



The Impact of Providing Patients with Internet Guidance on Clinical Decision-Making and Health Care Outcomes

Thesis prepared for the degree of Doctor of Philosophy in Dental Sciences by

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2017

Dedication

to the spirit of my dad

Prof Maher Batra Hanna

Professor of Economics

who was looking forward for this day and covered me with his kindness all over my life

to my mother

Mrs. Mariam Hanna

for doing every effort to make our family happy

to my sister and brother

Dr Amelie Hanna and Dr Fayeze Hanna

for their continuous support

Preface

The idea for this research arose during my clinical practice as an oral surgeon when discussing patients' internet-retrieved information during their consultation. Some of the information was not evidence-based and I provided them with the current best available evidence. Information forms an integral part of the clinical decision-making process. Although patients' seeking online health information is appreciated, clinicians are in fact not prepared to discuss internet-retrieved information due to the lack of time or awareness of high quality online information. To limit the scope of the research, I focused on the topic of wisdom teeth. This topic was selected as it is one of the most commonly performed oral surgical procedures and patients are required to make several choices. In addition, Australia has one of the highest rates in the world of hospitalization for wisdom teeth extractions which might create a pressure on the health system. To understand the current situation for wisdom teeth extraction in Australia, we used the 2013 National Dental Telephone Interview Survey. The pattern of wisdom teeth extraction suggested that multiple wisdom teeth extraction is more prevalent than single wisdom tooth extraction with no association with self-rated oral health. These findings were detailed in [paper 1](#).

Wisdom teeth patients might benefit from receiving information through the internet before consultation to improve their participation in decision-making and consequently health care outcomes such as quality of life. Providing patients with a pre-consultation internet-based set of information might fill the gap in informing wisdom teeth patients as the current evidence suggests that clinics are over-booked and patients are not adequately informed. Accordingly, the researcher wanted to explore the quality and readability of online health

information to have a short list of high quality resources that could be emailed to patients before their consultation – findings were presented in paper 3. The researcher found that the scientific information quality varies significantly across websites and patients themselves might not be able to identify high quality resources.

The researcher decided to test the impact of providing wisdom teeth patients with internet guidance before consultation on patients' knowledge, anxiety, participation in decision-making, and consultation outcomes. The researcher used a randomized controlled trial (RCT) design as it is ranked high on the level of evidence. During the phase of RCT design, the researcher wanted to use quality of life as an important end-point for this research. Then a series of question arose: how wisdom teeth experience might impact upon quality of life, what are the quality of life domains relevant to wisdom teeth and which of the available generic health-related quality of life or oral health-related quality of life instruments are the best in measuring them? There are limitations in our understanding of these issues that called for a qualitative study that could address these questions.

The researcher decided to use a novel approach by getting real-time qualitative data obtained from Twitter to address the previously raised research questions and to avoid the experimentally induced recall bias associated with conventional qualitative research methods. Findings of the Twitter study, which were presented in paper 2, showed that this novel approach is useful in not just modeling the impact of wisdom teeth experience on quality of life but also to observe how quality of life domains are interacting in real-time. In addition, the researcher was able to highlight the limitations of the available generic quality of life instruments. The study-identified combinations of quality of life domains might be

used in developing a new oral health-related quality of life measure that is more precise and sensitive to change.

Internet use and online information seeking behavior and associations with patients' knowledge about a specific topic such as wisdom teeth was an area of interest to the researcher. This is an important step in improving the usefulness of the Internet as an adjunct information source for dental patient. Accordingly, relevant questionnaire items were added to the trial baseline survey to address these research questions. Among the findings presented and discussed in paper 4, patients' use of the internet was not associated with better wisdom teeth knowledge. Close examination of participants' online information seeking revealed their inability to identify high quality information resources. This confirmed the suspected inability of patients to identify high quality internet resources based on findings of online information quality assessment reported in paper 3 in this piece of research and by other scholars. These findings supported the need to examine whether providing patients with a pre-consultation internet guidance might serve as an opportunity to overcome these issues in the short-term.

While the medical literature has addressed the topic of patients' involvement in decision-making and associations with health outcomes, there is a limitation for such evidence from dentally-related studies. Therefore, there was a need to explore dental patients' preferences for involvement in clinical decision-making and the contributing individual characteristics. Identifying these individual characteristics might improve patient-dentist communication by making clinicians more sensitive to the patients' desire for decisional control. To the best knowledge of the researcher, this is one of the emerging studies in the field of patients' preference for involvement in dental decision-making and identifying associations with

quality of life as an important end-point of health services research and was presented in paper 5.

This piece of research was able to identify an association between patients' knowledge and participation in decision-making suggesting the importance of enhancing patients' knowledge. However, results of group comparison in the RCT, which was presented in paper 6, showed that the intervention provided did not improve our participants' knowledge about wisdom teeth. Since the majority of RCT participants were community dental patients seeking public sector treatment, the majority of them had low educational levels. This might limit the uptake of the intervention provided and the researcher suggested the need to design information for patients of low literacy level. The lack for the efficacy of our intervention in improving patients' knowledge resulted in the observed lack of effect on participation in decision-making. The findings of our RCT showed that patients attending wisdom teeth consultation reported high levels of dental anxiety however, the intervention provided did not increase their anxiety levels. These finding might be important to consider while communicating with and examining wisdom teeth patients.

The period the researcher spent in undertaking this PhD project provided the researcher with skills including using several study designs, designing and deployment of the study surveys, obtaining multiple ethical approvals, collecting different types of data and the use of both quantitative and qualitative research methods. Another important skill the researcher gained was the ability to report his research finding in a manuscript style. This piece of research addressed a specific dental topic from different angles and perspectives including the current state for wisdom teeth extractions in Australia, online wisdom teeth information quality and readability, how wisdom teeth might impact on quality of life and what might be used to

measure these impacts, internet use and online information seeking behavior, dental decisional control preferences and associations with quality of life. As the researcher experienced a slow recruitment process for the trial, the researcher was not able to achieve the targeted sample size within the time frame of this project. The researcher presented findings for the trial as a drafted manuscript in [paper 6](#).

The present PhD thesis included 6 original research articles at various stages of the publication process. Each original article is presented as a chapter within the thesis preceded by a short statement that links the article to the body of work, bullet-point research highlights and indicates direction of future research. Details for the activities carried out by the researcher including the six original research articles, one relevant publication (trial registration), research presentations (local, national and international), journal club discussion, travel awards and teaching are found in [Appendix IX](#): Research activities, presentations, teaching activities and awards during the PhD period.

The researcher expects that findings reported in this PhD might contribute to the knowledge in relation to patient education, clinical decision-making and quality of life. In addition, the researcher expects that this research contributes to current clinical practice of wisdom teeth extraction decision-making. The research methods used in this PhD and the highlighted research directions might provide some guidance for future researchers.

Abstract

The majority of Australians who underwent third molar extractions (TME) over a 12-month period received multiple TME with no impact upon their short-term self-rated oral health—a finding from our analysis to the Australia’s 2013 National Dental Telephone Interview Survey. The number of TME was associated with being dentally insured suggesting a possible over-management. Additionally, our finding questioned the use of age as a justification for prophylactic TME. Since evidence does not support the prophylactic TME and those patients are not adequately informed, emailing patients a pre-consultation educational resources might be beneficial. A randomized control trial (RCT) was conducted to identify whether this intervention could improve TME knowledge and consequently participation in shared decision-making (SDM), dental anxiety and health outcomes.

High quality resources were provided as a RCT intervention after conducting a quality and readability assessment for TME online resources using criteria and tools developed for this purpose. The observed variability in TME information quality across websites might question the patients’ ability to get high quality information since our participants were unable to recognize online information quality seals. The majority of our participants were internet-ready with no impact upon their TME knowledge. The internet-ready phenomenon was explained by patients’ preference for an active decisional control. Although our RCT participants were community dental patients seeking public sector treatment, they preferred participation in decision-making. Being a female patient and/or having higher education was associated with an active decisional control preference. This might improve clinicians’ sensitivity to patients’ decisional control role. Preference for involvement in decision-

making was associated with a better oral health-related quality of life (QoL) suggesting the benefit for enhancing patients' involvement in SDM.

The researcher explored and modeled how third molars (TMs) experience might impact upon QoL and how QoL domains interact using a qualitative real-time twitter data. This approach showed that the available QoL measures have conceptual limitations in capturing these impacts with wide instrument to instrument variation. QoL domains identified from the Twitter study might be used to develop a new QoL measure for TMs. Although the researcher found that patients' TMs knowledge was associated with SDM, the intervention provided did not improve patients' knowledge and therefore it did not improve SDM and consultation outcomes. The lack of efficacy of the intervention provided might be attributed to the wide prevalence of low educational attainment that might limit information uptake. More research is needed to develop information resources for low literacy patients. Our intervention did not increase dental anxiety however, both groups reported high levels of dental anxiety which needs clinicians' attention.

This research contributes to clinical practice by improving patient-clinician communication and TME decision-making. It contributes to patient education theory by revealing gaps in online information quality and information seeking behavior. It contributes to the field of health service quality by revealing the association between involvement in SDM and oral health-related QoL. Arriving at these findings was enabled by using different study designs and mixed research methods. This research suggested several future research opportunities.

Thesis Declaration

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Dr Kamal Hanna
Date: 20/01/2017

Acknowledgement

The researcher prays thanks to God for the grace he receives throughout his life. The researcher acknowledges the support he received from his supervisory team during various stages of this research. The researcher express his sincere gratitude to Prof David Brennan for his guidance, positive and constructive feedback throughout this work. Prof Brennan's logistic support was unforgettable. The researcher thanks A/Prof Jason Armfield for his contribution to this work and the researcher has learned from him how to pay attention to details during manuscripts writing. The support that Dr Paul Sambrook provided to the researcher in accessing the Oral and Maxillofacial Surgery Unit, Adelaide Dental Hospital and supervising this work is appreciated. The researcher acknowledged the contributions of A/Prof Lisa Jamieson to part of this work.

The researcher acknowledges the role of the University of Adelaide in providing the researcher with Adelaide Scholarship international that supports the tuition fees and living costs. The researcher sincerely thanks Adelaide Dental School for awarding him two Eustas Travel Award (national and international) to present his findings. The researcher acknowledges a Colgate Travel Award to present a paper outlined in this research.

The researcher acknowledges the supportive environment at the Australian Research Centre for Population Oral Health, the University of Adelaide. The researcher also acknowledges the logistic support provided to this work by Dr Andrew Chartier at the Evaluation and Research Unit, South Australia Dental Services. The researcher sincerely thanks the administrative staff of Oral and Maxillofacial Surgery Unit for recruiting participants for the trial.

The researcher thanks his family for their faith in him and their patience during the period of this work which was hard for everyone in the family due to the loss of his beloved father Prof Maher Hanna (Professor of Economics). The researcher dedicated this work to the spirit of his dad who had continuously encouraging him to progress in his clinical and academic career. The researcher thanks his mother, Mrs. Mariam Hanna, who is doing every effort to make us happy. The researcher also acknowledges the support received from his sister Dr Amelie Hanna and his brother Dr Fayez Hanna.

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List of abbreviations

AGS	Average Global Score
ANOVA	Analysis of Variance
ANZCTR	Australian and New Zealand Clinical Trial Register
API	Application programming interface
AQoL-8D	Assessment of Quality of Life
CONSORT-PRO	Consolidation statement of reporting trial- patient reported outcomes
CMOHK	Conceptual Model of Oral Health Knowledge
DAS	Dental Anxiety Scale
DCPs	Decisional Control Preference Scale
DCS	Decision Conflict Scale
Dyadic-DCS	Dyadic Decisional conflict scale (Dyad-DCS)
eHEALS	eHealth Literacy Scale
EQ-5D	EuroQoL quality of life-5 dimensions
EQIP	The Ensuring Quality Information for Patients
GA	General Anesthesia
GDC	General Dental Council
GDPs	General Dental Practitioners
GOHAI	Geriatric Oral Health Assessment Index
GPs	General Practitioners
HON	Health on the Net
HREC	Human Research Ethics Committee
HRQoL	Health related quality of life
IDAF	Index of Dental Anxiety and Fear
ISQ	Index of Scientific Quality
IV	Intra Venous
JADA	Journal of American Dental Association
LA	Local Anesthesia
MDAS	Modified Dental Anxiety Scale
NHP	Nottingham Health Profile
OER	Open Educational Resources
OHRQoL	Oral Health Related Quality of Life
OHIP-14	Oral Health Impact Profile
OH-QoL-I	Oral Health Quality of life Inventory
OHRQoL	Oral health related quality of life
OHRQoL-UK	Oral Health Related Quality of Life-UK
OIDP	Oral Impact on Daily Performance
PDPAI	The Provider Decision Process Assessment Instrument
PHI	Private Health Insurance
POIQ Scale	Perceived Online Information Quality Scale
PRUS	The Physicians Reaction to Uncertainty Scale
QS	Quality Scale
RCT	Randomized Controlled Trial
SDM	Shared Decision Making
SDM-Q-9	The 9-item Shared Decision Making Questionnaire
SF-8D	Short Form Health Survey – 8 dimensions
SIP	Sickness Impact Profile
TMs	Third molars
UNESCO	United Nations Educational, Scientific and Cultural Organization

VAS

Visual Analog Scale

Chapter 1: Introduction

Background

Clinical decision-making is an interactive patient-clinician communication and information sharing in order to make a treatment decision that is evidence-based and respects patient's beliefs and values. It is suggested that patients' knowledge is important in making a treatment choice [1]. Furthermore, evidence from medical studies suggest that patients' involvement in clinical decisions-making is important to enhance health care outcomes [2,3]. Furthermore, there is some evidence suggesting a positive association between patients' oral health literacy and health outcomes such as a better oral health status [4]. In addition, it was found that supplying patients with health information materials, whether written or audio/visual, allows for a better understanding of their health condition and prevents complications [5] which might be a possible pathway in improving health outcomes. Health providers traditionally have relied on printed educational materials as an efficient way to communicate health advice and messages, assuming that these materials are sufficient. Recently, health providers became aware that these materials are hardly understood by a majority of patients [6], or perhaps are not sufficient.

