical activity behaviour change interventions in oncology settings has been steadily increasing, with a recent meta-analysis by Roberts and colleagues identifying fifteen studies designed for individuals with cancer (breast n=5; young adult survivors n=3; non-small-cell lung cancer n=1; mixed cancers n=6) (120). Overall, their meta-analysis (n=1034 participants) reported a significant increase in MVPA of 41 minutes per week [95% CI, 12-71; *P*=0.006] with very high levels of heterogeneity (120). This result indicates that the digital behaviour change methods are not dissimilar to face-to-face behavioural change interventions in improving MVPA (91,120). Roberts et al. also found a reduction in body mass index and a trend towards significance for fatigue (120). It should be noted that a majority of the physical activity behaviour change trials in oncology have only been two to four months in duration, and only two trials have follow-up measures (at four to six months) (120). Therefore, whilst short-term efficacy is looking promising, the longer-term change to physical activity is still unknown.

Given the reported population-specific physical activity barriers and facilitators such as prostate cancer-specific exercise education, there has been a recognition of the need for online physical activity behaviour change interventions specifically created for individuals with prostate cancer (127–131). Thus far, there have been a handful of prostate cancer-specific interventions that have demonstrated feasibility and acceptability whilst also showing variable success in changing MVPA levels (127–131). Trial methodologies have typically consisted of a study website or mobile phone app with behavioural change content. Study variations consisted of whether there was health professional contact (of varying degrees), the content was tailored, written feedback I via emails or SMS, self-monitoring was required, or activity tracking devices were provided (127–130). Intervention aim complexity ranged from aiming to improve step count with an app (RiseTx) to attempting to change multiple behaviours, including physical activity, diet and smoking with a website (Prostate 8). Golsteijn et al. (Oncoactive, n=478, 61%

prostate cancer survivors) increased the MVPA in the intervention group by 60 minutes, whereas the control group only increased by 8 minutes (*P*=0.006). Additionally, the single-arm trial by Trinh et al. (RiseTx, n=46) reported a significant improvement of 44.1 minutes of MVPA (*P*=0.010), a reduction of sedentary time by 455.4 minutes (*P*=0.005), and an increased step count of 1535 steps were observed (129). In contrast, Finlay et al. (PCHF, n=71), Kenfield et al. (Prostate8, n=76), Forbes et al. (n=95) and Chan et al. (TrueNth, n=160) reported no significant differences in MVPA in their randomised controlled interventions. However, lack of change in MVPA may have been due to the high levels of physical activity at baseline in the Kenfield et al. and Chan et al. and Forbes et al. studies, as well as the short intervention duration (4 weeks) in the Finlay et al. study. Besides the difference in trial design, one of the biggest differences between studies was the progression and partial tailoring of physical activity prescription seen in Golsteijn et al. (physical activity progressions provided at three-time points), Trinh et al. (step count progressions) and Chan et al. (individualised exercise prescriptions in level 3 and 4) (129,131,132). This may indicate that for physical activity behaviour change interventions to modify MVPA, interventions may need to provide graded physical activity instructions.

2.6.3 Current limitations of online behaviour change interventions for individuals with prostate cancer

Given the limited evidence to date, it is clear that there is substantial room to expand upon this research base. For one, there have been no tailored web-based physical activity behaviour change interventions designed specifically for individuals with metastatic prostate cancer and only two prostate cancer online physical activity studies included individuals with metastatic disease (32.6% and 5.9% of their study population respectively) (129,131). Behavioural and physical activity content was not tailored to the disease stage in these studies and outcomes were not reported separately for those with metestatic disease. As such, the efficacy of computer-tailored interventions for improving MVPA and quality of life among individuals with metestatic prostate cancer is unknown. Given that those with advanced disease have unique priorities, goals, and needs compared to those with localised prostate cancer, and given that they experience a greater burden of disease, interventions designed specific for this population seem warranted. Future research could look to expand previously tested intervention such as

RiseTx to create metastatic prostate cancer-specific content or develop a stand-alone intervention for this population.

Additionally, there has been a focus on general physical activity recommendations rather than the provision of structured exercise prescription advice in web-based behaviour change interventions. Due to the need for specific exercise intensities, modes and volumes in order to elicit particular physiological anti-tumour adaptations as well as reductions in treatment side effects and improvements in physical function, structured interventions are important (50,53,54). Furthermore, given that individuals with metastatic prostate cancer have varying levels of capacity and those with bone metastases require tailored exercise programs that consider the location, extent and type of their metastatic lesion, personalised multi-modal programs are necessary (43,54,55). With computer tailoring interventions indicating preliminary efficacy, an intervention that provides this approach using tailored multi-modal exercise prescription may improve health-related outcomes in patients with prostate cancer with metastatic disease. Therefore it is an exciting avenue worth exploring in future research.

The intervention requirements needed to create effective engagement in the behaviour change process are still unknown in the metastatic prostate cancer population. A review of the acceptability and engagement to web-based interventions completed by Corbett et al. found that the development of such interventions needs to be patient orientated and must meet the unique needs and abilities of the target population (133). One such method to achieve this is to involve patients and their informal caregivers in the creation and initial evaluation phase of research to capitalise on the expertise of end-users and not only of clinicians and researchers (134). It is theorised that interventions engaging end-users in the co-creation process help ensure improved knowledge of user needs, allow for real-time validation of ideas, produce better-differentiated interventions and may even lower development costs and reduce development time (134). In web-based interventions, it is important to guarantee that the intervention is user-friendly, aesthetically pleasing, beneficial and suitable to the end-users challenges face (133). In-person contact has also been shown to improve intervention engagement and efficacy (135). This may be because the quality of the interaction between health care professionals and participants can impact the success of an intervention. The SDT's key fundamental need of relatedness explains that individuals need to experience a sense of connection and belonging (87). As such, a higher quality relationship is more likely to lead to a more effective intervention (136). The problem with online interventions is understanding how to create this relationship without face-to-face interaction. Technological advancements such as real-time feedback via visual methods, reminders and well-timed prompts may be of use. Still, given the costs of developing many of these aspects, future research may be required to determine which elements are most effective.

2.7 Conclusion

Although supervised exercise programs are considered the gold standard in men with metastatic prostate cancer, there is also a need to provide alternate options. Computer-tailored programs that can be completed at home have been effective in other oncology populations and offer a promising approach. To date, however there have been no specific web-based exercise and behavioural change interventions for men with metastatic prostate cancer. Given this population is unique in both its exercise prescription and behavioural change needs, it is clear further research is needed to develop a person-centred intervention tool that is safe, relevant, easily accessible and user-friendly.

2.8 References

1. Stein GS, Luebbers KP. Cancer: prevention, early detection, treatment and recovery. Hoboken: John Wiley & Sons; 2019.
2. Torre LA, Siegel RL, Ward EM, Jemal A. Global cancer incidence and mortality rates and trends – An update. Cancer Epidemiology Biomarkers and Prevention. 2016;25(1):16-27. DOI: 10.1158/1055-9965.EPI-15-0578.
3. Prashanth R. Epidemiology of prostate cancer. World J Oncol. 2019;10(2):63–89. DOI: 10.14740/wjon1191.
4. Australian Institute of Health and Welfare. Australian Cancer Incidence and Mortality. In: AIHW, editor. Canberra; 2021. Available from: https://www.aihw.gov.au/reports/cancer/cancer-data-in-australia.
5. Cancer Australia. How is prostate cancer staged? Canberra: Cancer Australia; 2020. Available from: https://www.canceraustralia.gov.au/affected-cancer/cancer-types/prostate-cancer/how-prostate-cancer-diagnosed.
6. Tewari A, Whelan P, Graham J. Prostate cancer: diagnosis and clinical management. 1st ed. Hoboken: John Wiley & Sons; 2014.
7. Luo Q, Yu XQ, Smith DP, O'Connell DL. A population-based study of progression to metastatic prostate cancer in Australia. Cancer Epidemiol. 2015;39:617–22. DOI: 10.1016/j.canep.2015.04.013.
8. Sartor O, Flood E, Beusterien K, Park J, Webb I, MacLean D, et al. Health-related quality of life in advanced prostate cancer and its treatments: biochemical failure and metastatic disease populations. Clin Genitourin Cancer. 2015;13:101–12. DOI: doi: 10.1016/j.clgc.2014.08.001.
9. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8:e019917. DOI: 10.1136/bmjopen-2017-019917.
10. Drudge-Coates L, Oh WK, Tombal B, Delacruz A, Tomlinson B, Ripley AV, et al. Recognizing symptom burden in advanced prostate cancer: a global patient and caregiver survey. Clin Genitourin Cancer. 2018;16:e411–9. DOI: 10.1016/j.clgc.2017.09.015.

11. Colloca G, Colloca P. The effects of social support on health-related quality of life of patients with metastatic prostate cancer. Journal of Cancer Education. 2016;31(2):244-52. DOI: 10.1007/s13187-015-0884-2.
12. De Groot AE, Roy S, Brown JS, Pienta KJ, Amend SR. Revisiting seed and soil: examining the primary tumor and cancer cell foraging in metastasis. Molecular Cancer Research. 2017;15(4):361-70. DOI: 10.1158/1541-7786.MCR-16-0436.
13. Bubendorf L, Schöpfer A, Wagner U, Sauter G, Moch H, Willi N, Gasser TC, Mihatsch MJ. Metastatic patterns of prostate cancer: an autopsy study of 1,589 patients. Human pathology. 2000;31(5):578-83. DOI: 10.1053/hp.2000.6698.
14. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: a qualitative exploration. Support Care Cancer. 2018; 26(6):1747-1754. DOI: 10.1007/s00520-017-4008-x.
15. Holmstrom S, Naidoo S, Turnbull J, Hawryluk E, Paty J, Morlock R. Symptoms and impacts in metastatic castration-resistant prostate cancer: qualitative findings from patient and physician interviews. The Patient-Patient-Centered Outcomes Research. 2019;12(1):57-67. DOI: 10.1007/s40271-018-0349-x.
16. McDougall JA, Bansal A, Goulart BHL, McCune JS, Karnopp A, Fedorenko C, et al. The clinical and economic impacts of skeletal-related events among medicare enrollees with prostate cancer metastatic to bone. Oncologist. 2016;21(3):320–6. DOI: 10.1634/theoncologist.2015-0327.
17. Coleman RE. Clinical features of metastatic bone disease and risk of skeletal morbidity. Clin Cancer Res. 2006;12(20) :6243s-6249s. DOI: 10.1158/1078-0432.CCR-06-0931.
18. Sathiakumar N, Delzell E, Morrisey MA, Falkson C, Yong M, Chia V, et al. Mortality following bone metastasis and skeletal-related events among men with prostate cancer: a population-based analysis of US Medicare beneficiaries, 1999–2006. Prostate Cancer Prostatic Dis. 2011;14(2):177-183. DOI: 10.1038/pcan.2011.7.
19. Hill ME, Richards MA, Gregory WM, Smith P, Rubens RD. Spinal cord compression in breast cancer: a review of 70 cases. Br J Cancer. 1993; 68(5):969-73. DOI: 10.1038/bjc.1993.463.
20. Doveson S, Holm M, Axelsson L, Fransson P, Wennman-Larsen A. Facing life-prolonging treatment: The perspectives of men with advanced metastatic prostate

cancer – an interview study. Eur J Oncol Nurs. 2020;49:101859. DOI: 10.1016/j.ejon.2020.101859.

21. Yamada Y, Beltran H. The treatment landscape of metastatic prostate cancer. Cancer Lett. 2021;519:20–9. DOI: 10.1016/j.canlet.2021.06.010.
22. Di Maio S, Keller J, Hohl DH, Schwarzer R, Knoll N. Habits and self-efficacy moderate the effects of intentions and planning on physical activity. Br J Health Psychol. 2021;26(1):50–66. DOI: 10.1111/bjhp.12452.
23. Jayadevappa R, Chhatre S, Wong YN, Wittink MN, Cook R, Morales KH, Vapiwala N, Newman DK, Guzzo T, Wein AJ, Malkowicz SB. Comparative effectiveness of prostate cancer treatments for patient-centered outcomes: a systematic review and meta-analysis (PRISMA Compliant). Medicine. 2017;96(18). DOI: 10.1097/MD.0000000000006790.
24. Taylor JM, Chen VE, Miller RC, Greenberger BA. The impact of prostate cancer treatment on quality of life: a narrative review with a focus on randomized data. Res Rep Urol. 2020;12:533-546. DOI: 10.2147/RRU.S243088.
25. Rashid P. Prostate Cancer: Your guide to the disease, treatment options and outcomes. 3rd ed. Port Macquarie: Uronorth Group; 2010.
26. Cornford P, van den Bergh RCN, Briers E, Van den Broeck T, Cumberbatch MG, De Santis M, et al. EAU-EANM-ESTRO-ESUR-SIOG Guidelines on prostate cancer. Part ii—2020 update: treatment of relapsing and metastatic prostate cancer. European Urology. 2021;79(2):263-282. DOI: 10.1016/j.eururo.2020.09.046.
27. Steentjes L, Siesling S, Drummond FJ, van Manen JG, Sharp L, Gavin A. Factors associated with current and severe physical side-effects after prostate cancer treatment: what men report. Eur J Cancer Care. 2018;27(1):e12589. DOI: 10.1111/ecc.12589.
28. Abdollah F, Sun M, Thuret R, Jeldres C, Tian Z, Briganti A, et al. A competing-risks analysis of survival after alternative treatment modalities for prostate cancer patients: 1988–2006. Eur Urol. 2011;59(1):88–95. DOI: 10.1016/j.eururo.2010.10.003.
29. Nguyen PL, Alibhai SMH, Basaria S, D’amico A V, Kantoff PW, Keating NL, et al. Adverse effects of androgen deprivation therapy and strategies to mitigate them. Eur Urol. 2015;67(5):825–36. DOI: 10.1016/j.eururo.2014.07.010.

30. Harris WP, Mostaghel EA, Nelson PS, Montgomery B. Androgen deprivation therapy: progress in understanding mechanisms of resistance and optimizing androgen depletion. Nat Clin Pract Urol. 2009;6(2):76–85. DOI: 10.1038/ncpuro1296.
31. Kirk D. Immediate versus deferred treatment for advanced prostatic cancer: initial results of the Medical Research Council trial. Br J Urol. 1997;79(2):235–46. DOI: 10.1046/j.1464-410x.1997.d01-6840.x.
32. Edmunds K, Tuffaha H, Galvão DA, Scuffham P, Newton RU. Incidence of the adverse effects of androgen deprivation therapy for prostate cancer: a systematic literature review. Supportive Care in Cancer. 2020:28(5):2079-2093. DOI:10.1007/s00520-019-05255-5.
33. Braga-Basaria M, Dobs AS, Muller DC, Carducci MA, John M, Egan J, et al. Metabolic syndrome in men with prostate cancer undergoing long-term androgen-deprivation therapy. J Clin Oncol. 2006 Aug 20;24(24):3979–83. DOI: 10.1200/JCO.2006.05.9741.
34. Virgo KS, Basch E, Andrew Loblaw D, Oliver TK, Rumble RB, Carducci MA, et al. Second-line hormonal therapy for men with chemotherapy-I, castration-resistant prostate cancer: American society of clinical oncology provisional clinical opinion. J Clin Oncol. 2017 Jun 10;35(17):1952–64. DOI: 10.1200/JCO.2017.72.8030.
35. Tannock IF, de Wit R, Berry WR, Horti J, Pluzanska A, Chi KN, et al. Docetaxel plus prednisone or mitoxantrone plus prednisone for advanced prostate cancer. 2009;351(15):1502–12. DOI: 10.1056/nejmoa040720.
36. Sartor O, Michels RM, Massard C, Bono JS de. Novel therapeutic strategies for metastatic prostate cancer in the post-docetaxel setting. Oncologist. 2011;16(11):1487. DOI: 10.1634/theoncologist.2010-0412.
37. Resnick MJ, Penson DF. Quality of life with advanced metastatic prostate cancer. Urol Clin. 2018;39:505–15. DOI: 10.1016/j.ucl.2012.07.007.
38. Zist A, Amir E, Ocana A, Seruga B. Impact of comorbidity on the outcome in men with advanced prostate cancer treated with docetaxel. Radiol Oncol. 2015;49:402–8. DOI: 10.1515/raon-2015-0038.
39. Beer TM, Armstrong AJ, Rathkopf D, Loriot Y, Sternberg CN, Higano CS, et al. Enzalutamide in men with chemotherapy-naïve metastatic castration-resistant

prostate cancer: extended analysis of the phase 3 PREVAIL study. Eur Urol. 2017;71(2):151–4. DOI: 10.1016/j.eururo.2016.07.032.
40. Ryan CJ, Smith MR, de Bono JS, Molina A, Logothetis CJ, de Souza P, et al. Abiraterone in metastatic prostate cancer without previous chemotherapy. N Engl J Med. 2013;368(2):138–48. DOI: 10.1056/NEJMoa1209096.
41. Loriot Y, Miller K, Sternberg CN, Fizazi K, De Bono JS, Chowdhury S, et al. Effect of enzalutamide on health-related quality of life, pain, and skeletal-related events in asymptomatic and minimally symptomatic, chemotherapy-I patients with metastatic castration-resistant prostate cancer (PREVAIL): results from a randomised, phase 3 trial. Lancet Oncol. 2015;16(5):509–21. DOI: 10.1016/S1470-2045(15)70113-0.
42. Khalaf DJ, Annala M, Taavitsainen S, Daygen ;, Finch L, Oja C, et al. Optimal sequencing of enzalutamide and abiraterone plus prednisone in metastatic castration-resistant prostate cancer: a multi-centre, randomized, phase II trial. Lancet Oncol. 2019;20(12):1730–9. DOI: 10.1016/S1470-2045.
43. Sheill G, Guinan EM, Peat N, Hussey J. Considerations for exercise prescription in patients with bone metastases: a comprehensive narrative review. PM&R. 2018;10(8):843–64. DOI: 10.1016/j.pmrj.2018.02.006.
44. Heinrich D, Bektic J, Bergman AM, Caffo O, Cathomas R, Chi KN, et al. The contemporary use of radium-223 in metastatic castration-resistant prostate cancer. Clin Genitourin Cancer. 2018;16(1):e223–31. DOI: 10.1016/j.clgc.2017.08.020.
45. Sullivan PW, Mulani PM, Fishman M, Sleep D. Quality of life findings from a multicenter, multinational, observational study of patients with metastatic hormone-refractory prostate cancer. Qual Life Res. 2007;16(4):571–5. DOI: 10.1007/s11136-006-9156-2.
46. Zajdlewicz L, Hyde MK, Lepore SJ, Gardiner RA, Chambers SK. Health-related quality of life after the diagnosis of locally advanced or advanced prostate cancer: a longitudinal study. Cancer Nurs. 2017;40:412–9. DOI: 10.1097/NCC.0000000000000432.
47. Salvo N, Zeng L, Zhang L, Leung M, Khan L, Presutti R, et al. Frequency of reporting and predictive factors for anxiety and depression in patients with advanced cancer. Clin Oncol. 2012;24:139–48. DOI: 10.1016/j.clon.2011.05.003.

48. Bill-Axelson A, Garmo H, Lambe M, Bratt O, Adolfsson J, Nyberg U, et al. Suicide risk in men with prostate-specific antigen-detected early prostate cancer: a nationwide population-based cohort study from PCBaSe Sweden. Eur Urol. 2020;57(3):390–5. DOI: 10.1016/j.eururo.2009.10.035.
49. Heywood R, McCarthy AL, Skinner TL. Efficacy of exercise interventions in patients with advanced cancer: a systematic review. Arch Phys Med Rehabil [Internet]. 2018;99(12):2595-620. DOI: 10.1016/j.apmr.2018.04.008.
50. Campbell KL, Winters-stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, et al. Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable. Med Sci Sport Exerc. 2019;51(11):2375–90. DOI: 10.1249/MSS.0000000000002116.
51. Hart NH, Newton RU, Spry NA, Taaffe DR, Chambers SK, Feeney KT, et al. Can exercise suppress tumour growth in advanced prostate cancer patients with sclerotic bone metastases? A randomised, controlled study protocol examining feasibility, safety and efficacy. BMJ Open. 2017;7(5):e014458. DOI: 10.1136/bmjopen-2016-014458.
52. Liguori G, editor. ACSM's guidelines for exercise testing and prescription. 11th ed. Philadelphia: Lippincott Williams & Wilkins; 2021.
53. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: Exercise medicine in cancer management. J Sci Med Sport. 2019; 22(11):1175-1199. DOI: 10.1016/j.jsams.2019.05.003.
54. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11(3):247–57. DOI: 10.1097/SPC.0000000000000276.
55. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50:393–9. DOI: 10.1249/MSS.0000000000001454.
56. Murray LK, Bennett EK. The short-term effects of resistance training on quality of life, cancer related fatigue, body composition, and physical function in men with advanced and metastatic prostate cancer receiving androgen deprivation therapy: a

pilot study. Phys Ther Rev. 2020;25(4):238–45. DOI: 10.1080/10833196.2020.1784570.

57. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16(4):328–35. DOI: 10.1038/pcan.2013.22.
58. Cormie P, Turner B, Kaczmarek E, Drake D, Chambers SK. A qualitative exploration of the experience of men with prostate cancer involved in supervised exercise programs. InOncol Nurs Forum. 2015;42(1): 24-32. DOI: 10.1188/15.ONF.24-32.
59. Galvão DA, Taaffe DR, Spry N, Gardiner RA, Taylor R, Risbridger GP, et al. Enhancing active surveillance of prostate cancer: the potential of exercise medicine. Nat Rev Urol. 2016;13(5):258-65. DOI: 10.1038/nrurol.2016.46.
60. Kim J, Galvão DA, Newton RU, Gray E, Taaffe DR. Exercise-induced myokines and their effect on prostate cancer. Nat Rev Urol. 2021;18:519–542. DOI: 10.1038/s41585-021-00476-y.
61. Lynch ME, Brooks D, Mohanan S, Lee MJ, Polamraju P, Dent K, et al. In vivo tibial compression decreases osteolysis and tumor formation in a human metastatic breast cancer model. J Bone Miner Res. 2013;28(11):2357–67. DOI: 10.1002/jbmr.1966.
62. Newton RU, Kenfield SA, Hart NH, Chan JM, Courneya KS, Catto J, et al. Intense exercise for survival among men with metastatic castrate-resistant prostate cancer (INTERVAL-GAP4): a multicentre, randomised, controlled phase III study protocol. BMJ Open. 2018;8(5):e022899. DOI: 10.1136/bmjopen-2018-022899.
63. Hayes SC, Spence RR, Galvão DA, Newton RU. Australian Association for Exercise and Sport Science position stand: optimising cancer outcomes through exercise. J Sci Med Sport. 2009;12(4):428–34. DOI: 10.1016/j.jsams.2009.03.002.
64. Schmitz KH, Courneya KS, Matthews C, Demark-Wahnefried W, Galvão DA, Pinto BM, et al. American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. Med Sci Sport Exerc. 2010;42(7):1409–26. DOI: 10.1249/MSS.0b013e3181e0c112.
65. Scott JM, Zabor EC, Schwitzer E, Koelwyn GJ, Adams SC, Nilsen TS, et al. Efficacy of exercise therapy on cardiorespiratory fitness in patients with cancer: a

systematic review and meta-analysis. Journal of Clinical Oncology. 2018;36(22):2297-2305. DOI: 10.1200/JCO.2017.77.5809.

66. Wilk M, Kepski J, Kepska J, Casselli S, Szmit S. Exercise interventions in metastatic cancer disease: a literature review and a brief discussion on current and future perspectives. BMJ Support Palliat Care. 2020;10(4):404–10. DOI: 10.1136/bmjspcare-2020-002487.

67. Galvão D, Taaffe D, Cormie P, Spry N, Chambers S, Peddle-McIntyre C, et al. Efficacy and safety of a modular multi-modal exercise program in prostate cancer patients with bone metastases: a randomized controlled trial. BMC Cancer. 2011; 11(1):1-7. DOI: 10.1186/1471-2407-11-517.

68. Cormie P, Galvão DA, Spry N, Joseph D, Taaffe TR, Newton RU. Functional benefits are sustained after a program of supervised resistance exercise in cancer patients with bone metastases: longitudinal results of a pilot study. Support Care Cancer. 2014;22:1537–1548. DOI: 10.1007/s00520-013-2103-1.

69. Rief H, Petersen LC, Omlor G, Akbar M, Bruckner T, Rieken S, et al. The effect of resistance training during radiotherapy on spinal bone metastases in cancer patients – a randomized trial. Radiother Oncol. 2014;112(1):133–9. DOI: 10.1016/j.radonc.2014.06.008.

70. Rief H, Akbar M, Keller M, Omlor G, Welzel T, Bruckner T, et al. Quality of life and fatigue of patients with spinal bone metastases under combined treatment with resistance training and radiation therapy- a randomized pilot trial. Radiat Oncol. 2014;9(1):151. DOI: 10.1186/1748-717X-9-151.

71. Rief H, Bruckner T, Schlampp I, Bostel T, Welzel T, Debus J, et al. Resistance training concomitant to radiotherapy of spinal bone metastases – survival and prognostic factors of a randomized trial. Radiat Oncol. 2016;11(97):1–7. DOI: https://doi.org/10.1186/s13014-016-0675-x.

72. Rief H, Omlor G, Akbar M, Welzel T, Bruckner T, Rieken S, et al. Feasibility of isometric spinal muscle training in patients with bone metastases under radiation therapy – first results of a randomized pilot trial. BMC Cancer. 2014;14(1):67. DOI: 10.1186/1471-2407-14-67.

73. Rief H, Omlor G, Akbar M, Bruckner T, Rieken S, Förster R, et al. Biochemical markers of bone turnover in patients with spinal metastases after resistance training

under radiotherapy – a randomized trial. BMC Cancer. 2016;16(1):231. DOI: 10.1186/s12885-016-2278-1.

74. Rosenberger F, Sprave T, Clauss D, Hoffmann P, Welzel T, Debus J, et al. Spinal stabilization exercises for cancer patients with spinal metastases of high fracture risk: Feasibility of the DISPO-II training program. Cancers. 2021;13(2):1–11. DOI: .3390/cancers13020201.

75. Uth J, Hornstrup T, Schmidt JF, Christensen JF, Frandsen C, Christensen KB, et al. Football training improves lean body mass in men with prostate cancer undergoing androgen deprivation therapy. Scand J Med Sci Sport. 2014:24(S1):105-12. DOI: 10.1111/sms.12260.

76. Schnohr P, O'Keefe JH, Holtermann A, Lavie CJ, Lange P, Jensen GB, et al. Various leisure-time physical activities associated with widely divergent life expectancies: the Copenhagen city heart study. Mayo Clin Proc. 2018;93(12):1775–85. DOI: 10.1016/j.mayocp.2018.06.025.

77. Sheill G, Brady L, Guinan EM, Hussey JM, Hayes B, Baird A-M, et al. A randomized trial of exercise on quality of life in men with metastatic prostate cancer: The ExPeCT Trial. J Clin Oncol. 2019;37(S31):97. DOI: 10.1200/JCO.2019.37.31_suppl.97.

78. Brady L, Hayes B, Sheill G, Baird AM, Guinan E, Stanfill B, et al. Platelet cloaking of circulating tumour cells in patients with metastatic prostate cancer: Results from ExPeCT, a randomised controlled trial. PloS One. 2020;15(12):e0243928. DOI: 10.1371/journal.pone.0243928.

79. Elbourne H, Soo WK, O'Reilly V, Moran A, Steer CB. Exercise as a supportive care strategy in men with prostate cancer receiving androgen deprivation therapy at a regional cancer centre: a survey of patients and clinicians. Support Care Cancer. 2022;30(2):1379-1389. DOI: 10.1007/s00520-021-06512-2.

80. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care. 2017;26(6). DOI: 10.1111/ecc.12575.

81. Galvão DA, Chambers SK. Exercise medicine in men with prostate cancer: breaking barriers to increase participation. Prostate Cancer Prostatic Dis. 2021 244. 2021;24(4):942–3. DOI: 10.1038/s41391-021-00406-4.

82. Sattar S, Haase KR, Bradley C, Papadopoulos E, Kuster S, Santa Mina D, et al. Barriers and facilitators related to undertaking physical activities among men with prostate cancer: a scoping review. Prostate Cancer Prostatic Dis. 2021;24(4):1007-1027. DOI: 10.1038/s41391-021-00399-0.
83. Fox L, Wiseman T, Cahill D, Beyer K, Peat N, Rammant E, Van Hemelrijck M. Barriers and facilitators to physical activity in men with prostate cancer: a qualitative and quantitative systematic review. Psycho-Oncology. 2019;28(12):2270-85. DOI: 10.1002/pon.5240.
84. Newton RU, Taaffe DR, Chambers SK, Spry N, Galvão DA. Effective exercise interventions for patients and survivors of cancer should be supervised, targeted, and prescribed with referrals from oncologists and general physicians. J Clin Oncol. 2018;36(9):927–8. DOI:10.1200/JCO.2017.76.7400.
85. Knowlton SE, O'Donnell EK, Horick N, Perez GK, Park E, Rabin J, et al. Moving forward on all fronts: impact, patterns, and barriers to exercise in cancer survivors and patients living with advanced disease. Support Care Cancer. 2020;28(10):4979–88. DOI: 10.1007/s00520-020-05344-w.
86. Bøhn SKH, Fosså SD, Wisløff T, Thorsen L. Physical activity and associations with treatment-induced adverse effects among prostate cancer patients. Support Care Cancer. 2019;27(3):1001–11. DOI: 10.1007/s00520-018-4389-5.
87. Rhodes RE, McEwan D, Rebar AL. Theories of physical activity behaviour change: A history and synthesis of approaches. Psychology of Sport and Exercise.2019;42;100–9. DOI: 10.1016/j.psychsport.2018.11.010.
88. Grimmett C, Corbett T, Brunet J, Shepherd J, Pinto BM, May CR, et al. Systematic review and meta-analysis of maintenance of physical activity behaviour change in cancer survivors. International Journal of Behavioral Nutrition and Physical Activity. 2019;16(37):1–20. DOI: 10.1186/s12966-019-0787-4.
89. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018;52(9):798–808. DOI: 10.1093/abm/kax055.
90. Davis R, Campbell R, Hildon Z, Hobbs L, Michie S. Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. Health Psychol Rev. 2015;9(3):323-44. DOI: 10.1080/17437199.2014.941722.

91. Finlay A, Wittert G, Short CE. A systematic review of physical activity-based behaviour change interventions reaching men with prostate cancer. Journal of Cancer Survivorship. 2018;12(4):571-591. DOI: 10.1007/s11764-018-0694-8.
92. Hagger MS, Weed M. Debate: do interventions based on behavioral theory work in the real world? Int J Behav Nutr Phys Act [Internet]. 2019;16(1):36. DOI: 10.1186/s12966-019-0795-4.
93. Napolitano MA, Marcus BH. Targeting and tailoring physical activity information using print and information technologies. Exerc Sport Sci Rev. 2002;30(3):122–8. DOI: 10.1097/00003677-200207000-00006.
94. Bandura A. Health promotion by social cognitive means. Heal Educ Behav. 2004;31:143–64.
95. Stacey FG, James EL, Chapman K, Courneya KS, Lubans DR. A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behavior change interventions for cancer survivors. 2015;9(2):305-38. Doi: 10.1007/s11764-014-0413-z.
96. Ungar N, Wiskemann J, Sieverding M. Physical activity enjoyment and self-efficacy as predictors of cancer patients' physical activity level. Front Psychol. 2016;7:898. DOI: 10.3389/fpsyg.2016.00898.
97. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991 Dec 1;50(2):179–211.
98. Rhodes RE, De Bruijn GJ. How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. Br J Health Psychol. 2013;18(2):296–309. DOI: 10.1111/bjhp.12032.
99. Milne HM, Wallman KE, Gullfoyle A, Gordon S, Courneya KS. Self-determination theory and physical activity among breast cancer survivors. J Sport Exerc Psychol. 2008;30(1):23–38. DOI: https://doi.org/10.1123/jsep.30.1.23.
100. Teixeira PJ, Carraça E V., Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: A systematic review. International Journal of Behavioral Nutrition and Physical Activity. 2012;9(1):1-30. DOI: 10.1186/1479-5868-9-78.
101. Deci E, Ryan R. Handbook of Self-determination Research. Rochester: University of Rochester Press; 2002.

102. Strobach T, Englert C, Jekauc D, Pfeffer I. Predicting adoption and maintenance of physical activity in the context of dual-process theories. Perform Enhanc Heal. 2020 Jun 1;8(1):100162. DOI: 10.1016/j.peh.2020.100162.
103. Gardner B, Lally P, Wardle J. Making health habitual: The psychology of "habit-formation" and general practice. British Journal of General Practice. 2012; 62(605): 664–666. DOI: 10.3399/bjgp12X659466.
104. Gardner B, Rebar AL. Habit formation and behavior change. Oxford Res Encycl Psychol. 2019. 10.1093/acrefore/9780190236557.013.129.
105. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. Physical activity and cancer. 2010:367-87. DOI: 10.1007/978-3-642-04231-7_16.
106. Hallward L, Patel N, Duncan LR. Behaviour change techniques in physical activity interventions for men with prostate cancer: A systematic review. Journal of Health Psychology. 2020;25(1):105-122. DOI: 10.1177/1359105318756501.
107. Michie S, Ashford S, Sniehotta FF, Dombrowski SU, Bishop A, French DP. A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: the CALO-RE taxonomy. Psychol Health. 2011; 26(11):1479-98. Doi: 10.1080/08870446.2010.540664.
108. Short CE, Gelder C, Binnewerg L, McIntosh M, Turnbull D. Examining the accessibility of high-quality physical activity behaviour change support freely available online for men with prostate cancer. J Cancer Surviv. 2018;12(1):10–7. DOI: 10.1007/s11764-017-0638-8.
109. Buffart LM, Kalter J, Sweegers MG, Courneya KS, Newton RU, Aaronson NK, et al. Effects and moderators of exercise on quality of life and physical function in patients with cancer: an individual patient data meta-analysis of 34 RCTs. Cancer Treat Rev. 2017;52:91–104. DOI: 10.1016/j.ctrv.2016.11.010.
110. Steele RM, Mummery WK, Dwyer T. A comparison of face-to-face or internet-delivered physical activity intervention on targeted determinants. Health Educ Behav. 2009;36(6):1051–64. DOI: 10.1177/1090198109335802.
111. Lopez C, McGarragle K, Pritlove C, Jones JM, Alibhai SMH, Lenton E, et al. Variability and limitations in home-based exercise program descriptions in oncology: a scoping review. Supportive Care in Cancer. 2020;28(9):4005-4017 DOI:10.1007/s00520-020-05453-6.

112. Culos-Reed SN, Robinson JW, Lau H, Stephenson L, Keats M, Norris S, et al. Physical activity for men receiving androgen deprivation therapy for prostate cancer: Benefits from a 16-week intervention. Support Care Cancer. 2010;18(5):591–9. DOI:10.1007/s00520-009-0694-3.
113. Livingston PM, Craike MJ, Salmon J, Courneya KS, Gaskin CJ, Fraser SF, et al. Effects of a clinician referral and exercise program for men who have completed active treatment for prostate cancer: A multicenter cluster randomized controlled trial (ENGAGE). Cancer. 2015;121(15):2646–54. DOI:10.1002/cncr.29385.
114. Winters-Stone KM, Lyons KS, Dobek J, Dieckmann NF, Bennett JA, Nail L, et al. Benefits of partnered strength training for prostate cancer survivors and spouses: results from a randomized controlled trial of the exercising together project. J Cancer Surviv. 2016;10(4):633–44. DOI: 10.1007/s11764-015-0509-0.
115. Carmack Taylor CL, Demoor C, Smith MA, Dunn AL, Basen-Engquist K, Nielsen I, et al. Active for life after cancer: a randomized trial examining a lifestyle physical activity program for prostate cancer patients. Psychooncology. 2006;15(10):847–62. DOI: 10.1002/pon.1023.
116. Grimmett C, Bradbury K, Dalton SO, Fecher-Jones I, Hoedjes M, Varkonyi-Sepp J, et al. The role of behavioral science in personalized multimodal prehabilitation in cancer. Front Psychol. 2021;12:261. DOI: 10.3389/fpsyg.2021.634223.
117. Goode AD, Lawler SP, Brakenridge CL, Reeves MM, Eakin EG. Telephone, print, and web-based interventions for physical activity, diet, and weight control among cancer survivors: a systematic review. J Cancer Surviv. 2015;9:660–82. DOI: 10.1007/s11764-015-0442-2.
118. Groen WG, van Harten WH, Vallance JK. Systematic review and meta-analysis of distance-based physical activity interventions for cancer survivors (2013–2018): we still haven’t found what we’re looking for. Cancer Treat Rev. 2018;69:188–203. DOI: 10.1016/j.ctrv.2018.07.012.
119. Vandelanotte C, Müller AM, Short CE, Hingle M, Nathan N, Williams SL, et al. Past, present, and future of eHealth and mHealth research to improve physical activity and dietary behaviors. J Nutr Educ Behav. 2016;48:219-228. DOI: 10.1016/j.jneb.2015.12.006.
120. Roberts AL, Fisher A, Smith L, Heinrich M, Potts HWW. Digital health behaviour change interventions targeting physical activity and diet in cancer survivors: a

systematic review and meta-analysis. J Cancer Surviv. 2017;11:704–19. DOI: 10.1007/s11764-017-0632-1.

121. Müller AM, Maher CA, Vandelanotte C, Hingle M, Middelweerd A, Lopez ML, et al. Physical activity, sedentary behavior, and diet-related ehealth and mhealth research: bibliometric analysis. J Med Internet Res. 2018;20(4):e122. DOI: 10.2196/jmir.8954.

122. Australian Bureau of Statistics. Use of information technology by people with disability, older people and primary carers [Internet]. Canberra: Australian Government; 2018 [cited 2021 Jun 14]. Available from: https://www.abs.gov.au/articles/use-information-technology-people-disability-older-people-and-primary-carers.

123. Drummond FJ, Reidy M, Wagner C von, Livingstone V, Drennan J, Murphy M, et al. Health literacy influences men's active and passive cancer information seeking. HLRP Heal Lit Res Pract. 2019;3(3):e147. DOI: 10.3928/24748307-20190430-01.

124. Wilson J, Heinsch M, Betts D, Booth D, Kay-Lambkin F. Barriers and facilitators to the use of e-health by older adults: a scoping review. BMC Public Health. 2021;21(1):1–12. DOI: 10.1186/s12889-021-11623-w.

125. Ghalibaf AK, Nazari E, Gholian-Aval M, Tara M. Comprehensive overview of computer-based health information tailoring: a systematic scoping review. BMJ Open. 2019;9(1):e021022. DOI: 10.1136/bmjopen-2017-021022.

126. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Development of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: OncoActive. BMC Cancer. 2017;17(1):446. DOI: 10.1186/s12885-017-3397-z.

127. Kenfield SA, Van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (Prostate 8): a pilot randomized controlled trial in men with prostate cancer. Eur Urol. 2019;75(6):950–8. DOI: 10.1016/j.eururo.2018.12.040.

128. Finlay A, Evans H, Vincent A, Wittert G, Vandelanotte C, Short CE. Optimising Web-Based Computer-Tailored Physical Activity Interventions for Prostate Cancer Survivors: A Randomised Controlled Trial Examining the Impact of Website

Architecture on User Engagement. Int J Environ Res Public Health [Internet]. 2020;17(21):7920.

129. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: Testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49. DOI: 10.1186/s12966-018-0686-0.

130. Golsteijn RHJ, Bolman C, Peels DA, Volders E, De Vries H, Lechner L. A web-based and print-based computer-tailored physical activity intervention for prostate and colorectal cancer survivors: a comparison of user characteristics and intervention use. J Med Internet Res. 2017;19(8):e29. DOI: 10.2196/jmir.7838.

131. Chan JM, van Blarigan EL, Langlais CS, Zhao S, Ramsdill JW, Daniel K, et al. Feasibility and acceptability of a remotely delivered, web-based behavioral intervention for men with prostate cancer: Four-arm randomized controlled pilot trial. J Med Internet Res. 2020;22(12):e19238. DOI: 10.2196/19238.

132. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Short-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: a randomized controlled trial. Int J Behav Nutr Phys Act. 2018;15(1):106. DOI: 10.1186/s12966-018-0734-9.

133. Corbett T, Singh K, Payne L, Bradbury K, Foster C, Watson E, et al. Understanding acceptability of and engagement with web-based interventions aiming to improve quality of life in cancer survivors: A synthesis of current research. Psycho-oncology. 2018;27:22–33. DOI: 10.1002/pon.4566.

134. Sunderji N, Angl EN, Polaha J, Gao C. Why and how to use patient-oriented research to promote translational research. Families, Systems & Health. 2019;37(1):1-9. DOI: 10.1037/fsh0000405

135. Santarossa S, Kane D, Senn CY, Woodruff SJ. Exploring the role of in-person components for online health behaviour change interventions: can a digital person-to-person component suffice? J Med Internet Res. 2018;20(4):e144. DOI: 10.2196/jmir.8480.

136. Horvath AO, Del Re AC, Flückiger C, Symonds D. Alliance in individual psychotherapy. Psychotherapy. 2011;48(1):9-16. DOI: 10.1037/a0022186.

Chapter Three

Examining the priorities, needs, and preferences of men with metastatic prostate cancer in designing a personalised eHealth exercise intervention.

Evans HE, Forbes CC, Vandelanotte C, Galvão DA, Newton RU, Wittert G, Chambers S, Kichenadasse G, Brook N, Girard D, Short CE. Examining the priorities, needs and preferences of men with metastatic prostate cancer in designing a personalised eHealth exercise intervention. International Journal of Behavioral Medicine. 2020;23:1-3. DOI:10.1007/s12529-020-09932-2.

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Overall percentage	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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ii. permission is granted for the candidate in include the publication in the thesis; and

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3.1 Abstract

Background

Few individuals with metastatic prostate cancer have access to prostate cancer-specific exercise support, despite demonstrated benefits. eHealth tools, such as websites, may be viable options for increasing access. To be effective and acceptable, future eHealth websites need to consider end-users' perspectives, capacity and needs. We aim to provide insight into these factors by exploring daily priorities, activities and health literacy of individuals with metastatic prostate cancer and their perspectives towards exercise and exercise-based web-based eHealth interventions.

Methods

Semi-structured interviews explored participant's experiences and understanding of their disease, exercise levels, advice received from health care providers, as well as acceptability of and suggested content for an eHealth tool. A thematic analysis was undertaken.

Results

Interviews were conducted with eighteen Australians (55–83 years; M = 71.5, SD = 8.9) living with metastatic prostate cancer. Needing to perform daily responsibilities was a key priority. Participants had limited understanding of the benefits of prostate cancer-specific exercise, and less than half discussed exercise with their health team. Fourteen men felt they could report metastases location, but only four could provide detailed information, which has clinical implications for exercise prescription. A potential web-based intervention was considered acceptable by seventeen men for reasons such as affordability, accessibility and convenience. User-friendly design and practitioner support were important.

Conclusions

Results identified key aspects useful for person-centred design of exercise programs. Participants were positive towards the proposed web-based tool and expressed the need for individualised, user-friendly and reliable information with support from a professional embedded. Lastly, not all participants could accurately report metastasis locations.

3.2 Introduction

The estimated 5-year survival rate for men with metastatic prostate cancer is 30–46% (1-2). Consequently, these individuals live with considerable burden from the disease, life-prolonging treatments and any co-existing chronic health conditions. Reduced physical functioning, sarcopenia, increased adiposity, fatigue and osteoporosis are all commonplace, as well as an increased risk of comorbidities and psychological issues such as depression and anxiety (3, 4). Targeting the long-term ramifications of metastatic prostate cancer and its treatment is vital to enhance daily functioning, quality of life, and preserve health outcomes among survivors (5-7).

Tailored exercise interventions have the potential to moderate the known sequelae in metastatic prostate cancer, when completed appropriately (6, 8). Current recommendations are that the exercise prescription should be designed so as to adequately overload the cardiorespiratory, neural and musculoskeletal systems while avoiding high forces and in particular impact loading at sites of bone metastatic lesions (8, 9). However, despite the benefit of exercise, most individuals do not engage in sufficient exercise (10). A qualitative investigation reported a myriad of barriers linked to supervised exercise (11). Embarrassment around hot flushes, lack of suitable facilities (rural living), finances and a high level of medical commitments were all linked to reduced exercise adherence and participation (11). Furthermore, many individuals were unsure of what exercise is appropriate post bone metastases diagnosis (11).

Exercise interventions that can be delivered off-site, such as web-based programs, offer an alternative to address the current barriers to exercise reported in individuals with metastatic prostate cancer. In comparison with on-site interventions, distance-based interventions may reduce expense, time limitations, location constraints and overall burden (12-14). As such, it is not surprising that older adults are interested in using distance-based options (15). It is important to note that the current evidence-base demonstrates that distant-based interventions, which are typically unsupervised, are not as effective as supervised face-to-face programs in individuals with cancer (16). A meta-analysis by Buffart et al. showed significantly larger effect sizes in physical functioning and quality of life among studies comparing supervised exercise interventions to controls than studies comparing unsupervised exercise interventions to controls (16).

Preliminary, eHealth research in other chronic disease populations suggest that web-based interventions that offer personalised advice through the use of computer tailoring (adjusting intervention materials to the specific characteristics of an individual person through a computerized process) and additional support services such as telehealth consultations may ensure appropriate exercise prescription and improve exercise adherence, when compared with traditional static home programs (14, 17, 18). Additions such as these may advance current distance-based programs for cancer patients/survivors.

The success of eHealth interventions depends on good use of technology, high-quality content and patients' acceptance of and adherence to the intervention (18-19). Involving patients in the development process is essential for effective eHealth interventions (17). At present, insight into the lived experiences and current daily responsibilities of men with metastatic prostate cancer is preliminary and should continue to be explored (7). In addition, it is important to develop a clearer understanding of their knowledge and attitudes towards exercise and digital health interventions (17). For example, it is currently unclear if men with metastatic cancer can provide the medical information necessary to ensure exercise can be prescribed safely. Qualitative research may provide the best methodology to explore these factors in further detail.

The aims of this study were to qualitatively explore among individuals living with metastatic prostate cancer: [1] life priorities and daily activities; [2] whether individuals in this population can accurately describe location and extent of metastases to help ensure safety of exercise prescriptions; and [3] acceptability, needs and preferences towards exercise and a web-based tailored exercise intervention. The findings are expected to be useful for researchers and practitioners interested in providing exercise support to individuals with metastatic prostate cancer, primarily via Internet-based technology or other distance-based means.

3.3 Methods

3.3.1 Study Design

A qualitative study involving semi-structured interviews is analysed using an inductive thematic analysis approach (20).

3.3.2 Participants and Recruitment

Men living with metastatic prostate cancer, who had phone and Internet access, could speak fluently in English, and who reported feeling well enough and willing to engage in some form of aerobic, strength or flexibility exercise for five minutes or more were eligible to participate.

Participants were recruited using convenience-sampling methods within Australia between October 2017 and March 2018, including advertising the study via intermediaries (support groups, urologists, nurses, Freemasons Foundation Centre for Men's Health) and social media posts/advertisements (Appendix 2~~Appendix 2~~). If potential participants were interested, they contacted researchers for more information and were screened for eligibility (based on self-report). Recruitment occurred on a rolling basis until data saturation occurred. In total, 19 people gave informed consent to participate in the study; however, one was excluded at the time of interview as it was confirmed he was diagnosed with non-metastatic prostate cancer.

3.3.3. Procedure

Semi-structured interviews, either via telephone (n=17) or face to face at the South Australian Health and Medical Research Institute (n=1), were conducted, recorded and transcribed verbatim. Participants were interviewed individually, except for one gentleman who chose to include his partner (n=1). The interviews were conducted by one of two female researchers (CES, HJ) with postgraduate training in behavioural sciences and were currently working as an early career fellow and research assistant, respectively. There were no previous relationships between interviewers and participants prior to study commencement. The median interview duration was 43.1 min (range = 26.4–84.3 min, SD = 15.8 min). The interview schedule (Table 2), designed to collect information relating to each study aim, was informed by both clinical experience and current literature and pilot tested by HJ (7, 11, 20). To address objective two, as well as asking more open-ended questions, feedback on potential intervention content based on behaviour change theories of interest (e.g., social cognitive theory, habit theory, self-determination theory (21-24) was also sought. No field notes were taken during interviews, and there were no repeat interviews.

Table 2. Semi-structured interview questions.

Focus Area	Sample Questions
Daily activities questions	1. Can you walk me through what an average week looks like for you? 2. What things would you say are most important to you at the moment?
Medical questions	1. When were you diagnosed with metastatic prostate cancer? 2. Can you describe the extent and location of your metastases? 3. Do you have any other health issues?
General exercise questions	1. Can you tell me a little bit about what you are doing in terms of exercise at the moment? 2. Has anyone ever recommended exercise to you as part of your care plan for prostate cancer? a. For people not exercising: Would you be confident to start exercising if you wanted to? Why? What don't you know or what do you need? b. For people exercising: What got you started? Is there anything you have trouble with? Or anything you would like help with?
Potential eHealth tool questions	Our research team is designing a website that will help men learn about exercise benefits, what exercises are safe and appropriate, and how to exercise in a way that is likely to lead to physical functioning and quality of life gains. 1. What is your honest opinion about having this kind of resource available? 2. What are the positives and negatives of this type of resource? 3. At the moment, we have seven modules that we think might be of interest. 4. If I read each one to you, are you happy to provide some feedback on each one? (Benefits of exercise; exercise safety; your tailored exercise program; incidental exercise; activity tracking; healthy lifestyle; other support resources) 5. Are there other topics you would like more information on?

Ethical approval for this study was obtained from the University of Adelaide Ethics Committee on Research involving Humans ID #2017-174 (Appendix 3~~Appendix 3~~). The consolidated criteria for reporting qualitative research (COREQ) have been followed to ensure comprehensive and transparent reporting of this qualitative study.

3.3.4 Data Analysis

Data was analysed using an inductive thematic analysis approach (20). This approach is data-driven and involves becoming familiar with the data, developing codes and iteratively revising so that themes better fit the data. All transcripts were read using line by line coding by a single researcher (HE), and preliminary themes were derived from the data using Microsoft Excel software. Transcripts were not returned to participants for comments. Overlapping data or un-coded data were re-analysed to ensure all relevant information had been considered and included for analysis. The researcher (HE) discussed the data on an ongoing basis with a senior researcher (CES), including illustrative quotes for each suggested theme. A third researcher (LJ) independently coded one-third of the transcripts and also generated a coding scheme. Based on this process, the data was continually revised and refined for each theme, and subthemes were organised. Coders had exercise physiology (HE), behavioural science (CES) and public health (LJ) backgrounds with a wide range of experience from 2 to 10 years working in research.

3.4 Results

3.4.1 Sample Characteristics

A total of eighteen men diagnosed with metastatic prostate cancer were included in the study. Participants were aged 55 to 83 years (M = 71.5, SD = 8.9) and reported a median of 4.0 years (range = 1–13 years, SD = 3.2) since metastatic prostate cancer diagnosis. Most participants were located in a major city, except for two participants who were from regional areas and two from remote areas. Four participants considered themselves sedentary. Nine participants self-reported completing at least 150 minutes of moderate aerobic exercise as per general public health guidelines (25) and five completed light incidental activity such as walking the dog. Only four of the eighteen participants completed resistance training of any form.

Internet usage in this sample was relatively high with fourteen participants accessing the Internet at least once per day and two participants accessing the Internet at least once per week. One participant chose not to specify his Internet use, and another reported to not use the Internet. Common activities included researching prostate cancer information/forums, email, news, banking, communication with friends and family and work-related purposes. A majority of participants use a desktop or laptop computer, while some also access the Internet on their tablets or phones.

3.4.2 Summary of Themes

The data from the qualitative interviews were organised into four key themes comprising eight subthemes, as illustrated in Figure 7. The first theme reflected participant's perspectives of their current priorities in life. The second and third themes captured aspects of participant's current disease-specific health literacy and what influenced their adherence to exercise, respectively. Finally, the fourth theme discussed thoughts regarding the use of an eHealth tool for exercise-based cancer care. Quotations presented reflect the themes that were derived and were chosen because they illustrated the typical insights that participants offered during interviews.

Theme 1: Current Priorities in Life

Participants commonly reported that despite having metastatic prostate cancer, their life priorities centred around them being well enough to spend time with loved ones, completing activities they valued and performing their day-to-day responsibilities as best they could. Only three men listed exercise specifically as a priority. Their life priorities were categorised broadly into two sub-themes:

Loved Ones: Time and Support

Nine participants reported that their primary priority in life focused on looking after family members, specifically partners and children.

> *"Most important things are all my partners health problems... She's looking out for me, and I'm looking out for her." (ID13, 66yo, inner regional, 2 yrs post-diagnosis)*

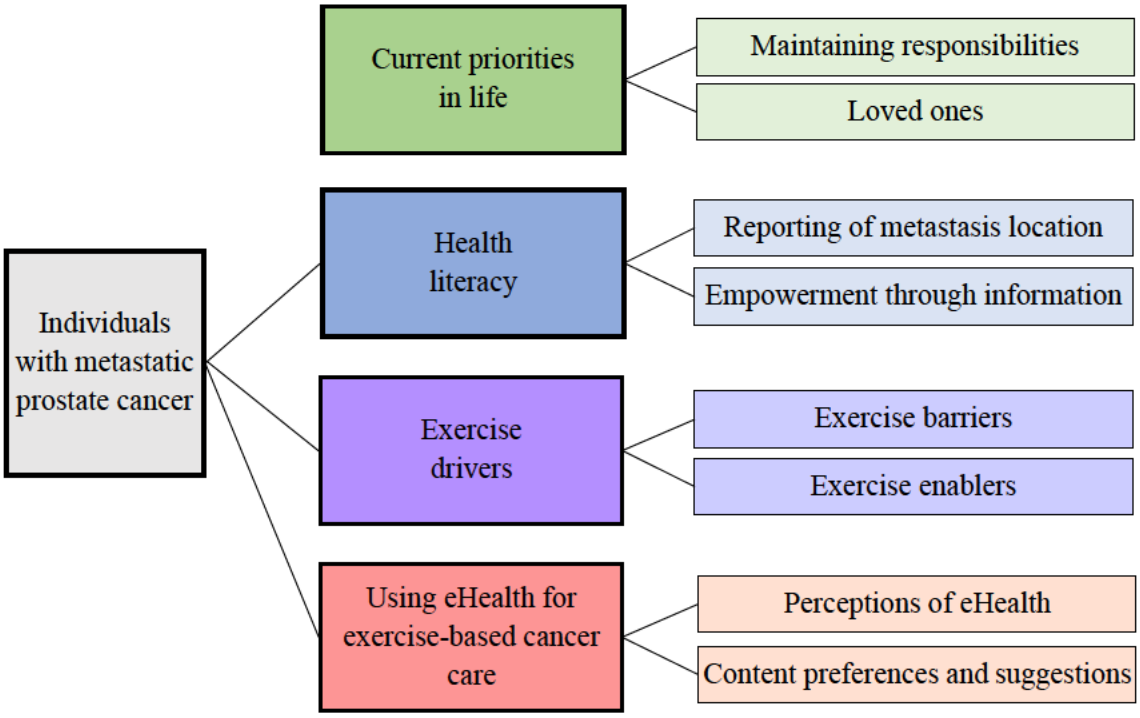

Figure 7. Summary of study themes and subthemes.

Consistent with this theme, participants spoke about the importance of spending time with loved ones. This included regular family gatherings, socialising with close friends, and helping to raise children and grandchildren,

> *"I'd love to spend some quality time with the family before, um, you know, before I passed, so to speak." (ID12, 52 years old, major city, 1 year post-diagnosis)*
>
> *"We have small grandchildren, we look after them at least one day a week." (ID05, 62 years old, major city, 7 years post-diagnosis)*

Two participants spoke of relocating interstate to spend time with families, and another spoke of the importance of research and better treatments to improve life expectancy, which was valued for the extra time it gives with loved ones and to be around for significant life events.

> *"That's the reason we moved from new south wales to Queensland because of the grandchildren… we are going to be living 1.5kms away, so we will see them quite regularly." (ID11, 71 years old, major city, 6 years post-diagnosis)*

Maintaining Responsibilities

A majority of participants spoke about the necessity to continue to complete their daily responsibilities even though they had been diagnosed with metastatic prostate cancer. Despite reporting multitude of side effects including muscular weakness, fatigue, hot flushes and incontinence, fourteen participants spoke of the importance of completing physical domestic tasks within the household such as gardening (lawn mowing, weeding and lifting heavy objects), house cleaning and repairing objects.

> *"I live by myself, so I have a house to keep, and a big backyard with a lot of grass, which gotta be mowed. (ID01, 72 years old, major city, 2 years post-diagnosis)"*

It was important to note that only two participants discussed the effects of their disease and or treatment on their ability to complete their household tasks.

> *"I do everything I have to do around here (home). Sometimes it takes a bit longer than it used to, but I get it done." (ID02, 82 years old, major city, 1 year post-diagnosis)*

The two youngest participants (≤ 60 years old) discussed the necessity to continue working even after diagnosis.

> *"I can't just sort of sit in the corner in a fetal position and rock around doing nothing. You know, you've still got to work… You've still got responsibilities... So, as much as it does affect you mentally, you know you've still got to try and push through and do what you need to do." (ID12, 52 years old, major city, 1 year post-diagnosis)*

Overall, it seemed that staying engaged in daily responsibilities for as long as possible was a priority among most participants.

Theme 2: Health Literacy

The theme of health literacy refers to the participants understanding of their health condition, especially relating to their beliefs around cancer-related health education and their understanding of their metastases location(s).

Empowerment Through Information

A theme of empowerment resulting from an understanding of their condition and possible treatment options was evident from many of the participants.

> *"Um, because the more knowledge I knew, the more informed I was, I don't know, the… less anxious, I was." (ID13, 66 years old, 2 years post-diagnosis)*

Almost half of the participants (n=8) spoke of wanting a proactive role in their health care. It was clear that some participants spent time reading medical literature and used that information to have direct and critical discussions with their health care team.

> *"I listen to his advice and he also listens to my advice…. So you know we can have a very good discussion, so I do not feel I am in the dark." (ID07, 55 years old, inner remote, 5 years post-diagnosis)*

Searching the Internet was seen as useful, but some participants (n=3) found the information unreliable and were unsure where to find appropriate information.

> *"If you go on a website which is related to this complaint, all you hear is people moaning and criticizing doctors, and misdiagnosing themselves. I don't do that anymore. I don't Google nothing. See you get a lot of misinformation on there and people who don't know what they're talking about." (ID01, 72 years old, major city, 2 years post-diagnosis)*

Reporting of Metastases Location/Extent

While most participants had some idea of the location of their metastases (n=14), the level of detail provided when prompted was mixed. Some participants (n=4) had looked at their scans and felt able to interpret them to help identify metastasis location and extent.

> *"I feel pretty confident I could explain that to you. I did a lot of reading when I was first diagnosed... Anyway, I learnt how they (scans) work, how to read them." (ID07, 55 years old, inner remote, 5 years post-diagnosis)*

Whereas others reported having more of a "rough" idea. Only half of the participants felt they could describe the extent of their metastases, but once again, the level of detail was decidedly mixed.

> *"They (specialists) confirmed that a couple of small spots had got to my bones, and one in the ribs I think, somewhere, probably, I think they said in the head? I know bugger all about this." (ID01, 72 years old, major city, 2 years post-diagnosis)*

Theme 3: Exercise Drivers

Participants within this study identified several exercise drivers. They were broken up into two subthemes: barriers and enablers.

Exercise Barriers

The participants identified several barriers to exercise, with finances being the most common.

> *"The trouble is it (supervised exercise physiology sessions) costs maybe $60 an hour every time. A dollar a minute… I couldn't quite keep up with the expense of it." (ID02, 82 years old, major city, 1 year post-diagnosis)*

Other barriers included a dislike of gyms, boredom and motivation post-diagnosis.

> *"I have never been that keen on gyms." (ID08, 73 years old, major city, 1 year post-diagnosis)*
>
> *"After my prostate I did lapse into a time of non-physical activity. I put on a lot of weight, and I felt like I was dying so I said no (to exercise)." (ID13, 66 years old, inner regional, 2 years post-diagnosis)*

Exercise Enablers

Participants identified several facilitators to their exercise. Social support was essential to many of the participants (n=10), especially family and peer support.

> *"My son actually helped me …he would say are you going for a walk today and I would say I can hardly get up and he would say you don't have to walk too far, walk to the end of the street, even to the letterbox and back." (ID07, 55 years old, inner remote, 5 years post-diagnosis)*

Another enabler included the understanding of the benefits of exercise for individuals with prostate cancer (n=5).

> *"The thing that I am driven by is the information given to me is that cancer does not like living in an oxygenated environment and also I wanted to get myself fit basically be able to come through the treatment fairly well and to manage the treatment fairly well." (ID15, 60 years old, major city, 7 years post-diagnosis)*

Interestingly, eight out of eighteen participants had a physician discuss exercise with them, and of those, seven participants currently completed structured aerobic training and four undertook resistance training. Only three participants (out of 10) completed moderate exercise without a physician's recommendation.

Theme 4: Using eHealth for Exercise-Based Cancer Care

In general, participants expressed positive attitudes to eHealth interventions (n=17) but did note some potential limitations. When asked about specific feature options, participants expressed a preference of including both educational and interactive features to improve individuals' knowledge, self-efficacy and skills. Findings are summarised in more detail below via subthemes.

Perceptions of eHealth

Several positives of distance-based eHealth services were identified. Many participants felt like they could complete their exercise in their own time at a location of their choosing.

> *"I don't want to be spending my life going down to the gym every second day. If I could do something at home, if the Internet was gonna, you know, give me some advice on some exercise then that's what I'd be doing." (ID01, 72 years old, major city, 2 years post-diagnosis)*

It was also seen as highly advantageous that the online nature meant they could digest the personalised information in their own time as well as easily refer back to information when needed.

> *"The benefit is well that I could do it right now. You can do it anywhere. You can do it if you are on holidays, you can access it anywhere." (ID07 55 years old, inner remote, 5 years post-diagnosis)*
>
> *"You could use it as a tool to refer back too." (ID11, 71 years old, major city, 6 years post-diagnosis)*

Many participants discussed the potential affordability of an eHealth resource in comparison to an on-site intervention. Some participants did not deem paying for exercise to be worthwhile, while others stopped exercising with an exercise physiologist once they ran out of private health cover or Medicare sessions.

"A few years ago I did actually go to see an exercise physiologist for ten or twelve weeks, but it got a bit expensive." (ID07 55 years old, inner remote, 5 years post-diagnosis)

Despite the acceptability of the personalised eHealth tool, the participants proposed some limitations about using the Internet to source exercise advice. Computer literacy was perceived as the main limitation, with over half believing it may limit who would choose to adopt the program (n=10). As one participant explained,

"A lot of older folk ... are not that tech-savvy. So that you might be missing out on getting to a proportion of the target group... who are in the upper age range." (ID05, 62 years old, major city, 7 years post-diagnosis)

Lack of adherence due to limited supervision and support was another concern noted (n=5).

"It requires self-motivation like anything that you can do yourself. It worked when I went to see an exercise therapist; he would say see you next Tuesday, and you would have to turn up." (ID04, 64 years old, very remote, 2 years post-diagnosis)

Content Preferences and Suggestions

The majority of the participants were very interested in educational material regarding the benefits of exercise. Currently, most participants are given general exercise information but minimal to no specific information concerning prostate cancer, let alone metastatic prostate cancer (n=8).

"I think it would be good (exercise education). I'm just trying to think back, you read stuff in books that you were given when you were diagnosed, and you see exercise, but I don't think it explains in laymen terms the real benefits of exercise." (ID19, 72 years old, inner regional, 9 years post-diagnosis)

'Specialists tend to deal with their specialty and say that an exercise program is really good, but they do not offer you anything else apart from that so I think that (personalised exercise program) it would be a damn good idea." (ID15, 60 years old, major city, 7 years post-diagnosis)

Participants felt that the information needed to be credible and relevant to find it motivating (n=6). Participants placed high importance on safety education, especially given the disease-specific concerns.

> *"Yes that (information) would be very good because I am aware that with that spinal-metastases there is a risk of fracture." (ID17, 63 years old, major city, 4 years post-diagnosis)*

Five participants discussed a fear of overexertion; specifically, two participants mentioned the use of education as a means of preventing "going over the top" and injuring themselves.

> *"We need to know what exercises are safe to do because we don't want people overexerting themselves and ending up with a heart attack." (ID16, 83 years old, major city, 1 year post-diagnosis)*

Over half the participants (n=13) were interested in receiving additional lifestyle-specific education which specifically relate to prostate cancer. Sleep (n=7), diet (n=7), alcohol (n=1) and mental health (n=1) information were the main concerns discussed, with some participants (n=5) believing that exercise and other healthy life choices go hand in hand. In addition, one participant contended that information would not be useful if it was not specific, practical and evidence-based.

> *"Well, if it's like a throwaway line… you know, eat in moderation… Um, it's probably not of great use… you know I think it's useful if we can get a little bit of science in there." (ID09, 67 years old, major city, 5 years post-diagnosis)*

There was overwhelming support for tailored exercise prescription (n=18). Many participants were aware that they should be exercising but not sure where to start.

> *"It is very hard to know what you should be aiming for. How much exercise you should be doing? What sort of exercises you should be doing? I know that with androgen deprivation I should be doing weight gain exercise but I struggle to know what weight gaining exercise is." (ID07 55 years old, inner remote, 5 years post-diagnosis)*

Over half of the participants (n=11) highlighted the importance of personalisation.

“Everybody’s different, so, one that takes into account my particular problems would be excellent I would think.” (ID10, 82 years old, major city, unknown)

Participants also believed that tailoring might reduce the risk of injury and increase both confidence and adherence but to have credibility, programming needed to be created by experts.

“I think it would be good if it’s done by experts.” (ID18, 80 years old, major city, 5 years post-diagnosis)

Four participants added that local resources are incredibly important, and at least two participants mentioned that they recently moved so having access to local resources is valuable. Participants liked the idea of information for local walking groups, cancer council resources and support groups, but the information needed to be user-friendly and detailed. Interestingly, one participant located in a very remote region felt like it would not be useful.

“It wouldn’t be useful to me, because I’m out of touch here, because I’m too far away from most people….I live in a town with 9,000 people, we don’t have too much of that (local resources).” (ID04, 64 years old, very remote, 2 years post-diagnosis)

Participants were also questioned regarding other forms of exercise education; approximately half reported that information on incidental activity would be useful, while the other half were not interested and did not believe it should be a stand-alone module.

“... I think it’s important to encourage people to, as you say, to look for opportunities, and not to say, ‘Okay, I’m gonna sit back and rest until I turn into an Olympic athlete...’ but rather to look for the small opportunities to be active.” (ID05, 62 years old, major city, 7 years post-diagnosis)

“Well, it might be helpful for somebody that’s, that’s passive and sits down all day… But, I do all those (incidental activity) things.” (ID16, 83 years old, major city, 1 year post-diagnosis)

When prompted, participants specifically discussed the importance of tracking tools to improve adherence to exercise (n=12). Tracking included objective measures such as distance, steps and heart rate and recording what exercise was completed.

> *"You got to see your results. You… have to see your improvement and when you see that improvement, you're now might be little by little, I think it gives you more incentive." (ID13, 66 years old, inner regional, 2 years post-diagnosis)*

One man believed this would also improve load management and overall safety.

> *"I think it is a good idea to know what you are doing, having some sort of results to see that you are not over-doing it." (ID06, 72 years old, inner regional, 6 years post-diagnosis)*

Personalised feedback and rewards were also discussed to increase accountability.

> *"Keeping track of trends even to the extent of getting an elephant stamp when you are doing well. That sounds trite, but you do not grow out of… when you are no longer a primary school kid." (ID14, 76 years old, major city, 13 years post-diagnosis)*

Many of the participants (n=7) believed that linking the program to wearable technology like Fitbit would help increase motivation.

> *"I do tend to keep track of my steps, because it is very good self-motivation, when I think I have not done much exercise and you look down and it says you have done 10,000 steps so you go ok… that can be motivating… Equally, if you are not very active, it is a kick up the bum to say you have not done anything." (ID07, 55 years old, inner remote, 5 years post-diagnosis)*

However, one man mentioned that they would not use wearable technology because it was "gimmicky" and another believed older adults might struggle with the technology.

Structure Preferences and Suggestions

When questioned about how they would like to see the information presented, participants expressed mixed views regarding intervention delivery structure. Out of the sample population, eight participants wanted the intervention to be tunnelled (predetermined chronology of content), seven wanted free choice (all information accessible) and two were flexible. Participants had concerns about information overload and a lack of engagement or adherence in free choice methods, *"Knowing my own mental capabilities, if you get too much information you read a little bit and put it down. Uh, I think feeding men information in short amounts is a good idea." (ID16, 83 years old, major city, 1 year post-diagnosis)*

Alternatively, within the tunnelled approach, participants felt they would not be able to the browse information in their own time or access information which may be deemed as most valuable to them.

"I think put it all up there and then whatever they want to look at then they could do that." (ID17, 63 year old, major city, 4 years post-diagnosis)

"I think it's probably better to have it all up there at once...Then they can see what's in it, and what they can get out of it. (ID04, 64 years old, very remote, 2 years post-diagnosis)

To combat adherence and uptake issues, two participants suggested monitoring may encourage adherence to the program; one individual stated that:

"I think that keeping a commitment on the part of the individual in continuing to take action even if it is as simple a thing as logging in, recording progress and maybe while logged in getting some questions answered." (ID15, 76 years old, major city, 7 years post-diagnosis)

Another two participants wanted an addition of telehealth consultations to add an extra line of individualised support.

"Maybe you'd want to every four or six weeks or whatever, that someone would touch base with the individual and sort of see how you're getting on." (ID12, 52 years old, major city, 1 year post-diagnosis)

Prompts to remind participants to exercise were another suggestion to aid accountability.

"If (the website) sort of prompts me to keep doing it (exercise) and to keep doing it properly, then I think it's a good idea…I can get a bit slack sometimes." (ID10, 82 years old, major city, unknown)

Lastly having the ability to watch exercise videos and also print out educational and exercise materials was also seen as an option to help improve adherence.

"I would prefer to have it in writing… It's easier if I have it written down. Also my wife gets to do it with me and I'd prefer doing it in a room with a bit of space." (ID10, 82 years old, major city, unknown)

3.5 Discussion

The present study explored the life priorities and daily activities of individuals with metastatic prostate cancer, whether those individuals were able to accurately describe the location of metastases and their acceptability, perceptions and preferences towards a potential eHealth web-based exercise intervention.

Maintaining daily responsibilities such as physical household work and spending time with loved ones were the two most prominent priorities for participants. This finding was similar to well-being focused research by Levy and Cartwright (26) who found that individuals with advanced prostate cancer tended to prioritise activities that reinforced their "sense of self" and allowed them to stay in the present including completing their typical daily activities, existing hobbies and looking after family and friends (26). Designing exercise programming in a way that acknowledges these priorities may help to boost acceptability and program adherence. This could be achieved in numerous ways, including involving family and friends in the exercise program. Previous research in prostate cancer has shown that involving partners who are supportive of healthy lifestyles can increase participation in supportive care interventions (27). It may also be possible to enhance the perceived relevance of exercise, by linking exercise with improvements in ability to complete household tasks and capacity to spend time with loved ones. This may also lead to more intrinsic motivation to exercise, which has been associated with successful exercise maintenance (28). Based on self-determination theory, intrinsic motivation is more likely when exercise interventions tap into what is meaningful and enjoyable and provides opportunities for competence, autonomy and relatedness (28).

Current results show approximately half of the participants were confident in reporting metastasis location, but the level of detail was mixed. Santarossa et al. (2018) found that increasing age was linked with inability to correctly identify the site or stage of cancer (29). Given current exercise prescription for men with metastatic prostate cancer is based on avoidance of loading metastatic lesions, incorrect metastasis location reporting could lead to exercise prescription which increases compressive and shear loads on compromised bones (8, 9, 30). Practically, exercise interventions may need to provide added measures to confirm metastasis specifics, for example, confirmation with a physician.

Interestingly, the study participants were also unsure of the appropriate dosages of exercise, concerned about overexertion and were rarely given individualised exercise advice. All of which may lead to increased risk of injury or alternatively, a lack of appropriate volume or intensity needed to create improvements in physical function. A qualitative study by Sutton et al. found that prostate cancer-specific health care professionals routinely offered cancer-specific physical activity leaflets or linked prostate cancer patients in with physical activity education sessions (31). However, health professionals rarely felt capable of providing individualised exercise advice (31). The recently updated Australian and American exercise in cancer population guidelines state that exercise prescription should be targeted and individualised (30, 32-33). Additionally, individuals with metastatic prostate cancer may require ongoing opportunities to access disease-specific individualised exercise education and support as the disease evolves, metastases increase or reduce in size and treatments vary.

Most participants responded favourably to using a web-based tool to seek exercise prescription and lifestyle advice. Only one participant found online advice unlikely to be helpful. The distance-based alternative to supervised exercise was seen as advantageous to the participants to gain knowledge, individual exercise prescriptions and support in one location and counter some of their barriers to supervised exercise such as affordability, accessibility and a dislike of gym environments. These results are in line with Sheill et al. (2017) and Mikkelsen et al. (2019) who also found symptoms of the disease and treatment, low confidence as well as generic barriers to exercise (bad weather, lack of support) affected exercise levels (11, 34). While the online nature of an eHealth website was seen as advantageous to participants as it would allow individuals to digest credible, up-to-date, disease-specific information in a self-paced manner, commonly reported issues linked with eHealth interventions for older adults such as computer literacy and issues relating to adherence were raised (35).

Within the current study, participants reported that support from family and health professionals has been crucial in continuing or beginning exercise post-diagnosis. As such, the inclusion of support-based features may be advantageous to adherence to an eHealth intervention for individuals with metastatic prostate cancer thanks to increased personalisation, relatedness and credibility (29, 36). Support can come in many forms, including feedback (i.e. activity trackers), social support, health professional support and automated reminders. Kenfield et al. found that while activity trackers were useful in increasing moderate-intensity exercise in individuals with prostate cancer, additional support mechanisms were needed to improve levels of vigorous activity (12). As noted above, implementing methods within interventions to provide social support, especially from loved ones, may aid motivation to exercise and increase enjoyment in individuals with metastatic prostate cancer (31). Qualitative data from two cancer-related fatigue eHealth studies also suggested the need for face to face or telephone contact (37-38). However, the benefit would need to be balanced against the cost of delivery. One participant considered one-on-one communication with a health professional every 4 weeks would be a suitable level of contact. Gogovor et al. reported that even minimal amount of personal contact (phone/email) could improve adherence, especially if tailored to individual preference (39). Future studies may be necessary to evaluate or refine different models of delivery in this population. Non-inferiority trials are also needed to compare cost and effectiveness with traditional face-to-face interventions.

Participants considered that computer literacy may be an important determinant of effective engagement. Previous research has shown that age, race and social-economic status impacts health-related technology use. For example, technological confidence is a significant barrier in adults over 65 when compared with younger generations (35, 40). Awareness of those who are less likely to access eHealth tools is important for service planning in an attempt to avoid widening the gap. Ensuring an intervention is easy to use will also reduce the effect computer literacy has on intervention success (41). Previous research highlights the importance of a simple interface, easy to understand language, meaningful information and the ability also to supply printable options if needed (41-43). There is also potential to engage computer literate members from the patient's support team (family, friends) to provide technical support as well as creating easily accessible troubleshooting options through the website. Golsteijn et al. found that providing print-based materials was advantageous in prostate and colon cancer populations but would increase intervention cost, so therefore, adding the ability to print through the website may be a suitable option (44). Lastly, usability and feasibility testing have been included in many eHealth interventions to further ensure the design is acceptable and user-friendly (45-48). Developers should ensure that users with lower computer literacy are involved in these quality improvement activities.

There was no consensus regarding the preferred structure of content delivery. Tunnelled interventions, which deliver information step by step, may reduce information overload and confusion (49). On the other hand, free choice provides instant access to all content to allow participants to explore what is of most importance to the individual (17). The danger with tunnelled interventions is that individuals may never get to the end of the intervention and therefore have overall less exposure to content, as compared with interventions where they are given all at once. There is some evidence from Wootten et al. for greater receptivity to a flexible structure when using an online eHealth psychological intervention (50). Further to this, given the importance of both prescription and safety, it may be valuable to allow participants to access what content they deem most important. In practical terms, this may not be a problem since Crutzen and colleagues found that the "idea of choice" was more important to participants than actual choice (49).

Study limitations should be acknowledged. First, a majority of the study participants were married men living in metropolitan areas of Australia. As such, some important perspectives (e.g. those living in rural and remote areas) may not be fully captured or explored. However, it should be noted that participants were varied in age and physical activity levels. Extensive demographic data was not collected (such as education or socio-economic status) and cannot be reported. Second, researchers were also not able to objectively confirm accuracy of participants' metastasis location and extent reporting. It is possible that some locations may have been missed when self-reported. Due to eligibility criteria, results may not apply to culturally and linguistically diverse populations. Further to this, participants were required to have Internet access to participate and reported relatively high usage, which may limit generalizability of findings. This may be particularly true for those who have low IT literacy levels, as most adults (89%) do have access to the Internet in our research setting; however, 26% of older adults report low IT literacy (51). Future research should explore design needs in different populations such as those who are linguistically diverse and those with internet access but low IT literacy. Finally, participants were only given a verbal explanation of the proposed web-based eHealth tool, which may have made it difficult to understand the design-based questions and suggested content. Certain aspects may be different for other modalities, like mobile phone-based interventions.

3.6 Conclusion and directions for future research

This study has enhanced the understanding of the perspectives of individuals with metastatic prostate cancer in regards to their priorities, daily activities and aspects of their disease-specific health literacy. This in turn provides user-centred information about how an eHealth website would need to fit within their life priorities, down to the features they need and prefer. Many individuals with metastatic prostate cancer were positive about a distance-based eHealth web-based intervention. Reliable health information was deemed as empowering and maintaining function to meet daily responsibilities, and spending time with loved ones was important. Individual's inability to report metastasis location and extent may impact the safety of exercise in this population, suggesting the need for physician input to inform exercise prescription. Lastly, eHealth interventions designed for this population would need to be user-friendly and intuitive to account for possible low levels of computer literacy and have some level of supervision and support embedded to aid adherence. Information within the tool would need to be reliable, individually relevant and aimed at all levels of health literacy. Future research is required to develop and evaluate a prototype of the tool to better investigate usability, design and information preferences, as well as determining with greater reliability the ability for individuals with metastatic prostate cancer to accurately self-report health information important for tailoring eHealth interventions.

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

3.7 References

1. Luo Q, Yu XQ, Smith DP, O'Connell DL. A population-based study of progression to metastatic prostate cancer in Australia. Cancer Epidemiol. 2015;39:617–22.
2. Berg KD, Thomsen FB, Mikkelsen MK, Ingimarsdóttir IJ, Hansen RB, Kejs AMT, et al. Improved survival for patients with de novo metastatic prostate cancer in the last 20 years. Eur J Cancer. 2017;72:20–7.
3. Resnick MJ, Penson DF. Quality of life with advanced metastatic prostate cancer. Urol Clin. 2018;39:505–15.
4. Coleman RE. Clinical features of metastatic bone disease and risk of skeletal morbidity. Clin Cancer Res. 2006;12:6243s.
5. Sheill G, Guinan EM, Peat N, Hussey J. Considerations for exercise prescription in patients with bone metastases: a comprehensive narrative review. PM&R. 2018;10(8):843–64.
6. Sartor O, Flood E, Beusterien K, Park J, Webb I, MacLean D, et al. Health-related quality of life in advanced prostate cancer and its treatments: biochemical failure and metastatic disease populations. Clin Genitourin Cancer. 2015;13:101–12.
7. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8:e019917.
8. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50:393–9.
9. Newton RU, Kenfield SA, Hart NH, Chan JM, Courneya KS, Catto J, et al. Intense exercise for survival among men with metastatic castrate-resistant prostate cancer (INTERVAL-GAP4): a multicentre, randomised, controlled phase III study protocol. BMJ Open. 2018;8:e022899.
10. Galvão DA, Newton RU, Gardiner RA, Girgis A, Lepore SJ, Stiller A, et al. Compliance to exercise-oncology guidelines in prostate cancer survivors and associations with psychological distress, unmet supportive care needs, and quality of life. Psychooncology. 2015;24:1241–9.

11. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: A qualitative exploration. Support Care Cancer. 2017;26(6):1747–54.
12. Kenfield SA, Van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (Prostate 8): a pilot randomized controlled trial in men with prostate cancer. Eur Urol. 2019;75:950–8.
13. Forbes CC, Finlay A, McIntosh M, Siddiquee S, Short CE. A systematic review of the feasibility, acceptability, and efficacy of online supportive care interventions targeting men with a history of prostate cancer. J Cancer Surviv. 2019;13(1):75–96.
14. Short C, Trinh L, James E. Effective technology-based behaviour change interventions in prostate cancer supportive care: are we there yet? Eur Urol. 2019;75(6):959–60.
15. Vandelanotte C, Caperchione CM, Ellison M, George ES, Maeder A, Kolt GS, et al. What kinds of website and mobile phone-delivered physical activity and nutrition interventions do middle-aged men want? J Health Commun. 2013;18:1070–83.
16. Buffart LM, Kalter J, Sweegers MG, Courneya KS, Newton RU, Aaronson NK, et al. Effects and moderators of exercise on quality of life and physical function in patients with cancer: an individual patient data meta-analysis of 34 RCTs. Cancer Treat Rev. 2017;52:91–104.
17. Yardley L, Morrison L, Bradbury K, Muller I. The person-based approach to intervention development: application to digital health-related behavior change interventions. J Med Internet Res. 2015;17:e30.
18. Granja C, Janssen W, Johansen MA. Factors determining the success and failure of eHealth interventions: systematic review of the literature. J Med Internet Res. 2018;20(5):e10235.
19. Bennell KL, Marshall CJ, Dobson F, Kasza J, Lonsdale C, Hinman RS. Does a web-based exercise programming system improve home exercise adherence for people with musculoskeletal conditions? Am J Phys Med Rehabil. 2019;98:850–8.

20. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3:77–101.
21. Finlay A, Wittert G, Short CE. A systematic review of physical activity-based behaviour change interventions reaching men with prostate cancer. J Cancer Surviv. 2018;12:571–91.
22. Bandura A. Health Promotion by Social Cognitive Means. Health Educ Behav. 2004;31:143–64.
23. Gardner B, Lally P, Wardle J. Making health habitual: the psychology of "habit-formation" and general practice. Br J Gen Pract. 2012;62(605):664–6.
24. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018;52:798–808.
25. AIHW (2018) Physical activity across the life stages. Canberra: Australian Institue of Health and Welfare.
26. Levy A, Cartwright T. Men's strategies for preserving emotional well-being in advanced prostate cancer: an interpretative phenomenological analysis. Psychol Health. 2015;30:1164–82.
27. Myers Virtue S, Manne SL, Kashy D, Heckman CJ, Zaider T, Kissane DW, et al. Correspondence of physical activity and fruit/vegetable consumption among prostate cancer survivors and their spouses. Eur J Cancer Care. 2015;24:827–39.
28. Teixeira PJ, Carraça EV, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. Int J Behav Nutr Phys Act. 2012;9:78.
29. Santarossa S, Kane D, Senn CY, Woodruff SJ. Exploring the role of in-person components for online health behavior change interventions: can a digital person-to-person component suffice? J Med Internet Res. 2018;20(4):e144.
30. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: exercise medicine in cancer management. J Sci Med Sport. 2019;22(11):1175–99.
31. Sutton E, Hackshaw-McGeagh LE, Aning J, Bahl A, Koupparis A, Persad R, et al. The provision of dietary and physical activity advice for men diagnosed with prostate cancer: a qualitative study of the experiences and views of health care professionals, patients and partners. Cancer Causes Control. 2017;28:319–29.