There are a number of questions regarding patient educational materials: 1) Are health care providers and practitioners aware of all the needs of patients? [7], 2) Do health providers and practitioners know what works and what does not in relation to patient education? [8], and 3) what can be done to satisfy patient's needs? [9]. Furthermore, a question remains: does the provided information improve patients' knowledge about a specific topic. In order for the provided information to be useful, the information needs to be understandable by the average patient [10]. Research has shown that patients may have difficulty in reading some educational materials [11] and a majority of patients find leaflets are difficult to understand

or off-putting [12]. This might limit their usefulness as an information source. Furthermore, dental patients are facing a lack of information from professional sources [13]. Even more, Kang et al. [14] argued that content style and structure as well as graphics play a role in the quality of educational materials provided to patients. It was also found that individual aspects such as self-care motivation impacts the efficiency of patient education [15]. This raises an important question: do health providers and practitioners know whether information provided to patients is engaging.

It is understandable that the lack of patients getting sufficient information from professional sources has resulted in many patients surfing the Internet to satisfy their demands in regard to health information [16]. In addition, there is some evidence suggesting that online information seeking occurs before consultation in a phenomena known as the internet-ready patient [17]. However, no explanation was provided on this phenomenon and therefore, it might be necessary to find an explanation to this phenomenon to understand patients' needs. Moreover, little is known about whether dental patients' online information seeking was associated with better knowledge regarding a specific topic for which they have sought information. Another question of interest might be related to the current status of online information quality regarding a specific topic and whether patients could be able to identify high quality information themselves due to the wide variation in information quality [18]. Although health related information seeking and their comprehensiveness is important in making a treatment choice [19], the previously mentioned questions might form a barrier for patients to retrieve high quality information that might help them in making a sound high quality decision. Therefore, it might be useful to examine whether using the internet in dental patient education is an effective way of improving knowledge that helps patients to make a

high quality decision and consequently improve the outcomes of treatment, as evidence in the medical field [20] has suggested this to be an opportunity.

Furthermore, the pattern of the patient-clinician relationship has changed from a paternalistic approach to an informed one after the introduction of The Medical Treatment Contract Act in the Netherlands in 1995 [21]. This only resulted in an increase in the information component of decision-making while patients' role in decision-making was still passive. We have now moved to the era of shared decision-making (SDM) where patients are encouraged to take responsibility in making decisions about their own health [22]. The percentage of patients involved in shared clinical decision-making is increasing over time [1,23]. When patients are involved in SDM, treatment outcomes might be improved [24]. Little is known about the association between dental patients' involvement in SDM and health outcomes such as quality of life in dentistry which might suggest the need to explore this area as it might be of benefit to dental patients.

Limiting the scope of the study

In order for the researcher to address the previously raised issues in a more specific way, to limit the study to suit the PhD study time frame and the resources available, the researcher limited the study to the topic of third molars (TMs). The selection of this area of focus was addressed by the researcher for a number of reasons: Firstly, Australia has seven times the rate of hospitalization for third molars extractions (TME) [25] in comparison with other countries such as the United Kingdom which might suggest that they are prophylactically removed; Secondly, although the current evidence does not support the prophylactic TME of the asymptomatic TMs and demands more research supported by patients' reported

outcomes [26,27], the Australian Dental Association [28] left the decision to patients after discussing it with their dentist: Thirdly, in order for patients to make a high quality decision, they need to be adequately informed which is argued to be not the case for TMs patients [29] due to the busy nature of oral surgery clinics: Fourthly, TMs patients are required to make several decisions about their treatment plan [30] which demands a high level of knowledge. These reasons serve as a justification the selection of TMs as a topic.

Research arguments

As indicated in the previous section, the researcher will take the reader through every aspect related to this topic and how it relates to the raised issues and how it will address these issues.

The researcher needed to explore the current situation in Australia in regards to TME in general and independently of where the TME was performed. This is because the study conducted by Anjrini et al. [25] was limited to hospitalization records only and ignored TME at the out-patient venues. While Australia does not have national guidelines in relation to prohibiting TME based on the current evidence [26] as the case in some countries such as the United Kingdom [31], The Australian Dental Association argue against such guidelines [32]. While the Australian Dental Association left the decision for prophylactic TME to patients and clinicians, there is some evidence suggesting that patients might go for it if they have insurance cover [33]. Even clinicians are advising their patients to use their dental insurance [34] since, they have already paid for it. This made the researcher interested in exploring the effect of the uncertainty related to TME in Australia and how it might be related to the prevalence of receiving multiple TME, and whether dental insurance might play a role in the number of TME received.

There is a need for studies that explore whether prophylactic TME is associated with patients' reported outcomes in the short-term and the long-term to optimize TME decisions [35,36]. Therefore, it might be important to explore this area to reduce the current state of uncertainty and improve TME decision-making. In addition, clinicians who recommend prophylactic TME in young age [37,38] justify their recommendation by the potential increased risk of developing post-extraction complication with an increase in age. However some scholars argue against such justification [39]. Therefore, it might be necessary to explore whether age might be a reasonable justification for prophylactic TME to reduce post-extraction complications. Arriving at an answer to these questions might also improve TME decision-making in Australia and shed the light onto current gaps in TME decision making that might be improved by providing TMs patients with high quality information.

Australians experiencing TMs problems are searching the internet for information which was evident from statistics published by Google Trends [40] which showed that Australia is ranked as one of the top three countries in the world for searching for "wisdom teeth" on Google. This raises a question: does online TMs information seeking improve patients' TMs knowledge? The reason behind this question was due to the variability of online information quality among websites in general [41] and nothing is known about online TMs information quality. While patients would like their health care professionals to provide them with quality internet resources [42], the lack of time to review websites and/or awareness of high quality resources [43,44] might hinder clinicians from recommending these resources. Therefore, it might be useful to conduct a quality and readability assessment of online information resources concerning TMs to provide clinicians with resources to recommend to their patients.

For the internet consumer health information to be useful as an adjunct information source, it might be necessary to understand how patients look for information on the internet and what characteristics might be associated with online information seeking. This is because seeking online information needs skills other than using computer/smart phone. This set of skills are known as the ehealth literacy [45]. Identifying gaps in online information seeking might be useful in designing and developing ehealth literacy interventions. Therefore, it is important to explore patients' use of the Internet in seeking online information about a specific topic (such as TMs), how they sought this information and whether patients' unguided information seeking is associated with a better TMs knowledge.

Although some medical studies have argued that patients' knowledge is associated with improved participation in decision-making, only a little is known about that in dentistry. In addition, there is a lack of dentally-related studies that explore the association between patients' involvement in decision-making and health outcomes which might be enhanced through improving the decision quality and patients' adherence to treatment recommendations [2,3]. To the knowledge of the researcher, there is a limitation for dentally-related studies that explored the association between patients' involvement in decision-making and health outcomes such as quality of life which is considered the most important end-point of health services research [46]. Therefore, it might be necessary to explore this further. Although quality of life might be measured via either a generic or a disease specific approach [47], only a little is known about which approach/tool might be suitable for use in exploring the association between participation in TME decision-making and quality of life. Conducting a qualitative study of how TMs impact upon quality of life might be useful to answer this research question.

The researcher argues that providing patients with internet guidance to high quality educational resources provides a solution to patients' demand for health information. This guidance might take place by providing patients with a list of high quality patient-centered resources, before consultation, based on website content analysis. This intervention might enhance patients' knowledge, participation in decision-making and consequently health outcomes.

Main research objectives

The main objectives of this study were to

- a. To examine whether providing TMs patients with a pre-consultation internet guidance, whereas the provided internet guidance is based on online content analysis, improves patients' TMs knowledge, participation in TME decision-making, reduces anxiety levels and improves health outcomes. These objectives were explored via a pilot randomized controlled trial and it was presented in [Chapter 10 \(paper 6\)](#): The impact of providing third molar patients with a pre-consultation internet guidance on their knowledge, anxiety, decision-making and consultation outcomes: A pilot randomized controlled trial

- b. To explore factors associated with patients' preferences for involvement in dental treatment decision-making; and to explore whether patient's participation in decision-making has an association with quality of life. These objectives were presented in a separate study: [Chapter 9 \(paper 5\)](#): Preferences for dental decisional control and associations with quality of life among third molar patients attending South Australia Dental Services.

Subsidiary research objectives

Since the present research has ambitious objectives the use of different data sources, study design and mixed research methods were needed to be able to achieve these objectives within the time frame of the PhD project. In addition, achieving these objectives demanded the need for a series of studies presented in paper formats and each of them has its own objectives. In the following section, the researcher presented the title for each of the included six papers (also presented as a chapter) and their objectives:

1. [Chapter 4 \(paper1\)](#): Wisdom teeth extractions among Australian adults: Findings from the 2013 National Dental Telephone Interview Survey

This study was performed as a step to make sure that population selected for this study that was determined earlier based on literature review, might benefit the most from receiving internet guidance as an intervention. This study has the following objectives:

- a. To identify, over the past 12 months, whether dental insurance is associated with a higher number of third molar extractions (TME).
 - b. To explore whether single versus multiple TME is associated with self-rated oral health.
 - c. To explore whether TME when aged 18-25 years is associated with fewer days absent from work due to dental problems.
2. [Chapter 5 \(paper 2\)](#): Exploring and modelling impacts of third molar experience on quality of life: A real-time qualitative study using Twitter

This study was conducted to understand how TMs impacts upon QoL. In addition, this study proposed an approach that the researcher might use to select their generic

QoL measure that will be used as an end-point for their intervention. This study has the following objectives:

- a. To explore and model domains for real-time impacts of TMs experience on QoL.
 - b. To explore actions which were taken to resolve TMs suffering.
 - c. To assess some generic HRQoL and OHRQoL instruments' percentage of coverage to the study-identified real-time TMs QoL domains.
3. [Chapter 7 \(paper 3\)](#): Third molars on the Internet: A guide for assessing information quality and readability

This study was conducted as a part of designing the provided intervention. Based on findings from this study, a list of high quality online resources was created and emailed to participants before consultation as an intervention. In order to make a rigorous assessment of the reviewed TMs online resource, a gold standard for online TMs information was created and was presented as a preceding chapter entitled: [Chapter 6](#): Gold standard for online patient information concerning wisdom tooth problems. The quality and readability of TMs online resources study has the following objectives:

- a. To develop a scale that measures the scientific information quality (SIQ) for online information concerning wisdom tooth problems.
 - b. To conduct a quality evaluation for TMs online resources.
 - c. To evaluate whether a specific piece of readability software (Readability Studio Professional 2012) might be reliable in measuring information comprehension.
 - d. To explore predictors for the SIQ scale scores.
4. [Chapter 8 \(paper 4\)](#): Internet use, online information seeking behavior and knowledge among third molar patients attending South Australia Dental Services

This study used data from the baseline survey of the RCT. This study was conducted after the researcher observed in the study of assessing the quality and readability of online TMs resources that they varied significantly across websites. This might question the patients' ability to find high quality online resources. In addition, it might be useful to understand how TMs patients seek online information to identify gaps in online information seeking and therefore, be able to provide recommendations to online information producers. This study has the following objectives:

- a. To explore internet use, online information seeking among third molar (TM) patients and associated predictors.
- b. To explore the association between internet use and patients' TM knowledge.
- c. To explore the association between eHealth Literacy Scale (eHEALS) scores and TM knowledge scores.

Thesis structure

An overview

This PhD thesis is structured as thesis in a combined format between thesis by publication and conventional thesis format. In Chapter 1, the researcher introduced the reader to the research problem, highlighted main gaps in the current literature and outlined the research objectives. In Chapter 2, the researcher reviewed key literature that the researcher depended on in this research in a comprehensive way specially, in some aspects such as shared decision-making instruments, quality of life measures, and a review of website content analysis studies. In Chapter 3, the researcher detailed the methodologies used in the different

studies presented here. These chapters were presented in a format used in a conventional thesis.

Chapters 4 to 10 present publications that have arisen from this study. These publications were presented in a logical order. This PhD consists of six original articles each of them presented in a separate chapter and one chapter that contains supplementary material published with one of the original articles. Five out of the six original articles were based on primary data for which the researcher created the initial conceptualization, designed the study, obtained ethical approvals, collected, analyzed and reported the findings, and produced manuscripts. In one of the six original article, the researcher used secondary data (NDTIS). Each journal article is preceded by a statement of authorship in accordance with the University of Adelaide policy. In addition, each original article is preceded by a statement that links the original article to the body of research. In each of these statements, the researcher presented the main research highlights and indicated future research directions.

In Chapter 11, the researcher provided a general discussion of the study findings, contributions of this study and future research opportunities. This thesis contains a number of appendices: ethical approvals, baseline package, clinician's survey, before and after consultation survey, follow-up survey, poster presentation for online TMs information quality and readability assessment, critical review of SDM instruments and critical evaluation of online content analysis studies.

Publications included and their aims

This PhD thesis contains six original journal articles at different stages of the publication process. In Chapter 4, the researcher presented a submitted original article (paper1) which

outlines the current status for wisdom teeth extractions in Australia. This study used a population representative sample of Australian residents aged 18 years and over. In this study, the researcher argued that the availability of private dental insurance might be associated with the number of TME. In addition, the researcher argued that the direction of the association might be opposite to the known association between dental insurance and extractions in general in the same population. Since there is a demand for more evidence in relation to the benefit of receiving prophylactic TME in the short-term on self-reported outcomes, this study investigated this area using the global self-rated oral health as an outcome measure. Additionally, this study explored whether receiving prophylactic TME in younger age (18-25 years of age) compared with the older age group might be justified by experiencing post-operative complications which indicated by the number of days absent from work/school due to dental problems. This paper might provide a justification of why TMs patients might benefit from receiving high quality information before consultation to improve their participation in TME decision-making. This might make them a suitable population to whom the intervention described was provided.

QoL is becoming an important end-point for health research in general and more specific to TMs research. This research focused on exploring whether participation in decision-making improves QoL, and the decision needed to select a suitable QoL instrument that is precise and sensitive to change. QoL instrument selection should be based on an instrument that is the most relevant to the condition of interest. Since there is a lack for qualitative studies that explored how TMs impact upon QoL, this makes instrument selection difficult. This is because, QoL instruments vary significantly in their conceptual framework, domains and items. Therefore, in Chapter 5, (an accepted paper for publication in *Int Dent J*) the researcher used real-time Twitter data to explore and model how TMs impact upon QoL.

Understanding how TME impact upon QoL might improve QoL instrument selection. Therefore, the researcher compared, theoretically, the ability of some of the available QoL instruments to the TMs domains identified in this study. This might make the comparison between instruments more rigorous and lead to the selection of an instrument that is precise and responsive to change.

Providing TMs patients with high quality information, through an email, and examining their effect upon TMs knowledge was our main aim, it was decided to use the existing online resources. In order to ensure that the assessment of these resources was systematic, the researcher created criteria for the information that should be provided to TMs patients. The criteria or the gold standard for TMs information was detailed in [Chapter 6](#) and was published as a supplementary material to the published TMs website content analysis.

In order to design the intervention that was provided to our participants, which was argued to improve their pre-consultation TMs knowledge, the researcher conducted a quality and readability assessment of online TMs information which was outlined in [Chapter 7](#). This paper was published in *Interact J Med Res*, 2015. To make the assessment process more robust, the researcher aimed to create and initially validate a tool to assess the Scientific Information Quality (SIQ). Since the provided information needed to be understandable, information needed to be evaluated for their readability. Available software (such as the Readability Studio Professional 2012) might evaluate the information readability however, it needed to be validated. Therefore, this study attempted to evaluate the validity of this software in assessing information readability. Although the quality of online information varies significantly across websites, there is a limitation for studies that assessed factors contributing to online information quality. Understanding these factors might help patients

to identify high quality information in the absence of internet guidance from their clinicians. Therefore, this study explored factors contributing to TMs online information quality.

For the purpose of examining the main research objective, the researcher conducted an RCT titled “Engaging patients in Decision-making”. The baseline survey of this study was designed to obtain data presented in two separate journal articles. In one of them (Chapter 8), (submitted paper) the researcher addressed internet use for dental procedural information and patients’ individual characteristics associated with it since only a little is known about dental patients’ use of the Internet. In addition, understanding online information seeking behavior might reveal barriers that patients might face during their online information seeking. This is why this study explored online information seeking among TMs patients. Whereas the researcher argued that variability in online information quality might reduce the usefulness of the Internet as an information source, this study explored the association between the un-guided online information seeking and TMs knowledge.

The second journal article (Chapter 9) (submitted paper) based on the data collected from the baseline information of the RCT addressed patients’ preferred role for involvement in making dental treatment choices and associations with QoL. This aim was an attempt to explore whether patients’ involvement in decision-making was associated with QoL—an important health care outcome. Since understanding of individual’s characteristics associated with decisional control preference might improve the clinician’s sensitivity to patients’ desire for decisional control, this study explored patients’ individual characteristics associated with preferences for decisional control.

In Chapter 10, (drafted journal article) the researcher presented an original article that reported findings of the consultation stage of the RCT. In this article, the researcher identified whether providing TMs patients with a pre-consultation high quality internet resources has an association with pre-consultation patients' TMs knowledge, pre-consultation anxiety level, participation in decision-making (from clinicians' and patients' perspectives) and consultation outcomes.

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Chapter 2: Literature review

This chapter reports on some of the key literature used in this study. The main aim of this study was to identify whether providing patients with high quality information has an association with improving the functional knowledge, participation in decision-making and whether participation in decision-making is associated with health outcomes (such as QoL). The researcher started this chapter with how, conceptually, information is related to participation in decision-making and how patients' participation in decision-making has an association with health outcomes.

The researcher, then, reviewed different sources of oral health information and current limitations of these sources. In addition, the researcher explored, in detail, the role of the internet in informing dental patients and why it is not yet considered as a reliable source for patient education. The researcher also addressed the role of health literacy and the ehealth literacy. Of course, quality of the online health information is an important issue, therefore, the researcher focused on factors which might affect the quality of online health information together with reviewing literatures about tools used in assessing different quality aspects of online health information. Since the researcher proposed the use of website content analysis to create a list of high quality online resources, the researcher systematically assessed dental website content analysis studies to help the researcher to develop the approach that will be used in this study. Such systematic review was not available at the time of conducting this review.

The researcher, also, addressed in this chapter clinical decision-making as it is an important outcome for the present study. The researcher stated to provide a historical background over clinical decision-making, factors that might be associated with making a treatment decision and also phases for making a clinical decision. Furthermore, the researcher provided a

systematic assessment of tools used to measure participation in decision-making. Although similar reviews were available, the latest review was more than 5 years old and the field of measuring shared decision-making is relatively young and new SDM measuring tools are still emerging. Another important reason for conducting this review was that all SDM measuring tool were not developed for a dental setting and therefore, it was necessary to find a suitable instrument to be used in this study. The researcher provided a justification for the SDM measuring tool used in this study based on this review.

The researcher also focused, in this chapter, on QoL as it is considered an important health care outcome in general and more specifically for the present study. The researcher reviewed conceptual aspects related to QoL together with QoL measuring tools. In this review, the researcher covered generic (health-related QoL) and disease specific (oral health-related QoL) approaches in measuring QoL. This review was basically conducted to help the researcher to select QoL tools that will be used as an end-point for this study. Since the population of this study were wisdom teeth patients, selecting the QoL measure that acts as an end-point was difficult. This has lead the researcher to develop a novel approach to facilitate QoL instrument selection by plotting QoL instruments' domains against QoL domains identified from a real-time qualitative analysis of wisdom teeth patients' Twitter feeds. This approach was presented in a separate paper.

The researcher has to limit the study to a specific topic for the best use of the available resources and proper time management of the PhD candidature. and has chosen wisdom teeth patients as described briefly in the introduction. The researcher reviewed literatures related to third molar extraction (TME) in general and also literatures about TME in Australia. In addition, the researcher reviewed literatures about educating TME patients and limitations

of the current clinical practice in informing TME patients. This review might provide some justification for selecting TME patients as a population in this study. In addition, the researcher reviewed some ways of measuring TME patients' knowledge that were used as a measure of online information seeking.

Conceptual model for oral health knowledge

Macek *et al.* [1] developed the first conceptual model for oral health knowledge. In their study, they developed a survey to assess oral health literacy. The survey questions were generated based on four main components that are closely related to decision-making and health care outcomes. They have found that age, education, and word comprehension were associated with the scores of the conceptual model of oral health knowledge (CMOHK). In the center of their framework, they have decision-making as it links the four components of health literacy with health care outcomes. However, the proposed model that links knowledge to decision-making and health outcomes needs to be tested which was the focus of this study. Figure 1 represents the framework of CMOHK.

Sources of health information: The role of the Internet

The first study for assessing health information seeking and its trustworthiness was carried out by Hesse et al. [2]. Data for their study were collected using Health Information National Trend Survey, USA. Their study assessed information seeking behavior and the trust in different health information sources such as physician, information leaflets, family member/friend, radio, television, newspapers and the internet. Their study has shown that 31% of the study Participants have looked for health information over the internet. Findings of their

study suggests that physicians remain as the most trusted source of information. In addition, one fourth of participants trusted internet related health information with the least trust given to the radio.

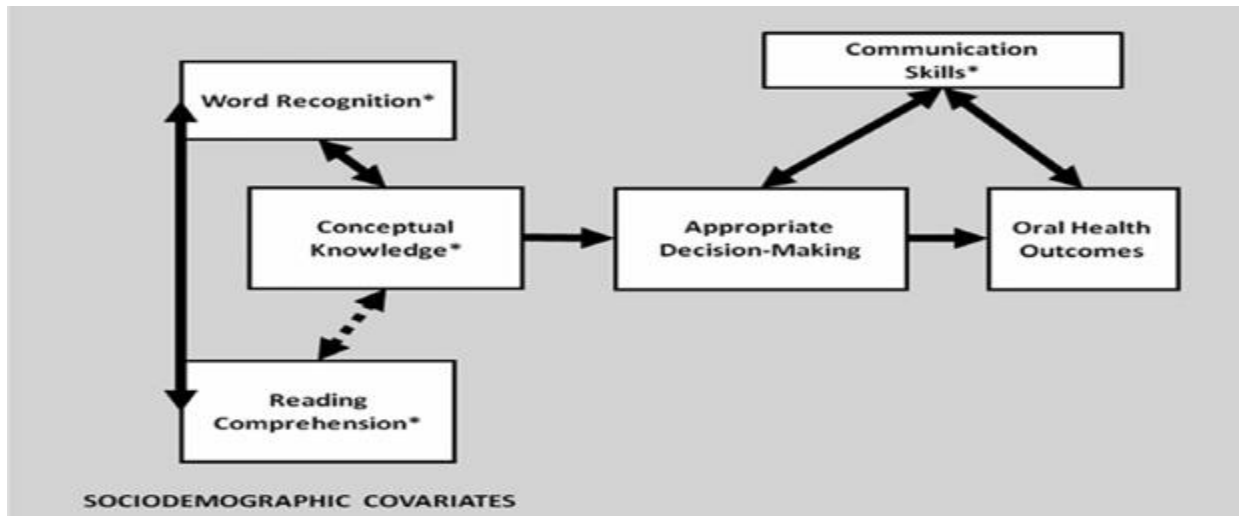


Figure 1: Conceptual framework for associations between different components of health literacy and oral health outcomes¹.

This study highlights that the role of the Internet as a source of health information is expanding. However, this study had a limitation in recruiting participants as it used random number telephone interviews. This resulted in an underestimation of the percentage of participants who were using the Internet for getting health-related information. This might be evident from a report by the Pew Research Center for Internet and American Life as they reported that the use of the internet for health information was higher (63%) during the same period.

¹: MACEK, M. D., HAYNES, D., WELLS, W., BAUER-LEFFLER, S., COTTEN, P. A. & PARKER, R. M. 2010b. Measuring conceptual health knowledge in the context of oral health literacy: preliminary results. *Journal of Public Health Dentistry*, 70, p202.

On the other hand, dental patient information seeking behavior has been studied by Hu et al. [3]. They found that 45% of their study participants searched for online dental information before visiting their dentist. However, they did not provide an explanation as to why their patients sought online information before consultation. In addition, Google was found to be the most commonly used search engine among their study participants. However, information from a friend or a family member was an important source of pre-consultation information. Among who have not reviewed dental information over the internet, they have related it to the difficulty in finding information or feeling that online information is difficult to understand. This might indicate the need to provide patients with internet guidance to resources that are of a high quality and at the same time understandable. In their study, they evaluated the participants' thoughts over a web-based 3D virtual reality program. Participants held a positive attitude. However, participants reported a limitation due to internet speed connection. The researcher believed that using 3D virtual reality program needs skills that may not be needed in reviewing normal web pages with illustrational graphics or videos.