32. Campbell KL, Winters-stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, et al. Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable. Med Sci Sports Exerc. 2019;51:2375–90.
33. Schmitz KH, Campbell AM, Stuiver MM, Pinto BM, Schwartz AL, Morris GS, et al. Exercise is medicine in oncology: engaging clinicians to help patients move through cancer. CA Cancer J Clin. 2019;69(6):468–84.
34. Mikkelsen MK, Nielsen DL, Vinther A, Lund CM, Jarden M. Attitudes towards physical activity and exercise in older patients with advanced cancer during oncological treatment – a qualitative interview study. Eur J Oncol Nurs. 2019;41:16–23.
35. Jansen F, Verdonck-De LI. Cancer survivors' perceived need for supportive care and their attitude towards self-management and eHealth. Support Care Cancer. 2015;23(6):1679–88.
36. Schubart JR, Stuckey HL, Ganeshamoorthy A, Sciamanna CN. Chronic health conditions and internet behavioral interventions. Comput Inform Nurs. 2011;29:81–92.
37. Bruggeman Everts FZ, van der Lee ML, de Jager Meezenbroek E. Web-based individual mindfulness-based cognitive therapy for cancer-related fatigue - A pilot study. Internet Interv. 2015;2:200–13.
38. Foster C, Grimmett C, May CM, Ewings S, Myall M, Hulme C, et al. A web-based intervention (RESTORE) to support self-management of cancer-related fatigue following primary cancer treatment: a multi-centre proof of concept randomised controlled trial. Support Care Cancer. 2016;24:2445–53.
39. Gogovor A, Visca R, Auger C, Bouvrette-Leblanc L, Symeonidis I, Poissant L, et al. Informing the development of an Internet-based chronic pain self-management program. Int J Med Inform. 2017;97:109–19.
40. Gordon NP, Hornbrook MC. Older adults' readiness to engage with eHealth patient education and self-care resources: a cross-sectional survey. BMC Health Serv Res. 2018;18(1):220.

41. Ware P, Bartlett SJ, Paré G, Symeonidis I, Tannenbaum C, Bartlett G, et al. Using eHealth technologies: interests, preferences, and concerns of older adults. Interact J Med Res. 2017;6:e3.
42. Hackshaw-Mcgeagh LE, Sutton E, Persad R, Aning J, Bahl A, Koupparis A, et al. Acceptability of dietary and physical activity lifestyle modification for men following radiotherapy or radical prostatectomy for localised prostate cancer: a qualitative investigation. BMC Urol. 2017;17(1):94.
43. SJ, Samra P, Rebar AL, Schoeppe S, Parkinson L, Power D, et al. A focus group study of older adults' perceptions and preferences towards web-based physical activity interventions. Inform Heal Soc Care. 2020;45(3):273–81.
44. Golsteijn RHJ, Bolman C, Peels DA, Volders E, De Vries H, Lechner L. A web-based and print-based computer-tailored physical activity intervention for prostate and colorectal cancer survivors: A comparison of user characteristics and intervention use. J Med Internet Res. 2017;19(8):e298.
45. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: Testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15:49.
46. Srikesavan C, Williamson E, Cranston T, Hunter J, Adams J, Lamb SE. An online hand exercise intervention for adults with rheumatoid arthritis (mySARAH): design, development, and usability testing. J Med Internet Res. 2018;20:e10457.
47. Danielson CK, Mccauley JL, Gros KS, Johnson RH, Jones AM, Barr SC, et al. SiHLEWeb.com: Development and usability testing of an evidence-based HIV prevention website for female African-American adolescents. Health Inform J. 2016;22:194–208.
48. Børøsund E, Mirkovic J, Clark MM, Ehlers SL, Andrykowski MA, Bergland A, et al. A stress management app intervention for cancer survivors: design, development, and usability testing. JMIR Form Res. 2018;2:e19.
49. Crutzen R, Cyr D, De Vries NK. The role of user control in adherence to and knowledge gained from a website: randomized comparison between a tunneled version and a freedom-of-choice version. J Med Internet Res. 2012;14:75–84.

50. Wootten AC, Abbott JAM, Chisholm K, Austin DW, Klein B, McCabe M, et al. Development, feasibility and usability of an online psychological intervention for men with prostate cancer: my road ahead. Internet Interv. 2014;1:188–95.
51. Australian Government (eSafety Commissioner). "Digital behaviours of older Australians." https://www.esafety.gov.au/sites/default/files/2019-08/Understanding-digital-behaviours-older-Australians-summary-report-2018.pdf. Accessed 5 September 2020.

Chapter Four

Usability, acceptability and safety analysis of a computer-tailored web-based exercise intervention (*ExerciseGuide*) for individuals with metastatic prostate cancer: A multi-methods lab-based study

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Girard D, Brook N, Short CE. Usability, Acceptability, and Safety Analysis of a Computer-Tailored Web-Based Exercise Intervention (*ExerciseGuide*) for Individuals With Metastatic Prostate Cancer: Multi-Methods Laboratory-Based Study. JMIR Cancer 2021;7(3):e28370. DOI: 10.2196/28370

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Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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4.1 Abstract

Background:

Digital health interventions such as tailored websites are emerging as valuable tools to provide individualized exercise and behavioural change information for individuals diagnosed with cancer.

Objective:

The aim of this study is to investigate and iteratively refine the acceptability and usability of a web-based exercise intervention (*ExerciseGuide*) for men with metastatic prostate cancer and determine how well individuals can replicate the video-based exercise prescription.

Methods:

A laboratory-based multi-methods design was used, incorporating questionnaires, think-aloud tests, interviews, and movement screening among 11 men aged 63 to 82 years with metastatic prostate cancer. Overall, 9 participants were undergoing androgen deprivation therapy, and 2 were completing chemotherapy. Data were collected in two waves, with changes made for quality improvement after participant 5.

Results:

The intervention's usability score was deemed moderate overall but improved after modifications (from 60, SD 2.9 to 69.6, SD 2.2 out of 100). Overall, the participants found the intervention acceptable, with scores improving from wave 1 (24.2, SD 1.1 out of 30) to wave 2 (26.3, SD 2.1 out of 30). The personalized multimodal exercise prescription and computer-tailored education were seen as valuable. After wave 1, website navigation videos were added, medical terminology was simplified, and a telehealth component was included after expert real-time telehealth support was requested. Wave 2 changes included the added variety for aerobic exercise modes, reduced computer-tailoring question loads, and improved consistency of style and grammar. Finally, the participants could replicate the resistance exercise videos to a satisfactory level as judged by the movement screen; however, additional technique cueing within the videos is recommended to address safety concerns.

Conclusions:
The acceptability and usability of *ExerciseGuide* were deemed satisfactory. Various problems were identified and resolved. Notably, the participants requested the inclusion of personalized expert support through telehealth. The resistance training algorithms were shown to provide appropriate content safely, and the users could replicate the exercise technique unaided to a satisfactory level. This study has optimized the *ExerciseGuide* intervention for further investigation in this population.

Trial Registration:
Australian New Zealand Clinical Trials Registry (ANZCTR) ACTRN12618001978257; https://anzctr.org.au/Trial/Registration/TrialReview.aspx?ACTRN=12618001978257

Keywords
exercise; metastatic prostate cancer; behavioural change; eHealth; computer-tailoring; usability; acceptability.

4.2 Introduction

Prostate cancer is the most prevalent cancer type and the second most common cause of cancer-related deaths among Australian men (1). The 5-year survival rate for prostate cancer diagnosed at stage 1 (localized cancer) is 95% (2). In contrast, the survival rate for stage 4 cancers (cancer metastasized beyond the tissues directly adjacent to the prostate gland) is just 36.4% (2). However, therapeutic advances in the management of metastatic prostate cancer continue to extend survival time, necessitating a focus on supportive care to optimize quality of life, maintain function, and further improve the survival rate (3,4). For example, individuals living with metastatic prostate cancer often present with numerous physical and psychological concerns, including cancer-related fatigue, urinary incontinence, pain, increased fat mass, reduced muscle mass, anxiety, and depression (4).

It has been well established that multimodal exercise (an intervention based on the combination of physical exercises of different components, such as cardiorespiratory and muscular strength) has been shown to maintain or improve well-being and physical functioning, including among men with localized prostate cancer (5). However, until recently, exercise interventions were avoided for many individuals diagnosed with metastatic prostate cancer, particularly those with bone lesions, for fear of adverse events. Recent studies, including those by Galvão et al (6) and Cormie et al (7), have demonstrated the safety and preliminary efficacy of individually tailored, modular (designed to avoid excessive loading of lesion sites), and clinic-based exercise programs using randomized controlled trials, thus indicating that individually tailored exercise may provide a powerful addition to improve supportive care in this population.

Currently, individually tailored supervised exercise interventions delivered by oncology-trained exercise professionals are not extensively available outside of urban areas (6,8,9). The time-related demands and financial pressures faced by men with metastatic prostate cancer may lead to reluctance or inability to attend supervised clinic-based exercise programs (4,10). Recently, Brown et al (11) commenced research into a home-based exercise approach for individuals with metastatic prostate cancer, which uses a one-time face-to-face exercise assessment, print-based material, and weekly telephone contact for remote supervision and behavioural change counselling. To further increase the scalability, accessibility, and adherence to home-based exercise, the addition of digital technologies to this type of home-based exercise intervention may be advantageous.

One type of digital technology that could be a viable tool in exercise interventions is a computer-tailored website or app (where content material is adapted, with the aid of algorithms within the website or app, to the specific characteristics of a particular person). In 3 recent studies, Golsteijn et al (12), Trinh et al (13), and Kenfield et al (14) have all demonstrated the feasibility and acceptability of using web- or app-based tools to increase physical activity levels in individuals with prostate cancer (only Trinh et al (13) had individuals with metastatic cancer, 36%). However, these interventions focused on improving behaviours such as reducing sedentary levels and increasing moderate-to-vigorous physical activity levels. Furthermore, the three interventions did not provide tailored exercise programming (12-14). Given that individuals with metastatic prostate cancer have varying levels of capacity and those with bone metastasis require tailored exercise programs that consider the location, extent, and type of metastatic lesion, personalized multimodal programs are exceptionally vital (5,6,8,15).

Engagement with digital physical activity interventions is considered important for their effectiveness, and thus evaluating the factors that influence engagement within tools such as *ExerciseGuide* is vital (16). Perski et al. (16) proposed a conceptual framework in which engagement with an intervention is influenced by factors such as the content and delivery of the tool, as well as the target population and environment. Delivery can be assessed by evaluating usability and the ease with which a platform can be used to attain a particular goal (17). Acceptability is another concept that can be used to predict user engagement (18). Acceptability is defined as “a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention” (19). Therefore, following a user-centred approach, it is important to have the usability and acceptability of the intervention's design and content assessed by individuals with metastatic prostate cancer.

Furthermore, the safety implications of computer-tailored exercise prescription in this population are unknown. It is necessary to determine whether individuals with metastatic prostate cancer can adequately replicate exercise without hands-on technique modification when needed. To answer these questions, we designed a laboratory-based study incorporating both quantitative and qualitative usability and acceptability user evaluations, as well as objective movement screening. This allows small-scale assessment of the intervention and iterative refinement before progressing to a larger-scale study (20).

4.2.1 Aims

This study aims to [1] examine and refine the acceptability and usability of a web-based exercise intervention (known as *ExerciseGuide*) for individuals with metastatic prostate cancer and [2] examine the safety of video-guided resistance exercises used within the *ExerciseGuide* intervention.

4.3 Methods

4.3.1 Study Design

Overview

This study is a laboratory-based assessment that used both qualitative and quantitative approaches. This trial was registered in the Australian New Zealand Clinical Trials Registry (ACTRN12618001978257) and approved by the University of Adelaide Human Research Ethics Committee (Appendix 3~~Appendix 3~~). Study materials, including the participant information sheet and data request forms, are available through the Open Science Framework.

ExerciseGuide Intervention Development

The design and development process of the web-based exercise website (*ExerciseGuide*) used a multidisciplinary approach (exercise physiology, behavioural science, public health, medical oncology, and urology) that was guided by the intervention mapping protocol (21) and preliminary research (6,22,23).

Participants and Screening

Men with metastatic prostate cancer were recruited using convenience sampling methods, which involved advertising the study through social media and intermediaries (oncologists, nurses, participant registries, and support groups). Previous evidence has shown that more than 80% of the usability issues can be detected with 5-9 participants and 90%-95% using 10-12 participants (24); therefore, a sample size of approximately 10 participants was proposed.

To be eligible, participants needed to be diagnosed with metastatic prostate cancer, able to obtain consent to participate from their physician, able to attend a single 90- to 120-minute face-to-face session at the University of Adelaide (Adelaide) or the University of Melbourne (Melbourne), confident of their ability to participate in some form of moderate resistance exercise for 5 minutes or more, and able to read and write in English. The participant flow is presented in Figure 8.

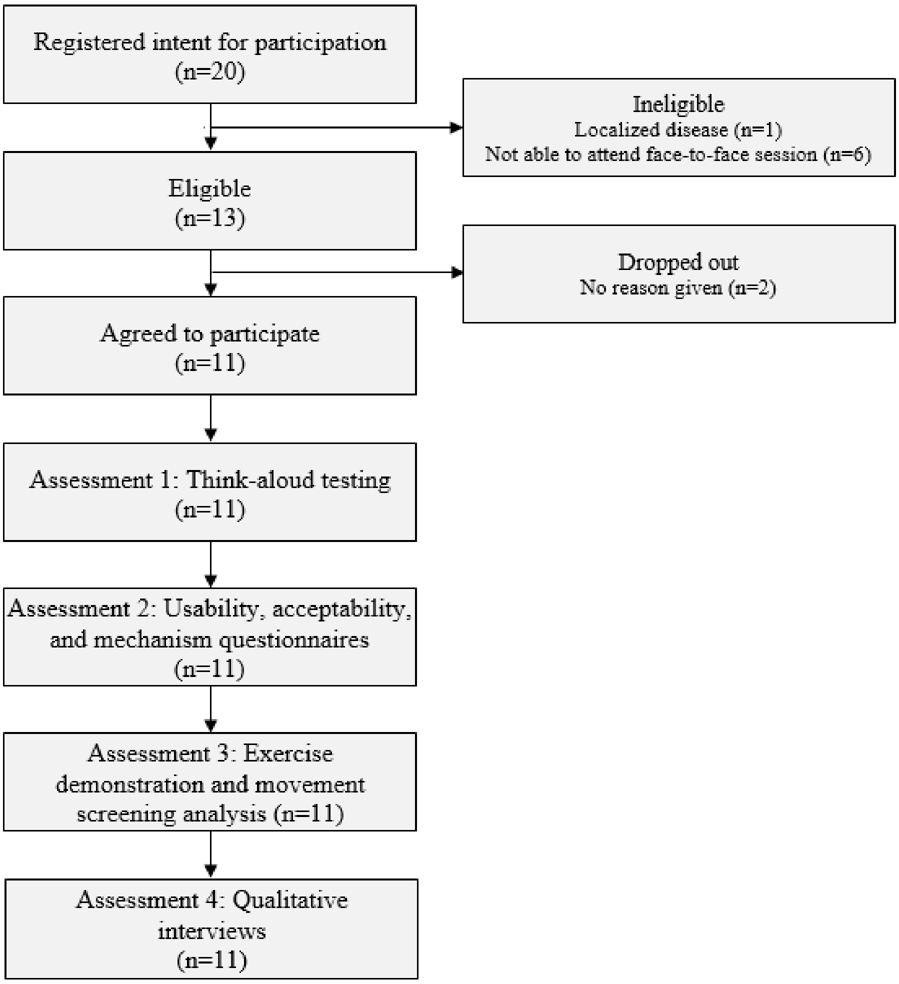

Figure 8. Participant flow chart for individuals with metastatic prostate cancer.

4.3.2 Study Procedure

Overview

To investigate the study aims, four assessment blocks were used: [1] a think-aloud usability test, [2] questionnaires to assess usability and acceptability, [3] exercise demonstration and movement screening to determine the safety and potential efficacy of video-guided resistance exercises, and [4] qualitative interviews further assessing acceptability and perceived usefulness. In all, two iterative cycles were conducted, with website alterations made after the fifth and eleventh participants based on usability issues identified across the assessment blocks.

The participants were sent a link to the self-administered baseline questionnaire through REDCap (Research Electronic Data Capture; Vanderbilt University) 24 hours before arriving at the laboratory for testing (Appendix 4). The questionnaire was used to collect general and prostate cancer–specific demographic data, including prostate-specific antigen score (ng/mL), time since disease diagnosis (years), and the number of bone metastases. Physical activity behaviour was measured using the modified Godin Leisure-Time Exercise Questionnaire. The weekly frequencies (longer than 15 minutes) of vigorous, moderate, and light physical activities were weighted and summed to obtain a total score in units (25). The 2-week test-retest reliability was found to be high (26). The 12-item Short Form Survey, which is a reliable and valid instrument for adults with cancer, was used to quantify health-related quality of life (27). Internet use was gauged based on a question used in the study by Short et al (28), and internet confidence (3 items rated on a 0-100 scale) questions were study specific.

Assessment Block 1: Usability Testing Using the Think-Aloud Testing Methodology

A concurrent think-aloud approach was used to identify usability issues within the website. This approach has been recognized as one of the most effective and commonly used tools to understand usability in eHealth work, especially when used in conjunction with other methods (17,29). The laboratory location was chosen because laboratory studies have shown results similar to those obtained in field testing, while being time and resource efficient (30). The *ExerciseGuide* website was presented on either a Windows (Microsoft Corporation) or Apple (Apple Inc) laptop, as chosen by the participants. A researcher (HELE) asked the participants to verbally narrate their thought processes and feelings while completing the designated tasks on the *ExerciseGuide* website (Appendix 5~~Appendix 5~~). The tasks included logging in, answering module questions (to read tailored content), generating their personalized exercise prescription, watching videos, and identifying key tools such as the library and frequently asked questions (Figure 9~~Figure 9~~). When the participants fell silent for approximately 30 seconds or became stuck in a particular task, they were encouraged to express what they were thinking. The think-aloud sessions were audiotaped, and written notes were taken by the researcher.

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Figure 9. *ExerciseGuide* website screenshots.

[1] the home page (top left), [2] making it last module tailoring questions (top right), [3] my exercise plan module (bottom left), and [4] library page (bottom right).

Assessment Block 2: Usability and Acceptability Questionnaires

A questionnaire was administered in private after the completion of think-aloud testing (Appendix 6) Website usability was assessed using the System Usability Scale (SUS), which includes 10 questions rated from 1 (strongly disagree) to 5 (strongly agree) (31). It is the most commonly used questionnaire for the assessment of perceived usability (32). The reliability of the SUS (coefficient α) was high, and the concurrent validity was significantly correlated (32).

For the purpose of this study, 6 questions were used to determine participant perception of intervention acceptability using a 5-point Likert scale (from 1=strongly disagree to 5=strongly agree) [19,28]. The questions were used previously by Short et al [28], and the internal consistency of the SUS was found to be high [28]. The purpose was to examine if the website was interesting, credible, easy to understand, relevant, and if the participants were likely to recommend the website to a friend.

Assessment Block 3: Resistance Exercise Demonstration and Movement Screening Analysis

A qualified exercise physiologist (HELE) reviewed the resistance exercise prescription that the participants generated using the *ExerciseGuide* website within the think-aloud protocol to determine if any of the recommended exercises were inappropriate. Any exercise deemed unsafe based on the location of the metastases would not be completed. The participants were asked to replicate each exercise under the direct observation of the exercise professional. For each exercise, they were able to watch the exercise demonstration video and read the written instructions as many times as needed. The participants selected the resistance exercise band that they felt would produce an effort of 6-7 out of 10 on the OMNI Perceived Exertion Scale for Resistance Exercise and completed 8 repetitions. The participant was recorded using 2 iPads (Apple Inc; 30 frames per second, 1080p) mounted on tripods positioned orthogonal to each other. Camera 1 was positioned to record the sagittal movement plane and camera 2 the frontal plane (33). The participants reported a verbal pain score [0-10] during and after the exercise and a verbal rating of perceived exertion [0-10] after the exercise. The exercise was halted if the pain level score was higher than 3 out of 10 or if the technique was unsafe.

The movement screening analysis was completed by 5 independent exercise physiologists, accredited by Exercise and Sports Science Australia, each with more than 5 years of clinical experience (Table 3). The video recordings of each resistance exercise were assessed using a standardized form developed by an exercise physiologist (HELE) a priori based on evidence-based movement quality assessment (Appendix 7 Appendix 8 and Appendix 9). Each exercise was individually scored in terms of both safety and efficacy items (between 6 and 8 items per exercise) on a scale of –1 (unsatisfactory, with major concerns) to 2 (good). The exercise physiologists were encouraged to provide notes regarding the movement issues where applicable. Before analysis, the scores were transformed to reflect a positive score ranging from 1 to 4 for each item. The item scores were then added to create an overall movement score. The information collected was also used to determine the interrater reliability of the tool among the experts.

Table 3. Reviewer (exercise physiologist) characteristics.

Reviewer	Occupational setting	Experience (years)	Gender	Current location
1	Private practice	9	Female	Victoria, Australia
2	Public health	9	Female	Victoria, Australia
3	University/private practice	20	Female	Queensland, Australia
4	Private practice	5	Female	New South Wales, Australia
5	Private practice	7	Male	South Australia, Australia

Assessment Block 4: Qualitative Interviews

Finally, the participants completed a one-on-one short semi-structured interview with a researcher (HELE) to identify further technical issues, investigate user experiences, and obtain feedback to improve site content and usability. The interview guide consisted of 8 open-ended questions (Appendix 10). The interviews were audiotaped and transcribed verbatim.

4.3.3 Data Analysis

Quantitative analyses were performed using Jamovi software (version 1.6.3; The Jamovi project). Descriptive statistics were calculated with mean values and SDs for normally distributed data and medians with range or percentage for nonnormal and categorical data. In addition, intraclass correlation coefficients were calculated to determine the interrater reliability of the overall exercise movement screening scores.

The qualitative data collected were analyzed using thematic analysis as described by Braun and Clarke [34]. This process has previously been used to analyze data from usability think-aloud studies and involves data familiarization, generation of initial codes, theme identification, refining of themes, and theme names (34). In this study, an initial set of themes was produced and organized by the first author (HELE) using Microsoft Excel (Microsoft Corporation) and iteratively refined with a second author (CES), leading to the discovery of new themes or renaming of existing themes. Descriptive quotes illustrating the themes were identified and reviewed by all the authors. The results were reported based on the topic area (i.e., usability, acceptability, and safety) rather than through assessment block to aid interpretation in accordance with the study aims.

4.3.4 Ethics Approval and Consent to Participate

This study was performed in accordance with the principles of the Declaration of Helsinki. Ethical clearance was obtained from the University of Adelaide Research Ethics Committee (H-2017-174). The participants were required to provide signed, freely given informed consent at the time of enrolment.

4.4 Results

4.4.1 Participant Characteristics

A total of 11 men with metastatic prostate cancer were recruited for this study, and their characteristics are presented in Table 4. Most of the participants were married and residing in a major city. There were no significant differences in the characteristics of the participants between wave 1 and wave 2. Confidence in internet use was moderate on average.

Table 4. Participant characteristics.

Characteristics	**Cycle 1 (n=5)**	**Cycle 2 (n=6)**	**Total (n=11)**
Age (years), mean (SD)	74.8 (7.2)	72 (6.5)	73.37 (6.7)
BMI (kg/m2), mean (SD)	27.13 (2.2)	29.9 (6.1)	28.6 (4.7)
Married, n (%)	4 (80)	6 (100)	10 (91)
Location, n (%)			
Major city	4 (80)	6 (100)	10 (91)
Very remote	1 (20)	0 (0)	1 (9)
Education, n (%)			

Characteristics	Cycle 1 (n=5)	Cycle 2 (n=6)	Total (n=11)
Secondary school	3 (60)	1 (17)	4 (36)
Trade, technical certificate, or diploma	2 (40)	1 (17)	3 (27)
University or other tertiary	0 (0)	2 (33)	2 (18)
Postgraduate	0 (0)	2 (33)	2 (18)
Employment, n (%)			
Employed full time	1 (20)	0 (0)	1 (9)
Employed part time	0 (0)	0 (0)	0 (0)
Self-employed	0 (0)	1 (16.7)	1 (9)
Retired	3 (60)	4 (67)	7 (64)
Volunteer	1 (20)	1 (17)	2 (18)
Current PSA[a] level, ng/mL, median (IQR)	0.32 (0-6.32)	0.015 (0.10-2.23)	0.02 (0-4.17)
Time since metastatic disease diagnosis, years, mean (SD)	2 (0.8)	2.6 (3.1)	2.3 (2.2)
Individuals with ≥1 bone lesion, n (%)	4 (80)	5 (83)	9 (82)
Comorbidities, mean (SD)[b]	2.8 (1.5)	2.7 (0.9)	2.7 (1.2)
Self-reported quality of life[c] (SF-12)[d], mean (SD)			
PCS-12[e] (physical score)	46.23 (5.6)	36.80 (12.8)	41.09 (10.9)
MCS-12[f] (mental score)	58.9 (3.3)	52.1 (4.3)	55.3 (5)
Self-reported physical activity, mean (SD)			
Aerobic physical activity (GLTEQ[g] units)[h]	53.8 (22.3)	32.8 (21.9)	42.4 (23.7)
Resistance training sessions (per week)	2.2 (1.7)	2.2 (1.3)	2.2 (1.5)
Average internet use (hours per week), n (%)			
≥6	1 (20)	4 (67)	5 (45)
3-5	2 (40)	0 (0)	3 (18)

Characteristics	Cycle 1 (n=5)	Cycle 2 (n=6)	Total (n=11)
2-3	1 (20)	1 (17)	2 (18)
≥1	0 (0)	1 (17)	1 (9)
None	1 (20)	0 (0)	1 (9)
Confidence to use the internet (0-100 scale)[i], mean (SD)			
Finding information on the internet	63.6 (30.1)	72.2 (36.1)	68.3 (33.7)
Using the internet to interact with others (eg, social media)	53.2 (36.4)	55.2 (20)	54.3 (28.6)
Using an interactive website to help increase physical activity	44 (39.9)	46.3 (40.9)	45.3 (40.5)

[a]*PSA: prostate-specific antigen.*

[b]*Comorbidities include hypertension, osteoarthritis, chronic nonspecific back pain, osteoporosis, type 2 diabetes, cardiovascular disease, and mental health conditions.*

[c]*Scores range from 0 to 100, where 0 implies the lowest level of quality of life, and 100 indicates the highest level of quality of life.*

[d]*SF-12: 12-item Short Form Survey.*

[e]*PCS-12: Physical Component Score.*

[f]*MCS-12: Mental Component Score.*

[g]*GLTEQ: Godin Leisure-Time Exercise Questionnaire.*

[h]*Self-reported physical activity level from the Godin Leisure-Time Exercise Questionnaire. Physical activity score (units) = strenuous (9 METs × times/week) + moderate (5 METs × times/week) + light (3 METs × times/week). One metabolic equivalent (MET) is the amount of oxygen consumed while sitting at rest and is equal to 3.5 mL of oxygen per kg body weight × minutes [26].*

[i]*Confidence in using the internet scored on a scale from 0 to 100 (0=not confident at all, 100=extremely confident).*

4.4.2 Usability

Overview

There was an increase in the usability score from 60 (SD 2.9) to 69.6 (SD 2.2) out of 100 between cycle 1 and cycle 2, indicating that the changes suggested by the participants increased the usability to slightly above average (based on industry standards) (31). Qualitative feedback regarding usability is summarized below. A list of changes made to the website based on user feedback is presented in Appendix 11.

The qualitative usability feedback centred around four themes, as shown in Figure 10. The participants discussed the need for simplicity in the website design and suggested that the function should trump looks, that the design needs to account for those with lower computer literacy, and that the terminology should be simplified but not come across as patronizing. They also observed that efforts to reduce information overload are required.

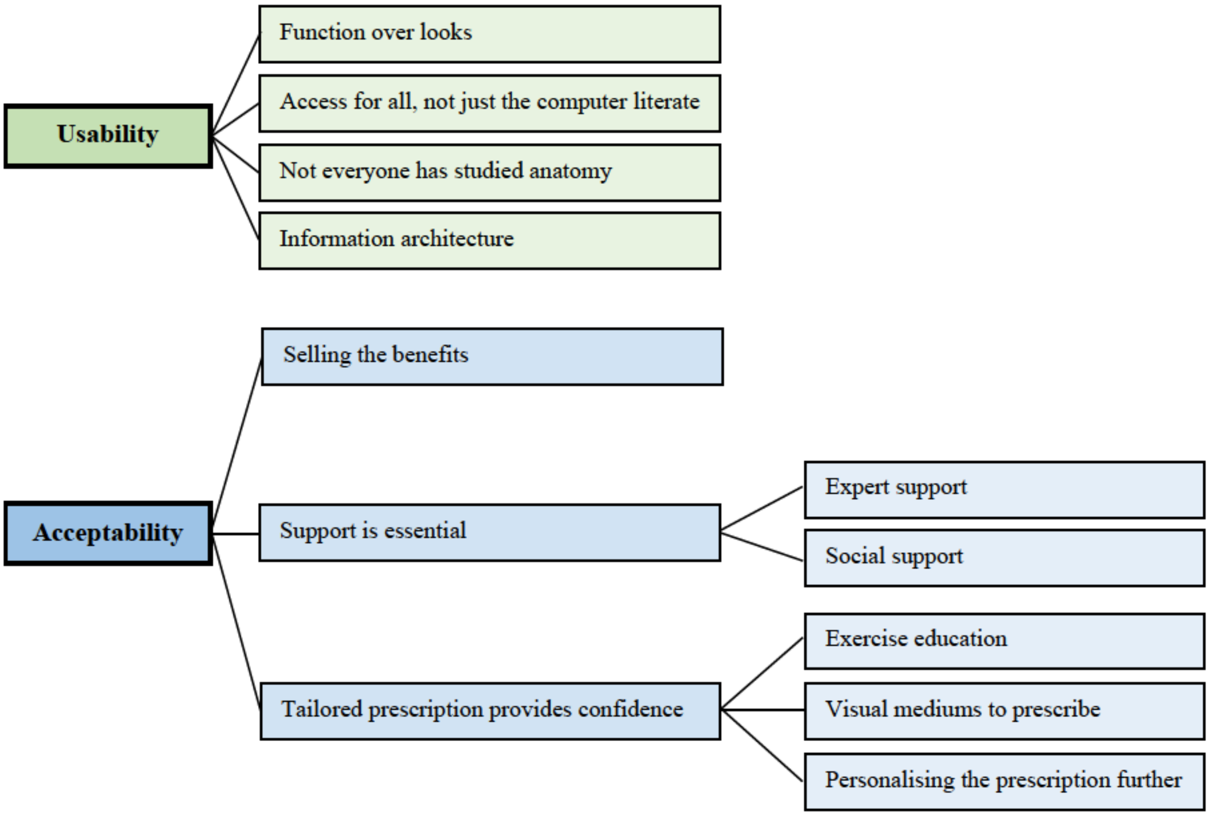

Figure 10. Coding structure derived from thematic analysis.

Theme 1: Function Over Looks

The participants (5/11, 45%) reported that esthetics were not as important as the functionality of a website:

> *"It is not very ornate, but I think the simplicity is helpful because it gives you the specifics, and it's not offensive in any way." [ID 03, aged 78 years, <1 year after diagnosis].*

Of the 11 participants, 2 (18%) reported that this desire was linked to their gender:

"I didn't need it to look more pretty, I don't care about that...a lot of males in my age group wouldn't be all that worried about that either." [ID 07, aged 72 years, 3 years after diagnosis]

In general, the participants liked that the website was plain but straightforward, and that made the website user friendly.

Theme 2: Access for All, Not Just the Computer Literate

Of the 11 participants, 3 (27%) believed that aspects of the website were not designed for individuals with lower literacy levels:

"You are 80% simple, but I still looked at it and went ehhhh...it was a bit daunting." [ID 11, aged 65 years, 1 year after diagnosis]

Questionnaires used to tailor content and the website navigation videos should be further simplified. Of the 11 participants, 3 (27%) could not get the videos to play, and 5 (45%) found that the introduction videos moved through information too quickly. Of the 11 participants, 1 (9%) man with low computer literacy could not complete the think-aloud protocol without support and preferred an option where information could be printed for him:

"I'm very unfamiliar with them [computers]. If you wrote it all on a piece of paper, then it would be easy, but it's not like that." [ID 02, aged 82 years, 4 years after diagnosis]

In addition, another participant suggested that the use of closed captions would increase usability for individuals with hearing concerns.

Theme 3: Not Everyone Has Studied Anatomy

The participants also desired more lay language in the health education provided. The use of medical terminology hampered usability in this population:

"The explanations need to be for someone like me who hasn't done anatomy." [ID 06, aged 73 years, 1 year after diagnosis].

Of the 11 participants, 5 (45%) men questioned words such as androgen deprivation therapy, neutrophils, and hypertrophy. Information should be presented in laymen's language without being patronizing. Of the 11 participants, 1 (9%) suggested that terminology is still useful but could be linked to a quick and easy definition:

"Where we have terminology, put in there so if the person hovers their mouse or their stylus over the word, then the definition would pop up?" [ID 07, aged 72 years, 3 years after diagnosis].

Theme 4: Information Architecture

The flexible modular design was seen as clear and user friendly by 55% (6/11) of the participants. The modules reduced the content into smaller bite-sized chunks and allowed simple navigation:

"I like the way it is modulised, so I can come into it any time and examine any part of it, then go away and come back and do another module later." [ID 09, aged 78 years, 6 years after diagnosis].

Most of the men (8/11, 73%) appreciated the flexible nature, where they could read the information that was most meaningful to them.

Furthermore, the use of computer tailoring was a standout for many of the participants (5/11, 45%) because it reduced the amount of content within the website:

"I thought the way it was designed to cater for individual people instead of a one-size-fits-all...That was a standout I thought." [ID 01, aged 74 years, 8 years after diagnosis]

However, of the 11 participants, 4 (36%) still felt that the website was very content dense and that modules and associated tailoring questions could be condensed or split. Furthermore, of the 11 participants, 1 (9%) believed that introducing the website and providing examples of how the website can be used may improve usability:

"Introducing the options of how to use the website at the outset, either sequentially or dipping in where appropriate. Going through the whole thing end to end, that's fairly daunting because of the amount of information." [ID 08, aged 64 years, 2 years after diagnosis]

4.4.3 Acceptability

Overview

Overall, the participants' perceptions of the website were largely positive across both cycles (Table 5). Of note, the participants were in strong agreement that they would be happy to recommend the website to a friend with the same diagnosis (11/11, 100% reporting agree or strongly agree). The lowest score revolved around the ease of understanding of the information presented. A list of changes made to the *ExerciseGuide* intervention based on user feedback is presented in Appendix 12 [35].

Table 5. Website acceptability ratings.

Acceptability item	Cycle 1 (n=5), mean (SD)	Cycle 2 (n=6), mean (SD)	Total (n=11), mean (SD)
The information provided to me on the website was interesting.	4 (0)	4.33 (0.5)	4.2 (0.4)
The information provided to me on the website was credible.	4 (0)	4.5 (0.5)	4.2 (0.5)
The information provided to me on the website was easy to understand.	3.6 (0.9)	4.2 (0.4)	3.9 (0.7)
The information provided to the website was relevant to me personally.	4 (0)	4.33 (0.52)	4.2 (0.4)
I would recommend the website to a friend with the same diagnosis as me.	4.4 (0.6)	4.7 (0.5)	4.6 (0.5)
The website seems like it was written for someone like me in mind.	4.2 (0.8)	4.3 (0.5)	4.3 (0.7)

Each item was scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The overall acceptability score was the sum of the scores from all 6 questions. The total overall acceptability mean score for cycle 1 was 24.2 (SD 1.1) and cycle 2 was 26.3 (SD 2.1). The combined mean score was 25.4 (SD 2).

The participants' qualitative feedback centred around the factors that they believed would improve the website (Figure 10~~Figure 10~~). More strongly, selling the benefits of exercise was deemed important, as was support from both experts and those close to the participants. Finally, confidence in completing the exercises safely and effectively was also noted.

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Theme 1: Selling the Benefits

Of the 11 participants, 3 (27%) noted the importance of exercise, and 2 (18%) believed that there was not enough emphasis on explaining the benefits of exercise:

> *"You need to sell the story. Explain the research behind it, that it's not a myth. That there is lots of evidence with prostate cancer, that Australia is leading the field." [ID 08, aged 64 years, 2 years after diagnosis]*

Another participant believed that the website should sell the benefits of exercise as soon as possible, rather than just addressing the benefits in one module that may not be accessed:

> *"The home page doesn't explain enough...you are trying to sell an idea to a person who is going to say fuey, I don't need that...you are selling the concept." [ID 04, aged 63 years, <1 year after diagnosis]*

Theme 2: Support Is Essential

Support by experts, family, and friends emerged as an important aspect of the intervention to improve adherence to an exercise program and help guide the website's use.

Expert Support

Expert support was highlighted as a method of support deemed valuable by 36% (4/11) of the participants. Having access to an expert may increase confidence in the exercises prescribed because the participants could ask questions about the website, have exercises modified, identify exercise barriers and facilitators, and receive external motivation:

"It would be good to have a backup, some actually contacting the person saying how's it going, did you like the exercises? You know...just to be a buddy." [ID 07, aged 72 years, 3 years after diagnosis]

The desired regularity of contact varied between weekly and monthly interactions, and video conferencing, phone calls, and emails were all acceptable. Of the 11 participants, 2 (18%) noted that the support would only be useful if it were personalized rather than automated.

Social Support

A supportive social environment was reported as the other possible facilitator to intervention adherence:

"The real attraction about going out [to exercise with friends] is to stop midway through for a coffee and a chat, and I think that makes a big thing." [ID 01, aged 74 years, 8 years after diagnosis].

Of the 11 participants, 2 (18%) believed that encouraging participants to develop, reconnect, or enhance social support structures such as family or friends to prompt and support exercise adherence would be effective.

Theme 3: Tailored Prescription Provides Confidence

The participants discussed a lack of confidence in exercising because they were unsure of what exercises were safe and effective. Supplying tailored prostate cancer–specific exercise information, which could be modified to suit the participant, was highlighted as a way to increase confidence.

Exercise Education

There was an appreciation that the website provided tailored prostate cancer–specific information:

"I understand that it is good to exercise, but I haven't had a definition of how much to do, and this may give me that information, which will be good." [ID 03, 78 years old, newly diagnosed].

In general, the multimodal exercise program was positively received by all participants:

"They [the exercises] were within my abilities but there again, with the different therabands, it's probably going to be suitable for a big range of people." [ID 01, aged 74 years, 8 years after diagnosis].

Of the 11 participants, 3 (27%) wanted additional options of aerobic activity, rather than just walking or cycling, and 2 (18%) requested a tailored stretching program.

Visual Mediums to Prescribe Exercise

Video-based exercise prescription was seen as an appropriate and useful medium by all participants. In general, the participants typically used the on-demand videos rather than the written instructions:

"The videos were great. The presenter was well spoken, you could hear what he was saying. They were crisp and clear. Easy to follow. Easy to backtrack". [ID 04, aged 63 years, newly diagnosed].

Of the 11 participants, 9 (82%) reported feeling confident in completing the exercises without additional support after watching the videos, and 4 (36%) were comfortable returning to the videos as often as needed to ensure that their technique was correct. Of the 11 participants, 1 (9%) noted that the exercise trainer could have more readily explained what muscles should be focused on and explain why the exercise would be useful from a functional perspective:

"The trainer could have explained what muscles he was using. That way, the person knows why he is doing that exercise; they are not just a sheep following a thing...He did on some, but he needed to acknowledge why." [ID 07, aged 72 years, 3 years after diagnosis].

There was a perception that many men may overload themselves when exercising, which may lead to an increased risk of injury (2/11, 18%). Providing simple ways to monitor their exercise intensity was highlighted and may reduce the risk of injury in this population:

"I think that this [rate of perceived exertion information] is really important. Sweeping generalization comes up, but men tend to push themselves slightly harder than they should. They are competing with themselves, and that can lead to injury". [ID 06, aged 73 years, 1 year after diagnosis].

Personalizing the Prescription Further

Multiple participants (7/11, 64%) provided further information to support individual autoregulation. Of the 11 participants, 4 (36%) discussed techniques to increase or decrease their exercise intensity to suit how they feel on the day, and 1 (9%) noted that not all participants wanted to make progress regarding their exercise intensity. Maintenance of strength and aerobic fitness are noteworthy goals, especially for those who do not enjoy exercise. Tailoring messages to avoid pushing individuals into making progress regarding their exercise intensity may improve adherence:

> *"Once you get to a fitness level that suits you, why push it. Where here is it's saying you need to make it harder to challenge yourself...I don't think we need to challenge ourselves. I think it is just a challenge just to exercise for some people." [ID 04, aged 63 years, <1 year after diagnosis]*

Finally, 27% (3/11) of the men found that the program needed to include modifications to suit those already doing some form of exercise to reduce confusion and possible overload. As long as safety concerns have been addressed, the *ExerciseGuide* program should sit within an individual's exercise schedule, rather than completely changing it.

Safety-Movement Screening

The website prescribed 6.6 (SD 1.5) exercises per participant on average. A total of 18 of the possible 25 exercises available were prescribed. No exercises were removed for safety reasons, as judged by the participant or by a supervising exercise physiologist. The participants reported a mean rate of perceived exertion score of 6.2 (SD 1.2) and a mean verbally reported pain score of 0.2 (SD 0.3) (possible range 0-10). Of the 11 participants, 2 (18%) reported a pain level of 3-4 out of 10 on 3 different exercises (single leg lift, seated knee extension, and seated march). On both accounts, the pain was linked to previous knee injuries and was not recorded as bone pain. Pain resolved once the movement ceased.

Overall, no exercises were deemed unsatisfactory, with all meeting the cutoff point for safety defined as a rating of satisfactory or good, as demonstrated in Appendix

13~~Appendix 13~~. Only reviewer 2 scored 1 exercise as unsatisfactory (seated triceps extension). However, it is noteworthy that the intraclass correlation coefficients for the combined item scores demonstrated very low interrater reliability among the assessors (0-0.592).

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When viewing the mean scores of the individual items within each exercise, it was clear that overall, participants set up satisfactorily (3.6, SD 0.3 out of 4). Of the 11 participants, only 2 (18%) set up in an unsatisfactory manner: 1 in the seated row and 1 in the incline push-up. On average, the participants could complete the movements in a slow, controlled manner (3.8, SD 0.2 out of 4) as directed. However, it was notable in the triceps extension and bicep curl exercises that the individuals did not satisfactorily maintain appropriate elbow positions that would isolate the target muscle groups, increasing loads around the thoracic region. In addition, in the lower body exercises that required resisted knee flexion and extension, the individuals did not satisfactorily maintain their torso vertical, which may lead to additional strain through the anterior hip and lumbar spine.

4.5 Discussion

This is the first study to examine the acceptability, usability, and safety aspects of a web-based exercise intervention tailored directly for individuals with metastatic prostate cancer. Overall, the participants found the tailored intervention acceptable and a user-friendly method of delivering credible health-based education, exercise prescription, and behavioural change advice. This is in line with previous studies in older adults with localized prostate cancer (14).

The participants were more interested in functionality than aesthetics. This is in accordance with the Technology Acceptance Model, which posits that use is determined by the perceived ease of use and usefulness of technology (36). Alterations made after the first cycle, including increased text size (from 12 point to 15 point), greater format consistency, and education to upskill users in website use, mirror existing eHealth recommendations (37).

The use of computer tailoring within the *ExerciseGuide* intervention was viewed as a strength by the participants. Older adults have been reported to have difficulty filtering out useful information from generalized text because of changes in working memory (38). Tailoring information ensures personal relevance, individualized exercise prescription, and limitation of superfluous information (39). Notably, additional tailoring occurred after the first iterative cycle, with the aim of increasing the personalization of exercise and reducing the amount of content. An improvement in both relevance and ease of understanding the scores was achieved in cycle 2. However, the use of questionnaires within each module to collate tailoring information still has some limitations. Ghalibaf et al (40) reported decreased usability and acceptability because participants find providing the system with information time consuming. Further research is needed to determine other user-friendly and accurate methods of information collection.

There was disagreement among the participants regarding the use of medical terminology within the intervention. Previous studies corroborate the viewpoint of several of the participants who deemed simplified language to be important for usability (41,42). However, other participants in this study appreciated the use of medical descriptions. As such, if medical terminology is used, it should be clearly explained, thus providing a chance to improve the health literacy of participants.

Most of the participants emphasized the need for multiple avenues of personalized expert support throughout the *ExerciseGuide* intervention to ensure higher levels of uptake, adherence, and safety. Haberlin et al (43) reported a need for on-site exercise prescription and behavioural change support at the start of a physical activity eHealth intervention. However, the participants in this study were comfortable with remote telehealth technology such as teleconferencing (otherwise known as real-time video counselling), phone conferencing, email, and instant messaging as vehicles of support from health professionals. It is theorized that the injection of this type of technology into home-based exercise prescription can increase supervision and improve the participant–health professional relationship while still being a cost-effective and accessible intervention (44,45). Interestingly, Byaruhanga et al (46) reported that real-time video counselling could enhance physical activity behaviours in clinical populations compared with usual care. However, other telehealth tools (e.g., email and SMS) also have benefits such as accessibility, satisfaction, and comfort (47). Further research is still needed to explore the efficacy of different types of technology for exercise prescription and support in this population and others.

The computer-tailored resistance exercise prescription was effective at prescribing clinically recommended exercises to the patients in this study. The participants reported finding the resistance exercise demonstration videos easy to follow and could replicate them to at least a satisfactory level, as judged by the novel movement screen. However, the movement screen analysis indicated that when prescribing distance-based exercise programs to individuals with metastatic prostate cancer, exercise professionals should focus on body positioning to allow greater isolation of the targeted muscles and reduce the mechanical load on bone lesions. Highlighting proper positioning by emphasizing the important cues in the video, explaining why isolation is important, and encouraging visual cues (i.e., mirrors) are all methods that could be beneficial.

4.5.1 Strengths and Limitations

A strength of this evaluation was the emphasis on user-centred assessment and the novel approach to appraising exercise prescription safety within a tailored web-based intervention. However, this study should be evaluated within its limitations. Overall, the sample population consisted of Caucasian, English-speaking men with a relatively high level of exercise activity and internet experience and may not reflect the full range of user experiences. Second, the methodology did not include safety testing for aerobic exercise because of resource constraints, and the interclass correlation for the movement screening tool was very low. Third, the study recruited a small number of participants. The sample size is typical for usability testing, and the researchers felt that data saturation for the qualitative components was achieved. However, it is possible that a greater range of feedback would have been captured in a larger sample. Finally, the sample website did not contain all the behavioural change and other educational content planned for the full website. The authors felt that the participants would experience the main components of the abridged website's design and content.

4.6 Conclusions

This preliminary study exemplifies how evidence-based theory and the target users' input can facilitate the development of a web-based exercise intervention to meet the needs and preferences of this population. On account of the iterative nature of this study, numerous issues were identified and resolved. A prominent finding was the request for distance-based personalized support as an addition to the intervention in the form of video conferencing, phone conferencing, or SMS. Overall, the design and content within *ExerciseGuide* were viewed as acceptable and user friendly. The resistance training algorithms were shown to provide appropriate content safely, and users could replicate the exercise technique unaided to a satisfactory level. This study will be used to further refine the *ExerciseGuide* website. The next phase of testing will be conducted to determine the feasibility and preliminary efficacy of the tool [35].

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4.7 References

1. Cancer Data in Australia. Australian Institute of Health and Welfare. 2021. URL:https://www.aihw.gov.au/reports/cancer/cancer-data-inaustralia/contents /summary [accessed 2021-01-04]
2. Prostate Cancer in Australia. Australian Institute of Health and Welfare. 2017. URL:https://www.aihw.gov.au/reports/cancer/prostate-cancer-in-australia/conte nts /table-of-contents [accessed 2021-05-05]
3. Litwin MS, Tan H. The diagnosis and treatment of prostate cancer: a review. J Am Med Assoc. 2017;317(24):2532-2542.
4. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8(2):e019917.
5. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11(3):247-257.
6. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393-399.
7. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16(4):328-335.
8. Hayes SC, Newton RU, Spence RR, Galvão DA. The exercise and sports science Australia position statement: exercise medicine in cancer management. J Sci Med Sport. 2019;22(11):1175-1199.
9. Mina DS, Petrella A, Currie KL, Bietola K, Alibhai SM, Trachtenberg J, et al. Enablers and barriers in delivery of a cancer exercise program: the Canadian experience. Curr Oncol. 2015;22(6):374-384.
10. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: a qualitative exploration. Support Care Cancer. 2018;26(6):1747-1754.
11. Brown M, Murphy M, McDermott L, McAneney H, O'Sullivan JM, Jain S, et al. Exercise for advanced prostate cancer: a multicomponent, feasibility, trial protocol for men with metastatic castrate-resistant prostate cancer (EXACT). Pilot Feasibility Stud. 2019;5:102.

12. Golsteijn RH, Bolman C, Peels DA, Volders E, de Vries H, Lechner L. A web-based and print-based computer-tailored physical activity intervention for prostate and colorectal cancer survivors: a comparison of user characteristics and intervention use. J Med Internet Res. 2017;19(8):e298.
13. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SM, et al. RiseTx: testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49.
14. Kenfield SA, van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (prostate 8): a pilot randomized controlled trial in men with prostate cancer. Eur Urol. 2019;75(6):950-958.
15. Newton RU, Kenfield SA, Hart NH, Chan JM, Courneya KS, Catto J, et al. Intense exercise for survival among men with metastatic castrate-resistant prostate cancer (INTERVAL-GAP4): a multicentre, randomised, controlled phase III study protocol. BMJ Open. 2018;8(5):e022899.
16. Perski O, Blandford A, West R, Michie S. Conceptualising engagement with digital behaviour change interventions: a systematic review using principles from critical interpretive synthesis. Transl Behav Med. 2017;7(2):254-267.
17. Broekhuis M, van Velsen L, Hermens H. Assessing usability of eHealth technology: a comparison of usability benchmarking instruments. Int J Med Inform. 2019;128:24-31.
18. Perski O, Short CE. Acceptability of digital health interventions: embracing the complexity. Transl Behav Med. 2021. In press.
19. Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. BMC Health Serv Res. 2017;17(1):88
20. Czajkowski SM, Powell LH, Adler N, Naar-King S, Reynolds KD, Hunter CM, et al. From ideas to efficacy: The ORBIT model for developing behavioral treatments for chronic diseases. Health Psychol. 2015;34(10):971-982.
21. Bartholomew LK, Mullen PD. Five roles for using theory and evidence in the design and testing of behavior change interventions. J Public Health Dent. 2011;71(Suppl 1):S20-S33.

22. Forbes CC, Finlay A, McIntosh M, Siddiquee S, Short CE. A systematic review of the feasibility, acceptability, and efficacy of online supportive care interventions targeting men with a history of prostate cancer. J Cancer Surviv. 2019;13(1):75-96.
23. Evans HE, Forbes CC, Vandelanotte C, Galvão DA, Newton RU, Wittert G, et al. Examining the priorities, needs and preferences of men with metastatic prostate cancer in designing a personalised ehealth exercise intervention. Int J Behav Med. 2021;28(4):431-443.
24. Virzi RA. Refining the test phase of usability evaluation: how many subjects is enough? Hum Factors. 2016;34(4):457-468.
25. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care. 2017;26(6).
26. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci. 1985;10(3):141-146.
27. Bhandari NR, Kathe N, Hayes C, Payakachat N. Reliability and validity of SF-12v2 among adults with self-reported cancer. Res Soc Adm Pharm. 2018;14(11):1080-1084.
28. Short CE, Rebar A, James EL, Duncan MJ, Courneya KS, Plotnikoff RC, et al. How do different delivery schedules of tailored web-based physical activity advice for breast cancer survivors influence intervention use and efficacy? J Cancer Surviv. 2017;11(1):80-91.
29. Jaspers MW, Steen T, van den Bos C, Geenen M. The think aloud method: a guide to user interface design. Int J Med Inform. 2004;73(11-12):781-795.
30. Kaikkonen A, Kekäläinen A, Cankar M, Kallio T, Kankainen A. Usability testing of mobile applications: a comparison between laboratory and field testing. J Usability Stud. 2005;1(1):4-16.
31. Brooke J. SUS - a quick and dirty usability scale. Usability Eval Ind. 1996;189(194):4-7.
32. Lewis JR. The system usability scale: past, present, and future. Int J Human Computer Interact. 2018;34(7):577-590.

33. Bennett H, Davison K, Arnold J, Martin M, Wood S, Norton K. Reliability of a movement quality assessment tool to guide exercise prescription (MovementScreen). Int J Sports Phys Ther. 2019;14(3):424-435.
34. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77-101.
35. Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, et al. Evaluating a web- and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial. Pilot Feasibility Stud. 2021;7(1):21.
36. Gücin N, Berk Ö. Technology acceptance in health care: an integrative review of predictive factors and intervention programs. Soc Behav Sci. 2015;195:1698-1704.
37. Berkowsky RW, Czaja SJ. Challenges associated with online health information seeking among older adults. Aging Technol Heal. 2018;31:48.
38. Bolle S, Romijn G, Smets EM, Loos EF, Kunneman M, van Weert JC. Older cancer patients' user experiences with web-based health information tools: a think-aloud study. J Med Internet Res. 2016;18(7):e208.
39. Finlay A, Evans H, Vincent A, Wittert G, Vandelanotte C, Short CE. Optimising web-based computer-tailored physical activity interventions for prostate cancer survivors: a randomised controlled trial examining the impact of website architecture on user engagement. Int J Environ Res Public Health. 2020;17(21).
40. Ghalibaf AK, Nazari E, Gholian-Aval M, Tara M. Comprehensive overview of computer-based health information tailoring: a systematic scoping review. BMJ Open. 2019;9(1):e021022.
41. Børøsund E, Mirkovic J, Clark MM, Ehlers SL, Andrykowski MA, Bergland A, et al. A stress management app intervention for cancer survivors: design, development, and usability testing. JMIR Form Res. 2018;2(2):e19.
42. Osipenko L, Gajraj E. NICE guidance and health technology assessment. In: Thomas D, editor. Clinical Pharmacy Education, Practice and Research: Clinical Pharmacy, Drug Information, Pharmacovigilance, Pharmacoeconomics and Clinical Research. Amsterdam, Netherlands: Elsevier; 2019:313-320.

43. Haberlin C, O' Donnell DM, Moran J, Broderick J. Perceptions of eHealth-enabled physical activity interventions among cancer survivors: mixed methods study. JMIR Cancer. 2020;6(1):e16469.
44. Bland KA, Bigaran A, Campbell KL, Trevaskis M, Zopf EM. Exercising in isolation? The role of telehealth in exercise oncology during the COVID-19 pandemic and beyond. Phys Ther. 2020;100(10):1713-1716.
45. Gell NM, Grover KW, Savard L, Dittus K. Outcomes of a text message, fitbit, and coaching intervention on physical activity maintenance among cancer survivors: a randomized control pilot trial. J Cancer Surviv. 2020;14(1):80-88.
46. Byaruhanga J, Atorkey P, McLaughlin M, Brown A, Byrnes E, Paul C, et al. Effectiveness of individual real-time video counseling on smoking, nutrition, alcohol, physical activity, and obesity health risks: systematic review. J Med Internet Res. 2020;22(9):e18621.
47. Orlando JF, Beard M, Kumar S. Systematic review of patient and caregivers' satisfaction with telehealth videoconferencing as a mode of service delivery in managing patients' health. PLoS One. 2019;14(8):e0221848.

Chapter Five

Evaluating a web- and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial

Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D, Short, CE. Evaluating a web-and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial. Pilot and feasibility studies. 2021;7(1):1-6. DOI: 10.1186/s40814-020-00763-2

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i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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5.1 Abstract

5.1.1 Introduction

Preliminary research has shown the effectiveness of supervised exercise-based interventions in alleviating sequela resulting from metastatic prostate cancer. Despite this, many individuals do not engage in sufficient exercise to gain the benefits. There are many barriers, which limit the uptake of face-to-face exercise in this population including lack of suitable facilities, remoteness, and access to experts, significant fatigue, urinary incontinence and motivation. Technology-enabled interventions offer a distance-based alternative. This protocol describes a pilot two-armed randomised controlled study that will investigate the feasibility and preliminary efficacy of an online exercise and behavioural change tool (*ExerciseGuide*) amongst individuals with metastatic prostate cancer.

5.1.2 Methods

Sixty-six participants with histologically diagnosed metastatic prostate cancer will be randomised into either the 8-week intervention or a wait-list control. The intervention arm will have access to a tailored website, remote supervision, and tele-coaching sessions to enhance support and adherence. Algorithms will individually prescribe resistance and aerobic exercise based upon factors such as metastasis location, pain, fatigue, confidence and current exercise levels. Behavioural change strategies and education on exercise benefits, safety and lifestyle are also tailored through the website. The primary outcome will be intervention feasibility (safety, usability, acceptability, and adherence). Secondary exploratory outcomes include changes in physical activity, quality of life, sleep, and physical function. Outcomes will be measured at baseline and week nine.

5.1.3 Discussion

The study aims to determine the potential feasibility of an online remotely monitored exercise intervention developed for individuals with metastatic prostate cancer. If feasible, this pilot intervention will inform the design and implementation of further distance-based interventions.

Trial registration: ACTRN12614001268639.

5.2 Introduction

Prostate cancer is one of the most common cancers diagnosed amongst men worldwide (1). Of those diagnosed, approximately 10–20% will present with metastatic disease at the time of diagnosis, and an additional one in five will progress from localised to metastatic disease despite treatment (2, 3). Once prostate cancer has metastasized, the 5-year survival rate drops from 95 to 36% (4). Metastatic disease and the subsequent treatments cause considerable physical and psychological burden (5). Androgen deprivation therapy, radiotherapy and chemotherapy can result in increased fat mass, fatigue and pain as well as reduced muscle mass, bone mineral density, physical function and sexual function (2, 6). In addition, over 80% of individuals with advanced prostate cancer will develop bone metastases, which can result in significant bone pain, pathological fractures and neurological impairments (5). Individuals in this population have also been found to exhibit higher levels of anxiety and depression than their age-matched peers, including men diagnosed with localised prostate cancer (7-9). Given the high burden, there is a clear need to develop interventions that help combat side effects, improve physical function and reduce overall burden in individuals with metastatic prostate cancer.

Research has demonstrated the beneficial effects from physical activity and more specifically, structured exercise interventions in individuals with prostate cancer (10-11). Currently, it has been suggested that exercise can play an important role in symptom management, rehabilitation and long-term survival (5, 10-11). Whilst the physiological mechanisms behind this are yet to be elucidated, it is hypothesised that exercise improves immune function, modulates circulating factors (such as insulin and growth factors), reduces inflammation and improves treatment efficacy (5). However, until recently, those with metastatic disease were discouraged from structured exercise for fear of exacerbation of symptoms or increased risk of skeletal-related events (12).

New evidence is now available to show that supervised multi-modal exercise can be safe, feasible and clinically relevant in individuals with metastatic prostate cancer (12- 15). Cormie et al. were the first to show that resistance training is both safe (no adverse events found) and tolerable (attendance 83% and compliance 93%) in this population using a pilot study (12). Galvão et al. then implemented a multi-modal (resistance, aerobic and flexibility training) intervention and found significant improvements in physical function (mean difference 3.2 points; 95% confidence interval (CI) = [0.4, 6.0]; P = 0.028) and muscular strength (mean difference of 6.6 kg (95% CI = [0.6, 12.7]; P = 0.033)) after 12 weeks (14). Currently, the Movember GAP4 INTERVAL trial is examining overall survival in individuals completing a vigorous-intensity face-to-face multi-modal exercise programme (16).

Despite the mounting evidence regarding the benefits of supervised multimodal exercise for this population, many do not engage in sufficient physical activity to obtain health benefits. Zopf et al. found that only 20% of patients achieved 50–149 min per week of self-rated moderate to vigorous aerobic activity, and 29% of patients achieved ≥ 150 min (17-18). This is despite evidence that 92% of individuals with advanced cancer being interested in becoming more active (19). Barriers to exercise in this population include general exercise barriers such as the lack of suitable facilities, remoteness, motivation and access to experts, as well as disease-specific barriers such as significant fatigue, urinary incontinence, mood, high levels of other medical commitments and lack of education regarding exercise for individuals with prostate cancer [8, 20]. It is currently unknown how many Australian individuals with metastatic prostate cancer receive individualised exercise advice.

Home-based exercise programmes offer a feasible alternative to counteract some of the obstacles to on-site exercise interventions because they may be able to reduce location constraints, financial and time limitations (21-22). However, current research indicates that these interventions produce smaller effect sizes in cancer populations on both quality of life and physical function when compared to face-to-face exercise (10, 23). Lack of supervision and personalised support, reduced intervention adherence and limited individualisation are all possible causes of this discrepancy (10, 24-25).

The use of technology in distance-based health care, otherwise known as eHealth, may help to improve the capacity of distance-based programmes. For example, web-based platforms have the ability to prescribe and demonstrate tailored exercise plans, provide tailored behavioural change advice, facilitate self-monitoring and support communication with healthcare professionals. Much of this can be achieved in an automated fashion using computer-tailoring techniques, thus allowing for personalization at a low-cost (26). Reviews of digital health interventions for behaviour change suggest that some level of human support is important for efficacy (27, 28). E-Health interventions utilising some of these techniques to support prostate, colorectal, breast and leukaemia cancer populations have already been trialled with good effects in terms of improved physical activity levels and reduced sedentary behaviour (24, 29-32). However, the extent to which these techniques are acceptable, safe and potentially effective for supporting individuals with metastatic prostate cancer, given their unique needs and risk profile, is unknown. Our study seeks to address this gap by conducting a pilot evaluation of *ExerciseGuide*, a web-based and telephone supported personalised exercise intervention designed for individuals living with metastatic prostate cancer.

The primary objective of the trial is to assess key areas of uncertainty regarding the use of *ExerciseGuide* (and other similar programmes) in future practice and research, including issues relating to feasibility, safety and potential for efficacy. Publication of this protocol aims to ensure transparency around pre-specified criteria for success, aid replication of study and intervention methods and inform interested parties of the upcoming trial results.

5.3 Methods

5.3.1 Study design

This study is a two-arm pilot randomised control trial with participants randomised into either the intervention group (8 weeks) or a wait-list control group. Mixed evaluation methods will be used, with main outcomes assessed using questionnaires and accelerometers at baseline and post-intervention, and via a qualitative interview at post-intervention only. A sub-group of participants will be invited to complete physical function testing at baseline and post-intervention.

The trial has been prospectively registered on the Australian New Zealand Clinical Trials Registry (http://www.anzctr.org.au): ACTRN12614001268639 and ethical clearance were obtained by the University of Adelaide Research Ethics Committee (H-2018-153) (Appendix 14). To aid replication, study materials, such as the participant information sheet and data request forms from physicians, are available via the open science framework (https://osf.io/jfmy2/). The reporting of the study protocol is in accordance with the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) guidelines (33). The SPIRIT figure outlining the time procedure is shown Figure 11~~Figure 11~~.

	STUDY PERIOD				
	Enrolment	Baseline	Exercise Intervention		Close-out
TIMEPOINT**		Week 0	*Week 1*	*Week 8*	*Week 9*
ENROLMENT:					
Eligibility screen	X				
Medical Clearance	X				
Informed consent	X				
Allocation		X			
INTERVENTIONS:					
Exercise Guide Group					
Control: Waitlist					
ASSESSMENTS:					
Baseline Variables		X			
Follow-up variables					X
Qualitative Assessment					X

Figure 11. SPIRIT figure of enrolments, interventions, and assessments.

5.3.2 Pre-established criteria

Feasibility of conducting a larger-scale evaluation will be interpreted based on the following:

1. The recruitment goal has been reached (66 participants in 10 months).
3. Behaviour change data are collected for ≥ 75% of participants recruited within the study.
4. Physical functioning data (collected on a subset of participants) can be collected for ≥ 75% of participants that (a) reside within 30 km from a study testing site and (b) are invited to complete testing.

The success of the intervention will be interpreted based on the following:

1. The acceptability of the intervention is satisfactory (score of ≥ 20 on the client satisfaction questionnaire) (34).

5. The system usability is satisfactory (score of ≥ 68 on the software usability scale) (35).
6. There is no grade 3+/life threatening or severe adverse events attributed to participating in the intervention using the Common Terminology Criteria for Adverse Events V.5.0 grading criteria.
7. There is evidence of meaningful participation in either aerobic activity and or resistance-based activity in the intervention group relative to the wait-list control. As the exercise prescription will be personalised, it is difficult to specify an average cut-point; however, we anticipate a between-group difference of at least 30 min of aerobic activity and/or one session of resistance training per week. This would be indicative of behaviour change that is in line with the minimum level of exercise progression prescribed in our intervention and should also allow us to detect differences in maintenance of activity (equivalent to one session per week) amongst those that enter the study already completing some exercise.

The trial team will determine if progression to a larger scale evaluation is warranted based on the criteria and will work together to revise aspects of the protocol if problem areas are identified (e.g. if recruitment is slow the study may still progress if additional recruitment sites can be secured). The process evaluation will be used to inform improvements to the intervention if usability, acceptability or potential for efficacy issues are identified.

5.3.3 Study setting

This study is being conducted in Australia. Due to the distance-based nature, participants can live anywhere in the country providing they meet the eligibility criteria. Recruitment began in February 2020 and will continue for a minimum of 10 months, unless the desired sample size is reached beforehand.

5.3.4 Participants and screening

Participants are being recruited via a variety of methods. This includes dissemination of study information to potential participants within Australia via intermediaries (e.g. urologists, oncologists and nurses from the Southern Adelaide Local Health Network and Central Adelaide Local Health Network). Recruitment will also occur through the South

Australian Prostate Cancer Clinical Outcomes Collaborative registry, Freemasons Foundation Centre for Men's Health recruitment registry, Prostate Cancer Foundation Australia (e.g. Pathfinders recruitment registry and support groups), social media advertisements (e.g. on twitter and Facebook), and direct contact (e.g. presentations to consumer groups). Interested individuals are referred to the project coordinator (HE) to confirm eligibility, obtain informed consent and clearances and arrange outcome assessments. Figure 12 outlines the participant flow diagram.

To be eligible, participants must have been diagnosed with metastatic prostate cancer (as confirmed by their physician) and have medical clearance from their physician (General Practitioner, Medical Oncologist, Radiation Oncologist or Urologist). Physicians are required to provide details regarding the extent and location of metastases. Participants also need to have access to a computer with the internet, be able to read and write in English and provide written consent prior to baseline testing. Finally, to be eligible participants should not already engage in two sessions of resistance-training and 60 minutes of structured moderate-vigorous aerobic exercise per week. Participants meeting one target but not the other will be eligible.

Patients will be deemed ineligible if they have any absolute contraindications to performing moderate physical activity (resistance, aerobic and flexibility) for at least 20 min (in bouts of 5 min), up to 2 days of the week. This includes no recent serious cardiovascular events (within 12 months), unstable bone metastases, spinal compressions or acute illness and infection (36). Participants will also be excluded from the study if they have moderate to severe bone pain (Common Terminology Criteria for Adverse Events V.5.0 grading criteria).

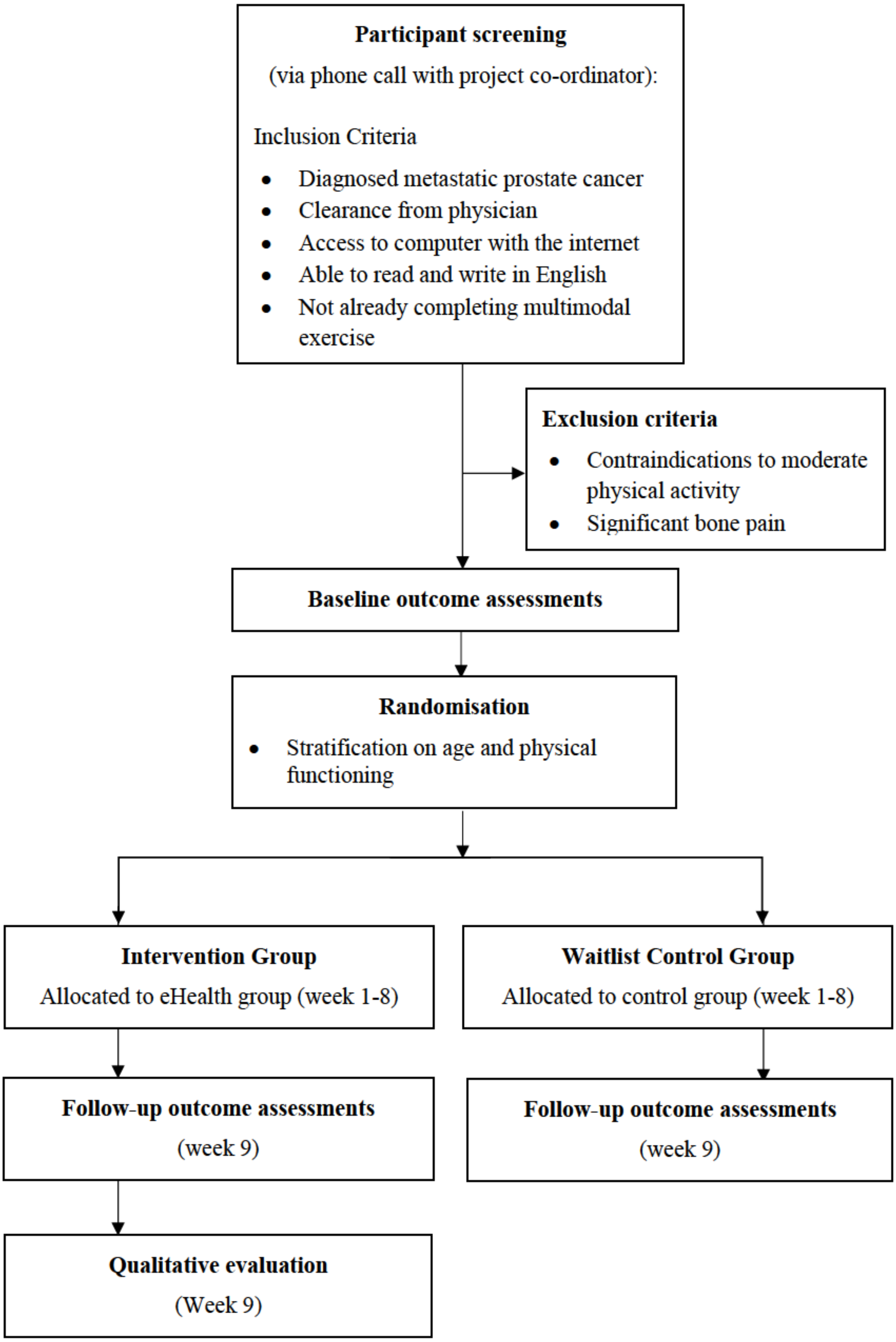

Figure 12: Participant flow diagram

Participant retention strategies will include flexible scheduling for telehealth consultations, reminder calls/texts and consistent study staff. Criteria for discontinuing intervention include participant request and worsening conditions which are absolute contraindications to exercise (including unstable bone metastasis, spinal compression and significant cardiovascular events). Concomitant care will be permitted during the study and any changes in treatment will be recorded.

5.3.5 Randomisation

Once baseline data have been collected, participants will be randomised into the intervention group or the control group at a ratio of 1:1. The study statistician (AV) will produce the random computer-generated number sequence in random block sizes of length 2 and 4, and will be blinded to identifying information. Stratification will occur based on age (≤ 65 years, > 65 years of age) and differences in physical function as determined by the EORTC QLC-30 (≤ 80, > 80). This is to control for potential confounders relating to age (including confidence using technology) and physical capacity. Participants will not be blinded to the primary goal of the project (evaluation of web-based tool in this population) but will not be informed of the pre-specified criteria for success.

5.3.6 Exercise guide intervention

Intervention development

Development of the intervention (*ExerciseGuide*) was guided by the Intervention Mapping protocol (37), which involves a needs assessment, identification of determinants of the desired intervention outcomes and the selection of theory-based and evidence-informed strategies to target key determinants or change objectives. The process was undertaken predominantly by HE and CES, in collaboration with consumer representatives, hence drawing on expertise in exercise prescription, behaviour change and the lived experience of prostate cancer. An overview of the development process, including original research conducted and theories considered is described below.

In brief, a qualitative interview study (n=18) was completed to better understand the needs and preferences of individuals in this population. This was conducted alongside a systematic review of online interventions for prostate cancer patients to determine feasibility, acceptability and efficacy, as well as factors associated with success (or failure) (38). These studies highlighted that online supportive care interventions are acceptable in individuals with prostate cancer. Participants within the qualitative study stressed the importance of individualised exercise prescription, the need for evidence-based educational content, support and feedback to aid adherence. Importantly, participant's accuracy of reporting metastasis location and extent was mixed, indicating further reporting measures would be required to ensure appropriate prescription.

The selection of theory to guide intervention development was informed by our original research, and evidence in the fields of exercise and health psychology more broadly (39-44). A summary of the theories used and associated implications is provided in Appendix 15. Of note, a variety of theories were considered necessary to draw upon based on the premise that exercise behaviour is guided by dual processes, and that for longer-term behaviour change to occur; it is necessary not only to address social-cognitive determinants like self-efficacy but also to address how people feel and the extent to which their behaviour change process is habit-forming in nature (41, 43). Theory was also used to inform the architecture of the intervention and the provision of computer-tailored feedback (self-determination theory and elaboration likelihood model) (45-46).

Once important determinants and potentially acceptable and efficacious strategies were identified based on the above research, a prototype of the intervention was developed in collaboration with consumer advisors and volunteers. This involved filming exercise videos and drafting website content and tailoring algorithms. Finally, the prototype was tested and iteratively refined in a lab-based usability and safety test (n=11 patients with metastatic prostate cancer), until the intervention was considered ready for trial in the proposed study.

Intervention description

The intervention will use a tailored website, exercise diary and tele-coaching sessions over a period of 8 weeks to provide exercise and lifestyle support for men living with metastatic prostate cancer. Participants can drop out of the intervention at any time and concomitant care is permitted at all times.

Tailored website

The intervention group will be given access to the tailored website (www.exerciseguide.org.au) for a period of 8 weeks (Figure 13~~Figure 13~~). The tailored content, delivered via modules, will be adjusted based on individual characteristics through an automated computer process. This approach (known as computer-tailoring) leads to the delivery of more personally relevant information, which increases message safety and efficacy (21, 47-48).

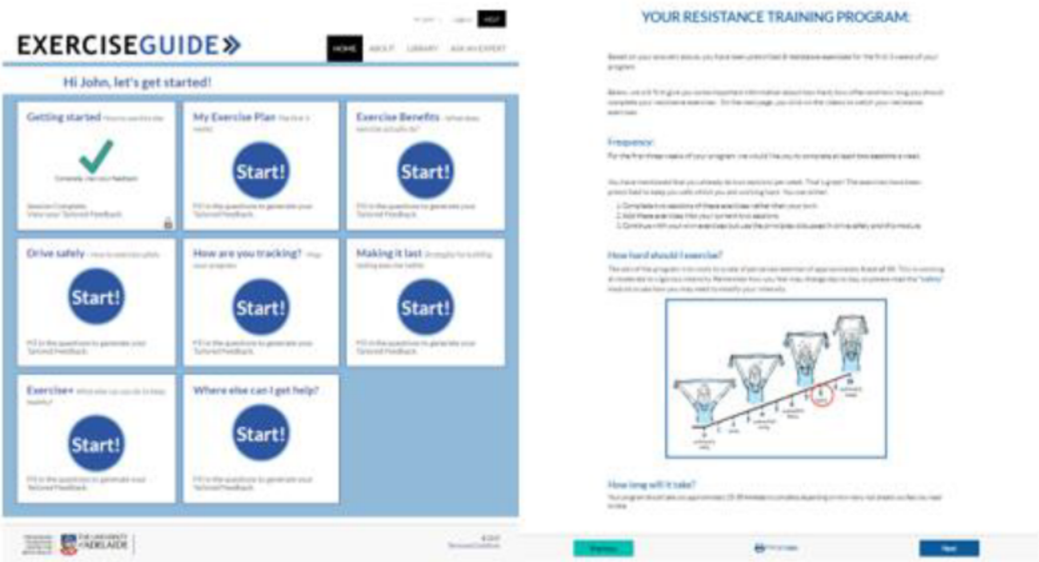

Figure 13: Screenshot of the *ExerciseGuide* website.
[1] the home page (left) and [2] my exercise plan module (right).

Modules include evidence-based information on the safety and benefits of physical activity, an individually tailored exercise programme, behaviour change information, self-monitoring, lifestyle information and other resources of use (Table 6~~Table 6~~). Based on the previous qualitative work in this area, participants will receive access to all modules as soon as they complete the initial introduction module and are free to complete the modules in order of personal priority.

Table 6: Overview of tailored modules included in 8-week intervention.

Module title	Module Goal(s)	Tailoring Variable	Mechanisms of Action
Getting Started (How to use this site)	Introduce the program, including how to navigate the site.	Nil.	Self-efficacy
My Exercise Plan (Week 1-3)	Provide individualised exercise prescription to participants.	The aerobic training component of the study is based on metastases location, current aerobic modes, current duration and frequency completed and pain levels. Self-reported ability which includes current fatigue levels, experience and confidence, will also be taken into account Resistance exercise prescription is be tailored to the individual based on metastasis location pain or injury location, current fatigue levels and both resistance training experience and confidence. Favoured modes of exercise and access to equipment is taken into account for both aerobic and resistance training.	Self-efficacy Intentions
My Exercise Plan (Week 4-8)	Progression of exercise prescription on current exercise levels.	Current aerobic exercise levels (current duration and frequency completed). Current resistance training levels (session frequency and percentage of sets and reps completed)	Self-efficacy Intentions

Module title	Module Goal(s)	Tailoring Variable	Mechanisms of Action
		Repeated questions from My Exercise Plan (week 1-3) with previous answers. Participants asked to re-evaluate their answers and change if needed.	
Exercise Benefits (What does exercise actually do?)	Help men to develop a deeper understanding of the benefits of exercise, and how these benefits accrue. Highlight benefits that are personally relevant. Strengthen intentions to participate in structured exercise.	Health issues that may be improved through exercise (e.g., fatigue, poor sleep, muscle weakness). Exercise types currently participated in (aerobic and resistance).	Outcome expectations and identified regulation of motivation. Proximal intentions (goals)
Drive Safely (How to exercise safely)	Provide men with tailored information regarding safety implications to promote educational empowerment. Provide an understanding of when exercise should be terminated to avoid risk of injury.	Cancer specific considerations that may impact the safety of exercise prescription; specifically, current treatment/disease side effects (e.g., fatigue, neuropathy) and treatments (e.g., chemotherapy, androgen deprivation therapy). Co-morbidities (e.g., diabetes, osteoarthritis) were also taken into account	Self-efficacy Outcome expectations/ knowledge
How are you Tracking? (Map your progress each week)	Facilitate self-monitoring of exercise behaviours and exercise outcomes, with the aim of strengthening self-regulation.	Date, frequency of exercise, satisfaction with goal, motivation, planning score, habit scores, perceived fitness and overall fatigue, mood, and pain.	Self-efficacy Self-regulation Intentions
Making it Last (Strategies for building lasting exercise habits)	Support the adoption and maintenance of health-enhancing exercise behaviours.	Structured exercise program status (interested but not commenced, commenced but finding it hard to adhere to, commenced and finding it easy to	Adoption Self-efficacy Self-regulation Intentions

Module title	Module Goal(s)	Tailoring Variable	Mechanisms of Action
		adhere to), barrier self-efficacy, exercise planning behaviors, automaticity of exercise.	Maintenance Intrinsic motivation Enjoyment Automaticity (habits)
Exercise + (What else can you do to keep healthy?)	Increase health literacy regarding other lifestyle factors that may impact on health and quality of life besides structured exercise. Provide links to further information. Provide men exhibiting high distress with information on where to find help.	Current diet, sitting time, alcohol consumption, sleep quality, hot flushes, distress.	Increasing knowledge Sign-posting Competence
Where else can I get help?	Facilitate access to additional support needed in order to improve lifestyle behaviours and quality of life.	Topics of interest (diet, exercise, distress, sleep, symptom management, clinical trials), preferred forms of help (e.g., guidance from a professional, booklets), and interest in advice specific to Aboriginal or Torres Strait Islander people, people who have English as a second language and/or people in the LGBTIQ community.	Increasing knowledge Sign-posting Human support

Web-based exercise prescription

Participants are individually prescribed an 8-week multi-modal (resistance, aerobic and flexibility) programme based upon the conservative prescription used in Galvão et al. (Table 7) and isometric spinal exercise prescription applied in Rief et al. [14, 15]. Exercise prescription variables can be autoregulated by re-completing module assessment questions using the links on the homepage. The intensity or volume of session regulated can be modified by participants modifying their fatigue ratings, pain levels and confidence. Resistance exercises which produce pain can also be changed by adjusting the movement-based questions (e.g. Do you experience pain when you bend or straighten your elbow whilst holding a heavy item?). Participants are educated on autoregulation via the safety and exercise plan modules and programme modification through computer-tailoring is discussed in the initial tele-coaching session).

Table 7: Multimodal exercise prescription for individuals with bone metastases.

Metastasis Location	Resistance		Aerobic		Flexibility	
	Upper	Trunk	Lower	WB	NWB	
Proximal humerus		✓	✓	✓		✓[c]
Cervical Spine	✓[a]		✓	✓		✓[b]
Thoracic spine/ribs	✓[a]		✓	✓		✓[d]
Lumbar spine	✓		✓		✓	✓[d]
Pelvis	✓	✓	✓[b]		✓	✓[b]
Proximal femur	✓	✓			✓	✓[e]

Target exercise region

[a] *Exclusion of shoulder flexion/extension/abduction/adduction – inclusion of elbow flexion/extension.*

[b] *Exclusion of hp extension/flexion – inclusion of knee extension/flexion.*

[c] *Exclusion of elbow flexion/extension.*

[d] *Exclusion of spinal flexion/extension/rotation.*

[e] *Exclusion of knee flexion/extension.*

WB = weight-bearing (walking); NWB= Non-weight bearing (water walking; cycling) (55)

Resistance-based component

There are twenty-seven possible resistance exercises available for prescription (Appendix 16), which have been used in Galvão et al. and Rief et al. (14-15). However, dependent on the algorithm, participants will be prescribed between three and eight exercises. Unpublished usability testing on eleven men reported a median of six exercises prescribed per person. Each resistance exercise will be accompanied by a video demonstration (see Figure 14~~Figure 14~~) and written exercise instructions to aid both safety and efficacy. Participants will be mailed four resistance exercise bands of different loads, which match the resistance bands used within the videos as well as a door anchor to help them to complete the exercises prescribed. Moreover, participants with access to home-based or gym resistance training equipment (e.g. dumbbells) will be encouraged to replicate the exercises with their equipment if possible. Eccentric and concentric phases are performed over a period of 2 seconds each to reduce peak forces transmitted to the skeleton (12-14).

Figure 14: Example of the video demonstrations in *ExerciseGuide* website.
(a) standing band row and (b) squat.

Intensity will be prescribed individually using the OMNI resistance exercise scale of perceived exertion (Figure 15~~Figure 15~~) and will range between seven to eight out of ten (moderate-vigorous intensity) as determined by current fatigue levels and both resistance training experience and confidence (50). This variability has been built in to help balance adherence with the stimulus needed to see clinically relevant outcomes. A 12- to 8-repetition maximum has been prescribed for two to three sets per exercise (Table 8). Self-reported questions at the end of week three will allow researchers to monitor compliance. Participants unable to comply to at least 80% of the prescription (based on total sessions completed and compliance to volume prescribed) will be given a modified prescription for the last five weeks (Appendix 17~~Appendix 17~~) to ensure the participant does not increase repetitions or sets too rapidly. To encourage progression, participants will be instructed to increase the resistance of the upper and lower body exercises by self-assessed 5-10% if the rate of perceived exertion standards were exceeded in each exercise set completed (14).