Furthermore, Ni Riordain and McCreary [4] have studied the role of dental patients using the internet as a source for information. They have randomly surveyed dental patients attending Cork University Dental Hospital and School, UK for their use of internet in getting information regarding their dental conditions. They found that 34.5% of the study participants have already searched for their condition over the internet by themselves or by a relative or a family member. Dental fillings, oral lichen planus and surgical extraction have been the most common information searched for by the study participants. Therefore, this finding might support the selection of wisdom teeth patients in our study. It worth noting that 45% of the sample participants were patients attending the restorative department. This

could explain the increased percentage of patients looking for dental fillings information over the Internet. Participants in this study claimed the use of the internet was to improve their knowledge, explore different treatment options and to decrease their anxiety. This might suggest the potential link between information seeking and clinical decision-making.

Third molars patients and their need for information

Surgical removal of impacted third molars is the most common surgical procedure carried out by oral and maxillofacial surgeons [5]. The majority of young adults have to decide either to have the third molar removed or not [6,7]. Supplying patients with adequate information before undergoing surgical removal of impacted third molars is important clinically and legally [8]. Ferrús-Torres et al. [9] have reported that, the majority of patients are not able to recall the information given to them after one week post-operatively despite information being given to them verbally and also in a written format. Ferrús-Torres et al have related it to the busy nature of oral surgery clinics and patients became tired from waiting before having information given to them.

Moreover, providing information to patients over the various treatment options and advantages and disadvantages of each treatment choice is time consuming and hard to bear [10]. However, patients undergoing third molar surgery prefer more information to be given to them before the procedure with no significant impact on their anxiety levels. This finding has been concluded by van Wijk et al., [11] in their study. In Australia, most of surgical removal of impacted teeth is carried out under general anesthesia with an average estimated cost of over than \$ 10 million per year [12].

Third molar surgery patients need high quality information that explained to them the uncertainty associated with the prophylactic removal of asymptomatic TME. Allowing patients, a considerable time to absorb and process the provided information might be beneficial for TMs patients to be actively involved in their TME decision-making. While the Australian Dental Association [13] left the decision for prophylactic TME to patients to decide with their clinicians, the lack of getting evidence-based information might have an impact upon the decision-making. Evidence about the lack of TMs patients in getting evidence-based information might be concluded from the high rates of hospitalization for TME observed in Australia [14]. Furthermore, statistics published in Google Trends reveals that Australia is one of the top third country in the world in searching for “wisdom teeth” on the internet [15]. This might suggest their demand for information. For the mentioned reasons, TMs patients might be a suitable population for our study in addition to other logistic reasons such as the high rate for referral to the Adelaide Dental Hospital for TMs consultations.

Types of internet-related health information

The internet related health information could be classified according to the nature of the content or according to the content modification.

Classification of internet related health information according to the nature of content

Horden et al. [16] have classified the nature of online related health information based on literature review into five main categories: peer to peer online support group, self-management/ self-monitoring, decision aids, personal health records and internet surfing.

Their study has pointed out the advantage and disadvantage of each type. All types have improved patient knowledge but many concerns have arisen regarding security of personal details and reliability of information. Despite the value of this study in categorizing the types of available online health-related information, it has not provided a comparative impact of each category on the outcome of specific chronic disease. Moreover, it has grouped internet surfing into one category and has not described the pattern of patients in surfing for health-related information.

Classification of internet related health information according to content modification

This analysis is based on the ability of the reader to edit the content of the website. Such ability to edit content might be important as a method for interaction however, it might impact upon the quality and reliability of the provided information. Therefore, websites might be classified into:

Open access

The reviewing patients cannot modify information materials on these websites. Websites of hospitals, institutes, clinics and affiliated universities are an example.

Open content

It includes all web 2.0 application websites that allow growth of its content by collaboration of users such as Facebook, Twitter, YouTube, Second Life and blogs.

Health care professional and online health information recommendation trend

Chestnutt and Reynolds [17] have studied the impact of the internet on dentistry and more specifically on the delivery of care and the participants use of the internet. Their study surveyed General Dental Practitioners (GDPs) on the General Dental Council (GDC) register in Wales, UK. Almost half of the study participants have agreed on the usefulness of the internet as a source of oral health information. Participants have claimed that cosmetic procedures have been the most commonly discussed topic in online oral health related information. On the other hand, about 38% of their participants believed that online health information resulted in patients requesting complex treatment or inappropriate care. Despite this, participants believed in the usefulness of the internet, but three quarters of them have never referred their patients to internet-related health resources. Participants have claimed difficulty in finding reliable patient friendly online resources. However, this study has not provided a solution to improve patients' referral to online health information resources.

In Australia, Usher, [18] has studied the trend of Australian (non-dental) health care professionals in recommending online health information to their patients. His study included GPs, dieticians, physiotherapist's optometrists, social workers, chiropractors, pharmacists, and psychiatrists. The study has found that 57% of overall participants were recommending online health websites for their patients. GPs, physiotherapists, and dieticians had higher recommending rates for online health websites than other health professionals included in the study. GPs claimed that recommending online health websites will improve the overall patient satisfaction, decrease consultation time and meet patient's demand in regard to health information. On the other hand, participants who have not recommended

online health websites related it to lack of time, and knowledge of reliable health information source. However, this study has not included dentists among its participants.

From these studies, it might be argued that clinicians need more content analysis studies for consumer health information on the Internet to form the foundation for recommending patients to these resources as they do not have time to review these resources. This might provide a solution to the lack of clinicians recommending online resources.

Factors affecting the clinical decision-making process

Clinical decision-making is a collaborative process of making treatment choices over the required health care services. Mulley [10] has addressed the factors involved in the determination of a clinical decision. He has summarized them as the followings:

Current clinical practice

There are some demographic variations in clinical decision making regarding the same procedure. In other words, different clinicians have different opinions regarding the same matter. For example, introducing the NICE guidelines for third molar surgery in 2000 resulted in an initial reduction in the number of third molar surgeries performed in the NHS by 30% [19]. On the other hand, The Australian Dental Association argue against such guidelines [20]. Therefore, this may have resulted in the observed high rates of TME in Australia [14] compared with the UK.

Clinical uncertainty

In some surgical situations, there is some clinical uncertainty regarding the clinical decision. For example, there are some variations among clinicians regarding prophylactic surgical removal of asymptomatic impacted TMs While, Mettes *et al.* [21] have claimed that no RCT has compared the retention versus the removal of asymptomatic wisdom teeth in relation to the quality of life, [22] there are recommended guidelines for surgical removal of third molar depending on patient age, eruption status and the presence of symptoms. However, these guidelines have not been supported with enough evidence. Another example of the uncertainty was raised by Pogrel [23] who has reported uncertainty to the use of antibiotics after third molar surgery, but, he recommended if it is to be used, it should be started pre-operatively. Accordingly, the patient will have its prophylactic advantage.

Patient attitude

Patients have different preferences toward treatment decision-making according to their beliefs and values. Their beliefs and values vary according to age, gender, educational attainments, ethnicity, income /insurance status and their severity of illness. These preferences were addressed by Degner *et al.* [24] to be in a range from totally passive, partially passive, collaborative, partially active and totally active. In the following section, factors affecting patient attitudes to participation in the process of SDM are discussed in detail.

Factors affecting patient preferences to be involved in SDM process

Researchers were interested to study the impact of various social and demographic characteristics on shared decision-making process and more specifically on the patient preferences for involvement in making treatment decisions. This section explores studies that focused on the impact of various socio-demographic characteristics on patient preference of involvement in decision-making process.

Thomson et al [25] searched the literature to explore these factors and found that, in general, younger age groups are more likely to be involved in the decision-making process. Also, they found that women are more actively involved in SDM. Being educated is also associated with involvement in the SDM process. However, there has been no significant evidence among the literature to support the association between marital status and involvement in SDM process. The following section included some socio-demographic factors that impacted patients' preferences in SDM.

Age

Researchers found that age has an impact on several parts of the SDM as preference for involvement, knowledge seeking and actual participation in SDM process. Levinson et al [26] found a positive association between age and all components of SDM. However, they found this relation changed above the age of 45 to be more physician directed. They related this behavioral change to the change in patients' beliefs by this age. In addition, Ekdahl *et al.* [27] considered being elderly could act as a barrier to participate in SDM due to communication difficulties and inability to understand medical information. Also, they agreed with other studies that, elderly people prefer a more passive role in SDM with few of

them receiving a less active role in SDM than they prefer. Since TME might be carried out at a wide range of age, it might be important to collect age information as a part of patient demographic data.

Gender

Women are found to be more prepared for consultation by seeking online information, prefer to be in control of their health decisions and more actively involved in SDM [26]. Furthermore, Chung *et al.* [28] found that, women are less likely to leave the decision to the hands of their health care professionals. This impact of gender on preference in participation in decision-making for women might be attributed to the women's movement in society and their life experience.

Educational attainment

The impact of education attainment on SDM was a matter of controversies among studies. Levinson *et al.* [26] surveyed 1500 patients in different outpatient settings and found that educational level has no significant impact on the OPTION scale scores. However, information seeking and control preferences for the decision increased with the increase in educational level. In a large scale study for hospitalized patients, Chung [28] also found that less educated patients were more likely to leave the decision to their doctors. Rademakers *et al.* [29] related the importance of patient educational attainment in improving doctor-patient communication by increasing the ability of patients to ask questions and receive understandable information. However, no significant difference in relation to SDM

experience was found between less and high educated groups. This might be due to the lack of clinicians to allow a room for patients to participate in SDM. This is why including the clinicians' perspective in SDM is of an importance.

Income and insurance status

Consumerism in health care system resulted in patient are more aware of their rights in relation to health services. Chapple et al [30] highlighted the possibility of making a payment for dental care to have an impact on dental patient decisional role. The majority of Australian adult patients are treated in private practices and need to make payments for dental services either directly or indirectly via individually purchased private health insurance (PHI). Brennan and Spencer [31] found that insurance is associated with lower extraction rate which indicates that dentists are driven by uninsured patients' preferences for choosing extraction as a cheaper treatment option.

On the other hand, Teusner et al [32] have questioned the "enabling effect" of insurance on the use of dental services. They found that 75.2% of Australians sampled had PHI with dental services cover with no significant impact on dental visiting (either regular or recent). Moreover, they found that "risk aversion" is significantly associated with dental visiting and purchasing a PHI. However, they did not indicate the types of dental services received during these visits and cost associated with them to identify the impact of cost/insurance status on the received dental services.

Despite everyone in Australia having Medicare cover, Medicare only covers dental services for the chronic disease scheme, no longer available since December 2012, and instead they have health care cards which provide co-payments for the eligible adults [33]. PHI contribution to treatment costs varies depending on the policy chosen and also the insurer. There are three types of cover for PHI in relation to oral surgery: hospital policy only, general

treatment only and hospital and general treatment [34]. Table 1 is representing these types of insurance policies and cost coverage for wisdom teeth extraction. Furthermore, the amount claimed for the dental services range from 37-75 % with an average of 52.5% [35].

Table 1: Hospital accommodation & theater fees, anesthetist fees & other medical fees, and dental fees from a dentist or oral surgery specialist

	Hospital accommodation & theater fees	Anesthetist and other medical fees	Oral surgeon fees
Hospital policy only	Yes	Yes	No
General treatment policy only	No	No	Yes
Hospital & general treatment	Yes	Yes	Yes

Source ²

This research is focusing on patients making a treatment decision regarding undergoing TME that could be carried out under LA, LA + IV sedation or GA with variation in cost that could result in a patient refusing or deferring the treatment due to a cost factor. In addition, the availability of PHI might be argued to affect prophylactic TME decision-making [36] which might have resulted in the observed high rates of hospitalization for TME [14]. Accordingly, income and insurance status were included as co-variables in this study.

Race and ethnicity

Race is related to persons' physical characteristics such as skin, eye and hair color. On the other hand, ethnicity is more related to cultural background, language and beliefs. There was

² Source: AUSTRALIAN PRIVATE HEALTH INSURANCE OMBUDSMAN 2012. Dental and oral surgery. Australian Government.

a growing effort from researchers to study the impact of race and ethnicity on patient knowledge and preferences in the SDM process.

Ratanawongsa et al [37] studied the impact of race and ethnicity on patient knowledge and participation in the SDM process. Using a cross-sectional study design, they obtained participants data from The National Survey of Medical Decision-Making Study for patients above the age of 40, English speakers and those who had made a decision over hyperlipidemia or hypertension. They randomly screened eligible participants using telephone interviews for ethnicity, patient knowledge and SDM experience. Data were analyzed using multivariate logistic regressions after controlling other confounding factors as age, gender, income and insurance status. They found that minorities (Black and Hispanic) were less informed and less involved in the process of SDM in comparison with white participants. Ethnic minorities prefer the final decision to be in the hands of health care professional. However, their study finding was based on a small sample size of black and Hispanic minorities that may impact the generalizability of their study finding.