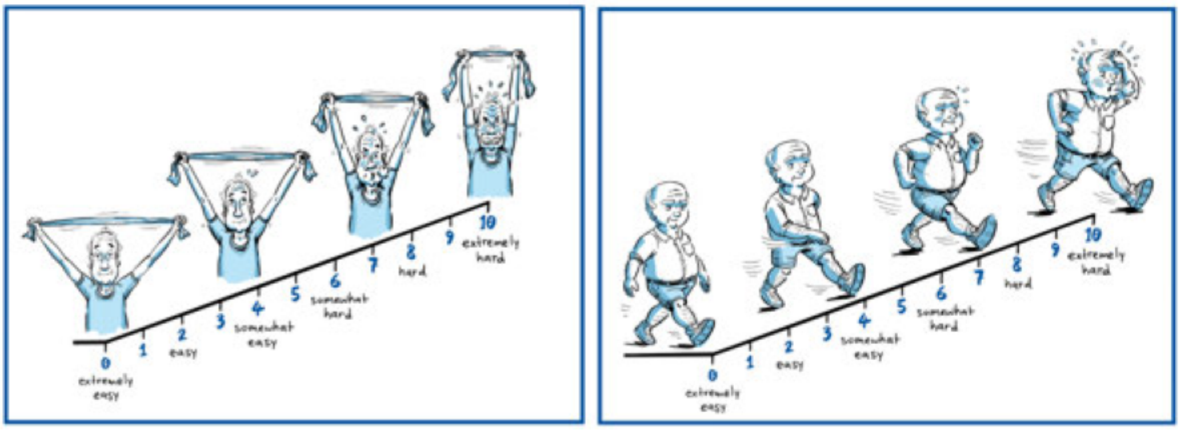

Figure 15: Modified illustrations of the OMNI exercise scale of perceived exertion a) resistance training, b) aerobic training.

Table 8. *ExerciseGuide* Resistance training prescription.

Exercise Type	Volume of exercise prescribed (sets x repetitions)			
	Week 1	**Week 2**	**Week 3**	**Weeks 4 - 8**
Upper body exercises	2 x 12	2 x 12	3 x 12	2-3 x 12-8*
Trunk exercises	2 x 8	2 x 8	2 x 10	2-3 x 10-12*
Lower body exercise	2 x 12	2 x 12	3 x 12	2-3 x 12-8*

**see additional file 3 for specific prescription.*

Frequency of resistance training will be two days per week for the first three weeks and then increased to three sessions if the participant was able to adhere. Participants already completing one or more sessions per week prior to the intervention starting will be required to complete at least two sessions per week of the *ExerciseGuide* programme and will be encouraged to complete more sessions of their own prescription if they wish.

Aerobic-based component

Individuals with bone metastases will be prescribed either stationary cycling, water walking or walking. For individuals without bone metastases, other modes such as conventional cycling, rowing or cross trainers are also prescribed. Equipment accessibility, metastasis location, pain and preference influence what mode is prescribed.

For individuals currently completing two sessions or less a week, two sessions a week will be prescribed for the first 3 weeks. If individuals are completing three or more sessions, then they will be prescribed three specific aerobic sessions. Individuals are encouraged to complete extra aerobic sessions if they feel capable. In terms of duration of sessions, participants will complete 2-3 sets of between 6 and 15 min, with rest intervals ranging from 0 to 5 min or 1 session of 30 min with no prescribed rest (Table 9~~Table 9~~). Session duration and rest intervals will be based on what activity duration the participant feels is feasible, if they are currently meeting this level and an ability score based on previous experience, levels of fatigue and confidence for completing two sessions per week. Intensity will be prescribed using the OMNI aerobic exercise scale of perceived exertion (50). Intensity will be prescribed individually and will be between six and seven out of ten (moderate intensity) as determined by current fatigue levels and both experience and confidence.

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Table 9. *ExerciseGuide* Aerobic training prescription.

Duration feasible	**Meeting duration**	**Ability**	**Aerobic prescription**	**Total active minutes**
0-4 min	No	Low/High*	2 × 3-min efforts with 3-5 min rest	6 min
0-4 min	Yes	Low/High*	2 × 4-min efforts with 3-5 min rest	8 min
5-9 min	No/yes*	Low	2 × 5 min with 2 min rest	10 min
5-9 min	No/yes*	High	3 × 5 min with 2 min rest	15 min
10-19 min 10-19 min	No/yes* No	Low High	2 × 10-min efforts with 5-min rest	20 min
10-19 min 20-29 min	Yes No/yes*	High Low	2 × 15-min efforts with 5-min rest	30 min
20-29 min 30-44 min 30-44 min 45-59 min 60 min +	No/yes* No Yes No/yes* No/yes*	High High Low Low Low	1 × 30-min effort	30 min
30-44 min 45-59 min 45-59 min 60 min +	Yes No Yes No/yes*	High High Low High	3 × 10-min high intensity	30 min

Duration feasible	Meeting duration	Ability	Aerobic prescription	Total active minutes
Unknown	No/Yes*	High/low*	2-3 × 5-10 min efforts with 2-5 min rest	10-30 min

**Prescription did not differ based on this variable for this prescription*

Prescription for session duration based on participant self-assessment of exercise duration feasibility, current participation and ability

Flexibility exercises will be prescribed based on previous work by Galvão et al. (see Table 7~~Table 7~~), which has been shown to be safe. Static stretching will involve all major muscle groups involved in the session held for 30-60 s over a period of 2-4 sets and will be prescribed via pictorial and written instructions.

Tele-health coaching and monitoring of progress

To keep participants engaged in the programme and ensure sufficient support, participants will also have access to an accredited exercise physiologist (HE). The role of the exercise physiologist will be to encourage uptake of the eight-week individually prescribed programme, provide feedback and monitor progress over the eight-week intervention period. Recent reviews of online digital behaviour change interventions suggest that the inclusion of human support increases the efficacy of online interventions (51). The exercise physiologist will make contact with participants allocated to the intervention during week one of the programme (by phone or internet call). They will discuss participant goals, provide advice about how best to use the programme to achieve their goals, and offer remote monitoring of participant progress throughout the eight weeks (Appendix 18). Remote monitoring will involve reviewing data entered into the website by participants weekly and providing encouragement, feedback and advice based on performance. Contact after week one will occur via email and text messages (up to one per week), with the exception of week three, which will involve a follow-up call (by phone or internet; see Appendix 18).). Participants will have the option of submitting questions to the exercise physiologist whenever they would like to via 'the ask the EP' (exercise physiologist) feature of the website. Responses will be sent to participants electronically where possible.

Additional components

Library: The Exercise Guide library is populated with 25 short articles written in layman's language about different aspects of living with prostate cancer, exercise and behaviour change. Example topics include 'Can exercise help your sexual health?', 'Sitting too much: What are the real consequences' and 'Exercise and depression: 5 tips to move your mood'.

Diary: A paper-based exercise diary will be provided to participants in the intervention group to self-report specific aspects of the resistance training (exercises, sets, repetitions, session rate of perceived exertion, duration, bone pain visual analogue score and general pain visual analogue scale), aerobic training (type, duration, session rate of perceived exertion, bone pain visual analogue score and general pain visual analogue scale) and stretching exercise sessions performed. This will allow researchers to monitor and report exercise completed, subjective intensity and any changes in pain levels.

Waitlist control group

Participants randomised into the wait-list control group will complete the baseline outcome measures as seen in Table 10 and will then be asked to continue with usual care, including maintaining their current physical activity levels for eight weeks. In week nine, wait-list control participants will repeat the outcome measures. At the end of the intervention, the control group will be sent therabands, given access to the eHealth tool for 8 weeks, complete two tele-coaching sessions and receive weekly contact from an exercise physiologist as authors felt it was unethical to deny participants access to supported treatment.

Table 10. Overview of measurement tools.

Outcome	Measure	Number of items	Intervention group	Control group	Collection point (week)
Acceptability	Module ratings	10	✓	x	1-8
	Website perceived personal relevance (52)	3	✓	x	9
	Client Satisfaction Questionnaire (34)	8	✓	x	9
	Perceived Environmental Supportiveness Scale (53)	15	✓	x	9
	Qualitative data (open-ended survey questions/qualitative interview)	4	✓	x	9
Usability	Software usability scale (35)	9	✓	x	9
Usage	Website usage data (54)	3	✓	x	1-8
	Number of exercise sessions	2	✓	x	1-8
Adverse events	Common Terminology Criteria for Adverse Events V.5.0 grading criteria	1	✓	✓	9
Mechanisms of action	Self-efficacy (55)	9	✓	✓	0, 9
	Outcome expectations (55)	8	✓	✓	0, 9
	Motivation type (56)	19	✓	✓	0, 9
	Social Support (55)	2	✓	✓	0, 9

Outcome	Measure	Number of items	Intervention group	Control group	Collection point (week)
	Intention (57)	4	✓	✓	0, 9
	Behavioural capability (52)	2	✓	✓	0, 9
	Habit formation (43)	4	✓	✓	0, 9
Behaviour change	ActiGraph Accelerometer (54)	1	✓	✓	0, 9
	Modified Godin-Leisure time questionnaire (12)	4	✓	✓	0, 9
	Self-rated exercise adherence (58)	2	✓	x	9
Health outcomes	European Organisation for Research and Treatment of Cancer Quality of Life-Core 30 (59)	30	✓	✓	0, 9
	Functional Assessment of Chronic Illness Therapy-fatigue subscale (60)	13	✓	✓	0, 9
	Hospital Anxiety and Depression Scale (61)	10	✓	✓	0, 9
	The Pittsburgh Sleep Quality Index (62)	14	✓	✓	0, 9
Sub-study physical function	400 m self-paced walk (14)	1	✓	✓	0, 9
	Timed up-and-go test (12)	1	✓	✓	0, 9
	Repeated chair stand (63)	1	✓	✓	0, 9
	One-repetition maximum (14)	2	✓	✓	0, 9

5.3.7 Measures

Feasibility

Trial parameters

Screening, recruitment and attrition rates will all be tracked, with reasons for ineligibility, lack of interest and drop-out recorded where possible. Recruitment source will also be assessed during study enrolment. The proportion of participants with complete data for each outcome measure will be assessed, along with the number of reminders and data collection attempts.

Intervention parameters

The time taken to deliver coaching sessions and respond to questions asked using the 'ask and EP feature' will be recorded in order to provide a proxy indicator of cost of delivery.

Success of the intervention

Acceptability

The acceptability of the intervention will be assessed using a mixed-methods approach. Participant's perceptions of module content will be assessed in real-time using a five-star rating system (1—poor to 5—excellent). All other acceptability items will be assessed in week 9. Perceived personal relevance of website content will be assessed via survey using three items designed to evaluate the success of tailoring on a 7-point Likert scale (e.g. 'the web-based content was written with someone like me in mind') (52). The extent to which the coaching was perceived as motivationally supportive will be assessed using the 15-item perceived environmental supportiveness scale (53) and overall satisfaction with the intervention as a health service will be assessed using the client satisfaction Questionnaire-8 (34). Finally, qualitative data will be collecting using open-ended survey questions and qualitative interviews exploring the pros and cons of the website, any unmet needs, and recommendations for improvement, including any suggested changes to intervention length.

Usability

Usability of the intervention website will be assessed using the System Usability Scale (35). The survey consists of a 9-item questionnaire with five response options for respondents ranging from 'strongly agree' to 'strongly disagree'.

Usage

Website usage data, including the number of logins, time on site and number of modules completed, will be assessed using Google analytics and inbuilt website tracking software (54). Usage of the exercise diary will also be recorded in terms of number of sessions logged.

Adverse events

Participants will be advised to report any injuries either through the website or by calling the study project coordinator (HE). An item on adverse events will also be included in the follow-up questionnaire based on the Common Terminology Criteria for Adverse Events V.5.0 grading criteria.

Behaviour change

Accelerometry will be used to objectively measure weekly minutes of light, moderate and vigorous physical activity at baseline and immediately post-intervention. Data will be collected using the ActiGraph (ActiGraph GT3X, http://www.theActiGraph.com) accelerometer, which will be worn on the right hip during waking hours for 7 days with the intention of gaining at least 5 days of usable data (54). Participants will record times the monitor was removed and wear-time will be validated using Choi et al. (64). Triaxial data will be collected in 1-s epochs along with step counts and inclinometry. The adapted Godin leisure-time questionnaire will be used to assess self-reported aerobic and resistance based physical activity at baseline (Appendix 19) and immediately post-intervention (Appendix 20 and Appendix 21) (12). Finally, at the immediate post-intervention follow-up only, self-rated exercise adherence will be measured using two items with an 11-point numeric rating scale (0 = strongly disagree, 10 = strongly agree). Participants will be asked to separately rate their agreement with two statements related to their adherence to their prescribed programme (overall aerobic exercise sessions, overall resistance exercise sessions) (58).

Health outcomes

All health-related outcomes will be assessed at baseline and immediately post-intervention. Health-related quality of life will be assessed using the EORTC Quality of Life-Core 30 (EORTC QLQ-C30), which is a validated and reliable questionnaire for quality of life in cancer patients (65). The 30-item core survey assesses a comprehensive range of quality of life domains including functioning (physical, role, cognitive, emotional and social), symptoms (fatigue, nausea and vomiting, sleep, pain, appetite, shortness of breath), financial hardship and global health status (59).

The 13-item Functional Assessment of Chronic Illness Therapy-fatigue subscale will be administered to measure participant's level of fatigue. The questionnaire has been demonstrated as a valid and reliable measure (60). The Hospital Anxiety and Depression Scale will be used to evaluate changes in anxiety and depression by using two 7-item Depression and Anxiety sub-scales (61). The reliability and validity has been shown to be acceptable in individuals with prostate cancer (66). Additionally, the Pittsburgh Sleep Quality Index questionnaire will measure sleep quality. Psychometric evaluation of the Pittsburgh Sleep Quality Index in cancer patients has established internal consistency, reliability and construct validity (62).

Intervention mechanisms

The proposed behavioural change mechanisms will be assessed at baseline and week 9. This will include measuring barrier self-efficacy for resistance and aerobic activities (9 items (55)), outcome expectations (8 items (67)), motivation type (19 items (56)). Social support (2 items (55)), intentions (4 items (57)), behavioural capability (7 items (52) and habit formation (4 items (43)). Collection of this data will provide preliminary insight into if the intervention is working as expected and will also provide useful information for directing further tailoring efforts (e.g. by allowing us to examine how variable individuals are in these variables at baseline, and thus the extent of tailoring that is needed). Collection of this information will also be useful for establishing feasibility of collecting data needed for a formal mediation analysis in the main trial.

Sub-study outcome measures

Subgroup selection will be based on proximity to available testing sites, with all participants (both intervention and waitlist control groups) who can easily access one of our testing sites invited to complete subgroup measures). We intend to have testing sites available in Adelaide (the University of Adelaide, University of South Australia) and Melbourne (University of Melbourne).

Physical function

The 400-m walk will be used to assess aerobic fitness level (14, 68). Participants will be asked to complete the walk as fast as they complete 20 laps of 20-m track. Measures of completion time (in seconds), maximal heart rate, average heart rate and rate of perceived exertion will be recorded. The timed up-and-go test and the repeated chair stand (5 repetitions) will be measured by time to completion to provide muscular power, ambulation and functional lower limb strength (12-13, 63).

Muscular strength

The one-repetition maximum method will be utilised to determine muscular strength (14). The leg extension will be used to determine lower limb strength, and the chest press will assess upper limb strength. Patients with proximal femur bone lesions will be excluded from the leg extension one-repetition maximum test, whereas those with rib, thoracic spine lesions and or humerus lesions will be excluded from the chest press one-repetition maximum test.

Data management and monitoring

All research data will be stored on a password-protected network drive on a password-protected computer and only members of the study team will have access to this data. Questionnaire data will be recorded using a secure online data collection instrument (RedCap) with participants being sent web links at the appropriate time points. Participant contact information and name will be held in a separate file to study data, and unique ID numbers will be allocated. Only ID numbers will appear alongside outcome data. A trial steering committee (CES, DG, GK, NB) will oversee the trial. Any adverse events will be reported to the committee and the steering committee have the power the terminate the study if necessary. As a clinical oncologist and urologist sit on the trial steering committee, it was determined that a trial data monitoring committee was not required. Trial results will be submitted for publication and communicated in a relevant medical or scientific journal.

5.3.8 Data analysis

Sample size

As this is a pilot study, which uses pre-specified criteria for success rather than a primary outcome, a formal sample size calculation was not essential (69). Similar 2-arm pilot studies have reported sample sizes of 36 and 30 per arm for dichotomous and continuous endpoints, respectfully (70). Similar to these studies, the enrolment target for this trial is 66 participants, 33 in each arm. Using a sample size calculation method created for pilot studies by Vichtbauer al., it was determined that the above sample size will allow us to identify feasibility problems (drop out, safety issues etc.) with a reasonable probability of occurring (i.e. a probability of 10% or greater), with a 95% level of confidence (71). If issues are detected the trial team will review and consider if progression to a larger trial is warranted and feasible.

Study data will be analysed using SPSS version 26 (IBM, Chicago, IL, USA). Descriptive statistics will be calculated for all study variables. ANCOVAs (or non-parametric equivalents) will be used to conduct between-group comparisons, with potential confounders included in the model (e.g. age, time since diagnosis, treatment status and baseline outcome assessments). Treatment effects will be estimated as covariate-adjusted mean differences between the two treatment groups at follow up. A senior University of Adelaide statistician employed by the Freemasons Foundation Centre for Men's Health will oversee the analyses. Sensitivity analyses will be conducted to explore the impact of missing data and remove any individuals who were unable to be prescribed with exercise from the analysis.

Qualitative analysis

Any verbal feedback from participants will be recorded (with permission) and transcribed verbatim. A thematic assessment will be undertaken to analyse the data as completed by Braun and Clarke (72). This approach is data-driven and involves becoming familiar with the data, generating initial codes, searching for themes amongst codes and refining the themes to fit the data better.

Protocol changes

Future amendments to the protocol will be considered and approved by the Steering Committee and resubmitted for ethical approval. Approved amendments will be subsequently distributed to participants through the study website.

5.4 Discussion

The primary objective of the trial is to assess key areas of uncertainty regarding the use of *ExerciseGuide* (and other similar programmes) in future practice and research, including issues relating to feasibility, safety and potential for efficacy. Publication of this protocol aims to ensure transparency around pre-specified criterion for success, aid replication of study and intervention methods, and inform interested parties of the upcoming trial results.

ExerciseGuide represents a novel approach to providing more geographically accessible individualised exercise prescription with distance-based multidisciplinary support. The addition of distance-based supervision, tailored behavioural change strategies and telehealth support, may improve adherence to distance-based interventions, which are currently seen as inferior in comparison to the gold standard 'face-to-face' intervention (23, 29). Increasing the feeling of personalisation, connectedness, and support through eHealth has been one method to address the disparity between the two approaches. It is anticipated that an intervention of this type would not replace face-to-face interventions, but rather play a role alongside on-site interventions as an alternative where no onsite interventions can be made available due to staffing or financial shortages.

Despite the potential advantages, there are a number of implementation issues that may be encountered when delivering a programme like *ExerciseGuide*. These need to be mitigated in order for high-quality implementation and evaluation to occur in the future. For example, whilst the use of eHealth technologies is useful to increase accessibility to individuals in remote areas, it is important to note that internet connection and reliability are reduced in remote Australian areas (73). Our provision of both written (printable) and video-based exercise prescription and education may improve access to those with poor Internet connections; however, those without a connection will remain without accessible support. Adherence to health behavioural change and exercise interventions is another limitation noted in the eHealth literature (26). We have attempted to improve adherence by working with consumers to refine content and by undergoing iterative usability testing in order to improve the user experience. We have also included elements of human support which should further enhance engagement. Lastly, it is well known that recruiting older males into health interventions is difficult (74). Numerous different recruitment strategies will be included such as mass mailing via prostate cancer registries, health service referrals and community outreach. Further to this, advertising materials were gender-specific and mass mailouts through the prostate cancer registry were personalised. Data from this trial will provide useful information regarding the success of these mitigation strategies.

Pilot trials studies of this nature can possibly reduce research waste and more significantly, they can lead to changes in development and design in order to maximise the intervention and trial characteristics for future trials (75). Usability, acceptability, adverse events, safety, and evidence of aerobic activity or resistance-based activity participation will all be monitored to determine if progression to a full randomised control trial is worthwhile.

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Ethics approval and consent to participate: Ethical clearance was obtained by the University of Adelaide Research Ethics Committee (H-2018-153). Participants are required to provide signed informed consent at the time of enrolment.

Consent for publication: Consent was given by participants and instructor to have still images from video demonstrations to be used in the publication.

Competing interests: There are no competing interests for this study

5.5 References

1. Prashanth, R. Epidemiology of prostate cancer. World J Oncol. 2019;10(2):63–89.
2. Collins A, Sundararajan V, Millar J, Burchell J, Le B, Krishnasamy M, et al. The trajectory of patients who die from metastatic prostate cancer: a population-based study. BJU Int. 2019;123:19–26.
3. Luo Q, Yu XQ, Smith DP, O'Connell DL. A population-based study of progression to metastatic prostate cancer in Australia. Cancer Epidemiol. 2015;39:617–22.
4. Australian Institute of Health and Welfare (AIHW): Cancer data in Australia. 2018. https://www.aihw.gov.au/reports/cancer/cancer-data-in-australia. Accessed 30 April 2020.
5. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11:247–57.
6. Sheill G, Guinan EM, Peat N, Hussey J. Considerations for exercise prescription in patients with bone metastases: a comprehensive narrative review. PM&R. 2018; 10(8):843-64
7. Welte SE, Wiskemann J, Scharhag-Rosenberger F, Förster R, Bostel T, Bruckner T, et al. Differentiated resistance training of the paravertebral muscles in patients with unstable spinal bone metastasis under concomitant radiotherapy: study protocol for a randomized pilot trial. Trials. 2017;18:155.
8. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8:e019917.
9. Lee M, Jim HS, Fishman M, Zachariah B, Heysek R, Biagioli M, et al. Depressive symptomatology in men receiving androgen deprivation therapy for prostate cancer: A controlled comparison. Psycho-Oncol. 2015;24(4):472–7.
10. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: Exercise medicine in cancer management. J Sci Med Sport. 2019.
11. Campbell KL, Winters-stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, et al. Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable exercise guidelines for cancer

survivors: consensus statement from international multidisciplinary roundtable. Med Sci Sport Exerc. 2019;51(11):2375–90.

12. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16:328–35.
13. Cormie P, Galvão DA, Spry N, Joseph D, Taaffe TR, Newton RU. Functional benefits are sustained after a program of supervised resistance exercise in cancer patients with bone metastases: longitudinal results of a pilot study. Support Care Cancer. 2014;22:1537–1548.
14. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393–399.
15. Rief H, Petersen LC, Omlor G, Akbar M, Bruckner T, Rieken S, et al. The effect of resistance training during radiotherapy on spinal bone metastases in cancer patients - A randomized trial. Radiother Oncol. 2014;112(1):133–9.
16. Newton RU, Kenfield SA, Hart NH, Chan JM, Courneya KS, Catto J, et al. Intense exercise for survival among men with metastatic castrate-resistant prostate cancer (INTERVAL-GAP4): a multicentre, randomised, controlled phase III study protocol. BMJ Open. 2018;8(5):e022899.
17. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care. 2017;26(6):e12575.
18. Galvão DA, Newton RU, Gardiner RA, Girgis A, Lepore SJ, Stiller A, et al. Compliance to exercise-oncology guidelines in prostate cancer survivors and associations with psychological distress, unmet supportive care needs, and quality of life. Psycho-Oncology 2015;24(10):1241–9.
19. Lowe SS, Watanabe SM, Baracos VE, Courneya KS. Physical activity interests and preferences in palliative cancer patients. Support Care Cancer. 2010;18:1469–75.
20. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: A qualitative exploration. Support Care Cancer. 2017; 26(6):1747-54.

21. Vandelanotte C, Müller AM, Short CE, Hingle M, Nathan N, Williams SL, et al. Past, present, and future of eHealth and mHealth research to improve physical activity and dietary behaviors. J Nutr Educ Behav. 2016;48:219-228.
22. Roberts AL, Fisher A, Smith L, Heinrich M, Potts HWW. Digital health behaviour change interventions targeting physical activity and diet in cancer survivors: a systematic review and meta-analysis. J Cancer Surviv. 2017;11:704–19.
23. Buffart LM, Kalter J, Sweegers MG, Courneya KS, Newton RU, Aaronson NK, et al. Effects and moderators of exercise on quality of life and physical function in patients with cancer: an individual patient data meta-analysis of 34 RCTs. Cancer Treat Rev. 2017;52:91–104.
24. Kenfield SA, Van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (Prostate 8): a pilot randomized controlled trial in men with prostate cancer. Eur Urol. 2019;75(6):950–8.
25. Newton RU, Taaffe DR, Chambers SK, Spry N, Galvão DA. Effective exercise interventions for patients and survivors of cancer should be supervised, targeted, and prescribed with referrals from oncologists and general physicians. J Clin Oncol. 2018;36(9):927–8.
26. Short CE, Trinh L, James E. Effective technology-based behaviour change interventions in prostate cancer supportive care: are we there yet? Eur. Urol. 2019;75:959–60.
27. Lau Y, Chee DGH, Chow XP, Cheng LJ, Wong SN. Personalised eHealth interventions in adults with overweight and obesity: A systematic review and meta-analysis of randomised controlled trials. Prev. Med. 2020;132:106001.
28. Andersson G, Cuijpers P. Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. Cogn Behav Ther. 2009;38(4):196–205.
29. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Short-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: a randomized controlled trial. Int J Behav Nutr Phys Act. 2018;15(1):106.

30. Haberlin C, O'Dwyer T, Mockler D, Moran J, O'Donnell DM, Broderick J. The use of eHealth to promote physical activity in cancer survivors: a systematic review. Support Care Cancer. 2018;26:3323–36.
31. Australian Communications and Media Authority: Digital lives of older Australians. https://www.acma.gov.au/publications/2016-08/publication/digital-lives-older-australians (2017). Accessed 12 January 2020.
32. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49.
33. Chan AW, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, et al. SPIRIT 2013 statement: defining standard protocol items for clinical trials. Ann. Intern. Med. 2013;158(3):200-7.
34. Attkisson CC, Greenfield TK. The UCSF client satisfaction scales: I. The Client Satisfaction Questionnaire-8. In: Maruish, editor. The use of psychological testing for treatment planning and outcomes assessment: Instruments for adults. New Jersey: Lawrence Erlbaum Associates Publishers; 2004. p. 799–811.
35. Brooke J. SUS-A quick and dirty usability scale. Usability Eval Ind. 1996;189(194):4–7.
36. American College of Sports Medicine. ACSM's exercise testing and prescription. 7th ed. Lippincott Williams & Wilkins; 2017.
37. Bartholomew LK, Parcel GS, Kok G. Intervention mapping: a process for developing theory- and evidence-based health education programs. Health Educ. Behav. 1998;25:545–63.
38. Forbes CC, Finlay A, McIntosh M, Siddiquee S, Short CE. A systematic review of the feasibility, acceptability, and efficacy of online supportive care interventions targeting men with a history of prostate cancer. J Cancer Surviv. 2019;13:75–96.
39. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018;52(9):798–808.

40. Rhodes RE, De Bruijn GJ. How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. Br J Health Psychol. 2013;18(2):296–309.
41. Rhodes RE, McEwan D, Rebar AL. Theories of physical activity behaviour change: a history and synthesis of approaches. Psychol Sport Exerc. 2019;42:100–9.
42. Teixeira PJ, Carraça E V., Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. Int J Behav Nutr Phy. 2012;9:78.
43. Gardner B, Lally P, Wardle J. Making health habitual: the psychology of "habit-formation" and general practice. Brit J Gen Pract. 2012;62:664–6.
44. Stacey FG, James EL, Chapman K, Courneya KS, Lubans DR. A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behavior change interventions for cancer survivors. J Cancer Surviv. 2015;9: 305–38.
45. Petty RE, Barden J, Wheeler SC. The Elaboration Likelihood Model of persuasion: Developing health promotions for sustained behavioral change. In: DiClemente RJ, Crosby RA, Kegler MC, editors. Emerging theories in health promotion practice and research. Jossey-Bass;2009. p. 185–214.
46. Nikoloudakis IA, Crutzen R, Rebar AL, Vandelanotte C, Quester P, Dry M, et al. Can you elaborate on that? Addressing participants' need for cognition in computer-tailored health behavior interventions. Health Psychol Rev. 2018;12(4):437–52.
47. Lustria MLA, Noar SM, Cortese J, Van Stee SK, Glueckauf RL, Lee J. A meta-analysis of web-delivered tailored health behavior change interventions. J. Health Commun. 2013;18:1039–69.
48. Wolfenden L, Nathan N, Williams CM. Computer-tailored interventions to facilitate health behavioural change. Br. J. Sports Med. 2015; 49:1478–9.
49. Galvão DA, Newton RU, Girgis A, Lepore SJ, Stiller A, Mihalopoulos C, et al. Randomized controlled trial of a peer led multimodal intervention for men with prostate cancer to increase exercise participation. Psycho-oncology. 2018;27(1):199–207.

50. Rief H, Petersen LC, Omlor G, Akbar M, Bruckner T, Rieken S, et al. The effect of resistance training during radiotherapy on spinal bone metastases in cancer patients–A randomized trial. Radiother Oncol. 2014;112:133–9.
51. Gearhart RF, Lagally KM, Riechman SE, Andrews RD, Robertson RJ. Strength tracking using the OMNI resistance exercise scale in older men and women. J Strength Cond Res. 2009;23(3):1011–5.
52. Santarossa S, Kane D, Senn CY, Woodruff SJ. Exploring the role of in-person components for online health behavior change interventions: Can a digital person-to-person component suffice? J. Med. Internet Res. 2018;20(4):e144.
53. Short C, James E, Girgis A, Mcelduff P, Plotnikoff R. The efficacy of two theoretically-based print interventions for promoting PA behaviour among post-treatment breast cancer survivors: A nationally-based 3-arm RCT. J Sci Med Sport. 2012;15:S175–6.
54. Markland D, Tobin VJ. Need support and behavioural regulations for exercise among exercise referral scheme clients: the mediating role of psychological need satisfaction. Psychol Sport Exerc. 2010;11(2):91–9.
55. Vandelanotte C, Short C, Plotnikoff RC, Hooker C, Canoy D, Rebar A, et al. TaylorActive - Examining the effectiveness of web-based personally-tailored videos to increase physical activity: a randomised controlled trial protocol. BMC Public Health. 2015;15(1):1020.
56. Plotnikoff RC, Lippke S, Courneya KS, Birkett N, Sigal RJ. Physical activity and social cognitive theory: a test in a population sample of adults with type 1 or type 2 diabetes. Appl Psychol. 2008;57(4):628–43.
57. Plotnikoff RC, Blanchard C, Hotz SB, Rhodes R. Measurement in physical education and exercise science validation of the decisional balance scales in the exercise domain from the transtheoretical model: a longitudinal test. Meas Phys Educ Exerc Sci. 2009;5(4):191-206.
58. Markland D, Tobin V. A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. J Sport Exerc Psychol. 2004;26(2):191–6.
59. Rhodes RE, Rebar AL. Conceptualizing and defining the intention construct for future physical activity research. Exerc Sport Sci Rev. 2017;45(4):209–16.

60. Choi L, Ward SC, Schnelle JF, Buchowski MS. Assessment of wear/nonwear time classification algorithms for triaxial accelerometer. Med Sci Sports Exerc. 2012;44(10):2009–16.
61. Bennell KL, Marshall CJ, Dobson F, Kasza J, Lonsdale C, Hinman RS. Does a web-based exercise programming system improve home exercise adherence for people with musculoskeletal conditions? Am J Phys Med Rehabil. 2019;98(10):850–8.
62. Kaasa S, Bjordal K, Aaronson N, Moum T, Wist E, Hagen S, et al. The EORTC core quality of life questionnaire (QLQ-C30): validity and reliability when analysed with patients treated with palliative radiotherapy. Eur J Cancer. 1995;31(13–14):2260–3.
63. Ware P, Bartlett SJ, Paré G, Symeonidis I, Tannenbaum C, Bartlett G, et al. Using eHealth technologies: interests, preferences, and concerns of older adults. Interact J Med Res. 2017;6(1):e3.
64. Cella D, Lai JS, Chang CH, Peterman A, Slavin M. Fatigue in cancer patients compared with fatigue in the general United States population. Cancer. 2002;94(2):528–38.
65. Greer JA, Jacobs J, Pensak N, MacDonald JJ, Fuh C, Perez GK, et al. Randomized trial of a tailored cognitive-behavioral therapy mobile application for anxiety in patients with incurable cancer. Oncologist. 2019;24(8):1111–20.
66. Gerbershagen HJ, Özgür E, Straub K, Dagtekin O, Gerbershagen K, Petzke F, et al. Prevalence, severity, and chronicity of pain and general health-related quality of life in patients with localized prostate cancer. Eur J Pain. 2008;12(3):339–50.
67. Beck SL, Schwartz AL, Towsley G, Dudley W, Barsevick A. Psychometric evaluation of the Pittsburgh sleep quality index in cancer patients. J Pain Symptom Manage. 2004;27(2):140–8.
68. Bohannon RW. Measurement of sit-to-stand among older adults. Top Geriatr Rehabil. 2012; 28(1):11-6.
69. Hart, NH, Newton, RU, Spry, NA, Taaffe, DR, Chambers, SK, Feeney, KT, & Galvão, DA. Can exercise suppress tumour growth in advanced prostate cancer patients with sclerotic bone metastases? A randomised, controlled study protocol examining feasibility, safety and efficacy. BMJ open. 2017;7(5).

70. Thabane L, Lancaster G. A guide to the reporting of protocols of pilot and feasibility trials. Pilot Feasibility Stud. 2019;5(37).
71. Billingham SA, Whitehead AL, Julious SA. An audit of sample sizes for pilot and feasibility trials being undertaken in the United Kingdom registered in the United Kingdom Clinical Research Network database. BMC Med Res Methodol. 2013; 13(1):104.
72. Viechtbauer W, Smits L, Kotz D, Budé L, Spigt M, Serroyen J, et al. A simple formula for the calculation of sample size in pilot studies. J Clin Epidemiol. 2015;68(11):1375–9.
73. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101.
74. Australian Bureau of Statistics. Household Use of Information Technology, Australia, 2016-2017. 2018. https://www.abs.gov.au/Ausstats/. Accessed 17 October 2020.
75. Bracken K, Askie L, Keech AC, Hague W, Wittert G. Recruitment strategies in randomised controlled trials of men aged 50 years and older: a systematic review. BMJ open. 2019;9(4):e025580.
76. Blatch-Jones AJ, Pek W, Kirkpatrick E, Ashton-Key M. Role of feasibility and pilot studies in randomised controlled trials: a crosssectional study. BMJ Open. 2018;8(9):e022233.
77. Parfitt G, Alrumh A, Rowlands A V. Affect-regulated exercise intensity: does training at an intensity that feels “good” improve physical health? J Sci Med Sport. 2012;15(6):548–53.
78. Short CE, James EL, Rebar AL, Duncan MJ, Courneya KS, Plotnikoff RC, et al. Designing more engaging computer-tailored physical activity behaviour change interventions for breast cancer survivors: lessons from the iMove More for Life study. Support Care Cancer. 2017;25(11):3569–85.
79. Bandura A. Health Promotion by social cognitive means. Heal Educ Behav. 2004;31(2):143–46
80. Craike M, Gaskin CJ, Courneya KS, Fraser SF, Salmon J, Owen PJ, et al. Predictors of adherence to a 12-week exercise program among men treated for prostate cancer: ENGAGE study. Cancer Med. 2016;5(5):787–94.

81. Courneya KS, Segal RJ, Reid RD, Jones LW, Malone SC, Venner PM, et al. Three independent factors predicted adherence in a randomized controlled trial of resistance exercise training among prostate cancer survivors. J Clin Epidemiol. 2004;57(6):571–9.
82. Rebar AL, Elavsky S, Maher JP, Doerksen SE, Conroy DE. Habits predict physical activity on days when intentions are weak. J Sport Exerc Psychol. 2014;36(2):157–65.
83. van Stralen MM, de Vries H, Mudde AN, Bolman C, Lechner L. Determinants of initiation and maintenance of physical activity among older adults: a literature review. Health Psychol. Rev. 2009;3: 147–207.

Chapter Six

Acceptability and preliminary efficacy of a web- and tele-phone-based personalised exercise intervention for individuals with metastatic prostate cancer: the *ExerciseGuide* pilot randomised controlled trial.

Evans HE, Galvão DA, Forbes CC, Girard D, Vandelanotte C, Newton RU, Vincent AD, Wittert G, Kichenadasse G, Chambers S, Brook N. Acceptability and preliminary efficacy of a web-and telephone-based personalised exercise intervention for individuals with metastatic prostate cancer: the *ExerciseGuide* pilot randomised controlled trial. Cancers. 2021;13(23):5925. DOI: 10.3390/cancers13235925.

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Overall percentage	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Signature		Date	21/12/2021

6.1. Abstract

Preliminary research has shown the effectiveness of supervised exercise-based interventions in alleviating sequela resulting from metastatic prostate cancer. However, many individuals encounter barriers that limit the uptake of face-to-face exercise. Technology-enabled interventions offer a distance-based alternative. This pilot study aimed to explore the acceptability, safety and preliminary efficacy of a web-based exercise intervention (*ExerciseGuide*) in individuals with metastatic prostate cancer. Forty participants (70.2 ± 8.5 years) with metastatic prostate cancer were randomised into the 8-week intervention (n=20) or a wait-list control (n=20). The intervention arm had access to a computer-tailored website, personalised exercise prescription and remote supervision. *ExerciseGuide* was deemed acceptable with a score ≥20 on the client satisfaction questionnaire; however, the usability score was just below the pre-specified score of ≥68 on the software usability scale. There were no serious adverse events reported. Moderate-to-vigorous physical activity levels between baseline and follow-ups were significantly higher (10.0 min per day; 95% CI, 1.3–18.6; P=0.01) in the intervention group compared to wait-list control. There were also greater improvements in step count (1332; 95% CI, 159–2505; P=0.02) and identified motivation (0.4; 95% CI 0.0-0.7; P=0.04). Our findings provide preliminary evidence that *ExerciseGuide* is acceptable, safe and efficacious among individuals with metastatic prostate cancer.

Keywords: exercise; metastatic prostate cancer; behavioral change; eHealth; computer-tailoring; usability; acceptability; rct.

6.2. Introduction

Prostate cancer is the second most common malignancy in Australia, with one in six individuals diagnosed by the age of 85 (1). Unlike individuals with localised prostate cancer who have a 95% five-year survival, individuals whose cancer has metastasised to secondary sites (bone, viscera and nodes) have an approximately 30% five-year survival despite treatment (1).

Individuals with metastatic prostate cancer face substantial physical and psychological deterioration due to toxicities relating to life-prolonging therapies such as treatment with abiraterone, enzalutamide, docetaxel, cabazitaxel, radium-223 and sipuleucel-T (2). Furthermore, individuals deal with symptoms from the disease, such as pain and disability relating to metastasis, which are typically found in bone, liver and thorax (3).

These negative changes create a vicious cycle of physical inactivity, which then accelerates their physical decline (4). It has been established that individuals with metastatic prostate cancer have a desire to maintain sufficient physical and emotional functioning to maintain their daily responsibilities (i.e., physical housework, hobbies and spending time with loved ones); it is essential that their physical function and cardiorespiratory fitness is retained for as long as possible in order to maximise quality of life (5).

Strong evidence supports tailored exercise prescription in individuals with metastatic prostate cancer within supervised research settings (4,6,7). Researchers have stated improved physical function, body strength, submaximal aerobic exercise capacity, ambulation, lean mass and emotional well-being (8-10). Although it is still unclear what effect a tailored exercise program has on long term survival in this population, observational studies have reported that increased physical activity is associated with a lower risk of cancer-specific mortality in individuals with localised prostate cancer (11,12).

Despite the significant positive benefits observed, the gold-standard but resource-intensive model of tailored supervised exercise seen in research settings and exercise clinics is unlikely to be accessible for all individuals. For example, Sheill et al. reported that individuals with metastatic prostate cancer can face considerable financial, access and time limitations, as well as treatment-related side effects that can impede supervised exercise uptake and adherence in community settings (13). Moreover, individuals within the Sheill et al. study noted that lack of appropriate exercise-based facilities in rural areas was also a notable barrier (13).

To address some of these barriers, technological advances, such as computer-tailored websites (where content is personalised using algorithms), present alternative exercise prescription and education opportunities. In other oncology populations, web-based interventions have shown promising behaviour changes in diet and physical activity (14-16). The advantage of web-based technology lies in the added scalability, reach, cost-effectiveness and accessibility (16). No studies have focused on utilising detailed algorithms to tailor both aerobic and resistance training prescriptions to individuals with metastatic prostate cancer, but the opportunities to provide adaptive distance-based individualised exercise prescription is especially valuable. Compared to individuals with localised disease, individuals with metastatic prostate cancer often have bone lesions and other considerations for exercise prescription, which increase the need for tailored programming to reduce risks. The lab-based evidence of computer-tailored exercise prescription shows encouraging acceptability, usability and safety levels in individuals with metastatic prostate cancer; however, feasibility, safety and efficacy in a real-world setting is currently unknown (17).

To be effective in the real-world, some level of human contact is likely needed. Previous research suggests that having someone to be accountable to is important for adherence to web-based programs, even when computer-tailoring is employed to personalise context (18). A recent review of web-based programs supports this, with web-based programs that incorporate human support found to have greater efficacy and adherence than those that are standalone (19).

We undertook a pilot randomised controlled trial to assess the acceptability, safety and preliminary efficacy of a computer-tailored web-based intervention (*ExerciseGuide*) in combination with brief tele-support for enhancing exercise and health among individuals with metastatic prostate cancer.

6.3. Methods

6.3.1. Trial design

A randomised controlled pilot trial comprising two study arms, [1] an 8-week exercise intervention arm (web-based tool and telehealth support) and [2] a wait-list control arm. The study protocol, including criteria for progression to a larger definitive trial, was published a priori (17). Assessments are completed at baseline and in week nine. Ethics approval was granted by the University of Adelaide Research Ethics Committee and two South Australian Health Human Research Ethics Committees (Southern Adelaide Local Health Network and Central Adelaide Local Health Network) (Appendix 14). The study was registered on the Australian New Zealand Clinical Trials Registry (ACTRN12618001979246) and reporting and conduct adhered to the Consolidating Standards of Reporting Clinical Trials (CONSORT) guidelines (20). Due to the nature of the study, it was not feasible to blind participants. All participants provided written informed consent to participate before entering the study.

The *ExerciseGuide* trial was conducted Australia-wide, with protocols described in depth previously (21). In short, mixed methods (questionnaires, accelerometry, qualitative interviews and physical function testing) were used for acceptability, safety and efficacy evaluation, with the success of the intervention interpreted based on the following criteria:

1. Acceptability:
    a. The acceptability of the intervention was satisfactory (an average score of ≥20 on the client satisfaction questionnaire) (22).
    b. The website usability was satisfactory (an average score of ≥68 on the software usability scale) (23).
2. Safety:
    a. No grade 3+/life threatening, or severe adverse events resulted from participating in the intervention.
3. Efficacy:
    a. Evidence of clinically meaningful participation in either aerobic and or resistance exercise in the intervention group relative to the wait-list control, defined as a between-group difference of at least 30 min of aerobic activity and or one resistance training session per week.
4. Feasibility of conducting a larger-scale trial:
    a. The recruitment goal of 66 participants was reached.
    b. Behaviour change data was collected for ≥75% of participants.
    c. Physical functioning data was collected for ≥75% of participants that [a] reside within 30 km from a study testing site and [b] are invited to complete testing.

Additional measures of acceptability, safety and efficacy were also included and are described in detail below.

6.3.2. Participants

One hundred and forty-one male patients with metastatic prostate cancer expressed interest in the study from February 2020 to January 2021 and forty-one were deemed eligible to participate. Participants met the inclusion criteria if they had a confirmed diagnosis of metastatic prostate cancer and medical clearance to participate in the study from their physician (i.e., General Practitioner, Medical Oncologist), which also detailed all metastasis location/s and severity (Appendix 22). Participants were required to be proficient in English, have access to the internet and be free from contraindications to performing moderate intensity exercise (i.e., no recent serious cardiovascular events within 12 months, unstable bone metastases, spinal compressions or acute illnesses) (24).

Participants were excluded if they were deemed as currently sufficiently active, which was defined as already engaging in two sessions of resistance training and 60 min of structured moderate–vigorous aerobic exercise per week or had current moderate to severe bone pain (Common Terminology Criteria for Adverse Events V.5.0 grading criteria).

6.3.3. Recruitment

Participants were recruited via social media advertisements (i.e., Facebook), Prostate cancer and men's health research volunteer registries (Prostate Cancer Foundation of Australia Pathfinders registry and The Freemasons Centre for Male Health and Wellbeing registry), the South Australian Prostate Cancer Registry prostate cancer nurses, urologists and medical oncologists. All potential participants were directed to the study webpage (www.exerciseguide.org.au; accessed 23 November 2021). Detailed study information, an automated screening tool and researchers' contact details were found on the website. Interested participants were encouraged to complete the automated web-based screening survey, and if assessed as potentially eligible, were asked to provide contact details. Researchers then verified eligibility via a phone interview, and an information pack was emailed or posted (Appendix 23). Once written consent and medical clearance was returned, baseline assessments were undertaken.

6.3.4. Randomisation

Participants were stratified by age (≤65 years, >65 years) and physical function (physical functioning domain of the European Organisation for Research and Treatment of Cancer (EORTC) quality of life questionnaire ≤80, >80). After the baseline assessments were completed, participants were randomised into either the *ExerciseGuide* intervention group or the wait-list control group using block randomization (block sizes of 2 and 4).

6.3.5. Intervention

The *ExerciseGuide* intervention

A detailed description of the *ExerciseGuide* intervention has been published previously (21). Briefly, participants received access to a computer-tailored website (www.exerciseguide.org.au; accessed 23 November 2021), which provided individualised multi-modal exercise prescription via text and videos and behavioural change information for eight weeks in the form of nine computer-tailored modules (see Figure 16~~Figure 16~~). All modules (with exception of the weekly tracking modules) were accessible all at once (free-choice design) in order to promote autonomy and allow users to self-tailor usage according to their interests. The weekly tracking module opened after the first seven days and once completed the next tracking module opened seven days later.

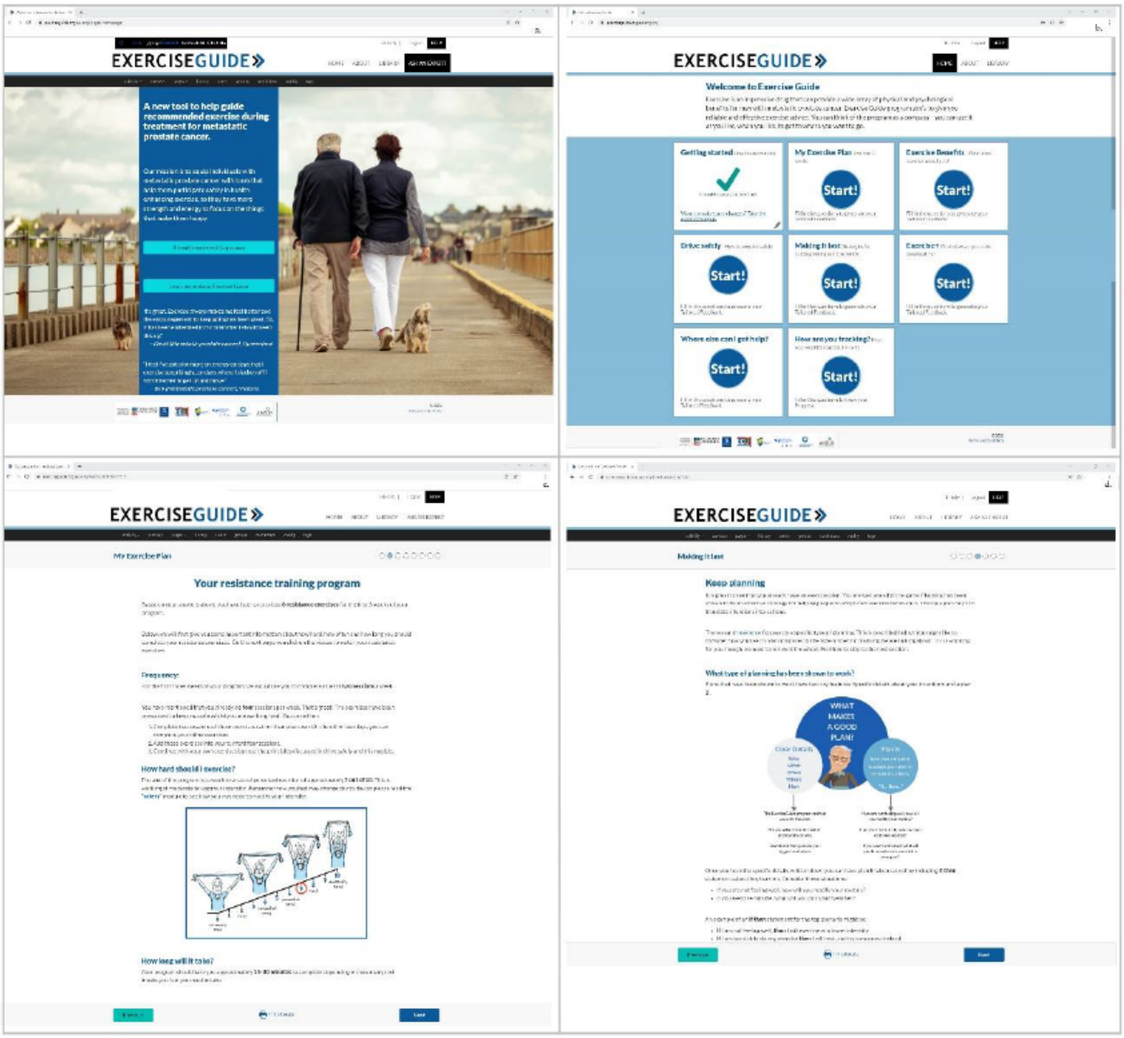

Figure 16. Screenshots of the *ExerciseGuide* intervention.

(a) the *ExerciseGuide* landing page, (b) the *ExerciseGuide* homepage, (c) the My exercise plan 1 module (d) the making it last (behaviour change) module.

The modules were developed from previous exercise oncology (7,8,25) and behavioural science studies (5,8,26), and were guided by behavioural change theories [27,28,29,30,31,32,33]. The modules included:

1. Getting started (how to use the website and basics of the intervention; Appendix 24)
2. My exercise plan 1 (tailored exercise programming for week 1-3;Appendix 25)
3. My exercise plan 2 (progression/regression tailored exercise programming for week 4-8; Appendix 26)
4. Exercise benefits (health benefits specific to metastatic prostate cancer; Appendix 27)
5. Exercise safely (considerations necessary to remain safe whilst exercising; Appendix 28)
6. Making it last (behavioural change information including building confidence and habits; Appendix 29~~Appendix 29~~)
7. Exercise plus (information on nutrition, distress, sedentary behaviours, sleep etc; Appendix 30~~Appendix 30~~)
8. Where else can I get help? (facilitate access to additional support; Appendix 31~~Appendix 31~~)
9. How are you tracking? (facilitate self-monitoring of exercise behaviours and exercise outcomes; Appendix 32 and Appendix 33).

The *ExerciseGuide* website also contained a library, with short prostate cancer, exercise or behaviour change articles, written in layman's language and an "Ask the EP" (Exercise Physiologist) feature of the website, where participants have the option of submitting questions to the exercise physiologist.

Participants were provided with an individualised aerobic, resistance-based and flexibility exercise prescription based on data they entered into the website in week one and week three as described in depth in the study protocol (21). Participants were also able to regress or progress their prescription at any time by changing the answers to the computer-tailoring questions within the module. The prescriptions were based upon exercise guidelines for cancer patients (25), and approaches used in previous studies for managing bone lesions (8,9,34). In short, the aerobic training prescription ranged from 2–3 sessions per week for 16–40 min (including rest breaks when prescribed). Regressions and progressions were made by manipulating duration and mode. The resistance training prescription ranged from 2–3 days per week and included 2–3 sets of 8–12 repetitions with a focus of strength and hypertrophy. The program aimed to slowly increase session volume until week six, where volume was reduced, and an emphasis was placed on increasing load to maintain intensity. This change was prescribed to reduce the likelihood of participants increasing repetition range past 12 repetitions as a method of progression, which would likely extend session duration without significant improvements in strength. The OMNI resistance and aerobic exercise scale of rate perceived exertion (RPE) was used to prescribe intensity, which ranged from 6 to 7 out of 10. Participants were instructed to increase or decrease the speed (aerobic training) or load (resistance training) of the exercises by a subjective 5–10% if RPE scores did not match the prescribed OMNI scale (14). Four resistance exercise bands with variable levels of tension and a door anchor were supplied. Participants with access to home-based or gym resistance training equipment were encouraged to replicate the exercises if the equipment was suitable. A paper-based exercise diary was also provided to allow self-reporting and tracking of resistance exercises (exercises, sets, repetitions, session RPE, duration, bone pain visual analogue score and general pain visual analogue scale), aerobic exercises (type, duration, session rate of perceived exertion, bone pain score and general pain scale) and stretching exercises performed.

Additionally, participants received two telehealth consultations (week 1 and 4) using a videoconferencing platform such as Zoom (35), Skype (36) or phone calls. Consultation mode was determined by participant preference. Within these sessions, behaviour change considerations that included barriers and confidence were discussed, and participant’s exercise prescription was reviewed and modified based on clinical judgement if required). The consultations were conducted by HELE, who is an accredited exercise physiologist with seven years of experience. In weeks 2–3 and 5–8, participants were contacted by short message service (SMS) or email based on their preference to monitor compliance, aid adherence and provide support when needed.

Wait-list control intervention

Participants in the wait-list control group received no specific instructions regarding physical activity or access to equipment during the eight-week intervention. After follow-up outcome measures were assessed, the wait-list control group were offered the full *ExerciseGuide* intervention and were also supplied resistance bands.

6.3.6. Outcome measure

Unless otherwise specified, outcome measures were assessed at baseline (0 weeks) and at follow-up (week 9).

Acceptability

For the purposes of this trial, acceptability was viewed as a multi-faceted construct related to user thoughts and feelings about the intervention. Several measures of acceptability were included, with priority given to facets that were thought to potentially influence efficacy or future uptake (30,37). All acceptability measures were assessed in intervention participants only and only at follow-up, with the exception of star ratings and comments (37) for modules, which were collected in real-time and were optional. For all measures, higher scores indicate higher acceptability.

The client satisfaction questionnaire-8 (CSQ-8) was used to evaluate overall intervention satisfaction. Eight items were measured on a 4-point scale (22). The cut-point of 20 was chosen to designate satisfaction as it represents an average score of 2.5 on each item. The perceived usability of the intervention website was evaluated using the System Usability Scale (SUS). A score above 68 is considered “above average” and was chosen as the cut-point for success (23).

The perceived environmental supportiveness scale (15 items) was used to assess perceptions of need support provided by *ExerciseGuide* (38). The measure provides an overall score and autonomy, structure and involvement subscale scores (38).

The extent to which the intervention was considered personally relevant was assessed using three items (“the program was very relevant to me”, “the program was very applicable” and “the program seems like it was written for someone like me in mind”) on a 7-point scale ranging from strongly disagree to strongly agree.

Finally, three open-ended survey questions asking for feedback on the positives of the program, constructive feedback and suggestions for improvement were used to understand users' perception (39).

Website Usage

Website usage was measured using the Google Analytics web traffic analysis platform and built-in website tracking software (40).

Safety

Two methods assessed the safety of the exercise program. Participants were instructed to report any adverse events in the study period to the study project coordinator (HELE). Information collected included date event occurred, date reported and grade based on the Common Terminology Criteria for Adverse Events V.5.0 grading criteria. An adverse events item ("Do you feel that you have experienced any health issues as a result of participating in this research study") was also included within the follow-up questionnaire based on the same criteria.

Efficacy

Behaviour Change–Physical Activity and Exercise

The ActiGraph GT3X activity monitor (Actigraph, Pensacola, FL, USA) was used to objectively measure minutes of moderate to vigorous physical activity (MVPA) as well as light physical activity and sedentary time minutes at baseline and follow-up. Participants were mailed and asked to wear the devices on the right hip for seven days and only remove during water-based activities and sleep (40). The validity and reliability of the ActiGraph GT3X has been established (41). Triaxial data was recorded in 1-s epochs for at least 600 min of wear time per day on at least five days within a seven-day period, and wear-time was validated using Choi et al. (42). The Godin leisure-time exercise questionnaire assessed self-reported physical activity (average frequency and duration of mild, moderate and vigorous aerobic exercise and total resistance training) at baseline and follow-up (43,44).

Adherence to the prescribed exercise program was assessed by auditing participant's exercise diaries, which included self-reported information on the frequency, intensity, time and type of exercise completed. This was then cross-referenced with their individualised prescription. Perceptions of adherence were also assessed using two items ("I have been doing all of the aerobic [cardiovascular] exercises I was asked to by *ExerciseGuide*" and "I have been doing all of resistance-based [strength] exercises I was asked to by *ExerciseGuide*") with an 11-point numeric rating scale (0 = strongly disagree, 10 = strongly agree) (45).

Patient-Reported Outcomes

The EORTC Quality of Life-Core 30 (EORTC QLQ-C30) measured health-related quality of life using a 30-item core survey (46). Fatigue was assessed using the Functional Assessment of Chronic Illness Therapy-fatigue subscale (13-items) (47). The Hospital Anxiety and Depression Scale evaluated depression and anxiety (14-items), and the Pittsburgh Sleep Quality Index questionnaire measured sleep quality (48-50).

Socio-cognitive determinants of physical activity (intervention mechanisms)

Barrier self-efficacy (9 items) (51), outcome expectations (8 items) (52), motivation type (19 items) (53), social support (2 items) (51), intentions (4 items) (54), behavioural capability (3 items) (39) and habit formation (4 items) (31) were all assessed at baseline and follow-up.

Objective Measures of Physical Function and Muscular Strength

Face-to-face measures assessing aerobic fitness, muscular strength and ambulation were completed on a sub-group of participants to examine the feasibility of conducting face-to-face testing as part of the trial design and to understand preliminary efficacy of the *ExerciseGuide* intervention on physical function and muscular strength. Selection was based on proximity to the University of South Australia testing site (Adelaide). Aerobic fitness was measured with the time taken (seconds) to complete a 400-m walk (on a 20-m track) (8). The timed up-and-go test (3 m track) and the repeated chair stand (5 repetitions) were measured by time to completion to provide physical functioning scores (55,56). Tests were performed in triplicate (except 400 m) with recovery time between trials. Dynamic muscle strength was assessed with the one-repetition maximum method. The leg extension and chest press exercises were used to determine lower and upper limb strength, respectively. Patients with proximal femur bone lesions were excluded from the leg extension one-repetition maximum test. Those with rib, thoracic spine and humerus lesions were excluded from the chest press one-repetition maximum test (8).

Trial Feasibility

Feasibility was evaluated using screening, recruitment and attrition data, as well as the proportion of participants with complete data for each outcome measure. As an approximate representation of intervention delivery expense, the time taken to deliver coaching sessions and respond to questions was collected.

6.3.7. Sample size

The target sample size for this study was 66. This sample size was considered sufficient, based on previous similar pilot studies to reasonably estimate performance against our pre-specified criteria for success (57,58). A more detailed overview of sample size determination is provided in the study protocol (21).

6.3.8. Data analysis

Study data was analysed using SPSS version 26 (IBM, Chicago, IL, USA). Descriptive statistics were calculated for all outcome measures by study arm and were expressed as means and standard deviations and as medians and range if the distribution was skewed. Categorical data was presented as a frequency (percentage). Efficacy outcome measures were compared between groups using analysis of covariance (ANCOVA) where baseline values and treatment status were the covariates. In all analyses residual distributional assumptions were checked and if appeared violated, the data was natural log transformed. Randomised participants were analysed in the group they were allocated to. All analyses were performed with complete cases. Significance was set at 0.05 two-sided and no adjustments were made for multiple testing. Qualitative data from open-ended questions were analysed for common themes as well as feedback for intervention refinement.

6.4. Results

6.4.1. Participants

Participant flow through the study is outlined in Figure 17~~Figure 17~~. A total of 141 individuals screened themselves for eligibility on the *ExerciseGuide* website or were directly contacted and were screened by a researcher (HELE) over the 12-month period (scheduled date of closure). Of that, 41 eligible participants provided written informed consent, and medical clearance (with any metastasis locations listed) and 40 were then randomised to either the control group (n=20) or intervention group (n=20). One participant withdrew before finishing the baseline testing, and two participants withdrew during the intervention, as explained in Figure 17~~Figure 17~~. The prespecified recruitment goal of 66 was not met. Participant characteristics are presented in Table 11~~Table 11~~. Participants had a mean age of 70 ± 8.5 years, all identified as male and were approximately 3 ± 3 years since metastatic prostate cancer diagnosis. Over 80% had greater than one bone metastasis, a majority (93%) were currently undergoing androgen deprivation therapy, and approximately half had undergone chemotherapy (56%) and radiotherapy (46%). At baseline, participants completed 241.5 ± 154.7 min of moderate-to-vigorous physical activity per week and 1.3 ± 1.9 sessions of resistance training per week (total of 12.4 ± 19.1 min per week and a rate of perceived exertion of 0.5 ± 0.9.

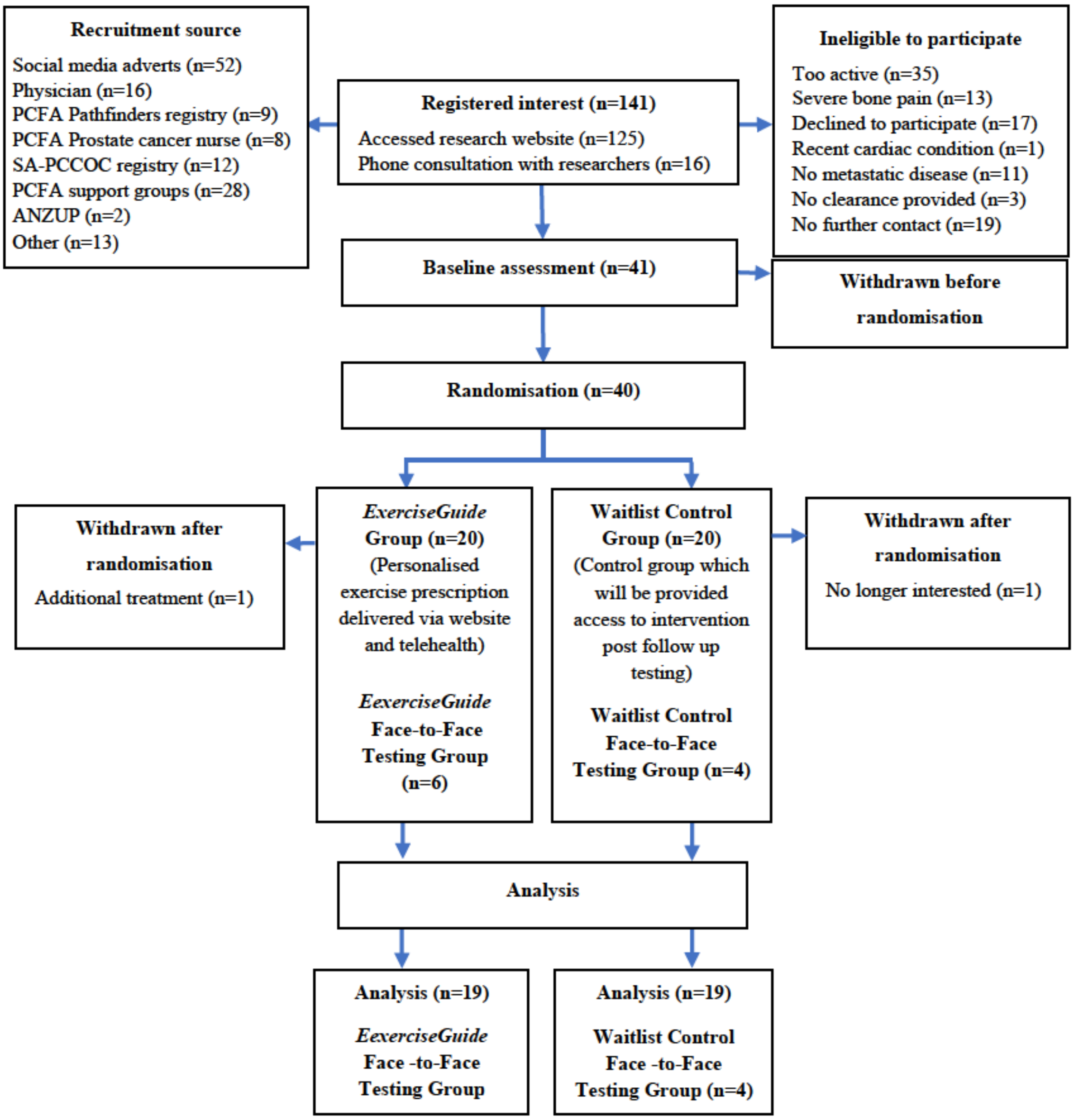

Table 11. Participant characteristics for the whole sample at baseline.

Figure 17. Pilot RCT participant flow chart

Characteristics		Intervention n=20	Control n=20	Total n=40
Age, mean ± SD, year		69.5 ± 6.6	70.8 ± 10.2	70.2 ± 8.5
Weight, mean ± SD, kg		95.9 ± 20.8	90.0 ± 17.1	92.9 ± 19.0
Body Mass Index, mean ± SD, kg/m^2		30.5 ± 5.2	28.7 ± 5.2	29.6 ± 5.3
Marital status, N (%)	Married/de facto	15 (75.5%)	13 (61.9%)	28 (68.3%)
	Widowed	1 (5.0%)	2 (9.5%)	3 (7.3%)
	Separated	4 (20.0%)	2 (9.5%)	6 (14.6%)

Characteristics		Intervention n=20	Control n=20	Total n=40
	Single	0 (0.0%)	4 (19.0%)	4 (9.8%)
Location, N (%)	Major city	12 (60.0%)	14 (66.7%)	26 (63.4%)
	Inner regional	5 (25.0%)	4 (19.0%)	9 (22.0%)
	Outer regional	1 (5.0%)	3 (14.3%)	4 (9.8%)
	Remote or very remote	2 (10.0%)	0 (0.0%)	2 (4.8%)
Education, N (%)	Secondary School	2 (10.0%)	8 (38.1%)	10 (24.4%)
	Trade/TAFE	11 (55.0%)	5 (23.8%)	16 (39.0%)
	University/Other Tertiary	7 (35.0%)	8 (38.1%)	15 (36.6%)
Employment, N (%)	Employed full-time	1 (5.0%)	2 (9.5%)	3 (7.3%)
	Employed part-time	1 (5.0%)	2 (9.5%)	3 (7.3%)
	Self-employed	0.0 (0%)	3 (14.3%)	3 (7.3%)
	Unemployed	2 (10.0%)	1 (4.8%)	3 (7.3%)
	Retired	16 (80.0%)	13 (61.9%)	29 (70.8%)
Current treatment, N (%)	Surgery	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Radiotherapy	2 (10.0%)	2 (9.5%)	4 (9.8%)
	Chemotherapy	6 (30.0%)	7 (9.5%)	13 (31.7%)
	Hormone therapy	19 (90.0%)	19 (90.5%)	38 (92.7%)
Previous treatment, N (%)	Surgery	8 (40.0%)	5 (23.8%)	13 (31.7%)
	Radiotherapy	9 (45.0%)	10 (47.6%)	19 (46.3%)
	Chemotherapy	9 (45.0%)	14 (66.7%)	23 (56.1%)
	Hormone therapy	1 (5.0%)	1 (5.0%)	2 (9.5%)
Current PSA, mean ± SD,		15.2 ± 31.9	10.2 ± 38.7	12.5 ± 35.2
Time since metastatic disease diagnosis, mean ± SD, years		3.5 ± 3.1	2.57 ± 3.1	3.0 ± 3.1
Number of individuals with ≥ 1 bone lesion, N (%)		15 (75.0%)	18 (85.7%)	33 (80.5%)
Number of co-morbidities, mean ± SD		1.5 ± 1.6	2.0 ± 1.6	1.7 ± 1.6

Abbreviations: SD, standard deviations; N, number; PSA, prostate specific androgen.

6.4.2. Intervention acceptability

The median score of the CSQ-8 was 28.0 (range = 16–31) out of 32, indicating a high level of intervention satisfaction and was above the pre-defined cut-points for success (i.e., ≥20). The system usability scale mean score was 67.0 ± 15.1 out of 100, which is one point under the pre-defined cut-point of 68 out of 100 (see Appendix 34~~Appendix 34~~ for more detail). The overall median score of the perceived environmental supportiveness scale (PESS) was 6.5 out of 7.0 (range = 4.3–7.0). The subscores of the PESS, autonomy, structure and involvement were rated as 6.2 (range = 4.3–7.0), 6.6 (range = 3.2–7.0) and 6.2 (range = 4.6–7.0), respectively, out of 7. Website perceived relevance was high, with a score of 6.0 out of 7.0 (range = 1.7–7.0). Lastly, the individual module star ratings ranged from 3 to 4.5 out of 5, which is above average except for tracking modules 2 and 3 (Table 12~~Table 12~~).

Eighteen participants from the *ExerciseGuide* group provided written feedback regarding the intervention in the follow-up questionnaire. The support provided by the intervention and exercise physiologist was seen as a highlight by half of the participants (n=9) and the structure of the program was noted as a positive by six participants, with comments including “the program got me out of the chair with definite plan in mind” and “the program is very structured, there is lots of information on how and why to exercise”.

Table 12. *ExerciseGuide* website usage within the intervention group.

Module Name	Percentage of modules viewed		Average total time in module per participant (mins)		Average total page views		Star Ratings		
	(%)	(N)	(M)	(SD)	(M)	(SD)	(Median)	(Range)	(N)
Introduction	100%	20	2.4	2.3	6.7	4.5	Nil	Nil	0
Exercise plan (Week 1-3)	100%	20	19.5	21.0	18.9	13.4	4.0	4.0-4.0	3
Exercise plan (Week 4-8)	65%	13	5.2	6.0	5.7	6.0	3.0	3.0-3.0	1
Exercise benefits	75%	15	2.0	1.0	3.7	2.5	4.0	4.0-5.0	4
Exercise safely	60%	12	4.0	3.0	1.5	1.5	4.5	4.0-5.0	6
Make it last	55%	11	1.5	1.3	2.0	2.2	4.0	4.0-5.0	3
Exercise+ (lifestyle)	50%	10	4.3	3.4	1.3	1.6	4.0	4.0-4.0	2
Extra help	45%	9	1.3	1.3	1.2	1.4	4.0	4.0-5.0	3
Weekly tracking module 1	65%	13	3.1	2.2	3.0	2.7	3.0	1.0-5.0	5
Weekly tracking module 2	25%	5	2.0	1.1	0.7	1.2	2.5	2.0-3.0	2
Weekly tracking module 3	10%	2	1.2	1.1	0.2	0.7	2.0	4.0-4.0	4

Tracking modules were available weekly. Tracking modules 4–8 were completed by 0% (n=0) of the *ExerciseGuide* intervention group. Abbreviations: N, number; M, mean; SD, standard deviations.

Constructive feedback included lack of exercise prescription variety and boredom (n=4), navigation and usability issues (n=3) and inability to adhere to the program (n=3). Finally, potential improvements suggested by participants included ability to autogenerate multiple programs for diversity or increase the range of exercises (n=4), increased personalised support from the exercise physiologist (n=3) by increasing “regular contact” to help increase both adherence and supervision. See Appendix 35, Appendix 36 and Appendix 37 for more detailed feedback.

6.4.3. Usage: behavioural outcomes relating to engagement

Website usage

ExerciseGuide participants spent an average of 93.3 ± 101.6 min (range = 4.3–373.6) on the site over the eight-week period. Participants logged into the website 6.1 ± 5.9 times (range = 1–22) over the intervention. Weekly logins were highest in week one and week three, as seen in Figure 18~~Figure 18~~.

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(a) (b)

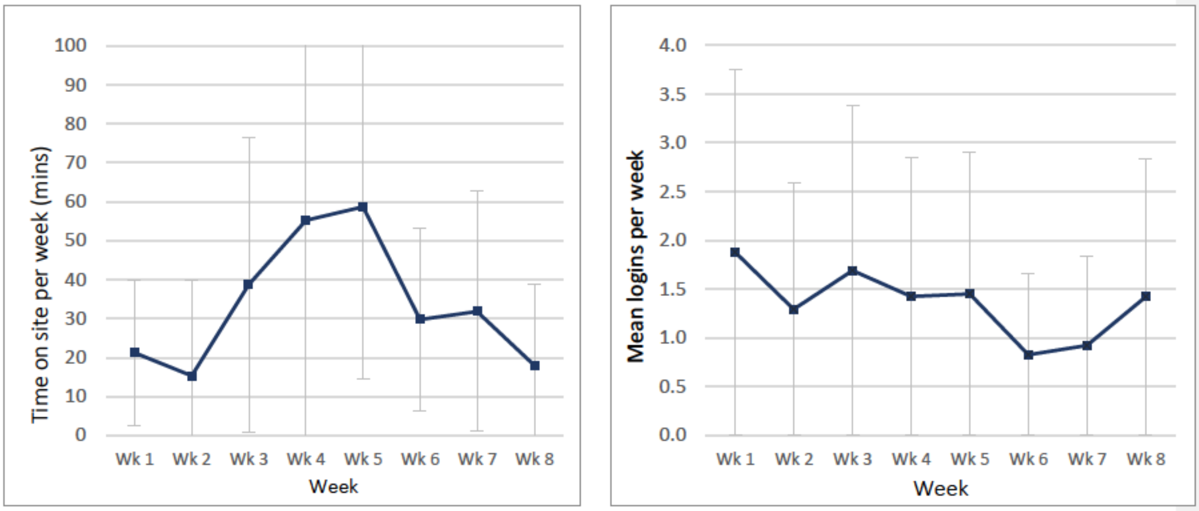

Figure 18. Website usage in the *ExerciseGuide* intervention group.
(a) time spent on website per week and (b) number of logins per week.

Website modules completed

The percentage of participants who viewed each module is shown in Table 12~~Table 12~~. There was a 100% (n=20) completion rate in the Getting Started and Exercise Plan 1 (week 1-3) modules. The remaining modules had moderate competition rates, ranging

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from 45% for the Extra Help module to 75% for the Exercise Benefits module. There was a decrease in completing tracking modules over time (65% started the tracking module, 10% progressed through to week three of tracking and 0% completed the tracking module. The library function was used by 50% of the *ExerciseGuide* group, with an average usage time of 5.3 ± 6.4 minutes. Only one participant used the "Ask an Expert" feature.

Self-Reported Adherence to Exercise Prescription

The exercise diary was completed and returned by 89% (n=17) of the intervention group. The diaries indicated that participants had a self-reported resistance training session attendance (sessions completed divided by sessions prescribed) 64.6 ± 40.2% and aerobic training session attendance of 102 ± 62.7%. The self-reported volume adherence in resistance training (total sets × total repetitions prescribed per session) was 78.3 ± 77.9% and 91.5 ± 56.5% in aerobic training (total time prescribed per session). The perceived exercise intensity was reported as 6.6 ± 0.9 out of 10 in the resistance exercise sessions and 6.6 ± 1.1 out of 10 in aerobic sessions. In terms of self-perceived adherence, participants rated their adherence to their aerobic exercise program as 6.1 ± 3.3 out of 10 and 5.4 ± 3.8 out of 10 for their resistance training at follow-up.

Telehealth Consults and Time

In week one, the mean telehealth consult time per participant was 25.15 ± 7.80 min. Telehealth mode varied; 50% of participants requested a Zoom call (n=10), 40% of participants favoured a phone call (n=8) and 5% used Skype (n=1). The mean consult time for the week four telehealth consult was 23.92 ± 7.47 min. One participant switched from zoom to a phone consultation, and one participant withdrew from the study. One participant chose not to engage in the consultations due to time limitations.

Over the intervention, the exercise physiologist sent 65 text messages and 81 emails to support participants. Furthermore, 11 phone calls were completed throughout the intervention when participants requested or if participants did not reply to more than two messages in a row. The mean call time per participant was 11.50 ± 8.46 min, and the total call time per participant was 92.38 ± 8.43 min.

6.4.4. Safety

On follow-up, 85% of participants reported no (grade zero) bone pain (n=16), 10% reported mild (grade one) bone pain (n=2), and 5% reported moderate (grade two) bone pain resulting from the intervention (n=1) (Appendix 38). There were no grade three/life-threatening or serious adverse events resulting from participating in the *ExerciseGuide* intervention and as such met the criteria for success. The self-reported exercise diaries showed a severity of bone pain post resistance exercise of 0.3 ± 0.8 out of 10, with a 0.0 ± 0.2 change from pre-exercise levels. The severity of bone pain post aerobic exercise was 0.4 ± 0.8 with a 0.1 ± 0.2 increase from pre-exercise levels. Participants also reported non-bone pain post resistance exercise of 0.7 ± 0.9 and non-bone pain post aerobic exercise of 0.6 ± 0.9.

6.4.5. Efficacy

Physical activity

Between-group differences for all physical activity-related outcomes are presented in Table 13~~Table 13~~. In brief, accelerometer assessed moderate-to-vigorous physical activity (MVPA) differed between groups at follow-up by 10.0 min per day (95% CI,1.3-18.6; *P*=0.01) in the *ExerciseGuide* group compared to the control. An increase observed in the *ExerciseGuide* group, and a reduction observed in activity per day in the control group accounted for this difference. The adjusted mean difference per day is sufficient to meet our efficacy criteria. When assessing weekly physical activity, accelerometry data showed a group difference of 69.9 min in favour of the intervention group compared to the control (95% CI, 15.1-124.8; *P*=0.01). No changes were seen in light or vigorous physical activity or sedentary activity (Table 13~~Table 13~~). Step count also differed between groups (*P*=0.02). Self-reported exercise values did not differ significantly between groups at follow-up; however, resistance training duration (mins) increased by 10.3 min between groups at follow-up in favour of the intervention group and this change was borderline not significant.

Table 13. Effect of *ExerciseGuide* pilot RCT on physical activity measures.

Outcome	Baseline		Follow-up		Adjusted mean differences	P-Value
	EG (n=20)	CON (n=20)	EG (n=19)	CON (n=19)	M (95% CI)	
MVPA (min/day)	30.57 ± 22.0	38.4 ± 22.2	35.1 ± 23.6	32.0 ± 22.7	10.0 (1.3, 18.6)	0.01*
Sedentary Activity (min/day)	668.1 ± 171.0	708.7 ± 66.5	693.6 ± 117.1	731.0 ± 66.5	-33.46 (-95.0, 28.1)	0.63
Steps (steps/day)	4977 ± 3146	6169 ± 3001	5885 ± 3071	5556 ± 3141	1332 (159, 2505)	0.02*
Light PA (min/week)	469.5 ± 206.9	561.6 ± 159.8	544.9 ±230.4	526.2 ± 199.3	96.7 (-5.4, 198.8)	0.10
Moderate PA (min/week)	203.0 ± 149.7	256.9 ± 150.0	232.7 ± 158.8	208.6 ± 142.3	69.9 (15.1, 124.8)	0.01*
Vigorous PA (min/week)	11.0 ± 14.1	13.4 ± 13.3	12.0 ± 16.0	15.6 ± 21.1	1.9 (-12.4, 8.5)	0.88
GLTEQ (aerobic)	37.9 ± 37.7	40.6 ± 29.2	52.3 ± 38.8	36.7 ± 28.0	16.9 (-0.5, 33.8)	0.07
Resistance training frequency (sessions/week)	1.4 ± 2.0	1.2 ± 1.8	2.3 ± 3.6	1.8 ± 2.0	0.5 (-0.8, 1.6)	0.90
Resistance training duration (min)	10.8 ± 17.9	14.0 ± 20.3	22.4 ± 18.2	12.5 ± 17.3	10.3 (-1.2, 21.7)	0.08
Resistance training RPE	0.4 ± 0.8	0.6 ±0.1	6.2 ± 18.9	4.2 ± 3.0	2.1 (0-0.4, 3.9)	0.13

Abbreviations: EG, *ExerciseGuide* group; CON, Control group; PA, Physical activity; GLTEQ, Godin leisure time questionnaire; RPE, rate of perceived exertion.

Computer-tailored individualised exercise prescription

Based on the data provided by participants, the *ExerciseGuide* resistance exercise programming for weeks 1–3 resulted in a mean frequency of 2.0 ± 0.0 sessions per week, and 6.4 ± 1.7 (range = 4–8) exercises prescribed per person. Overall, an RPE of six out of ten was prescribed for 68% of participants and seven out of ten for 32% of participants. The average weekly resistance exercise volume (total sets × total repetitions) was 1001.7 ± 291.0 units. The exercises prescribed are shown in the Appendix 39. The individualised aerobic programming in weeks 1–3 prescribed an average of 2.5 ± 0.5 sessions per week and a mean duration of 28.3 ± 4.9 (range = 10–36) minutes per session. An RPE of six out of ten was prescribed for fourteen participants (74%) and seven out of ten for five (26%) participants. A summary of the aerobic modes and flexibility exercises prescribed are shown in Appendix 40 and Appendix 41).

At the end of week three, self-reported responses to questions allowed for total exercise volume modifications based on reported compliance. In weeks 4–8 (exercise plan 2 module), the resistance algorithm prescribed 6.3 ± 1.8 (range = 4–8) exercises per person, and the rate of perceived exertion prescription did not change. The average session frequency per week increased to 2.5 ± 0.3, and the average weekly resistance exercise volume (total sets × total reps) was 1358 ± 515 units. The exercise plan 2 module prescribed 2.7 ± 0.5 aerobic sessions for weeks 4–8, 27.7 ± 7.6 min per session and one participant’s rate of perceived exertion changed from six to seven out of ten.

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6.4.6. Secondary outcomes

Patient-reported outcomes

When controlling for baseline and active treatment, there were no differences detected between groups at follow-up in self-reported quality of life (*P*=0.22–0.86), see Table 14~~Table 14~~. Whilst not statistically significant, the reduction in fatigue levels (5.3; 95% CI, −0.4-11.1; *P*=0.06) and depression levels (−1.3; 95% CI, −2.4–−2.4; *P*=0.06) reported in the intervention relative to the control may be clinically relevant (47,59). Lastly, over time, there were no statistical differences in sleep quality and anxiety between the *ExerciseGuide* and control groups.

Mechanisms of action

Changes in social cognitive determinants of exercise between groups adjusted for baseline and active treatment are presented in Table *15*~~Table *15*~~. Barrier self-efficacy was lower among *ExerciseGuide* group participants compared to control group participants for both aerobic (−3.9; 95% CI,−8.2, 0.3; *P*=0.07) and resistance training (−3.50; 95% CI, −10.7- 2.3; *P*=0.08) at follow-up. This finding was borderline not significant. There were positive effects on motivation type with greater identified regulation (i.e., driven by exercise being seen as personally important) observed in the intervention group relative to the control at follow-up. However, the mean difference was relatively small (0.4; 95% CI, 0.0-0.7; *P*=0.04). There was also a trend showing greater intrinsic motivation (motivated by exercise being inherently satisfying) in the intervention group in comparison to the control group. This difference was also relatively small (0.3; 95% CI, 0.0-0.7); *P*= 0.07).