In addition, Manfredi *et al.* [38] have tried to find an explanation of why African-American cancer patients have poor treatment outcomes when controlling all other factors such as age, education, insurance, and stage of treatment. They conducted a literature review to find a starting point for their explanation. They found that African-American patients reported poor patient-doctor communication more frequently and also were less satisfied with the treatment provided. They used a case controlled study design that included 248 African-Americans and 244 white who were diagnosed with breast, prostate or colorectal cancer two years before the start of data collection. Data were collected using a survey which included many variables including background, patient-doctor communication and exchange of

information. Data were analyzed with chi-square for categorical variables, *t* test for continuous variables. Moreover, multivariate regression for continuous variables and logistic regression for dichotomized variables. Despite, insignificant differences in desire to be involved in the decision-making and trust in physicians' knowledge, it was found that African-American patients were less likely to be involved in the decision-making than Whites. Furthermore, African-American patients reported poorer communication and satisfaction with information than did White patients.

Accordingly, a section for birth place information needed to be included in the baseline survey as an indicator for the ethnic background.

Severity of illness

Patient health condition is negatively associated with patient preference to be involved in the decision-making process. Tak et al. [39] studied the impact of patient self-rated general health on the patients' decisional role preferences. They found that patients with poor or fair health had a slightly lower preference for involvement in SDM.

Health literacy

The individual's ability to seek and understand the sought information are vital in shaping their abilities to make health-related decisions about a needed health care service. Health literacy is found to be associated with a positive role of patients in the process of decision-making [40]. While Amalraj *et al.* [41] showed the importance of health literacy in patient-physician communication and consequently the shared decision-making in older adult oncology patient, Safeer, Keenan [42] pointed out that patients with low health literacy were found to delay treatment decisions. To overcome the communication gap between the health care professional and their low health literacy patients, Heinrich [43] recommended that the

patients' levels of health literacy should be evaluated on their registration and then the physician would be able to tailor the communication accordingly. This proposed recommendation might overcome situation where patients of low health literacy do not admit that they do not understand the provided information.

e-Health literacy

e-health literacy was introduced to health care to as a result of increased dependence on IT services in health care which not only involves health care professionals [44] but also patients [45]. The e-health literacy involves the person's ability to perform basic computer skills, access the Internet, ability to search for information and the ability to identify high quality information.

The ehealth literacy skills are important for patients to find high quality information [46] due to the wide variability in online health information in general [47] and observed also in some dentally-related website content analysis studies [48]. Patients' eHealth literacy skills might be measured through an observational assessment or self-reported skills attainment [49]. While the observational approach in measuring ehealth literacy is time consuming, it needs more staffing and it is difficult to conduct in busy clinics, the self-reported measures such as the eHealth Literacy Scale [50] might be an opportunity. Therefore, it might be necessary to identify whether ehealth literacy has an association with TMs internet retrieved knowledge and consequently an association with patients' participation in SDM.

Phases of clinical decision-making

The process of developing a shared clinical decision passes through several phases. Heggland and Hausken [51] studied the phases involved in the process of shared clinical decision-making for surgical treatments from clinicians' and patients' prospective. They

carried out eighteen semi-structured interviews with health care professionals from various surgical specialties and patients who underwent surgical procedures to get their views over their participation in the process of shared clinical decision-making. Using content analysis, they came out with four main phases of developing a shared clinical decision. These four phases are:

Providing adequate information

Both patients and health care professionals pointed out the importance of providing an adequate amount of information in order to allow patients to participate in the process of clinical decision-making. It was found that the scope of information provided to patients by the health care professional varies. Surgeons have claimed that they provide their patients with treatment options available and advantages and disadvantages of each option. On the other hand, nurses claimed that they provide patients with information over their hospital stay and advise them with the pre-operative preparations.

Patients' need for information was found to empower participation in decision-making in some patients [52]. In particular, TME patients expressed their need for detailed information [11] however, information associated with participation in TME is still lacking in the available literature.

Providing treatment alternatives

Participants agreed that the second phase in making the clinical decision is providing patients with treatment alternatives. From a patients' point of view, the treatment alternatives need to be supported by evidence, and some of the patients would like their health care professional to guide them to internet resources that give evidence-based information over

treatment options. However, there is some evidence suggesting that the provided treatments options on the internet were not evidence-based [53].

Information merging

At this stage, patients are fusing the information that has been given to them and starting to ask questions. However, patients and nurses claimed that physicians are not providing enough information to their patients due to lack of time [9,11] and this has resulted in patients asking nurses over their treatments and they are not able to provide them with detailed information.

Making a decision

Surgical patients prefer the final treatment decision to be in the hands of the treating physician. Physicians are encouraging patients to be actively involved in the decision-making process. However, it is not always possible to do so in surgical procedures whereas patients need to take more responsibility in making their own decisions due to the rise in the available treatment choices [54].

Despite Heggland and Hausken [51] efforts to model phases involved in the process of surgical decision making, it needs further testing before applying it to different medical or dental specialties. Moreover, their study had a limited sample size ($n=18$).

Measuring Shared Decision-Making

The doctor-patient relationship has changed over the past three decades from a paternalistic relationship, where the patient is passive in choosing the treatment, to an informed relationship where patient knowledge has increased, however, the patient participation in the clinical decision is limited and the physician acts as a guardian for the patients best

interest [55]. Shared decision-making (SDM) was officially introduced in the US [56] and has emerged as a reversal of the concept of informed decision [57]. SDM is the process where the clinician and the patient are communicating and exchanging information based on current evidence-based studies to reach the best treatment alternative that is desirable, ethical, legal and respects patient autonomy [55]. “No decision about me without me” concept has been widely adopted by the health care providers [58]. Recently, there is a strong movement toward developing the culture of SDM on a micro level (patients, clinicians, and commissioners) and on a macro level in the health care system [59,60].

Actively involving patients in SDM is associated with positive outcomes such as: improving treatment choices, self-efficacy, satisfaction with the provided care and other parameters such as hospital stay and treatment costs [57]. There is an increasing demand to develop dyadic instruments that measure patient and clinician participation in SDM simultaneously as this area of research is still young [61,62]. Furthermore, by searching PubMed and Embase databases, there is a limitation in SDM studies in the field of dentistry. SDM tools could be categorized in three main categories: scales that capture decision anticipation (such as role of patient and control preference), scales that assess the decision-making process and scales that measure the decisional outcomes (such as conflict, satisfaction and knowledge). Another way in classifying SDM measurement instruments could be from its measuring perspective into: patient perspective, health care perspective, a rater perspective and a dyad whether self-reported or observational. While there were two systematic reviews of instruments used in SDM [61,63], the researcher preferred to undertake his own review of SDM instruments as this is a relatively new field in dentistry and the latest review is 5 years old while, new SDM measures are still emerging. This decision was to identify differences on item levels and whether they are relevant for use in our study. In this review, the

researcher examined SDM conceptual frameworks, their development methods, statistical approaches used, items response recording, perspective and limitation of some key SDM instruments. This review was carried out to determine if there is a need to develop a new instrument to measure SDM for dental practice or use a generic instrument with or without adaptation to the dental field. Details of this comparative review in a tabular format can be found in Appendix XI: Systematic evaluation of decision-making instruments.

The OPTION scale

Elwyn *et al.* [64] developed a conceptual framework for assessing patient participation in SDM based on literature review of qualitative and quantitative studies of improving patient involvement in SDM. In addition, they used qualitative assessment of clinical consultation recordings in general practice. Their framework includes: identification of problem, professional equipoise, formulating options and finalizing the decision. Based on that, they have developed the OPTION (observing patient involvement) to assess patient participation in SDM by a rater. However, this framework ignored an important part in the process of SDM which is deliberating the treatment choices as indicated by Hausken [51]. In the deliberation stage, the patient starts to ask questions to the clinicians about these options.

The OPTION initially has consisted of 18 items the measure patient involvement in SDM for audio /video recorded clinical consultations. The rater scores the observation on a 5-point Likert scale ranging from strongly agree to strongly disagree. Further development excluded six items. The final instrument piloted again and correlated with other instruments: the determination of “common ground” developed by Stewart *et al* and Braddock’s measure of “informed decision-making” and established convergent validity [65]. However, in their study, they correlated their instrument to patient age and ignored patient education.

Furthermore, researchers addressed some methodological issues related to the OPTION scale.

Nicolai et al [66] indicated that studies dealt with the OPTION as a one-dimensional instrument whereas empirical studies found that is not true. While internal reliability assessment using Cronbach alpha ranging from 0.68-0.9, decision on individual basis requires Cronbach alpha greater than 0.9. Accordingly, the OPTION is not suitable for individual assessment. In addition, there was a lack of correlation between the OPTION and other measures of SDM such as the 9-item Shared Decision Making Questionnaire (SDM-9Q), the Control Preference Scale (CPS), and the Decisional Conflict Scale (DCS). Moreover, the OPTION is not assessing patient participation in SDM as it was designed to measure how clinicians involve patients in SDM.

The CollaboRATE

The CollaboRATE is a patient reported measure of SDM developed by Elwyn *et al.* [67]. They have claimed that CollaboRATE is a quick and cost-effective measurement of SDM. It has been developed based on two main concepts. Firstly, health care professionals provide information to patients and the patient understands that information. Secondly, the chosen decision considers patient's beliefs and values. However, they have ignored other concepts that form a milestone in clinical decision as deliberation of the treatment choices and decision control preference that have been addressed by Heggland and Hausken [51].

The development of the CollaboRATE has passed through four stages: item generation, two stages of cognitive interviews, and a pilot testing of the final instrument. During the two stages of cognitive interviews, they made refinements to the CollaboRATE to avoid some terminologies such as health care professionals, despite the majority of their study

participants being educated to the level of a degree. Furthermore, after the stage of the cognitive interview, patient preference elicitation emerged as an additional domain. The final CollaboRATE consists of 3 questions and the patients report their answers on a 10-point Likert scale ranging from 1: No effort to 10: every effort. Despite Collaborate appearing to be quick and user friendly, it requires further testing in regard to content and convergent validity. In addition, the CollaboRATE is not a dyadic measure of SDM.

The decisional conflict scales (DCSs)

Decisional conflict reflects the individual uncertainty about a course of actions to take especially when they involve a certain amount of risk or loss. O'Connor [68] mentioned four different decisional conflict scales (3 for research and one for clinical practice). In addition, the researcher added other scales that adopt the same conceptual framework [69] and were developed recently [62].

Decisional conflict scale (DCS) statement format

O'Connor [70] developed the first patient self-reported decisional conflict scale based on the conceptual framework of conflict. The DCS items lay in three subscales: decisional uncertainty, factors contributing to uncertainty and perceived effective decision. The DCS consists of 16 items and the patient responses are recorded on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). It has acceptable reliability and validity scores. However, the DCS is considered long especially if it is combined with other scales in surveys. Furthermore, it lacks measurement of the decision control preference component of the decision.

Decisional Conflict Scale (question format)

It was mentioned in O'Connor [68], however no information was given about the background of its development. It has 16 items that are formulated in the form of questions and the answers that are recorded on 5-categories ranging from yes, probably yes, unsure, probably no and no. O'Connor claimed that the question format of DCS was an easier response format. However, this format is believed to be just a change in the method of delivery but has no actual wording change.

Decisional Conflict Scale (low literacy)

It is the second most tested version of Decisional Conflict Scale after the traditional DCS. It consists of a 10-item questionnaire and responses are recorded as: yes, no and unsure. However, after careful reading of the scale and comparing it to the DCS-question format, there was no difference in terms of wording and sentence structure. It is only a shorter version of DCS question format with fewer responses that may reduce the sensitivity of the scale.

The SURE scale

The SURE scale was developed by Legare *et al.* [71].and recently validated by Ferron Parayre *et al.* [72] as a quick patient self-reported measure of decisional conflict. It was developed to enable health care professionals to quickly screen their patients in every day clinical practice to identify patients with high levels of decisional uncertainty. The SURE items have been generated from the Ottawa Decision Support Framework main ideas [73] which constitute all phases of decision-making process. These dimensions are: uncertainty, being informed, values clarity and support. However, they have excluded the perceived effectiveness of the decision – as in their views, it is not applicable to all phases of decision-

making. The SURE instrument has four items: Sure of myself; Understand information; Risk-benefit ratio and Encouragement. Answers to the SURE scale are reported as yes or no. Despite the simplicity of the SURE, it does not provide grades for the patient response so making the instrument less sensitive.

The Provider Decision Process Assessment Instrument (PDPAI)

Dolan [69] developed the first health care provider version of the decisional conflict scale and named it as: The Provider Decision Process Assessment Instrument (PDPAI). He developed his instrument based on the theoretical framework of decisional conflict of O'Connor [70]. He adapted the decisional conflict scale items to reflect the health care professional perspectives. The instrument consists of 12-items where health care provider responses are recorded on a 5-point Likert scale ranging from strongly agree to strongly disagree. Furthermore, he correlated PDPAI with two satisfaction items related to the quality of the decision and it was found to be correlated. However, using the satisfaction with the decision as an outcome of decision quality is questionable, as there is a difference between actual decision and optimal decision.

Dyadic Decisional Conflict Scale (Dyad-DCS)

There was a growing demand to assess decision conflict simultaneously and have the opportunity to assess the agreement or difference between the health care professionals and the patient. Legare et al [62] developed a dyadic measure of decisional conflict by combining the patient version of DCS with the health care provided version of DCS (Provider Decision Process Assessment Instrument (PDPAI) They used data from a RCT of 40 health care professional and 153 female patients who needed to make a decision about hormonal

therapy. Despite the good scores for the internal consistency for both scales, they have low inter-class correlation (ICC). This could be due to item dissimilarity between both scales. Legare et al [62] recommended that further development of several versions of dyad-DCS in order to assess different types of interpersonal perception. Furthermore, they have recommended the future instruments consider the following:

1. Develop analytical technique for the dyad.
2. As short as possible for ease of use in every day practice.
3. Change the name from Decisional Conflict scale to Decisional Comfort scale to avoid confusion of the word Conflict.
4. Nature of items in the dyadic measure.

The 9-item Shared Decision Making Questionnaire (SDM-Q-9)

The SDM-Q-9 was developed by Kriston *et al.* [74] to measure patient self-reported SDM. It was developed as a refinement of SDM-Q instrument by having one item representing the Rasch model. They have changed the psychometric instrument testing from Item Response Theory to Classical Test Theory. This was due to the additive nature of SDM items. They changed the response rate to be on a 6-point Likert scale ranging from completely agrees, strongly agree, agree disagree, strongly disagree and completely disagree to avoid a ceiling effect. Finally, they added demographics and clinical setting information to enable testing of item functioning among different subgroups. Initially, 26 items were generated, by three of the authors from the conceptual framework of SDM and then rated by two independent raters and only 9 items were selected according to its scores when assessed by external reviewers. However, this instrument does not assess the decisional uncertainty.

In addition, Scholl *et al.* [75] attempted to assess the SDM-Q-9 convergent validity in relation to the OPTION scale using three different statistical approaches: correlation and inter-class correlation), spearman's correlation co-efficient and sub-group differential item functioning. However, they have found no significant correlation between both scales. Scholl et al. discussed some methodological concerns related to their study as patient perception in participation in SDM, a ceiling effect of the SDM-9 scale compared to a floor effect of the OPTION. In addition to what was mentioned by Scholl et al that there is a difference between the OPTION and the SDM-Q-9 in the assessor perspective as the OPTION measures how clinicians involve patients in SDM assessed by a rater. On the other hand, the SDM-Q-9 is self-reported patient participation in SDM.

The Shared Decision Making Questionnaire – physician version (SDM-Q-Doc)

The physician version of SDM questionnaire was developed by Scholl *et al.* [76]. They adapted the nine items SDM-Q (patient version) by making it more relevant to physicians and tried to keep the wording as similar as possible. They used a sample of 35 physicians having consultations with patients suffering from long term chronic conditions (type II diabetes, back pain and depression). Data were analyzed using inter-item correlation, internal consistency of the scale, inter class item correlation and item completion as a reflection of acceptance of the scale. Inter-class correlation shows high physician related variability which the authors related to physicians not rating SDM based on specific patient consultations but more likely on their overall SDM practice. In addition, authors recommended the physicians to fill in the questionnaire forms immediately after consultation

to avoid this variability. Despite that they simultaneously measured SDM for patients using SDM-Q-0 and for physicians using SDM-Q-Doc, the number of physicians who participated in their study was low ($n= 33$), which may impact the generalizability of the study results.

The Physicians Reaction to uncertainty scale (PRU)

Gerrity *et al.* [77] developed their instrument after refinement of a model that was developed in an earlier stage [78], which consists mainly of two domains: uncertainty and reluctance to disclose uncertainty to others. Their conceptual model relies on four domains: anxiety, bad outcomes, disclosure of uncertainty and disclosure of mistakes. Their new instrument consists of 27 items (22 from the original scales and 5 new items for the disclosure domain). Despite this instrument measuring physician uncertainty, it could not be used to measure SDM from the physicians' perspective as it lacks assessment of the information that was provided to patients and assessment of the control phase of the decision.

Measuring of surgical patient participation in SDM process from health care professionals' perspectives

Hegglund *et al.* [79] developed a tool to measure patient participation in the process of shared clinical decision-making in surgical treatment from a health care professionals' point of view. Their tool was developed based on data that were collected from an earlier study carried out by Hegglund and Hausken [51] over the phases of patient participation in the decision-making process. They used these phases to generate a questionnaire. The initial tool consists of 48 items. These items were reduced to 21 items answered on 7-point Likert scales by a panel of experts. However, items were not equally distributed across domains. The reliability was tested using Cronbach alpha and validity was tested using confirmatory factor analysis (CFA). The final instrument consists of 16 items. However, their instrument

measures participation in the clinical decision-making process from the health care professionals' perspective. Furthermore, the collected data assessed the overall physician perception of patient participation in surgical decision-making and were not based on specific clinical consultations. Accordingly, this instrument needs further adaptation to be used to measure patients' participation in clinical decision-making.

This research aimed to measure the shared decision-making process as a primary outcome of the randomized controlled clinical trial of providing TMs patients with internet guidance based on content analysis. The hypothesis was that the provided guidance might enhance the process of shared decision-making. Accordingly, this research needed to use an instrument that measured the SDM process itself and to be in the form of a dyad that measures the SDM process from the patient and clinician perspective. Literature review revealed two dyadic instruments that measure the decision-making process: the dyadic OPTION scale and the dyadic SDM-Q-9/Doc.

Previous studies raised some concerns regarding the OPTION scale [66,75,80] such as the doubt regarding its uni-dimensionality, floor effect of its scores with restricted range, lack of convergent validity with other scales and inter-rater variability. In addition, using the OPTION is not feasible from the researcher view as it requires recording of the consultation (which may cause burden for the clinicians or patient). Another feasibility issue with the OPTION is that, it requires a rater where another person other than the researcher is needed to avoid cognitive dissonance [75] and an independent rater could not be appointed due to limitation of resources.

Despite lack of validation of the SDM-Q-9/Doc, the researcher decided to use it as a measurement of the decision-making process for the following reasons:

1. To the knowledge of the researcher, no instrument with a focus on the SDM process itself was validated in the dental field. Researchers recommended that validation of SDM instrument is necessary if it is used in a setting different than its development/ validation setting.
2. SDM-Q-9/Doc has 9-items that measure the phases of SDM process.
3. SDM-Q-9/Doc is a dyadic instrument that measures the SDM process simultaneously for the patient and the clinician.
4. SDM-Q-9/Doc is self-reported instrument.
5. SDM-Q-9/Doc is covering most of the phases of SDM process.

Factors affecting the quality of online dental resources

The quality of consumer dental information on the internet varies and depends on several factors. Roberts [81] discussed some of these factors. He grouped them as 5Cs to systematically review the content of a website. As anyone could create a website, so credibility is an important factor. In other words, do the website authors have the knowledge and experience to give information? Another factor is the currency of the materials and it could be determined by the date of page last update and the reference list. Content is another factor as websites can be developed for several reasons. Construction affects the ability of the readers to take up the information. It could be affected by the site look, headings, color and font. Clarity is a factor in evaluating the quality of online materials. It includes the availability of the educational materials in different languages, different forms to suit demographic variation of age, level of education and disability.

Moreover, Shedlosky-Shoemaker and et al. [82] addressed the importance of website authors to be accessible to get feedback from online users. They also pointed that it is essential to formulate a tool to assess factors affecting the quality of online health websites. It is also essential for online health websites to show the funding source and its advertising policy. Another factor is the justifiability, in other words, the ability of the website to support claims related to benefits and performances. In this section, some of the factors affecting the quality of internet information was discussed in detail.

Readability

Health literacy is the way that patients seek, understand and use health information [83]. The readability of educational material plays an important role in the process of patient education. Alexander [84] pointed out in his study of the readability of dental educational materials that 20% of Americans have reading difficulties, especially if English is not their first language. His study included 23 brochures that were normally found in the waiting area of dental schools and the majority of them were publications of the American Dental Association. The readability was tested against Flesch-Kincaid reading difficulty level using a computer program called Grammarian. This study considered that any medical terminology mentioned in the document without explanation is difficult to read, as there was no available study that discussed what terminology patients understand. The study concluded that the majority of the written educational materials were above the level of the target audience. Moreover, the study recommended that the educational materials should be structured to the level of the patients' understanding, not the dentist. Although this piece of research assessed the reading difficulty of the available educational materials, it only focused on printed materials and did not include available online educational materials. Furthermore, the study examined a limited number of printed materials.

D'Alessandro et al. [85] focused their study on the readability of pediatric educational material on the World Wide Web. They mentioned in their study that the average reading level in the United States is between eight and nine. The local newspaper readability level is ranging from nine to twelve. The study included one hundred websites using Microsoft 08 (Microsoft Corp.) computer program assigned with Flesch reading ease score, Flesch-Kincaid reading level and also by hand calculation using Fry Formula and SMOG method. The study concluded that the educational materials were written in a higher level than the average reading level. Moreover, the study recommended the health care professional to ensure that the selected educational materials are readable to the average patient.

Woodmansey [86] has evaluated the readability of endodontic educational materials. He evaluated 22 websites and 15 brochures using Microsoft Word. Microsoft Word can assess the readability using two different scales, one of them is the Flesch Ease of Read scoring and the other is Flesch-Kincaid readability score. The sample was selected according to availability, reputation of the source and relevance to the patient. This study revealed the limitation of using words to assess the readability of educational materials and recommended the use of focus groups to learn which terms are not understood. This study concluded that the readability of endodontic materials is above the average patient. Despite the importance of this research in evaluating the readability of endodontic patient educational materials, this study has some limitations such as small sample size, analytic tool (MS Word) and it did not assess the role of illustrations.

Richman et al. [87] went beyond the use of terminology in their assessment of readability of an educational material as they have studied the impact of word recognition, vocabulary knowledge and comprehension on the readability of 35 pediatric oral health terms. The study

was carried out on 45 English-speaking parents. The study concluded that the use of word recognition is inadequate to assess the readability, as parents with adequate reading abilities may have difficulty in understanding pediatric terminologies. The study recommended the use of simple language, use of visual aids and verbal communication are important to improve the understanding of pediatric oral health terms.

Sanghvi et al. [88] studied the readability of internet-based patient educational materials on facial fractures. The assessment was carried out using Flesch-Kincaid Grade Level (FKGL), Flesch Reading Ease Score (FRES), Simple Measure of Gobbledygook (SMOG), and Gunning Frequency of Gobbledygook (Gunning FOG). The researchers typed “facial fracture” in Google search engine and selected websites that were related to professional societies, US hospitals, clinical practices and affiliated universities. Data were collected using Microsoft Word 2010 (Microsoft Corp.) and the data were analyzed using Microsoft Excel 2010 (Microsoft Corp.). The study showed that the readability level of internet educational materials was above the level of an average patient. Although this study assessed the readability of internet patient educational materials, the study did not assess word comprehension and illustrations in the educational materials. Moreover, another limitation mentioned by the author related to the use of readability equations.

Eloy et al. [89] have assessed the readability of otolaryngology websites using eight numerical and two graphical tools. Links to 262 educational materials under the patient section from those websites were evaluated. The authors used Microsoft Word to transform materials into a plain text then they have used Readability Studio Professional version 2012 (Oleander Software, Ltd, Vandalia, Ohio) [90] to assess the readability of the educational materials. The study showed that the readability level is greater than recommended by the

National Institute of Health. The study lacks the assessment of the readability through word comprehension, and use of graphs. However, the study recommended the exploration of the perceived difficulty of reading patient educational materials through a direct patient feedback. Furthermore, the study recommended the use of shorter sentences (8-10 words), using simple language and inclusion of multimedia to improve the readability of patient educational materials.

Recently, Misra et al. [91] used the Readability Studio Professional Edition software, version 2012, (Oleander Software, Ltd, Vandalia) to assess the readability of seventeen online patient educational articles for the American Academy of Facial Plastic and Reconstructive Surgery. This software can assess readability using ten different scales. All ten different scales showed that the educational materials were above the average reading level. However, they claimed that the plastic surgery patient readability level is higher than average based demographic data analysis of patients attending private plastic surgery practices. This study lacks the use of word comprehension in evaluating the readability of patient educational materials. Moreover, this study has a limited sample size for online patient educational materials.

Tools for measuring the readability

Flesch Reading Ease

It indicates how the text is easy to read based on a word length and sentence length. It forms a score ranging from 0-100 where scores ranging from 0-30 reflects readability to university graduates, scores 70-80 reflects readability for 13-15 years students while scores 90-100 reflects readability suitable for 11 years student [92].

Flesch–Kincaid Grade Level

This score translates the Flesch Reading Ease scores into a reading level in accordance with the US educational grades. Flesch-kincaid scores and inversely related to the Flesch reading ease. For example, FRE scores of 0-30 is readable to university graduates, FRE scores 60-70 is readable for grade 6-7 student (age 13-15) while FRE scores is readable for grade 7 It is helpful for designing educational materials for students. In addition, governmental health organizations requires the readability of consumer health information to be at level 8 grade [93].