Sub-group (physical function measures)

In total, 27.5% (n=11) of the total participant group were eligible to complete the subgroup measures prior to group randomisation. Of that, 90.9% agreed to participate in had been randomised into the intervention group, and four were randomised into the control group. Despite the very small sample size, there was a significant difference in 400 m walk time favouring the intervention group when comparing baseline to follow-up (0.8 min; 95% CI, −1.5-−0.1; *P*=0.02). A significant mean difference of 8.5 kg, 95% CI, 0.9-16.0, *P*=0.04 was also seen in the one-repetition maximum chest press. This difference is clinically meaningful (60). No other significant differences were observed between groups over the 8-week intervention (Appendix 42).

Table 14. Effect of *ExerciseGuide* pilot RCT on patient-reported outcome measures.

Outcome	Baseline		Follow-up		Mean Difference	P-Value
	EG (n=20)	CON (n=20)	EG (n=19)	CON (n=19)	M (95% CI)	
Quality of life (EORTCQoL)						
Global Health status [1]	62.7 ± 22.3	71.9 ± 15.0	68.4 ± 22.0	64.5 ± 22.2	9.3 (-3.7 – 22.4)	0.24
Functional status [2]						
Physical functioning	84.1 ± 16.2	90.9 ± 12.0	85.9 ± 17.4	87.0 ± 12.5	4.1 (-2.8 – 10.9)	0.44
Role functioning	84.2 ± 22.5	82.5 ± 18.0	82.5 ± 26.9	75.4 ± 28.5	5.2 (-10.6 – 21.0)	0.37
Emotional functioning	86.8 ± 10.9	86.4 ± 16.2	84.6 ± 13.4	84.2 ± 18.4	-0.2 (-8.1 – 7.6)	0.86
Cognitive functioning	77.2 ± 18.6	85.1 ± 13.5	77.2 ± 18.6	81.6 ± 12.5	0.3 (-9.3 – 9.8)	0.81
Social functioning	78.9 ± 22.1	74.6 ± 21.1	80.7 ± 21.7	70.2 ± 27.0	8.4 (-5.7 – 22.6)	0.63
Symptom Scales [3]						
Fatigue	36.3 ± 20.2	31.6 ± 21.7	39.8 ± 19.4	38.0 ± 23.0	2.5 (-7.2 – 12.2)	0.56
Nausea/Vomiting	3.5 ± 11.9	1.8 ± 7.6	0.9 ± 3.8	3.5 ± 8.9	-3.4 (-7.6 – 0.9)	0.22
Insomnia	36.8 ± 27.0	24.6 ± 24.4	36.8 ± 6.7	29.8 ± 29.2	-1.3 (-13.9 – 26.2)	0.27
Pain	21.1 ± 24.7	14.9 ± 19.2	24.6 ± 25.1	21.9 ± 26.7	-0.5 (-15.5 – 14.5)	0.81
Dyspnoea	14.0 ± 16.9	15.8 ± 17.1	15.8 ± 20.4	19.3 ± 16.9	-2.6 (-14.4 – 9.2)	0.40
Appetite loss	10.5 ± 15.9	1.8 ± 7.6	5.3 ± 16.7	12.8 ± 27.7	-11.7 (-27.5 – 27.5)	0.18
Diarrhoea	3.5 ± 15.3	5.3 ± 13.0	5.2 ± 12.5	13.0 ± 20.3	-7.7 (-19.0 – 3.5)	0.22

Outcome	Baseline		Follow-up		Mean Difference	P-Value
	EG (n=20)	CON (n=20)	EG (n=19)	CON (n=19)	M (95% CI)	
Constipation	3.5 ± 10.5	8.8 ± 18.7	7.0 ± 23.8	3.5 ± 10.5	0.5 (-1.0 – 2.0)	0.49
Financial difficulties	15.8 ± 23.2	10.5 ± 19.4	7.1 ± 17.8	14.0 ± 27.9	-9.6 (-23.9 – 4.6)	0.26
Fatigue (FACIT-F) [4]	37.7 9.6	41.4 ± 6.5	38.4 ± 15.0	37.9 ± 12.4	5.3 (-0.4 – 11.1)	0.06
Depression (HADS-D) [5]	3.3 ± 3.1	2.9 ± 1.9	3.1 ± 2.8	4.1 ± 2.3	-1.3 (-2.4 – -2.4)	0.06
Anxiety (HADS-A) [5]	2.9 ± 3.2	4.4 ± 2.7	3.2 ± 3.4	4.7 ± 3.3	-0.2 (-1.7 – 1.2)	0.74
Sleep Index (PSQI) [6]	7.2 ± 2.9	6.9 ± 3.3	11.5 ± 3.7	10.7 ± 3.1	0.6 (-1.4 – 2.6)	0.10

1 Global health status/quality of life score ranged from 0–100, with a higher score representing a higher quality of life.

2 Scores for the functional scales ranged from 0–100, with a higher score representing a high level of functioning.

3 Scores for the symptom item ranged from 0–100, and a higher score represents a higher level of symptomatology/problems.

4 FACIT-fatigue, all items were summed to create a single fatigue score ranging from 0 to 52, with higher scores representing better functioning or less fatigue.

5 Hospital anxiety and depression scale score provides two subscale scores (HADS-D) and (HADS-A). A score greater than seven denotes anxiety or depression.

6 The PSQI total score can range from 0 to 21. A global score of five or more indicates poor sleep quality, the higher the score, the worse the sleep quality.

Abbreviations: EG, ExerciseGuide group; CON, Control group.

Table 15. Effect of *ExerciseGuide* pilot RCT on mechanisms of actions.

Outcome	Baseline EG (n=20)	Baseline CON (n=20)	Follow-up EG (n=19)	Follow-up CON (n=19)	Adjusted Change Mean difference (95% CI)	P-Value
Self-efficacy [1]						
Barrier (aerobic) sum	36.2 ± 8.6	36.7 ± 6.7	33.5 ± 8.7	36.3 ± 5.7	-3.9 (-8.2, 0.3)	0.07
Barrier (resistance) sum	35.6 ± 8.6	35.8 ± 6.7	33.1 ± 7.7	36.5 ± 5.2	-3.50 (-10.7, 2.3)	0.08
Outcome expectations [2]						
Sum	31.9 ± 4.0	31.4 ± 4.3	32.3 ± 4.5	31.7 ± 3.5	0.23 (-1.5, 2.0)	0.79
Motivation type [3]						
Amotivation	0.6 ± 0.7	0.4 ± 0.8	0.3 ± 0.7	0.4 ± 0.5	-0.1 (-0.5, 0.2)	0.40
External regulation	0.9 ± 0.9	0.9 ± 1.0	0.6 ± 0.6	0.8 ± 1.0	-0.1 (-0.6, 0.3)	0.54
Introjected regulation	1.6 ± 1.2	1.9 ± 1.2	1.5 ± 1.0	1.9 ± 1.3	-0.1 (-0.6, 0.5	0.59
Identified regulation	2.6 ± 0.7	3.1 ± 0.7	2.8 ± 0.7	2.9 ± 0.9	0.4 (0.0, 0.7)	0.04*
Intrinsic regulation	2.0 ± 1.1	2.7 ± 0.8	2.3 ± 0.9	2.5 ± 0.8	0.3 (0.0, 0.7)	0.07
Social support [4]						
Sum	7.7 ± 2.3	6.7 ± 2.6	6.9 ± 2.2	7.4 ± 2.1	-1.0 (-2.5, 0.3)	0.14
Intention [5]						
Aerobic intention strength	68.2 ± 27.1	67.7 ± 22.3	62.4 ± 27.7	68.4 ± 19.3	-7.2 (-20.8, 6.4)	0.29
Resistance intention strength	64.8 ± 31.9	66.6 ± 37.7	54.8 ± 30.6	67.3 ± 25.9	-14.7 (-30.5, 1.1)	0.06

Outcome	Baseline		Follow-up		Adjusted Change Mean difference (95% CI)	P-Value
	EG (n=20)	CON (n=20)	EG (n=19)	CON (n=19)		
Behavioural capability						
Aerobic training experience [6]	2.5 ± 1.3	3.4 ± 0.8	3.0 ± 1.0	3.2 ± 0.9	0.2 (-0.4, 0.8)	0.47
Resistance training experience [6]	1.7 ± 1.4	2.1 ± 1.3	1.7 ± 1.3	1.8 ± 1.4	0.2 (-0.3, 0.9)	0.37
Falls confidence [7]	3.0 ± 0.7	3.0 ± 1.1	2.9 ± 1.2	2.9 ± 1.1	0.0 (-1.1, 0.4)	0.39
Habit formation [8]						
Sum	12.9 ± 6.3	16.8 ± 6.1	13.8 ± 6.7	17.1 ± 6.1	-1.2 (-4.9, 2.3)	0.47

1 Barrier self-efficacy consisted of nine items which were scored from one (not very confident at all) to five (very confident) and the barrier self-efficacy sum is the summation of all nine item scores (ranging from 5–45).

2 Outcome expectation consisted of eight items which were scored from one (strongly disagree) to five (strongly agree) and outcome expectation sum is the summation of all eight item scores (ranging from 5–40).

3 Motivation type was determined by the Behavioural Regulations in Exercise Questionnaire (BREQ). Items were scored from one (not true for me) to five (very true for me). The mean score was calculated for every sub-item and scores range from 0–5.

4 Social support was the summation of two items (ranging from 2–14), which were scored from one (strongly disagree) to seven (strongly agree).

5 Intention was determined on a scale of 0 (no intention to exercise) to 100 (full intention to exercise).

6 Exercise experience for both aerobic and resistance training was scored on a scale of one (not true for me) to five (very true for me).

7 Confidence of not falling within the next 12 months was scored on a scale of one (not true for me) to five (very true for me).

8 Habit formation consisted of four items which were from one (strongly disagree) to five (strongly agree) and the habit formation sum is the summation of all four item scores (ranging from 5–20).

** Indicates significant values ($p < 0.05$).*

6.5. Discussion

This study examined the acceptability, safety and preliminary efficacy of *ExerciseGuide* to determine if progression to a larger scale trial is merited. There were four important findings: [1] three of the four (acceptability, safety and meaningful moderate-to-vigorous physical activity participation) pre-specified criteria for intervention success were achieved; [2] intervention usability was just below criteria despite a high level of online engagement; [3] findings for the mechanisms of action were mixed; [4] criteria for trial feasibility were met except for recruitment.

The high levels of intervention acceptability observed in this pilot study are encouraging. While our sample likely suffers from some self-selection bias, it is notable that our study population is inclusive of older adults and others often perceived to have difficulties accessing online programs (e.g., those living in remote Australia) (61). It is also notable that positive results were observed across multiple facets of acceptability, including those associated with uptake and efficacy (e.g., relevance) (37,62). Of exception, intervention usability was deemed marginal, scoring 67.0 ± 15.1 out of 100. The score was one point under the pre-specified cut point for success, suggesting that the *ExerciseGuide* website performed just at or below average compared to industry standards. Similar scores have been observed in evaluations of other web-based physical activity websites in similar populations. Alley et al. reported a usability score of 62.9 ± 10.2 in a study evaluating a tailored website with interactive features for older Australian adults (63). Finlay et al. compared usability of a computer-tailored website among Australian men with localised prostate cancer set up to deliver modules either in a free choice scenario (similar to *ExerciseGuide*) or a tunnelled scenario where a new module was unlocked each week. Average usability was higher in the tunnelled intervention 67.4 ± 14.6 compared to the free choice intervention 56.4 ± 12.2 (63,64), but as in the current study the score was marginal. Usability testing and iterative refinement was undertaken with *ExerciseGuide* in a small lab-based study to enhance usability with some success (17). However, given, that usability is likely to affect the uptake and continued use of web-based tools additional strategies should be considered, including implementation of feedback from pilot study participants (65). Findings in the Finlay study and qualitative feedback from two *ExerciseGuide* participants consider that usability may improve if participants are navigated through future interventions (64). This may also lead to increased usage of education modules which were not accessed as often as the exercise prescription modules in the current study. Lastly, further revision to the exercise prescription component of the intervention may improve the acceptability of the intervention. Real world usability testing with iterative changes may be useful to ensure the changes are positive.

Prior to the study, another unknown aspect was the safety of a distance-based exercise prescription tool in individuals with metastatic prostate cancer. The current study reported zero serious adverse events (≥3 CTCAE grading criteria) and twelve study-related grade one events (increased muscular or joint soreness and acute fatigue levels). A recent systematic review in individuals with bone metastases supports the use of unsupervised exercise as long as there is a supervised component, including face-to-face exercise instruction (66). The novel use of distance-based supervision may provide another safe method of instruction by qualified practitioners.

In terms of preliminary efficacy, the *ExerciseGuide* intervention resulted in additional 10.0 min (95% CI, 1.3-18.6; *P*=0.01) of moderate-to-vigorous physical activity minutes per day compared to the wait-list control group, which equates to 70 min per week. Our results are moderately higher than other web-based studies that included individuals with metastatic prostate cancer, including Trinh et al., who showed a 44.1 min (11.1 to 77.0) improvement over 12 weeks and Golsteijn et al. reported a raw score change of 60 min within the OncoActive intervention [15,67]. The additional physical activity increase observed in the current study may be due to increased individualised support through telehealth consults or multi-modal exercise prescription tailored to individuals' current level of physical activity and metastases/injury locations, which were not available in the Trihn et al. or Golsteijn et al. studies. Although it is important to note that the current study was only eight weeks in duration, it is unknown what effect increased intervention length may have on key factors such as moderate-to-vigorous physical activity, physical fitness, fatigue and depression. There is limited research on optimal duration to see significant changes in this population and further research is required.

A highlight of the current study is the measurement of changes in targeted theoretical constructs to improve understanding of why the *ExerciseGuide* intervention changed moderate-to-vigorous physical activity behaviours, which can have implications for future research. There was an increase in identified motivation in the *ExerciseGuide* group, which indicates a rise in individuals performing exercise because they are driven by reasons personally important, which may be indicative of using computer-tailoring algorithms to provide personally relevant messages (38). A review by Teixeira et al. examining the association between motivation type (based on self-determination theory) and uptake and maintenance of exercise found that increased identified motivation is associated with exercise adoption (30). As such, *ExerciseGuide* may be a promising intervention for engaging individuals with metastatic prostate cancer in exercise. However, additional strategies may be needed to encourage exercise maintenance as there were large variations in attending and completing prescribed exercise among participants over the 8-week intervention. The review by Teixeira et al. suggested that it is an increase in intrinsic motivation that is associated with longer term exercise participation (30). In our study, there was a positive trend, but no significant difference compared to the control in intrinsic motivation. Strategies to increase exercise enjoyment, such as affect regulated exercise (68) and a greater variety of exercises may be useful.

Previous research has also suggested that habit strength and self-efficacy are important for maintenance of exercise behaviours (29). Our intervention did not improve habit strength relative to the control. There was a trend towards reduced self-efficacy in the *ExerciseGuide* group in comparison to the control group despite introducing behaviour change techniques to improve self-efficacy, including allowing participants to adapt their prescription based on perceived confidence levels, video demonstrations showing how to perform the behaviour, psycho-education around goal-setting, planning and obtaining further support, and by facilitating self-monitoring (26,69). Interestingly, reductions in self-efficacy have been seen in other web-based physical activity interventions in individuals diagnosed with cancer. Forbes et al. suggest that if participants have not recently undertaken a physical activity regime, their personal beliefs regarding physical activity such as ease or acute benefits may be overestimated (26). Once they undertake the program, their beliefs may become more realistic within their current constraints (26). Given intrinsic motivation, habits scores and self-efficacy are predictive of long-term exercise adherence (30), changes to the *ExerciseGuide* intervention may be needed to support exercise maintenance. Evaluating behavioural determinants during the intervention and targeting strategies to improve these constructs over time is recommended.

The difference between the self-reported aerobic and resistance adherence (102 ± 62.7% vs. 64.6 ± 40.2%) and volume (91.5 ± 56.5% vs. 78.3 ± 77.9%) was interesting. A possible explanation for the disparity may be due to the higher levels of aerobic exercise behaviours at baseline. Participants may have found it easier to adhere to aerobic exercise in comparison to resistance training as it was a modality that they were already completing in some form. Therefore, participants in distance-based exercise interventions such as *ExerciseGuide* may require more targeted support to develop resistance training routines, such as increased real-time remotely supervised sessions or tools to track, prompt and reward resistance training behaviours. Some changes to the resistance training prescription library to increase variety may also improve adherence through increased enjoyment. Participant qualitative feedback suggested increased variety of resistance-training exercises would be appreciated for this reason. Another strategy that may work to increase adherence could be providing opportunities for participants to complete their individualised program in remotely supervised online group classes using a telehealth platform (70). This could increase feelings of relatedness, which according to self-determination theory, would enhance intrinsic motivation (71).

The authors conclude there is reasonable feasibility of conducting a larger-scale trial. Pre-specified criteria were surpassed for the proportion of outcome data collected and participant retention. The study did not meet the pre-specified criteria of recruiting 66 participants; however, recruitment source was tracked, and lessons learned from the trial should increase recruitment feasibility for future studies. In terms of enrolled participants, recruitment from support groups (free), physicians (free) and paid social media advertisements (USD 81 per person recruited) were most cost-effective. In contrast, paid-registry recruitment was not as cost-effective (USD 800 per person recruited). We had few physicians/hospital sites involved and increasing this would likely lead to increased feasibility. Overall, evidence-based strategies to enhanced recruitment would be welcome. For example, Frampton et al. recommended that future researchers embed recruitment trials within randomised trials to help us better understand the efficacy of recruitment strategies in terms of increasing uptake and recruiting representative samples (72).

6.5.1. Strengths and limitations of the study

The current pilot study should be interpreted within the context of key strengths and limitations. The recruitment goal of 66 participants was not met, which may have implications on future trial design (58). The study was eight weeks in duration, and there was no long-term follow-up. As such, authors could not determine whether the intervention resulted in long term changes of key parameters such as moderate-to-vigorous activity levels. Despite a diagnosis of metastatic cancer, participants who were reasonably active prior to the intervention may not be representative of all individuals with metastatic prostate cancer. Finally, self-report measures were used for various study outcomes, such as intervention adherence, which may introduce response biases.

A strength of the study is that the *ExerciseGuide* intervention was methodically developed based on behavioural theory, previously investigated exercise prescription methodology, and formative user-centred research (5,8,17). Furthermore, the study used a randomised design and publication of the study protocol aimed to ensure transparency around pre-specified criteria for success (21). Lastly, the study examined different measures of acceptability and mechanisms of action, which has provided the researchers with the opportunity to explore what intervention components may be efficacious and improve future intervention development.

6.6. Conclusions

Our findings provide preliminary evidence that a web-based tailored exercise and behavioural change intervention designed for individuals with metastatic prostate cancer is acceptable, safe and efficacious for improving moderate-to-vigorous activity levels, fatigue and motivation. Given the high disease burden in this population, there is a clear need to develop effective distance-based and scalable supportive care interventions for individuals who are unable to access supervised interventions. As such, we consider that a large-scale trial with an enhanced version of the intervention is justified.

Author Contributions: CES, CF, DG, RN, CV, SC, AV, GW, GK and NB collaborated to design the study and successful grant application. All authors contributed to the study protocol. HE and CF adapted the exercise prescription work by DG and RN into computer algorithms. HE, CES and CF produced the exercise videos and HE and CES developed the written website content. GK assisted with recruitment and AV oversaw data analysis. HE and CES drafted the manuscript, and all authors contributed to

reviewing the draft manuscript. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Please refer to suggested Data Availability Statements in section "MDPI Research Data Policies" at https://www.mdpi.com/ethics. You might choose to exclude this statement if the study did not report any data.

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6.7. References

1. Australian Institute of Health and Welfare (AIHW). Australian cancer incidence and mortality [Internet] Canberra: Australian Government; 2021. Available from: https://www.aihw.gov.au/reports/cancer/cancer-data-in-australia.
2. Kretschmer A, Ploussard G, Heidegger I, Tsaur I, Borgmann H, Surcel C, et al. Health-related quality of life in patients with advanced prostate cancer: a systematic review. 2020;7(4):742–751. DOI:10.1016/j.euf.2020.01.017
3. Gandaglia G, Abdollah F, Schiffmann J, Trudeau V, Shariat SF, Kim SP, et al. Distribution of metastatic sites in patients with prostate cancer: a population-based analysis. Prostate.2014;74(2):210–6. DOI:10.1002/pros.22742
4. Sheill G, Guinan EM, Peat N, Hussey J. Considerations for exercise prescription in patients with bone metastases: a comprehensive narrative review. PM&R. 2018;10(8):843–864 . DOI: 10.1016/j.pmrj.2018.02.006
5. Evans HEL, Forbes CC, Vandelanotte C, Galvão DA, Newton RU, Wittert G, et al. Examining the priorities, needs and preferences of men with metastatic prostate cancer in designing a personalised eHealth exercise intervention. Int J Behav Med. 2021;28(4):431–43. DOI: 10.1007/s12529-020-09932-2
6. Dasso NA. How is exercise different from physical activity? A concept analysis. Nurs Forum. 2019;54(1):45–52. DOI: 10.1111/nuf.12296
7. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11(3):247–57. DOI: 10.1097/SPC.0000000000000276.
8. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393–399. DOI: 10.1249/MSS.0000000000001454.
9. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16(4):328–35. DOI: 10.1038/pcan.2013.22.
10. Murray LK, Bennett EK. The short-term effects of resistance training on quality of life, cancer related fatigue, body composition, and physical function in men with advanced and metastatic prostate cancer receiving androgen deprivation therapy: a pilot study. Phys Ther Rev. 2020;25(4):238–45. DOI: 10.1080/10833196.2020.1784570

11. Ballard-Barbash R, Friedenreich CM, Courneya KS, Siddiqi SM, McTiernan A, Alfano CM. Physical activity, biomarkers, and disease outcomes in cancer survivors: A systematic review. Journal of the National Cancer Institute. 2012;104(11):815-40. DOI: 10.1093/jnci/djs207.
12. Bonn SE, Sj A, Trolle Lagerros Y, Wiklund F, Stattin ar, Holmberg E, et al. Physical activity and survival among men diagnosed with prostate cancer. 2015; 24(1):57-64. DOI: 10.1158/1055-9965.EPI-14-0707.
13. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: a qualitative exploration. Support Care Cancer. 2018; 26(6):1747-1754. DOI: 10.1007/s00520-017-4008-x.
14. Ariza-Garcia A, Arroyo-Morales M, Lozano-Lozano M, Galiano-Castillo N, Postigo-Martin P, Cantarero-Villanueva I. A web-based exercise system (e-cuidatechemo) to counter the side effects of chemotherapy in patients with breast cancer: randomized controlled trial. J Med Internet Res. 2019;21(7):126. DOI: 10.2196/14418.
15. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: Testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49. DOI: 10.1186/s12966-018-0686-0.
16. Golsteijn RHJ, Bolman C, Peels DA, Volders E, De Vries H, Lechner L. A Web-based and print-based computer-tailored physical activity intervention for prostate and colorectal cancer survivors: a comparison of user characteristics and intervention use. J Med Internet Res. 2017;19(8):e298. DOI: 10.2196/jmir.7838.
17. Evans H, Forbes C, Galvão D, Vandelanotte C, Newton R, Wittert G, et al. Usability, acceptability, and safety analysis of a computer-tailored web-based exercise intervention (*ExerciseGuide*) for individuals with metastatic prostate cancer: multi-methods laboratory-based study. JMIR cancer. 2021;7(3):e28370. DOI: 10.2196/28370.
18. Short CE, James EL, Rebar AL, Duncan MJ, Courneya KS, Plotnikoff RC, et al. Designing more engaging computer-tailored physical activity behaviour change interventions for breast cancer survivors: lessons from the iMove More for Life

study. Support Care Cancer. 2017;25(11):3569–85. DOI: 10.1007/s00520-017-3786-5.

19. Santarossa S, Kane D, Senn CY, Woodruff SJ. Exploring the role of in-person components for online health behaviour change interventions: can a digital person-to-person component suffice? J Med Internet Res. 2018;20(4):e144. DOI: 10.2196/jmir.8480.

20. Eldridge SM, Chan CL, Campbell MJ, Bond CM, Hopewell S, Thabane L, et al. CONSORT 2010 statement: Extension to randomised pilot and feasibility trials. Pilot Feasibility Stud. 2016;2(1): i5239. DOI: 0.1136/bmj.i5239

21. Evans HEL, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, et al. Evaluating a web- and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial. Pilot Feasibility Stud. 2021;7(1):1–16. DOI: 10.1186/s40814-020-00763-2.

22. Attkisson CC, Greenfield TK. The UCSF Client Satisfaction Scales: I. the client satisfaction questionnaire-8. In: Maruish, ME, editor. The use of psychological testing for treatment planning and outcomes assessment: Instruments for adults. Lawrence Erlbaum Associates Publishers; 2004. p. 799–811.

23. Brooke J. SUS-A quick and dirty usability scale. Usability Eval Ind. 1996;189(194):4–7.

24. ACSM. ACSM’s exercise testing and prescription. Lippincott Williams & Wilkins; 2017.

25. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: Exercise medicine in cancer management. J Sci Med Sport. 2019; 22(11):1175-1199. DOI: 10.1016/j.jsams.2019.05.003.

26. Forbes CC, Blanchard CM, Mummery WK, Courneya KS. A pilot study on the motivational effects of an internet-delivered physical activity behaviour change programme in Nova Scotian cancer survivors. Psychol Health. 2017;32(2):234-252. DOI: 10.1080/08870446.2016.1260725

27. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018 Aug 16;52(9):798–808. DOI: 10.1093/abm/kax055.

28. Rhodes RE, De Bruijn GJ. How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. Br J Health Psychol. 2013;18(2):296–309. DOI: 10.1111/bjhp.12032.
29. Rhodes RE, McEwan D, Rebar AL. Theories of physical activity behaviour change: A history and synthesis of approaches. Psychology of Sport and Exercise.2019;42;100–9. DOI: 10.1016/j.psychsport.2018.11.010.
30. Teixeira PJ, Carraça E V., Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: A systematic review. International Journal of Behavioral Nutrition and Physical Activity. 2012;9(1):1-30. DOI: 10.1186/1479-5868-9-78
31. Gardner B, Lally P, Wardle J. Making health habitual: The psychology of "habit-formation" and general practice. British Journal of General Practice. 2012; 62(605): 664–666. DOI: 10.3399/bjgp12X659466
32. Stacey FG, James EL, Chapman K, Courneya KS, Lubans DR. A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behavior change interventions for cancer survivors. J Cancer Surviv. 2015;9:305–38. DOI: 10.1007/s11764-014-0413-z.
33. Petty RE, Barden J, Wheeler SC. The Elaboration Likelihood Model of persuasion: developing health promotions for sustained behavioral change. In: DiClemente RJ, Crosby RA, Kegler MC, editors. Emerging theories in health promotion practice and research. 2nd ed. San Francisco: Jossey-Bass/Wiley; 2009. p. 185–214.
34. Galvão D, Taaffe D, Cormie P, Spry N, Chambers S, Peddle-McIntyre C, et al. Efficacy and safety of a modular multi-modal exercise program in prostate cancer patients with bone metastases: a randomized controlled trial. BMC Cancer. 2011; 11(1):1-7. DOI: 10.1186/1471-2407-11-517
35. Video Communications Inc. Zoom [Internet]. San Jose: Video Communications Inc; 2021. Available from: https://www.zoom.us.
36. Microsoft Pty. Skype [Internet]. Redmond: Microsoft Pty; 2021. Available from: https://www.skype.com/en/.
37. Perski O, Short C. Acceptability of digital health interventions: embracing the complexity. Transl Behav Med. 2021; 11(7):1473-1480. DOI: 10.1093/tbm/ibab048.

38. Markland D, Tobin VJ. Need support and behavioural regulations for exercise among exercise referral scheme clients: the mediating role of psychological need satisfaction. Psychol Sport Exerc. 2010;11(2):91–9. DOI:10.1016/j.psychsport.2009.07.001 39.
39. Short C, James E, Girgis A, Mcelduff P, Plotnikoff R. The efficacy of two theoretically-based print interventions for promoting PA behaviour among post-treatment breast cancer survivors: A nationally-based 3-arm RCT. J Sci Med Sport. 2012;15:S175–6. DOI: 10.1016/j.jsams.2012.11.427
40. Vandelanotte C, Short C, Plotnikoff RC, Hooker C, Canoy D, Rebar A, et al. TaylorActive - Examining the effectiveness of web-based personally-tailored videos to increase physical activity: a randomised controlled trial protocol. BMC Public Health. 2015;15(1):1020. DOI: 10.1186/s12889-015-2363-4.
41. Troiano RP, McClain JJ, Brychta RJ, Chen KY. Evolution of accelerometer methods for physical activity research. Br J Sports Med. 2014;48(13):1019–23. DOI: 10.1136/bjsports-2014-093546.
42. Choi L, Ward SC, Schnelle JF, Buchowski MS. Assessment of wear/nonwear time classification algorithms for triaxial accelerometer. Med Sci Sports Exerc. 2012;44(10):2009–16. DOI: 10.1249/MSS.0b013e318258cb36.
43. Short C, Rebar A, James E, Duncan M, Courneya K, Plotnikoff R, et al. How do different delivery schedules of tailored web-based physical activity advice for breast cancer survivors influence intervention use and efficacy? J Cancer Surviv. 2017;11(1):80–91. DOI: 10.1007/s11764-016-0565-0
44. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care. 2017;26(6). DOI: 10.1111/ecc.12575.
45. Bennell KL, Marshall CJ, Dobson F, Kasza J, Lonsdale C, Hinman RS. Does a web-based exercise programming system improve home exercise adherence for people with musculoskeletal conditions? Am J Phys Med Rehabil. 2019;98(10):850–8. DOI: 10.1097/PHM.0000000000001204.
46. Kaasa S, Bjordal K, Aaronson N, Moum T, Wist E, Hagen S, et al. The EORTC Core Quality of Life questionnaire (QLQ-C30): validity and reliability when analysed with patients treated with palliative radiotherapy. Eur J Cancer. 1995;31(13–14):2260–3. DOI: 10.1016/0959-8049(95)00296-0.

47. Cella D, Lai JS, Chang CH, Peterman A, Slavin M. Fatigue in cancer patients compared with fatigue in the general United States population. Cancer. 2002;94(2):528–38. DOI: 10.1002/cncr.10245

48. Greer JA, Jacobs J, Pensak N, MacDonald JJ, Fuh C, Perez GK, et al. Randomized trial of a tailored cognitive-behavioral therapy mobile application for anxiety in patients with incurable cancer. Oncologist. 2019;24(8):1111–20. DOI: 10.1634/theoncologist.2018-0536

49. Gerbershagen HJ, Özgür E, Straub K, Dagtekin O, Gerbershagen K, Petzke F, et al. Prevalence, severity, and chronicity of pain and general health-related quality of life in patients with localized prostate cancer. Eur J Pain. 2008;12(3):339–50. DOI: doi: 10.1016/j.ejpain.2007.07.006.

50. Beck SL, Schwartz AL, Towsley G, Dudley W, Barsevick A. Psychometric evaluation of the Pittsburgh sleep quality index in cancer patients. J Pain Symptom Manage. 2004;27(2):140–8. DOI: 10.1016/j.jpainsymman.2003.12.002

51. Plotnikoff RC, Lippke S, Courneya KS, Birkett N, Sigal RJ. Physical activity and social cognitive theory: a test in a population sample of adults with type 1 or type 2 diabetes. Appl Psychol. 2008;57(4):628–43.DOI: 10.1111/j.1464-0597.2008.00344.

52. Plotnikoff RC, Blanchard C, Hotz SB, Rhodes R. Measurement in physical education and exercise science validation of the decisional balance scales in the exercise domain from the transtheoretical model: a longitudinal test. 2009;5(4):191-206. DOI: 10.1207/S15327841MPEE0504_01

53. Markland D, Tobin V. A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. J Sport Exerc Psychol. 2004;26(2):191–6. DOI: 10.1123/jsep.26.2.191

54. Rhodes RE, Rebar AL. Conceptualizing and defining the intention construct for future physical activity research. Exerc Sport Sci Rev. 2017;45(4):209–16. DOI: 10.1249/JES.0000000000000127.55.

55. Cormie P, Galvão DA, Spry N, Joseph D, Taaffe TR, Newton RU. Functional benefits are sustained after a program of supervised resistance exercise in cancer patients with bone metastases: longitudinal results of a pilot study. Support Care Cancer. 2014;22:1537–1548. DOI: 10.1007/s00520-013-2103-1.

56. Bohannon RW. Measurement of sit-to-stand among older adults. Top Geriatr Rehabil [Internet]. 2012;28(1):11-16. DOI: 10.1097/TGR.0b013e31823415fa
57. Thabane L, Lancaster G. A guide to the reporting of protocols of pilot and feasibility trials. Pilot Feasibility Stud. 2019;5(37). DOI: 10.1186/s40814-019-0423-8
58. Billingham SA, Whitehead AL, Julious SA. An audit of sample sizes for pilot and feasibility trials being undertaken in the United Kingdom registered in the United Kingdom Clinical Research Network database. BMC Med Res Methodol. 2013;13(1): 104. DOI: 10.1186/1471-2288-13-104.
59. Puhan MA, Frey M, Büchi S, Schünemann HJ. The minimal important difference of the hospital anxiety and depression scale in patients with chronic obstructive pulmonary disease. Health Qual Life Outcomes. 2008;6:46. DOI: 10.1186/1477-7525-6-46.
60. Kwon S, Perera S, Pahor M, Katula JA, King AC, Grossl EJ, et al. What is a meaningful change in physical performance? Findings from a clinical trial in older adults (the LIFE-P study). J Nutr Health Aging. 2009;13(6):538-44. DOI: 10.1007/s12603-009-0104-z.
61. Hodge H, Carson D, Carson D, Newman L, Garrett J. Using internet technologies in rural communities to access services: the views of older people and service providers. J Rural Stud. 2017;54:469–78. DOI: 10.1016/j.jrurstud.2016.06.016
62. Corbett T, Singh K, Payne L, Bradbury K, Foster C, Watson E, et al. Understanding acceptability of and engagement with web-based interventions aiming to improve quality of life in cancer survivors: A synthesis of current research. Psycho-oncology. 2018;27:22–33. DOI: 10.1002/pon.4566.
63. Alley SJ, Kolt GS, Duncan MJ, Caperchione CM, Savage TN, Maeder AJ, et al. The effectiveness of a web 2.0 physical activity intervention in older adults – a randomised controlled trial. Int J Behav Nutr Phys Act. 2018;15(1):1–11. DOI: 10.1186/s12966-017-0641-5.
64. Finlay A, Evans H, Vincent A, Wittert G, Vandelanotte C, Short CE. Optimising web-based computer-tailored physical activity interventions for prostate cancer survivors: a randomised controlled trial examining the impact of website architecture on user engagement. Int J Environ Res Public Health. 2020;17(21):7920. DOI: 10.3390/ijerph17217920.

65. Short CE, Rebar AL, Plotnikoff RC, Vandelanotte C. Designing engaging online behaviour change interventions: a proposed model of user engagement. Eur Heal Psychol. 2013;17(1):32–8.
66. Weller S, Hart NH, Bolam KA, Mansfield S, Santa Mina D, Winters-Stone KM, et al. Exercise for individuals with bone metastases: a systematic review. Crit Rev Oncol Hematol. 2021;166:103433. DOI: 10.1016/j.critrevonc.2021.103433
67. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Short-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: a randomized controlled trial. Int J Behav Nutr Phys Act. 2018;15(1):106. DOI: 10.1186/s12966-018-0734-9
68. Parfitt G, Alrumh A, Rowlands, AV. Affect-regulated exercise intensity: does training at an intensity that feels “good” improve physical health? J. Sci. Med. Sport, 2012;15(6), 548–553. DOI: 10.1016/j.jsams.2012.01.005.
69. Valle CG, Tate DF, Mayer DK, Allicock M, Cai J. Exploring mediators of physical activity in young adult cancer survivors: evidence from a randomized trial of a facebook-based physical activity intervention. J Adolesc Young Adult Oncol. 2015;4(1):26. DOI: 10.1089/jayao.2014.0034.
70. Fox L, Wiseman T, Cahill D, Beyer K, Peat N, Rammant E, Van Hemelrijck M. Barriers and facilitators to physical activity in men with prostate cancer: a qualitative and quantitative systematic review. Psycho-Oncology. 2019;28(12):2270-85. DOI: 10.1002/pon.5240.
71. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. Physical activity and cancer. 2010:367-87. DOI: 10.1007/978-3-642-04231-7_16.
72. Frampton GK, Shepherd J, Pickett K, Griffiths G, Wyatt JC. Digital tools for the recruitment and retention of participants in randomised controlled trials: a systematic map. Trials. 2020;21:1-23. DOI: 10.1186/s13063-020-04358-3.

Chapter Seven

Thesis discussion and conclusions

The body of research within this dissertation has been presented as a collection of publications related to the development and evaluation of a web-based exercise and behaviour change tool to support individuals with metastatic prostate cancer. The three main aims of the thesis were to: [1] explore the priorities of individuals living with metastatic prostate cancer as well as the needs and preferences regarding a tailored web-based exercise intervention; [2] examine and refine the acceptability and usability of a tailored web-based exercise intervention (*ExerciseGuide*) for individuals with metastatic prostate cancer in a lab-based setting; and finally [3] to assess the acceptability, safety and preliminary efficacy of a computer-tailored web-based exercise intervention (*ExerciseGuide*) in individuals with metastatic prostate cancer in a pilot randomised controlled trial.

To our knowledge, the *ExerciseGuide* intervention is among the first web-based interventions designed for individuals with cancer to include both individualised multi-modal exercise prescription and tailored behaviour change support. Additionally, the hybrid delivery model of using computer-tailoring to automate exercise prescription delivery, combined with health professional support, may be the first in this field. The outcomes of each of the publications were described and thoroughly discussed in the previous chapters. In this final chapter, the key research outcomes will be synthesised, strengths and limitations will be acknowledged, and implications for future research will be discussed.

7.1 Summary of thesis findings

Chapter three [paper 1] qualitatively analysed acceptability, perceptions and preferences towards a potential eHealth web-based exercise intervention for individuals with metastatic prostate cancer. Eighteen male participants were interviewed from across Australia. The majority of participants were comfortable using technology and responded favourably to using a web-based tool to seek exercise prescription and lifestyle advice. The distance-based alternative to supervised exercise was seen as advantageous to the participants to gain knowledge, individual exercise prescriptions and support in one location. Participants also believed that distance-based exercise could counter some of their barriers to face-to-face exercise, such as affordability, accessibility and the dislike of exercise clinics or gym environments. In general, study participants reported that they were rarely provided individualised exercise advice and were uncertain of appropriate exercise dosage for individuals with metastatic prostate cancer. Five out of the eighteen participants were concerned about overexertion and safety during exercise. This concern may likely affect the initiation and maintenance of exercise in unsupervised settings. A major finding from the third chapter was the need for a level of personalised support (video conferencing, phone conferencing, or SMS) rather than solely automated communication. Whilst this addition would increase intervention cost and practitioner load; it may increase intervention engagement, safety and relatedness (1,2). All of which could improve intervention efficacy. Lastly, given that only half of the participants were confident describing the location of metastases, it was proposed that future exercise interventions should provide enhanced methods to confirm specific sites of bone metastases to enhance exercise prescription and ensure safety.

Given the findings from the qualitative paper, researchers determined a distance-based exercise tool with a level of personalised support may be valuable in this population if safe and usable. As such, the tool was created taking a patient-centred approach to development. Chapter four examined and refined the acceptability and usability of *ExerciseGuide* in a lab-based setting [paper 2]. Overall, participants viewed the simple modular design and computer-tailored content within *ExerciseGuide* as acceptable. Feedback indicated that the function of the intervention website was more important than the aesthetics. On account of the iterative nature of this study, numerous notable usability issues were identified and modified, including increasing text size, increasing the amount of navigation support, reducing the number of repeating questions required for tailoring different modules and the use of unnecessary medical terminology. Changes made between the first (n=5) and second wave (n=6) of participants increased the intervention's usability, with the second wave deeming the usability satisfactory. Finally, the resistance training algorithms were shown to provide appropriate content safely (by excluding the load of metastatic lesions), and in general, users could replicate the exercise technique unaided to a satisfactory level.

The fifth chapter [paper 3] outlined the research protocol for the pilot randomised controlled trial, which focused on evaluating *ExerciseGuide,* a web and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer. The methodology for the web-based *ExerciseGuide* trial was outlined. One-on-one real-time video counselling and other distance-based communication means (i.e. email, SMS) to provide personalised support were included as a result of the findings from chapters three and four. The pre-specified criteria for success and feasibility to progress to a larger trial were reported a priori. The overall aim of this publication was to ensure transparency around pre-specified criteria for success and aid replication of the study.

Chapter six [paper 4] reports the results from the evaluation of *ExerciseGuide*. In all, 40 participants (70.2 ± 8.5 years of age) were recruited from across Australia, with 9.8% of participants living in outer regional areas and 4.8% living in remote or very remote areas. Participants were randomised into the 8-week *ExerciseGuide* intervention or a wait-list control group. Results indicated that the *ExerciseGuide* intervention was acceptable to participants (CSQ-8 score of 28 out of 32; range = 16) and safe (no CTCAE v5.0 grade 3+ adverse events). Despite lab-based usability testing and refinement in chapter four, the system usability scale score was 67.0 ± 15.1 out of 100, which was deemed as just below satisfactory.

There was a between group difference in MVPA per day of 10.0 minutes (95% CI, 1.3-18.6; P=0.01) favouring the *ExerciseGuide* intervention group relative to the control group. This would equate to a difference of 70.0 minutes per week between groups, which is markedly higher than other web-based physical activity interventions for individuals with prostate cancer (3–6). It is also possible that the increase in MVPA could produce a clinically meaningful change for health outcomes in individuals with prostate cancer. Bonn et al. reported a benefit with 60 minutes of MVPA per week for reducing prostate cancer-specific mortality. However, Gaskin et al. suggested the minimally clinically significant change needed to improve quality of life in individuals with prostate cancer would be 107-231 minutes per week (7,8).

It should be noted that there is significant variation in the self-reported adherence to the exercise intervention in the pilot RCT. Adherence to the resistance training component was 64.6% ± 40.2% and 102% ± 62.7% to the aerobic prescription, indicating that while a proportion of participants adhered exceptionally well, others did not. This variation is much higher than the face-to-face intervention used in Galvão et al., which uses the same modular exercise prescription approach (89% ± 28%) (9).

There was also a positive but small change in identified (0.4; 95% CI, 0.0, 0.7; P=0.04) and intrinsic (0.3; 95% CI, 0.0-0.7; P=0.07) motivation levels in the intervention group in comparison to the control group. This result is promising as it indicates the intervention led to an increase in individuals performing exercise because they are driven by reasons personally important to them and, to a lesser extent, enjoyment. According to the self-determination theory, these drivers have a positive impact on exercise adoption (identified motivation) and long-term adherence to exercise (intrinsic motivation) (10). It was also notable that there was a clinically relevant trend towards the reduction in fatigue (5.3; 95% CI, −0.4-11.1); P=0.06) and levels of depression (−1.3; 95%, −2.4–−2.4); P=0.06) in the *ExerciseGuide* group between baseline and follow up eight weeks later. Given the symptom burden of both fatigue and depression can be significant in this population, this finding is encouraging (11,12).

Based on the results in this study, *ExerciseGuide* could also be a scalable intervention to reach individuals living with metastatic prostate cancer as an alternative supportive tool for those who are unable to access face-to-face interventions. Overall, progression to a large-scale trial is recommended with advancements to the *ExerciseGuide* intervention.

7.2 Interpretation of key findings and lessons learned

This dissertation has highlighted several key findings that have significant implications for both future research and clinical practice.

7.2.1 Distance-based exercise in metastatic prostate cancer can be prescribed safely.

One of the most valuable findings of this program of research was that individuals with metastatic prostate cancer could be prescribed exercise safely using a web-based tool. Overall, there were only fourteen grade one (mild symptoms) study-related adverse events from aerobic training and five from resistance training reported. All study-related adverse events were associated with mild joint, bone or muscle pain, which is relatively common in exercise interventions in older adults (13). Our study adds evidence to a recent systematic review by Weller et al., who reported that distance-based individualised exercise prescriptions might be safe in individuals with bone metastases (14). Up until recently, individuals with metastatic prostate cancer were advised to limit exercise for fear of significant adverse events such as fractures and spinal compression (15). While this paradigm is slowly shifting, exercise prescription in this population is still quite conservative in nature. Weller et al. suggest that while not all exercise prescribed should be completed in a supervised environment, distance-based interventions still require at least one face-to-face supervised session to ensure adequate instruction and practice (14). In contrast, the *ExerciseGuide* intervention appears to provide an appropriate amount of remote supervision, exercise instruction, and support without any face-to-face interaction. As such, it could be another modality utilised to provide exercise prescription and support safely.

A highlight of the current research was the safe adaptation of the well-researched individualised modular exercise prescription previously used in face-to-face settings (9). Furthermore, the novel approach of using the movement screen analysis in the lab-based usability study (chapter four) provided researchers valuable knowledge to ensure the exercise videos could be replicated safely by individuals with metastatic prostate cancer without face-to-face supervision. Videos and corresponding text were modified slightly post lab-based testing to highlight proper positioning and muscle isolation by emphasising the important cues in the video and explaining why isolation is important for safety and strength development. Introducing this type of analysis in the refinement of other remotely supervised exercise prescription video demonstrations would be beneficial in the future. Furthermore, it could be surmised that the addition of human interaction and remote support from the exercise physiologist, which resulted from the qualitative feedback in chapter three, increased the safety of the *ExerciseGuide* intervention.

Excitingly, the continued rapid advancement of accessible technology and the rise of video-based telehealth communication in the last two years have sped up telehealth use in populations such as older adults who may have previously been unwilling or unable to engage in these services (16). As such, it is likely that the confidence and capability of both clinicians and patients with video-based telehealth or real-time remote monitoring will only continue to improve. Consequently, remote supervision appears to be a viable alternative to a face-to-face exercise prescription when individuals with metastatic prostate cancer cannot or choose not to attend in person.

7.2.2 Computer-tailoring is valuable in distance-based exercise prescription tools designed for individuals with cancer

Despite an increasing understanding of the benefits of exercise in individuals with prostate cancer, it is evident that simply providing generic guidelines around structured exercise in oncology populations is not sufficient to produce physical activity behaviour change (17). Notably, this collection of work has demonstrated for the first time that the novel use of computer-tailoring algorithms for prescribing suitable individualised exercise prescriptions in digital behavioural change interventions is acceptable in individuals with metastatic prostate cancer. Results from chapter three indicated that participants were rarely provided individualised exercise advice from their health care team and were unsure of the appropriate dosages of exercise for their unique situation; this method would increase the access to individualised exercise support for many.

The benefits of automated computer-tailoring in exercise interventions are that participants can log on, generate their program and view the exercise demonstrations in their own time, as well as having access to behavioural change focused resources. It is seen to be a time-efficient and cost-effective approach in light of the fact that providing evidence-based supervised exercise interventions with qualified health professionals to all individuals diagnosed with cancer survivors puts a financial and resources burden on health care systems and individuals (18).

Given the acceptability and efficacy seen in this population, it is also valuable to consider the development of computer-tailored exercise prescription interventions for individuals with other cancer types and stages. Like the prostate cancer population, many others diagnosed with cancer do not perform the necessary amount of MVPA to achieve the health benefits (19,20). Moreover, many oncology health care providers lack the time in appointments and or knowledge of where to refer to in order to adequately assist individuals with cancer to begin or maintain MVPA safely (21). Having a one-stop online exercise prescription and behaviour change website such as *ExerciseGuide*, which could individually tailor information and prescriptions based on cancer type and stage, would reduce the time burden on referring health professionals and increase access for many individuals with cancer unable to exercise in a supervised environment with cancer-specific exercise professionals.

In addition, it is not uncommon for those living with cancer to present or develop multiple morbidities over the course of their cancer treatments (22). Integrating condition-specific exercise considerations via computer tailoring into the education and prescription may be another step forward with online exercise interventions in cancer. For example, exercise prescription for individuals with a cancer diagnosis and Type 2 diabetes could account for type and time of medications, glucose monitoring and current nutrition and hydration status on top of the oncological considerations (23). While developing computer-tailored patient-centred exercise interventions for different cancers, stages and co-morbidities would be complex and challenging, it may allow for a low-cost delivery method and may therefore be cost-effective in the long term.

However, despite the acceptability of computer-tailored web-based prescription, some participants in the evaluation study (chapter six) still expressed the need for greater exercise diversity, exercise prescription suited to personal goals and an ability to further manipulate the exercise selection to suit individual limitations. It is unknown whether additional exercise videos and further development of computer-tailoring algorithms with the ability to modify exercises from the back end are required or if already established exercise prescription platforms such as PhysiTrack or TechnoGym could be integrated into the *ExerciseGuide* website to improve acceptability and usability for both individuals with metastatic prostate cancer and health professionals.

In conclusion, computer tailoring is a valuable addition to a web-based exercise prescription tool for individuals with metastatic prostate cancer, and future research should evaluate its suitability in other cancer populations. However, continued technical development in how to best use computer-tailoring to individualise and manipulate prescriptions in real-time is still required.

7.2.3 Putting the "support" into supportive care in web-based exercise interventions

A recurring theme in this body of work is the need for support structures in digital behavioural change interventions targeting individuals with metastatic prostate cancer. Participants in chapter three believed ongoing human interactions using telehealth consultations would provide an additional layer of individualised support and accountability to individual goals. Automated communication was not seen as a supportive tool as it did not create the same interpersonal connection. Additionally, the usability study (chapter four) identified that having access to a qualified exercise professional may increase confidence and perceived competence in the exercises prescribed because participants could ask questions, have technique checked (via videoconferencing) and have exercises modified when necessary. These findings are supported by Grimmett et al., who reported that while low-intensity interventions (such as educational pamphlets) may be suitable for motivated, educated and young individuals, increased support may be needed for older adults or those with considerable limitations (24).

Despite improvements in MVPA levels in the *ExerciseGuide* intervention, there was a large variation in aerobic and resistance adherence overall. Given the importance of regular multi-modal exercise to improve physical function and potentially create changes in the systemic environment that may alter disease progression, maintaining high levels of adherence is important (9,15). Written qualitative feedback from the *ExerciseGuide* intervention indicated that some participants preferred more remote supervision and increased contact from the exercise physiologist. Interestingly, a majority of the face-to-face interventions in the oncology population include 2-3 contacts (supervised sessions) per week for between 15-60 minutes in duration (which would equate to between 240 minutes to 1,260 minutes of contact over eight weeks) (25,26). However, many distance-based interventions have a reasonably low level of remote support (27). For example, the *ExerciseGuide* intervention implemented two telehealth consultations (week one and week four), which only resulted in an approximate contact time of 92 minutes per person (plus an average of 6 SMS/email messages) across the entire 8-week intervention. While increasing practitioner support may increase intervention cost and practitioner time burden, it is hypothesised that non-adhering participants in the *ExerciseGuide* intervention may have benefited from increased contacts in the form of one-on-one video-based exercise sessions or more personalised text-based check-ins. Another cost effective method, which could be used in future may be the use of group-based behavioural change coaching, which would allow for an increase in interpersonal interactions whilst still being more cost-effective than a one-on-one approach.

As such, while distance-based interventions without remote supervision may cost less to roll out and have increased scalability, they do not appear as appealing to individuals with metastatic prostate cancer. It is more important to be investing valuable research resources into interventions with in-person support structures (face-to-face or remote), which are more likely to be effective.

7.2.4 Understanding what effect the ExerciseGuide intervention has on determinants of physical activity behaviour change

Another key finding from the pilot randomised controlled trial was the preliminary determination of what effect the *ExerciseGuide* intervention had on the proposed mechanisms of behaviour change. Measuring these underlying factors provides researchers with the knowledge about how effective the intervention was at modifying target determinants and what behavioural change techniques may need to be included or adapted to improve the efficacy of future interventions.

Findings from the evaluation study indicated that the strategies incorporated within the *ExerciseGuide* intervention created a shift towards identified regulation (P=0.04) and, to a lesser extent, intrinsic motivation (P=0.07). The importance of this shift cannot be understated as identified regulation is associated with the uptake of exercise behaviours, and intrinsic motivation is linked with exercise maintenance (28). Providing information on the benefits of exercise behaviour (e.g., exercising may improve physical function) can increase individuals knowledge of 'why' exercise can be a personally valuable modality (28). However, this knowledge can also increase feelings of guilt and stress if individuals do not adhere. Crucially, the *ExerciseGuide* intervention did not lead to increased levels of introjected motivation (e.g., I feel ashamed when I do not exercise) and improved identified regulation (e.g., I personally value the benefits of exercise), indicating the way the information was delivered and received was effective for most individuals. The involvement of end-users in understanding what the target population value when communicating the potential benefits of exercise, as well as the qualitative work reviewing modules, may have been a major factor in this success.

However, it should be noted that if the aim of *ExerciseGuide* is to promote longer-term behaviour change in this at-risk clinical population, there still needs to be a greater focus on shifting individuals further towards intrinsic motivation (28). The challenge to this is finding the balance between creating autonomy (allowing individuals to feel in control and enjoy their exercise) and still providing a highly supervised and structured approach that has previously been shown to be safe and effective (29). Encouraging autonomy at a micro-level may offer this balance. Whilst the exercise prescription was quite structured, the *ExerciseGuide* intervention allowed participants to pick the time and location of their exercise. However, other strategies such as encouraging participants to develop their own action plans where they will link their exercise session to a frequently completed cue or context such as a time of day (e.g., just before breakfast) have been used to good effect in other studies (30). This addition creates autonomy and helps strengthen habits and intentions (31). The intervention could also provide a greater variety of safe and suitable resistance and aerobic exercises within the program after the initial prescription and education have been provided. This would allow participants to increase their exercise-specific health literacy before being offered more autonomy. Lastly, computer tailoring could also be improved to refine the grading of tasks. An example of this includes the prescription of resistance training duration based on the length of time participants felt they could achieve rather than based on the number of exercises that were able to be prescribed.

One unexpected outcome was a reduction in barrier self-efficacy in individuals within the *ExerciseGuide* intervention despite specific behavioural change techniques implemented to improve this determinant. Barrier self-efficacy (the confidence to overcome barriers to complete a behaviour) influences the choice to engage in an activity and the amount of persistence to continue it despite barriers encountered (32). While MVPA increased compared to the control group in the short-term, exercise maintenance may not be as successful because barrier self-efficacy is positively linked with long-term physical activity adherence (32,33). This drop in self-efficacy is consistent with findings documented in Forbes et al., who piloted a web-based physical activity intervention for individuals diagnosed with cancer (34). Due to different measures used, direct comparisons cannot be drawn; however, the underlying reasoning may be comparable. It is well understood that disease and treatment-related barriers, including fatigue and bone pain, are additional barriers encountered by individuals with metastatic prostate cancer compared to the healthy population, which may interfere with the ability to adhere to the prescribed exercise program (14,21,35–37). It has been proposed that if individuals diagnosed with cancer are not currently active, their personal beliefs regarding physical activity barriers may not be in line with their current physical and psychological constraints (34). Once a program has been undertaken, their beliefs may become more realistic.

Similarly, to barrier self-efficacy, intention to complete either aerobic or resistance training (in the next eight weeks as measured using a scale of 0-100) was another determinant that reduced throughout the *ExerciseGuide* intervention compared to the control group. With intention to complete resistance training [-14.7; 95% CI, -30.5-1.1; *P*=0.06] reducing to a greater extent than aerobic training [-7.2; 95% CI, -20.8-6.4; *P*=0.29]. Interestingly, this result mirrored adherence. Participants self-reported a lower level of adherence (64.6% ± 40.2%) to the resistance training component compared to the aerobic prescription (102% ± 62.7%). Intention is one of the most consistent psychosocial predictors of physical activity reported in addition to self-efficacy, so it is imperative that future distance-based exercise interventions in prostate cancer populations take this finding into account and potentially measure determinants regularly throughout the intervention to monitor change in beliefs and put in place strategies to counter these reductions. Given the reasonable levels of outcome expectations in the *ExerciseGuide* pilot RCT, it is likely that improving intention throughout the intervention could be done by influencing self-efficacy and sociostructural factors such as facilitators and barriers (10,32). The *ExerciseGuide* intervention had tailored educational content on motivation, self-efficacy, and habit formation in a detailed behaviour change module. However, the behaviour change focused module was only opened by 55% of participants. This figure is lower than in Finlay et al., who reported that their behaviour change modules (split into three separate sections) were opened by 81-89% of the study population (38). Although the *ExerciseGuide* provided avenues to deliver behavioural change information and techniques throughout the intervention (e.g., confidence to exercise and providing education on benefits and safety of exercise), it is unknown if the intervention would have seen greater changes to some of the determinants of physical activity if more individuals with reduced adherence levels were encouraged to access this information. To counter this, expanding behavioural change techniques to improve feelings of competence and confidence in completing an exercise prescription could be another method to enhance self-efficacy and, therefore intentions, in individuals who are not interested in viewing the behaviour change information directly. This may include increasing the number of video consultations to allow both role modelling/demonstrations of the exercise by the health professional and learning by doing with the ability to receive real-time positive feedback when performed correctly (39). Also, self-monitoring was a deliberate technique used within the *ExerciseGuide* intervention with both written physical activity diaries and tracking modules. However, these tools were not monitored by the supervising health professional until the end of the intervention, which may have limited the tool's meaningfulness to participants. It may be worthwhile to develop avenues to monitor these tools in real-time or increase the number of contacts that directly assesses the individuals' current adherence, barriers to exercise and motivation levels. If required, the health professional can then use motivational interviewing or problem-solving methods to address areas of concern (24,30).

Overall, measuring what effect the intervention had on the determinants of behaviour indicated that the *ExerciseGuide* intervention positively influenced motivation levels in participants but resulted in reductions in barrier self-efficacy and intentions. Increased within-intervention monitoring and provision of additional support strategies to counter this drop are essential in future web-based interventions in this population.

7.2.5 Recruitment and retention of patients with metastatic prostate cancer in exercise research trials

Despite initial evidence indicating that exercise is a safe and efficacious therapy for metastatic prostate cancer, recruitment of this population into the current body of research was difficult. Although recruitment in chapters three and four hit saturation, recruitment periods were significantly longer than expected in each study conducted. Participants within the current research program were all older males (71.6 ± 8.0; range = 49-84). It has been well established that recruiting older males and those with advanced cancers into research trials is typically difficult (40–42). For example, Maher et al.'s systematic review found that males encompass only 20% of health behaviour change interventions that use online social networks (42). Furthermore, all 18 studies in a systematic review of recruitment and attrition rates of exercise interventions involving individuals with advanced cancer reported difficulties with patient accrual (41). As such, efficient recruitment strategies that reach older males and or those with advanced cancers are extremely critical in trials in this population.

Based on recruitment lessons from the first two studies, multiple avenues were taken to recruit participants for the pilot randomised controlled trial. However, the study only met 60% of the pre-specified criteria despite lengthening the recruitment period to 12 months. In terms of screened participants, social media created the greatest number of interested individuals (n=52), then support groups (n=28) and physician referrals (n=16). In terms of enrolled participants, recruitment from support groups (free; n=11), physicians (free; n=10) and paid social media advertisements ($81 per person recruited; n=8) were most cost-effective. In contrast, paid-registry recruitment was not as cost-effective ($800 per person recruited; n=3) in the randomised controlled trial. It appears that recruitment information from trusted sources such as health professionals or peers were the most successful methods and should be a focus for future interventions. Difficulties in the current studies could be linked with the findings from Millar et al., who has shown that individuals diagnosed at an advanced stage were less likely to respond than those with less advanced disease (43). Suggestions to improve cancer registry recruitment uptake includes having less than ten days between the initial contact and follow-up letter (the current study had a fourteen-day break) as well as unconditional pre-incentives (sent with the first letter) (43).

The pilot randomised controlled trial had a retention rate of 93%. This figure is higher than the retention rates of 83% and 74%, found in systematic reviews of physical activity-based behaviour change interventions reaching men with prostate cancer and exercise studies for individuals with bone metastases, respectively (14,38). The easy onboarding process of *ExerciseGuide* may have contributed to the retention within the study as participants could screen themselves via the website but was given access to the study coordinator (who doubled as the exercise physiologist) throughout the process. The *ExerciseGuide* coordinator provided reminders to provide documentation (consent and medical clearance forms), answered questions and ensured appropriate technical support was offered when needed throughout the trial. In contrast, Chan et al. found that at least a quarter of participants in their web-based physical activity behaviour change intervention did not complete their onboarding process (3). This was partially attributed to using an automated web-based screening, registration and allocation method. They recommended that future interventions include some form of personal contact in the initial process (3). Additionally, having one contact for the entire intervention may have reduced confusion and increased participant confidence. To support this argument, McHenry et al. found that when recruiting older adults, researchers must focus on providing a research environment of trust, comfort and security (44). Providing personal contact at the beginning of digital intervention studies may be one variable that builds trust and comfort in participants.

7.3 Future directions

7.3.1 A larger-scale ExerciseGuide intervention evaluation is warranted

The present body of work from this thesis indicates that progression to a larger-scale randomised controlled trial is warranted, considering recommended modifications. Our results have suggested that before any future *ExerciseGuide* trials, researchers will need to improve the intervention's usability (i.e., improved navigation support), enhance exercise prescription individualisation via increased computer-tailoring algorithms and enhance sources of recruitment.

The *ExerciseGuide* study evaluated the initiation of a multi-modal exercise program (8 weeks). However, additional research is needed to determine if an 8-week program provides adequate time to improve key outcome measures and modify long-term behavioural change drivers such as habit and intrinsic motivation. Furthermore, no follow-up measures were undertaken. Completing further post-intervention follow-up assessments between six and twelve months like Cormie et al. or Gaskin et al. may offer insight into the maintenance of exercise behaviours, changes in the determinants of behaviour, and long-term patient-reported outcomes (i.e., fatigue and quality of life) (45–47). However, given the age and disease burden of the population, it should be recognised that recruitment into longer studies would require multiple methods and a long recruitment period (41). Given the beneficial findings of exercise studies in this population, future trials could use a non-inferiority design to compare the distance-based intervention to face-to-face exercise. Such trial design would provide exercise prescriptions to all recruited participants, which is currently recommended in the Australian guidelines (22).

The findings of a larger-scale randomised controlled trial would help inform the clinical practice of exercise professionals when providing remotely supervised exercise prescriptions for individuals with metastatic prostate cancer. Furthermore, if the trial provides positive outcomes, it would also increase oncological health professionals' confidence to refer individuals with metastatic prostate cancer to web-based exercise interventions in the future.

7.3.2 Introducing multidisciplinary support into distance-based behavioural change interventions for individuals with metastatic prostate cancer.

There is consensus that individuals with metastatic prostate cancer deal with significant physical and psychological burden (48,49). Whilst exercise has some of the strongest evidence to date to improve aspects of symptom management; a multidisciplinary approach would likely be beneficial to help address other aspects of supportive care, including maintaining a healthy weight, psychosocial management, and assessing and managing long term side effects such as sexual dysfunction (50,51). Given the acceptability of a distance-based health intervention in this population, it may be worth investigating the expansion of the other supportive care education modules in *ExerciseGuide* with the addition of remote-supportive care from other oncology trained health professionals such as dieticians or psychologists (50). Moreover, presenting a single web-based intervention targeting multiple supportive care services may reduce the number of individual interventions required. It will also allow individuals to investigate more sensitive cancer-based concerns such as distress, fear of mortality and sexual dysfunction in a private setting. Chan et al. used a four-arm (ranging from automated website support to telehealth practitioner support) study to demonstrate the feasibility of delivering a web-based physical activity and diet behavioural intervention among men with all stages of prostate cancer (n=202; including six individuals with metastatic prostate cancer) (3). However, while the study was feasible, it only reported small effect sizes in both physical activity [0.22; 95% CI, -0.03–0.46] and diet [0.33; 95% CI, 0.18–0.49] (3). Overall, given the low number of individuals with metastatic disease recruited (only 3% of the study population), the feasibility and efficacy of a multidisciplinary approach in this population still remains to be determined (3). It does, however, appear to have potential and future research is necessary.

7.3.3 Cost-effective distance-based behavioural change interventions for individuals with metastatic prostate cancer.

Another potential avenue of research would be to investigate the cost-effectiveness of distance-based behaviour change interventions. Evaluating the economic value of a health-focused program is vital because it helps ensure the limited health resources can be directed to where they can be most effective (52). To date, there are no economic evaluations of distance-based exercise interventions in metastatic prostate cancer, but Edmunds et al. has evaluated the cost-effectiveness of the face-to-face exercise intervention (Cormie et al.) in this population (45,52). Based on the small sample size and limited follow-up measures, the intervention was found not to be cost-effective (willingness to pay threshold of AU$50,000). Still, Edmunds et al. suggested a similar study undertaken with reduced costings would be worthwhile economically. There was not enough data collected in the pilot RCT to ensure an adequate cost-effectiveness assessment. However, if a larger-scale *ExerciseGuide* randomised controlled trial (with sufficient sample size and follow-up) were to be completed, it would be valuable to conduct a cost-effectiveness evaluation in conjunction with the trial. Furthermore, it would be useful for funding purposes to determine if a distance-based exercise intervention with additional health professional support in this population is more or less cost-effective than face-to-face interventions.

It is also imperative to consider what is the base level of support necessary in distance-based exercise intervention to create meaningful change in this population. Chan et al. demonstrated that physical activity levels (to a small degree) and satisfaction in a remotely delivered behavioural change intervention for individuals with prostate cancer was enhanced when health professional contact and supportive measures increased (3). Written feedback from the pilot RCT indicated that some participants felt additional support from the health professional would have been worthwhile to improve compliance to the exercise prescription. Whereas other participants were happy with the amount provided. This indicates that it is unlikely that there is a one size fits all approach to supportive care in web-based behaviour change programs. The findings from this thesis suggest that the *ExerciseGuide* model of delivery might serve as a good base model. Future studies might consider a stepped-care approach using experimental designs, like SMART trials, where those with lower adherence are offered additional support may be useful to explore in this context (53–55). For example, additional support such as additional telehealth consults, activity trackers or even gym memberships could be incrementally added to individuals unable to adhere to the basic distance-based intervention. This strategy facilitates improved individualisation of the treatment, which mimics real-world situations, whilst also evaluating multiple interventions and responses in one study (53,54). In conclusion, providing further information on cost-effectiveness and optimum level of support in distance-based behavioural change interventions would not just be useful in individuals with metastatic prostate cancer, but would also accelerate the development of effective health promotion interventions in many other populations.

7.4 Thesis strength and limitations

7.4.1 Strengths

This dissertation contributed to a significant and growing field of research and was strengthened by taking a user-centred and systematic mixed-methods approach to web-based intervention development and evaluation (56). Additionally, in line with the gold standard, the intervention was theory-informed, and consultation with consumer representatives and guidance from a multidisciplinary project team occurred (57). The development process ensured targeted materials would be specific, meaningful and safe to individuals with metastatic prostate cancer, including the novel approach to appraise exercise prescription safety within a lab-based setting. Moreover, the *ExerciseGuide* intervention benefitted from iterative usability testing as it caught many content, usability and design concerns earlier in the development process.

The evaluation study involved a well-constructed 2-arm pilot randomised research design, and a pilot protocol manuscript was published to encourage transparent evaluation and aid replication of methodology (58). Participants recruited over the three studies had a wide-ranging geographical representation across Australia. They were also generally representative of the target population in terms of age (mean 71.3 years), time from metastatic disease diagnosis (mean 3.2 years) (59), and all participants from the usability study and the randomised controlled trial were undergoing some form of treatments (including hormone therapy, chemotherapy or radiotherapy). A strength of the evaluation was the measurement of changes in targeted theoretical constructs to improve understanding of why the ExericiseGuide intervention changed moderate-to-vigorous physical activity behaviours, as well as the use of objective measures of behaviour and physical functioning.

7.4.2 Limitations

As with many web-based physical activity interventions, there is an inherent self-selection bias of those with relatively high levels of interest activity at baseline, which may not reflect the full range of user experiences. Overall, the sample population in each study consisted of Caucasian, English-speaking men. It is unknown if including the perspectives of more culturally and linguistically diverse (CALD) samples might have produced different results. Efforts to establish acceptability, usability, safety and efficacy in CALD populations should be a priority in future work to ensure the *ExerciseGuide* tool is suitable to a majority of individuals with metastatic prostate cancer and improve overall health equality in the Australian population. In future, strategies to enhance the recruitment of CALD individuals could include removing the English-speaking inclusion criteria, making study materials available in the target group's language(s) and providing health education in the CALD communities prior to study recruitment.

As previously mentioned, a limitation of the pilot evaluation study was the recruitment of only 41 participants as opposed to 66, which was set as one of the pre-established criteria for the trial's success. The concern is that researchers may not have had enough participants in each study arm to detect potential problems regarding acceptability, usability and safety. However, given the very small participant dropout rate (7%), this pilot study provides evidence that a larger study is worthwhile as long as suitable referral pathways are established.

Lastly, due to the short randomised controlled intervention duration and lack of follow-up, the long-term outcomes of the *ExerciseGuide* intervention remains to be tested. It could be suggested that providing longer-term support may result in additional improvements in functional outcomes and quality of life. However, it is unknown whether participants, especially those with a higher disease burden, are able to adhere to the exercise intervention over a longer period and whether participants can self-manage or require the long-term support of an exercise professional. Despite the limitations, it is important to recognise that the pilot randomised controlled trial has provided high-quality initial data that supports further investigation.

7.5 Thesis conclusions

The findings of this dissertation add to the preliminary body of knowledge on exercise for individuals with metastatic prostate cancer and web-based exercise and behavioural change interventions in high-risk populations. Prior to this work, little was known about the acceptability and safety of computer-tailored distance-based exercise prescription in this population and how best to engage this group of patients using web-based delivery of supportive care interventions. Encouragingly, pilot data from this research program has demonstrated that web-based computer-tailor exercise methods, in conjunction with suitable remote support may assist individuals with metastatic disease to become or stay engaged with moderate-to-vigorous exercise.

Numerous recommendations for future trials were presented to build upon the outcomes described in this dissertation. These include improving usability based on user feedback, increasing remote supervision, manipulating trial design to increase support for non-adherers, adding multi-disciplinary support, manipulating intervention design to better influence behaviour change, and finally improving recruitment methodology to target a greater proportion of individuals with metastatic prostate cancer.

In conclusion, a computer-tailored web-based model could contribute as a scalable and potentially cost-effective approach to providing supportive care to individuals with prostate cancer who cannot access supervised interventions. Importantly, this work paves the way for future definitive clinical trials in this field.

7.6 References:

1. Byaruhanga J, Atorkey P, McLaughlin M, Brown A, Byrnes E, Paul C, et al. Effectiveness of individual real-time video counseling on smoking, nutrition, alcohol, physical activity, and obesity health risks: Systematic review. Journal of Medical Internet Research. 2020; 22(9): e18621. DOI: 10.2196/18621
2. Marthick M, Dhillon HM, Alison JA, Cheema BS, Shaw T. An interactive web portal for tracking oncology patient physical activity and symptoms: prospective cohort study. JMIR Cancer. 2018;4(2):e11978. DOI: 10.2196/11978.
3. Chan JM, van Blarigan EL, Langlais CS, Zhao S, Ramsdill JW, Daniel K, et al. Feasibility and acceptability of a remotely delivered, web-based behavioral intervention for men with prostate cancer: four-arm randomized controlled pilot trial. J Med Internet Res. 2020;22(12):e19238. DOI: 10.2196/19238.
4. Trinh L, Arbour-Nicitopoulos KP, Sabiston CM, Berry SR, Loblaw A, Alibhai SMH, et al. RiseTx: Testing the feasibility of a web application for reducing sedentary behavior among prostate cancer survivors receiving androgen deprivation therapy. Int J Behav Nutr Phys Act. 2018;15(1):49. DOI: 10.1186/s12966-018-0686-0.
5. Golsteijn JRH, Bolman C, Peels AD, Volders E, de Vries H, Lechner L. A web-based and print-based computer-tailored physical activity intervention for prostate and colorectal cancer survivors: a comparison of user characteristics and intervention use. J Med Internet Res. 2017;19:e298. DOI: 10.2196/jmir.7838.
6. Kenfield SA, Van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorek AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (Prostate 8): a pilot randomized controlled trial in men with prostate cancer. Eur Urol. 2019;75(6):950–8. DOI: 10.1016/j.eururo.2018.12.040.
7. Bonn SE, Sj A, Trolle Lagerros Y, Wiklund F, Stattin AR, Holmberg E, et al. Physical activity and survival among men diagnosed with prostate cancer. Cancer Epidemiol Biomarkers Prev. 2015 24(1):57-64. DOI: 10.1158/1055-9965
8. Gaskin CJ, Craike M, Mohebbi M, Salmon J, Courneya KS, Broadbent S, et al. Associations of objectively measured moderate-to-vigorous physical activity and sedentary behavior with quality of life and psychological well-being in prostate

cancer survivors. Cancer Causes Control. 2016;27(9):1093. DOI: 10.1007/s10552-016-0787-5.

9. Galvão DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393–399. DOI: 10.1249/MSS.0000000000001454.
10. Rhodes RE, McEwan D, Rebar AL. Theories of physical activity behaviour change: A history and synthesis of approaches. Psychology of Sport and Exercise. 2019;42:100–9. DOI: 10.1016/j.psychsport.2018.11.010.
11. Sullivan PW, Mulani PM, Fishman M, Sleep D. Quality of life findings from a multicenter, multinational, observational study of patients with metastatic hormone-refractory prostate cancer. Qual Life Res. 2007;16(4):571–5. DOI: 10.1007/s11136-006-9156-2.
12. Drudge-Coates L, Oh WK, Tombal B, Delacruz A, Tomlinson B, Ripley AV, et al. Recognizing symptom burden in advanced prostate cancer: a global patient and caregiver survey. Clin Genitourin Cancer. 2018;16:e411–9. DOI: 10.1016/j.clgc.2017.09.015.
13. Stathokostas L., Jones G. Risks of exercise for older adults. In: Sullivan G., Pomidor A, editor. Exercise for aging adults. Springer, Cham; 2015. p. 29-39. DOI: 10.1007/978-3-319-16095-5_3
14. Weller S, Hart NH, Bolam KA, Mansfield S, Mina DS, Winters-Stone KM, et al. Exercise for individuals with bone metastases: a systematic review. Res Online Crit Rev Oncol Hematol. 2021;166:1040–8428. DOI: 10.1016/j.critrevonc.2021.103433.
15. Hart NH, Galvão DA, Newton RU. Exercise medicine for advanced prostate cancer. Curr Opin Support Palliat Care. 2017;11(3):247–57. DOI: 10.1097/SPC.0000000000000276.
16. Hawley CE, Genovese N, Owsiany MT, Triantafylidis LK, Moo LR, Linsky AM, et al. Rapid integration of home telehealth visits amidst covid-19: what do older adults need to succeed? J Am Geriatr Soc. 2020;68(11):2431–9. DOI: 10.1111/jgs.16845
17. Zopf EM, Newton RU, Taaffe DR, Spry N, Cormie P, Joseph D, et al. Associations between aerobic exercise levels and physical and mental health outcomes in men with bone metastatic prostate cancer: a cross-sectional investigation. Eur J Cancer Care (Engl). 2017;26(6). DOI: 10.1111/ecc.12575.
18. van de Wiel HJ, Stuiver MM, May AM, van Grinsven S, Aaronson NK, Oldenburg HSA, et al. Effects of and lessons learned from an internet-based physical activity

support program (with and without physiotherapist telephone counselling) on physical activity levels of breast and prostate cancer survivors: the pablo randomized controlled trial. Cancers. 2021;13(15):3665. DOI: 10.3390/cancers13153665

19. Schmitz KH, Campbell AM, Stuiver MM, Pinto BM, Schwartz AL, Morris GS, et al. Exercise is medicine in oncology: engaging clinicians to help patients move through cancer. CA Cancer J Clin. 2019;69(6):468-484. DOI: 10.3322/caac.21579
20. Blanchard CM, Courneya KS, Stein K. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: Results from the American Cancer Society's SCS-II. J Clin Oncol. 2008;26(13):2198–204.
21. Elbourne H, Soo WK, O'Reilly V, Moran A, Steer CB. Exercise as a supportive care strategy in men with prostate cancer receiving androgen deprivation therapy at a regional cancer centre: a survey of patients and clinicians. Support Care Cancer. 2022;30(2):1379-1389. DOI: 10.1007/s00520-021-06512-2.
22. Hayes SC, Newton RU, Spence RR, Galvão DA. The Exercise and Sports Science Australia position statement: Exercise medicine in cancer management. J Sci Med Sport. 2019; 22(11):1175-1199. DOI: 10.1016/j.jsams.2019.05.003.
23. Turner G, Quigg S, Davoren P, Basile R, Mcauley SA, Coombes JS. Resources to guide exercise specialists managing adults with diabetes. 2019;5(1):20 DOI: 10.1186/s40798-019-0192-1.
24. Grimmett C, Corbett T, Brunet J, Shepherd J, Pinto BM, May CR, et al. Systematic review and meta-analysis of maintenance of physical activity behaviour change in cancer survivors. International Journal of Behavioral Nutrition and Physical Activity. 2019;16(37):1–20. DOI: 10.1186/s12966-019-0787-4
25. Buffart LM, Kalter J, Sweegers MG, Courneya KS, Newton RU, Aaronson NK, et al. Effects and moderators of exercise on quality of life and physical function in patients with cancer: an individual patient data meta-analysis of 34 RCTs. Cancer Treat Rev. 2017;52:91–104. DOI: 10.1016/j.ctrv.2016.11.010.
26. Lopez P, Taaffe DR, Newton RU, Buffart LM, Galvão DA. What is the minimal dose for resistance exercise effectiveness in prostate cancer patients? Systematic review and meta-analysis on patient-reported outcomes. Prostate Cancer Prostatic Dis. 2020;24(2):465–81. DOI: 10.1038/s41391-020-00301-4.
27. Groen WG, van Harten WH, Vallance JK. Systematic review and meta-analysis of distance-based physical activity interventions for cancer survivors (2013–2018): we

still haven’t found what we’re looking for. Cancer Treat Rev. 2018;69:188–203. DOI: 10.1016/j.ctrv.2018.07.012

28. Teixeira PJ, Carraça E V., Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. Int J Behav Nutr Phy. 2012;9:78. DOI: 10.1186/1479-5868-9-78
29. Galvão DA, Chambers SK. Exercise medicine in men with prostate cancer: breaking barriers to increase participation. Prostate Cancer Prostatic Dis. 2021 244. 2021;24(4):942–3. DOI: 10.1038/s41391-021-00406-4
30. Hallward L, Patel N, Duncan LR. Behaviour change techniques in physical activity interventions for men with prostate cancer: A systematic review. Journal of Health Psychology. 2020;25(1):105-122. DOI: 10.1177/1359105318756501
31. Gardner B, Rebar AL. Habit formation and behavior change. Oxford Res Encycl Psychol. 2019. 10.1093/acrefore/9780190236557.013.129.
32. Bandura A. Health Promotion by Social Cognitive Means. Heal Educ Behav. 2004;31(2):143–64. DOI: 10.1177/1090198104263660
33. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018;52(9):798–808. DOI: 10.1093/abm/kax055.
34. Forbes CC, Blanchard CM, Mummery WK, Courneya KS. Feasibility and preliminary efficacy of an online intervention to increase physical activity in Nova Scotian cancer survivors: a randomized controlled trial. JMIR cancer. 2015;1(2):e12. DOI: 10.2196/cancer.4586.
35. Fox L, Wiseman T, Cahill D, Beyer K, Peat N, Rammant E, et al. Barriers and facilitators to physical activity in men with prostate cancer: A qualitative and quantitative systematic review. Psycho-Oncology. 2019;28(12):2270-2285. DOI: 10.1002/pon.5240.
36. Sattar S, Haase KR, Bradley C, Papadopoulos E, Kuster S, Santa Mina D, et al. Barriers and facilitators related to undertaking physical activities among men with prostate cancer: a scoping review. Prostate Cancer Prostatic Dis. 2021;24(4):1007-1027. DOI: 10.1038/s41391-021-00399-0.
37. Sheill G, Guinan E, Neill LO, Hevey D, Hussey J. The views of patients with metastatic prostate cancer towards physical activity: a qualitative exploration. Support Care Cancer. 2018; 26(6):1747-1754. DOI: 10.1007/s00520-017-4008-x.

38. Finlay A, Wittert G, Short CE. A systematic review of physical activity-based behaviour change interventions reaching men with prostate cancer. Journal of Cancer Survivorship. 2018;12(4):571-591. DOI: 10.1007/s11764-018-0694-8.
39. Seiler A, Klaas V, Tröster G, Fagundes CP. eHealth and mHealth interventions in the treatment of fatigued cancer survivors: a systematic review and meta-analysis. Psycho-oncology. 2017; 26(9):1239-1253. DOI: 10.1002/pon.4489.
40. Bracken K, Askie L, Keech AC, Hague W, Wittert G. Recruitment strategies in randomised controlled trials of men aged 50 years and older: a systematic review. BMJ Open. 2019;9(4):e025580. DOI: 10.1136/bmjopen-2018-025580.
41. Sheill G, Guinan E, Brady L, Hevey D, Hussey J. Exercise interventions for patients with advanced cancer: A systematic review of recruitment, attrition, and exercise adherence rates. Palliat Support Care. 2019;17(6):686–96. DOI: 10.1017/S1478951519000312.
42. Maher CA, Lewis LK, Ferrar K, Marshall S, De Bourdeaudhuij I, Vandelanotte C. Are health behavior change interventions that use online social networks effective? A systematic review. J Med Internet Res 2014;16(2)e40. DOI: 10.2196/jmir.2952.
43. Millar MM, Kinney AY, Camp NJ, Cannon-Albright LA, Hashibe M, Penson DF, et al. Predictors of response outcomes for research recruitment through a central cancer registry: evidence from 17 recruitment efforts for population-based studies. Am J Epidemiol. 2019;188(5):928. DOI: 10.1093/aje/kwz011.
44. McHenry JC, Insel KC, Einstein GO, Vidrine AN, Koerner KM, Morrow DG. Recruitment of older adults: success may be in the details. Gerontologist. 2015;55(5):845–53. DOI: 10.1093/geront/gns079.
45. Cormie P, Newton RU, Spry N, Joseph D, Taaffe DR, Galvão DA. Safety and efficacy of resistance exercise in prostate cancer patients with bone metastases. Prostate Cancer Prostatic Dis. 2013;16(4):328–35. DOI: 10.1038/pcan.2013.22.
46. Cormie P, Galvão DA, Spry N, Joseph D, Taaffe TR, Newton RU. Functional benefits are sustained after a program of supervised resistance exercise in cancer patients with bone metastases: longitudinal results of a pilot study. Support Care Cancer. 2014;22:1537–1548. DOI: 10.1007/s00520-013-2103-1.
47. Gaskin CJ, Craike M, Mohebbi M, Courneya KS, Livingston PM. A clinician referral and 12-week exercise training program for men with prostate cancer: outcomes to 12 months of the ENGAGE cluster randomized controlled trial. J Phys Act Heal. 2017;14(5):353–9. DOI: 10.1123/jpah.2016-0431.