Gunning FOG Index

It measures the readability of a text in relation to the US educational grade. It was developed by Gunning [94] and based on the average sentence length and the word complexity (of three syllables or more). As it was designed to measure text clarity, it used clause as a sentence. It is argued that syllables are pure measure of reading difficulty as some words could be polysyllabic and not difficult as they are frequently used and vice versa.

Automated Readability Index (ARI)

It was developed by Smith, Senter [95] to assess the readability in reference to the US educational grades. It is based on counting characters per word not syllables per word as in the formulas previously discussed: SOMG, Gunning FOG formula, and Flesch-kincaid grade level. They claimed to be easier to calculate when using character per word that syllables per word, however characters per word is doubted to accurately measure the complexity of a text.

Simple Measure of Gobbledygook (SMOG) reading formula

It was developed by McLaughlin [96] as a further development for Gunning FOG formula. He claimed it is as a quick and simple measure of readability based on regression analysis of linguistic characteristics. It counts polysyllable words in a fixed sentence and converts it into grades. Fitzsimmons *et al.* [97] claimed it to be more reliable in assessing the reading difficulty in comparison with the Flesch-Kincaid Reading Grade as they found the later underestimate the reading difficulty of consumer health information. However, SMOG is not valid in assessing the reading difficulty of a document of less than 30 sentences.

Therefore, the researcher argued that readability is an important factor to consider in addition to the scientific information quality to make information usable by the average patient. However, a question remains: are the computer-generated readability grade estimates calculations reliable in assessing the comprehensiveness of the information? This might need to be explored by the researcher.

Access to open educational resources

Open Educational Resources (OER) are digitalized materials that offer an open and flexible learning opportunity. Openness means it is freely available with as few restrictions as possible. These restrictions could be technical, legal or financial. Researchers argue that open means at a minimum, no cost to the consumers (learners). Openness involves open access and open content. Open content allows additive growth where new components could be added to a larger system without an effort. Accessibility depends on the individual capabilities like when the learning materials are available in a language the learner cannot understand [98].

Harris and Chestnutt [99] have evaluated the use of the internet to access oral health information through a quota sample of 280 patients attending dental hygiene clinics. The study was conducted using 14 self-administered questionnaires. The study showed that 54.6% of the subjects accessed the internet for health-related information and in contrast, only 3% of the subjects used the internet for oral health information. Demographic variations played an important role in the prevalence of the use of the internet, especially age and education level. However, 43.5% showed an interest to use the internet in the future to access oral health information especially if they will be guided by their dentist. This study did not focus on how patients accessed online oral health information.

Wikis, blogs and podcasts are examples of freely accessible collaborative resources that could be used for patient education [100]. Boulos et al. [100] focused on defining different types of web 2.0 applications that are currently in use. Furthermore, their study mentioned examples of health-related websites that use this kind of web application. One of the advantages of these resources is its ability to grow due to the increasing rate of collaboration especially with the introduction of these services on mobile phones. Moreover, with the emergence of this new technology, pedagogy leaning (anytime, anywhere) could be easily achieved. Although their study focused on describing the new educational technology and its promising future, they did not indicate how to implement this technology in patient education.

Another example of open content resources is social media websites. It includes, but is not limited to, Facebook, blogs, Twitter and Youtube [101]. Limoli [101] pointed out the impact of these social media on improving communication between the dental team and patients. These social media websites have an increasing popularity even among older people. She

also indicated that the dental practice should implement guidelines for the use of social media. Although her study has described the types of social media available and its increasing popularity (700 million are registered with Facebook alone), the study did not indicate how the dental practice can use it in patient education.

McAndrew and Johnston [102] focused in their study on the use of social media as an e-learning source for students. The study addressed the use of wikis in pre-clinical education of anatomy and linking it to clinical diagnosis in a form of collaborative work. Moreover, this study has addressed that dental students who used course blogs performed better in their examinations than those who did not use it. The study came across another form of virtual 3D social media website called Second Life. This site used in an interactive mode to train the dental students how to deal with nervous patients. They also discovered that non-English native speakers are more comfortable in posting on these websites than speaking in classrooms. However, this study did not indicate the possibility of using social media in patient education.

Currency

Currency of open educational materials means it is up to date. Brown and Brown [103] in an early study of the factors affecting the quality of online oral health information materials, have determined currency as an important factor. The study created a platform for determining the currency of online information materials. This platform has to show when the materials were created, when the materials were placed on the web and when the materials last updated.

Mattheos et al. [104], in their study, despite being focused on the use of the internet in dental education, determined the currency of online educational materials as an important factor

affecting the quality of online educational materials. Their study recommended the use of peer-review to determine the quality of educational materials including currency. Therefore, the currency of information provided to patients is of an importance due to the rapid movements in evidence generation in the medical and dental field.

Accuracy

It was published by the Nature in December 2005 that Wikipedia is as accurate as the encyclopedia Britannica. In a study on the information provided to cancer patients on Wikipedia by Burki [105], it was found that it is as correct as the information provided on Cancer Institute's physician data query website. However, the study has found Wikipedia is difficult to read by the average patient. On the other hand, other means of patient information could deliver understandable information such as CancerHelp-UK that is run by nurses who are experienced in answering patients' queries. No methodology has been mentioned about accuracy evaluation.

Other factors that affect the quality of online health information such as funding source, author trustworthiness, and coverage of intended audience, construction, justifiability and advertising policy will be discussed in the literature review chapter.

Review of tools available for assessment of the quality of online health information

The quality of health information websites vary [106]. Many authors believe that there is a need for some criteria to evaluate the quality of health information websites. These quality assessment tools were developed to be used by health care professionals, publishers or

patients [107]. Different tools that were used to assess the quality of health information websites were reviewed and evaluated in this section.

Index of Scientific Quality (ISQ)

ISQ was the earliest quality index for health reports that was developed by Oxman et al. [108]. It was developed to evaluate the scientific quality of articles in press. In their view, health articles should allow the reader to draw a conclusion about the applicability of information to any potential personal decision taking, the strength on which the study was based and determination of the magnitude, risk and cost associated. The process of development went through item generation, reduction, pre-testing, reliability and sensibility assessment. Item generation created through review of literature and a survey of a random sample of members of the Department of Epidemiology and Biostatistics and members of the Faculty of Graduate Journalism, University of Western Ontario. Eighty-five articles were chosen for the pre-testing phase. The selection made against proposed criteria. A panel of six (three physicians and three non-physicians) was recruited to delete redundant items. The sensibility of the instrument was assessed by sending the form to 36 members of the Department of Epidemiology and Biomedical Statistics who were not included in the instrument development survey. The final index consisted of seven questions and one global question. However, some raters have considered a few questions as misunderstood and there was a need for subjective judgment.

Quality Scale (QS)

The QS was developed by Ademiluyi *et al.* [109] and is based on seven items that are: ownership, authorship, source, currency, interactivity, navigability and balance. Every item

is given a rating ranging from zero to two for unsatisfied, partially satisfied and fully satisfied respectively. The score ranges from 0 to 14. However, these domains are more related to reliability of information and lacks actual evaluation of the scientific information quality.

DISCERN

Charnock et al. [110] developed and evaluated the use of DISCERN as a tool for evaluating the reliability of consumer health information. They claimed that, it enables patients and information providers to judge the quality of the given information and improve its quality. DISCERN was developed in two stages. The first stage was the development process and its validation, the second stage was through national testing by health information providers and help groups. It consists of 15 questions assessing the face and the content validity plus an overall rating questionnaire. Each question is scored on a 5-point Likert scale ranging from 1 for definite 'No' to 5 for definite 'Yes'. DISCERN items are grouped into three main groups: questions 1-8 are related to reliability of information provided, question 9-15 are related to specific treatment choices that are provided and question 16 which acts as an overall quality assessment for the information provided. DISCERN originally was developed for assessing the reliability of written health information however, due to increased use of the internet as a source for health information, Charnock, Shepperd [111] successfully applied it to online health information. They used a series of workshops for which participants were recruited via an online advert. The majority of participants in that workshop found it useful in assessing the reliability of online health information. It is the most popular tool in assessing dental online related information [4,48,112].

DISCERN was found to be a reliable and valid instrument for reliability evaluation of health-related websites, however It has some limitations. DISCERN cannot be used to evaluate the

scientific quality of the provided health related information and also does not assess the authorship of the provided information. Moreover, this tool is static and cannot be used for open content educational resources. DISCERN could not be used to assess the readability and design aspects of educational materials. Due to the limitations of DISCERN, the researcher recommends using it in conjunction with other reliability tools for online health information assessment.

The Ensuring Quality Information for Patients (EQIP)

EQIP has been developed by Molt et al. [113]. This tool was formulated to overcome the limitations of DISCERN. EQIP was designed to assess the presentation of all types of written information materials. The draft tool was designed by two health information experts. Twenty items criteria were created to assess the presentation, understandability and usability of written information materials. The authors pointed out the limitation of their tool in assessing the accuracy of information, as it needs a specialized health care professional in the same field to judge the accuracy of information. Accordingly, the accuracy of information was checked before running the quality assessment of the presentation. The validity of EQIP was tested using correlation coefficient with DISCERN and it was found to be valid. However, the EQIP could not be used to assess readability, accuracy and comprehension of written materials.

The LIDA tool

It was developed to assess the accessibility, usability and reliability of health-related websites [114]. The instrument consists of 41 items questionnaire and is claimed to take no more than 30 minute to complete. Responses for the questionnaires are recorded on a 4-point Likert scale ranging from 0 to 3. As the instrument is relatively new, only a very few dental studies has used it [115,116]. The LIDA website provides an online comprehensive tool for assessing some of the accessibility features for websites; however, they declared its limitation. No information was mentioned in relation to which accessibility feature their online tool is able to evaluate. Despite LIDA has a broader scope of evaluating health-related websites, no information was mentioned about how items are weighted if they are not equally distributed across domains. In addition, LIDA was validated using score ranking in comparison with Resources Rating Scheme. It is recommended to establish convergent validity of LIDA with other well validated widely used instruments as DISCERN as they are measuring the same construct.

Health on the Net (HoN)

The Health on the Net Foundation begun in 1995 after a telemedicine conference that was held in Geneva, Switzerland entitled “The Use of the Internet and World-Wide Web for Telematics in Healthcare” [117]. Experts from around the world that participated in this conference voted for formation of a body that promotes effective and reliable use for the new technology in health care. HoN foundation provides several tools in relation to internet health information: a medical search engine called MedHunt, HoN seal and HoNCode of Conduct. HoN seal is now used by more than three thousand health related websites. The HoN code consists of eight principles that are related to the reliability of internet-related health

information. These principles are: authorship, complementary information, maintaining privacy, appropriate referencing of information sources, claim policy, transparent, disclose funding source, clarity, clear advertising policy. Despite many of internet-related health information studies used it as a reliability assessment tool, it is not an instrument for reliability assessment by itself. It is a code of conduct for the health-related websites publishers to follow so the provided information is reliable and get the HoN seal. To check for the currency for HoN certification, the HoN foundation provides health consumers with HoN toolbar that could be freely installed to the internet browser to check for the visited website current certification status by connecting to the HoN server. The HoN toolbar provides also a search tool for HoN database. Figure 2 shows how HoN toolbar check for the currently reviewed website certification status. In addition, HoN do not assess the scientific quality of internet-related health information. However, the HoN foundation supports another facility to overcome this issue called “WRAPIN”. This facility has the ability to check websites information through searching medical databases for published articles in different formats and also clinical trial information. However, using this facility by patients is questionable as the information they get is scientific in nature and difficult for them to understand.



Figure 2: How HoN toolbar shows the current accreditation of a health-related website.

Average Global Score (AGS)

This tool was developed by Curro et al. [107] to be used by non-professionals to assess the quality of online health information. The content was evaluated through three main criteria after setting a gold standard which was the American Academy of Pediatrics' patient

information about pharyngitis. Medical content was evaluated by adherence to the gold standard. Average scores of epidemiology, clinical manifestations, diagnosis, therapy and complications were calculated. Moreover, completeness, update and references were also included. Every component was given a score ranging from 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or 1 according to the adherence to the gold standard. Accountability of authors includes author name, certification, and commercial or not-for-profit sponsors were considered. Moreover, they considered usability, aesthetics, e-mail, ease of use, and availability of links. The sample websites were selected through a meta-search engine called MetaCrawler. It combines multiple search engines to eliminate duplicates and ranking differences.

There are other generic instruments used to evaluate the reliability of online health information such as OMNI, Evaluation Guidelines, NetScoring, etc. However, these tools share a main limitation which is the lack in the ability of these instruments to assess the scientific information quality. In order for the researcher to be able to assess the quality of online consumer health information concerning TMs, the researcher needed to develop a tool in an attempt to initially validate it to assess the scientific information quality of these websites.