48. Chambers SK, Hyde MK, Laurie K, Legg M, Frydenberg M, Davis ID, et al. Experiences of Australian men diagnosed with advanced prostate cancer: a qualitative study. BMJ Open. 2018;8:e019917. DOI: 10.1136/bmjopen-2017-019917.
49. Collins A, Sundararajan V, Millar J, Burchell J, Le B, Krishnasamy M, et al. The trajectory of patients who die from metastatic prostate cancer: a population-based study. BJU Int. 2019;123:19–26. DOI: 10.1111/bju.14593
50. Crawford-Williams F, March S, Goodwin BC, Ralph N, Galvão DA, Newton RU, et al. Interventions for prostate cancer survivorship: A systematic review of reviews. Psychooncology. 2018;27(10):2339–48. DOI: 10.1002/pon.4888
51. Schulz DN, Smit ES, Stanczyk NE, Kremers SP, De Vries H, Evers SM. Economic evaluation of a web-based tailored lifestyle intervention for adults: findings regarding cost-effectiveness and cost-utility from a randomized controlled trial. J Med Internet Res. 2014;16(3):e3159. DOI: 10.2196/jmir.3159.
52. Edmunds K, Scuffham P, Reeves P, Galvão DA, Taaffe DR, Newton RU, et al. Demonstrating the value of early economic evaluation alongside clinical trials: Exercise medicine for men with metastatic prostate cancer. Eur J Cancer Care. 2021;30(5):e13479. DOI: 10.1111/ecc.13479
53. Almirall D, Nahum-Shani I, Sherwood NE, Murphy SA. Introduction to SMART designs for the development of adaptive interventions: with application to weight loss research. Transl Behav Med. 2014;4(3):260. DOI: 10.1007/s13142-014-0265-0.
54. Lambert SD, Grover S, Laizner AM, McCusker J, Belzile E, Moodie EEM, et al. Adaptive web-based stress management programs among adults with a cardiovascular disease: a pilot sequential multiple assignment randomized trial (SMART). Patient Educ Couns. 2021;in press. DOI: 10.1016/j.pec.2021.10.020.
55. Smith SK, Somers TJ, Kuhn E, Laber E, Sung AD, Syrjala KL, et al. A SMART approach to optimizing delivery of an mHealth intervention among cancer survivors with posttraumatic stress symptoms. Contemp Clin Trials. 2021;110:106569. DOI: 10.1016/j.cct.2021.106569
56. Yardley L, Morrison L, Bradbury K, Muller I. The person-based approach to intervention development: application to digital health-related behavior change interventions. J Med Internet Res. 2015;17:e30. DOI: 10.2196/jmir.4055.

57. Michie S, Yardley L, West R, Patrick K, Greaves F. Developing and evaluating digital interventions to promote behavior change in health and health care: recommendations resulting from an international workshop. J Med Internet Res. 2017;19(6):e232. DOI: 10.2196/jmir.7126.
58. Thabane L, Ma J, Chu R, Cheng J, Ismaila A, Rios LP, et al. A tutorial on pilot studies: the what, why and how. BMC Medical Research Methodology. 2010;10:1. DOI: 10.1186/1471-2288-10-1.
59. Australian Institute of Health and Welfare. Australian Cancer Incidence and Mortality. In: AIHW, editor. Canberra; 2021. Available from: https://www.aihw.gov.au/reports/cancer/cancer-data-in-australia.

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Appendix 1. Behaviour change technique taxonomy (v1)

Page	Grouping and BCTs
1	**1. Goals and planning**
	1.1. Goal setting (behavior)
	1.2. Problem solving
	1.3. Goal setting (outcome)
	1.4. Action planning
	1.5. Review behavior goal(s)
	1.6. Discrepancy between current behavior and goal
	1.7. Review outcome goal(s)
	1.8. Behavioral contract
	1.9. Commitment
3	**2. Feedback and monitoring**
	2.1. Monitoring of behavior by others without feedback
	2.2. Feedback on behaviour
	2.3. Self-monitoring of behaviour
	2.4. Self-monitoring of outcome(s) of behaviour
	2.5. Monitoring of outcome(s) of behavior without feedback
	2.6. Biofeedback
	2.7. Feedback on outcome(s) of behavior
5	**3. Social support**
	3.1. Social support (unspecified)
	3.2. Social support (practical)
	3.3. Social support (emotional)
6	**4. Shaping knowledge**
	4.1. Instruction on how to perform the behavior
	4.2. Information about Antecedents
	4.3. Re-attribution
	4.4. Behavioral experiments
7	**5. Natural consequences**
	5.1. Information about health consequences
	5.2. Salience of consequences
	5.3. Information about social and environmental consequences
	5.4. Monitoring of emotional consequences
	5.5. Anticipated regret
	5.7. Information about emotional consequences
8	**6. Comparison of behaviour**
	6.1. Demonstration of the behavior
	6.2. Social comparison
	6.3. Information about others' approval
9	**7. Associations**
	7.1. Prompts/cues
	7.2. Cue signalling reward
	7.3. Reduce prompts/cues
	7.4. Remove access to the reward
	7.5. Remove aversive stimulus
	7.6. Satiation
	7.7. Exposure
	7.8. Associative learning
10	**8. Repetition and substitution**
	8.1. Behavioral practice/rehearsal
	8.2. Behavior substitution
	8.3. Habit formation
	8.4. Habit reversal
	8.5. Overcorrection
	8.6. Generalisation of target behavior
	8.7. Graded tasks
11	**9. Comparison of outcomes**
	9.1. Credible source
	9.2. Pros and cons
	9.3. Comparative imagining of future outcomes
12	**10. Reward and threat**
	10.1. Material incentive (behavior)
	10.2. Material reward (behavior)
	10.3. Non-specific reward
	10.4. Social reward
	10.5. Social incentive
	10.6. Non-specific incentive
	10.7. Self-incentive
	10.8. Incentive (outcome)
	10.9. Self-reward
	10.10. Reward (outcome)
	10.11. Future punishment
15	**11. Regulation**
	11.1. Pharmacological support
	11.2. Reduce negative emotions
	11.3. Conserving mental resources
	11.4. Paradoxical instructions
16	**12. Antecedents**
	12.1. Restructuring the physical environment
	12.2. Restructuring the social environment
	12.3. Avoidance/reducing exposure to cues for the behavior
	12.4. Distraction
	12.5. Adding objects to the environment
	12.6. Body changes
17	**13. Identity**
	13.1. Identification of self as role model
	13.2. Framing/reframing
	13.3. Incompatible beliefs
	13.4. Valued self-identify
	13.5. Identity associated with changed behavior
18	**14. Scheduled consequences**
	14.1. Behavior cost
	14.2. Punishment
	14.3. Remove reward
	14.4. Reward approximation
	14.5. Rewarding completion
	14.6. Situation-specific reward
	14.7. Reward incompatible behavior
	14.8. Reward alternative behavior
	14.9. Reduce reward frequency
	14.10. Remove punishment
19	**15. Self-belief**
	15.1. Verbal persuasion about capability
	15.2. Mental rehearsal of successful performance
	15.3. Focus on past success
	15.4. Self-talk
19	**16. Covert learning**
	16.1. Imaginary punishment
	16.2. Imaginary reward
	16.3. Vicarious consequences

Appendix 2: Chapter three recruitment materials

PARTICIPANT INFORMATION SHEET

Designing an online exercise guidance tool for men with metastatic prostate cancer

HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2017-174

PRINCIPAL INVESTIGATOR: Dr Camille Short

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?

We are seeking input from men who have been diagnosed with metastatic prostate cancer to help us design an online exercise guidance tool that may help other men learn about exercise while undergoing treatment for or living with metastatic disease.

Who is undertaking the project?

The project is being conducted by researchers in behavioural, exercise and medical science from various institutions across Australia. This includes researchers from the University of Adelaide, The Exercise Medicine Research Institute at Edith Cowan University, CQUniversity, The Flinders Centre for Innovation in Cancer, and the NHMRC Centre for Research Excellence in Prostate Cancer Survivorship. The lead researcher, Dr Camille Short, is a behavioural scientist working within the Freemasons Foundation Centre for Men's Health, within the School of Medicine at the University of Adelaide. The research team is described in full at the end of this document.

Why am I being asked to participate?

We are seeking input from men who have direct experience of living with metastatic prostate cancer. We feel this is important for guiding the design of our online tool to so that we can make sure we take men's wants and needs into account. Resources that are developed in this way are usually better quality than those that do not consult with the target audience.

Am I eligible?

To be eligible, you must:

- Be over 18 years old
- Have been diagnosed with metastatic prostate cancer
- Be able to participate in some form of aerobic, strength or flexibility exercise for 5 minutes or more (if you wanted to).
- Be able to read and write fluently in English
- Have telephone and internet access

What will I be asked to do?

- You will be asked to confirm that you have read this information sheet and that your provide your consent to participate. This will involve completing a form that we will either post or email to you – depending on what you prefer.
- Once we have received your form we will arrange an interview time with you.
- The interview will be conducted via the phone in most cases (those living in Adelaide can opt for a face-to-face interview if preferred) and will last for 25-30 minutes. There are no right or wrong answers, we are just interested in your opinions.

How much time will the project take?

The interview will take approximately 25-30 minutes. It may be longer or shorter depending on how much you have to say.

Are there any risks associated with participating in this project?

We will be asking questions relating to your cancer diagnosis and treatment. If you have any discomfort answering such questions, you have the right to skip them or terminate the interview at any point. Please seek support by calling the free Cancer Council service on 13 11 20 if you feel any discomfort.

What are the benefits of the research project?

You may not experience a direct benefit yourself but you will be contributing to the design of services for men with metastatic prostate cancer. By talking to you, we hope to make sure that we have considered the views and experiences of Australian men when designing our exercise guidance tool. The aim of the exercise guidance tool is to provide tailored exercise advice and support to men with metastatic prostate cancer. Exercise can help to reduce symptoms from cancer and cancer treatment, but it can be difficult for men to know what exercises are safe and will be of benefit. The aim of our tool is to provide this information in a way that will be easy for men to access and understand.

Can I withdraw from the project?

Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time.

What will happen to my information?

All information will be stored on a password protected network drive at the University of Adelaide. To protect your privacy you will be given an ID number at the start of the study, and this number will be used to identify you and link your data rather than your real name. We will primarily use your information to inform the development of our tool. The data, which may include participant quotes, will also be published in scientific journals and may be presented at research or community forums. This will help other researchers to learn from our findings. Of importance, no identifying information will ever be published about you. If direct quotes are used, all identifying information (e.g., names of places or people) will be removed.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2017-174). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding a concern or complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on: P: +61 8 8313 6028; E:hrec@adelaide.edu.au

Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I am interested to participate, what do I do?

Please contact the lead investigator, Dr Camille Short, to express your interest in participating and/or ask questions about the study.

Email: Camille.short@adelaide.edu.au or call 61 8 8313 0532

The Research Team

Dr Camille Short (Behavioural Scientist)

Freemasons Foundation Centre for Men's Health, School of Medicine, University of Adelaide, South Australia; Affiliate member of the Centre for Research Excellence in Prostate Cancer Survivorship

Professor Daniel Galvão (Exercise Scientist)

Co-Director, Exercise Medicine Research Institute, Edith Cowan University, Western Australia; Theme leader, Centre for Research Excellence in Prostate Cancer Survivorship

Professor Corneel Vandelanotte (Public health scientist)

Director, Physical Activity Research Group, CQU, Queensland

Dr Cynthia Forbes (Behavioural scientist)

Dalhousie University, Halifax, Canada; Visiting research fellow, Freemasons Foundation Centre for Men's Health, School of Medicine, University of Adelaide, South Australia

Associate Professor Nicholas Brook (Urological Surgeon)

Royal Adelaide Hospital, South Australia; School of Medicine, University of Adelaide

Professor Robert Newton (Exercise Physiologist)

Co-Director, Exercise Medicine Research Institute, Edith Cowan University, Western Australia; Theme leader, Centre for Research Excellence in Prostate Cancer Survivorship

Professor Suzanne Chambers (Health Psychologist)

Director, Menzies Health Institute, Griffith University, Queensland; Director, Centre for Research Excellence in Prostate Cancer Survivorship

Professor Gary Wittert (Endocrinologist)
Director, Freemasons Foundation Centre for Men's Health, School of Medicine, University of Adelaide; Theme leader, Centre for Research Excellence in Prostate Cancer Survivorship

Dr Ganessan Kichenadasse (Medical Oncologist)
Flinders Medical Centre; Flinders University, South Australia

Dr Andrew Vincent (Statistician)
Freemasons Foundation Centre for Men's Health, School of Medicine, University of Adelaide, South Australia

Harshani Jayasinghe (Research Assistant)
School of Public Health, The University of Adelaide

Holly Evans (Exercise Physiologist)
PhD Student - School of Medicine, University of Adelaide, South Australia

Appendix 3: Chapter three and four ethics approval

THE UNIVERSITY of ADELAIDE

RESEARCH SERVICES
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND INTEGRITY
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Our reference 0000022491

14 February 2019

Dr Camille Short
Medical Specialties - RAH

Dear Dr Short

ETHICS APPROVAL No: H-2017-174
PROJECT TITLE: Development and usability testing of a web-based physical activity guidance tool for men with metastatic prostate cancer
The amendments detailed in the revised application dated 22/01/19 have been approved.

The ethics amendment for the above project has been reviewed by the Human Research Ethics Committee and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)*.

You are authorised to commence your research on: 20/09/2017
The ethics expiry date for this project is: 30/09/2020

NAMED INVESTIGATORS:

Chief Investigator:	Dr Camille Short
Associate Investigator:	Daniel A Galvão
Associate Investigator:	Dr Cindy Forbes
Associate Investigator:	Corneel Vandelanotte
Associate Investigator:	Associate Professor Nicholas Roger Brook
Associate Investigator:	Robert U Newton
Associate Investigator:	Suzanne K Chambers
Associate Investigator:	Professor Gary Wittert

Associate Investigator:	Dr Andrew Vincent
Associate Investigator:	G Kichenadasse
Associate Investigator:	Miss Harshani Pradeepa Jayasinghe Pedige
Student - Postgraduate Doctorate by Research (PhD):	Ms Holly Elizabeth Louise Evans

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability
- of the project, proposed changes to the protocol or project investigators; and the project is discontinued before the expected date of completion.

Yours sincerely,

Professor Paul Delfabbro Convenor
The University of Adelaide

Appendix 4. Usability and safety testing baseline questionnaire

Usability and Safety Testing: Pre-Appointment Survey

Thank you for agreeing to complete this survey. It will provide us with valuable information about who is participating in the study, as well as useful information for improving our website in the future. It will take approximately 20-30 minutes to complete.

We will ask you for information about:
- Demographics
- Your health, including cancer treatments
- Your internet use
- Your current levels of physical activity
- Your exercise goals and current level of knowledge and confidence about exercise.

Please answer to the best of your ability.

If you have any questions while completing this questionnaire please do not hesitate to call Holly Evans (Project Manager) by telephone on 8128 4043 or email: holly.evans@adelaide.edu.au.

Thank you for your time.

<u>SECTION A. Demographical Information</u>

This information is important to know who our participants are. All information is held confidentiality. Group based information of all participants will be presented in any reports or research findings, individual information will not be published and your information will be protected.

1. What is your first name? ___________________________________

2. What is your last name? ___________________________________

3. What is your date of birth? ___________________________________

4. What is your current marital status?
   - Married ☐
   - Single ☐
   - Long-term relationship (not living together) ☐
   - De facto or living a with partner ☐
   - Separated or divorced ☐
   - Short-term relationship (not living together) ☐

5. What is your current post code? ___________________________________

6. What is the highest level of education you completed? Primary School
   - Secondary School ☐
   - Trade or TAFE? ☐
   - University or other tertiary levels ☐
   - Post graduate study ☐
   - Other ☐

Please describe "other":
____

7. How would you describe your occupational status? Paid full time
   - Paid part-time/causal ☐
   - Self-employed ☐
   - Retired ☐
   - Volunteer ☐
   - Not employed - looking for work ☐
   - Not employed - unable to work ☐

8. How tall are you (cm)? ___________________________________

9. How much do you weigh (kg)? ___________________________________

SECTION B - HEALTH INFORMATION.

This section is going to ask questions about your health and cancer treatment.

1. What year did you first get diagnosed with prostate cancer? ______________

2. What stage of prostate cancer were you first diagnosed with?

Stage 1 ☐
Stage 2A ☐
Stage 2B ☐
Stage 3 ☐
Stage 4 ☐
I don't know ☐

Please note:
Stage I: Tumour is small has not spread outside the prostate (Gleason ≤ 6; PSA ≤10)
Stage IIA: Tumour has not spread outside the prostate (Gleason ≤ 6; PSA between 10 & 20) or (Gleason score ≤7; PSA ≤20).
Stage IIB: Tumour has not spread outside the prostate (Gleason score ≥8 or PSA level ≥ 20).
Stage III: Tumour has spread beyond outer layer of prostate and may have spread to the seminal vesicles, but not to nearby lymph nodes.
Stage IV: the cancer has spread to nearby tissues or to distant parts of the body such as the bones.

3. What year where you diagnosed with metastatic prostate cancer? _______________

4. Please indicate what treatment you have had, currently having and/or have scheduled by ticking the boxes. Please leave blank if you have not?

	I have previously had this treatment	**I am currently having this treatment**
Active Surveillance	☐ Yes; When ________________	☐ Yes
Surgery	☐ Yes; When ________________	☐ Yes
Radiotherapy	☐ Yes; When ________________	☐ Yes
Chemotherapy	☐ Yes; When ________________	☐ Yes

	I have previously had this treatment	I am currently having this treatment
Hormone therapy (ADT)	☐ Yes; When ________________	☐ Yes
Other (please specify): ______________________ ______________________	☐ Yes; What ________________ When________________	☐ Yes

5. Do you have any new treatments scheduled?

Yes ☐ Please Specify: ______________________________

No ☐

6. In addition to a history of a diagnosis of prostate cancer, are there other health conditions that affect you?

	No	Yes
Blood pressure (high or low)	☐	☐
Arthritis (osteo or rheumatoid)	☐	☐
Chronic Back Pain	☐	☐
Osteoporosis	☐	☐
Diabetes (type 1 and 2)	☐	☐
Cardiovascular Disease (heart disease, stroke etc.)	☐	☐
Kidney Disease	☐	☐
Lung Conditions (asthma, emphysema etc.)	☐	☐
Mental Health Conditions (depression, anxiety etc.)	☐	☐
Dementia	☐	☐
Visual Impairment (cataract disease, blindness etc.)	☐	☐
Hearing impairment (hard of hearing, hearing aids etc.)	☐	☐
Parkinson's or other neurological conditions (such as multiple sclerosis)	☐	☐

7. Do you have any other health conditions that affect your ability to exercise besides those listed above?

Yes	☐	Please Specify:
No	☐	______________________________

<u>SECTION C - VIEWS ABOUT YOUR HEALTH.</u>

This set of questions asks for your views about your health. Answer every question by marking a single answer. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is:

Excellent	☐
Very Good	☐
Good	☐
Fair	☐
Poor	☐

The following questions are about activities you might do during a typical day.

2. Does your health now limit you in undertaking the following?

	Yes. I am limited a lot	**Yes. I am limited a little**	**No, not at all**
a) Moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐	☐	☐
b) Climbing several flights of stairs	☐	☐	☐

3. During the past 4 weeks:

	Yes.	**No**
a) Have you accomplished less than you would like with your work or other regular daily activities as a result of your PHYSICAL health?	☐	☐

	Yes.	No
b) Were you limited in the kind of work or other activities as a result of your PHYSICAL health?	☐	☐
c) Have you accomplished less than you would like with your work or other regular daily activities as a result of any EMOTIONAL problems, such as feeling depressed or anxious?	☐	☐
d) Did you not do work or other activities as carefully as usual as a result of any EMOTIONAL problems, such as feeling depressed or anxious?	☐	☐

4. During the past 4 weeks how much did PAIN interfere with your normal work, including both work outside the home and housework?

Not at all	☐
A little bit	☐
Moderately	☐
Quite a bit	☐
Extremely	☐

The next few questions are about how you feel and how things have been with you during the past 4 weeks.

5. Please give the one answer that comes closest to the way you have been feeling. How much of the time during the past four weeks:

	All of the time	**Most of the time**	**A good bit of the time**	**Some of the time**	**A little of the time**	**None of the time**
Have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
Did you have a lot of energy?	☐	☐	☐	☐	☐	☐
Have you felt downhearted and blue (or down)?	☐	☐	☐	☐	☐	☐
Has your physical health or emotional problems interfered with your social activities like visiting friends or relatives?	☐	☐	☐	☐	☐	☐

<u>SECTION D - PHYSICAL ACTIVITY DETERMINANTS</u>

The following section will ask questions about what you know and how you feel towards physical activity.

1. We would like to know about your current knowledge about exercise in prostate cancer:

	Not at all	Not really	Moderately	Fairly	Extremely
How would you rate your knowledge about the role of exercise for managing cancer symptoms?	☐	☐	☐	☐	☐

	Not at all	**Not really**	**Moderately**	**Fairly**	**Extremely**
How would you rate your knowledge about what types of exercises are safe for you to do?	☐	☐	☐	☐	☐
How would you rate your knowledge about how much exercise is safe for you to do?	☐	☐	☐	☐	☐

2a. Have you heard of the exercise guidelines for cancer patients?

Yes ☐ *Complete question 2b.*

No ☐ *Move to question 3.*

2b. If you answered yes, have you read any of those exercise guidelines for cancer patients?

Yes ☐

No ☐

3. To the best of your knowledge, describe the amount and type of exercise (if any) you think would currently benefit your health. Please be as specific as possible in terms of the frequency, type, intensity and volume of exercise.

____

____

____

____

4. How CONFIDENT are you that you could participate in regular physical activity over the next 8 weeks when....

(Note: Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure ie: shopping, walking the dog etc)

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed	☐	☐	☐	☐	☐
Doing it by yourself	☐	☐	☐	☐	☐
It becomes boring	☐	☐	☐	☐	☐
No noticeable differences or improvements in health	☐	☐	☐	☐	☐
You have other demands	☐	☐	☐	☐	☐
You feel stiff or sore	☐	☐	☐	☐	☐
There is bad weather	☐	☐	☐	☐	☐
You have to get up early	☐	☐	☐	☐	☐
You feel unwell	☐	☐	☐	☐	☐

Tell us if you agree or disagree regarding these statements:

5. Participating in regular physical activity over the next 8 weeks will...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Reduce tension or manage stress	☐	☐	☐	☐	☐
Help me to feel more confident about my health	☐	☐	☐	☐	☐
Help me to sleep better	☐	☐	☐	☐	☐
Give me a more positive outlook	☐	☐	☐	☐	☐
Help me to control my weight	☐	☐	☐	☐	☐
Improve my quality of life	☐	☐	☐	☐	☐
Be a waste of time	☐	☐	☐	☐	☐
Distract me from other things I'd rather be doing	☐	☐	☐	☐	☐
Be unnecessary risk to my health	☐	☐	☐	☐	☐
Cause me harm or injury	☐	☐	☐	☐	☐
Cost too much money	☐	☐	☐	☐	☐

6. Please rate how CONFIDENT you are that you could perform the following activities over the next 8 weeks:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
I can do one small session of resistance training (at least 6 exercises working different muscle groups)	☐	☐	☐	☐	☐
I can walk or ride a stationary bike for at least 15 minutes at a level hard enough to cause an increase in your heart rate and breathing rate	☐	☐	☐	☐	☐
I can climb 3 flights of stairs without stopping	☐	☐	☐	☐	☐
I can sit down and stand up out of a kitchen chair without the use of my arms	☐	☐	☐	☐	☐

7. Please rate how likely it is that you will do the following exercise:

	Not at all likely	**Not really likely**	**A bit likely**	**Moderately**	**Likely**	**Very likely**
How likely is it that you will do regular aerobic activity within the next 2 weeks?	☐	☐	☐	☐	☐	☐
How likely is it that you will do regular resistance training within the next 8 weeks?	☐	☐	☐	☐	☐	☐

Note: Regular aerobic activity equates to approximately 150 minutes spread out over the week

Regular resistance training equates to approximately 2-3 resistance training sessions spread out over the week

This question is about your perception of social support for physical activity.

Over the next 8 weeks...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
People in your social network are likely to help you participate in regular physical activity (go for a walk together)	☐	☐	☐	☐	☐
Someone in your social network will provide the support you need in order to be regularly physically active (be encouraging)	☐	☐	☐	☐	☐

SECTION E - PHYSICAL ACTIVITY BEHAVIOUR

These next questions are going to ask you about your level of physical activity at the moment.

On average over the past month, how many times per week did you do the following kinds of physical activity?

1. Aerobic/Cardiovascular Activity

	Times per week	Estimate Minutes Per Session
a. Strenuous activity (heart beats rapidly, huffing and puffing) Examples: running, jogging, football, soccer, fast cycling, vigorous swimming, climbing a long steep hill, vigorous gym classes		
Example only: I swam fast pool laps	*1*	*15*
b. Moderate activity (could talk to someone, but couldn't sing) Examples: brisk walking, gentle hill climb, dancing, easy cycling, swimming,		
Example only: In this past month I did brisk walking	*3*	*10mins per walk*
c. Mild physical activity (not a lot of effort needed, no sweat) Examples: gentle walking, bowling, fishing, lawn bowls		
Example only: In this past month I played bowls	*1*	*(1.5 hours) = 90 min*

2. Strength/Resistance Activity

	Times per week	Number exercise and repetitions
a. How many times (on average) <u>per week</u> do you do the following types of activities in the <u>last month?</u> *Strength or resistance training is a method of exercise used to improve your muscular strength. It is done by gradually increasing your ability to resist a force through your own body weight (push ups, dips, calve raises), free weights (medicine balls, dumb bells) or a weighted machine.* For example: leg lifts, push-ups, pulling, controlled lowering, sit to stand exercises, free weight lifting, machine, arm lifts etc.		
Example only: I did leg lifts and arm lifts	1	10 of each type. 2 times over.

SECTION F - INTERNET USAGE AND BEHAVIOURS

These next questions are going to ask you about your use of the internet and how confident

you feel using different aspects of it

1. On average, how many hours per week do you spend using the Internet?

None	☐
Less than 30 minutes	☐
Up to an hour	☐
Up to 2 hours	☐
Up to 3 hours	☐
Up to 4 hours	☐
Up to 5 hours	☐
Up to 6 hours	☐
Over 6 hours	☐

2. Rate how CONFIDENT you are at doing each of the activities listed below on a scale of 0 to 100

(0 being not at all certain and 100 being highly certain.)

a. Finding information on the internet *(Place a mark on the scale below)*

Not certain at all (0)	(50)	Highly Certain (100)

b. Using the internet to interact with others (e.g., social media sites) *(Place a mark on the scale below)*

Not certain at all (0)	(50)	Highly Certain (100)

c. Using an interactive website to help you increase your physical activity? (e.g., a website that helps to set goals, log activity, track progress and provide advice). *(Place a mark on the scale above)*

Not certain at all (0) — (50) — Highly Certain (100)

c. Using an interactive website to help you increase your physical activity? (e.g., a website that helps to set goals, log activity, track progress and provide advice). *(Place a mark on the scale above)*

Not certain at all (0) — (50) — Highly Certain (100)

c. Using an application on your mobile phone to help you increase your physical activity? (e.g., an app that helps you set goals, log activity, track progress and provide advice). *(Place a mark on the scale above)*

Not certain at all (0) — (50) — Highly Certain (100)

d. Using a fitness tracker? (e.g: a wearable device or a computer application like a pedometer that records a person's daily physical activity, together with other data relating to their fitness or health like a Fitbit) *(Place a mark on the scale above)*

Not certain at all (0) — (50) — Highly Certain (100)

There are lots of different ways to design an online exercise program for men with metastatic prostate cancer.

3. If you had a choice, what type of web-based program would you prefer?

One that guides you through topics step-by-step and provides feedback as you go	☐
One that allows you to control what topics you access and when to receive feedback	☐

Thank you for filling in this questionnaire. We know it is long, but the information you give is valuable. If there are any questions you were uncertain about, we can discuss it during your appointment.

We look forward to seeing you soon

Appendix 5: Think aloud test instructions

Researcher:

During this part, I will be working from a script to ensure my instructions are the same for all participants. We will ask you to use the website to complete a set of tasks. As you do these tasks, I'm going to ask you as much as possible to try to think out loud: to say what you're looking at, what you're trying to do, and what you're thinking.

It's really important to know that we are only testing the site, not you. You can't do or say anything wrong here. Let us know at any time if there's something you like, dislike, is confusing etc. I promise you won't hurt our feelings. We're doing this to improve the site, so we need to hear your honest reactions. If you have any questions as we go along, just ask them. We may not be able to answer them right away, since we're interested in how people do when they don't have someone sitting next to them to help. But if you still have any questions when we're done, I'll try to answer them then.

We are going to start with a quick practice on an already available website: www.cricketaustralia.com.au

Practice run task list:

1. Take some time telling us what your general impressions are?
2. What do you want to do first?
3. Please find the contact us button, click on it and read out the phone number if you wanted to call Cricket Australia?
4. Can you go back to the home page?

Researcher:

Okay, it is time to do the test with our website now. Do you have any questions before we start?

ExerciseGuide task list:

1. Please log into the website (hand them an email with login details)
2. Considering this is the first time you logged in, we will give you a minute to take the website in.

1. [Pause 10 seconds]
2. 'Can you think aloud?'
3. …prompt What are your general impressions?; What caught your eye first?
4. Can you show us what the first thing you might do is?
5. Just from looking at the titles, what modules (topics) seem most interesting to you?
6. Please click into the "getting started" module (if they haven't already) and watch the "getting started" video
7. Please click on the "Drive Safely" module and complete the questions.
8. From there we would like you to click through until you get to the topic of "Exercise with Metastases." Can you read this page and the next two at your own pace and in as much detail as you typically would if you were in your own home.
9. Please find the "library," click on it and find article called "Cancer-related fatigue: Does exercise help or hinder?"
10. Can you please head to the "My Exercise Plan Weeks 1-3" and complete the questions. Please read through the tailored information at your own pace and in as much detail as you typically would if you were in your own home.
11. Please click on the "Tracking module"
12. Do you have any questions about the website?
13. FREE TIME: We have finished completing the set tasks. Are there any other areas of the website that you may want to visit. Please feel free to take time to look at them.

Appendix 6. Post think aloud usability questionnaire

SECTION A. Website usability

1. Please tell us your thoughts on your ability to use the website.

	Strongly Disagree 1		3		Strongly Agree 5
I think that I would like to use this website frequently.	☐	☐	☐	☐	☐
I found the website unnecessarily complex.	☐	☐	☐	☐	☐
I think that I would need the support of a technical person to be able to use this website.	☐	☐	☐	☐	☐
I found the various functions in the website were well integrated.	☐	☐	☐	☐	☐
I thought the website was easy to use	☐	☐	☐	☐	☐
I thought there was too much inconsistency in the website.	☐	☐	☐	☐	☐
I would imagine that most people would learn to use this system very quickly.	☐	☐	☐	☐	☐
I found the system very cumbersome to use.	☐	☐	☐	☐	☐
I felt very confident using the website.	☐	☐	☐	☐	☐
I needed to learn a lot of things before I could get going with the website.	☐	☐	☐	☐	☐

	Strongly Disagree 1		3		Strongly Agree 5
I liked the presentation and layout of the website, colours, content and images	☐	☐	☐	☐	☐
I experienced negative emotions when using the website	☐	☐	☐	☐	☐

SECTION B. Website usability

2. Please tell us how acceptable you found the website.

	Strongly Disagree 1		3		Strongly Agree 5
The information provided to me on the website was interesting.	☐	☐	☐	☐	☐
The information provided to me on the website was credible	☐	☐	☐	☐	☐
The information provided to me on the website was easy to understand	☐	☐	☐	☐	☐
The information provided to the website was relevant to me personally.	☐	☐	☐	☐	☐
I would recommend the website to a friend with the same diagnosis as me.	☐	☐	☐	☐	☐
The website seems like it was written for someone like me in mind.	☐	☐	☐	☐	☒

3. Please rate how CONFIDENT you are that you could perform the following activities over the next 8 weeks:

	Strongly disagree		Neutral		Strongly agree
I can do one small session of resistance training (at least 6 exercises working different muscle groups)	☐	☐	☐	☐	☐
I can walk or ride a stationary bike for at least 15 minutes at a level hard enough to cause an increase in heart rate and breathing rate	☐	☐	☐	☐	☐
I can climb 3 flights of stairs without stopping	☐	☐	☐	☐	☐
I can sit down and stand up out of a kitchen chair without the use of my arms	☐	☐	☐	☐	☐

4. How likely is it that you will do regular aerobic activity within the next 2 weeks? (e.g.: regular equates to approximately 150minutes spread out over the week)

☐ Not at all likely
☐ Not really likely
☐ A bit likely
☐ Moderately
☐ Likely
☐ Very likely

4. How likely is it that you will do regular resistance activity within the next 2 weeks? (e.g.: Regular equates to approximately 2-3 resistance training sessions spread out over the week.)

☐ Not at all likely
☐ Not really likely
☐ A bit likely
☐ Moderately
☐ Likely
☐ Very likely

Thank you for completing this survey.

Appendix 7. Upper body movement screening proforma

Upper Body Exercise	Assessment set up	Key points	Objective scoring criteria
Seated band chest press	Wrap band around the back of your chair. Grip the band around each thumb and make a fist like action. Sit up tall (avoid curling forwards, straining neck or lower back). Extend arms out in front at chest height for 2 seconds and then 2 seconds back to the starting position.	Avoid letting elbows travel back behind your back (which can put extra strain on the front of the shoulders). Keep shoulders relaxed, elbows below underarm height and focus on using chest and arm muscles	Set up based on the provided video-based instruction?
			Kept their spine in a neutral zone throughout the exercise?
			Kept trunk vertical (avoided leaning backwards or forwards)?
			Avoided significant scapular elevation(hitching) throughout the exercise?
			Kept their shoulder abduction between approximately 40-60 degrees
			Completed the exercise in a slow, smooth, controlled manner?
Incline Push Up	Using a solid object such as a kitchen bench, place your hands slightly wider than shoulder width apart. Start with your arms straight and your body long and straight (you can start on your toes). Slowly lower your chest (and whole body) towards the bench (over the course of 2 seconds) until you gently touch the bench, and then push yourself back to the starting position (taking 2 seconds).	Avoid letting your shoulders scrunch up towards your ears (we want the muscles of the chest/arms rather than your neck muscles to work). Keep your elbows from flaring out towards the side (40-60degrees from your side). Keep your body straight as letting your body sink in the middle can lead to injury. Focus on using chest and arm muscles to create the movement. Abdominals and gluteal muscles can be used to keep the body steady.	Set up based on the provided video-based instruction?
			Kept their spine in a neutral zone throughout the exercise?
			Avoided significant scapular elevation (hitching) throughout the exercise?
			Kept their shoulder abduction between approximately 40-60 degrees?
			Brought their chest (pectorals) toward hands?
			Completed the exercise in a slow, smooth, controlled manner?
Standing Band Row	Attach a band to an anchor point. Face the band and grip the band around each thumb (make a fist). Step away until there is adequate tension (with your arms outstretched). Stand up tall (avoid curling forwards, arching back or straining neck). Taking 2 seconds, slowly bring fists to underarms by flexing the elbow and pulling the shoulder blades towards the spine, hold for 1 second and then slowly straighten arms and relax shoulder blades.	Avoid letting elbows travel back behind your back (can put extra strain on the front of the shoulders). Keep shoulders relaxed, elbows below underarm height (avoid elbows flaring out). Focus on using chest and arm muscles to create the movement. Abdominals and gluteals can be used to keep the body steady.	Set up based on the provided video-based instruction?
			Kept their spine in a neutral zone throughout the exercise?
			Avoided significant scapular elevation (hitching) throughout the exercise?
			Exhibited retraction and protraction of the scapula during the exercise
			Minimised abduction of the elbow (avoidance of elbow flare)?
			Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Upper Body Exercise	Assessment set up	Key points	Objective scoring criteria
Seated Band Row	Attach band to an anchor point. Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Face the band and grip the band around each thumb (make a fist) ensuring there is adequate tension (arms outstretched). Taking 2 seconds, slowly bring fists to underarms by flexing the elbow and pulling the shoulder blades towards the spine, hold for 1 second and then slowly straighten arms and relax shoulder blades.	Avoid rocking the upper body to generate momentum. Keep shoulders relaxed, elbows below underarm height (avoid elbows flaring out). Focus on using mid-back and arm muscles to create the movement and abdominals to keep trunk steady	Set up based on the provided video-based instruction (see booklet)?
			Kept their spine in a neutral zone throughout the exercise?
			Avoided significant scapular elevation (hitching) throughout the exercise?
			Exhibited retraction and protraction of the scapula during the exercise?
			Kept trunk vertical (avoided leaning backwards or forwards)?
			Minimised abduction of the elbow (Avoidance of elbow flare)
			Completed the exercise in a slow, smooth, controlled manner?
Standing Band Bicep Curl	Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Wrap theraband around hands (making a fist) and place the band under your feet (keeping feet flat on the ground). Taking 2 seconds, slowly bring fists to shoulders (palms facing shoulders) by flexing the elbow, hold for 1 second and then slowly lower again till arms are almost straight	Keep elbows touching the side of your body throughout the whole movement. Avoid rocking the upper body to generate momentum. Keep shoulders relaxed and chest up tall. Focus on using bicep muscles to create the movement and abdominals to keep trunk steady	Set up based on the provided video-based instruction (see booklet)?
			Kept their spine in a neutral zone throughout the exercise?
			Kept a neutral scapular position (minimal hitching, forward shoulder) during exercise?
			Avoided significant elbow deviation from the start position (both forward and lateral)
			Complete the full range of motion (approximately 0°-110°)
			Completed the exercise in a slow, smooth, controlled manner?
Seated Band Bicep Curl	Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Wrap theraband around hands (making a fist) and place band under your feet (keeping feet flat on the ground). Taking 2 seconds, slowly bring fists to shoulders (palms facing shoulders) by flexing the elbow, hold for 1 second and then slowly lower again till arms are almost straight	Keep elbows touching the side of your body throughout the whole movement. Avoid rocking the upper body to generate momentum. Keep shoulders relaxed and chest up tall. Focus on using bicep muscles to create the movement and abdominals to keep trunk steady	Set up based on the provided video-based instruction (see booklet)?
			Kept their spine in a neutral zone throughout the exercise?
			Kept a neutral scapular position (minimal hitching, forward shoulder) during exercise?
			Kept trunk vertical (avoided leaning backwards or forwards)?
			Avoided significant elbow deviation from the start position (both forward and lateral)
			Complete the full range of motion (approximately 0°-140°)
			Completed the exercise in a slow, smooth, controlled manner?
	Attach band to an anchor point at about head height. Sit on the edge of the chair, with a tall	Focus on using shoulder and arm (triceps) muscles to create the movement. Abdominals can be used to	Set up based on the provided video-based instruction?
			Kept their spine in a neutral zone throughout the exercise?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Upper Body Exercise	Assessment set up	Key points	Objective scoring criteria
Seated Band Triceps Extension	posture (avoid curling forwards, arching back or straining neck). Face the band and grip the band around each thumb (make a fist) ensuring there is adequate tension. Start with your arms bent by your sides and whilst keeping your elbows touching your side, slowly extend your arms till they are straight (taking 2 seconds). Pause for 1 second and then slowly bring your arms to the starting position (bent by sides). Pause for 1 second before starting your next repetition	keep the body steady. Avoid letting your shoulders scrunch up towards your ears (we want the muscles of the arms and not neck to work). Keep elbows in the same spot throughout the action, otherwise we are not targeting the appropriate muscles.	Kept a neutral scapular position (minimal hitching, forward shoulder) during exercise?
			Kept trunk vertical (avoided leaning backwards or forwards)?
			Avoided significant elbow deviation from the start position (both forward and lateral)
			Complete the full range of motion (approximately 110°-0°)
			Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Appendix 8. Trunk-focused movement screening proforma

Trunk Exercises	Assessment set up	Key points	Objective scoring criteria
Seated March	Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Ensure feet are flat on the floor. Over the course of 2 seconds, slowly raise knee up as high as you can without curling your spine or leaning back and then slowly straighten your leg. Hold for 1 second and very slowly lower. Alternate legs each repetition.	Aim to keep your trunk vertical and avoid shifting too much weight when alternating sides. The muscles of the trunk should be used to keep your trunk still and the muscles around the front of the hip. Keep shoulders and neck relaxed	Set up based on the provided video-based instruction? Kept their spine in a neutral zone throughout the exercise? Kept trunk vertical (avoided leaning backwards or forwards)? Kept shoulders and neck relaxed (not co-contracting to assist movement) Completed the exercise in a slow, smooth, controlled manner?
Leg Fallout	Lie on the ground on you back, with your knees bent and feet flat on the ground. Ensure your body weight is evenly spread over the back of your hips. Focus on keeping your hips touching the ground at all times, as you slowly control (over 2 seconds) one knee falling out towards the ground to the side of you. The aim is to go as far as you can before your opposite hip moves (you may want to keep your hands on your hips to feel any movement). When you cannot go any further, slowly bring the leg back to the starting position. Alternate sides each repetition.	The deeper muscles of the abdominals should be used to keep your trunk/hips still as you move. Breathe as normally as possible. Keep shoulders and neck relaxed.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their pelvis level throughout the movement (watch for lateral movement) Kept shoulders and neck relaxed (not co-contracting to assist movement) Completed the exercise in a slow, smooth, controlled manner?
Single Leg Lift	Lie on the ground on you back, with your knees bent and feet flat on the ground. Ensure your body weight is evenly spread over the back of your hips and you have a gentle curve in you lower back (neutral spine). Focus on keeping your hips in this position over the course of the repetition. The aim is to very slowly (2 seconds) lift your leg up to approximately 90 degrees and hold for 1 second before slowly lowering to the starting position. Alternate legs (but avoid rocking through your pelvis, spine or rib cage)	The deeper muscles of the abdominals should be used to keep your trunk/hips still as you move. We want to avoid a large doming of your outer abdominals (a big puff up) as this means you may not have engaged your deeper muscles. You can have your hands resting on your stomach or hips to help you feel any doming or rocking. Breathe as normally as possible. Keep shoulders and neck relaxed.	Set up based on the provided video-based instruction? Kept their spine in a neutral zone throughout the exercise? Avoided abdominal doming (significant activation of rectus abdominis)? Kept show3ulders and neck relaxed (not co-contracting to assist movement)? Completed the exercise in a slow, smooth, controlled manner?
	Lie on the ground on you back, with your knees bent and feet flat on the ground. Ensure your body weight is	The deeper muscles of the abdominals should be used to keep your trunk/hips	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Trunk Exercises	Assessment set up	Key points	Objective scoring criteria
Single Leg Lift with Extension	evenly spread over the back of your hips and you have a gentle curve in you lower back (neutral spine). Focus on keeping your hips in this position over the course of the repetition. The aim is to very slowly (2 seconds) lift your leg up to approximately 90 degrees, hold for 1 second before slowly lowering the leg out straight. This will add extra load onto the working muscles (avoid arching through the spine). Slowly bring the leg back to the 90 degree position and then return to the starting position. Alternate legs (but avoid rocking through your pelvis, spine or rib cage).	still as you move. We want to avoid a large doming of your outer abdominals (a big puff up) as this means you may not have engaged your deeper muscles. Breathe as normally as possible and aim to keep the shoulders and neck relaxed.	Avoided abdominal doming (significant activation of rectus abdominis)? Kept shoulders and neck relaxed (not co-contracting to assist movement)? Completed the exercise in a slow, smooth, controlled manner?
Double Leg Lift	Lie on the ground on you back, with your knees bent and feet flat on the ground. Ensure your body weight is evenly spread over the back of your hips and you have a gentle curve in you lower back (neutral spine). Focus on keeping your hips in this position over the course of the whole exercise. The aim is to very slowly (2 seconds) lift your leg up to approximately 90 degrees, hold for 1 second before slowly bringing the other leg up to the same position. This will add extra load onto the working muscles (avoid arching through the spine). Slowly bring the second leg back to the ground and then return the first leg to the starting position. Alternate legs (but avoid rocking through your pelvis, spine or rib cage).	The deeper muscles of the abdominals should be used to keep your trunk/hips still as you move. We want to avoid a large doming of your outer abdominals (a big puff up) as this means you may not have engaged your deeper muscles. Breathe as normally as possible. Keep shoulders and neck relaxed.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Avoided abdominal doming (significant activation of rectus abdominis)? Kept shoulders and neck relaxed (not co-contracting to assist movement)? Completed the exercise in a slow, smooth, controlled manner?
Double Leg Hip Lift	Lie on the ground on you back, with your knees bent and feet flat on the ground. Ensure your body weight is evenly spread over the back of your hips and you have a gentle curve in you lower back (neutral spine). Focus on keeping your hips in this position over the course of the whole exercise. The aim is to very slowly (2 seconds) lift your hips off the ground using your gluteal muscles as high as you can without arching your spine. Hold for 1	The gluteal muscles should be used to lift your hips and the deeper muscles of the abdominals should be used to keep your trunk/hips still as you move. Breathe as normally as possible. Keep shoulders and neck relaxed.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their pelvis level throughout the movement? Extended hips to an approximate full range (0-15 degrees hip flexion)? Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Trunk Exercises	Assessment set up	Key points	Objective scoring criteria
	second at the top and then slowly (2 seconds) bring your hips back onto the ground evenly.		
All Fours With Single Leg Extension	Position yourself on hands and knees, with your body weight is evenly spread evenly and you have a gentle curve in you lower back (neutral spine). The aim is to very slowly (2 seconds) lift one leg/knee off the ground, without shifting your body weight, arching spine or tipping hips (you want to imagine your back is a table which has a glass of water on it that you do not want to spill). Hold for 1 second when you have reach as far as your leg can comfortably lift and then slowly (2 seconds) bring your leg back to the ground. Alternate which leg you lift each repetition.	The deeper muscles of the abdominals should be used to keep your trunk/hips still as you move and your glute muscles are used to help lift the leg. Avoid collapsing through the shoulders/mid-back and chest – keep your chest tall. Go slow as the aim is to keep balance throughout the entire movement. Breathe as normally as possible.	Set up based on the provided video-based instruction (see booklet)?
			Kept their spine in a neutral zone throughout the exercise?
			Kept their scapula in a neutral scapular position (minimal hitching/winging/tilting) during the exercise
			Do they maintain balance while the leg is off the ground
			Kept a level pelvis throughout the movement
			Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Appendix 9. Lower body exercise movement screening proforma

Lower Body Exercise	Assessment set up	Key points	Objective scoring criteria
Sit to stand	Start seated with feet a little wider than shoulder-width apart and cross your arms. Initiate the movement by leaning through the hips and driving through the bottom to stand up. Focus on keeping your spine relatively long and straight (bend from hips, not lower back). Keep heels on the ground and spread your bodyweight evenly between the heel and ball of each foot. Once you are standing up fully, very slowly (over 2 seconds) unlock the hips, bringing them back towards the seat and allow you knees to bend to continue the movement. Once your bottom is touching the seat, complete the next repetition.	The gluteal muscles are used to stand up and the quadriceps muscles are used to lower yourself towards the seat. Keep the knees, ankles in line with each other (they should run in two lines like train tracks), we want to avoid the knees collapsing inwards. Breathe as normally as possible. Avoid rounding the shoulders or back (we are only moving through the hips, knees and ankles.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their pelvis parallel to the ground throughout the exercise? Kept their knees travelling in the same direction as their hips and toes (no excessive varus or valgus movement)? Kept both feet in full contact with the ground (heels and balls of feet)? Completed the exercise in a slow, smooth, controlled manner?
Partial (1/4) Squat	Stand tall with feet a little wider than shoulder-width apart and cross your arms. Initiate the movement by unlocking the hips, slightly bringing them back towards a seat and allow you knees to bend to continue the movement. Focus on keeping your spine relatively long and straight (bend from hips, not lower back). As you bottom goes back, allow your knees to travel forwards, so your centre of gravity remains through your ankles. Keep heels on the ground and spread your bodyweight evenly between the heel and ball of each foot. Continue to squat down until your thighs are at an angle of 45degrees from the floor	The quadriceps muscles are used to lower yourself towards the seat and gluteal muscles are used to stand up. Keep the knees, ankles in line with each other (they should run in two lines like train tracks), we want to avoid the knees collapsing inwards. Breathe as normally as possible. Avoid rounding the shoulders or back (we are only moving through the hips, knees and ankles.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their pelvis parallel to the ground throughout the exercise? Kept their knees travelling in the same direction as their hips and toes (no excessive varus or valgus movement)? Kept both feet in full contact with the ground (heels and balls of feet)? Maintained a similar hip flexion angle in comparison to dorsiflexion angle? Achieved a quarter squat depth? Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Lower Body Exercise	Assessment set up	Key points	Objective scoring criteria
	(halfway from standing to sitting). Pause for 1 second before standing up tall.		
Squat (1/2)	Stand tall with feet a little wider than shoulder-width apart and cross your arms. Initiate the movement by unlocking the hips, slightly bringing them back towards a seat and allow you knees to bend to continue the movement. Focus on keeping your spine relatively long and straight (bend from hips, not lower back). As you bottom goes back, allow your knees to travel forwards, so your centre of gravity remains through your ankles. Keep heels on the ground and spread your bodyweight evenly between the heel and ball of each foot. Continue to squat down until your thighs are at an angle of about 90 degrees from the floor, just gently touching the front of a seat. Pause for 1 second before standing up tall.	The quadriceps muscles are used to lower yourself towards the seat and gluteal muscles are used to stand up. Keep the knees, ankles in line with each other (they should run in two lines like train tracks), we want to avoid the knees collapsing inwards. Breathe as normally as possible. Avoid rounding the shoulders or back (we are only moving through the hips, knees and ankles.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their pelvis parallel to the ground throughout the exercise? Kept their knees travelling in the same direction as their hips and toes (no excessive varus or valgus movement)? Kept both feet in full contact with the ground (heels and balls of feet)? Maintained a similar hip flexion angle in comparison to dorsiflexion angle? Achieved a hip flexion angle of approximately 90 degrees (half squat depth)? Completed the exercise in a slow, smooth, controlled manner?
Seated Band Knee Extension	Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Begin by looping the centre of the band around the ankle of your exercising leg. Bring the ends of the band underneath the foot of the opposite leg (which is pulled back as far as it can go) to stabilize and grasp the ends by your knee. Slowly extend your leg so your knee is straight against the band over a count of 3 seconds. Hold for 1 second and then slowly	Ensure the band is tight enough to challenge the muscles of the thigh. Keep the arm/shoulder/neck of the hand holding the band as relaxed as possible. Focus on using the muscles of the thigh and not the knee joint itself. Make sure you do not rock forward or back, this will make the exercise easier.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their hip, knee and foot remain aligned throughout the movement? Achieved a full range of motion (0-90°) without hyperextension? Kept trunk vertical (avoided leaning backwards or forwards)? Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Lower Body Exercise	Assessment set up	Key points	Objective scoring criteria
	(3 seconds) bring your exercising leg back to the starting position.		
Seated Band Hamstring Curl	Sit on the edge of the chair, with a tall posture (avoid curling forwards, arching back or straining neck). Begin by looping the centre of the band around the ankle of your exercising leg. Bring the ends of the band underneath the foot of the opposite leg (which is as far forward as it can go) to stabilize and grasp the ends by your knee. Slowly pull your heel back towards your bottom as far as you can over a count of 3 seconds. You should feel this in the back of your thigh. Hold for 1 second and then slowly (3 seconds) bring your leg back to the starting position.	Ensure the band is tight enough to challenge the muscles of the back of the thigh. Keep the arm/shoulder/neck of the hand holding the band as relaxed as possible. Focus on using the muscles of the thigh and not the knee or ankle joint itself. Make sure you do not rock forward or back, this will make the exercise easier.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their hip, knee and foot remain aligned throughout the movement? Kept trunk vertical (avoided leaning backwards or forwards)? Completed the exercise in a slow, smooth, controlled manner?
Standing Calf Raise	Start standing in front of a stable object or wall with feet shoulder-width apart. Lift your heels off the ground as high as you can, spreading weight evenly through ball of big toe and outside toe. Hold at the top for 1 second. Very slowly lower yourself to the ground over the course of two seconds before repeating the exercise again.	The calf muscles are the main muscles working to lift your heels off of the ground. Keep the knees, ankles in line with each other (they should run in two lines like train tracks). Keep yourself standing as tall as possible, avoid bending back or hips.	Set up based on the provided video-based instruction (see booklet)? Kept their spine in a neutral zone throughout the exercise? Kept their hips and knees in vertical alignment with the shoulders and ankles? Appeared to keep their foot neutral (even weight distribution on all metatarsals)? Kept their full range of motion for the full set? Completed the exercise in a slow, smooth, controlled manner?

Objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good. Safe is equal to a score of 1 or 2.

Appendix 10. Semi-structured interview guide

Topic	Question/s
Website	1. What things did you like about the website? 2. What didn't you like about the website?
Exercise prescription	3. Can you tell me about what you thought about the exercises prescribed? Easy/hard. Do you think you could do them at home without someone helping? 4. How did you find the videos?
ExerciseGuide program	5. Can you provide some feedback on the pros of this program? 6. Can you provide some feedback on the cons of this program? 7. a) Would you like to have access to an exercise professional (via phone or video conference) to aid accountability and help in other aspects of the program? * b) How often would you like the exercise professional to contact you? 8. What could we do to improve the program in the future?
**Please note question 7 was added to the interview after the first iterative changes to the ExerciseGuide program after feedback from previous participants.*	

Appendix 11. Think-aloud modifications

Think aloud modifications from cycle one.

Cycle	Topic	Observation feedback from users	Revisions made
One (n=5)	Navigation	A navigation tutorial video would be helpful	A navigation tutorial video was added
	Design	Text too small	Text size increased
		Modules were too long	Content tailored further. Dot points. Additional information moved to the library.
	Content	Medical terminology is confusing	Reduced medical terminology. Links added for additional information in the library. Matched metastases locations in questions to patient information form.
		Discuss maintenance of health, not just progressions. Some participants do not want to progress, just avoid deconditioning	Information revised to reduce the emphasis on progressing and increase information on 'minimum dose' exercise for maintenance.
	Exercise prescription	Modifications of prescriptions for those already meeting aerobic or resistance targets.	Tailored information to explain how participants integrate the Exercise Guide program into their current exercise schedule.
		A maximum of ten exercises is too many	Maximum of eight exercises prescribed
	Program	Additional of further support to aid adherence	Addition of a telehealth component to intervention.

Think aloud modifications from cycle two.

Cycle	Topic	Observation feedback from users	Revisions made
Two (n=6)	Navigation	Unable to use embedded videos easily (both starting and exiting the video)	A video tutorial was made to explain typical issues encountered (how to watch and then exit an embedded video.
		Navigation videos need to be slower	Re-create videos with increased duration to explain the navigation.
	Design	Ensure images are not all Anglocentric	Change some images to ensure
		Ensure consistency of style and grammar	Changes made to style and grammar
		Two modules asked very similar questions for tailoring. Reduce question double-ups.	Moved important tailoring questions (i.e. metastasis location) to the "getting started" module to ensure completion – this data is drawn into other tailoring algorithms.
	Exercise Prescription	Would like other methods of exercise prescription (if safe)	Other methods (i.e.: rowing and swimming) were prescribed for individuals without bone metastases. Walking in water was added for individuals with bone metastases.
		Addition of stretching exercises	Tailored stretching exercises to resistance training exercises prescribed
	Program	More information needed to address distress and hot flushes	Additional information added into the Exercise plus and where else can I get help modules around these two areas.

Appendix 12. *ExerciseGuide* changes pre- and post-usability study

Program	Specific	Pre-usability study	Post-usability study
Information modules	Getting started	Text to explain website navigation	Text and video to explain website navigation Additional tailoring questions (metastases location)
	Exercise benefits	Text and images to explain benefits of exercise Tailored information (text/images) based on benefits of exercise on: 1. Reduced muscular strength 2. Fatigue 3. Anxiety and or depression 4. Bone pain 5. Sleep 6. Incontinence 7. Sexual function 8. Balance	Text and images to explain benefits of exercise Tailored information (text/images) based on benefits of exercise on: 1. Reduced muscular strength 2. Fatigue 3. Anxiety and or depression 4. Bone pain 5. Sleep 6. Incontinence 7. Sexual function 8. Balance
	Drive safely	Tailored information (text/images) on: 1. Exercise safety whilst undergoing treatments 2. Exercise safety based on bone metastases location/s 3. Aerobic exercise safety 4. Exercise safely with treatment side effects 5. When should exercises be paused or stopped 6. Exercising safely with other medical conditions	Tailored information (text/images) on: 1. Exercise safety whilst undergoing treatments 2. Exercise safety based on bone metastases location/s 3. Aerobic exercise safety 4. Exercise safely with treatment side effects 5. When should exercises be paused or stopped 6. Exercising safely with other medical conditions 7. Monitoring exercise

<table>
<tr><th>Program</th><th>Specific</th><th>Pre-usability study</th><th>Post-usability study</th></tr>
<tr><td></td><td>Making it last</td><td>Tailored information (text/images) on:
1. Factors that influence exercise
2. How to improve confidence to exercise
3. How to plan
4. Motivation
5. Habits</td><td>Tailored information (text/images) on:
1. Factors that influence exercise
2. How to improve confidence to exercise
3. How to plan
4. Motivation
5. Habits</td></tr>
<tr><td></td><td>Exercise Plus</td><td>Tailored information (text/images) on:
1. Nutrition
2. Sedentary behaviours
3. Alcohol
4. Sleep</td><td>Tailored information (text/images) on:
1. Nutrition
2. Sedentary behaviours
3. Alcohol
4. Sleep
5. Distress
6. Hot flushes</td></tr>
<tr><td></td><td>Where else can I get help</td><td>Tailored information (text/images) on:
1. General information for advanced prostate cancer
2. Further exercise resources support
3. Further diet and nutrition support
4. Further information for symptom support
5. Further sleep support
6. Location based support
7. Resources for Aboriginal and Torres Strait Islander support
8. Resources for individuals with English as a second language</td><td>Tailored information (text/images) on:
1. General information for advanced prostate cancer
2. Further exercise resources support
3. Further diet and nutrition support
4. Further information for symptom support
5. Further sleep support
6. Location based support
7. Resources for Aboriginal and Torres Strait Islander support
8. Resources for individuals with English as a second language</td></tr>
</table>

Program	Specific	Pre-usability study	Post-usability study
		9. Resources for individuals in the LGBTIQ community	9. Resources for individuals in the LGBTIQ community 10. Further information to assist with distress
Exercise Prescription modules	Duration	8-week intervention	8-week intervention
	Resistance exercise prescription	Maximum of ten exercises prescribed per program	Maximum of eight exercises prescribed per program
		Mode: Body weight and resistance exercises	Mode: Body weight and resistance exercises
		Frequency: Two to three sessions per week.	Frequency: Two to three sessions per week but tailored to encourage participants who are already completing two or more sessions to fit the prescription in to current routine.
		Intensity: 6-7 out of 10	Intensity: 6-7 out of 10
	Aerobic exercise prescription	Modes: Walking and cycling	Modes: Walking, cycling and other methods (i.e.: rowing and swimming) were prescribed for individuals without bone metastases. Walking in water was added for individuals with bone metastases.
		Frequency: Two to five sessions per week.	Frequency: Two to five sessions per week but tailored to encourage participants who are already completing two or more sessions to fit the prescription in to current routine.
		Intensity: 6-7 out of 10	Intensity: 6-7 out of 10
	Flexibility exercise prescription	None prescribed	Program prescribed based upon resistance training muscle groups used
	Other	Exercise prescription tailored to exercise volume or intensity progressions.	Exercise prescription tailored to either exercise volume or intensity progressions or maintenance of health.

Program	Specific	Pre-usability study	Post-usability study
Support	Telehealth	No telehealth included	Three telehealth consults (via real-time teleconferencing or phone calls) at week 1, week 4 and week 8. Approximately 20 minutes in duration.
	How are you tracking	Includes personalised information of: 1. Participants weekly activity summary 2. Goal progression tracker 3. Symptom tracker 4. Confidence tracker	Includes personalised information of: 1. Participants weekly activity summary 2. Goal progression tracker 3. Symptom tracker 4. Confidence tracker

A detailed explanation of the *ExerciseGuide* intervention after the completion of this study can be found at: Evans HE, Forbes CC, Galvão DA, Vandelanotte C, Newton RU, Wittert G, Chambers S, Vincent AD, Kichenadasse G, Brook N, Girard D. Evaluating a web-and telephone-based personalised exercise intervention for individuals living with metastatic prostate cancer (*ExerciseGuide*): protocol for a pilot randomised controlled trial. Pilot and feasibility studies. 2021;7(1):1-6.

Appendix 13. Movement screening scores and intraclass correlation

Region	Exercise	Number of screening items per exercise	Possible range of scores	Safety cut point	Expert movement screening scores					Overall score M (SD)	ICC
					Expert 1 M (SD)	Expert 2 M (SD)	Expert 3 M (SD)	Expert 4 M (SD)	Expert 5 M (SD)		
Upper body exercises	Seated Bicep Curl (n=4)	7	7-28	<14	22.0 (2.9)	19.0 (7.7)	25.3 (2.2)	21.0 (3.7)	26.5 (1.0)	22.8 (4.7)	0.197
	Standing Bicep Curl (n=6)	6	6-24	<12	22.5 (1.4)	17.7 (2.4)	22.7 (1.4)	19.3 (1.9)	22.7 (1.4)	21.0 (2.7)	0.000
	Seated Triceps Extension (n=9)	6	6-24	<12	16.7 (3.2)	10.7 (4.7)	21.4 (1.2)	15.0 (4.7)	22.6 (1.0)	17.4 (5.4)	0.053
	Incline Push Up (n=3)	6	6-24	<12	19.3 (4.6)	18.0 (6.9)	22.7 (1.2)	18.0 (3.0)	22.7 (1.5)	20.1 (4.1)	0.103
	Seated Chest Press (n=2)	6	6-24	<12	23.5 (0.7)	16.5 (0.7)	24.0 (0.0)	20.5 (2.1)	24.0 (0.0)	21.7 (3.2)	0.000
	Seated Row (n=3)	7	7-28	<14	22.7 (2.3)	21.3 (5.1)	27.0 (1.7)	16.7 (3.1)	27.3 (1.2)	23.0 (4.8)	0.000
	Standing Row (n=1)*	6	6-24	<12	19.3 (4.6)	18.0 (6.9)	22.7 (1.2)	18.0 (3.0)	22.7 (1.5)	21.4 (3.6)	N/A
Trunk exercises	Seated March with Leg Extension (n=4)	5	5-20	<10	17.3 (2.2)	11.8 (2.8)	19.5 (1.0)	16.3 (3.0)	19.8 (0.5)	16.9 (3.5)	<0.001
	Leg Fallout (n=5)	5	5-20	<10	18.8 (2.2)	16.4 (1.8)	18.0 (4.5)	16.2 (4.3)	17.8 (4.4)	17.4 (3.5)	0.592
	Single Leg Lift (n=3)	5	5-20	<10	19.7 (0.6)	17.3 (2.1)	20.0 (0.0)	18.3 (1.5)	20.0 (0.0)	19.1 (1.5)	0.068
	Double Leg Lift (n=2)	5	5-20	<10	19.7 (0.6)	16.0 (3.0)	19.7 (0.6)	16.7 (1.2)	19.7 (0.6)	18.3 (2.1)	0.000
	Double Leg Hip Lift (n=1)*	5	5-20	<10	19.0 (0.0)	19.0 (0.0)	20.0 (0.0)	20.0 (0.0)	20.0 (0.0)	19.6 (0.6)	N/A
	All Fours with Single Leg Extension (n=2)	6	6-24	<12	23.0 (0.0)	15.5 (5.0)	19.5 (0.7)	21.0 (1.4)	22.5 (0.7)	20.3 (3.3)	<0.001
	Sit to stand (n=1)*	6	6-24	<12	22.0 (0.0)	21.0 (0.0)	24.0 (0.0)	23.0 (0.0)	24.0 (0.0)	22.8 (1.3)	N/A

Lower body exercises	Squat (n=3)	8	8-32	<16	28.7 (1.2)	27.0 (1.7)	31.0 (1.7)	30.3 (2.1)	31.7 (0.6)	29.7 (3.0)	0.000
	Seated Knee Extension (n=6)	6	6-24	<12	20.7 (1.1)	16.5 (2.9)	23.2 (1.2)	19.2 (1.9)	23.2 (0.8)	20.5 (3.0)	0.000
	Seated Hamstring Curl (n=6)	5	5-20	<12	21.5 (1.4)	21.3 (1.2)	23.8 (0.4)	19.7 (1.2)	24.0 (0.0)	22.1 (1.9)	0.000
	Standing calf raise (n=11)	6	6-24	<12	21.5 (1.4)	21.2 (1.5)	23.8 (0.4)	19.8 (1.8)	22.9 (3.0)	21.9 (2.2)	<0.001

*ICC not determined due to single sample.

An exercise was deemed safe if, on average, it was scored as satisfactory or good, with the cut point indicating this score.

Original objective scoring criteria (scale): -1 = unsatisfactory with major concerns, 0 = unsatisfactory with major concerns, 1 = satisfactory, 2 = good.

For statistical purposes, scores were then transformed into positive scores: 1 = unsatisfactory with major concerns, 2 = unsatisfactory with major concerns, 3 = satisfactory, 4 = good.

Appendix 14. Chapter five and six ethics approval

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25 July 2018

Dr Camille Short
Medical Specialties - RAH

Dear Dr Short

ETHICS APPROVAL No:	H-2018-153
PROJECT TITLE:	Delivering a tailored evidence-based exercise intervention to support men with metastatic prostate cancer: A pilot randomized control trial examining behaviour change and functional quality of life

The ethics application for the above project has been reviewed by the Human Research Ethics Committee and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)*. You are authorised to commence your research on:25/07/2018
The ethics expiry date for this project is: 31/07/2021

NAMED INVESTIGATORS:

Chief Investigator:	Dr Camille Short
Student - Postgraduate Doctorate by Research (PhD):	Ms Holly Elizabeth Louise Evans
Associate Investigator:	Professor Gary Wittert
Associate Investigator:	Miss Lisa Irene Jones
Associate Investigator:	Dr Cynthia Forbes
Associate Investigator:	Daniel A Galvão
Associate Investigator:	Associate Professor Nicholas Roger Brook
Associate Investigator:	Robert U Newton
Associate Investigator:	Suzanne K Chambers
Associate Investigator:	Dr Andrew Vincent
Associate Investigator:	Corneel Vandelanotte
Associate Investigator:	G Kichenadasse

CONDITIONS OF APPROVAL: Thank you for the detailed response and amended ethics application dated 24 July 2018.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant

- review of ethical approval including: serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical
- acceptability of the project, proposed changes to the protocol or project
- investigators; and the project is discontinued before the expected date

of completion.

Yours sincerely,

Professor Paul Delfabbro Convenor

The University of Adelaide

Appendix 15. Theoretical tenants and strategies within the *ExerciseGuide* program

Theoretical tenets and supporting evidence	Strategies
Self-determination theory	
Motivation that regulates our behaviour exists on a continuum, ranging from extrinsic (doing the activity for instrumental reasons or to obtain an outcome separate from the activity) to intrinsic (performing a behaviour because it is inherently satisfying). Behaviours are more likely to be maintained when they are more intrinsically motivated. Core determinants of intrinsic motivation include three basic psychological needs: autonomy, competence and relatedness.	Autonomy: Intervention architecture promotes choice and is self-timed; Participant preferences are taken into account with exercise prescription where possible (balancing safety, efficacy); affect-regulated exercise is encouraged if participants are not enjoying their prescribed program (1). Relatedness: The intervention provides direct access to an Exercise Physiologist twice and an option to ask questions to the Exercise Physiologist to provide a sense of attachment and personalization to the intervention. Photographs of all team members are also included on the website. Human support has been shown to enhance the efficacy of online interventions (2). Competency: The intervention provides education, behavioural change tools and individualised exercise prescription with video demonstrations to increase skill level that is needed to help take actions that will help them achieve their goals. A positive, encouraging tone is adopted throughout and the intervention has been designed to be simple and easy to use. (3)
Social Cognitive Theory	
The core determinants that influence behaviour include perceived self-efficacy, outcome	Self-efficacy: Video demonstrations and safety advice provided to improve task self-efficacy, especially for resistance-training. Exercise prescription is progressed over-

Theoretical tenets and supporting evidence	Strategies
expectations, goals people set for themselves and strategies people have for realizing them and perceived impediments and facilitators (4). Self-efficacy and goals (proximal intentions), as well as perceived health impediments have been associated with exercise behaviour change in prostate cancer patients. (5-7)	time and tailored to meet individual needs. Encouragement is provided throughout to build confidence. Outcome expectations: Comprehensive education is provided on exercise benefits focusing on both physical and mental health. Perceived costs of participating reduced by providing convenient program structure and all necessary equipment and information. Goal and self-control strategies: A print-based exercise diary and tracking module is provided allowing participants to monitor progress. Tailored psycho-education is provided regarding implementation planning. Impediments: Health impediments are addressed by tailoring exercise prescriptions based on functional capacity. Environmental barriers are reduced by offering a distance-based program free of charge.
Habit Formation Theory	
Habit formation theory states that 'habits' are behaviours that are triggered automatically in response to cues that have been linked with the behaviours' performance (8). Habitual behaviour is regulated by impulsive processes, and so does not require large amounts of cognitive effort, control or	Context-behaviour associations: Tailored psycho-education is provided describing current habit strength and providing information on the benefits of habits and guidance on how they are formed. .

Theoretical tenets and supporting evidence	Strategies
even a conscious intention. Habits have been shown to predict physical activity behaviour when intentions are weak (8,9). Having an exercise habit has been associated with increased maintenance of behaviour change (8).	
Elaboration Likelihood Model of Persuasion	
According to this information processing theory persuasion can occur via two pathways, a central route involving elaborate thinking and a peripheral route involving the use of heuristics and feelings. Persuasion can occur via either pathway but persuasion via the central route may result in more enduring attitude change. A key determinant of using the central route pathway is perceived personal relevance of the information. Need for Cognition, a personality factor also predicts tendency to use central or peripheral route processing (10-11).	Relevance: All modules provide tailored content based on an individual assessment. This is expected to increase perceived personal relevance of the website content. Need for cognition: Detailed explanations and source of recommendations are provided to appeal to those with moderate-high need for cognition (i.e., those who tend to enjoy effortful cognitive activities). Pictures and videos, credibility cues (e.g. university logos), and the ability to skip information and ask direct questions is designed to appeal to those with a lower need for cognition.

References:

1. Parfitt G, Alrumh A, Rowlands AV. Affect-regulated exercise intensity: does training at an intensity that feels “good” improve physical health? J Sci Med Sport. 2012;15(6):548–53.
2. Santarossa S, Kane D, Senn CY, Woodruff SJ. Exploring the role of in-person components for online health behavior change interventions: Can a digital person-to-person component suffice? J. Med. Internet Res. 2018;20(4):e144.
3. Short CE, James EL, Rebar AL, Duncan MJ, Courneya KS, Plotnikoff RC, et al. Designing more engaging computer-tailored physical activity behaviour change interventions for breast cancer survivors: lessons from the iMove More for Life study. Support Care Cancer. 2017;25(11):3569–85.
4. Bandura A. Health Promotion by social cognitive means. Heal Educ Behav. 2004;31(2):143– 46
5. Craike MJ, Gaskin CJ, Mohebbi M, Courneya KS, Livingston PM. Mechanisms of physical activity behavior change for prostate cancer survivors: a cluster randomized controlled trial. Ann Behav Med. 2018;52(9):798–808.
6. Craike M, Gaskin CJ, Courneya KS, Fraser SF, Salmon J, Owen PJ, et al. Predictors of adherence to a 12-week exercise program among men treated for prostate cancer: ENGAGE study. Cancer Med. 2016;5(5):787–94.
7. Courneya KS, Segal RJ, Reid RD, Jones LW, Malone SC, Venner PM, et al. Three independent factors predicted adherence in a randomized controlled trial of resistance exercise training among prostate cancer survivors. J Clin Epidemiol. 2004;57(6):571–9.
8. Rebar AL, Elavsky S, Maher JP, Doerksen SE, Conroy DE. Habits predict physical activity on days when intentions are weak. J Sport Exerc Psychol. 2014;36(2):157–65.
9. Gardner B, Lally P, Wardle J. Making health habitual: the psychology of “habit-formation” and general practice. Brit J Gen Pract. 2012;62:664–6.
10. Petty RE, Barden J, Wheeler SC. The Elaboration Likelihood Model of persuasion: Developing health promotions for sustained behavioral change. In: DiClemente RJ, Crosby RA, Kegler MC, editors. Emerging theories in health promotion practice and research. San Francisco: Jossey-Bass; 2009. p. 185–2.
11. Nikoloudakis IA, Crutzen R, Rebar AL, Vandelanotte C, Quester P, Dry M, et al. Can you elaborate on that? Addressing participants’ need for cognition in computer-tailored health behavior interventions. Health Psychol Rev. 2018;12(4):437–52.

Appendix 16. *ExerciseGuide* resistance-based exercises

Upper body exercises	Trunk Exercises	Lower body exercises
Seated Chest Press	Seated Alternate hip flexion	Seated Knee Extension
Seated Bicep Curl	Supine Leg Fallout	Seated Hamstring Curl
Seated Row	Supine Single-Leg Lift	Sit to Stand
Seated Shoulder Press	Supine Single-Leg Lift with Extension	Partial Squat
Seated Shoulder Raise	Supine Double Leg Lift	Squat
Seated Triceps Extension	Supine Hip Lift	Standing Calf Raise
Standing Chest Press	All Fours with Single Leg Extension	
Standing Bicep Curl	All Fours with Single Arm Extension	
Standing Row	All Fours Progression	
Standing Shoulder Press		
Standing Shoulder Raise		
Incline Push Up		

Appendix 17. *ExerciseGuide* modified exercise prescription (weeks 4-8)

Session frequency over first 3 weeks	Prescription compliance over first 3 weeks	Exercise modifiable variables	Weeks 4	5	6	7	8
> 8	100%	Sessions per week	3	3	3	3	3
> 8	80-99%	Upper body exercises	3 x 12	3 x 10	3 x 10	3 x 10	3 x 8
> 8	50-79%	Lower body exercises	3 x 12	3 x 10	3 x 10	3 x 10	3 x 8
		Trunk exercises	3 x 10	3 x 10	3 x 12	3 x 12	3 x 12
> 8	0-49%	Sessions per week	2	2	2	2	2
6-8	0-49%	Upper body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Lower body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Trunk exercises	2 x 10	3 x 10	3 x 10	3 x 10	3 x 12
6-8	100%	Sessions per week	2	2	3	3	3
6-8	80-99%	Upper body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
6-8	50-79%	Lower body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Trunk exercises	2 x 10	3 x 10	3 x 10	3 x 10	3 x 12
5	100%	Sessions per week	2	3	3	3	3
5	80-99%	Upper body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Lower body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Trunk exercises	3 x 10	3 x 10	3 x 10	3 x 12	3 x 12
5	50-79%	Sessions per week	2	2	2	2	2
5	0-49%	Upper body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Lower body exercises	3 x 12	3 x 12	3 x 10	3 x 10	3 x 8
		Trunk exercises	3 x 10	3 x 10	3 x 10	3 x 12	3 x 12
3-4	100%	Sessions per week	2	2	3	3	3
3-4	80-99%	Upper body exercises	2 x 12	3 x 10	3 x 10	3 x 10	3 x 10
3-4	50-79%	Lower body exercises	2 x 12	3 x 10	3 x 10	3 x 10	3 x 10
		Trunk exercises	2 x 10	3 x 10	3 x 10	3 x 10	3 x 12
3-4	0-49%	Sessions per week	2	2	2	2	2
		Upper body exercises	2 x 12	3 x 12	3 x 12	3 x 10	3 x 10
		Lower body exercises	2 x 12	3 x 12	3 x 12	3 x 10	3 x 10
		Trunk exercises	2 x 10	3 x 10	3 x 10	3 x 10	3 x 12
0-2	100%	Sessions per week	2	2	2	2	2
0-2	80-99%	Upper body exercises	2 x 12	2 x 12	3 x 12	3 x 12	3 x 10
0-2	50-79%	Lower body exercises	2 x 12	2 x 12	3 x 12	3 x 12	3 x 10
0	0-49%	Trunk exercises	2 x 8	2 x 10	3 x 10	3 x 10	3 x 10

Appendix 18. *ExerciseGuide* telehealth consult scripts (week 1 and week 4)

Telehealth Appointment: Week 1

Study: *ExerciseGuide*	Participant ID: __EG______________	Starting time: ____:____
Date: ___/____/___	Call completed by: ________________	End time: _______:____

Introduction (Exercise Physiologist):

Thank you for organising time to talk with us. My name is _____________. I will be your Exercise Physiologist over the next eight weeks. The aim of the call today is to discuss what you want to achieve by using ExerciseGuide, and for me to give you some guidance about how to use the program. I can also answer any questions you have about the website or exercise more generally. The call should take about 20 minutes, depending on how many questions you have. Does that sound okay?

Goal setting and needs:

1. What are you hoping to get out of doing the exercise guide program? *(goal setting)*
2. Why is that important to you?
3. What do you think you need to be able to do so you can achieve this?
4. Have you logged into the system yet?

For people who have <u>not</u> logged on:

1. Why have you not logged onto the system yet?
2. Do you need extra IT support (i.e., younger family members)?
3. *EP to explain how the website works and point towards important modules for them. For example:*
    a. *Education: Exercise Benefits (what benefits they can expect), Drive safely (what safety aspects should be considered).*
    b. *Behaviour change advice: Making it last.*
    c. *Exercise program: My exercise plan.*
    d. *An ask an expert button: Button where you can write to the ExerciseGuide team at any time and ask any questions you have.*
    e. *Tracking/recording: A place to record how you are going.*

For people who have logged on:

1. Do you need extra IT support (i.e., younger family members)?
2. Do you have any questions regarding the intervention?

Exercise programming:

1. Have you created an exercise program yet via the website?
    a. If yes:
        i. Do you have any questions about your resistance exercise prescription?
        ii. Do you have any questions about your aerobic exercise prescription?
        iii. Have you begun your exercise program? Why/Why not?
    b. If no:
        i. Why not? (Note: *If not interested, suggest reading the exercise benefits and drive safely model to help encourage)*

Exercise specific behavioural change questions:

1. Where are you planning to do your exercise? (Place/times/people)?
2. How confident are you about doing your exercise (aerobic and resistance)?
3. How do you think you will go with sticking to a regular exercise routine over the next month? *(link into barriers, facilitators, segue to "sticking with it module")*

Questions:

1. Do you have any questions for me?

Telehealth Appointment – Week 4

Study: ExerciseGuide Participant ID: __EG______________ Starting time: ____:_____

Date: ___/____/___ Call completed by: ________________ End time: ______:____

Current Aerobic Rx: ____

Current Resistance Rx: ____

Modules currently completed: Exercise plan 1 □ Exercise plan 2 □ Benefits □ Drive Safely □

Tracking □□□ Make it last □ Exercise+ □ Resources □

Introduction:

Thank you for organising time to talk with us. Today's session aims to touch base with you to see how you are going, discuss anything that may help or hinder your exercise, and answer any other questions you may have. We will have approximately 20 minutes for this appointment.

Goals:

1. You spoke about your goal being (see above). Is that/are they still your goal/s?
2. Do you think you are progressing towards achieving them? Why/why not?
3. Is there anything getting in the way of you achieving your goals (time, health, motivation)?
4. What aspects of the intervention are helping you achieve your goals?
5. Do you need any other support? *(Notes: Point them towards a module that they may not have looked at that may help them achieve their goal)*

Exercise:

1. How do you feel your exercise going? *(check tracking module)*
    a. If positively:
        i. How is your aerobic exercise going?
        ii. How is your resistance training going?
    b. If not as positive:
        i. Why?
        ii. What do you feel are the barriers/hurdles to getting stuck into your program?
            Note: You can go in to modify your exercise prescription at any time

        iii. Have you thought about what you could do to overcome these barriers/hurdles?
2. Where have you been doing your exercise?
3. Have you been filling in your exercise diary?
4. Have you opened the Exercise 2 module?
    a. If yes:
        i. Are the exercises challenging enough, or are there any that are too challenging?

Questions:

1. Do you have any questions for me?

Conclusion

Thank you for chatting with us. Don’t forget if you would like to know anything, please feel free to use the Ask an EP button

Appendix 19. Pilot RCT baseline questionnaire

EXERCISEGUIDE

Baseline Study Questionnaire

Please take your time completing the survey below. It may take between 30-45 minutes so feel free to grab a cup of tea/coffee.

If answering any of these questions causes distress, or highlight unaddressed issues for you please contact your GP. You can also call the Cancer Council on 13 11 20 to speak with a cancer nurse who can provide information and support to people with cancer and their families or Mental Health Line (available 24 hours a day on FREECALL 1800 011 511).

SECTION ONE – DEMOGRAPHIC INFORMATION

1. What is your date of birth? (DD/MM/YYYY) ______________________________

2. What is your current post code? ______________________________

3. What is your current marital status?

☐ Married

☐ De facto or living a with partner

☐ Single

☐ Widowed

☐ Separated or divorced

☐ Long-term relationship (not living together)

☐ New relationship (not living together)

☐ Prefer not to say

4. What is the highest level of education you completed?

☐ Primary School

☐ Secondary School

☐ Trade or TAFE

☐ University or other tertiary levels

☐ Post graduate study

☐ Other ______________________________

5. How would you describe your occupational status?

☐ Paid full time

☐ Paid part-time/causal

☐ Self-employed

☐ Retired

☐ Volunteer

☐ Not employed - looking for work

☐ Not employed - unable to work

☐ Household duties

6. How tall are you (cm)? ____________________

7. How much do you weigh (kg)? ____________________

SECTION TWO – HEALTH INFORMATION

This section is going to ask questions about your health and cancer treatment.

8. What year did you first get diagnosed with prostate cancer? ____________________

9. What stage of prostate cancer were you first diagnosed with?

☐ Stage 1: *Tumour is small has not spread outside the prostate (Gleason ≤ 6; PSA ≤10).*

☐ Stage 2A: *Tumour has not spread outside the prostate (Gleason ≤ 6; PSA between 10 & 20) or (Gleason score ≤7;PSA ≤20).*

☐ Stage 2B: *Tumour has not spread outside the prostate (Gleason score ≥8 or PSA level ≥ 20).*

☐ Stage 3: *Tumour has spread beyond outer layer of prostate and may have spread to the seminal vesicles, but not to nearby lymph nodes.*

☐ Stage 4: *The cancer has spread to nearby tissues or to distant parts of the body such as the bones.*

☐ I don’t know.

10. What year where you diagnosed with metastatic prostate cancer? ____

11. Please indicate what treatment you have had, currently having and/or have scheduled by ticking the boxes. Please leave blank if you have not?

Treatment type	I have previously had this treatment	I am currently having this treatment
Active Surveillance	☐ Yes; When _______________	☐ Yes
Surgery	☐ Yes; When _______________	☐ Yes
Radiotherapy	☐ Yes; When _______________	☐ Yes
Chemotherapy	☐ Yes; When _______________	☐ Yes
Hormone therapy (ADT)	☐ Yes; When _______________	☐ Yes
Other (please specify)	☐ Yes; What _______________ When ______________	☐ Yes

12. Do you have any new treatments scheduled? ☐ Yes ☐ No

Please Specify:

____

____

13. In addition to a history of a diagnosis of prostate cancer, are there other health conditions that affect you?

	No	Yes
Blood pressure (high or low)	☐	☐
Arthritis (osteo or rheumatoid)	☐	☐
Chronic Back Pain	☐	☐
Osteoporosis	☐	☐
Diabetes (type 1 and 2)	☐	☐
Cardiovascular Disease (heart disease, stroke etc.)	☐	☐
Kidney Disease	☐	☐
Lung Conditions (asthma, emphysema etc.)	☐	☐
Mental Health Conditions (depression, anxiety etc.)	☐	☐
Dementia	☐	☐
Visual Impairment (cataract disease, blindness etc.)	☐	☐
Hearing impairment (hard of hearing, hearing aids etc.)	☐	☐
Parkinson's or other neurological conditions (such as multiple sclerosis)	☐	☐
Stroke	☐	☐

14. Do you have any other health conditions that affect your ability to exercise besides those listed above? ☐ No ☐ Yes

Please Specify:

____

____

____

____

SECTION THREE - THOUGHTS AND ATTITUDES TOWARDS EXERCISE

The following section will ask questions about how you feel towards exercise.

Note:

- *Exercise is a physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective.*
- *Aerobic exercise typically involves larger muscle groups that are performed over extended periods to improve cardiovascular function. Examples of aerobic exercise include walking and cycling.*
- *Resistance exercise is a type of physical exercise involving the use of resistance to induce muscular contraction, which builds the strength, size of skeletal muscles and bone density.*

15. Please rate how confident you are that you can engage in aerobic (cardiovascular) exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐

You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

16. Please rate how confident you are that you can engage in resistance (strength) exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐
You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

17. Tell us if you agree or disagree regarding these statements about exercise: “Participating in regular exercise over the next 8 weeks will ... “

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Help me reduce tension or manage stress.	☐	☐	☐	☐	☐
Make me feel more confident about my health.	☐	☐	☐	☐	☐
Help me to sleep better.	☐	☐	☐	☐	☐
Give me a more positive outlook.	☐	☐	☐	☐	☐
Help me fight cancer.	☐	☐	☐	☐	☐
Take too much of my time.	☐	☐	☐	☐	☐
Make me tired.	☐	☐	☐	☐	☐
Cost too much money.	☐	☐	☐	☐	☐

18. We would like to know how <u>knowledgeable</u> you feel regarding exercise. Please rate your knowledge about the following things:

	Not at all	A little	Moderately	Fairly	Extremely
The <u>role of exercise</u> for managing prostate cancer symptoms	☐	☐	☐	☐	☐
<u>What types</u> of exercises are safe for you to do?	☐	☐	☐	☐	☐
<u>How much</u> exercise is safe for you to do?	☐	☐	☐	☐	☐

19. Which type of exercise or exercises do you think is likely to be most beneficial to your health? (pick only one)

☐ Aerobic (cardiovascular) exercise
☐ Resistance (strength) exercise
☐ Completing one would be just as effective as the other
☐ Completing a combination of both aerobic and strength would have the most benefit.

20a. Do you intend to participate in aerobic (cardio) activity over the next 8 weeks?

☐ Yes ☐ No

20b. Using a scale of 0 – 10, to what degree do you intend to perform <u>aerobic</u> exercise in the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

21a. Do you intend to participate in resistance (strength) activity over the next 8 weeks?

☐ Yes ☐ No

21b. Using a scale of 0 – 10, to what degree do you intend to perform <u>resistance</u> exercise over the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

This question is about your perception of social support for physical activity.

22. Over the next 8 weeks...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
People in your social network are likely to help you participate in regular physical activity (e.g. go for a walk together, give advice)	☐	☐	☐	☐	☐
Someone in your social network will provide the support you need in order to be regularly physically active (e.g. be accountable to, encouraging)	☐	☐	☐	☐	☐

We are interested in the underlying reasons that people might or might not engage in exercise. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise.

23. To what extent do you agree with the following statements:

	Strongly disagree			Neutral			Strongly agree
Exercise is something I do automatically	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without having to consciously remember	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without thinking	☐	☐	☐	☐	☐	☐	☐
Exercise is something I start	☐	☐	☐	☐	☐	☐	☐

doing before I realize I'm doing it

24. Using the scale below, please indicate to what extent each of the following items is true for you.

	Not true for me		Sometimes true for me		Very true for me
I exercise because other people say I should.	☐	☐	☐	☐	☐
I feel guilty when I don't exercise.	☐	☐	☐	☐	☐
I value the benefits of exercise.	☐	☐	☐	☐	☐
I exercise because it's fun.	☐	☐	☐	☐	☐
I don't see why I should have to exercise.	☐	☐	☐	☐	☐
I take part in exercise because of my friends/family/partner say I should.	☐	☐	☐	☐	☐
I feel ashamed when I miss an exercise session.	☐	☐	☐	☐	☐
It's important to me to exercise regularly.	☐	☐	☐	☐	☐
I can't see why I should bother exercising.	☐	☐	☐	☐	☐
I enjoy my exercise sessions.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐
I don't see the point in exercising.	☐	☐	☐	☐	☐

I feel like a failure when I haven't exercised in a while.	☐	☐	☐	☐	☐
I think it is important to make the effort to exercise regularly.	☐	☐	☐	☐	☐
I find exercise a pleasurable activity.	☐	☐	☐	☐	☐
I feel under pressure from my friends/family to exercise.	☐	☐	☐	☐	☐
I get restless if I don't exercise regularly.	☐	☐	☐	☐	☐
I get pleasure and satisfaction from participating in exercise.	☐	☐	☐	☐	☐
I think exercising is a waste of time.	☐	☐	☐	☐	☐

25. We would like to know about your experience with exercise?

	Not true for me		Sometimes true for me		Very true for me
I am experienced with resistance (strength) exercises (such as bodyweight exercises, weights etc)	☐	☐	☐	☐	☐
I am experienced with aerobic exercise (such as walking, cycling etc)	☐	☐	☐	☐	☐
I feel confident I will not fall over in the next 12 months	☐	☐	☐	☐	☐

SECTION FOUR - EXERCISE BEHAVIOUR

These next questions are going to ask you about your level of physical activity at the moment.

During a typical 7-day period (a week): How many times on average do you do the following kinds of exercise for more than 15 minutes at a time and if you average over 15 minutes per session, what your average session time is.

26a. Aerobic/Cardiovascular Activity

	Times per week	Estimated average minutes per session
Strenuous activity (heart beats rapidly, huffing and puffing) *Examples: running, jogging, football, soccer, fast cycling, vigorous swimming, climbing a long steep hill, vigorous gym classes*		
Example only: I swam fast pool laps	*1*	*15 minutes*
Moderate activity (could talk to someone, but couldn't sing) Examples: brisk walking, gentle hill climb, dancing, easy cycling, swimming,		
Example only: In this past month I did brisk walking	*3*	*25 mins per walk*
Mild physical activity (not a lot of effort needed, no sweat) Examples: gentle walking, bowling, fishing, lawn bowls		
Example only: In this past month I played bowls	*1*	*(1.5 hours) = 90 min*

26b. Strength/Resistance Activity

	Times per week	Estimate average minutes per session
How many times (on average) <u>per week</u> do you do the following types of activities in the <u>last month?</u> Examples: Strength or resistance training is a method of exercise used to improve your muscular strength (ie: push ups, dips, calve raises), free weights (medicine balls, dumb bells) or a weighted machine.		
Example only: I did leg lifts and arm lifts	*1*	*10 of each type. 2 times over.*
Please rate (on average) on a scale of 0-10, how hard you usually work out during your resistance exercise (over your whole session not per exercise)? 0 = no exertion, 5 = moderate exertion, 10 = maximal exertion		

SECTION FIVE – GENERAL HEALTH

We are interested in some things about you and your health. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

27. Please answer all of the questions yourself by selecting the number that best applies to you.

	Not at all	A little	Quite a bit	Very much
Do you have any trouble doing strenuous activities, like carrying a heavy shopping bag or a suitcase?	☐	☐	☐	☐

Do you have any trouble taking a long walk?	☐	☐	☐	☐
Do you have any trouble taking a short walk outside of the house?	☐	☐	☐	☐
Do you need to stay in bed or a chair during the day?	☐	☐	☐	☐
Do you need help with eating, dressing, washing yourself or using the toilet?	☐	☐	☐	☐

28a. During the past week…

	Not at all	A little	Quite a bit	Very much
Were you limited in doing either your work or other daily activities?	☐	☐	☐	☐
Were you limited in pursuing your hobbies or other leisure time activities?	☐	☐	☐	☐
Were you short of breath?	☐	☐	☐	☐
Have you had pain?	☐	☐	☐	☐
Did you need to rest?	☐	☐	☐	☐
Have you had trouble sleeping?	☐	☐	☐	☐
Have you felt weak?	☐	☐	☐	☐

28b. During the past week…

	Not at all	A little	Quite a bit	Very much
Have you lacked appetite?	☐	☐	☐	☐
Have you felt nauseated?	☐	☐	☐	☐
Have you vomited?	☐	☐	☐	☐
Have you been constipated?	☐	☐	☐	☐
Have you had diarrhoea?	☐	☐	☐	☐
Were you tired?	☐	☐	☐	☐
Did pain interfere with your daily activities?	☐	☐	☐	☐
Have you had difficulty in concentrating on things, like reading a newspaper or watching television?	☐	☐	☐	☐
Did you feel tense?	☐	☐	☐	☐
Did you worry?	☐	☐	☐	☐
Did you feel irritable?	☐	☐	☐	☐
Did you feel depressed?	☐	☐	☐	☐
Have you had difficulty remembering things?	☐	☐	☐	☐
Has your physical condition or medical treatment interfered with your FAMILY life?	☐	☐	☐	☐

Has your physical condition or medical treatment interfered with your SOCIAL activities?	☐	☐	☐	☐
Has your physical condition or medical treatment caused you financial difficulties?	☐	☐	☐	☐

29. For the following questions please circle the number between 1 and 7 that best applies to you

	Very Poor 1	2	3	4	5	6	Excellent 7
How would you rate your overall health during the past week?	☐	☐	☐	☐	☐	☐	☐
How would you rate your overall quality of life during the past week?	☐	☐	☐	☐	☐	☐	☐

30. Below is a list of statements that other people with your illness have said are important to assess. Please give one response per line to indicate your response as it applies to the past 7 days.

	Not at all	A little bit	Some-what	Quite a bit	Very much
I feel fatigued.	☐	☐	☐	☐	☐
I feel weak all over.	☐	☐	☐	☐	☐
I feel listless ("washed out").	☐	☐	☐	☐	☐
I feel tired.	☐	☐	☐	☐	☐
I have trouble starting things because I am tired.	☐	☐	☐	☐	☐

I have energy.	☐	☐	☐	☐	☐
I am able to do my usual activities.	☐	☐	☐	☐	☐
I need to sleep during the day.	☐	☐	☐	☐	☐
I am too tired to eat.	☐	☐	☐	☐	☐
I need help doing my usual activities.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐
I am frustrated by being too tired to do the things I want to do.	☐	☐	☐	☐	☐
I have to limit my social activity because I am tired.	☐	☐	☐	☐	☐

31. Please choose the box that best describes how you have been feeling in the past week. Don't take too long over your replies: Your immediate is best.

I feel tense of wound up.	☐ Most of the time ☐ A lot of the time ☐ From time to time, occasionally ☐ Not at all
I still enjoy the things I used to enjoy.	☐ Definitely as much ☐ Not quite so much ☐ Only a little ☐ Hardly at all
I get a sort of frightened feeling as if something awful is about to happen.	☐ Very definitely and quite badly ☐ Yes, but not too badly ☐ A little, but it doesn't worry me ☐ Not at all

I can laugh and see the funny side of things	☐ As much as I always could ☐ Not quite so much now ☐ Definitely not so much now ☐ Not at all
Worrying thoughts go through my mind.	☐ A great deal of the time ☐ A lot of the time ☐ From time to time but not often ☐ Only occasionally
I feel cheerful.	☐ Not at all ☐ Not often ☐ Sometimes ☐ Most of the time
I can sit at ease and feel relaxed.	☐ Definitely ☐ Usually ☐ Not often ☐ Not at all
I feel as if I am slowed down.	☐ Nearly all the time ☐ Very often ☐ Sometimes ☐ Not at all
I get a sort of frightened feeling like 'butterflies' in the stomach.	☐ Not at all ☐ Occasionally ☐ Quite often ☐ Very often

Cont.

I have lost interest in my appearance.	☐ Definitely ☐ I don't take as much care as I should

	☐ I may not take quite as much care ☐ I take just as much care as ever
I feel restless as I have to be on the move.	☐ Very much indeed ☐ Quite a lot ☐ Not very much ☐ Not at all
I look forward with enjoyment to things.	☐ As much as I ever did ☐ Rather less than I used to ☐ Definitely less that I used to ☐ Hardly at all
I get sudden feelings of panic.	☐ Very often indeed ☐ Quite often ☐ Not very often ☐ Not at all
I can enjoy a good book or radio or TV program.	☐ Often ☐ Sometimes ☐ Not often ☐ Very seldom

32. The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

During the past month, what time have you usually gone to bed at night? *Please note: Time is 24-hour format*	______________________________

During the past month, how long (in minutes) has it usually taken you to fall asleep each night?	____________________
During the past month, what time have you usually gotten up in the morning? *Please note: Time is 24-hour format*	____________________
During the past month, how many hours of actual sleep did you get at night? *Please note: This may be different than the number of hours you spent in bed.*	____________________

33. During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes.	☐	☐	☐	☐
Wake up in the middle of the night or early morning.	☐	☐	☐	☐
Have to get up to use the bathroom.	☐	☐	☐	☐
Cannot breathe comfortably.	☐	☐	☐	☐
Cough or snore loudly.	☐	☐	☐	☐

Feel too cold.	☐	☐	☐	☐
Feel too hot.	☐	☐	☐	☐
Have bad dreams.	☐	☐	☐	☐
Have pain.	☐	☐	☐	☐
Please list any other reasons for trouble sleeping over the last month: ______________________ ______________________				
During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	☐	☐	☐	☐
During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	☐	☐	☐	☐

34. Please answer the following questions regarding your sleep:

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	☐ No problem at all ☐ Only a very slight problem ☐ Somewhat of a problem ☐ A very big problem
During the past month, how would you rate your sleep quality overall?	☐ Very good ☐ Fairly good ☐ Fairly bad

	☐ Very bad
Do you have a bed partner or roommate?	☐ No bed partner or roommate ☐ Partner/roommate in other room ☐ Partner in the same room but not the same bed ☐ Partner in the same bed. ☐ Prefer not to say.

35. If you have a roommate or bed partner, ask him/her how often in the past month you have had:

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Loud snoring.	☐	☐	☐	☐
Long pauses between breaths while asleep.	☐	☐	☐	☐
Legs twitching or jerking while you sleep.	☐	☐	☐	☐
Episodes of disorientation or confusion during sleep.	☐	☐	☐	☐

Other restlessness while you sleep, please describe:

____

____

____

36. There are lots of different ways to design an online exercise program for men with metastatic prostate cancer. If you had a choice, what type of web-based program would you prefer?

☐ One that guides you through topics step-by-step and provides feedback as you go

☐ One that allows you to control what topics you access and when to receive feedback

37. If you had a choice, how much support you would prefer during a web-based exercise program?

☐ One I could complete completely independently.

☐ One that allows some supervision (distance-based) by health professionals.

Thanks for your patience filling out this information, we really appreciate it. A member of our research team will post you the objective assessment materials shortly.

If you had any questions regarding the questionnaire, please contact the project coordinator Ms Holly Evans on holly.evans@adelaide.edu.au or 08 8128 4043). If you have concerns or complaints, please contact the chief investigator, Dr Camille Short on: P +61 3 8344 1192; E: Camille.Short@unimelb.edu.au.

If answering any of these questions causes distress, or highlight unaddressed issues for you please contact your GP. You can also call Mental Health Line (available 24 hours a day on FREECALL 1800 011 511); or the Cancer Council on 13 11 20 to speak with a cancer

Appendix 20. Pilot RCT intervention group follow up questionnaire

EXERCISEGUIDE

Follow up Study Questionnaire

(EG_GROUP)

Thank you for agreeing to participate in our evaluation study of an online exercise guidance tool for men with metastatic prostate cancer. This survey will take approximately 30 minutes to complete. Please read the questions carefully and answer what is true for you. There are no right or wrong answers.

In this survey, we will ask you some similar questions to the initial survey you were sent as well as some questions about the program. If you need to take a break you can. Your answers will be saved and you can come back to complete the survey at any time.
If you have any questions regarding the questionnaire, please contact the project coordinator Ms Holly Evans on holly.evans@adelaide.edu.au or 08 8128 4043). If you have concerns or complaints, please contact the chief investigator, Dr Camille Short on: P +61 3 8344 1192; E: Camille.Short@unimelb.edu.au. If any of this information makes you uncomfortable, please talk to your doctor, or call the Cancer Council Help Line on 13 11 20 or Lifeline on 13 11 14 for support.

SECTION ONE - THOUGHTS AND ATTITUDES TOWARDS EXERCISE

The following section will ask questions about how you feel towards exercise.

Note:

- *Exercise is a physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective.*
- *Aerobic exercise typically involves larger muscle groups that are performed over extended periods to improve cardiovascular function. Examples of aerobic exercise include walking and cycling.*
- *Resistance exercise is a type of physical exercise involving the use of resistance to induce muscular contraction, which builds the strength, size of skeletal muscles and bone density.*

1. Please rate how confident you are that you can engage in aerobic (cardiovascular) exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐

You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

2. Please rate how <u>confident</u> you are that you can engage in <u>resistance (strength)</u> exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐
You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

3. Tell us if you agree or disagree regarding these statements about exercise:
“Participating in regular exercise over the next 8 weeks will ... “

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Help me reduce tension or manage stress.	☐	☐	☐	☐	☐
Make me feel more confident about my health.	☐	☐	☐	☐	☐
Help me to sleep better.	☐	☐	☐	☐	☐
Give me a more positive outlook.	☐	☐	☐	☐	☐
Help me fight cancer.	☐	☐	☐	☐	☐
Take too much of my time.	☐	☐	☐	☐	☐
Make me tired.	☐	☐	☐	☐	☐
Cost too much money.	☐	☐	☐	☐	☐

4. We would like to know how <u>knowledgeable</u> you feel regarding exercise. Please rate your knowledge about the following things:

	Not at all	A little	Moderately	Fairly	Extremely
The <u>role of exercise</u> for managing prostate cancer symptoms	☐	☐	☐	☐	☐
<u>What types</u> of exercises are safe for you to do?	☐	☐	☐	☐	☐
<u>How much</u> exercise is safe for you to do?	☐	☐	☐	☐	☐

5. Which type of exercise or exercises do you think is likely to be most beneficial to your health? (pick only one)

☐ Aerobic (cardiovascular) exercise

☐ Resistance (strength) exercise

☐ Completing one would be just as effective as the other

☐ Completing a combination of both aerobic and strength would have the most benefit.

6a. Do you intend to participate in aerobic (cardio) activity over the next 8 weeks?

☐ Yes ☐ No

6b. Using a scale of 0 – 10, to what degree do you intend to perform <u>aerobic</u> exercise in the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

7a. Do you intend to participate in resistance (strength) activity over the next 8 weeks?

☐ Yes ☐ No

7b. Using a scale of 0 – 10, to what degree do you intend to perform <u>resistance</u> exercise over the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

This question is about your perception of social support for physical activity.

8. Over the next 8 weeks...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

People in your social network are likely to help you participate in regular physical activity (e.g. go for a walk together, give advice)	☐	☐	☐	☐	☐
Someone in your social network will provide the support you need in order to be regularly physically active (e.g. be accountable to, encouraging)	☐	☐	☐	☐	☐

We are interested in the underlying reasons that people might or might not engage in exercise. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise.

9. To what extent do you agree with the following statements:

	Strongly disagree			Neutral			Strongly agree
Exercise is something I do automatically	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without having to consciously remember	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without thinking	☐	☐	☐	☐	☐	☐	☐
Exercise is something I start doing before I realize I'm doing it	☐	☐	☐	☐	☐	☐	☐

10. Using the scale below, please indicate to what extent each of the following items is true for you.

	Not true for me		Sometimes true for me		Very true for me
I exercise because other people say I should.	☐	☐	☐	☐	☐
I feel guilty when I don't exercise.	☐	☐	☐	☐	☐
I value the benefits of exercise.	☐	☐	☐	☐	☐
I exercise because it's fun.	☐	☐	☐	☐	☐
I don't see why I should have to exercise.	☐	☐	☐	☐	☐
I take part in exercise because of my friends/family/partner say I should.	☐	☐	☐	☐	☐
I feel ashamed when I miss an exercise session.	☐	☐	☐	☐	☐
It's important to me to exercise regularly.	☐	☐	☐	☐	☐
I can't see why I should bother exercising.	☐	☐	☐	☐	☐
I enjoy my exercise sessions.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐
I don't see the point in exercising.	☐	☐	☐	☐	☐
I feel like a failure when I haven't exercised in a while.	☐	☐	☐	☐	☐
I think it is important to make the effort to exercise regularly.	☐	☐	☐	☐	☐
I find exercise a pleasurable activity.	☐	☐	☐	☐	☐

I feel under pressure from my friends/family to exercise.	☐	☐	☐	☐	☐
I get restless if I don't exercise regularly.	☐	☐	☐	☐	☐
I get pleasure and satisfaction from participating in exercise.	☐	☐	☐	☐	☐
I think exercising is a waste of time.	☐	☐	☐	☐	☐

11. We would like to know about your experience with exercise?

	Not true for me		Sometimes true for me		Very true for me
I am experienced with resistance (strength) exercises (such as bodyweight exercises, weights etc)	☐	☐	☐	☐	☐
I am experienced with aerobic exercise (such as walking, cycling etc)	☐	☐	☐	☐	☐
I feel confident I will not fall over in the next 12 months	☐	☐	☐	☐	☐

SECTION TWO - EXERCISE BEHAVIOUR

These next questions are going to ask you about your level of physical activity at the moment.

During a typical 7-day period (a week): How many times on average do you do the following kinds of exercise for more than 15 minutes at a time and if you average over 15 minutes per session, what your average session time is.

12a. Aerobic/Cardiovascular Activity

	Times per week	Estimated average minutes per session
Strenuous activity (heart beats rapidly, huffing and puffing) *Examples: running, jogging, football, soccer, fast cycling, vigorous swimming, climbing a long steep hill, vigorous gym classes*		
Example only: I swam fast pool laps	*1*	*15 minutes*
Moderate activity (could talk to someone, but couldn't sing) Examples: brisk walking, gentle hill climb, dancing, easy cycling, swimming,		
Example only: In this past month I did brisk walking	*3*	*25 mins per walk*
Mild physical activity (not a lot of effort needed, no sweat) Examples: gentle walking, bowling, fishing, lawn bowls		
Example only: In this past month I played bowls	*1*	*(1.5 hours) = 90 min*

12b. Strength/Resistance Activity

	Times per week	Estimate average minutes per session
How many times (on average) <u>per week</u> do you do the following types of activities in the <u>last month?</u>		

Examples: Strength or resistance training is a method of exercise used to improve your muscular strength (ie: push ups, dips, calve raises), free weights (medicine balls, dumb bells) or a weighted machine.		
Example only: I did leg lifts and arm lifts	*1*	*10 of each type. 2 times over.*
Please rate (on average) on a scale of 0-10, how hard you usually work out during your resistance exercise (over your whole session not per exercise)? 0 = no exertion, 5 = moderate exertion, 10 = maximal exertion		

13a. Did you generate an exercise program using *ExerciseGuide*?

☐ Yes ☐ No

13b. If you answered no, please explain why?

____

____

____

14. Please rate how much you agree with the following statements below:

a. I have been doing my exercise program exactly as recommended by the Exercise Guide program (all the number of sessions and exercises). (Please mark your score with an X)

Strongly agree **Strongly disagree**

b. I have been doing all of the aerobic (cardiovascular) exercises I was asked to by exercise guide. (Please mark your score with an X)

Strongly agree **Strongly disagree**

c. I have been doing all of the resistance-based (strength) exercises I was asked to by exercise
guide. (Please mark your score with an X)

Strongly agree **Strongly disagree**

d. I felt confident in my ability to undertake the exercise program prescribed by Exercise Guide.
(Please mark your score with an X)

Strongly agree **Strongly disagree**

SECTION THREE – GENERAL HEALTH

We are interested in some things about you and your health. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

15. Please answer all of the questions yourself by selecting the number that best applies to you.

	Not at all	A little	Quite a bit	Very much
Do you have any trouble doing strenuous activities, like carrying a heavy shopping bag or a suitcase?	☐	☐	☐	☐
Do you have any trouble taking a long walk?	☐	☐	☐	☐

Do you have any trouble taking a short walk outside of the house?	☐	☐	☐	☐
Do you need to stay in bed or a chair during the day?	☐	☐	☐	☐
Do you need help with eating, dressing, washing yourself or using the toilet?	☐	☐	☐	☐

16a. During the past week…

	Not at all	A little	Quite a bit	Very much
Were you limited in doing either your work or other daily activities?	☐	☐	☐	☐
Were you limited in pursuing your hobbies or other leisure time activities?	☐	☐	☐	☐
Were you short of breath?	☐	☐	☐	☐
Have you had pain?	☐	☐	☐	☐
Did you need to rest?	☐	☐	☐	☐
Have you had trouble sleeping?	☐	☐	☐	☐
Have you felt weak?	☐	☐	☐	☐
Have you lacked appetite?	☐	☐	☐	☐
Have you felt nauseated?	☐	☐	☐	☐
Have you vomited?	☐	☐	☐	☐
Have you been constipated?	☐	☐	☐	☐
Have you had diarrhoea?	☐	☐	☐	☐

	Not at all	A little	Quite a bit	Very much
Were you tired?	☐	☐	☐	☐
Did pain interfere with your daily activities?	☐	☐	☐	☐
Have you had difficulty in concentrating on things, like reading a newspaper or watching television?	☐	☐	☐	☐
Did you feel tense?	☐	☐	☐	☐
Did you worry?	☐	☐	☐	☐
Did you feel irritable?	☐	☐	☐	☐
Did you feel depressed?	☐	☐	☐	☐
Have you had difficulty remembering things?	☐	☐	☐	☐
Has your physical condition or medical treatment interfered with your FAMILY life?	☐	☐	☐	☐
Has your physical condition or medical treatment interfered with your SOCIAL activities?	☐	☐	☐	☐
Has your physical condition or medical treatment caused you financial difficulties?	☐	☐	☐	☐

17. For the following questions please circle the number between 1 and 7 that best applies

	Very Poor					Excellent	
	1	2	3	4	5	6	7

How would you rate your overall health during the past week?	☐	☐	☐	☐	☐	☐	☐
How would you rate your overall quality of life during the past week?	☐	☐	☐	☐	☐	☐	☐

18. Below is a list of statements that other people with your illness have said are important. Please give one response per line to indicate your response as it applies to the past 7 days.

	Not at all	A little bit	Some-what	Quite a bit	Very much
I feel fatigued.	☐	☐	☐	☐	☐
I feel weak all over.	☐	☐	☐	☐	☐
I feel listless ("washed out").	☐	☐	☐	☐	☐
I feel tired.	☐	☐	☐	☐	☐
I have trouble starting things because I am tired.	☐	☐	☐	☐	☐
I have energy.	☐	☐	☐	☐	☐
I am able to do my usual activities.	☐	☐	☐	☐	☐
I need to sleep during the day.	☐	☐	☐	☐	☐
I am too tired to eat.	☐	☐	☐	☐	☐
I need help doing my usual activities.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐

I am frustrated by being too tired to do the things I want to do.	☐	☐	☐	☐	☐
I have to limit my social activity because I am tired.	☐	☐	☐	☐	☐

SECTION THREE – GENERAL HEALTH (continued)

19. Please choose the box that best describes how you have been feeling in the past week. Don't take too long over your replies: Your immediate is best.

I feel tense of wound up.	☐ Most of the time ☐ A lot of the time ☐ From time to time, occasionally ☐ Not at all
I still enjoy the things I used to enjoy.	☐ Definitely as much ☐ Not quite so much ☐ Only a little ☐ Hardly at all
I get a sort of frightened feeling as if something awful is about to happen.	☐ Very definitely and quite badly ☐ Yes, but not too badly ☐ A little, but it doesn't worry me ☐ Not at all
I can laugh and see the funny side of things	☐ As much as I always could ☐ Not quite so much now ☐ Definitely not so much now ☐ Not at all
Worrying thoughts go through my mind.	☐ A great deal of the time ☐ A lot of the time ☐ From time to time but not often ☐ Only occasionally

I feel cheerful.	☐ Not at all ☐ Not often ☐ Sometimes ☐ Most of the time
I can sit at ease and feel relaxed.	☐ Definitely ☐ Usually ☐ Not often ☐ Not at all
I feel as if I am slowed down.	☐ Nearly all the time ☐ Very often ☐ Sometimes ☐ Not at all
I get a sort of frightened feeling like 'butterflies' in the stomach.	☐ Not at all ☐ Occasionally ☐ Quite often ☐ Very often
I have lost interest in my appearance.	☐ Definitely ☐ I don't take as much care as I should ☐ I may not take quite as much care ☐ I take just as much care as ever
I feel restless as I have to be on the move.	☐ Very much indeed ☐ Quite a lot ☐ Not very much ☐ Not at all
I look forward with enjoyment to things.	☐ As much as I ever did ☐ Rather less than I used to ☐ Definitely less that I used to

	☐ Hardly at all
I get sudden feelings of panic.	☐ Very often indeed ☐ Quite often ☐ Not very often ☐ Not at all
I can enjoy a good book or radio or TV program.	☐ Often ☐ Sometimes ☐ Not often ☐ Very seldom

20. The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

a. During the past month, what time have you usually gone to bed at night? *Please note: Time is 24-hour format*	______________________
b. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?	______________________
c. During the past month, what time have you usually gotten up in the morning? *Please note: Time is 24-hour format*	______________________
d. During the past month, how many hours of actual sleep did you get at night? *Please note: This may be different than the number of hours you spent in bed.*	______________________

21. During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes.	☐	☐	☐	☐
Wake up in the middle of the night or early morning.	☐	☐	☐	☐
Have to get up to use the bathroom.	☐	☐	☐	☐
Cannot breathe comfortably.	☐	☐	☐	☐
Cough or snore loudly.	☐	☐	☐	☐
Feel too cold.	☐	☐	☐	☐
Feel too hot.	☐	☐	☐	☐
Have bad dreams.	☐	☐	☐	☐
Have pain.	☐	☐	☐	☐

Please list any other reasons for trouble sleeping over the last month:

____

____

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	☐	☐	☐	☐

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	☐	☐	☐	☐

22. Please answer the following questions regarding your sleep:

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	☐ No problem at all ☐ Only a very slight problem ☐ Somewhat of a problem ☐ A very big problem
During the past month, how would you rate your sleep quality overall?	☐ Very good ☐ Fairly good ☐ Fairly bad ☐ Very bad
Do you have a bed partner or roommate?	☐ No bed partner or roommate ☐ Partner/roommate in other room ☐ Partner in the same room but not the same bed ☐ Partner in the same bed. ☐ Prefer not to say.

23. If you have a roommate or bed partner, ask him/her how often in the past month you have had:

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Loud snoring.	☐	☐	☐	☐
Long pauses between breaths while asleep.	☐	☐	☐	☐
Legs twitching or jerking while you sleep.	☐	☐	☐	☐
Episodes of disorientation or confusion during sleep.	☐	☐	☐	☐

Other restlessness while you sleep, please describe:

____

____

24. Have you begun any treatments during the course of this study?

☐ No

☐ Yes - Radiotherapy

☐ Yes - Chemotherapy

☐ Yes - Hormone therapy

☐ Yes - Surgery

☐ Yes - Other

If you clicked other treatments, please describe:

____

____

____

SECTION FOUR – THOUGHTS AND ATTITUDES TOWARDS *EXERCISEGUIDE*

25. The following 8 questions are about your experience of the program that you have received from participating in the last 8 weeks.

How would you rate the quality of the exercise support you have received?	☐ Excellent ☐ Good ☐ Fair ☐ Poor
Did you get the kind of program you wanted?	☐ No, definitely ☐ No, not really ☐ Yes, generally ☐ Yes, definitely
To what extent has our program met your needs?	☐ Almost all my needs ☐ Most of my needs ☐ Only a few of my needs ☐ None
If a friend were in need of similar help, would you recommend our program to them?	☐ No, definitely ☐ No, not really ☐ Yes, generally ☐ Yes, definitely
How satisfied are you with the amount of help you have received?	☐ Quite dissatisfied ☐ Indifferent/mildly dissatisfied ☐ Mostly satisfied ☐ Very satisfied
Has the program you received helped you to deal more effectively with your problems?	☐ Yes, they helped a great deal ☐ Yes, they helped

	☐ No, they didn't really help ☐ No, they made things worse
In an overall, general sense, how satisfied are you with the program you have received?	☐ Quite dissatisfied ☐ Indifferent/mildly dissatisfied ☐ Mostly satisfied ☐ Very satisfied
If you were to seek help again, would you come back our program?	☐ No, definitely ☐ No, not really ☐ Yes, generally ☐ Yes, definitely

26. This questionnaire aims to find out how you view your exercise environment. Using the scale below, please indicate to what extent you disagree or agree with each of the following statements.

Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel. Your responses will be held in confidence and only used for our research purposes.

The Exercise Guide program and instructor(s) ....

	Strongly disagree 1	2	3	Neutral 4	5	6	Strongly agree 7
Take into account my individual needs.	☐	☐	☐	☐	☐	☐	☐
Give me good advice.	☐	☐	☐	☐	☐	☐	☐
Make time for me even though they are busy.	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree 1	2	3	Neutral 4	5	6	Strongly agree 7
Provide a range of activities.	☐	☐	☐	☐	☐	☐	☐
Make clear to me what I need to do to get results.	☐	☐	☐	☐	☐	☐	☐
Make me feel like I matter to them.	☐	☐	☐	☐	☐	☐	☐
Provide me with choices and options.	☐	☐	☐	☐	☐	☐	☐
Make clear what to expect from engaging in the activities	☐	☐	☐	☐	☐	☐	☐
Are concerned about my wellbeing.	☐	☐	☐	☐	☐	☐	☐
Encourage me to take my own initiative.	☐	☐	☐	☐	☐	☐	☐
Give me exercises that are suited to my level.	☐	☐	☐	☐	☐	☐	☐
Look after me well.	☐	☐	☐	☐	☐	☐	☐
Consider my personal needs.	☐	☐	☐	☐	☐	☐	☐
Help me to feel confident about exercising.	☐	☐	☐	☐	☐	☐	☐
Care about me.	☐	☐	☐	☐	☐	☐	☐

27. These questions are about if our online system was useable for you. Please answer the following questions about using the online program.

	Strongly Disagree 1		3		Strongly Agree 5
I think that I would like to use this website frequently.	☐	☐	☐	☐	☐
I found the website unnecessarily complex.	☐	☐	☐	☐	☐
I think that I would need the support of a technical person to be able to use this website.	☐	☐	☐	☐	☐
I found the various functions in the website were well integrated.	☐	☐	☐	☐	☐
I thought there was too much inconsistency in the website.	☐	☐	☐	☐	☐
I would imagine that most people would learn to use this system very quickly.	☐	☐	☐	☐	☐
I found the system very cumbersome to use.	☐	☐	☐	☐	☐
I felt very confident using the website.	☐	☐	☐	☐	☐
I needed to learn a lot of things before I could get going with the website.	☐	☐	☐	☐	☐
I liked the presentation and layout of the website, colours, content and images	☐	☐	☐	☐	☐
I experienced negative emotions when using the website	☐	☐	☐	☐	☐

28. This next section is about the relevance of the information provided to you in the program.

	Strongly disagree 1	2	3	Neither agree nor disagree 4	5	6	Strongly Agree 7
Was very relevant to me.	☐	☐	☐	☐	☐	☐	☐
Was very applicable.	☐	☐	☐	☐	☐	☐	☐
Seems like it was written for someone like me in mind.	☐	☐	☐	☐	☐	☐	☐

SECTION FIVE – FINAL THOUGHTS

This is the last section, thank you so much for completing this post-intervention survey. The purpose of this research is to develop and evaluate an online approach to supporting men with a history of prostate cancer engage in exercise.

Can you provide some feedback on the pros and cons of this program, and what we can do to improve programs in the future?

29. Were there any pros of the program? Please describe.

____

____

____

____

____

30. Were there any cons of the program? Please describe.

____

____

30. What could we do to improve the program in the future? Please describe.

32. Can we call you to obtain additional feedback over the phone if needed.

☐ Yes ☐ No

Thank you so much for your participation. We will send you a summary of the final results as soon as possible. If you had any questions regarding the questionnaire, please contact the project coordinator Ms Holly Evans on holly.evans@adelaide.edu.au or 08 8128 4043). If you have concerns or complaints, please contact the chief investigator, Dr Camille Short on: P +61 3 8344 1192; E: Camille.Short@unimelb.edu.au. If answering any of these questions causes distress, or highlight unaddressed issues for you please contact your GP. You can also call Mental Health Line (available 24 hours a day on FREECALL 1800 011 511); or the Cancer Council on 13 11 20 to speak with a cancer

Appendix 21. Pilot RCT wait-list control group follow up questionnaire

EXERCISEGUIDE

Follow up Study Questionnaire

(CON_GROUP)

Thank you for agreeing to participate in our evaluation study of an online exercise guidance tool for men with metastatic prostate cancer. This survey will take approximately 30 minutes to complete. Please read the questions carefully and answer what is true for you. There are no right or wrong answers.

In this survey, we will ask you some similar questions to the initial survey you were sent as well as some questions about the program. If you need to take a break you can. Your answers will be saved and you can come back to complete the survey at any time.

If you have any questions regarding the questionnaire, please contact the project coordinator Ms Holly Evans on holly.evans@adelaide.edu.au or 08 8128 4043). If you have concerns or complaints, please contact the chief investigator, Dr Camille Short on: P +61 3 8344 1192; E: Camille.Short@unimelb.edu.au. If any of this information makes you uncomfortable, please talk to your doctor, or call the Cancer Council Help Line on 13 11 20 or Lifeline on 13 11 14 for support.

SECTION ONE - THOUGHTS AND ATTITUDES TOWARDS EXERCISE

The following section will ask questions about how you feel towards exercise.

Note:

- *Exercise is a physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective.*
- *Aerobic exercise typically involves larger muscle groups that are performed over extended periods to improve cardiovascular function. Examples of aerobic exercise include walking and cycling.*
- *Resistance exercise is a type of physical exercise involving the use of resistance to induce muscular contraction, which builds the strength, size of skeletal muscles and bone density.*

1. Please rate how confident you are that you can engage in aerobic (cardiovascular) exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐

You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

2. Please rate how confident you are that you can engage in resistance (strength) exercise at least twice per week over the next 8 weeks when....

	Not very confident at all	Not really confident	Moderately confident	Fairly confident	Very confident
You are tired?	☐	☐	☐	☐	☐
You are in a bad mood or feeling depressed?	☐	☐	☐	☐	☐
Doing it by yourself?	☐	☐	☐	☐	☐
It becomes boring?	☐	☐	☐	☐	☐
No noticeable differences or improvements in health?	☐	☐	☐	☐	☐
You have other demands?	☐	☐	☐	☐	☐
You feel stiff or sore?	☐	☐	☐	☐	☐
There is bad weather?	☐	☐	☐	☐	☐
You have to get up early?	☐	☐	☐	☐	☐

3. Tell us if you agree or disagree regarding these statements about exercise: "Participating in regular exercise over the next 8 weeks will ... "

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Help me reduce tension or manage stress.	☐	☐	☐	☐	☐
Make me feel more confident about my health.	☐	☐	☐	☐	☐
Help me to sleep better.	☐	☐	☐	☐	☐
Give me a more positive outlook.	☐	☐	☐	☐	☐
Help me fight cancer.	☐	☐	☐	☐	☐
Take too much of my time.	☐	☐	☐	☐	☐
Make me tired.	☐	☐	☐	☐	☐
Cost too much money.	☐	☐	☐	☐	☐

4. We would like to know how knowledgeable you feel regarding exercise. Please rate your knowledge about the following things:

	Not at all	A little	Moderately	Fairly	Extremely
The role of exercise for managing prostate cancer symptoms	☐	☐	☐	☐	☐
What types of exercises are safe for you to do?	☐	☐	☐	☐	☐
How much exercise is safe for you to do?	☐	☐	☐	☐	☐

5. Which type of exercise or exercises do you think is likely to be most beneficial to your health? (pick only one)	☐ Aerobic (cardiovascular) exercise ☐ Resistance (strength) exercise ☐ Completing one would be just as effective as the other ☐ Completing a combination of both aerobic and strength would have the most benefit.

6a. Do you intend to participate in aerobic (cardio) activity over the next 8 weeks?

☐ Yes ☐ No

6b. Using a scale of 0 – 10, to what degree do you intend to perform aerobic exercise in the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

7a. Do you intend to participate in resistance (strength) activity over the next 8 weeks?

☐ Yes ☐ No

7b. Using a scale of 0 – 10, to what degree do you intend to perform resistance exercise over the next 8 weeks? (Please mark your score with an X)

0 1 2 3 4 5 6 7 8 9 10

This question is about your perception of social support for physical activity.

8. Over the next 8 weeks...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
People in your social network are likely to help you participate in regular physical activity (e.g. go for a walk together, give advice)	☐	☐	☐	☐	☐
Someone in your social network will provide the support you need in order to be regularly physically active (e.g. be accountable to, encouraging)	☐	☐	☐	☐	☐

We are interested in the underlying reasons that people might or might not engage in exercise. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise.

9. To what extent do you agree with the following statements:

	Strongly disagree			Neutral			Strongly agree
Exercise is something I do automatically	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without having to consciously remember	☐	☐	☐	☐	☐	☐	☐
Exercise is something I do without thinking	☐	☐	☐	☐	☐	☐	☐
Exercise is something I start	☐	☐	☐	☐	☐	☐	☐

doing before I realize I'm doing it					

10. Using the scale below, please indicate to what extent each of the following items is true for you.

	Not true for me		Sometimes true for me		Very true for me
I exercise because other people say I should.	☐	☐	☐	☐	☐
I feel guilty when I don't exercise.	☐	☐	☐	☐	☐
I value the benefits of exercise.	☐	☐	☐	☐	☐
I exercise because it's fun.	☐	☐	☐	☐	☐
I don't see why I should have to exercise.	☐	☐	☐	☐	☐
I take part in exercise because of my friends/family/partner say I should.	☐	☐	☐	☐	☐
I feel ashamed when I miss an exercise session.	☐	☐	☐	☐	☐
It's important to me to exercise regularly.	☐	☐	☐	☐	☐
I can't see why I should bother exercising.	☐	☐	☐	☐	☐
I enjoy my exercise sessions.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐

	Not true for me		Sometimes true for me		Very true for me
I don't see the point in exercising.	☐	☐	☐	☐	☐
I feel like a failure when I haven't exercised in a while.	☐	☐	☐	☐	☐
I think it is important to make the effort to exercise regularly.	☐	☐	☐	☐	☐
I find exercise a pleasurable activity.	☐	☐	☐	☐	☐
I feel under pressure from my friends/family to exercise.	☐	☐	☐	☐	☐
I get restless if I don't exercise regularly.	☐	☐	☐	☐	☐
I get pleasure and satisfaction from participating in exercise.	☐	☐	☐	☐	☐
I think exercising is a waste of time.	☐	☐	☐	☐	☐

11. We would like to know about your experience with exercise?

	Not true for me		Sometimes true for me		Very true for me
I am experienced with resistance (strength) exercises (such as bodyweight exercises, weights etc)	☐	☐	☐	☐	☐
I am experienced with aerobic exercise (such as walking, cycling etc)	☐	☐	☐	☐	☐

I feel confident I will not fall over in the next 12 months	☐	☐	☐	☐	☐

SECTION TWO - EXERCISE BEHAVIOUR

12a. Did you seek additional exercise support from a qualified exercise professional train in the area of exercise oncology over the last 8-weeks? (please note: additional support does not negatively influence the result of the study)

☐ Yes ☐ No

12b. If you answered yes: What professional did you seek out and why did you gain additional support?

____

____

____

____

____

These next questions are going to ask you about your level of physical activity at the moment.

During a typical 7-day period (a week): How many times on average do you do the following kinds of exercise for <u>more than 15 minutes</u> at a time and if you average over 15 minutes per session, what your average session time is.

13a. Aerobic/Cardiovascular Activity

	Times per week	Estimated average minutes per session

Strenuous activity (heart beats rapidly, huffing and puffing) *Examples: running, jogging, football, soccer, fast cycling, vigorous swimming, climbing a long steep hill, vigorous gym classes*		
Example only: I swam fast pool laps	*1*	*15 minutes*
Moderate activity (could talk to someone, but couldn't sing) Examples: brisk walking, gentle hill climb, dancing, easy cycling, swimming,		
Example only: In this past month I did brisk walking	*3*	*25 mins per walk*
Mild physical activity (not a lot of effort needed, no sweat) Examples: gentle walking, bowling, fishing, lawn bowls		
Example only: In this past month I played bowls	*1*	*(1.5 hours) = 90 min*

13b. Strength/Resistance Activity

	Times per week	Estimate average minutes per session
How many times (on average) <u>per week</u> do you do the following types of activities in the <u>last month?</u> Examples: Strength or resistance training is a method of exercise used to improve your muscular strength (ie: push ups, dips, calve raises), free weights (medicine balls, dumb bells) or a weighted machine.		

Example only: I did leg lifts and arm lifts	*1*	*10 of each type. 2 times over.*
Please rate (on average) on a scale of 0-10, how hard you usually work out during your resistance exercise (over your whole session not per exercise)? 0 = no exertion, 5 = moderate exertion, 10 = maximal exertion		

SECTION THREE – GENERAL HEALTH

We are interested in some things about you and your health. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

14. Please answer all of the questions yourself by selecting the number that best applies to you.

	Not at all	A little	Quite a bit	Very much
Do you have any trouble doing strenuous activities, like carrying a heavy shopping bag or a suitcase?	☐	☐	☐	☐
Do you have any trouble taking a long walk?	☐	☐	☐	☐
Do you have any trouble taking a short walk outside of the house?	☐	☐	☐	☐
Do you need to stay in bed or a chair during the day?	☐	☐	☐	☐
Do you need help with eating, dressing, washing yourself or using the toilet?	☐	☐	☐	☐

15a. During the past week…

	Not at all	A little	Quite a bit	Very much
Were you limited in doing either your work or other daily activities?	☐	☐	☐	☐
Were you limited in pursuing your hobbies or other leisure time activities?	☐	☐	☐	☐
Were you short of breath?	☐	☐	☐	☐
Have you had pain?	☐	☐	☐	☐
Did you need to rest?	☐	☐	☐	☐
Have you had trouble sleeping?	☐	☐	☐	☐
Have you felt weak?	☐	☐	☐	☐
Have you lacked appetite?	☐	☐	☐	☐
Have you felt nauseated?	☐	☐	☐	☐
Have you vomited?	☐	☐	☐	☐
Have you been constipated?	☐	☐	☐	☐
Have you had diarrhoea?	☐	☐	☐	☐
Were you tired?	☐	☐	☐	☐
Did pain interfere with your daily activities?	☐	☐	☐	☐
Have you had difficulty in concentrating on things, like reading a newspaper or watching television?	☐	☐	☐	☐
Did you feel tense?	☐	☐	☐	☐
Did you worry?	☐	☐	☐	☐
Did you feel irritable?	☐	☐	☐	☐
Did you feel depressed?	☐	☐	☐	☐

	Not at all	A little	Quite a bit	Very much
Have you had difficulty remembering things?	☐	☐	☐	☐
Has your physical condition or medical treatment interfered with your FAMILY life?	☐	☐	☐	☐
Has your physical condition or medical treatment interfered with your SOCIAL activities?	☐	☐	☐	☐
Has your physical condition or medical treatment caused you financial difficulties?	☐	☐	☐	☐

16. For the following questions please circle the number between 1 and 7 that best applies

	Very Poor 1	2	3	4	5	6	Excellent 7
How would you rate your overall health during the past week?	☐	☐	☐	☐	☐	☐	☐
How would you rate your overall quality of life during the past week?	☐	☐	☐	☐	☐	☐	☐

17. Below is a list of statements that other people with your illness have said are important. Please give one response per line to indicate your response as it applies to the past 7 days.

	Not at all	A little bit	Some-what	Quite a bit	Very much
I feel fatigued.	☐	☐	☐	☐	☐

I feel weak all over.	☐	☐	☐	☐	☐
I feel listless ("washed out").	☐	☐	☐	☐	☐
I feel tired.	☐	☐	☐	☐	☐
I have trouble starting things because I am tired.	☐	☐	☐	☐	☐
I have energy.	☐	☐	☐	☐	☐
I am able to do my usual activities.	☐	☐	☐	☐	☐
I need to sleep during the day.	☐	☐	☐	☐	☐
I am too tired to eat.	☐	☐	☐	☐	☐
I need help doing my usual activities.	☐	☐	☐	☐	☐
I exercise because others will not be pleased with me if I don't.	☐	☐	☐	☐	☐
I am frustrated by being too tired to do the things I want to do.	☐	☐	☐	☐	☐
I have to limit my social activity because I am tired.	☐	☐	☐	☐	☐

18. Please choose the box that best describes how you have been feeling in the past week. Don't take too long over your replies: Your immediate is best.

I feel tense of wound up.	☐ Most of the time ☐ A lot of the time ☐ From time to time, occasionally ☐ Not at all
I still enjoy the things I used to enjoy.	☐ Definitely as much ☐ Not quite so much ☐ Only a little ☐ Hardly at all
I get a sort of frightened feeling as if something awful is about to happen.	☐ Very definitely and quite badly ☐ Yes, but not too badly ☐ A little, but it doesn't worry me ☐ Not at all
I can laugh and see the funny side of things	☐ As much as I always could ☐ Not quite so much now ☐ Definitely not so much now ☐ Not at all
Worrying thoughts go through my mind.	☐ A great deal of the time ☐ A lot of the time ☐ From time to time but not often ☐ Only occasionally
I feel cheerful.	☐ Not at all ☐ Not often ☐ Sometimes ☐ Most of the time
I can sit at ease and feel relaxed.	☐ Definitely ☐ Usually ☐ Not often

	☐ Not at all
I feel as if I am slowed down.	☐ Nearly all the time ☐ Very often ☐ Sometimes ☐ Not at all
I get a sort of frightened feeling like 'butterflies' in the stomach.	☐ Not at all ☐ Occasionally ☐ Quite often ☐ Very often
I have lost interest in my appearance.	☐ Definitely ☐ I don't take as much care as I should ☐ I may not take quite as much care ☐ I take just as much care as ever
I feel restless as I have to be on the move.	☐ Very much indeed ☐ Quite a lot ☐ Not very much ☐ Not at all
I look forward with enjoyment to things.	☐ As much as I ever did ☐ Rather less than I used to ☐ Definitely less that I used to ☐ Hardly at all
I get sudden feelings of panic.	☐ Very often indeed ☐ Quite often ☐ Not very often ☐ Not at all

I can enjoy a good book or radio or TV program.	☐ Often ☐ Sometimes ☐ Not often ☐ Very seldom

19. The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

a. During the past month, what time have you usually gone to bed at night? *Please note: Time is 24-hour format*	______________________
b. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?	______________________
c. During the past month, what time have you usually gotten up in the morning? *Please note: Time is 24-hour format*	______________________
d. During the past month, how many hours of actual sleep did you get at night? *Please note: This may be different than the number of hours you spent in bed.*	______________________

20. During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes.	☐	☐	☐	☐
Wake up in the middle of the night or early morning.	☐	☐	☐	☐
Have to get up to use the bathroom.	☐	☐	☐	☐
Cannot breathe comfortably.	☐	☐	☐	☐
Cough or snore loudly.	☐	☐	☐	☐
Feel too cold.	☐	☐	☐	☐
Feel too hot.	☐	☐	☐	☐
Have bad dreams.	☐	☐	☐	☐
Have pain.	☐	☐	☐	☐

Please list any other reasons for trouble sleeping over the last month:

____

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	☐	☐	☐	☐
During the past month, how often have you had trouble staying awake while driving, eating	☐	☐	☐	☐

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
meals, or engaging in social activity?				

21. Please answer the following questions regarding your sleep:

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	☐ No problem at all ☐ Only a very slight problem ☐ Somewhat of a problem ☐ A very big problem
During the past month, how would you rate your sleep quality overall?	☐ Very good ☐ Fairly good ☐ Fairly bad ☐ Very bad
Do you have a bed partner or roommate?	☐ No bed partner or roommate ☐ Partner/roommate in other room ☐ Partner in the same room but not the same bed ☐ Partner in the same bed. ☐ Prefer not to say.

22. If you have a roommate or bed partner, ask him/her how often in the past month you have had:

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week

Loud snoring.	☐	☐	☐	☐
Long pauses between breaths while asleep.	☐	☐	☐	☐
Legs twitching or jerking while you sleep.	☐	☐	☐	☐
Episodes of disorientation or confusion during sleep.	☐	☐	☐	☐

Other restlessness while you sleep, please describe:

____

____

24. Have you begun any treatments during the course of this study?

☐ No

☐ Yes - Radiotherapy

☐ Yes - Chemotherapy

☐ Yes - Hormone therapy

☐ Yes - Surgery

☐ Yes - Other

If you clicked other treatments, please describe:

____

____

____

Thank you so much for your participation. We will send you a summary of the final results as soon as possible. If you had any questions regarding the questionnaire, please contact the project coordinator Ms Holly Evans on holly.evans@adelaide.edu.au or 08 8128 4043). If you have concerns or complaints, please contact the chief investigator, Dr Camille Short on: P +61 3 8344 1192; E: Camille.Short@unimelb.edu.au. If answering any of these questions causes distress, or highlight unaddressed issues for you please contact your GP. You can also call Mental Health Line (available 24 hours a day on FREECALL 1800 011 511); or the Cancer Council on 13 11 20 to speak with a cancer

Appendix 22. Patient information request form

Patient Information Request Form (page 1 of 2)

Dear Doctor,

Your patient is interested in participating in our research project, which aims to pilot test an online exercise guidance tool for men with metastatic prostate cancer. We have already developed safe face-to-face programs and demonstrated their efficacy for improving physical functioning and quality of life among men with metastatic prostate cancer (Galvao et al, 2011, BMC Cancer, 11(1); Cormie et al, 2013, Prostate Cancer Prostatic Dis, 16(4)). We have also tested the safety and usability of the guidance tool in a lab-based setting at the University of Adelaide (approval number H-2017-174). The aim of the website is to provide evidence-based information and advice to those unable to or uninterested in attending face-to-face sessions.

Participants will be randomized to receive access to either our online tool or usual care. The online tool will recommend resistance-training exercises to users based on the location of their metastases and other important health and personal considerations. Video demonstrations will be used to demonstrate appropriate exercise techniques, and participants will be able to seek advice from an accredited exercise physiologist via the telephone or videoconferencing. The online tool will also provide advice and support to build and stick with an exercise routine. The study period will last for approximately 10 weeks. At the end of this period those allocated to the usual care condition will be given access to the guidance tool. There may be no direct benefit to your patient, though all participants will receive evidence-based exercise advice and be reimbursed for the time taken to complete assessments.

To be eligible, participants must have their Physician's (General Practitioners, Medical Oncologists, Radiation Oncologists or Urologists) approval, and provide physician supplied information about their last PSA test and location of metastases. This information will help us to tailor the exercise advice provided. Prior to providing approval, please consider if your patient has contraindications to performing moderate physical activity for at least 20 minutes, up to two days of the week. This can be completed in blocks of 5-10 minutes. Participants with contraindications will not be eligible to participate. Please complete the appended form if you give approval for your patient to participate. If you have any concerns, please do not hesitate to contact me.

Kind regards,

Camille Short
Senior Research Fellow University of Melbourne
Email: camille.short@unimelb.edu.au Phone: 03 83441192

On behalf of the research team.
The project is being conducted by researchers in exercise, behavioural and medical science from various institutions across Australia. This includes researchers from the University of Adelaide, The Exercise Medicine Research Institute at Edith Cowan University, CQUniversity, The Flinders Centre for Cancer Innovation and the NHMRC Centre for Research Excellence in Prostate Cancer Survivorship. The study team includes an experienced urologist (Nicholas Brook), medical oncologist (Ganessan Kichenadasse), and exercise physiologist (Daniel Galvao). The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2018-153).

Patient Information Request Form (page 2 of 2)

Patient Name: ___________________________________

Date of last PSA test ______________ (dd/mm/yyyy)

PSA value at last test ______________ ng/ml

Frequency of PSA tests Every ________ Months

PSA history last 6 months PSA is: ☐ relatively stable / ☐ steadily increasing / ☐ declining

Date of last PSMA/bone scan ______________ (dd/mm/yyyy)

Known Metastases

Please indicate all applicable metastases locations and make comments regarding lesions if necessary. The patients will be using the form to help correctly report metastases in the online tool.

Location	Yes	Comments
Cervical spine	☐	
Clavicle	☐	
Scapula	☐	
Humerus	☐	
Ribcage/sternum	☐	
Thoracic spine	☐	
Lumbar spine	☐	
Sacrum	☐	
Pelvis	☐	
Femur	☐	
Other (please list):		

Current treatments/medications (please list): ___________________________________

____

____

Contraindications to exercise:

To the best of my knowledge, the above-named patient has no contraindications to participating in appropriately prescribed moderate exercise. Including, but not limited to serious cardiovascular events within the last 12 months (such as transient ischemic attack, cerebrovascular accident or myocardial infarction), acute pulmonary embolus/infarction, acute myocarditis or pericarditis, aneurysm, acute infection or unstable bone metastases.

☐ No known contraindications ☐ Contraindications to exercise

Physician Name:____________________ **Physician Signature:** ___________________ **Date:** ____________

Please return this form to:
Ms Holly Evans (Project Coordinator)
Email: holly.evans@adelaide.edu.au
Address: Freemasons Foundation Centre for Men's Health,
The University of Adelaide
PO Box 1046, Gilles Plains, SA 5086

DR STAMP HERE

Appendix 23. *ExerciseGuide* RCT information sheet and consent form

Participant Information Sheet/Consent Form

Health/Social Science Research

Title	*Delivering a tailored evidence-based exercise intervention to support men with metastatic prostate cancer: A pilot randomised control trial*
Protocol Number	*150.20*
Project Sponsor	*University of Adelaide*
Principal Investigator	*Dr Camille Short*
Location	*Southern Adelaide Local Health Network (Flinders Medical Centre / SA-PCCOC)*

Part 1 What does my participation involve?

1 Introduction

You are invited to take part in this research project, which is called "Delivering a tailored evidence-based exercise intervention to support men with metastatic prostate cancer". This Participant Information Sheet/Consent Form tells you about the research project. It explains the processes involved in taking part. Knowing what is involved will help you decide if you want to take part in the research.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not to take part, you might want to talk about it with a relative, friend or local health worker. Participation in this research is voluntary. If you don't wish to take part, you don't have to.

If you decide you want to take part in the research project, you will be asked to sign the consent section. By signing it, you are telling us that you:

- Understand what you have read
- Consent to take part in the research project
- Consent to be involved in the research described
- Consent to the use of your personal and health information as described.

You will be given a copy of this Participant Information and Consent Form to keep.

2 What is the purpose of this research?

We are seeking to evaluate whether a web-based tool designed to help men with metastatic prostate cancer participate in regular health-enhancing exercise is acceptable and effective.

Exercise is a promising activity to improve the mental and physical well-being of men with metastatic prostate cancer. Recent clinical trials in this population have demonstrated that individually tailored exercise interventions can improve clinically meaningful outcomes such as physical functioning, quality of life and symptom distress. However, given the complexity of this population, expert exercise advice is a necessity to ensure treatment efficacy without exacerbating health issues.

Whilst face-to-face interventions are the gold standard in this population. In many cases, face-to-face interventions can be hard to access on an ongoing basis. Many men may not live locally to these interventions, or maybe too ill, lack finances or not wish to partake in face-to-face options. Given the benefits of exercise in this population, it is imperative to develop ways to address these barriers.

The lead researcher, Dr Camille Short, is a behavioural scientist and Senior Research Fellow working within the Melbourne School of Health and Psychological Sciences at the University of Melbourne. She holds an affiliate position at the University of Adelaide, the Peter MacCallum Cancer Centre and the Centre for Research Excellence in Prostate Cancer Survivorship. The project is funded by a Below the Belt Fund research grant and will form part of Holly Evans' doctorate of philosophy research at the University of Adelaide. All investigators are listed at the end of this sheet.

3 What does participation in this research involve?

i. After reading the information in this sheet, the next step will be to complete the screening questionnaire (approximately five minutes in duration), which can be found on the Exercise Guide website (www.exerciseguide.org.au), which will determine your eligibility. To be eligible, you must:
   - Be living with metastatic prostate cancer.
   - Have no reason why you cannot perform moderate exercise (resistance and aerobic) for at least 20 minutes, up to two days of the week. This can be completed in blocks of 5-10 minutes at a time.
   - Not already be meeting the resistance-training guidelines for cancer survivors (2 sessions per week) and not already completing 60 minutes of structured moderate-vigorous aerobic activity. You can be meeting one of these cut-points but not both.
   - Have no severe bone pain.
   - Be able to read and write in English.
   - Have access to the internet.

- Provide consent and information form your physician (General Practitioner, Medical Oncologist, Radiation Oncologist or Urologist) detailing the extent and location of metastases as well as any significant medical conditions.

ii. If eligible, you will be asked to register with the website, and a private account will be made for you. A study investigator will follow-up with you to confirm eligibility and provide additional instructions. You will be asked to sign a consent form.

iii. At this stage, you will be asked to obtain clearance from your physician (General Practitioner, Medical Oncologist, Radiation Oncologist or Urologist) to participate and have them complete a study form providing details of your diagnosis and treatment.

iv. Once your enrolment in the study has been confirmed, you will be asked to complete a detailed initial assessment. This will involve wearing an activity monitor for a week and completing an online survey. The activity monitor will be mailed to you with instructions, and a reply-paid envelope.

v. If you are located close to an available testing site (the University of Adelaide, the University of South Australia, and the University of Melbourne), you will be invited to complete sub-group physical testing. Testing includes a walk test, an agility test and up to three strength tests. Participants with femur bone lesions will be excluded from the lower body strength testing. Participants with rib, thoracic spine lesions and or humerus lesions will be excluded from the upper body testing.

vi. After the assessments are complete, you will be randomly split into one of two groups. One that receives access to the online exercise guidance tool straight away, or one that receives access at the end of the first eight weeks (after another assessment). You will not be able to choose which group you are allocated to. However, participants in both groups will be given access to the websites for eight weeks and supported to engage in health-enhancing exercise during that time. In addition to the website, you will be able to speak to an accredited exercise physiologist as part of the exercise program.

vii. The second assessment will commence in the 9th week of the study. For this assessment, you will be asked to repeat the assessments you completed at baseline. If you are allocated to the group that receives immediate access to the tool, you will also be asked about your views on the usefulness of the tool. You will also be invited to provide additional feedback over the phone.

This research project has been designed to make sure the researchers interpret the results fairly and appropriately and avoids study doctors or participants jumping to conclusions. There are no costs associated with participating in this research project. To compensate you for your time, you will receive a $25 voucher for each assessment segment you complete. There are two possible segments at the beginning of the study: (1) The initial assessment (inclusive of the survey and physical activity monitoring) and (2) the physical functioning (sub-group) testing. There are three possible assessments at the end of the study: (1) The final survey and activity monitoring, (2) the physical functioning (sub-group) testing and (3) the feedback interview.

4 Other relevant information about the research project

The project is being conducted by researchers in behavioural, exercise and medical science from various institutes across Australia. Our team includes experienced researchers from The University of Melbourne, The University of Adelaide, The Exercise Medicine Research Institute at Edith Cowan University, CQUniversity, and the NHMRC Centre for Research Excellence in Prostate Cancer Survivorship.

5 Do I have to take part in this research project?

Participation in any research project is voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. If you do decide to take part, you will be given this Participant Information and Consent Form to sign, and you will be given a copy to keep. Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine care, your relationship with professional staff or your relationship with the University of Adelaide, the Flinders Medical Centre and the South Australian Prostate Cancer Clinical Outcomes Collaborative.

6 What are the possible benefits of taking part?

We cannot guarantee or promise that you will receive any benefits from this research; however, the individualised exercise information you will receive will be evidence-based and tailored based on your capabilities and needs. You may increase your knowledge and skills and maybe more motivated to participate in exercise. The overarching aim of this research is to evaluate the potential of our online program for supporting men with metastatic prostate cancer to optimise their exercise routine. Your participation may help us, and others to ensure high-quality online support is available in the future.

7 What are the possible risks and disadvantages of taking part?

There is a small risk of physical harm or injury. The exercise promoted in our program has been shown to be safe in previous research and is in line with national guidelines. As with any physical activity, some participants may experience some muscle pain or soreness as a result of becoming more active and there is also an increased risk of bone pain, cardiac events, falls or fainting. For these reasons, your GP should monitor your health during the study. You may also experience some emotional discomfort when completing study questionnaires about your health and well-being. If any issues do arise with your physical or mental health please contact our research co-ordinator, Holly Evans (+61 81284043 81284043 or holly.evans@adelaide.edu.au) as soon as possible. The research team will assist you to find appropriate support services. Contacting the research team if issues arise will also help us to address any safety issues with the program, which is an important part of our evaluation. You may also find talking to your GP or contacting telephone support services helpful. You can call the Cancer Council Help Line on 13 11 20 or the Mental Health Line (available 24 hours a day on FREECALL 1800 011 511). *In the case of an emergency please call 000 and inform the research team at your earliest convenience.*

Lastly, we would like you to be aware that your website usage will be monitored to track engagement with the program. Features monitored will include (but are not limited to): number of logins, time on website, pages visited, and number of library articles read. This information will be combined with other users' data to help us understand how the website is used by participants and to guide quality improvement. Your coach may also check to see if you have generated your exercise program before your phone call together. This will help them to guide their discussion with you.

8 What if I withdraw from this research project?

If you do consent to participate, you may withdraw at any time. If you decide to withdraw from the project, please notify a member of the research team before you withdraw. A member of the research team will inform you if there are any special requirements linked to withdrawing. If you do withdraw, you will be asked to complete and sign a 'Withdrawal of Consent' form; this will be provided to you by the research team.

If you decide to leave the research project, the researchers will not collect additional personal information from you. However, personal information already collected will be retained to ensure that the results of the research project can be measured properly and to comply with the law. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want your data to be included, you must tell the researchers when you withdraw from the research project.

9 Could this research project be stopped unexpectedly?

This research project may be stopped unexpectedly for a variety of reasons. These may include reasons such as difficulty recruiting individuals to participate, or the exercise program is shown to have unexpected risks.

10 What happens when the research project ends?

As researchers invested in improving health services for men with prostate cancer, it is important to us that our tool is thoroughly tested before making it publicly available. This is to ensure it is both safe and effective before promoting it to patients. As such, access to the website may be restricted at the end of the study for research or quality improvement purposes. We will send all participants a brief summary of our study findings as well as our plans for the website at the end of the study.

Part 2 How is the research project being conducted?

11 What will happen to information about me?

By signing the consent form, you consent to the research team collecting and using personal information about you for the research project. Any information obtained in connection with this research project that can identify you will remain confidential. All information will be stored on a University of Adelaide password-protected network drive for five years. De-identified research outputs, including figures and datasets, will be stored on Figshare, which is an online open-access archive. The archive aims to preserve and share data for future research. As other researchers may have access to this data, your privacy will be protected by being provided with an ID number at the start of the study. This ID number will be used to identify you and link your data rather than your real name. No identifying information will ever be published about you. All data, except for interview data, will be published and discussed in an aggregate format only (e.g., the average increase in physical activity across all participants). For interview data, individual quotes (e.g., relating to what people like and do not like about the tool) may be published. However, all identifying information (e.g., names of places or people) will be removed. Your information will only be used for the purpose of this research project, and it will only be disclosed with your permission, except as required by law.

In accordance with relevant Australian and/or South Australian privacy and other relevant laws, you have the right to request access to the information about you that is collected and stored by the research team. You also have the right to request that any information with which you disagree be corrected. Please inform the research team member named at the end of this document if you would like to access your information.

12 Complaints and compensation.

If you have questions or problems associated with the practical aspects of your participation in the project or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator, Dr Camille Short on +61 3 8344 1192 or Camille.Short@unimelb.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome. If you suffer any distress or injury as a result of this research project, you should contact the research team as soon as possible.

13 Who is organising and funding the research?

This research project is being conducted by Dr Camille Short and funded by the Australian and New Zealand Urogenital and Prostate Cancer Trials Group "Below the Belt" grant. You will not benefit financially from your involvement in this research project even if, for example, knowledge acquired from your information proves to be of commercial value to the University of Adelaide. No member of the research team will receive a personal financial benefit from your involvement in this research project (other than their ordinary wages).

14 Who has reviewed the research project?

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the HREC of The University of Adelaide and Southern Adelaide Local Health Network. This project will be carried out according to the *National Statement on Ethical Conduct in Human Research (2007)*. This statement has been developed to protect the interests of people who agree to participate in human research studies.

15 Further information and who to contact

The person you may need to contact will depend on the nature of your query. If you want any further information concerning this project or if you have any problems which may be related to your involvement in the project, you can contact any of the following people:

Research contact person

Name	Holly Evans
Position	Project Coordinator / PhD Candidate
Telephone	+61 8 8128 4043
Email	Holly.evans@adelaide.edu.au

For matters relating to research at the site at which you are participating, the details of the local site complaints person are:

Complaints contact person

Position	Director, Office for Research
Telephone	8204 6453
Email	Health:SALHNofficeforresearch@sa.gov.au

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about being a research participant in general, then you may contact:

Reviewing HREC approving this research and HREC Executive Officer details

Reviewing HREC name	Southern Adelaide Clinical HREC
HREC Executive Officer	Executive Officer
Telephone	8204 6453
Email	Health:SALHNofficeforresearch@sa.gov.au

Local HREC Office contact

Position	Research Governance Officer
Telephone	8204 6453
Email	Health:SALHNofficeforresearch@sa.gov.au

Consent Form

Title	*Delivering a tailored evidence-based exercise intervention to support men with metastatic prostate cancer: A pilot randomised control trial*
Protocol Number	*150.20*
Project Sponsor	*The University of Adelaide*
Principal Investigator	*Dr Camille Short*
Location	*Southern Adelaide Local Health Network*

Declaration by Participant

I have read the Participant Information Sheet, or someone has read it to me in a language that I understand.

I understand the purposes, procedures and risks of the research described in the project. I have had the opportunity to ask questions, and I am satisfied with the answers I have received.

I have been informed that, while information gained during the study may be published, I will not be identified, and my personal results will not be divulged.

I have been informed that the data from the study will be stored on Figshare and may be made publicly available in a de-identified format. I understand that this is to promote research transparency and extend the benefit gained from collecting the data.

I understand that I require approval from my physician to participate and will gain this approval prior to the start of the trial.

I agree to the interview being audio recorded.

I freely agree to participate in this research project as described and understand that I am free to withdraw at any time during the project without affecting my future care.

I understand that I will be given a signed copy of this document to keep.

Name of Participant (please print) ______________________________

Signature ______________________ Date ______________

Declaration by Researcher†

I have given a verbal explanation of the research project, its procedures and risks, and I believe that the participant has understood that explanation.

Name of Researcher† (please print) ______________________	
Signature ______________________	Date ______________

† An appropriately qualified member of the research team must provide the explanation of and information concerning the research project.

Note: All parties signing the consent section must date their own signature.

Appendix 24. Getting started module questions and example of feedback

//Getting started: Introduction text

Welcome to Exercise Guide.

Exercise is an impressive drug that can provide a wide array of physical and psychological benefits for men with metastatic prostate cancer. However, sometimes it is hard to know what safe and effective. The aim of the Exercise Guide program is to give you reliable and effective exercise advice. You can think of the program as a compass - you can use it as you like, when you like, to get to where you want to go.

Where do I start?

Read through the information on this page and answer the questions asked. This will begin the process of tailoring the information to suit you, Then please click "next" on the bottom right of your screen. There will be some more information for you to read through. When you are done, you can click finish and go back to the home page. If you are not very comfortable using computers, please click on the "taking the tour" video below to help you navigate this module or you can always ask someone to help you navigate the website. To watch the video in full-screen mode, please click the square (the last icon on the bottom right of the video) and to exit, please click the same button again. Once finished, you will notice there will be eight modules for you to investigate in your own time, in whatever order you want.

In each module, the information is tailored to your needs by a series of questions at the start of each module, you only need to do this once. You can log in and read the information as many times as you like. If you need to change your answers, just click the "want to make some changes" text at the bottom of the module box.

We also have a library full of extra information for you to view if it interests you.

Some questions to get started

To ensure the program is tailored to you, we will need you to answer some questions in each module. Let's start with the information regarding any metastases you may have been diagnosed with. If you are not sure, please refer to the document you physician has filled in.

//Getting started - Computer tailoring questions (collected here for use in multiple module tailoring)

1. **Have you been diagnosed with metastases in your bones?** O No O Yes

2. **Have you been diagnosed with bone metastases in any of the following locations?** *Note: If you are unsure of your exact metastases' location, please refer to the doctors note for confirmation.*
    a. Your neck bones (Cervical Spine C1-C7)? O No O Yes
    b. Your collarbone (Clavicle)? O No O Yes
    c. Your shoulder blades (Scapula)? O No O Yes
    d. Your upper arm bones (Humerus)? O No O Yes
    e. The bones in the middle section of your spine running from base of the neck down to the abdomen (Thoracic Spine T1-T12)? O No O Yes
    f. Your rib cage? O No O Yes
    g. Your sternum? O No O Yes
    h. The bones of the lower spine running from the bottom of your rib cage to your coccxyc (Lumbar Spine L1-L5)? O No O Yes
    i. The triangular bone in the lower back situated between the two hip bones of the pelvis (Sacrum)? O No O Yes
    j. Your hip bones (Pelvis)? O No O Yes
    k. Your upper leg bones (Femur)? O No O Yes
    l. Your lower leg bones (Tibia or fibula)? O No O Yes
    m. Other metastases not listed? O No O Yes

    Thank you for answering our questions.

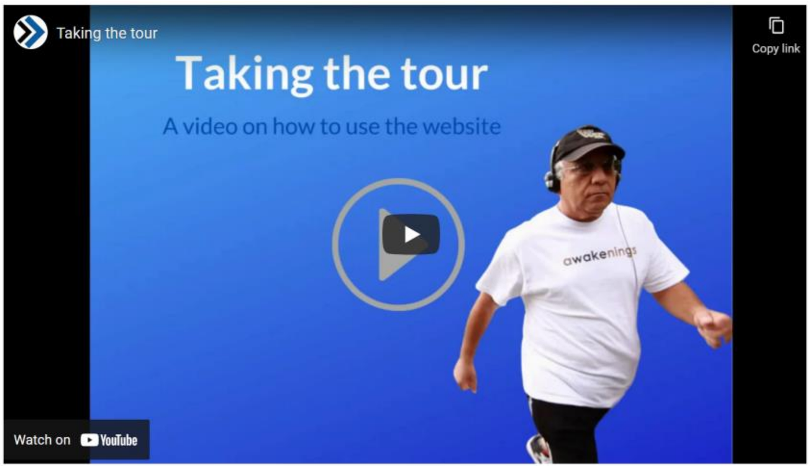
//Getting started – example feedback

Your personalised exercise program.

One of the features of Exercise Guide is an 8-week individualised aerobic and resistance training exercise program, which are found in the My Exercise Plan module. We have specially created exercise technique videos to help you exercise safely and effectively. You can complete this program at home (using the exercise bands that were sent to you), in an area near you or take it to your local gym**.**

Take a quick video tour of the website.

This video gives you a brief rundown of the Exercise Guide website, click on the centre of the box to get started.



We hope you enjoy the program. Please click finish (on your bottom right) to continue.

Appendix 25. My exercise plan 1 (week 1-3) questions and example of feedback

//My Exercise Plan (Week 1-3) - Introduction text

Introduction:

There is not a one-size-fits-all approach to exercise. For it to be truly beneficial and manageable, your exercise regime should be personalized just for you. It should take into account your current circumstances, activity levels and other injuries.

Please answer all the questions to receive your tailored exercise program. It will include components such as:

- A resistance training program to increase your muscular strength
- An aerobic fitness program to help improve your endurance
- A mobility program

// My Exercise Plan (Week 1-3) - Computer tailoring questions

1. **In your everyday life, do you experience pain when you:** *Note: This may or may not relate to your metastases.*
    a. Pull a heavy door open? O No; O Yes
    b. Push a heavy door open with your arms? O No; O Yes
    c. Lift your arms above your head whilst holding a heavy object? O No; O Yes
    d. Bend or straighten your elbow whilst holding a heavy item? O No; O Yes
    e. Completing activities like picking up heavy boxes in your lower back? O No; O Yes
    f. Kneel down on a soft surface like carpet? O No; O Yes
    g. Squat down to pick up a heavy object? O No; O Yes
    h. Bend or straighten your knees? O No; O Yes
    i. Lift yourself on to your tip toes (heels off the ground)? O No; O Yes

2. **In your everyday life, do you experience great difficulty or pain when you:**

a. Try to get up and down off of the ground (even when using objects for assistance)? O No; O Yes
b. Try to get yourself up and down out of a kitchen chair without using your arms? O No; O Yes

3. **On a scale of 0-10, please select the number that best:**
   a. Describes how EXPERIENCED you feel you are in resistance training (in a gym and/or home-based)? *Note: 0 equates to 'extremely inexperienced' and 10 equates to 'very experienced'.*
   O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
   Describes how EXPERIENCED you feel you are in aerobic training (in a gym and/or home-based)? *Note: 0 equates to 'extremely inexperienced' and 10 equates to 'very experienced'.*
   O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
   b. Describes how CONFIDENT you are about being able to complete an individually prescribed training program independently twice a week if you were given enough information. *Note: 0 equates to 'not confident' to 10 'very confident'.*
   O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
   c. Describes your current average FATIGUE level over the last three days. *Note: We understand fatigue changes over the day and week, just try to best pick the number that you think suits best. 0 equates to 'no fatigue' whilst 10 equates to 'extremely fatigued.'*
   O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.

4. **If you think about your last three weeks: On average how many aerobic exercise sessions have you completed per week?**
   O 0; O 1; O 2; O 3; O 4; O 5+.

5. **If you were to go out for a brisk walk, how long could you walk for before you become fatigued or experience pain?** *Note: A brisk walk is defined as a pace where you can talk but because you are huffing and puffing it is not comfortable to yell or sing.*

O 0-4min; O 5-9min; O 10-19min; O 20-29min; O 30-44min; O 45-59min; O 60min+; O I don't know

6. **If you think about your last three weeks: Did you complete at least one session per week of the walking duration you listed above?** O No; O Yes

7. **If you were to stationary cycle/exercise bike at a brisk pace, how long can you cycle for?** *Note: A brisk cycle is defined as a pace where you can still talk if you tried but because you are huffing and puffing it is not comfortable to yell or sing.*
   O 0-4min; O 5-9min; O 10-19min; O 20-29min; O 30-44min; O 45-59min; O 60min+; O I don't know.

8. **If you think about your last three weeks, did you complete at least one session per week of the riding duration you listed above?** O No; O Yes.

9. **What type of aerobic exercise do you think you may want to use during the program to improve your aerobic capacity?**
   O Walking inside (on a treadmill); O Stationary cycling; O Walking in water (ie hydrotherapy pool); O Walking outside.

10. **Do you get pain when you walk that would limit your ability to use walking as a mode of exercise?** O No; O Sometimes; O Yes
11. **If you think about your last three weeks: On average how many resistance exercise sessions have you completed per week?**
   O 0; O 1; O 2; O 3; O 4; O 5+.

12. **Do you have regular and easy access to the following equipment/activity? Walking outside (in a safe environment)?** O Exercise bike (stationary); O Treadmill (walking machine); O Resistance training equipment such as machines or dumbbells at home; O Swimming pool; O A supervised gym with resistance training equipment.

13. **Would you like a stretching program prescribed within your program?** O No; O Yes.

Thank you for completing our questions.

We will use this information to prescribe you an individualised resistance training program and aerobic program.

Please note, the resistance training component of this program is based on numerous factors including your metastases location, pain levels and ability to get yourself up and down off the ground. We will aim to prescribed 6-8 exercises, which we believe will be safe and not increase your risk of injury. However, if we can only prescribe 2 (or less) based on your answers, we highly encourage you to visit an exercise physiologist who will be able to modify exercises to reduce the risk of increasing your pain levels.

The reason for this is because we want the exercises to create meaningful changes to your strength, functioning and quality of life. If we cannot prescribe enough exercises, you may not see enough change as you would if you were to see someone for a bit of extra help.

// My Exercise Plan (Week 1-3) – Computer Tailored Feedback Example

//TABLE_TO_PRESCRIBE_6

Your exercise plan:

Hi {user_firstname}, from your answers we have been able to prescribe your Exercise Guide program. Your week 1-4 tailored exercise program includes a:

1. Resistance training program
2. Aerobic Program

//TSTRETCHING_PROGRAM_INTRO

3. Stretching program

//TGYM_RTHOME

Where do I complete my exercise?

This program has been designed to be completed in a location that best suits you. In the questionnaire, you reported that you have access to a supervised gym and some equipment at home. Feel free to take the program into the gym and ask the gym instructor to show you any machines or equipment that safely replicate the exercises prescribed. Please use the "ask an expert section" if you want to confirm the safety of those choices. If you cannot make it to the gym (or do not want to go), the four therabands you have been sent also allow you to complete your program anywhere (even when travelling). The black rope object is a door anchor. It allows you to use most doors as a safe spot to hook your therabands to without damaging your door. Click here to see how it works. You can complete your exercises in the gym using these bands as well if you wish. The choice is yours.

//TRT_TYPE

Your resistance training program

Based on your answers above, you have been prescribed {numExercisesCalculated} resistance exercises for the first 3 weeks of your program.

Below, we will first give you some important information about how hard, how often and how long you should complete your resistance exercises. On the next page, you click on the videos to watch your resistance exercises.

//TONE_EXTRA_FREQUENCY

Frequency:

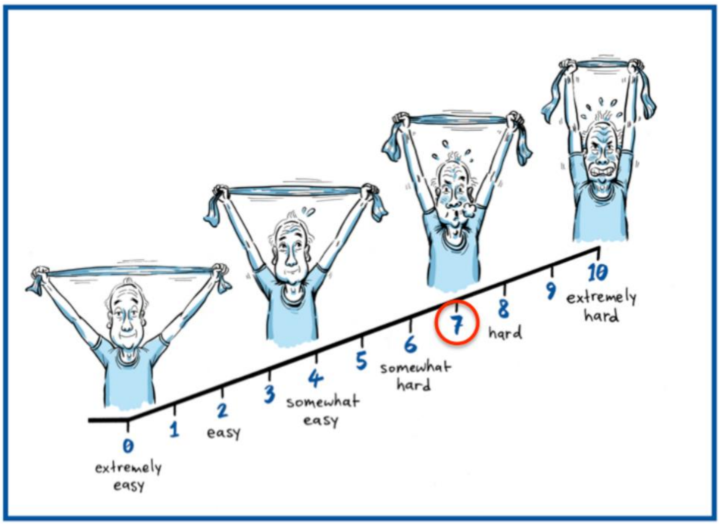
For the first three weeks of your program, we would like you to complete two sessions a week.

You have mentioned that you already do one session of aerobic exercise per week, so we would like you to add one more session into your weekly schedule. This will help maintain and even improve your ability to complete your day-to-day activities without feeling as tired.

//THIGH_RT_INTENSITY

How hard should I exercise?

The aim of the program is to work to a rate of perceived exertion of approximately 7 out of 10. This is working at moderate to vigorous intensity. Remember how you feel may change day to day, so please read the "safety" module to see how you may need to modify your intensity.



//THIGH_RT_TIME

How long will it take?

Your program should take you approximately 15-30 minutes to complete depending on how many rest breaks you feel you need to take.

//TRT_EXERCISE_INTRO

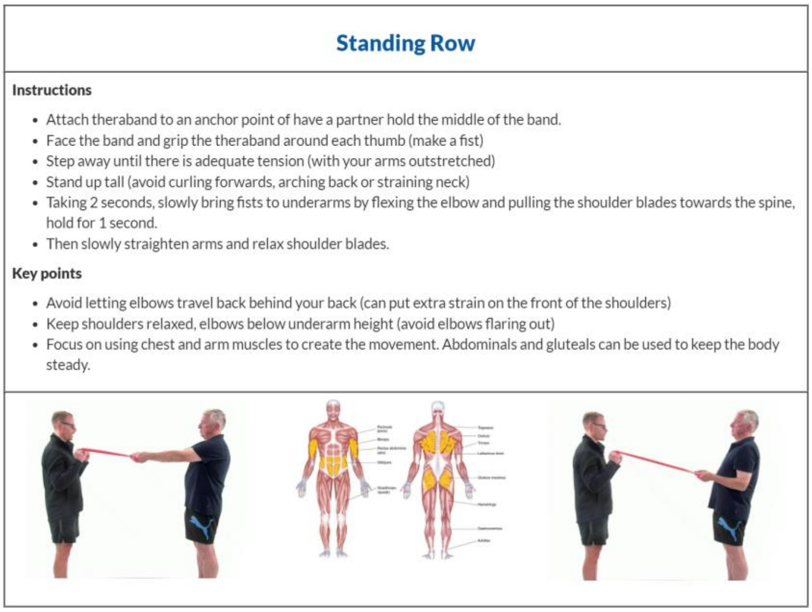
Your resistance training exercises

We have given you three helpful tools to make the exercises safe and easy to complete:

- Video demonstration of each exercise with James, Bob and Norman
- Written explanations with both pictures and tips (You can also click the show instructions to read the written information. You can hide these at any time by clicking the show instruction button again).
- Exercise Guide Prescription sheet (Print out this sheet to have at home or at the gym using the button at the bottom of this page).

//TSTANDPULL

//with show instructions expanded



Standing Row

Instructions

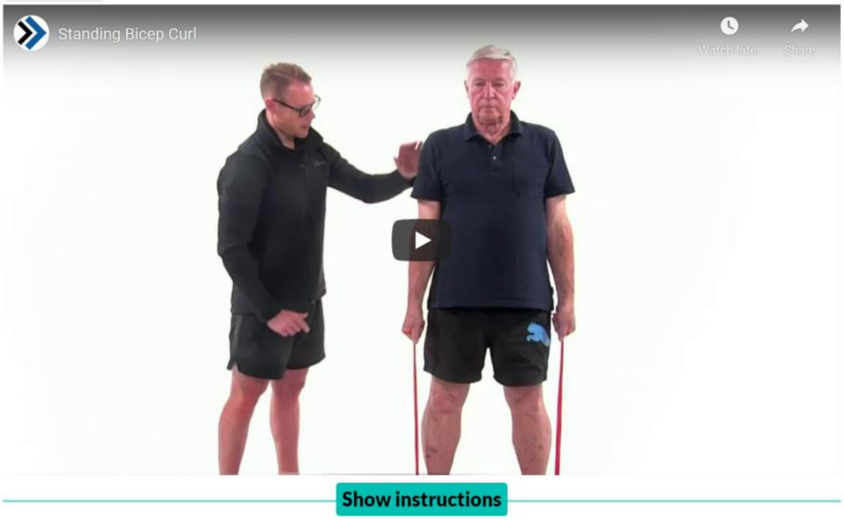
- Attach theraband to an anchor point of have a partner hold the middle of the band.
- Face the band and grip the theraband around each thumb (make a fist)
- Step away until there is adequate tension (with your arms outstretched)
- Stand up tall (avoid curling forwards, arching back or straining neck)
- Taking 2 seconds, slowly bring fists to underarms by flexing the elbow and pulling the shoulder blades towards the spine, hold for 1 second.
- Then slowly straighten arms and relax shoulder blades.

Key points

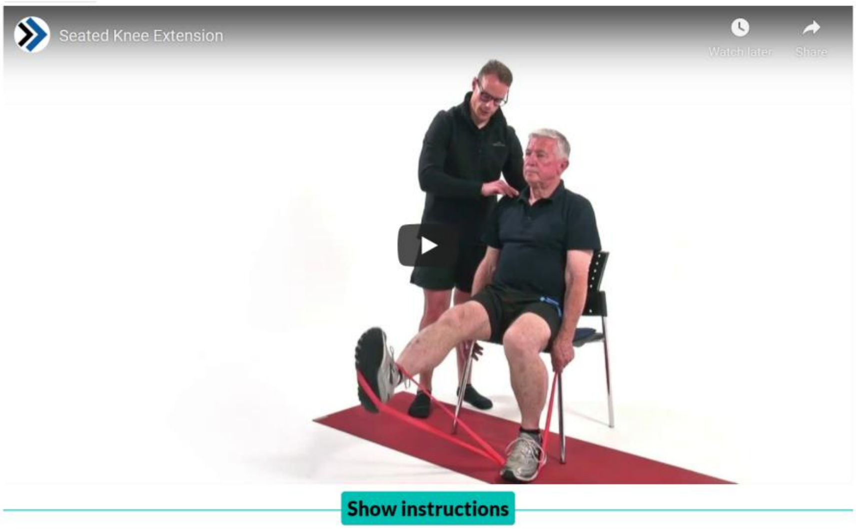
- Avoid letting elbows travel back behind your back (can put extra strain on the front of the shoulders)
- Keep shoulders relaxed, elbows below underarm height (avoid elbows flaring out)
- Focus on using chest and arm muscles to create the movement. Abdominals and gluteals can be used to keep the body steady.

//TINCLINEPU

//TSTANDBC



//TKNEEEXT



//TCR

//TSQUAT

//TDLLIFT

How many repetitions should I complete for each exercise?

Here are the sets and repetitions you have been prescribed for the first three weeks to best suit your goals. Each exercise might be different and they slightly change over time so make sure you keep track of what you do. Avoid skipping forward, even if you miss a session.

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Standing Bicep Curl 	2 x 12	2 x 12	2 x 12	2 x 12	3 x 12	3 x 12
Standing Row 	2 x 12	2 x 12	2 x 12	2 x 12	3 x 12	3 x 12
Incline Push Up 	2 x 8	2 x 8	2 x 10	2 x 10	3 x 10	3 x 10
Seated Knee Extension 	2 x 12	2 x 12	2 x 12	2 x 12	3 x 12	3 x 12
Standing Calf Raise 	2 x 8	2 x 8	2 x 10	2 x 10	3 x 10	3 x 10
Squat 	2 x 8	2 x 8	2 x 10	2 x 10	3 x 10	3 x 10
Double Leg Lift 	2 x 8	2 x 8	2 x 10	2 x 10	3 x 10	3 x 10

//TRT_MONITORING

How do you monitor how you are going?

As discussed in both the safety module and the tracking module, monitoring is really important to see your progressions. You can use your exercise diary and the tracking module to see how you are travelling. If you see improvements in the resistance used or how you are feeling then it can indicate you are getting fitter and or stronger.

//TRT_PROGRESSION_REGRESSION_EXPLAN

How do I make my resistance training program harder or a little lighter?

We have specifically prescribed the amount of each exercise based on scientific research. This allows us to determine your total loads per session and is specific to the type of exercise you are doing. If you feel that you need to make your resistance training either more challenging or a little easier based on your scores of how hard it is or your pain levels, think about these principles:

1. Slowly increase or reduce your resistance level (band) or your movement depth (bodyweight exercises) to achieve your desired rate of perceived exertion rather than changing your sets or repetitions.
2. The sets and repetitions are specifically prescribed, however, if the exercises are too challenging to complete, then only complete the number of sets and repetitions you are able to without breaking yourself.
3. We recommend you not increase your resistance by more than 5-10% each time (avoid skipping a band thickness). The ground-based exercises are not easily increased with resistance, but the slower you do them the harder they become (up to 3 seconds per movement).
4. If you cannot complete an exercise due to an increase in your pain levels, please modify the answers you gave at the start of this module. This may take out that exercise and or prescribe a new one for you if suitable. If you have completed this and the program is not taking your pain levels into account (they are increasing past a 3), please contact our Exercise Physiologist on holly.evans@adelaide.edu.au or 8128 4043
5. .If you are finding the exercises very fatiguing, increase the rest between sets. If necessary you can break up the exercises over the course of the day or even over the course of two days.

//TRT_TYPE_CONTINUED

Some more information

You have been prescribed two types of resistance training.

1. Isotonic Exercise – where the exercises cause the muscle involved to lengthen and shorten. This includes basic exercises such as squats, bicep curls, calf raises. The aim will be to move the muscles for a duration of 2 seconds and then back to the start over 2 seconds. Slow and steady is always harder!
2. Isometric exercises – this is where the working muscles do not change length and are typically the ones completed on the floor such as the leg fallout, double leg lift or leg extension. Whilst the limbs are moving, it is the abdominals working to keep the trunk still. This type of exercise allows us to work the

abdominals without stressing the spine and is also great to help strengthen your postural muscles

Each exercise works the muscles differently and for that reason, they are given different repetitions over the 8 weeks. For this reason, please refer to your individual program above to see how many sets and repetitions you have been given for each session. Try and stick to them as closely as you can.

It is preferred that you rotate between each set of exercises so you give one muscle group a chance to rest whilst another is working. If you do want to do all of one exercise in one go, please have a rest break of at least 1 minute between each set.

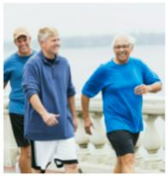
//TAEROBIC_TYPE

Your aerobic training program

Based on your answers we have been able to prescribe you the following exercise/s for your aerobic training. The prescription is based on safety (taking into account your metastases location, pain levels) as well as access to equipment, current exercise levels, and what you may prefer.

Type:

Preferred option: Walking outside



Walking outside can be a great option for you if you are not currently experiencing pain. If you begin to experience a pain level greater than 3 out of 10, it may be worthwhile using the secondary option if prescribed to you. If you are concerned with your balance you can always use walking poles to assist you.

Secondary Options: Stationary Bike / Water Walking / Treadmill Walking

Other options that will be safe and effective include stationary cycling and walking in water. If you would rather walk on a treadmill and it does not cause you pain you can also use treadmill walking (as long as your pain levels do not move past a 3 out of 10). We advise that you to use a bike with a backrest if you have access to one. If not, focus on good posture whilst cycling.

If you are concerned with your balance when walking, you can always use the handrails to assist you. If you have another pain-free form of aerobic exercise you want to try, please double-check the safety of your choice by using the 'ask an expert' function on the home page.

//T2_10EFFORT_5REST

Time:

Your session will be broken up in two blocks.

1. Please complete 10 minutes of your prescribed aerobic exercise and then have up to 5 minutes of rest where we want to let your breathing rate and heart rate recover (this can be very slow moving or sitting).
2. From there we would like you to complete another 10 minutes of aerobic exercise before cooling down (a few minutes of slow movement to let your heart rate recover)

In total, you will be completing 20 minutes of aerobic exercise and it should take no more than 30 minutes to complete (including the rest breaks).

//TAEROBIC_FREQUENCY_3_DAYS_PLUS

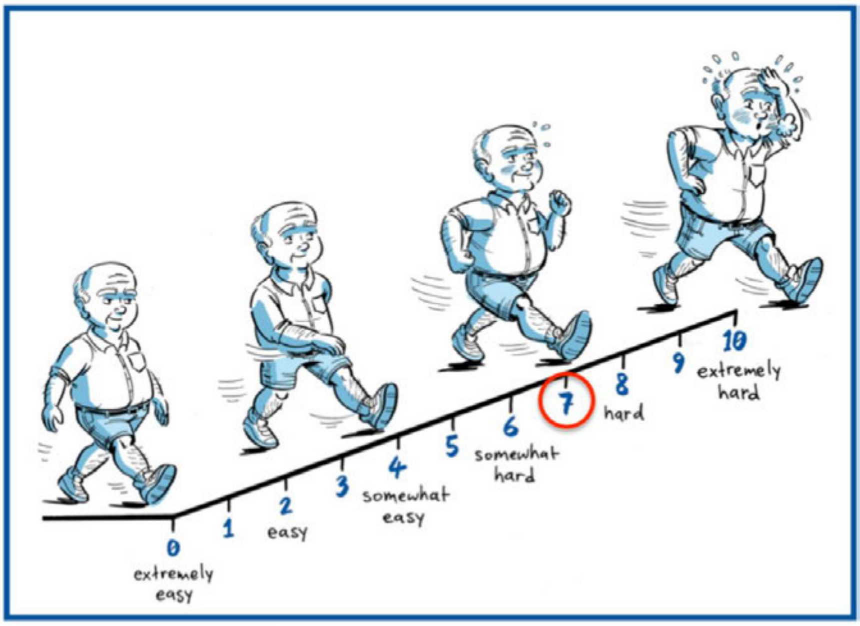
Frequency:

We would like you to try completing your aerobic sessions at least three times per week for the first three weeks. We do not necessarily want this to displace your normal exercise routine, but we want to ensure you are getting the benefits of the moderate to vigorous aerobic exercise. If you typically do more than three sessions a week, continue your extra sessions on days that you are not completing this program on. If you still want to do activities like walking the dog, try an incorporate it into your fitness session or have a good rest period between sessions.

//THIGH_AEROBIC_INTENSITY

Intensity:

One of the most important factors to ensure you are getting therapeutic benefits is what intensity you complete your exercise at. Given you are fairly active and confident, we would like you to work at a rate of perceived exertion of approximately: 7 out of 10!



If we wanted to put this intensity into words it would mean you can only use shorter sentences where words are somewhat forced and a bit rushed. You can see your chest moving more to get more oxygen in and you can hear huffing and puffing.

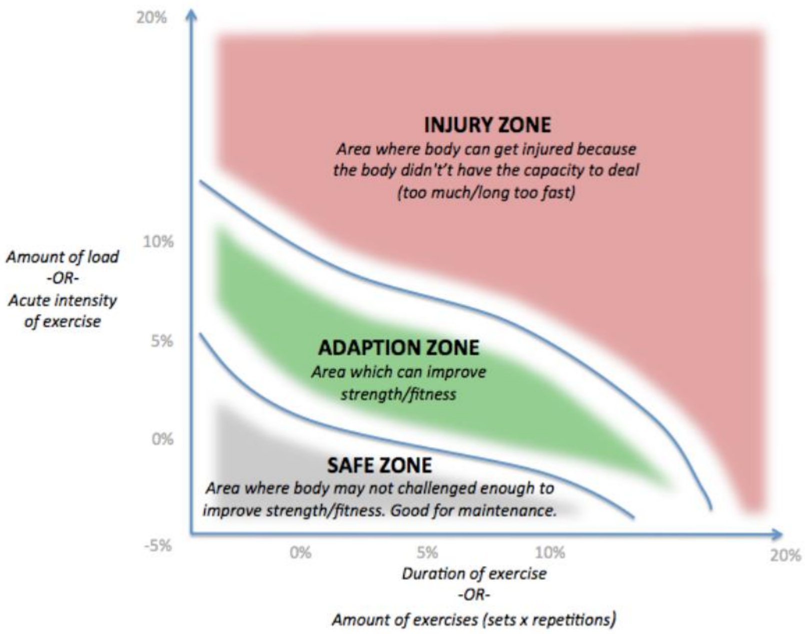
//TAEROBIC_PROGRESSION_EXPLAN

How do I adapt my program when I need to?

Your aerobic program is prescribed based off of what you currently have access to, metastases location and your current capacity. However, as you will know, not every day is the same and there is no doubt you may need to modify your program at some stage.

If you need to make your aerobic training either more challenging (based on your scores of perceived exertion or pain) think about these principles.

1. Increase either your duration, distance, speed or resistance (if you are on a stationary bike). Do not increase more than one factor at a time. If you then feel overloaded, you won't be able to tell which the contributing factor was.
2. We recommend you not increase your factor (speed, distance, time etc) by more than 5-10% each time. This may mean increasing your walk from 10 to 12 minutes rather than 10 minutes to 20minutes.



If your aerobic exercise session is too challenging and you would like to reduce your exercise session, this is completely fine.

1. If fatigue or breathlessness is an issue, use the rate of perceived exertion scale (0-10) as a guide rather than a specific time or distance. If your rate of perceived exertion becomes higher than prescribed, you can slow down or stop.
2. If you need, you can break up your exercise session into more manageable blocks, such as 2 x 10 minutes rather than one session lasting 20 minutes.

//TSTRETCHING_TYPE

Your stretching program

Based on the exercises you have been given, we have been able to prescribe you the following stretches. The prescription is based on your metastases location and pain levels.

Stretching for sport and exercise improves flexibility, which increases the ability of a joint to move through its full range of motion; in other words, how far it can bend, twist and reach. Your stretches are as follows:

//TCHEST_STRETCH

Chest stretch

1. Your pectorals muscles are found in your chest. To stretch your chest muscles:
2. In a split stance, left leg on the front and right leg on the back, stand at the end of a wall or in a doorway.
3. Bring the right arm up to shoulder height and position the palm and inside of the arm on the wall surface or doorway.
4. Gently press the chest through the open space to feel the stretch.
5. Moving the arm higher or lower will allow you to stretch various sections of the chest.
6. Repeat on the other side.

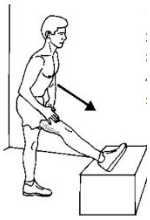
//TGLUTE_STRETCH

Glute stretch

1. Your gluteal muscles are a group of three muscles which make up the buttocks. To stretch your glutes:
2. Sit on a chair.
3. Bring one ankle up onto the knee of your other leg (if you cannot get your ankle up that high, rest as high up on your shin as you can).
4. Use a hand to keep the ankle there comfortably.
5. Lean forward, keeping your back straight, and you should immediately feel the stretch in your bottom (gluteus maximus.)
6. Hold for 20-40 seconds.
7. To increase the stretch – lean forward a little more or push gently on the top knee with your hand.

//THAMSTRING_STRETCH

Hamstring stretch



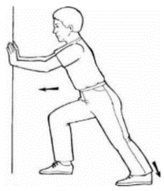
1. Your hamstring muscles run along the back of your thigh. To stretch your hamstring muscles:
2. Stand near a wall or a piece of sturdy furniture for support.
3. Rest your leg (straight) with your foot flexed towards you on a table or chair (at a height that suits you).

4. To increase the stretch bend forward toward your flexed foot, by creasing at your hips (keep your back stretch).
5. Hold for 20-40 seconds and then switch legs.
6. To increase the stretch, use a slightly higher object.

//TCALF_STRETCH

Calf stretch

Your calf muscles run along the back of your lower leg. To stretch your calf muscles:



1. Stand near a wall or a sturdy object with one foot in front of the other, front knee slightly bent.
2. Keep your back knee straight, your heel on the ground, and lean toward the wall.
3. Feel the stretch all along the calf of your back leg.
4. Hold for 20-40 seconds and then switch legs.
5. To increase the stretch, step back a little.

When should I stretch?

Your decision to stretch or not to stretch should be based on what you want to achieve. If the objective is to reduce injury, stretching before exercise is not all that helpful. Your time would be better spent by warming up your muscles with light aerobic movements (like walking) and gradually increasing their intensity.

The best time to stretch is when the muscles are warm and pliable. A great time to do this is just after exercising. A post-exercise stretch will also slow down your breathing and heart rate, and bring the mind and body back to a resting state.

A couple of other great stretching tips can be read in “six tips for better stretching” which is found in the library.

//TWHAT_TO_MONITOR

What should you monitor when exercising?

In the Exercise Benefits module, we discuss the importance of monitoring to ensure we are not overloading you, but providing you with a program that improves your strength and fitness. You should have been sent an exercise diary to record your exercise. Here's what you should record:

1. What you completed in your session

Resistance training, it is very useful to record:

- Your exercises completed
- Repetitions (the number of movements)
- Sets (the amount rounds you completed of each exercise)
- Resistance (what colour theraband was used, what weight was used, or your body weight etc)
- Duration

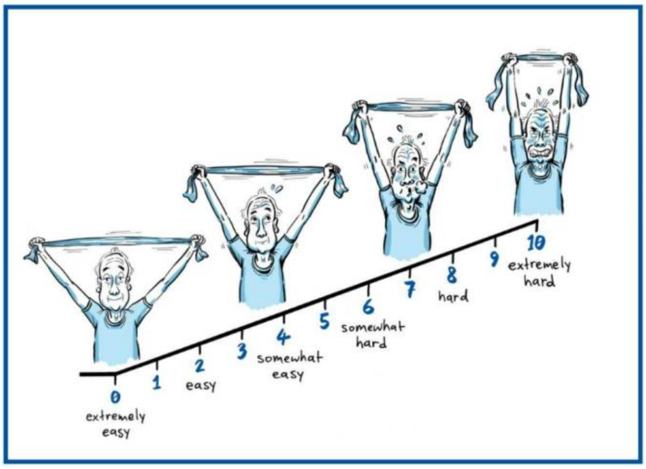
Aerobic training:

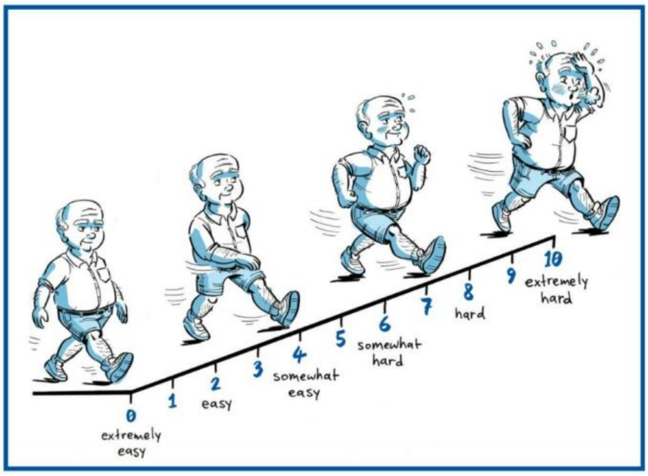
- How far you went
- How long you went

2. How hard the exercise session was

Using a rating of perceived exertion allows you to quantify how hard you found the session. It also helps you determine if you need to increase the resistance or speed/distance in your next session. We recommend you use the 0-10 scale for both aerobic (not tired at all to very tired) and resistance (extremely easy to extremely hard) exercises.

Click here to read more about using the rate of perceived exertion scale to rate your exercise





//TDOUBLE_PAIN_MONITORING

3. Pain levels during and after your session

You mentioned you have bone pain as well as pain from other regions/causes. We want to ensure the program does not increase these levels, so we encourage you to rate your pain levels using a 0-10 scale. It ranges from no pain to the worst pain you can imagine.

What exactly should I record?

Session to session:

- Your bone pain before and after your exercise sessions (from 0-10)
- Your general pain (unrelated to bone pain) before and after your exercise sessions (from 0-10).
- Any exercises that exacerbate either pain in particular

Week by week:

- Your highest bone pain level over the week (from 0-10)
- Your highest non-bone pain level over the week (from 0-10)

//THOW_MUCH_PAIN

Can I push through my pain?

A little bit of pain is ok, as long as it does not increase in intensity and it ceases when the exercise stops. As such, 0-2 is ok but if your pain level reaches a 3 or more you should stop that exercise. If the pain does not disappear, you should stop your exercise session. You can use this type of monitoring to manage any other physical activities that you normally do like gardening or sports.

If you are getting a pain level of 3 or more during the Exercise Guide program, it would be useful to recheck your technique by re-watching the videos that are provided in "My Exercise Plan". If that does not reduce the pain levels then stop that exercise and re-complete the "My Exercise Plan" module assessment or contact the Exercise Physiologist by clicking on the "ask an EP" button.

//TCONCLUSION_MY_PROG

Conclusion:

We hope you enjoy getting stuck into your program and in doing so that you reap the rewards outlined in the "Exercise Benefits" module. Feel free to complete your resistance and aerobic program on the same day as you wish, but we would encourage you to complete your aerobic session first.

Have fun!

Appendix 26. My exercise plan 2 (week 4-8) questions and example of feedback

// My Exercise Plan 2 (Week 4-8) - Introduction text

Congratulations:

You have made it to the fourth week of the exercise guide program. Now is a good time to check in and see if we need to make any changes to your program based on how you have gone so far.

You will see some new exercise-based questions, please answer these. You will also see many questions which you have already answered. Please check over these questions and modify anything which you feel may have changed.

// My Exercise Plan 2 (Week 4-8) - Computer tailoring questions

1. **How many resistance training sessions in total did you complete over your first three weeks?** *For example: if you were able to complete the prescribed 2 resistance training sessions a week for three weeks you would have completed 6 sessions.*
   O More than 5 sessions; O 4-5 sessions; O 2-3 sessions; O 0-1 sessions.

2. **On average in the three weeks so far, what percentage of the time were you able to fully complete the prescribed amount of sets and repetitions?** *For example: If you were prescribed 3 sets of 12 repetitions for 8 exercises, did you complete all of those repetitions (100%) or did you only complete 2 sets of 12 repetitions (50-79% of the time).*
   O 100% of the time; O 80-99% of the time; O 50-79% of the time; O Less than 50% of the time.

3. **If you think about your last three weeks, on average how many aerobic exercise sessions have you completed per week?**
   O More than 4 sessions; O 4 sessions; O 3 sessions; O 2 sessions; O 1 session; O 0 sessions.

4. **Currently, if you were to go out for a brisk walk, how long could you walk for before you become fatigued or experience pain?** *Note: A brisk walk is*

defined as a pace where you can talk but because you are huffing and puffing it is not comfortable to yell or sing.

O 0-4min; O 5-9min; O 10-19min; O 20-29min; O 30-44min; O 45-59min; O 60min+; O I don't know

5. **If you think about your last three weeks: Did you complete at least one session per week of the walking duration you listed above?** O No; O Yes

6. **If you were to stationary cycle/exercise bike at a brisk pace, how long can you cycle for?** *Note: A brisk cycle is defined as a pace where you can still talk if you tried but because you are huffing and puffing it is not comfortable to yell or sing.*

   O 0-4min; O 5-9min; O 10-19min; O 20-29min; O 30-44min; O 45-59min; O 60min+; O I don't know.

7. **If you think about your last three weeks, did you complete at least one session per week of the riding duration you listed above?** O No; O Yes.

The next batch of questions have been repeated from your initial exercise questionnaire.

You will notice that they have your original answers. Please have a read through them and change any answers you would like, otherwise, you may leave them the same.

1. **In your everyday life, do you experience pain when you:** *Note: This may or may not relate to your metastases.*
   a. Pull a heavy door open? O No; O Yes
   b. Push a heavy door open with your arms? O No; O Yes
   c. Lift your arms above your head whilst holding a heavy object? O No; O Yes
   d. Bend or straighten your elbow whilst holding a heavy item? O No; O Yes
   e. Completing activities like picking up heavy boxes in your lower back? O No; O Yes

f. Kneel down on a soft surface like carpet? O No; O Yes
g. Squat down to pick up a heavy object? O No; O Yes
h. Bend or straighten your knees? O No; O Yes
i. Lift yourself on to your tip toes (heels off the ground)? O No; O Yes

2. **In your everyday life, do you experience great difficulty or pain when you:**
   a. Try to get up and down off of the ground (even when using objects for assistance)? O No; O Yes
   b. Try to get yourself up and down out of a kitchen chair without using your arms? O No; O Yes

3. **On a scale of 0-10, please select the number that best:**
   a. Describes how EXPERIENCED you feel you are in resistance training (in a gym and/or home-based)? *Note: 0 equates to 'extremely inexperienced' and 10 equates to 'very experienced'.*
      O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
      Describes how EXPERIENCED you feel you are in aerobic training (in a gym and/or home-based)? *Note: 0 equates to 'extremely inexperienced' and 10 equates to 'very experienced'.*
      O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
   b. Describes how CONFIDENT you are about being able to complete an individually prescribed training program independently twice a week if you were given enough information. *Note: 0 equates to 'not confident' to 10 'very confident'.*
      O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.
   c. Describes your current average FATIGUE level over the last three days. *Note: We understand fatigue changes over the day and week, just try to best pick the number that you think suits best. 0 equates to 'no fatigue' whilst 10 equates to 'extremely fatigued.'*
      O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.

4. **What type of aerobic exercise do you think you may want to use during the program to improve your aerobic capacity?**

O Walking inside (on a treadmill); O Stationary cycling; O Walking in water (ie hydrotherapy pool); O Walking outside.

5. **Do you get pain when you walk that would limit your ability to use walking as a mode of exercise?**
   O No; O Sometimes; O Yes

6. **Do you have regular and easy access to the following equipment/activity? Walking outside (in a safe environment)?**
   O Exercise bike (stationary); O Treadmill (walking machine); O Resistance training equipment such as machines or dumbbells at home; O Swimming pool; O A supervised gym with resistance training equipment.

7. **Would you like a stretching program prescribed within your program?** O No; O Yes.

Thank you for completing our questions.

We will use this information to update your program if needed. This will ensure the program is as suitable to you as possible. If you have any questions about the program, feel free to "ask an expert."

// My Exercise Plan 2 (Week 4-8) - Computer Tailored Feedback Example

//TABLE_TO_PRESCRIBE_6B

Hi {user_firstname}, from your latest answers, we have been able to prescribe you the next stage of the Exercise Guide program. The biggest change you will notice is the sets and repetitions prescribed to you in the weights program.

Your week 4-8 tailored exercise program includes a:

1. Resistance training program
2. Aerobic Program

//TSTRETCHING_PROGRAM_INTRO

14. Stretching program

//TGYM_RTHOME

Where do I complete my exercise?

This program has been designed to be completed in a location that best suits you. In the questionnaire, you reported that you have access to a supervised gym and some equipment at home. Feel free to take the program into the gym and ask the gym instructor to show you any machines or equipment that safely replicate the exercises prescribed. Please use the "ask an expert section" if you want to confirm the safety of those choices.

If you cannot make it to the gym (or do not want to go), the four therabands you have been sent also allow you to complete your program anywhere (even when travelling). The black rope object is a door anchor. It allows you to use most doors as a safe spot to hook your therabands to without damaging your door. Click here to see how it works. You can complete your exercises in the gym using these bands as well if you wish. The choice is yours.

//THEADING_RT_WEEK4-8

Your resistance training program

Based on your answers above, you have been prescribed **{numExercisesCalculated} resistance exercises.**

//TWEEK3_7_TWO_THREE

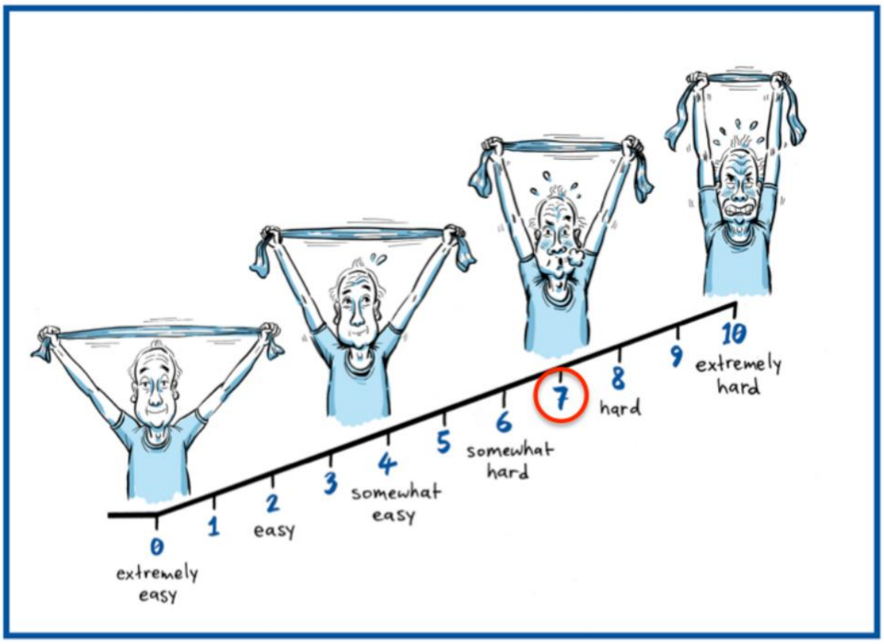
Frequency:

You have been doing well so far. We would like to encourage you to complete two to three resistance training sessions per week, depending on how you feel.

//THIGH_RT_INTENSITY

How hard should I exercise?

The aim of the program is to work to a rate of perceived exertion of approximately 7 out of 10. This is working at moderate to vigorous intensity. Remember how you feel may change day to day, so please read the “safety” module to see how you may need to modify your intensity.



//THIGH_RT_TIME

How long will it take?

Your program should take you approximately 15-30 minutes to complete depending on how many rest breaks you feel you need to take.

TRT_EXERCISE_INTRO_4-8

Your resistance exercises:

Please have a look at the exercises that have been prescribed to you as they may have changed. At any time, you can refer back to the videos to ensure you are completing the exercise with a safe and effective technique. Don’t forget: To assist with your exercise technique, you can also look at the exercise instructions by clicking on the “show instructions.”

//TSTANDPULL

//with show instructions expanded

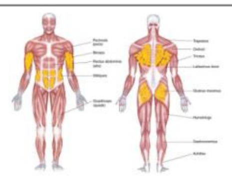
Standing Row

Instructions

- Attach theraband to an anchor point of have a partner hold the middle of the band.
- Face the band and grip the theraband around each thumb (make a fist)
- Step away until there is adequate tension (with your arms outstretched)
- Stand up tall (avoid curling forwards, arching back or straining neck)
- Taking 2 seconds, slowly bring fists to underarms by flexing the elbow and pulling the shoulder blades towards the spine, hold for 1 second.
- Then slowly straighten arms and relax shoulder blades.

Key points

- Avoid letting elbows travel back behind your back (can put extra strain on the front of the shoulders)
- Keep shoulders relaxed, elbows below underarm height (avoid elbows flaring out)
- Focus on using chest and arm muscles to create the movement. Abdominals and gluteals can be used to keep the body steady.



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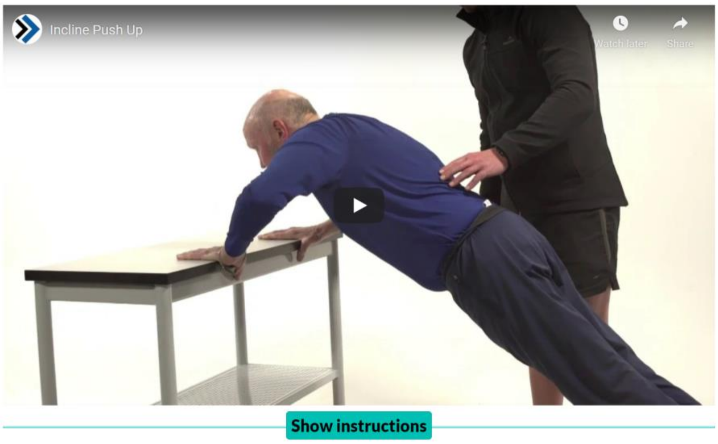
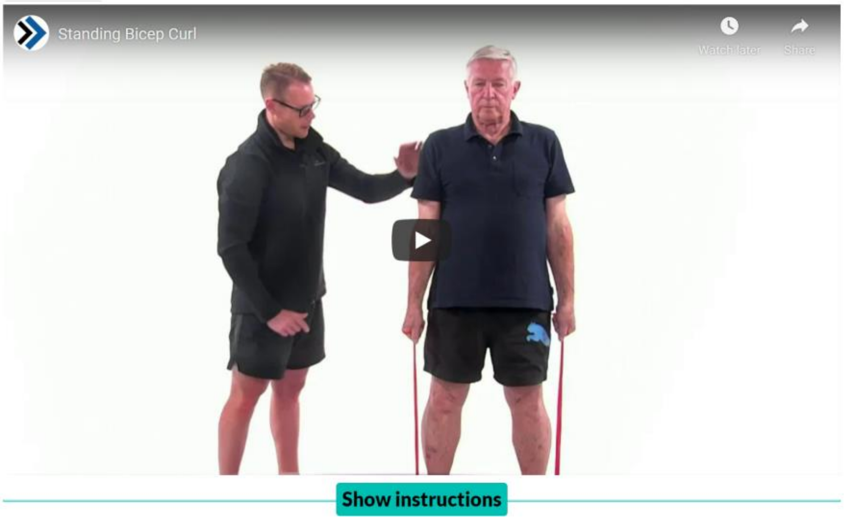


//TSTANDBC



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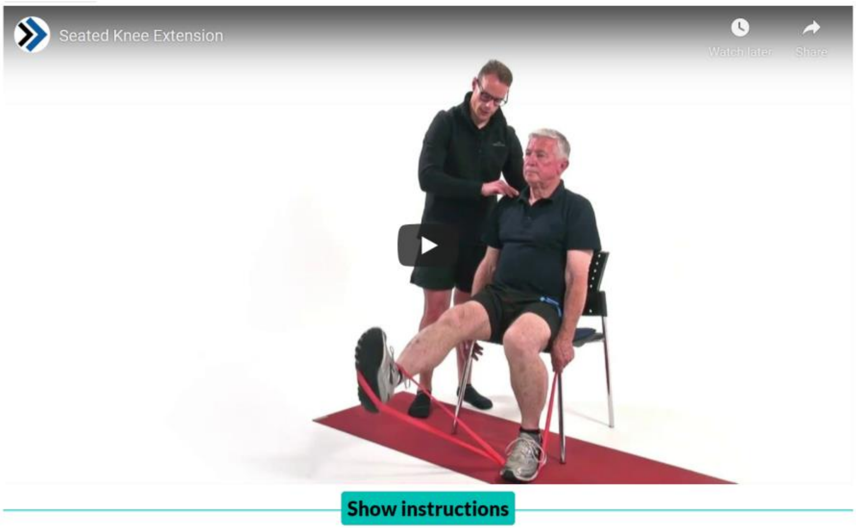


//TCR

//TSQUAT

//TDLLIFT

//TRT_REPS_SETS_INTRO_4-8

Here are the sets and repetitions you have been prescribed to best suit your goals. Each exercise might be different and they slightly change over time so make sure you keep track of what you do. Avoid skipping forward, even if you miss a session.

	Week 4		**Week 5**		**Week 6**			**Week 7**			**Week 8**		
Session	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Standing row	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8
Incline push up	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8

	Week 4		Week 5		Week 6			Week 7			Week 8		
Session	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Bicep curl	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8
Knee extension	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8
Calf Raise	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8
Partial Squat	3x12	3x12	3x12	3x12	3x10	3x10	3x10	3x10	3x10	3x10	3x8	3x8	3x8
Double leg lift	3x10	3x10	3x10	3x10	3x10	3x10	3x10	3x10	3x10	3x10	3x12	3x12	3x12

//TRT_MONITORING

How do you monitor how you are going?

As discussed in both the safety module and the tracking module, monitoring is really important to see your progressions. You can use your exercise diary and the tracking module to see how you are travelling. If you see improvements in the resistance used or how you are feeling then it can indicate you are getting fitter and or stronger.

//TRT_PROGRESSION_REGRESSION_EXPLAN

How do I make my resistance training program harder or a little lighter?

We have specifically prescribed the amount of each exercise based on scientific research. This allows us to determine your total loads per session and is specific to the type of exercise you are doing. If you feel that you need to make your resistance training either more challenging or a little easier based on your scores of how hard it is or your pain levels, think about these principles:

6. Slowly increase or reduce your resistance level (band) or your movement depth (bodyweight exercises) to achieve your desired rate of perceived exertion rather than changing your sets or repetitions.
7. The sets and repetitions are specifically prescribed, however, if the exercises are too challenging to complete, then only complete the number of sets and repetitions you are able to without breaking yourself.
8. We recommend you not increase your resistance by more than 5-10% each time (avoid skipping a band thickness). The ground-based exercises are not easily

increased with resistance, but the slower you do them the harder they become (up to 3 seconds per movement).

9. If you cannot complete an exercise due to an increase in your pain levels, please modify the answers you gave at the start of this module. This may take out that exercise and or prescribe a new one for you if suitable. If you have completed this and the program is not taking your pain levels into account (they are increasing past a 3), please contact our Exercise Physiologist on holly.evans@adelaide.edu.au or 8128 4043
10. If you are finding the exercises very fatiguing, increase the rest between sets. If necessary you can break up the exercises over the course of the day or even over the course of two days.

//TAEROBIC_TYPE

Your aerobic training program

Based on your answers we have been able to prescribe you the following exercise/s for your aerobic training. The prescription is based on safety (taking into account your metastases location, pain levels) as well as access to equipment, current exercise levels, and what you may prefer.

Type:

Preferred option: Walking outside

Walking outside can be a great option for you if you are not currently experiencing pain. If you begin to experience a pain level greater than 3 out of 10, it may be worthwhile using the secondary option if prescribed to you. If you are concerned with your balance you can always use walking poles to assist you.

Secondary Options: Stationary Bike / Water Walking / Treadmill Walking

Other options that will be safe and effective include stationary cycling and walking in water. If you would rather walk on a treadmill and it does not cause you pain you can also use treadmill walking (as long as your pain levels do not move past a 3 out of 10). We advise that you to use a bike with a backrest if you have access to one. If not, focus on good posture whilst cycling.

If you are concerned with your balance when walking, you can always use the handrails to assist you. If you have another pain-free form of aerobic exercise you want to try, please double-check the safety of your choice by using the 'ask an expert' function on the home page.

//T2_15EFFORT_5REST

Time:

Your session will be broken up in two blocks.

1. Please complete **15 minutes** of your prescribed aerobic exercise and then have up to 5 minutes of rest where we want to let your breathing rate and heart rate recover (this can be very slow moving or sitting).

2. From there we would like you to complete another **15 minutes** of aerobic exercise before finishing up with a slow recovery movement of 3-5 minutes.

In total, you will be completing 30 minutes of aerobic exercise and should take no more than 40 minutes to complete (including the rest breaks).

//TAEROBIC_FREQUENCY_3_DAYS_4-8

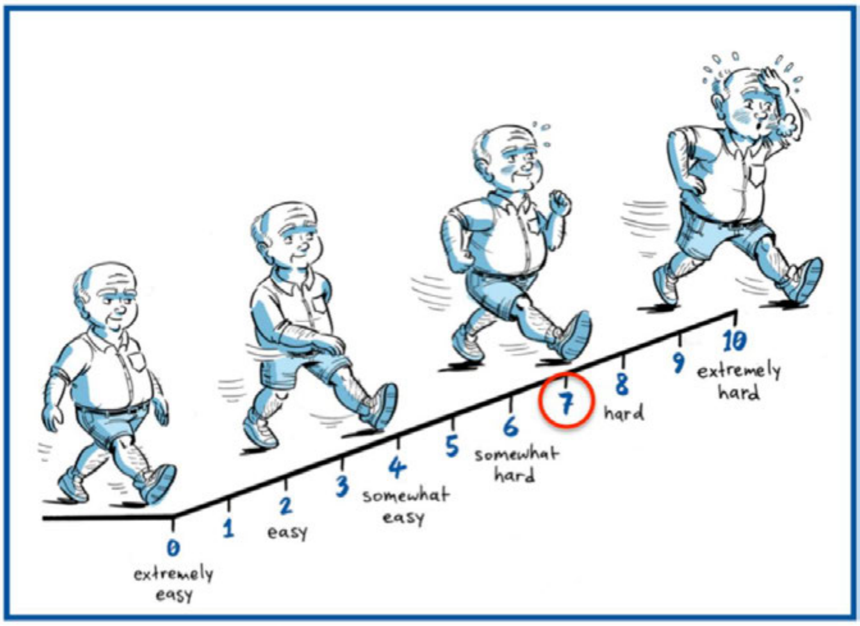
Frequency:

We would like you to try completing your aerobic sessions at least three times per week. We do not necessarily want this to displace your normal aerobic exercise routine, but we want to ensure you are getting the benefits of the moderate to vigorous aerobic exercise.

//THIGH_AEROBIC_INTENSITY

Intensity:

One of the most important factors to ensure you are getting therapeutic benefits is what intensity you complete your exercise at. Given you are fairly active and confident, we would like you to work at a rate of perceived exertion of approximately: 7 out of 10!



If we wanted to put this intensity into words it would mean you can only use shorter sentences where words are somewhat forced and a bit rushed. You can see your chest moving more to get more oxygen in and you can hear huffing and puffing.

//TAEROBIC_PROGRESSION_EXPLAN

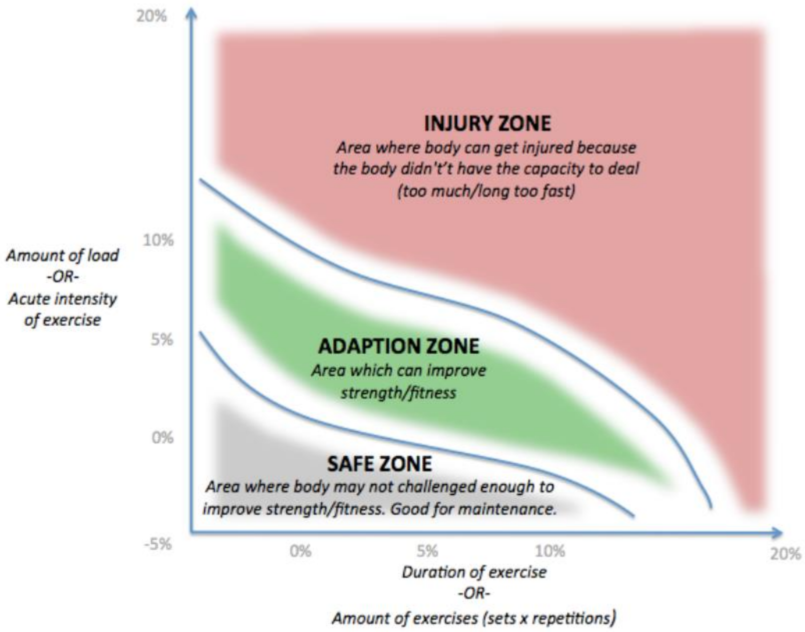
How do I adapt my program when I need to?

Your aerobic program is prescribed based off of what you currently have access to, metastases location and your current capacity. However, as you will know, not every day is the same and there is no doubt you may need to modify your program at some stage.

If you need to make your aerobic training either more challenging (based on your scores of perceived exertion or pain) think about these principles.

3. Increase either your duration, distance, speed or resistance (if you are on a stationary bike). Do not increase more than one factor at a time. If you then feel overloaded, you won't be able to tell which the contributing factor was.

4. We recommend you not increase your factor (speed, distance, time etc) by more than 5-10% each time. This may mean increasing your walk from 10 to 12 minutes rather than 10 minutes to 20minutes.



If your aerobic exercise session is too challenging and you would like to reduce your exercise session, this is completely fine.

3. If fatigue or breathlessness is an issue, use the rate of perceived exertion scale (0-10) as a guide rather than a specific time or distance. If your rate of perceived exertion becomes higher than prescribed, you can slow down or stop.
4. If you need, you can break up your exercise session into more manageable blocks, such as 2 x 10 minutes rather than one session lasting 20 minutes.

//TSTRETCHING_TYPE

Your stretching program

Based on the exercises you have been given, we have been able to prescribe you the following stretches. The prescription is based on your metastases location and pain levels.

Stretching for sport and exercise improves flexibility, which increases the ability of a joint to move through its full range of motion; in other words, how far it can bend, twist and reach. Your stretches are as follows:

//TCHEST_STRETCH

Chest stretch

7. Your pectorals muscles are found in your chest. To stretch your chest muscles:
8. In a split stance, left leg on the front and right leg on the back, stand at the end of a wall or in a doorway.
9. Bring the right arm up to shoulder height and position the palm and inside of the arm on the wall surface or doorway.
10. Gently press the chest through the open space to feel the stretch.
11. Moving the arm higher or lower will allow you to stretch various sections of the chest.
12. Repeat on the other side.

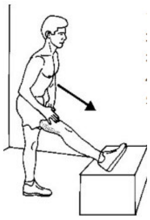
//TGLUTE_STRETCH

Glute stretch

8. Your gluteal muscles are a group of three muscles which make up the buttocks. To stretch your glutes:
9. Sit on a chair.
10. Bring one ankle up onto the knee of your other leg (if you cannot get your ankle up that high, rest as high up on your shin as you can).
11. Use a hand to keep the ankle there comfortably.
12. Lean forward, keeping your back straight, and you should immediately feel the stretch in your bottom (gluteus maximus.)
13. Hold for 20-40 seconds.
14. To increase the stretch – lean forward a little more or push gently on the top knee with your hand.

//THAMSTRING_STRETCH

Hamstring stretch

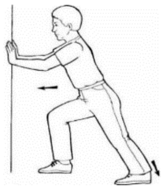


7. Your hamstring muscles run along the back of your thigh. To stretch your hamstring muscles:
8. Stand near a wall or a piece of sturdy furniture for support.
9. Rest your leg (straight) with your foot flexed towards you on a table or chair (at a height that suits you).
10. To increase the stretch bend forward toward your flexed foot, by creasing at your hips (keep your back stretch).
11. Hold for 20-40 seconds and then switch legs.
12. To increase the stretch, use a slightly higher object.

//TCALF_STRETCH

Calf stretch

Your calf muscles run along the back of your lower leg. To stretch your calf muscles:



6. Stand near a wall or a sturdy object with one foot in front of the other, front knee slightly bent.
7. Keep your back knee straight, your heel on the ground, and lean toward the wall.
8. Feel the stretch all along the calf of your back leg.
9. Hold for 20-40 seconds and then switch legs.
10. To increase the stretch, step back a little.

When should I stretch?

Your decision to stretch or not to stretch should be based on what you want to achieve. If the objective is to reduce injury, stretching before exercise is not all that helpful. Your time would be better spent by warming up your muscles with light aerobic movements (like walking) and gradually increasing their intensity.

The best time to stretch is when the muscles are warm and pliable. A great time to do this is just after exercising. A post-exercise stretch will also slow down your breathing and heart rate, and bring the mind and body back to a resting state.

A couple of other great stretching tips can be read in “six tips for better stretching” which is found in the library.

//TWHAT_TO_MONITOR

What should you monitor when exercising?

In the Exercise Benefits module, we discuss the importance of monitoring to ensure we are not overloading you, but providing you with a program that improves your strength and fitness. You should have been sent an exercise diary to record your exercise. Here's what you should record:

1. What you completed in your session

Resistance training, it is very useful to record:

- Your exercises completed
- Repetitions (the number of movements)
- Sets (the amount rounds you completed of each exercise)
- Resistance (what colour theraband was used, what weight was used, or your body weight etc)
- Duration

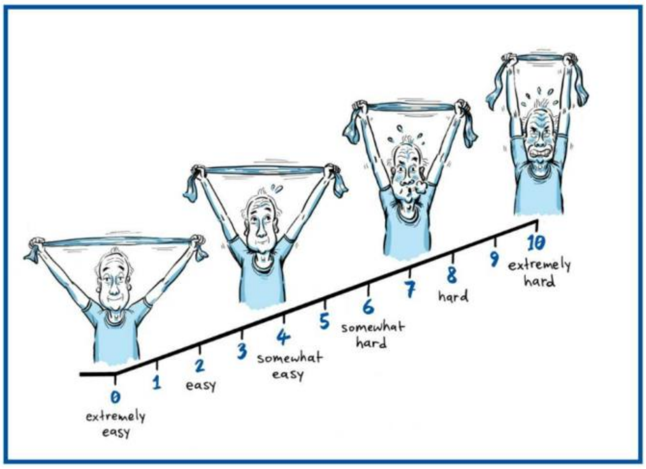
Aerobic training:

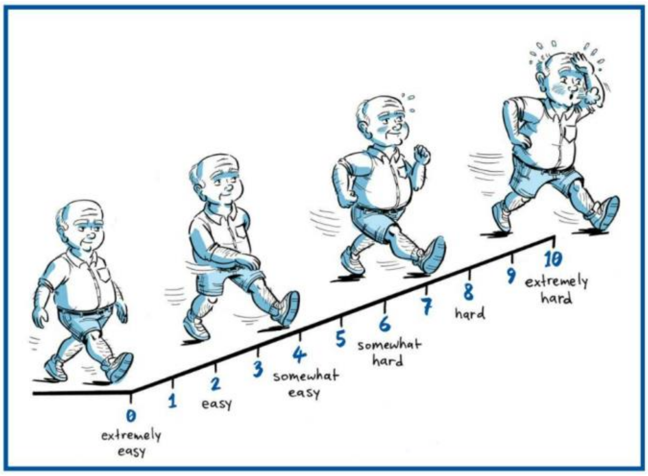
- How far you went
- How long you went

2. How hard the exercise session was

Using a rating of perceived exertion allows you to quantify how hard you found the session. It also helps you determine if you need to increase the resistance or speed/distance in your next session. We recommend you use the 0-10 scale for both aerobic (not tired at all to very tired) and resistance (extremely easy to extremely hard) exercises.

Click here to read more about using the rate of perceived exertion scale to rate your exercise





//TDOUBLE_PAIN_MONITORING

3. Pain levels during and after your session

You mentioned you have bone pain as well as pain from other regions/causes. We want to ensure the program does not increase these levels, so we encourage you to rate your pain levels using a 0-10 scale. It ranges from no pain to the worst pain you can imagine.

What exactly should I record?

Session to session:

- Your bone pain before and after your exercise sessions (from 0-10)
- Your general pain (unrelated to bone pain) before and after your exercise sessions (from 0-10).
- Any exercises that exacerbate either pain in particular

Week by week:

- Your highest bone pain level over the week (from 0-10)
- Your highest non-bone pain level over the week (from 0-10)

//THOW_MUCH_PAIN

Can I push through my pain?

A little bit of pain is ok, as long as it does not increase in intensity and it ceases when the exercise stops. As such, 0-2 is ok but if your pain level reaches a 3 or more you should stop that exercise. If the pain does not disappear, you should stop your exercise session. You can use this type of monitoring to manage any other physical activities that you normally do like gardening or sports.

If you are getting a pain level of 3 or more during the Exercise Guide program, it would be useful to recheck your technique by re-watching the videos that are provided in "My Exercise Plan". If that does not reduce the pain levels then stop that exercise and re-complete the "My Exercise Plan" module assessment or contact the Exercise Physiologist by clicking on the "ask an EP" button.

//TCONCLUSION_MY_PROG

Conclusion:

We hope you enjoy getting stuck into your program and in doing so that you reap the rewards outlined in the "Exercise Benefits" module. Feel free to complete your resistance and aerobic program on the same day as you wish, but we would encourage you to complete your aerobic session first.

Have fun!

Appendix 27. Exercise benefits questions and example of feedback

//Exercise Benefits - Introduction text

Welcome!

This module provides a summary of the evidence about exercise and prostate cancer. Our focus is to show the benefits of specifically tailored exercise in regard to your prostate cancer, whilst still encouraging you to increase your general physical activity levels.

We hope this information is motivating and helps you to make informed decisions about the types of exercise you do, how much and how often. If you are already quite knowledgeable about this we'd be interested to hear if you learned anything new.

Please complete the following questions to generate information on benefits from exercise that relate personally to you.

Let's get started!

//Exercise Benefits - Computer tailoring questions

1. **Do you currently experience any of the following?**
    a. Strength problems? O No; O Yes
    b. Fatigue? O No; O Yes
    c. Anxiety and/or depression? O No; O Yes
    d. Bone pain? O No; O Yes
    e. Sleep problems? O No; O Yes
    f. Incontinence issues? O No; O Yes
    g. Sexual dysfunction? O No; O Yes
    h. Falls or balance problems? O No; O Yes

2. **Have you been diagnosed with a chronic disease besides prostate cancer? This may include conditions such as osteoarthritis or diabetes.** O No; O Yes

3. **What kind of structured exercise do you currently participate in?** *PLEASE NOTE: Structured exercise is planned, intentional exercise often in the form of a training program, so this question doesn't include things like gardening or*

walking to the shops. Resistance training is any planned exercise that causes the muscles to contract against an external resistance (ie: dumbbells, exercise tubing, your own body weight, or any other object that causes the muscles to work hard). Aerobic training exercises are any activities that raise heart rate and make breathing somewhat harder.

O I don't do any structured exercise at the moment; O I am completing aerobic exercise (like walking) but no resistance exercise; O I am completing resistance exercise but I am not doing any aerobic work; O I am performing both aerobic and resistance exercises.

4. **You have said you engage in structured exercise. How many times a week (on average) would you exercise?** *PLEASE NOTE: Structured exercise is planned, intentional exercise often in the form of a training program, so this question doesn't include things like gardening or walking to the shops.*

   O Once or twice a week; O Three or more a week

Thank you for completing our questions.

We have tailored the advice on the next page below based on your answers.

Please click next button.

// Exercise Benefits – Computer Tailored Feedback Example

TAT_A_GLANCE

Is exercise medicine?

It was in the mid-1980s that exercise was first considered as a potential 'medicine' for cancer patients and survivors. Since then, it has been an emerging area of interest for researchers, particularly for using exercise to prevent, manage and delay cancer progression. For example, recent evidence suggests exercise can work as a complementary therapy and increase the potency, delivery and effectiveness of treatments such as chemotherapy and radiotherapy.

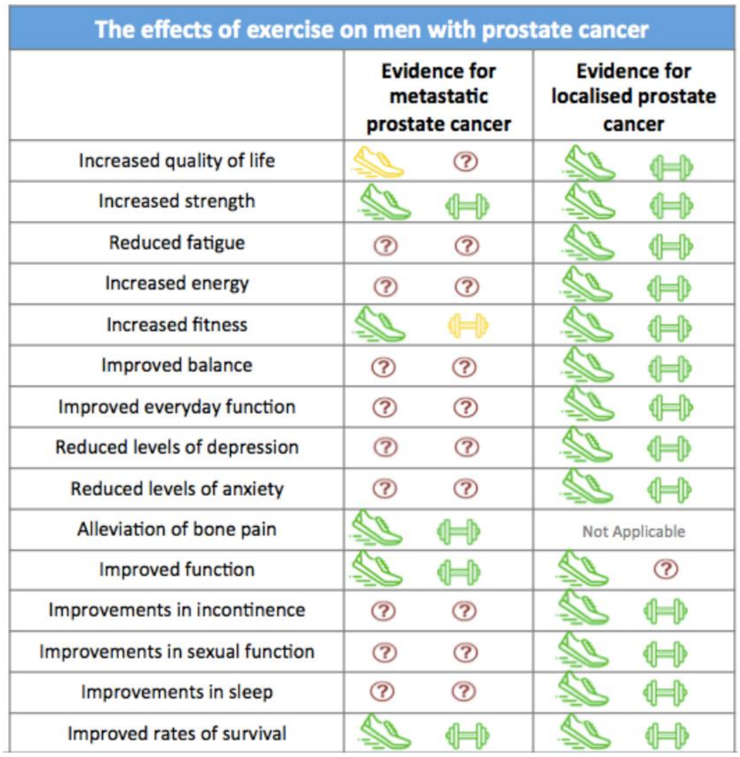
One of the most recognisable benefits may be an improvement in the quality of your life - it may help you play with your grandchildren or keep up with other speedsters, work in the shed, garden and other activities you find joy in.

TSPECIFIC_BENEFIT

Exercise benefits specific to individuals with prostate cancer.

The impact of exercise on men with prostate cancer is a growing area of research. To date, there have been three studies explicitly examining the benefits and safety of exercise for men with metastatic prostate cancer - and over 20 studies exploring the benefits of exercise among either men with localised prostate cancer or people with advanced cancer of other types.

The upcoming table summarises the evidence from these trials. It shows what type of exercise (resistance-based or aerobic) has been associated with what benefit, and how strong the evidence is based on the quality of the studies.



SYMBOL KEY:

Running shoe = Cardiovascular (aerobic) fitness

Dumbbell = Resistance(weights) training

Question mark = Not tested

COLOUR KEY:

Green = Strong evidence

Amber = A little evidence

Red = No evidence or not yet studies

The strength of evidence is colour coded using the traffic light principle

- Green is best!
- Weaker, amber
- Red, or no evidence, doesn't mean there is no benefit – just that it hasn't been studied widely to date.

One of the most recognisable benefits may be an improvement in the quality of your life - it may help you play with your grandchildren or keep up with other speedsters, work in the shed, garden and other activities you find joy in.

TSURVIVAL_BENEFIT

So... can exercise prolong life after a cancer diagnosis?

Although this is a hard question to answer, the latest observational studies involving men with prostate cancer suggest there is an association between both incidental exercise and non-specific physical activity and increased survival.

It is thought that multi-modal exercise (a combination of aerobic and resistance training) might slow the tumour progression through reduction of fat mass, inflammation, changes in the tumour itself and in the body's hormone regulation. Furthermore, recent animal studies have shown that just one bout of exercise can induce death of some cancer cells.

However, it is important to note that although one bout of exercise may have an anti-cancer effect, studies have shown a 'dose-dependent effect' – meaning the more you continue to exercise, the greater the benefits. Although we don't currently know the full extent of exercise and survivability, for now, we do know it can help enormously with improving how you feel.

Are you interested in reading more?

The physiology of exercise as a form of treatment for metastatic prostate cancer, please click here.

Click here to read about the biggest study to date on exercise for men with metastatic prostate cancer.

TPERSONAL_BENEFIT_1SYM

Specific to you

{user_firstname}, we are sorry to hear that you are experiencing some side effects from your disease and treatment. For this reason, we've expanded on the information located in the exercise benefits table based on the issue(s) you reported in the questions you answered earlier.

TBENEFIT_ENERGY

Increased energy levels / Reduced fatigue

Fatigue is a common side effect of undergoing cancer treatment and living with cancer. Over a hundred studies have investigated the impact of exercise for tackling fatigue, specifically cancer-related fatigue, and have found it to be an **effective treatment**, often better than some pharmaceutical options. However, if you are on medication, do not change any medications without consulting your GP.

Although we still don't know exactly why exercise can reduce cancer-related fatigue, there is enormous support behind using **moderate-intensity exercise as a first-line treatment**.

Despite the research, it is normal to have 'good' and 'bad' days whilst living with cancer and sometimes you might not feel like getting off the couch at all - let alone to exercise. If you would like to know more about how you should modify your exercise when you have cancer-related fatigue, please visit the "Safety Module".

//TBENEFIT_STRENGTH

Muscular Strength

Feelings of decreased strength are often associated with hormone therapy, chemotherapy, radiation therapy and as a result of becoming more sedentary post-treatment. You may feel like you are not as able to do those odd jobs like carrying big boxes or heavy shopping as easily as you used to.

One study involving individuals who either had metastatic prostate cancer or metastatic breast cancer showed **a significant improvement** in lean mass and physical function after **incorporating two resistance exercise sessions into a weekly routine**.

It is thought muscular strength improvements in the first few weeks occur because the muscles become a little more coordinated and efficient. After that, we start to see an increase in the size of the skeletal muscle. Moreover, a study on older men also showed that aerobic training (such as going for a brisk walk or cycling) can improve muscular strength through similar mechanisms - often overcoming feelings of weakness.

TBENEFIT_SLEEP

Sleep Improvements

A research study carried out suggested some men with prostate cancer wake up on average 3 times a night. This disruption in sleep stems from a range of factors including needing to urinate, distress, side effects from cancer treatment and general ageing.

Exercise can strengthen circadian rhythms, which promotes daytime alertness and helps bring on sleepiness at night - plus it is also believed **to increase longer periods of the deeper more restorative sleep** stages. Regular exercise may lead to greater improvements in sleep quality, with sleep efficiency and duration associated with carrying out aerobic exercise (such as walking) in particular.

Want to read more?

Click here to read a research article on sleep and daily functioning during Androgen Deprivation Therapy.

What is recommended for you based on research studies?

It is great that you are doing some aerobic exercise already. Depending on your circumstances, you may be able to obtain additional benefits by altering your routine to include some resistance exercise. The current research recommends participating in both aerobic and resistance training to squeeze the most benefit out of the exercise.

The My Exercise Plan module will provide you with a tailored exercise program suitable to your level of fitness, metastases location and your current state of health. The resistance-training component uses bodyweight and resistance bands so you can do it anywhere you like. There will be videos to show you how to perform the exercises.

Appendix 28. Drive safely questions and example of feedback

//Drive Safely - Introduction text

Australian and international oncology guidelines suggest that men with metastatic prostate cancer should avoid inactivity, however in the past clinicians have been uncertain of what exercise is safe and will not lead to increased pain levels.

The aim of this module is to give you specific information about how to make the program and your everyday physical activity safe for you. This should allow you to be able to make informed decisions about what types of exercise and incidental activity (gardening, shopping) you want to do, whilst reducing your risk of disease-related injuries.

This module includes information on:

1. The importance of monitoring your exercise
2. Exercising safely with metastases
3. Disease and treatment-related side effects and exercise
4. Exercising whilst undergoing treatments
5. Effects of other conditions you have been diagnosed with (if any).

This is a bit of a longer module, so feel free to read it in small sections and come back later to continue reading. If you have access to a printer, you can print it so you have access at all times. Feel free to give this to family, friends, training partners, doctors and even those who you may see for exercise advice.

Please complete the following questions to generate the personalized content for this module.

//Drive Safely - Computer tailoring questions

1. **Are you experiencing any of the following side effects or issues?** *Note: This question incorporates both prostate cancer and non-prostate cancer side effects.*
    a. Cognitive function/fogginess/chemo brain? O No; O Yes

b. Muscle weakness (motor dysfunction)? O No; O Yes
c. Headaches? O No; O Yes
d. Gastrointestinal complaints (Vomiting, constipation, diarrhoea, urgency, obstruction, and incontinence)? O No; O Yes
e. Nausea and/or dizziness? O No; O Yes
f. Reduced flexibility (muscular stiffness or reduced range of muscles)? O No; O Yes
g. Peripheral Neuropathy (tingling or numbness in hands or feet)? O No; O Yes
h. Skin irritation or rashes? O No; O Yes

2. Are you currently or have you been treated (in the last year) using any of the following therapies?

a. Chemotherapy? *Anti-cancer drugs injected into a vein or given by mouth.* O No; O Yes
b. Androgen deprivation therapy? *Injections or tablets that block the body's production of testosterone* O No; O Yes
c. Radiation therapy? *The treatment that uses radiation to kill or damage cancer cells* O No; O Yes
d. Immunotherapy? *The treatment involves filtering out your immune cells, stimulating them and then reinfusing the cells.* O No; O Yes
e. Bisphosphonates? *A type of drug that can help to strengthen bones that have become weak or thin. Given either as tablets or through a drip into a vein*. O No; O Yes

3. Has your doctor ever diagnosed you with the following?

a. Diabetes (type I or type II)? O No; O Yes
b. A heart condition or stroke? O No; O Yes
c. Osteoporosis? O No; O Yes
d. Arthritis in one or more joints? *Note: This includes osteoarthritis, rheumatoid arthritis, psoriatic arthritis.* O No; O Yes
e. High blood pressure (hypertension)? O No; O Yes
f. A respiratory condition? *Note: Includes chronic obstructive pulmonary disease, emphysema or asthma?* O No; O Yes

4. **Do you have lower back pain (not attributable to bone metastases or acute injury)?**
   O No; O Yes

5. **Do you have affordable gym or fitness facilities that are close enough to your location that you would be happy to use?** O No; O Yes

Thank you for completing our questions. We have tailored the advice below based on your answers.

// Drive Safely – Computer Tailored Feedback Example

TSAFETY_INTRO

This module aims to present you with information about how to exercise safely and what you may need to aware of to get the best out of an exercise program.

//TEXERCISE_WITH_METS_INTRO

//TEXERCISE_TREATMENTS_INTRO

Exercising whilst going through cancer treatments

Your current treatments may influence your ability to exercise, but it still doesn't mean you can't get active and strong. Some days you may not want to move and whilst sometimes it is best not to, other times it will make you feel better.

//TCHEMOTHERAPY_SAFETY

Exercise and Chemotherapy

Exercising whilst completing or just after finishing chemotherapy is safe, however, it can be useful to create an exercise plan around your chemotherapy cycles. Most people experience side effects over 1-4 days post chemo. You may want to structure your exercise sessions in advance so you do lighter sessions over this period. This may stop you from feeling guilty about not doing your exercises if you are feeling poorly. Did you know that there is evidence that says that exercising on the day of your chemotherapy can reduce some of the side effects and may even make treatment more effective? Click here to read more in one of our great blogs "Exercise and chemotherapy: 6 key reasons why they should go hand in hand!"

Your doctors or specialists may have told you that chemotherapy can reduce the amount of white cells in your body and can increase your risk of infection. For this reason, exercising in your home may be better than a public gym if your immune system is often compromised (lower than 4000 white blood cells per microliter of blood). It would be recommended that you avoid public swimming pools over this time. If you do have an infection, just stick to light intensity physical activity until you are feeling better. For safety reasons, avoid completing your exercise session if your neutrophil count is less than 0.5× 109/L. Your doctor should be able to tell you your levels.

//TANDROGEN_DEPRIVATION_THERAPY_SAFETY

Androgen deprivation therapy and exercise

There have been many research studies that have shown that exercise is safe whilst or after being treated with Androgen Deprivation Therapy. That type of drug does tend to reduce your muscle and bone density but we have designed this program to start slowly, which works perfectly. Whilst it is not great to suddenly decide to lift a really heavy object out of the blue, you can definitely build your strength up! If you are interested, feel free to read more about the effects of exercise on ADT side effects here.

//TRT_BONE_METS_SAFETY

Resistance training with bone metastasis

Resistance training is safe and beneficial for someone with metastatic prostate cancer as long as a few things are taken into account. For example, bone lesions can reduce the load-bearing ability of that area of the bone. For this reason, current research recommends that resisted exercises should avoid putting a direct strain on the bone with the metastases. This reduces the forces on areas where the bone may not be as strong but allows us to make other parts of your body strong. A study completed using a supervised version of your program found that the men reported their bone pain at each exercise session was on average 0.7 out of 10 (little to no pain) on a scale of 0 (no pain) to 10 (very severe pain) and they reported maximum values of 1.8 across all sessions.

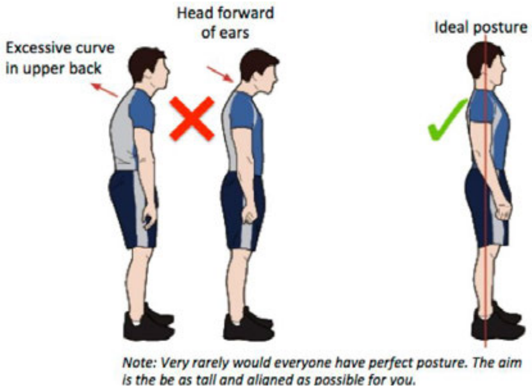
Just as a side note, the techniques used in the exercise videos are based on up to date evidence with a focus on both effectiveness and safety. It is recommended that you follow the directions given by James in each of the videos.

// TINDIVIDUAL_BONE_METS

What does that mean for you?

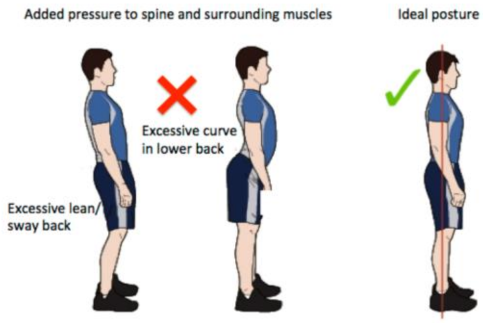
// TTHORACIC_MET_RT_SAFETY

Research recommends that if you have a lesion in your thoracic region, then it is best to reduce loading your shoulders, rib cage and mid-back. For example, avoid pulling open a very heavy door or lifting weighty boxes above your head if you can. Rotation under a heavy load can also lead to issues with the bone, so it is important to keep a neutral spine if possible (click here to watch a video on "what is a neutral spine").



//TLUMBAR_MET_RT_SAFETY

You reported you have a metastasis in your lumbar spine or sacrum (lower back). We would recommend you avoid bending or twisting your lower back under load. This may include picking up heavy objects with a flexed spine. Keep your trunk controlled and in a neutral position if you are doing physical activity.



//TRT_EXERCISE_WITH_METS_EXTRA

Tips to make your resistance training safe and effective

One way to reduce the risk of bone injury is to complete the movement in a slow and controlled manner, which minimizes forces going into the bones. Aim for each segment of the movement to take 2 seconds. For example, a push up would be 2 seconds down and 2 seconds up. It is important to note that we are not saying, do not use these joints in daily life. However, completing lots of heavy repetitions of one exercise may stress the bone to the point of injury such as a fracture. We don't want that! Luckily there are still other areas of the body that we can focus on.

Avoid trying to complete all the repetitions in one go without having a rest between sets (ie: doing 1 set of 30 rather than 3 sets of 10 with rests between) as this does not improve muscle strength but rather endurance. We are using aerobic training to improve that type of fitness. You should also be able to use a higher level of resistance when completing sets with rest breaks and this should also reduce the risk of injury.

You can, however, swap from one leg exercise to one trunk exercise without resting as this is using different muscle groups. This is called super-setting and can be time-efficient if needed (click here to read an article explaining supersetting in more detail).

It is also interesting to note that the latest research has shown we can load areas around the spinal metastases safely if we do not change the bone's position. This is known as isometric training. This may be added into your program with the aim to strengthen your postural muscles around the trunk. When completing these exercises the aim is to keep the spine stable whilst moving other areas of the body.

// TAEROBIC_TRAIN_BONE_METS

Aerobic exercise for metastatic prostate cancer

It is safe to complete aerobic exercise with metastases! But just like a lot of people, you may need to have your aerobic training tailored to suit you. In Exercise Guide, we think about your lesion site, pain levels, capacity and mode available to you when the exercise is prescribed.

You may need to modify based on how you feel day-to-day and so it can be important to understand how your side effects and treatments may determine the modification of your daily session. For example: if your bone pain levels increase past a 2-3 out of 10, it is advisable to use another form of aerobic training.

// TSIDE_EFFECTS_SAFETY_INTRO

Exercising safely with your side effects

It is important to recognize that some of your treatment side effects can sometimes mess around with your ability to exercise and complete general life activities. Below is some information that may make it a little easier for you to modify your activity when you need and feel comfortable and safe.

// TFATIGUE_SIDE_EFFECT

Moderate to severe fatigue

- Due to your fatigue levels, we suggest that you monitor your fatigue levels and focus on using rate of perceived exertion (0-10) as your guide to how much you should do rather than set weights or times.
- If you need, break up your exercise session or activity into smaller, more manageable blocks like 4-5 minutes with a good recovery break. This may even include gardening and cleaning
- Try to still do some low-intensity exercise during times of excessive fatigue. You may not feel like it but stopping all activity may lead to losing fitness and strength, which can make the fatigue worse.

//TCOG_FUNCT_SIDE_EFFECT

Cognitive function/fogginess/chemo-brain

- If you have noticed changes in your memory, concentration levels or find it difficult to learn new skills, it may be useful putting strategies in place to ensure your exercise is easy to complete and safe
- It is not cheating to use memory aids. Some guys find it beneficial to use the printouts and videos every session just to jog their memory. Other people find it

is useful to exercise with someone, either with a friend, family member or in a supervised gym

- Pay attention to your technique, avoid going on autopilot.

// TMOTOR_DYS_SIDE_EFFECT

Muscle weakness:

- Changes in your movement patterns, muscle control or walking (unsteadiness) may make completing the exercises harder than you first think. Take your time with them and focus on your technique! We really encourage slowing each resistance training exercise down and focusing on the control of your movements. Your body will thank you for it.
- You may need to be aware of unsteadiness or balance changes. It is a great option to complete your exercise in a controlled environment, where you have objects to hold on to if you feel unbalanced, or where you can sit down (if able).

// TNEUROPATHY_SIDE_EFFECT

Peripheral Neuropathy:

Oncology treatments sometimes cause damage to the nerves (known as peripheral neuropathy), which can cause numbness, tingling, or burning sensations in the hands or feet and this can make it hard to grip or balance. If this is the case:

- Think about exercising in an environment that is safe (like a gym) rather than outside, or on a stationary bike rather than uneven footpaths.
- If you are struggling to grip the theraband, try wrapping the band around the wrist as well as the hand to gain leverage.

// TWARNING_SIGNS_TO_STOP

When should I stop exercising?

Some symptoms are warning signs to stop.

If you experience any of the following symptoms while exercising, stop the activity immediately and seek urgent medical assistance:

1. Pain or pressure in your chest or pain down your arms;
2. Severe shortness of breath;
3. Dizziness or fainting;
4. Irregular or unusually rapid heartbeat;
5. Nausea and/or vomiting;
6. Extreme muscular weakness;
7. Extreme fatigue;
8. Increased levels of bone pain;
9. Symptoms of spinal compression - Numbness of legs or belly, increased levels of back pain (sometimes with pain going down one or both legs); sudden loss of control of urine or stool.

What about muscle or joint pain - how far can I push?

A little bit of pain is ok, as long as it does not increase in intensity and it ceases when the exercise stops. As such, 0-2 is ok but if your pain level reaches a 3 or more you should stop that exercise. If the pain does not disappear, you should stop your exercise session. You can use this type of monitoring to manage any other physical activities that you normally do like gardening or sports.

If you are getting a pain level of 3 or more during the Exercise Guide program, it would be useful to recheck your technique by re-watching the videos that are provided in "My Exercise Plan". If that does not reduce the pain levels then stop that exercise and re-complete the "My Exercise Plan" module assessment. You can also use the "ask an expert" section if you would like some more guidance.

// TCO_MORBIDITY_SAFETY_INTRO

Exercising safely when you have other medical conditions

We understand that you have other medical conditions that you need to consider as well. Here is a quick snippet of information to keep in mind whilst you are exercising.

If you would like to know more, please click on the headings for each condition (in blue).

//TDIABETES_SAFETY

Diabetes (Type 1 or Type II)

- Monitor your blood glucose levels.
- You may need to adjust your insulin if needed.

//THYPERTENSION_SAFETY

High Blood Pressure

- Ensure you breathe throughout your exercise session - breathe out when you are exerting force.
- Monitoring your blood pressure can be important.
- Be aware that you should stop your exercise if your systolic blood pressure is greater than 180 mmHg or diastolic blood pressure is greater than110 mmHg.

// TLOW_BACK_PAIN_SAFETY

Low back pain

- Begin slowly and progress your exercise intensity gently.
- Keep a good posture, and avoid bending your spine whilst holding heavy loads.
- Do not be afraid to seek help from allied health professionals to help you resolve any muscle pain you may have.

// TIMPORTANCE_MONITORING

Monitoring your exercise

Monitoring your exercise is very important to make sure you are keeping your exercise as safe and effective as possible. Here are some essential ways in which monitoring yourself can help:

- It lets you see your progress! You can see where you have been and where you are going. Increased fitness and strength are often hard to perceive but when we track our progress we can see the change we have made.

- Exercise can be tedious at times and when we see records on paper (especially ones that show improvement), we may be compelled to do it more when we may not feel like it.

- Ensuring you are working at the correct intensity can be the difference between exercise being effective or not. As our fitness levels increase, we often need to make our exercise activity harder to ensure we are still challenging ourselves. We only know how to do that, if we can see what we completed in the past.

- It is a way to see what does and does not work - we may see that a certain form of exercise was associated with increased bone pain or no strength increases. By tracking exercise, we can track progress, figure out what works, and change if needed.

- It is useful for tracking ‘good days’ and ‘bad days’, and considering how much exercise to do on those days. If you are able to determine that you need to reduce your intensity because you are feeling greater than usual fatigue then you have an idea about what that looks like. This is better than not doing the session at all.

// TRT_PROGRESSION_SAFETY

Handyman's weight training

You might have experienced something similar to Bob in the story below. The Exercise Guide program takes a similar approach with our strength training.

Bob is pretty handy with the tools and has been asked by his friend Norman to build him a shed with the timber lying around Norman's property. Bob loves helping a mate out and a couple of days a week for an hour or two, he spent time finding and carrying good pieces of timber that he can use for this shed. Each log wasn't that big but felt pretty heavy and could just manage it (Bob wanted to make sure he lifted it safely and didn't try and overdo it).

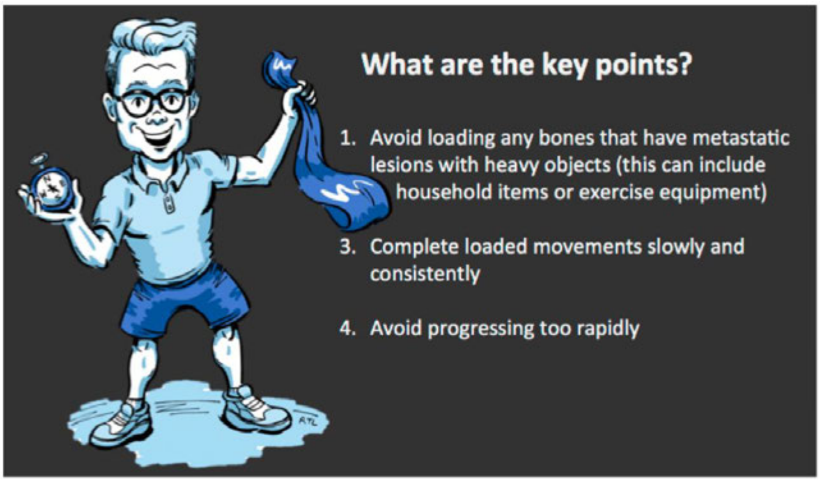
After a week or so he started to notice that didn't find it as difficult and was able to carry bigger logs. After three or four weeks Bob started noticing that he was not as pooped and decided he could take more trips for more logs.

By the time they had all the timber they needed, Bob felt like he was stronger and fitter and once made, the shed looked pretty decent.

Moral to the story? You don't need to overdo it to become stronger, to help yourself and to help others!

//TSAFETY_CONCLUSION

Final thoughts



Exercise Guide is tailored for you to give you the confidence to self-manage your exercise and increase the intensity when you are ready to. This should help you feel like you are getting the most out of life with strength and vigour. We know we have given you a large amount of information, but we are always here to help. You do not have to remember every single point but it is great to refer back to when you need to.

Appendix 29. Making it last questions and example of feedback

//Making it last - Introduction text

This module is here to provide you with some scientific advice about how to develop and stick with an exercise routine.

We are assuming that you will already have an idea of what might be helpful for you. We will focus on some of the things research has shown to help and explain why this is the case. It is information that you can apply to your own goals, and potentially use to support other people around you that may be struggling to make behaviour changes.

To help us gain a better sense of what information might be most useful for you, we have some questions we would like you to answer:

//Making it last - Computer tailoring questions

1. **Which of the options below best describes your current situation:**

   O I am interested in starting a structured exercise program.

   O I have started a structured exercise program and am finding it easy to adhere to.

   O I have started a structured exercise program and I am finding it difficult to adhere to

2. **How confident are you right now that you could adhere to a structured exercise program when:**
   a. The weather is bad? O Not at all; O Somewhat confident; O Confident.
   b. You feel tired? O Not at all; O Somewhat confident; O Confident.
   c. You lack time? O Not at all; O Somewhat confident; O Confident.
   d. You don't enjoy it? O Not at all; O Somewhat confident; O Confident.
   e. You feel stiff and/or sore? O Not at all; O Somewhat confident; O Confident.
   f. You don't have anyone to encourage you or keep you accountable? O Not at all; O Somewhat confident; O Confident.

3. **Which of the following best describes what motivates you to exercise?**

O I exercise because other people say I should.

O I feel guilty when I don’t exercise.

O I think it is important to make the effort to exercise regularly.

O I find exercise a pleasurable activity.

4. To what extent do you agree with the following statements:

a. I have made plans concerning what, when and where I will perform my structured exercises over the next week. O Not true of me; O Somewhat true of me; O Completely true of me.

b. I have purposefully planned ways to do my exercise program when other things may get in the way (e.g., when on trips away from home, when the weather is bad, or when I feel ill). O Not true of me; O Somewhat true of me; O Completely true of me.

5. To what extent do you agree with the following statements:

a. Exercise is something I do automatically.
Strongly disagree O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Strongly agree.

b. Exercise is something I do without having to consciously remember.
Strongly disagree O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Strongly agree.

c. Exercise is something I do without thinking.
Strongly disagree O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Strongly agree.

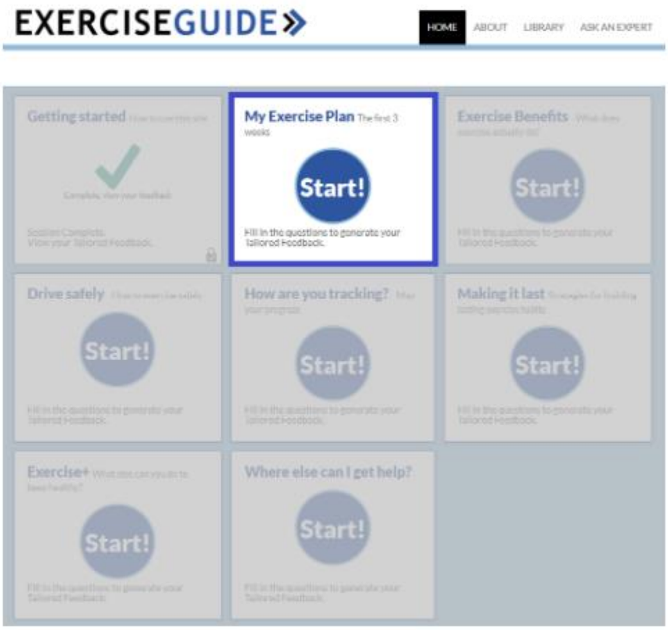
d. Exercise is something I start doing before I realize I’m doing it.
Strongly disagree O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Strongly agree.

Thank you for completing our questions.

//Make it last – Computer Tailored Feedback Example

//TBc1a

We are really excited that you are interested in starting a new exercise routine. If you haven't already, you can generate a program for yourself using the "My Exercise Plan" box on the homepage.



The program available through ExerciseGuide is based on the research of our team members at Edith Cowan University. They conducted one of the first studies showing the benefits of exercise for men with metastatic prostate cancer and provide the know-how for how to select exercises for each person to maximise safety and benefits.

You can use the information and tasks in this module to help you complete the 8-week ExerciseGuide program or an alternative if you would prefer, and to continue exercising thereafter. Your exercise physiologist will be in contact in week one and week four to answer any questions you may have and keep you accountable to your program goals.

Click next to continue.

//TBC2

What does the research say?

This image summarises five key factors that research has shown to influence our exercise behaviours. Consider if any of the words you mentioned before could relate to these. Some things you thought of might be more outside of your control, like access to services. However, the five factors are based on issues most people should be able to have some control over.

//TCONFIDENCEM1

Increasing Confidence

One thing you could do to help you adopt an exercise routine is to increase your confidence levels. Your confidence score was {SE_TOTAL} out of 12.

The level of confidence you have for overcoming barriers to exercise impacts on your behaviour in a number of ways. This is because, naturally, we have a tendency to avoid things we don't feel very confident about. For example, if you don't feel confident in your ability to fit exercise in when you are busy, you are more likely to feel stressed about making it a priority, and less likely to intend to exercise in the first place.

There is no magic bullet for increasing confidence, but here are some things you could consider trying:

Increase your knowledge.

ExerciseGuide has information on the benefits of exercise, how to exercise safely, and video and written demonstrations on how to perform the resistance-training exercises suggested for you. There is a fair amount of information and instructions. You don't have to read it all and understand it all at immediately. You can come back to it as many times as you would like. If you aren't confident in your ability to perform specific exercises, or aren't sure about the possible benefits, this would be a good start.

Set goals using the "sweet-spot" principle.

Set a goal that is Just right – i.e., the right mix of achievable and challenging. If you goal is unrealistic, it might be tempting to quit at the first sight of trouble. If it is too easy, you won't feel like you have really achieved something. A goal that is just right will keep you focused, help you identify what barriers need addressing, if any, and give you a sense of accomplishment when you achieve it.

Adapt your program as needed.

The exercises recommended by ExerciseGuide are selected in part based on your level of confidence. If you still feel like the amount of exercise prescribed is too much, consider the prescription as a suggestion to work towards. You can also be creative to make the recommended amount work for you. For example, if your suggested prescription is to walk for 20 minutes, you could split it into two smaller sessions throughout the day if that is more manageable.

Find sources of feedback and support.

Positive constructive feedback does wonders. This can come from the buzz of a fitness tracker, a best mate, your family, an exercise professional. However or whoever you like. Even the most self-motivated people can benefit from the added accountability and support from engaging others. ExerciseGuide has a built-in “tracking module” that can help you stay accountable if you need and you can use the "ask an EP" for additional support

Confidence, having clear goals and a plan are things considered important for getting started. Whereas, the type of motivation you have, and whether or not you have a habit can predict how likely you are to stick with your routine. These are of course the things we asked you questions about. Let’s take a closer look.

//TPLANM1

Become a man with a plan

Most of us can relate to having the best of intentions, but then watching them fall flat as our intentions do not translate into actions. Unfortunately, intentions are one of those things that are necessary, but not sufficient to guarantee success.

Having a plan helps to translate intentions into actions. It does this in 3 main ways:

- Scheduling in exercise like we would other appointments makes it a priority, and less likely it will fall down the priority list.

- It provides an opportunity to address potential barriers (e.g., hot weather) and outline alternative arrangements (Plan B!).
- It makes us more likely to remember our intentions at the time we are supposed to act.

A good plan has specific details and accounts for potential disruptions with a Plan B. **If then** statements are useful for plan B. An example of an **if then** statement if you are not feeling 100% might be:

*"**If** I am not feeling well, **then** I will exercise at a lower intensity. **If** I am too sick to do any exercise **then** I will rest, and try tomorrow instead."*

Using planning in this specific way has been shown to work to help people adopt exercise behaviours. We recommend you give it a go for the next 3 weeks and see if it works for you.

//TMOTIVATIONM5

Be driven by what you value and enjoy

You reported that your main motivation for exercise is based on what other people think you should do. While any source of motivation can get you exercising, motivation that is more about what you yourself value and your own satisfaction is more likely to keep you exercising.

With this in mind, we recommend you think about what rewards from exercising you personally value and consider how to make your existing routine as satisfying and enjoyable as possible. Naturally, we are more likely to stick to a routine that we want to do rather than one that we have to do.

So how could you do this?

Here are some tips that might help:

- We all have the basic needs of wanting some control over what we do, of feeling capable, and of connecting with others. If you consider your routine in terms of how well it meets these needs, your might be ale to adapt it to be more enjoyable and satisfying.

- If you are not the sort of person that typically enjoys exercise you can consider modifying the exercise prescription (e.g., how hard you exercise) based on what feels good. This is called "affect regulated exercise". It has been shown to lead to fitness gains. At the end of the day, some exercise that you can maintain because you enjoy it is going to be better than the best laid prescription that you don't stick to because you don't enjoy it.

- Another way to increase enjoyment is to pair exercise with other activities that you do enjoy and value e.g., listening to music, spending time with friends/family. It can be great to meet with like-minded people who enjoy the same activity and perhaps you can pair it with coffee or a meal after.

- Exercise for mental health as well as physical health. Many of the benefits of exercise do not immediately occur after an exercise session. The exception are the mental health benefits. Exercise can lift spirits, provide a sense of control and accomplishment, and increase motivation for other activities.

//THABITM1

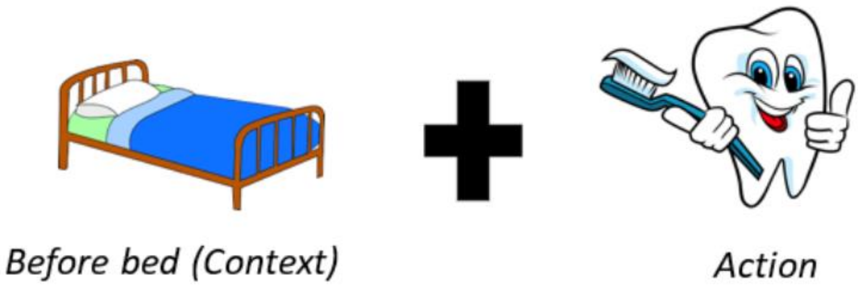
Set your auto-pilot to exercise mode – create a habit

Habits aren't just about doing an activity frequently. Habits, in a psychological sense at least, are about doing an activity automatically. In our opinion, this is where most structured programs let people down – they don't generally focus on building habits.

Your results to the survey suggest that exercise is not yet a habit for you. So how does habit formation work, how can you develop one, and why should you?

How do habits form?

Habits refer to a process whereby a particular situation prompts us to do something somewhat automatically, because of how we learn to associate them together.



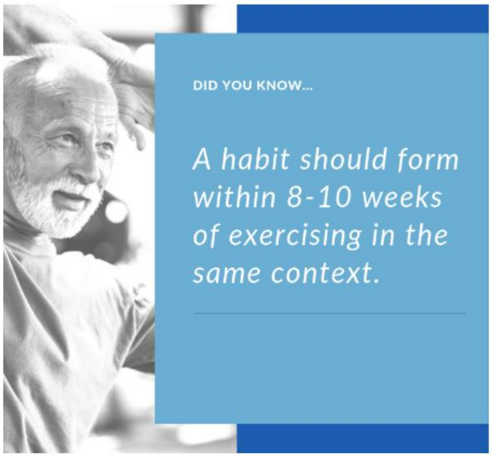
Associations are learned and strengthened through repetition. Take the example of brushing our teeth. By always doing this action in the same context (e.g., before bed), eventually we start automatically brushing our teeth when this context occurs – without even needing to set goals or track our progress.

How can I develop a habit?

To form a habit, the advice is simple - repeat exercise consistently in the same context. Think about what context would be best to act as a cue for your exercise routine. Pick something attached to a common event (like "before my shower") that can act as a cue. If you pick a specific time of day (e.g., 9am) you might not notice as it rolls on by.

Once you have selected what your cue to exercise will be, you can then incorporate this into your plan using an if/when, then statement. E.g., When I finish my breakfast then I will get ready to exercise then I will start my exercises.

Structure and consistency is the most important action you can do.

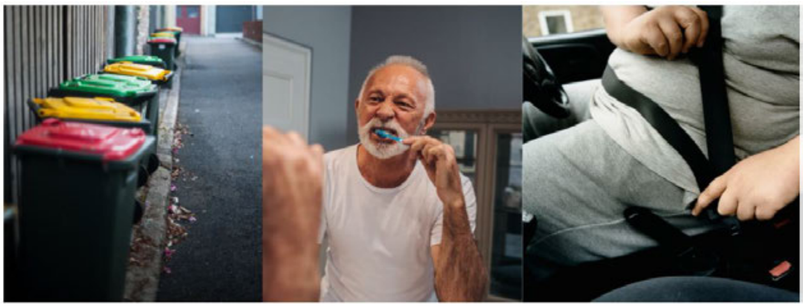


What is the benefit of having a habit?

Previous research has shown that people who have an exercise habit are more likely to maintain regular participation in exercise. Having a habit makes managing an exercise routine less taxing and more doable in the long-term.

Things like increasing knowledge, setting goals, and obtaining social support are useful (and often necessary) in the beginning to adopt a behaviour (none of us developed a spontaneous teeth cleaning habit after all).

These can become burdensome overtime. If we had to pay attention and be actively motivated to carry out all of the health behaviours we engage in every day (e.g., putting our seat belt on, brushing our teeth, putting rubbish in the bin, flushing the toilet etc!) it would be exhausting.



//TBC_FINAL_MESSAGE

Final thoughts

There are always challenges to maintaining exercise routines but we hope this module may have given you a few tips and tricks to use to help you stick with it - so you can reap the benefits.

If you feel like you need more help, feel free to use the "Ask an Expert" page or call Ms Holly Evans (Exercise Physiologist) for some extra support.

If you are interested in the science that has guided the advice in this module you might find this interview interesting. It is of one of our lead website developers Dr Camille Short talking about the science of behaviour change on the Reasearch in Exercise and Cancer Podcast (REACH).

Just remember: More is better than less, some is better than none and consistency is key!

Appendix 30. Exercise plus questions and example of feedback

// Exercise Plus - Computer tailoring questions

1. **From the list below, please indicate which food or beverage items you have on a regular basis (e.g., once or more a week).**
    a. Processed meat (Bacon, Sausage, Lunch meats) O No; O Yes
    b. Poultry with skin on (chicken, turkey) O No; O Yes
    c. Fish O No; O Yes
    d. Legumes O No; O Yes
    e. Whole milk O No; O Yes
    f. Cooked tomatoes O No; O Yes
    g. Cruciferous vegetables (broccoli, cauliflower, cabbage, Brussel sprouts, kale, bok choy) O No; O Yes
    h. Other vegetables (other than potato) O No; O Yes
    i. Cakes, biscuits, pastries, chips O No; O Yes
    j. Fruit O No; O Yes
    k. Sugary drinks (e.g., soft drinks, fruit juice, cordials O No; O Yes

2. **Please estimate how many hours you spend sitting or lying down each day from when you wake up in the morning until you go to bed at night.**
   O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10; O 11; O 12; O 13; O 14; O 15; O 16; O 17; O 18; O 19; O 20; O 21; O 22; O 23; O 24.

3. **On days that you drink alcohol, how many serves of alcohol would you consume on average?**
   O None, I am a non-drinker; O 1-2; O 3+

4. **How would you rate your sleep quality?**
   O Unsatisfactory; O Satisfactory

5. **Do you suffer from regular hot flashes?** O No; O Yes

6. **Thinking about how you have been feeling over the past week, including today, how distressed do you feel on a scale of '0', no distress to '10' extreme distress?**
O 0; O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10.

Thank you for completing the survey.

Please click the next button to read your tailored information.

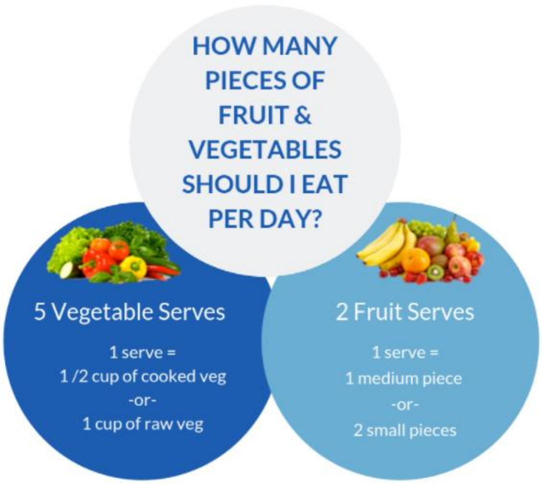
// Exercise Plus – Computer Tailored Feedback Example

//TDIET

The diet questions you answered relate to foods that are recommended for men with prostate cancer, as well as those that evidence suggests should be minimised. Here is some information based on your answers:

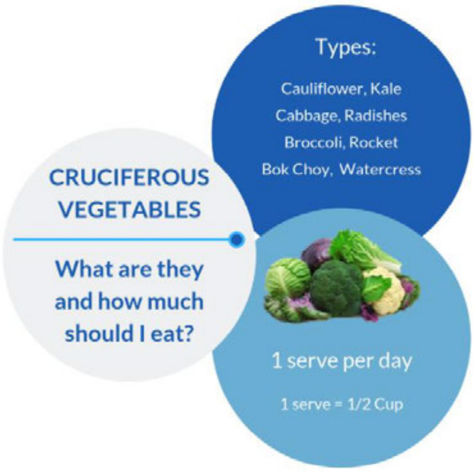
Eat vegetables and fruit every day

Vegetables of different types and colours have different nutrient profiles. Eating a wide variety is therefore recommended to obtain the different benefits.



Cruciferous vegetables

This group of vegetables yield compounds that may detoxify carcinogens (which are cancer-causing agents) and/or reduce cancer cell growth.



Tomatoes

Tomatoes are rich in lycopene, which is an antioxidant that some studies suggest can inhibit prostate cancer growth. Cooking tomatoes increases the body's ability to absorb lycopene. You can include cooked tomatoes in your diet through tomato-based pasta sauces, tomato-based soups, or enjoy roasted tomatoes as a side.

//TVEG1

How is your intake?

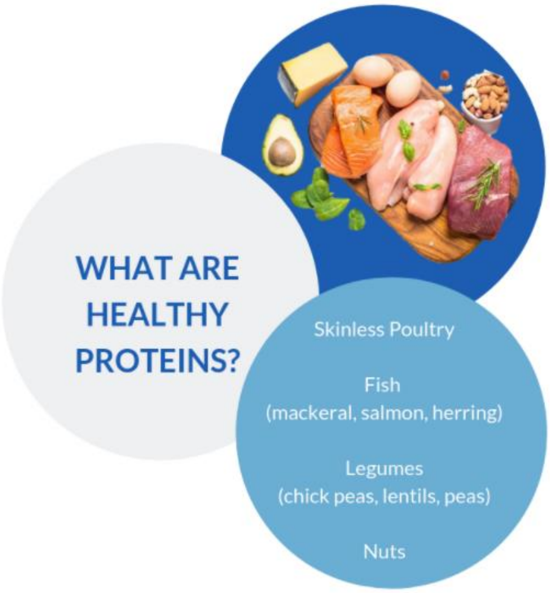
You indicated that you do not regularly eat vegetables or fruit. Incorporating 1 serve of cruciferous vegetables into your diet most days, as well as some cooked tomatoes and fresh fruit would be a good start to improve your health.

//THEALTHY_PROTEIN

Choose healthy proteins

It is recommended that men with prostate cancer stay away from eating processed meat, as well as poultry with skin, and minimise eating red meat particularly if it is well-done. Processed meat includes sausages, hotdogs, bacon, and lunch meats (e.g., salami). These usually have salt and other preservatives added that are associated with an increased risk of cancer spreading. Eating high amounts of poultry with skin is also associated with higher cancer risk among men with prostate cancer. It is thought that the skin releases chemicals when cooked that increase cancer risk. Carcinogens are also found in well-cooked or charred meats, including beef, lamb and pork. These have been linked to various cancers including prostate cancer.

Instead of these meats, it is recommended that you choose skinless poultry, fish, legumes and nuts as your main protein sources.



What if I want to eat red meat?

It is encouraged that you only have a moderate consumption of unprocessed lean red meat. This equates to a 65g serve of cooked meat each day (or 2 serves 3-4 times a week). Avoid consuming more than 455g of cooked lean red meat each week.

//TMEAT13

How is your intake?

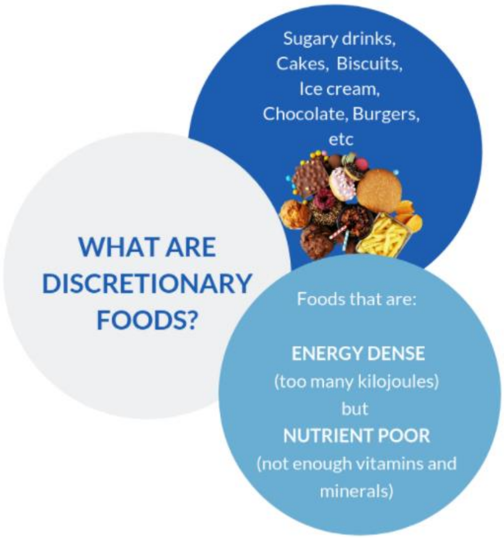
- You have plenty of room to improve your diet. As a starting point, consider removing the skin off your chicken, turkey or other poultry before eating it.
- It is also recommended that you cut down on processed meat, and try and include some healthier protein choices such as fish, legumes and nuts.
- Fish with high levels of omega-3 fatty acids is best, such as salmon, mackerel and herring. At least 2 serves of fish each week is the recommended amount.

//TAVOID_FOODS

Avoid whole milk, excess sugar and foods high in saturated fat

Choose low-fat milk rather than whole milk as there is some evidence that whole milk can increase the risk of cancer spreading. Low-fat dairy is a better option than full-fat dairy to help prevent unwanted weight gain. It is not clear why this is the case, as low-fat milk and other dairy foods have not been linked to worse cancer outcomes.

Limiting intake of foods high in sugar and saturated fats is also recommended. These are called 'discretionary foods' as they are not necessary for a healthy diet, and can impact health negatively due to being energy-dense but nutrient-poor (meaning they can lead to weight gain and poor nutrition).



//TOTHERDIET7

You indicated that you already limit discretionary foods, but do drink whole fat milk and some sugary drinks.

- Switching from whole milk to low-fat milk may improve your health. You can get adequate calcium from low-fat dairy products, vegetables (e.g. Spinach, Kale, Bok choy, Sweet potatoes, Butternut squash, Broccoli) and fortified whole-grain cereals or soy/nut milks.
- Rethinking sugary drinks may also be worth considering. You could switch to water or low-fat milk instead. Soft drinks and other highly sweetened drinks, such as cordial or fruit juices generally provide a high number of kilojoules but few nutrients. This includes some fruit juice, which can be high in energy and low in dietary fibre (whole fruits are considered a better choice than fruit juice). There is good evidence that sugary drinks can lead to weight gain and increase the risk of poor health.

//TDIET_RESOURCES

Additional diet support

If you would like professional advice about your diet we recommend speaking to an accredited practising dietician if you haven't already. You can search via postcode on this website, or ask your treating doctor for a referral.

Through a 'GP management plan and team care arrangement' you may be able to access up to five sessions with any allied health professional considered beneficial for you. This can include an Accredited Practicing Dietitian. Please see the where else can I get help module for more information.

The library page of this website also has some additional information, including some recipes that are easy to make and delicious.

//TSITTING

Breaking up sitting time

Sitting or lying down is what we call "sedentary behaviours". These behaviours (e.g., watching TV, reading, driving) require little energy expenditure. There is growing evidence that being sedentary for long periods throughout the day can negatively impact on our health, even if we exercise each day. For example, someone who sits down all day, but performs 30 minutes of high-quality exercise at the end of the day, may still experience negative health consequences of too much sitting.

//TSLEEP_HOW_MUCH

How do you know if you are sitting too much?

{user_firstname}, you reported sitting for {TSITTING} hours each day between waking and going to bed.

There are no recommendations yet on how much sitting is too much. Some studies suggest a cut-off of no more than 7 hours a day would help to reduce risk, but more evidence is really needed before we can be sure. Because of this, the Australian physical activity and sedentary behaviour guidelines recommend that adults should: minimise the amount of time spent in prolonged sitting, and break up long periods of sitting as often as possible.

Overall, we recommended listening to your body. It is important to get the rest you need. When and if you are able though, continue to move throughout the day. Here are some useful tips if you are trying to reduce your sedentary time:

//TALCOHOL2

A quick message about alcohol

It looks like your level of alcohol consumption may already be within recommended limits. If you are having a glass of wine or a beer every now and then and enjoying that, there should be no reason to stop unless you notice any ill effects. The time-tested methods of moderation and watchfulness make a lot of sense here.

The National Health and Medical Research Council of Australia recommends that all adults limit their alcohol intake to no more than two standard drinks on any day. This amount has been shown1,2,3 to reduce alcohol-related risk of harm from prostate cancer and other diseases. Drinking more than this amount regularly has been associated with increased mortality rates among men with prostate cancer.

Just be aware that alcohol can affect certain chemotherapies and some medications. If you are currently on treatment, it may be worth speaking with your medical oncologist about your alcohol consumption so that you can make an informed choice about how much to drink and when.

//TSLEEP2

Getting better sleep

Unfortunately, sleep problems are a commonly reported issue among men with prostate cancer, especially those experiencing hot flashes. One man, we spoke to recently put it like this:

Managing hot flashes.

There hasn’t been a lot of research exploring how to help men manage hot flashes, though there is some preliminary evidence that medications, acupuncture, relaxation and/or keeping a diary to identify triggers may help.

Medications:

Sex hormone treatments with oestrogens and progesterones, neurendrocine agents, and selective serotonin-reuptake inhibitors have all been trialled among men with prostate cancer and have had positive effects on hot flashes. However, these medications can have their own side effects, such as weight gain, cardiovascular complications, and nausea. You may like to discuss this with your treating doctor or GP, or perhaps even share this article with them.

Acupuncture:

There has been one trial evaluating acupuncture for men with prostate cancer. In this trial, 60 men undergoing hormone agonist prostate cancer treatment had auricular acupuncture (stimulation of acupuncture point on the external ear surface) weekly for 10 weeks. All participants completed the treatment and 95% reported having a decrease in the severity of their symptoms.   For more information on acupuncture click here. Note that there are different types of acupuncture and it is auricular acupuncture that has been evaluated among men with prostate cancer.

Self-management with relaxation and diary keeping.

A study involving 20 men who had either localised or advanced prostate cancer carried outpaced breathing, relaxation and stress-reducing techniques including mediation (check out Headspace or smiling mind for more information on meditation), was well received amongst the men. Additionally, this study involved men utilising a diary to document their hot flashes, which had positive feedback as it provided a structure and helped to identify triggers or precipitants of flashes.

Are there other issues impacting on your sleep?

Unfortunately, sleep problems are a commonly reported issue among men with prostate cancer. This can be due to:

- Fear, worry and stress about prostate cancer and treatment.
- Pain, and other side effects of advanced cancer and cancer treatment (e.g., nausea).
- Being less active during the day.
- Other health conditions, such as nocturia (waking in the night to urinate) and sleep apnea.

We appreciate you have probably already tried several things to improve your sleep. Below is a list of strategies that may give you some additional ideas.

Psychological therapies can be very useful.

This is because sleep issues often have a psychological component, even if they started due to a physical problem. Cognitive behavioural therapy is a recommended front-line treatment for persistent poor sleep (insomnia). This can include several components, including stimulus control therapy (conditioning your body and mind to associate bedtime with sleep), relaxation training (developing confidence in relaxation strategies that you can use if you wake and throughout the day to reduce anxiety), and practising good sleep hygiene (e.g., having a regular routine). If this interests you, speak to your GP and ask about a referral to a psychologist, or a medical doctor who specialises in sleep (sleep and respiratory physician) within your local area. If you do not have access to an appropriate health professional you can accomplish some of these techniques on your own, starting with the tips below.

Avoid caffeine 4-6 hours before bedtime.

For most people, the caffeine level in the body halves roughly every five hours. So half of the caffeine from a 4pm cuppa is still in your system when preparing for sleep. When most people think of caffeine they think of coffee. Black tea also contains a fair amount of caffeine, about half the amount in a cup of coffee. Herbal caffeine-free teas can be a good alternative, though it is always good to check they are from a reputable company (many teas made outside of Australia may not be regulated and tested). The Memorial Sloan Kettering "Search About Herbs" website is a good resource. It provides information on possible interactions with medication and an overview of evidence for health benefits.

Limit your alcohol consumption.

Alcohol can help you fall asleep quickly, but studies have found that it disrupts the quality of your sleep and the body's ability to stay asleep. This can leave you feeling more tired the following day.

Be active during the day.

Try and avoid sleeping during the day if you can, but don't feel guilty if you do need to nap, just keep it short if possible. Although it is hard to do when you are feeling tired, it is actually very helpful to try replacing a nap with some light activity. This may increase your energy in the day while helping you rest better at night.

Establish a regular relaxing bedtime routine if you don't have one already.

This may involve things like reading, listening to relaxing music, drinking herbal tea, meditation or having a warm bath or shower. This can put you in a positive frame of mind before sleep and helps the body recognise that it is bedtime.

Think about when your toilet timing.

Aim to the toilet before bed and limit excessive fluid intake 3 hours before bedtime.

Have a sleep assessment completed.

If you believe your sleep problems may be caused by a sleep disorder such as sleep apnoea, then having an assessment may be able to give you some solutions.

//TDISTRESS1

Keeping your distress in check

Being diagnosed and treated for prostate cancer can be a major life stress. From your response to the survey, it seems you are coping ok, but like many men in your situation, are experiencing moderate levels of distress.

There are several effective intervention options that can assist to reduce feelings of anxiety, depression and distress. Exercise is a recommended option. It can help to:

- Increase feelings of control and self-esteem
- Reduce the impact of physical side-effects on well-being
- Elevate mood and increase energy

Exercise also has social benefits if undertaken with others. Given this, you may find some additional benefit if you follow the Exercise Guide program with an exercise partner, or if you join a group exercise program (preferably run by an exercise physiologist) and do that some of the time.

There are additional intervention options that have been shown to reduce distress effectively.

Cognitive behaviour therapy

Based on the idea that what we think and do, impacts how we feel.
Usually offered in 30-to-60 minute sessions, where you work with a practitioner to develop skills to recognize, counteract, and manage problematic thoughts and beliefs.

Peer support

- About 10,000 men attend prostate cancer support groups in Australia.
- They can offer the following benefits:
  - Source of useful Information and advice
  - Help to understand cancer better
  - Feel less alone and more in control

Click here for more information

Where to from here?

We recommend talking to your GP. You may be able to access a psychologist (the main provider of cognitive behavioural therapy), and/or an exercise physiologist through Medicare. Through the ‘better access to mental health care’ initiative you may be able to access up to 10 sessions with a psychologist per year. Alternatively, through a ‘GP management plan and team care arrangement’ you may be able to access up to five session with any allied health professional considered beneficial for you. This can include an exercise physiologist and a psychologist. If you are unsure of what to say to your GP, or nervous about talking about mental health to them, you may find the video demonstration and script on this website helpful. It is from an Australian website targeted at farmers who are having trouble coping with stressful life events outside of their control (e.g., drought).

It may also be useful to find out if there is a support group near you by entering your suburb or postcode into the form on the Prostate Cancer Foundation of Australia website.

The Prostate Cancer Foundation of Australia is a good source of information for other aspects as well. If you haven’t viewed it already, you might find the ‘Advanced prostate cancer information pack’ a valuable resource. It is free and can be ordered by clicking here or phoning 1800 220 099.

Beyond Blue offers immediate support. You can call 1300 22 4636 any time of day, chat to someone online or email and get a response within 24 hours. All calls and chats are one-on-one with a trained mental health professional and are completely confidential. Click here if you would like more information.

//TLIFESTYLE_FINAL_THOUGHTS

Final thoughts

Making lifestyle changes is sometimes easy and other times quite difficult. Some of these changes may help your health, others may improve your quality of life right now, whilst others may not have an effect on you. The first step is developing an understanding of why change may be useful for you and then you can make decisions about what you feel suits you best.

Just remember: Lifestyle change is not about deprivations, its about enjoying life in moderation.

Appendix 31. Where else can I get help questions and example of feedback

//Where else can I get help - introduction

This module aims to provide a summary of what types of health resources are currently available to you, with a focus on local options when possible.

//Where else can I get help - Computer tailoring questions

Please complete the following questions to generate information on resources that relate personally to you.

1. **What state or territory are you currently residing in?** O Australian Capital Territory; O New South Wales; O Northern Territory; O Queensland; O South Australia, O Tasmania; O Victoria; O Western Australia.

2. **Are you interested in receiving more information about:**
   a. Exercise? O Yes; O No
   b. Diet and nutrition? O Yes; O No
   c. Coping effectively and getting the most out of every day? O Yes; O No
   d. Sleep? O Yes; O No
   e. Symptom management (e.g., erectile issues, incontinence)? O Yes; O No
   f. Clinical trials in prostate cancer? O Yes; O No

3. **What forms of help appeal to you? Please tick all that apply.**
   a. Guidance from a professional. O Yes; O No
   b. Talking to other men with a similar diagnosis. O Yes; O No
   c. Booklets (paper-based). O Yes; O No
   d. Mobile applications (e.g., to help you track exercise or go to sleep). O Yes; O No
   e. Websites (e.g., videos, chat forums, information). O Yes; O No
   f. Telephone call. O Yes; O No

4. **Are you interested in resources specific to:**
   a. Aboriginal or Torres Strait Islander peoples. O Yes; O No
   b. People who have English as a second language. O Yes; O No
   c. The LGBTIQ community. O Yes; O No

Thank you for completing the survey. The information compiled in this module is a collection of resources that may be useful to anyone in Australia. Some of the resources you may have seen, and others may be new. If you know of additional resources, please feel free to email the team at info@exerciseguide.org.au. This will help us improve our resource list in the future.

//Where else can I get help – Computer Tailored Feedback Example

//THELP_INTRO

This module aims to present you with a collection of useful resources, which best suit you (based on your answers). They are here to help you understand advanced prostate cancer but also help you get on with your day-to-day life and spend time with your loved ones. Depending on your answers, you may find you are presented a lot of information or just a little. Feel free to read at your own pace and come back as often of you need to look through the information. Click on the next tab or the next circle to read on.

//THELP_INTRO_FIRSTNATIONS

WARNING: Aboriginal and Torres Strait Islander viewers are warned that videos within the following information may contain images and voices of deceased persons.

//TGENERAL_INFO_WEBSITES

General information for advanced cancer

You may have seen some of these resources before. If so, feel free to skip through to the next section. However, taking a fresh look may just point you in a new helpful direction.

The Prostate Cancer Foundation of Australia (PCFA)

This is a great place to start for finding comprehensive online resources specific to prostate cancer. They have evidence-based and easy to understand information pages in the area of diagnosis, treatment, side effects, and wellbeing for men with metastatic prostate cancer. The PCFA also has some advanced cancer-specific information if you are interested:

True Nth – A Movember initiative

True Nth is a Movember funded support service for men who have prostate cancer. Their website is a useful collection of information and resources. Importantly, they have an advanced cancer section of the website. They also have care coordinators who are available to help you (visit their website or call 1300 878 368 if you have any questions).

There is also an American True Nth website (https://us.truenth.org) which doesn't provide the care coordinating service, but the site has some different information which may be useful.

Australian Prostate Cancer Collaboration

Another excellent resource comes from the Australian Cancer Network and Australian Prostate Cancer Collaboration. Click here or on the picture to view the online booklet, which has been created to be an advanced prostate cancer guide for individuals and their families.

Prostmate

Prostmate is a website for men and their families dealing with prostate cancer. Once signed up (free), you are given access to the latest research information, personalised support, specialised programs and consultations with prostate cancer specialist nurses and psychologists. One of the best aspects of Prostmate is it's extensive library. Just pick some topics that you are interested, and it will give you articles and short courses to help improve your knowledge and help you feel confident. Visit the Prostmate website to sign up.

Life, hope and reality

Life, hope and reality is a website designed specifically for people with advanced cancer, carers and friends. It is a great resource developed with funding from the National Health and Medical Research Council.

Advanced Prostate Cancer Xplained

Another resource created for advanced prostate cancer is the "Advanced Prostate Cancer Xplained" visual story. It is useful to look at yourself but may also be useful to explain your health to your family.

Medicare support - allied health professionals

The Australian health care system has a range of allied health providers, who are essentially university-qualified health professionals that are not part of the medical, dental or nursing professions. They are practitioners who can provide specialised support for different patient needs for those with metastatic prostate cancer.

As you have been diagnosed with prostate cancer, you have access to Medicare-funded allied health services through a "Team Care Arrangement" (TCA). Your TCA will be created and organised by your general practitioner and allows you up to five services with any allied health professional of your (and your GP's) choice. Click here to read more.

Click on the next tab or the next circle to find some more information specific to your needs.

//CLINICAL_TRIALS_INFO

Clinical trials information

If you are interested in what clinical trials are currently running and possibly looking into participation the following websites to learn more:

The Australian and New Zealand Urogenital and Prostate Cancer Trials Group (ANZUP)

ANZUP Cancer Trials Group Limited

Clinical trials help us move research forward to develop the next step in treatment while giving patients the very best possible care. ANZUP has a multitude of trials currently recruiting for individuals with prostate cancer. Please speak to your doctor to see if you would be eligible and suitable for any of the trials.

Australian New Zealand Clinical Trials Registry

ANZCTR Australian New Zealand Clinical Trials Registry

The ANZCTR is an online registry of clinical trials being undertaken in Australia. The search function allows you to conduct either a basic search or an advanced search of clinical trials available on the ANZCTR database. Once you find a relevant trial, you will be able to contact the person listed as the 'public contact' on the trial record for more information.

Pathfinder: Prostate Cancer Research Register

Pathfinder Prostate Cancer Research Register

Pathfinder is a unique prostate cancer research register that enables prostate cancer survivors to participate in research into improving the health and lives of people post-prostate cancer treatment. For more information visit https://pathfinderregister.com.au.

Freemasons Foundation Centre for Men’s Health: Men’s Register

FREEMASONS FOUNDATION CENTRE FOR MEN'S HEALTH | THE UNIVERSITY of ADELAIDE

The Freemasons Foundation Centre for Men's Health (FFCMH) brings together and supports a multi-disciplinary network of men's health researchers undertaking world-class research and delivering programs aimed at preventing and better treating the inter-related chronic conditions that contribute the most to ill-health, loss of independence and workforce participation and premature death in men. When you join the Register you will be invited to participate in men’s health research, and research where it is important to have good representation by men. You will have the opportunity to have a say on a range of issues affecting men's health and join studies of new treatments and programs and receive up to date men's health information.

//TDIET_F2F

Face-to-face diet and nutrition support

If you found the information in Exercise+ module interesting and would like some more individualised support, you can access an accredited practising dietician. You can search here to find some practitioners in the area. For more information or assistance to find an accredited practising dietician, please call (02) 6189 1200 or email info@daa.asn.au.

Team care arrangements – dieticians

As mentioned already, you can use your Medicare-funded “Team Care Arrangement” (TCA) to visit your dietician. Speak to your GP if you wish to know more.

//TDIETAPPS

Nutrition and diet-based applications

There are applications available, which may help support your general nutrition choices. Unfortunately, there is only one (paid) app that is prostate cancer-specific. You can search for the following applications in your app store:

Prostate Cancer CTNT (paid)

The app provides suggestions on nutrition and food choices. Features include a "Is this good for me?" section, recipes, food suggestions and actionable information.

My Fitness Pal (free)

This app allows you to keep an electronic food diary. You can record the food and drinks that you consume.

Noom (free)

Noom is a psychology-based app which allows you to identify your thoughts and feelings about food and then builds a customised approach to help you create better nutritional habits.

//TDIET_PHONE

Phone-based contacts for nutrition and diet resources

Dieticians

If you found the information in Exercise+ module interesting and would like some more individualised support, you can access an accredited practising dietician via phone consultations. You can search here to find some practitioners that suits your needs – for example, if you look at the "Type of Consultation" button, you can choose to find individuals who may do virtual consultations and if you click "Area of Practice" you can choose Oncology (cancer). If you need a little more help, you can call the association on (02) 6189 1200 or email info@daa.asn.au, and they should be able to give you more information.

Cancer council

You can also call the Cancer Council on 13 11 20 and speak to one of the wonderful counsellors, who may be able to point you in some good directions.

//TSYMPTOM_F2F

Professional symptom support

General symptom support

Prostate Cancer Specialist Nurses

The Prostate Cancer Specialist Nursing Service supports the placement of prostate cancer specialist nurses in a variety of Australian health care settings in partnership with health service providers. Please click here to read more about the service and which hospitals have access to the service

Continence symptoms

Find a men's health physiotherapist in your area:

Conservative management such as physiotherapy is recommended for continence matters as a first-line treatment strategy in research reviews and by the International Continence Society. To see an Accredited Physiotherapist in your area, visit https://choose.physio/your-lifestage/adults/mens-health. It is important to note that the treatment/s you have had may influence the effectiveness of physiotherapy modalities, so it is important to give as much information as you can to the physiotherapist.

Information on other treatments available

If you are having longer-term bowel or bladder issues, there are other options available to men. Click here to read up on the options and then visit your GP or a trusted member of your health care team to discuss your options.

Sexual symptoms

Find a sexual counsellor in your area

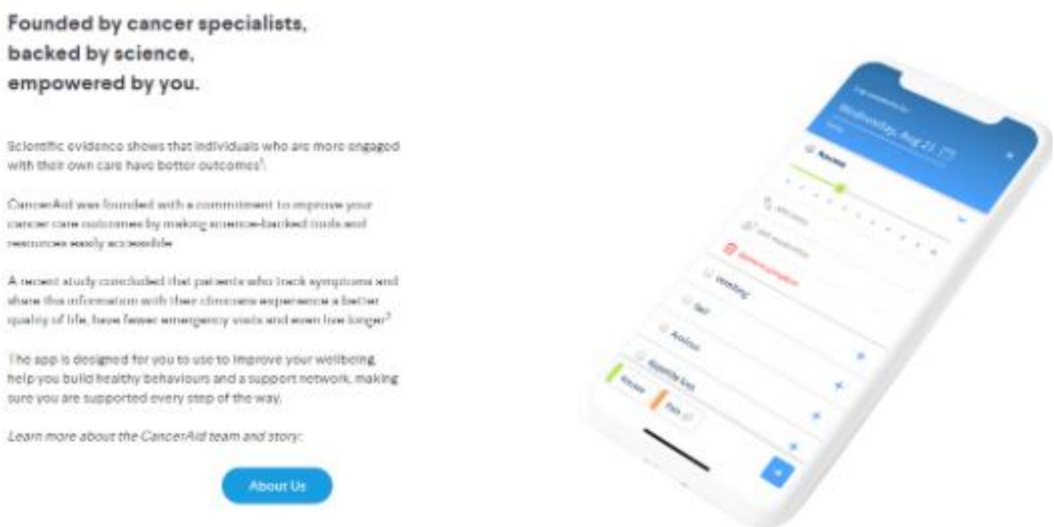
The Australian Society of Sexual Counsellors provides contact details for accredited psychosexual therapists and sexuality educators. They will be able to offer you individualised information that may help with any sexual concerns you may have. Just visit http://societyaustraliansexologists.org.au/ to find a provider in your area.

//TSYMPTOM_APPS

Application-based symptom support

Cancer aid

Cancer aid allows you to monitor your symptoms, provides treatment information and allows you to connect with others going through similar experiences. It is not prostate cancer-specific, but it may provide some help.



//TSYMPTOM_PHONE

Phone-based symptom support

General symptom support

The Cancer Council

The Cancer Council has a free, confidential telephone information and support service run in each state and territory, where you can ask questions regarding any side effects including fatigue, sexual and continence symptoms. If you have a question about your cancer, or if you're seeking emotional or practical support, call 13 11 20 to speak to their specially trained staff.

Prostmate

Prostmate provides consultations with trained nurses on many different facets of prostate cancer including treatment side effects. You will have to register with Prostmate online and then book a consultation through the home page.

True Nth

This Movember initiative allows men to gain access to prostate cancer care coordinators. Call 1300 878386 to learn more. Please note you will need to be eligible and still need to be referred to the program by your doctor/specialist.

Continence symptoms

The Continence Foundation of Australia

If you would like extra resources on continence matters, then a good place to start is the Continence Foundation of Australia. You can call their national continence helpline on 1800 33 00 66 to learn more. Qualified nurses are available Monday to Friday, between 8.00 am to 8.00 pm (Australian Eastern Standard Time) for free.

Sexual symptoms

Phone-based sexual counsellors

The Australian Society of Sexual Counsellors provides contact details for accredited psychosexual therapists and sexuality educators. They will be able to offer you individualised information that may help with any sexual concerns you may have. Just visit https://societyaustraliansexologists.org.au/practitioner-directory/ to find a provider who may be able to complete phone consults.

//TSYMPTOM_FUNDING

Australian Government: Continence Aids Payment Scheme

The Continence Aids Payment Scheme (CAPS) is an Australian Government Scheme that provides a payment to eligible people to assist with some of the costs of their continence products. If you have permanent and severe incontinence, and you are an Australian citizen or permanent resident five years of age or older, you may be eligible for CAPS.

//TFIRSTNATIONS_INTRO

Useful resources for Aboriginal and Torres Strait Islander People

We have collated information regarding services and resources for Aboriginal and Torres Strait Islander people who have been diagnosed with cancer. Feel free to investigate the information in your own time.

//TNSW_FIRSTNATIONS

Cancer Council

The NSW cancer council has put together a range of cancer-specific resources for Indigenous men and women, which you may find interesting. The Cancer Council WA have also created publications, factsheets and videos, including the book Aboriginal Cancer Journeys.

//TOTHER_ FIRSTNATIONS _INFO

Cancer Stories

The WA Centre for Rural Health has interviewed individuals around Australia who share their cancer story.

Click here

Click here

Click here

Click here

WARNING: Aboriginal and Torres Strait Islander viewers are warned that the following program may contain images and voices of deceased persons.

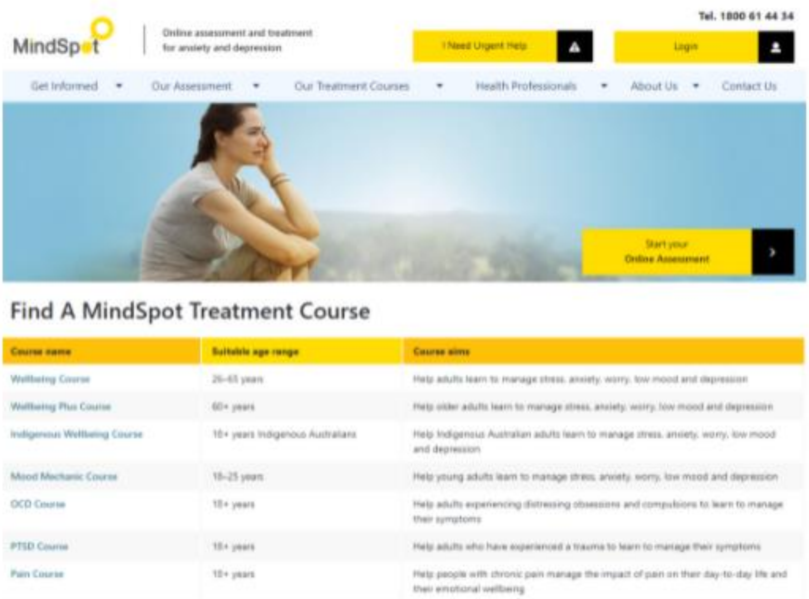
NACCHO Aboriginal Health App

An app developed by the National Aboriginal Community Controlled Health Organisation. It provides health information online or by phone and features a location-based service to find your nearest Aboriginal Community Controlled Health service.

Here are the URL links to the App – alternatively you can type NACCHO into both stores, and they come up (iPhone/iPad and Android).

MindSpot Indigenous Wellbeing Course - Website

The Indigenous Wellbeing Course is designed to help Aboriginal and Torres Strait Islanders aged 18 years and over to learn to manage mild, moderate and severe symptoms of depression and anxiety. The Indigenous Wellbeing Course consists of five lessons over eight weeks. It is designed to provide the information and skills that you could receive from a mental health professional. There is an option for a weekly appointment, or you can choose the timing of appointments. The course aims to help people break unhelpful habits and learn the following core psychological skills.



Other news (click links to read):

- Ngangkari healers (Aboriginal healers) treat patients alongside doctors and nurses at Lyell McEwin Hospital.
- There is no Aboriginal word for cancer.
- New initiative encouraging cancer conversation in Indigenous communities.

//TCALD

Useful resources for individuals where English is your second language

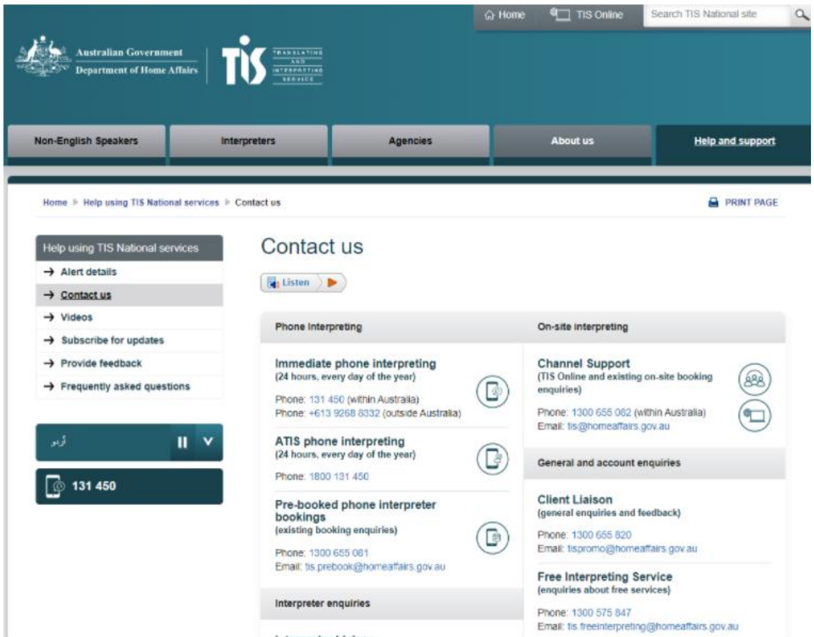
When English isn't your first language, you may face unique challenges in the management of your treatment and support needs. Here are a few resources that may be suitable for you.

The Cancer Council

The Cancer Council offers cancer-based resources in 28 other languages. Please click here.

Translating service

If you would like someone in your care to speak to a Cancer Council nurse in a language other than English, you can call the Translating and Interpreting Service on 131 450 and then ask for Cancer Council 13 11 20.



If you require a translator to help liaise between you and your health team, call 1300 575 847 to enquire about free services. Otherwise, visit https://www.tisnational.gov.au/en/Help-using-TIS-National-services/Contact-TIS-National to learn more.

//TLGBTIQ

Resources for individuals in the LGBTIQ community

For those in the LGBTIQ community, prostate cancer will create unique challenges throughout their prostate cancer journey. Here are some resources, which may help answer questions and offer support if needed.

The Prostate Cancer Foundation of Australia

The PCFA has put together a detailed set of resources which discuss the diagnosis, treatment, side effects and wellbeing for gay and bisexual individuals diagnosed with prostate cancer.

This pack can be read online, or you can order copies. To order resources please fill in and submit the order form, or call 1800 220 099 or email enquiries@pcfa.org.au.

Australia LGBTIQ Support Groups (PCFA)

- Shine a Light Support Group for Gay & Bisexual Men (NSW)
- Gay Prostate Support Adelaide (SA)
- Melbourne - Gay Men's PCSG (VIC)
- Perth Gay / Bisexual PCSG (WA)

QLife

QLife is a national, free, confidential LGBTI phone and webchat service, open 3 pm to midnight every day of the year. You can talk to a peer counsellor for LGBTI-specific support, information and referrals, including for people with cancer. Webchat: qlife.org.au | Phone: 1800 184 527

The Cancer Council

This is a great website that offers resources, on online community and peer support. Click here to read more. They also offer an information and support service, which can be reached by 13 11 20. It is also a referral pathway to access emotional and practical LGBTI assistance for anyone affected by a cancer diagnosis.

The Canadian Cancer Society

The CCS has created some films (in 2010) which tell the personal stories and real-life experiences of several Canadian gay men who are dealing with prostate cancer. Some of then live in cities; others live in small towns and rural areas. The opinions you will hear are not necessarily those of the Canadian Cancer Society but rather based on the experiences of the men involved. Please be aware that there may be strong language and frank discussion of sexuality.

- Part 1
- Part 2
- Part 3
- Part 4
- Part 5

Prostate Cancer UK

The Prostate Cancer UK website has information and support including information for trans women, real-life stories and an online community for those that identify as LGBTIQ. Click here to read further.

Yahoo Group

Another option to connect with other gay men who have experienced prostate cancer is to join the yahoo group. Go to http://groups.yahoo.com/neo/groups/prostatecancerandgaymen/info. To subscribe to this group you can email prostatecancerandgaymen-subscribe@yahoogroups.com.

//TNSW_SUPPORT

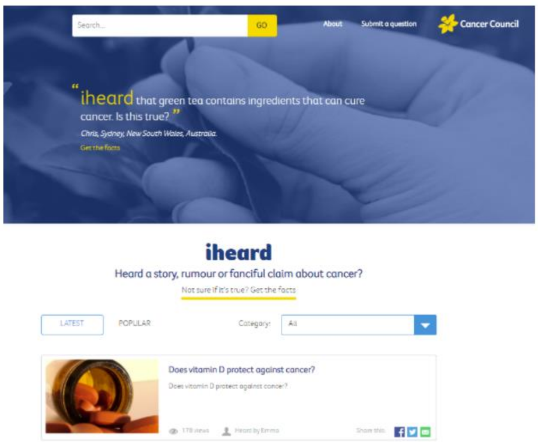
Other resources in New South Wales

Cancer Council New South Wales:

To get NSW specific information including information about legal and financial assistance, accommodation in Sydney, in-home help and much more, visit their website. The Cancer Council NSW has metro and regional offices, which offer different services based on the needs of that area. Visit https://www.cancercouncil.com.au/local-services/ to find your area.

iHeard

Have you been told a certain berry will help cure cancer? There is a website run by the cancer council that allows you to search some of your questions to help you separate fact from fiction.



//HELP_FINISH

Final thoughts

Thank you for taking the time to look through some extra resources that may be useful to you. We hope this was useful to you. We are always looking to update this information, so if there is anything else that you have found that is useful, please send us an email to let us know.

Appendix 32. How are you tracking (week 1) questions and example of feedback

//How are you tracking (week 1) - Introduction

//TRACK_INTRO

The aim of the tracking module is to allow you to monitor how you are going week-to-week and understand what may be influencing your exercise levels.

We want to give you feedback on the things that keep you on track and your health outcomes. You can choose at the end of the module if you would like to share this information with the study exercise physiologist to inform your telephone check-in with them.

We won't ask you to report your exercises in detail here. The easiest way to record your exercises (type, frequency, time) is the exercise diary that you were sent in your start-up package. You can also use an activity tracker (fitbit, pedometer etc) to objectively measure your incidental activity if it interests you.

//How are you tracking (week 1) - Computer tailoring questions

1. **What is the date today?**

2. **Thinking of the past 7 days: How many days did you do?**
   a. Intentional aerobic exercise (e.g., walking)? O 1; O 2; O 3; O 4; O 5; O 6; O 7
   b. Strength exercises (e.g., calf raise)? O 1; O 2; O 3; O 4; O 5; O 6; O 7

3. **On a scale of 0-10, how satisfied are you with your progress towards achieving your goals?**
   Very unsatisfied O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very satisfied.

4. **Thinking of the past 7 days: How would you rate each of these in regards to completing your exercise program?**
   a. How motivated are you to do your program?

Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.

b. How confident are you to do your program?

Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.

c. How much do you agree with this statement: "My exercise program is something that I do without having to consciously remember to do it.

Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.

d. How much do you agree with this statement: "Exercise is something I make specific plans for - regarding what exercises, when and where."

Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.

5. Thinking of the past 7 days: How would you rate each of these in regards to your health?

a. Your aerobic (cardiac) fitness?

Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

b. Your muscular strength?

Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

c. Your fatigue levels?

Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

d. Your general mood?

Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

e. Your average level of pain?

Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

6. Do you want to make any comments to note either for yourself or for your Exercise Physiologist?

O Yes; O No

<Leave comments here>

7. **Would you like to share this information with the study exercise physiologist so that they can review it prior to your telephone call?** *If you would prefer, you can keep this for your own records and use it to answer any questions about pain or fatigue that Holly may ask to adjust your program. It is up to you. We respect your privacy.*

   O Yes; O No

Thank you, click next to view your feedback

//How are you tracking (week 1) - Computer tailoring example feedback

//TPROGRESS_SUMMARY1

Log: {Datelog1}

Activity and Fitness Summary

Over the last 7 days:

- You reported participating in intentional aerobic activity on {Daysaerobic} day(s). \
- Your self-rated aerobic fitness is currently {Cardiofit} out of 10.
- You reported {RTdays} strength training sessions and a self-rated strength score of {strengthself} out of 10.

Please bear in mind that in future logs, you will be able to see if your fitness and strength change over time.

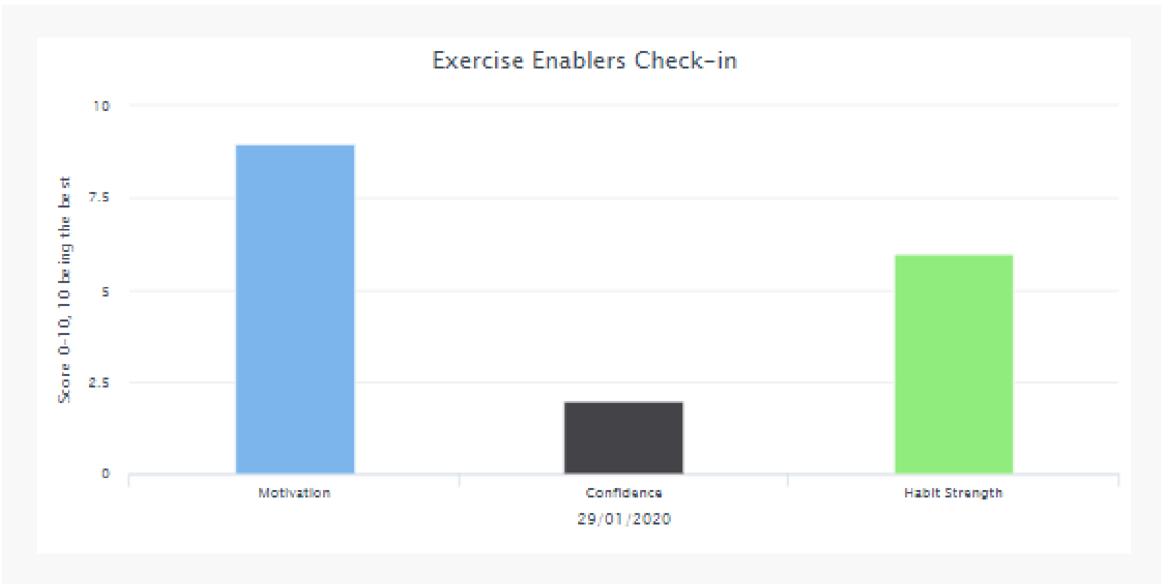
//TGOALS_TRACKER_MOD

Your goal progress

You reported that you are moderately satisfied with how you are progressing to your goals. Have a think about what you need to continue to progress. If you would like to modify your exercise program, please use the "ask an expert" section to discuss it with your exercise physiologist. You can also brainstorm what that may help you stay accountable to your goals.

//TPROGRESS_PSYC1

Tracking aspects that help you stick with an exercise routine



// TMOTIVATION_TRACKER_HIGH

Your motivation to exercise

Motivation is one of the most important factors in determining your level of success. You recorded a score of {BC_MOTIVATION} out of 10, which is great.

// TCONFIDENCE_TRACKING_LOW

Your confidence to maintain your exercise

You have rated your current confidence as {BC_CONFIDENCE} out of 10. Is there anything we can help you with, you can always use the "ask an expert" section if you would like any advice related to your exercise program.

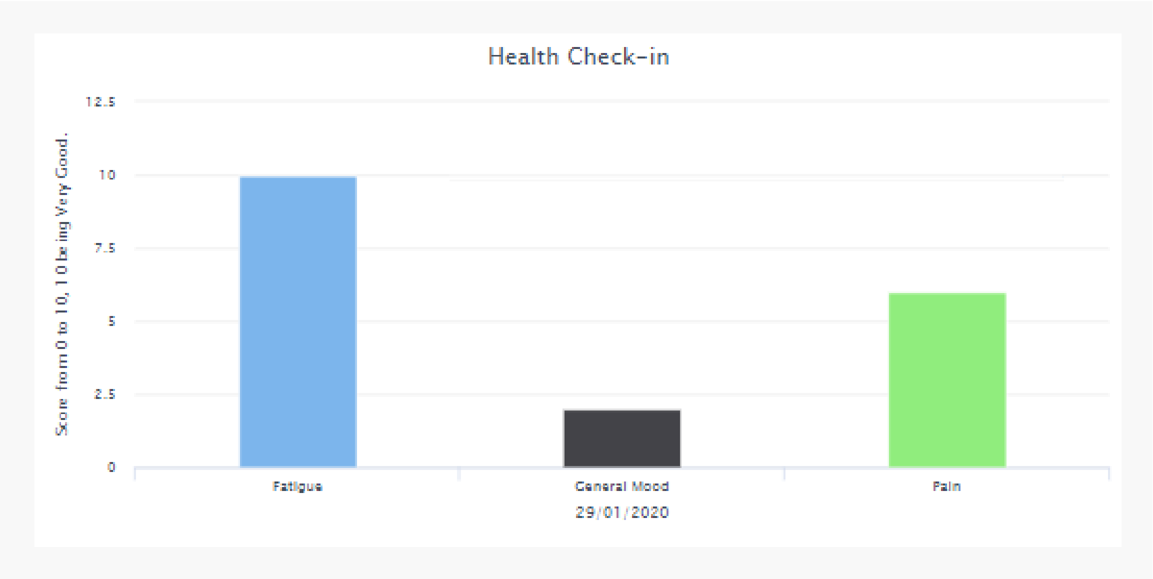
// THABIT_TRACKING_MOD

Exercise as a habit

Habits make it possible for us to do things without spending exorbitant mental effort. You have rated your exercise habits as a {BC_HABIT} out of 10. You are doing reasonably well in this department. If you want to make your exercise more automatic, think about some tactics that may make it easier (for example, set an exercise appointment in your schedule).

//TPROGRESS_HEALTH

Your symptom trackers



//TFATIGUE_TRACKER_LOW

Fatigue

You have reported a fatigue level of the {FATIGUE} out of 10. We understand that fatigue can make your exercise challenging, try to plan your sessions for days where you are not as busy or pick times of the day that you may feel more energetic.

//TMOOD_TRACKER_LOW

Your mood

You have rated your current mood to be a {MOOD} out of 10. If you are feeling low, have you thought about speaking with your health team, friends or family? Support and connection is linked to increased mood.

// TPAIN_TRACKER_MOD

Your pain levels

You scored your overall pain levels as a {PAIN} out of 10. If you feel as if the exercises are increasing your pain levels, use the "ask an expert" section to discuss it with your exercise physiologist. You could also speak to your health care team to see if there are ways to manage your pain levels so you feel more comfortable.

// TCOMMENT_HEADER

Your comments

{Datelog1}:

{comments1}

Thank you.

Appendix 33. How are you tracking (week 8) questions and example of feedback

//How are you tracking (week 8) - Introduction

//TRACK_INTRO

Welcome back and thanks for checking in and tracking your progress. Let's see where you are at.

//How are you tracking (week 8) - Computer tailoring questions

1. **What is the date today?**

2. **Thinking of the past 7 days: How many days did you do?**
   c. Intentional aerobic exercise (e.g., walking)? O 1; O 2; O 3; O 4; O 5; O 6; O 7
   d. Strength exercises (e.g., calf raise)? O 1; O 2; O 3; O 4; O 5; O 6; O 7

3. **On a scale of 0-10, how satisfied are you with your progress towards achieving your goals?**
   Very unsatisfied O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very satisfied.

4. **Thinking of the past 7 days: How would you rate each of these in regards to completing your exercise program?**
   e. How motivated are you to do your program?
   Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.
   f. How confident are you to do your program?
   Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.
   g. How much do you agree with this statement: "My exercise program is something that I do without having to consciously remember to do it.
   Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.
   h. How much do you agree with this statement: "Exercise is something I make specific plans for - regarding what exercises, when and where."

Not at all O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Extremely.

5. **Thinking of the past 7 days: How would you rate each of these in regards to your health?**
    f. Your aerobic (cardiac) fitness?
    Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.
    g. Your muscular strength?
    Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.
    h. Your fatigue levels?
    Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.
    i. Your general mood?
    Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.
    j. Your average level of pain?
    Very bad O 1; O 2; O 3; O 4; O 5; O 6; O 7; O 8; O 9; O 10 Very good.

6. **Do you want to make any comments to note either for yourself or for your Exercise Physiologist?**
    O Yes; O No
    <Leave comments here>

7. **Would you like to share this information with the study exercise physiologist so that they can review it prior to your telephone call?** *If you would prefer, you can keep this for your own records and use it to answer any questions about pain or fatigue that Holly may ask to adjust your program. It is up to you. We respect your privacy.*
    O Yes; O No

Thank you, click next to view your feedback

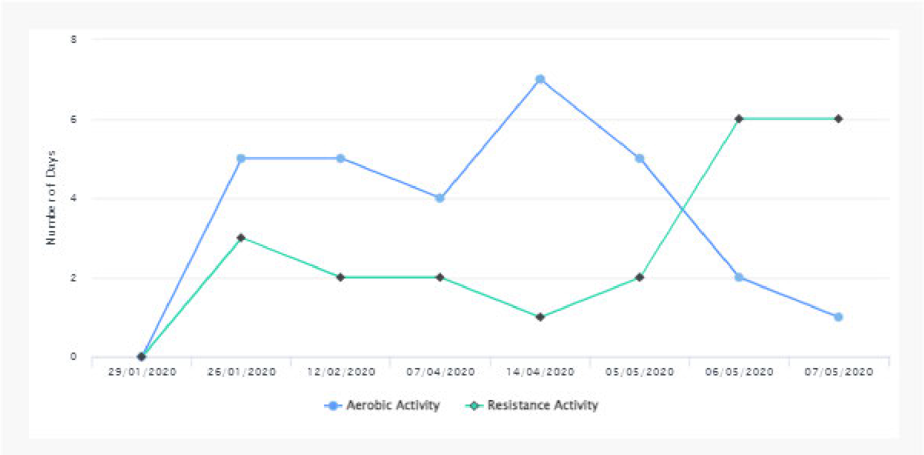
//How are you tracking (week 8) - Computer tailoring example feedback

//TPROGRESS_SUMMARY8

Log: {Datelog8}

Activity and Fitness Summary

This is the eighth and final tracking entry of the program. We hope you have found the process of tracking different aspects of your health useful.



//TRESISTANCESAME

Resistance training

- You have continued to complete {RTdays8} days of resistance training this week.
- Two or more resistance training sessions a week can help improve your muscle strength. Hopefully, you are noticing small improvements in your ability to do the things you enjoy - whether it is physical work around the house or physical hobbies.

//TAEROBICDROP

Aerobic training

- You have reduced your aerobic exercise sessions from {Daysaerobic7} to {Daysaerobic8}. This is a bit of a drop from last week.
- Do you have a plan to try and increase your aerobic activity next week or are you comfortable with the amount you are doing?

//TFITNESS_LEVEL_SUMMARY8

How do you feel about your fitness?

//TSUBFITSTRENGTH_POOR8

- Your self-rated feeling of strength was less than last week. Is there a reason for this? Can you help improve this in your next week?

//TSUBFITSTRENGTH_POOR8

- Your aerobic fitness score has dropped a little bit this week. Is there a reason for this?

//TGOAL_SATISFACTION8

Your goal progress

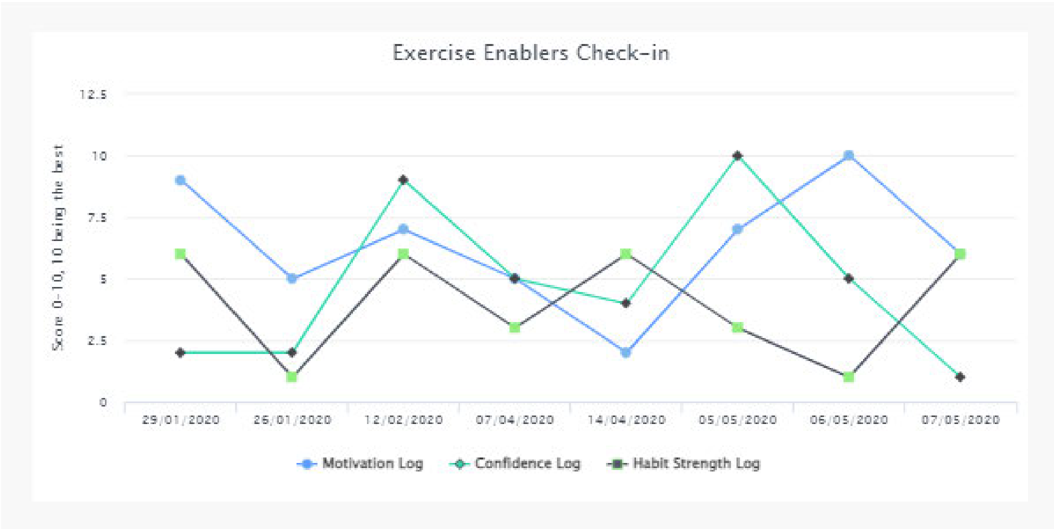
//TGOALP1

Your goal satisfaction is still fairly low. Why do you think this is? If you need any help don't forget you can ask our exercise physiologist and there is plenty of advice and support on the website too.

//TPROGRESS_PYSC8

Tracking aspects that help you stick with an exercise routine

This is your motivation, confidence and habit check-in ratings:



// TMOTIVE_ENABLERS_POOR8

Motivation

Your motivation has dropped this week. Do you need some support? Perhaps think about what support would work for you - family, health professionals, etc.?

//TCONFID_ENABLERS_POOR8

Confidence

Your confidence in your ability to complete your program has dropped this week. Is there a reason? If there is something you need modified, please use the "ask an EP" button

// THABIT_ENABLERS_GOOD8

Habit

Your ability to complete your program without having to consciously have to think about it is was improved this week. Keep up the good work. This will help reduce your need for will power.

//TPROGRESS_HEALTH8

Your symptom tracker

Your fatigue, general mood and pain check-in ratings so far:

//TSYMPTOM8

Thank you for completing the health check-in. Looking at your scores, it looks like it would be good to get some additional support to help manage your pain levels if you haven't already. Your General Practitioner or an allied health professional who may manage your pain. The where else can I get help module in this program also has some resources that might be helpful.

//TCOMMENTS_ANSWER8

Your comments

{Datelog8}:{comments8}

{Datelog7}:{comments7}

{Datelog6}:{comments6}

{Datelog5}:{comments5}

{Datelog4}:{comments4}

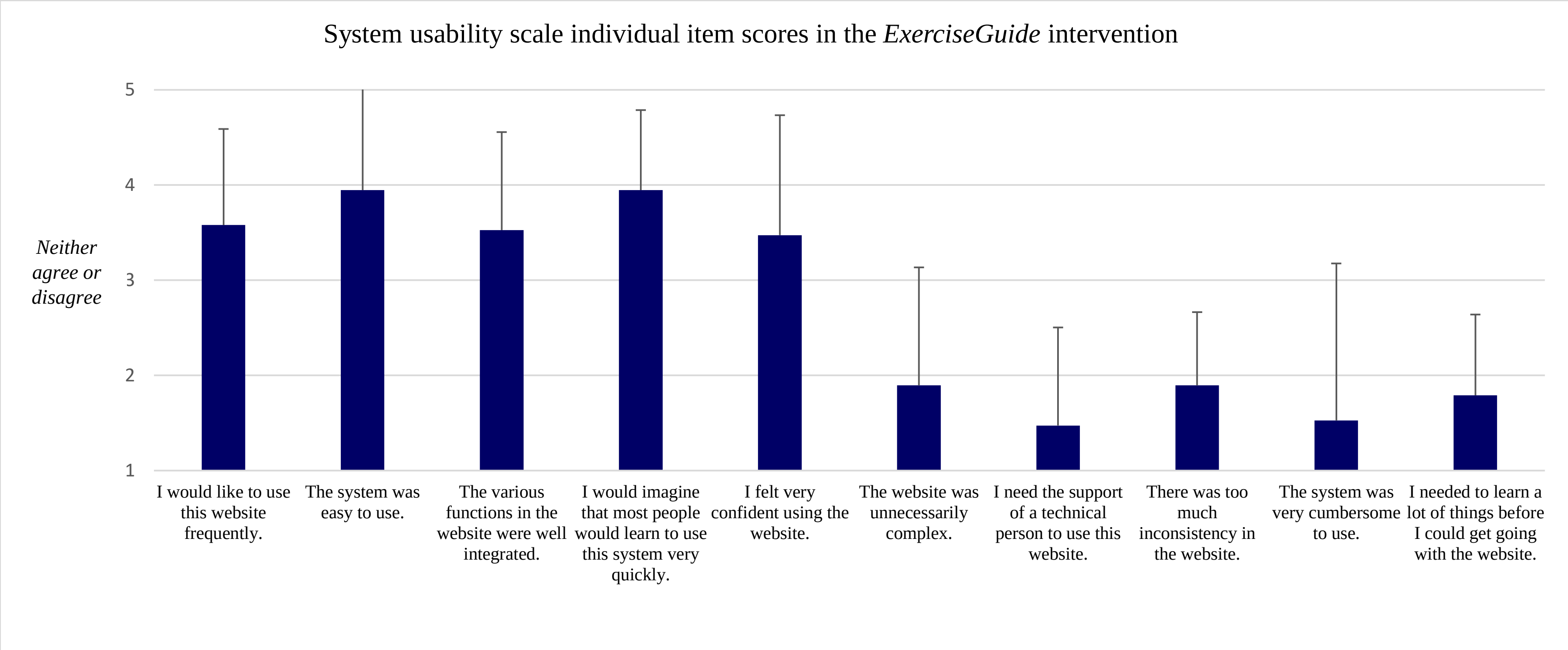
{Datelog3}:{comments3}

{Datelog2}:{comments2}

{Datelog1}:{comments1}

Thank you for tracking.

Appendix 34. System usability scores in the *ExerciseGuide* intervention



Appendix 35. Written positive qualitative feedback from the *ExerciseGuide* intervention

Theme	Participant quotes
Support	Having the AEP available allowed me to adjust the program as I progressed (EG01). Someone available for support (EG11). Regular contact from the exercise team (EG15). The online face-to-face consultation was very good, plus the flexibility to adjust the program (EG30). The interactive contact by the exercise physiologist (EG33). Having a qualified physiologist who is enthused about the programme is a great asset (EG39). Getting to do some exercise instruction at home with backup (EG40). Provided (guilt) motivation. Helped me transition from inactive (EG47). Helpful from a support viewpoint, encouraging to still be active (EG53).
Focus/structure	Made me focus on helping myself to achieve better wellbeing both physical and mentally (EG11). The program is very structured, there is lots of information on how and why to exercise (EG20). Program give you something to look forward to and you can set goals (EG37). Got me out of the chair with definite plan in mind (EG50). The program was very relevant and easy to follow (EG55). Very precise and straightforward (EG11).
Instruction	The exercises and stretching modules clearly explained with a video to negate any doubts (EG39). Good structure, clear instructions on how to complete the exercises (EG48).
Equipment	Easy to use and versatile bands (EG10).
Tailoring	Having a tailored program that allowed me to vary my effort when I needed to (EG01).
Tracking	Booklet to keep track of exercises (EG15).
Other	All exercise is good. I suppose (EG13). I really can't comment as my participation has been nothing short of dismal (EG29). A fantastic program and very beneficial. I lost weight and felt a lot better both mentally and physically and mentally and this was during the first outbreak of Covid19 and lockdown and a very traumatic time due to major family issues (EG01). I cannot say enough about this program, brilliant work putting it together (EG01).

Appendix 36. Written constructive qualitative feedback from *ExerciseGuide* intervention

Theme	Participant quotes
Lack of variety in exercise prescription	Exercise program lacks motivation. Is the same old set of exercises that have been known to be difficult to maintain for decades (EG13). Only one program of exercises (EG10). The resistance program became boring (EG30). Not enough variety (EG40).
Navigation and usability issues	The website was difficult to navigate unless you have IT experience (EG15). It wasn't always clear when to do which parts. So, for example I thought it was sequential so didn't start the later modules until I had virtually finished the 8 weeks. A 'roadmap' to navigate the program might help (EG20). I got mixed up between no of repetitions and number of sessions per week early on but that's probably because I 'didn't read the instructions' properly (EG50).
Information about why certain exercises prescribed.	Could not feel any benefit in one of the exercises (Leg Fallout) and could not find any reason why this was so on the web site (EG39). Not always clear why exercises were suggested (EG48).
Adherence issues	I started the program during chemotherapy after having suddenly retired. The changing circumstances of my life complicated the way in which I was able to engage with the program. Too many things changing too quickly. I struggled to remain consistent (EG47). In my case I had bad hip pain, which made it hard to complete the program (EG37). Could not get enthusiastic about regimented artificial exercise. Considering that I am physically capable of doing everything I need to do, I have not been able to find the necessary enthusiasm for this program. This may not always be the case though and I would welcome the chance to become re-involved if and when I require help in the future (EG41).
Needed more support	No threat of punishment for not doing exercises (EG10).
Time consuming	Were too time consuming with all the breaks I needed to take (EG13).

Appendix 37. Written thoughts for improvement feedback from *ExerciseGuide* intervention

Theme	Participant quotes
Increased exercise variety	Auto generate multiple programs for diversity (EG10). Increase the range of exercises i.e.: above head extension and other muscle groups, these could be in a section for an ongoing programme (EG39). May be vary the exercise program (EG30). More back/core strengthening exercises (so it's easier to get up off the floor) (EG50).
Increased support from exercise physiologist	I feel I would have benefited from more supervision/oversight (EG47). Possibly a more regular contact with an exercise physiologist would enable slackers like me to adhere to the schedule a bit (EG30). Provide more follow up telephone calls (EG53).
Ability to manipulate exercise program	I had to change my exercises due to some physical limitations (after week 4). However, the new exercises could not be incorporated in the online version of the program (EG30). Clearer explanation of outcomes would be useful together with explanations of alternatives (EG48). A trial initially to see which work for me, and how many repeats before setting a target program (EG13). The ability to alter the exercise to suit you (EG40).
Usability concerns	A web or phone app to track your exercise progress (EG10).
IT literacy	I had some minor technical glitches - when printing all the pages of the exercise program in weeks 4-8, the detailed exercise plan is truncated on the right-hand edge (EG20). Software needs an update, there were inconsistencies between my responses and what the program (EG39).
Increased socialisation	Maybe provide an opportunity for participants to meet in a social environment (EG55).
Improved usability	The rubber bands were awkward to use (EG13). Need a video to follow with music (EG13).

Appendix 38. Nonserious adverse events self-reported during *ExerciseGuide* intervention.

Table S4

Nonserious adverse events	**Grade 1[1]**	**Grade 2[2]**	**Grade 3[3]**	**Grade 4[4]**	**Grade 5[5]**	**Total**
Total adverse events, n	26	6	0	0	0	32
Adverse events related to pre-existing conditions, n	14	6	0	0	0	20
Study-related adverse events, n	12	0	0	0	0	12

Specific Adverse Events, n		**Grade 1**		**Grade 2**		**Grade 3**		**Grade 4**		**Grade 5**		**Total**	
		AT	*RT*	*AT*	*RT*	*AT*	*RT*	*AT*	*RT*	*AT*	*RT*	*AT*	*RT*
Joint or bone pain	Pre-existing	1	2	1	1	0	0	0	0	0	0	2	3
	Study related	2	1	0	0	0	0	0	0	0	0	2	1
Muscle pain or injury	Pre-existing	3	2	1	1	0	0	0	0	0	0	4	3
	Study related	7	4	0	0	0	0	0	0	0	0	7	4
Fatigue	Pre-existing	2	2	1	1	0	0	0	0	0	0	3	3
	Study related	0	0	0	0	0	0	0	0	0	0	0	0

[1] Grade 1 Mild; asymptomatic or mild symptoms; clinical or diagnostic observations only; intervention not indicated. [2] Grade 2 Moderate; minimal, local or noninvasive intervention indicated; limiting age-appropriate instrumental ADL*; [3] Grade 3 Severe or medically significant but not immediately life-threatening; hospitalization or prolongation of hospitalization indicated; [4] Grade 4 Life-threatening consequences; urgent intervention indicated; [5] Grade 5 Death related to AE; Abbreviations: n = number; AT = aerobic training; RT = resistance training

Appendix 39. Resistance exercise prescribed within the *ExerciseGuide* intervention

Table S5:

Mode	Region	Exercise	Exercise Plan 1 Total number of times prescribed N (%)	Exercise Plan 2 Total number of times prescribed N (%)
Prescribed by *ExerciseGuide* website	Upper Limb	Seated Chest Press	3 (15%)	1 (5%)
		Seated Bicep Curl	6 (30%)	5 (25%)
		Seated Row	7 (35%)	5 (25%)
		Seated Shoulder Press	0 (0%)	0 (0%)
		Seated Shoulder Raise	0 (0%)	0 (0%)
		Seated Triceps Extension	10 (50%)	8 (40%)
		Standing bicep curl	7 (35%)	6 (30%)
		Standing Row	2 (10%)	0 (0%)
		Standing Shoulder Press	0 (0%)	0 (0%)
		Standing Shoulder Raise	0 (0%)	0 (0%)
		Incline Push Up	8 (40%)	4 (20%)
	Trunk	Seated March	10 (50%)	8 (40%)
		Leg Fallout	4 (20%)	3 (15%)
		Single Leg Lift	3 (15%)	2 (10%)
		Single Leg Lift with Extension	4 (20%)	3 (15%)
		Double Leg Lift	2 (10%)	0 (0%)
		Double Leg Hip Lift	5 (25%)	2 (10%)
		All Fours	0 (0%)	1 (5%)
		All Fours Progression	0 (0%)	0 (0%)
	Lower Limb	Seated Knee Extension	7 (35%)	5 (25%)
		Seated Hamstring Curl	11 (55%)	8 (40%)
		Sit to stand	0 (0%)	0 (0%)
		Partial Squat	6 (30%)	4 (20%)
		Squat	2 (10%)	0 (0%)
		Standing Calf Raise	17 (85%)	12 (60%)
Added in during telehealth consult	Upper limb	Seated row	1 (5%)	1 (5%)
	Lower Limb	Wall sit	0 (0%)	2 (10%)
		Isometric leg extension	0 (0%)	1 (5%)
		Seated knee extension	1 (5%)	1 (5%)
		Seated hamstring curl	1 (5%)	1 (5%)

Appendix 40. Aerobic exercise prescribed and completed within the *ExerciseGuide* intervention

	Mode	Exercise Plan 1 Week 1-3 (n=20)	Exercise Plan 2 Week 4-8 (n=19)[1]
Primary mode prescribed by website	Any option (no bone metastases)	7 (35%)	3 (16%)
	Water walking	7 (35%)	6 (32%)
	Stationary cycling	4 (20%)	2 (11%)
	Walking	2 (10%)	2 (11%)
	No prescription	0 (0%)	6 (32%)
Secondary mode/s prescribed by website	Water walking	3 (15%)	1 (5%)
	Stationary cycling	9 (45%)	8 (42%)
	Walking	8 (40%)	6 (32%)
	Elliptical/climber	2 (10%)	2 (11%)
Actual aerobic prescription completed	Walking	12 (60%)	10 (53%)
	Stationary cycling	4 (20%)	4 (21%)
	Pool Walking	2 (10%)	1 (5%)
	Water aerobics	1 (5%)	1 (5%)
	Jogging	1 (5%)	1 (5%)
	Cross-trainer	1 (5%)	1 (5%)
	No prescription completed	4 (20%)	5 (26%)

[1] One participant withdrew prior to week 4 and was not prescribed an updated program (exercise plan 2)

Appendix 41. Flexibility exercise prescribed within the *ExerciseGuide* intervention

		Exercise Plan 1 **Week 1-3** **(n=20)**	**Exercise Plan 2** **Week 4-8** **(n=19)[1]**
Stretching program	Stretching program requested	19 (95%)	7 (37%)
Number of stretches prescribed	Mean ± SD	4.8 ± 2.3	4.3 ± 2.8
Stretches prescribed	Triceps	17 (85%)	6 (32%)
	Chest	17 (85%)	6 (32%)
	Quads	11 (55%)	6 (32%)
	Glutes	7 (35%)	2 (11%)
	Groin	11 (55%)	6 (32%)
	Hamstring	11 (55%)	6 (32%)
	Calf	18 (90%)	7 (37%)

[1] One participant withdrew prior to week 4 and was not prescribed an updated program (exercise plan 2)

Appendix 42. Subgroup physical functioning measures at baseline and follow up

Outcome (n=10)	Baseline		Follow-up		Adjusted Change	P-Value
	EG	CON	EG	CON	Mean difference (95% CI)	
400m walk (min)	5.49 ± 1.52 (n=5)	4.53 ± 1.36 (n=4)	5.23 ± 2.02 (n=5)	4.80 ± 1.94 (n=4)	-0.8 (-1.5 – -0.1)	0.02*
Timed up and go (s)	9.72 ± 3.04 (n=6)	7.10 ± 3.83 (n=4)	8.64 ± 3.08 (n=6)	7.29 ± 3.84 (n=4)	-1.0 (-2.5 – 0.5)	0.15
Repeated chair stand (s)	16.93 ± 7.05 (n=6)	13.30 ± 4.58 (n=4)	16.07 ± 6.00 (n=6)	13.22 ± 4.76 (n=5)	-0.7 (-2.1 – 0.6)	0.22
1RM – Chest press (kg)	58.75 ± 14.36 (n=5)	56.67 ± 11.55 (n=3)	65.00 ± 16.83 (n=5)	56.67 ± 11.55 (n=3)	8.5 (0.9 – 16.0)	0.04*
1RM – Leg extension(kg)	57.5 ± 25.0 (n=5)	50.0 ± 10.0 (n=4)	63.13 ± 21.35 (n=5)	53.3 ± 20.21 (n=4)	2.5 (-25.3 – 30.3)	0.82