Comprehensive review of the quality of dental internet information studies

A comprehensive review of website content analysis studies related to dentistry was carried out as a part of the literature review. This was to enable the researcher to be more familiar with these studies in a systematic approach. This might allow the researcher to improve strategies to be used in the study he was going to conduct. This review was presented in Appendix XII: Comprehensive review of website content analysis studies. “Quality of dental

internet information” was used as a search keyword. The search was carried out on 10th June 2013 using PubMed and Embase as they have 22.7 and 25 million records respectively [118,119]. All search results were considered (89 from PubMed and 459 from Embase). Duplicated and non-relevant results were excluded by screening the title and abstract. Only eight studies were selected. These studies were analyzed according to the study purpose, method used for search, content analysis and the study results.

Study areas

There were two studies for oral cancer/head and neck cancer, one for mouth guards, two for surgical aspects related to orthodontics (orthodontic extractions and orthognathic surgery), one for TMD and one for cleft lip and palate.

Search methods

Keyword determination

For example, in the study for mouth guards’ information over the internet, Magunacelaya, Glendor [120] used three search keywords: mouth guards, mouth protection and gum shields. However, Park et al [48], in their study for TMD internet-related information, used temporomandibular disorders and temporomandibular joint disorders. These terminologies might not be known to the average patient. They should have considered using keywords such as jaw joint problems. Since it is known that keywords have associations with the search output [121], the researcher believes that several combinations of keywords should be used.

Selection of search engines

Most of the reviewed studies used a combination of Google and Yahoo! [48,115,120,122,123]. This was related to the popularity on both search engines and frequency of link updating. In addition, Google has PageRank option in its toolbar. Search

engine selection is known to be associated with the search output [124], the researcher recommends the use of search engines known to be popular for their use among patients.

Selection of the results

The selection of the search results varied between studies and mainly depended on the number of queries and the number of search engines used. However, most of the studies selected 100 results in total to be taken to the filtering step. Although scholars such as [125] claim that patients do not normally go beyond the first 25 results, no evidence was provided to support that claim.

Filtering

Most of the studies excluded non-English, non-functional, duplicated links and non-relevant websites. However, no comprehensive exclusion criteria were created in relation to the suitability of the identified information for use as an adequate resource for patient education. This might be needed to be considered by the researcher in the planning for TMs online information content analysis study.

Content evaluation

Reliability scores

DISCERN was the commonly used as a generic tool for reliability assessment of online health information [4,48,112]. DISCERN was used alone or in combination with other tools such as HON tools (HONCode, HON toolbar and HON seal) and Journal of American Medical Association JAMA benchmark [48]. These tools are limited in assessing the scientific information quality and the researcher recommends the need to combine them with an instrument that measures the scientific information quality.

Readability grades

The majority of the studies used Flesch Reading Ease scores for assessing information readability assessment [115,123]. However, there is a limitation in assessing information comprehensiveness by this evaluator. This might need to be considered by the researcher.

Scientific information quality

There was no generic tool used to measure the scientific quality of information. Each study developed its own instrument to assess the scientific quality related to the field of study. The assessment of scientific information quality share some information domains such as etiology of the disease, symptoms, treatment options and complications. Park et al [48] went deeply in all aspects of TMD as it could be found in textbooks. Accordingly, their scientific content results came as poor. Some aspects need to be considered during the development of the scientific information quality assessment tools such as what information that patients need to know to make the appropriate management or treatment choice.

Data analysis

Mean scores of websites were calculated and websites were ranked according to their total scores. Some studies used correlations to validate the reliability scores with scientific information quality scores to establish convergent validity. In addition, One-Way ANOVA was used to identify the difference in mean scores across website affiliation groups.

Conclusions and recommendations

Only four of the reviewed eight studies have recommended websites as they have the highest scores. Moreover, few studies recommended dentists to guide their patients in surfing the internet due to variation in quality of internet information. However, they did not mention how they will be able to guide them.

Healthcare outcomes

The main role of healthcare services is to help people to maintain functional health status and be engaged in different aspects of life while feeling and functioning well [126]. In this section, the researcher discusses some determinants of healthcare outcomes the researcher interested in: QoL, satisfaction and attainment of treatment goal.

Quality of Life (QoL)

“Quality of life is an individualized, dynamic, collective interaction between biomedical, psychological and socio-environmental factors that affect the individual’s perception of wellbeing” K Hanna

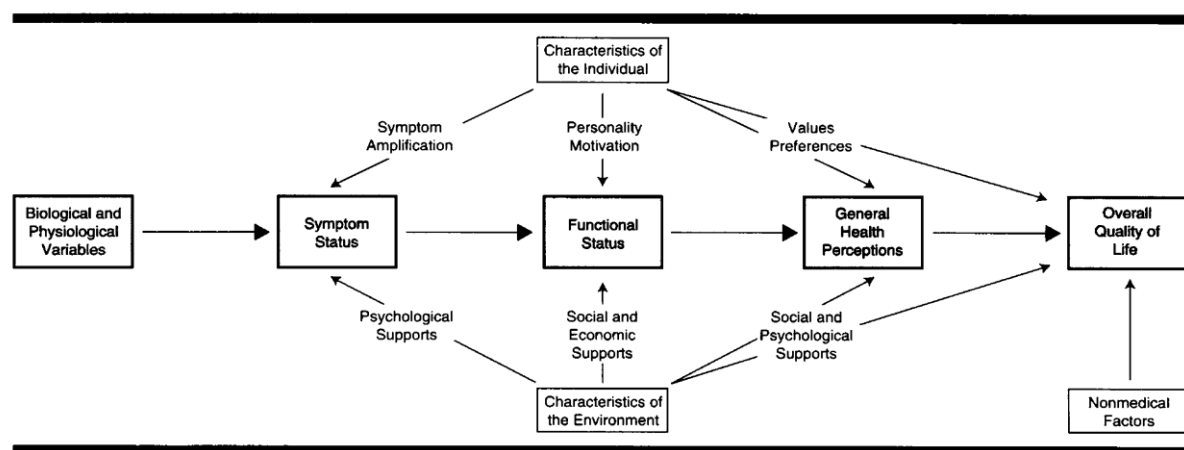
The reviewer of the Quality of life literature will realize that there is no exact definition for the concept of QoL [127,128]. This is because the QoL concept is amorphous and there is no agreement between scholars about a definition for QoL. The QoL is a perception of an individual about his/her well-being. This perception involves interaction of biomedical (physical status or the pathology model), psychological, socio-environmental factors. In addition to the interaction between these factors, QoL is a sum of these interactions. Moreover, QoL is dynamic in nature as it differs from time to time depending on the magnitude of these factors and their interactions.

The concept of quality of life came into use by the WHO constitution preamble while defining health as a state of functional, psychological and social wellbeing. Oral and general health-related quality of life are considered subdomains of the quality of life.

Conceptual aspects for HRQoL

Since HRQoL is an amorphous concept, researchers worked on proposing several conceptual frameworks for better understanding HRQoL and therefore be able to measure it. In a recent

systematic review for HRQoL models by Bakas *et al.* [129], they have identified the most commonly used HRQoL models. The most widely used HRQoL model was the Wilson and Cleary HRQoL model [130]. The Wilson and Cleary model [130] (Figure 3) is based on the biomedical concept for HRQoL where a disease or disorder leads to physiologic changes causing symptoms that affects the functional health which in turn lowers individual perception of health, thus impacting their quality of life.



Relationships among measures of patient outcome in a health-related quality of life conceptual model.

Figure 3: Relationship among measures of patient outcome and health-related quality of life conceptual mode.³

The second most commonly used HRQoL model was the revised version of the original Wilson and Cleary model that was authored by Ferrans *et al.* [131]. Their revision included the addition of individual and environmental characteristics as they were believed to have an association with the functional health. The third mostly used HRQoL model was the WHO International Classification of Functional Disability and Health [132]. The WHO-ICF HRQoL model is based on biomedical and socio-environmental factors that affect

³ WILSON, I. & CLEARY, P. 1995. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *Jama*, 273, 59-65.

individuals' perception of their well-being. [133] However, the WHO-ICF model is more suitable for epidemiological studies rather than intervention studies where the Wilson and Cleary model or its revised version is more suitable. Since the present study was looking for the possibility of improving the health care outcomes (including QoL) via improving patient participation in SDM, the researcher argued that the Wilson and Cleary HRQoL is the most suitable to avoid the impact of environmental factors.

Although other HRQoL models are available, many of them did not report the QoL definition on which their model is based [133]. In addition, HRQoL measures developed might not include all factors illustrated in the HRQoL model. Despite these definitions and models, HRQoL is conceptualized based on either: how individual is able to enjoy every aspect of their life or how a condition prevents the individual from enjoying aspects of life [134]. However, understanding aspects of life that matter to patients needs more qualitative work using a non-conventional approach to minimize the possibility of recall bias [135].

Based on the previously mentioned HRQoL models, several HRQoL measuring tools were developed. Measuring QoL is important. Since oral health is found to be part of general health; accordingly, researchers are interested to assess the impact of oral health conditions on general health. There has been a little association between oral health and general health in young adults [136]. Although undergoing third molar surgery could have an impact on both general and oral health, the magnitude of these impacts might be challenging and needs careful instrument selection. The HRQoL is measured via generic or disease specific instruments. While the disease specific instruments are able to capture more details, generic HRQoL tools allow comparing the scores to population norms. In addition, generic HRQoL are widely used and been validated (structural and discriminative).

In the following section, the researcher discussed approaches to measure HRQoL with reviewing the available measuring instruments in relation to their domains, items and their suitability for use in the present study.

Measuring health-related quality of life (HRQoL)

QoL in relation to health is known as Health-Related Quality of Life (HRQoL). There are many generic tools that were developed to measure HRQoL. Generic HRQoL instruments were more commonly used and preferred over either disease specific or individualized measures as the latter are incomparable with the population data. However, there has been a growing criticism over the use of generic HRQoL as they are not patient-centered with difficulty to measure different values for different people [137].

Generic quality of life instruments were identified using PubMed search engine and reference lists of studies that reviewed these generic instruments such as [138-141]. The researcher discussed some of the commonly used HRQoL instruments.

WHO Quality of Life (WHOQoL-100)

The WHOQoL-100 was developed by World Health Organization [142] and validated for its comparability across 18 worldwide centers by Power *et al.* [143] using structural equation modeling. A battery of 300 questions were generated based on the following definition of the QoL: “*individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.*” The final instrument consist of 100 items lays in four main domains which are: physical, psychological, social relationship and environment. The WHO QoL reports the

individual perception of quality of life over the past two weeks. The response to items is reported on a 5-point Likert like scale. The researcher considers this instrument as a composite scale. In addition, the researcher found that this instrument is excessively long especially, when used as a section in a survey.

WHO QoL –BRIEF

It is a 26-items, shorter than WHO QoL [144], however, it's still considered too long to be used in the present study. In addition, it does not provide an overall indication of health as domains are separately evaluated.

Activities of Daily Living (ADL)

There were several instruments that were developed to measure individual's functional status throughout the day. The conceptual framework of these tools is based on the eligibility criteria for providing personal assistance to older adults obtained from social workers, family members and friends of older adults. Self-maintenance requires a complex cognitive and physical competences or a combination of them. Instrumental Activities of Daily Living [145] is an example of ADL utilities. IADL consists of 30-items in 8 domains representing different activities that are performed during the day. Domains for IADL are: telephone use, shopping, housekeeping, food preparation, Laundry, ambulation, responsibility for medication and handling of finance. The IADL was validated by establishing convergent validity with other scales such as Physical Classification Mental Status Scale. IADL or other ADL utilities are narrow in their focus while the QoL is broader than just a measure of functional health. Accordingly, ADL utility tools should be used in the context in which they were developed such as determining the need for assistance within the population of older adults.

Sickness Impact Profile (SIP)

Sickness Impact Profile (SIP) was developed by Bergner *et al.* [146] as a perceived measure of health status which conceptually based on how illness might impact the individual daily activities. Items for this scale were obtained from healthy individuals and health care professional statements that describe sickness and dysfunction. Initially 317 statements were obtained and then they were tested through several field trials. The final instrument consists of 136 items that lay in 12 domains. These domains are: sleep and rest, eating, work, home management, recreation, ambulation, mobility, body care, social interaction, alert behavior, emotional behavior and communication. The scale showed discriminative validity when used with individuals with different health conditions and also was found to be reliable on test-retest. This scale despite been conceptually able to capture third molar impact upon the QoL, it is considered extensively long to be included as an instrument in our study's survey.

Nottingham Health Profile (NHP)

The Nottingham Health Profile was developed by Hunt, McEwen [147] as a subjective measure of health status. They claimed that the subjective measure is more realistic as in many disorders it is hard to objectively differentiate between sickness and health. The domains of NHP are conceptually based on "Health Belief Model" where it postulated that, patients seek medical advice if they face threat to their perceived health [148]. Items for this profile was generated using interviews of patients having a variety of conditions. From these interviews, 2200 statements were generated then a pool of 82 statements that lay in 12 domains forming the initial tool. Items were then revised by discussion where items were kept if they are positively worded, could be answered as 'Yes' or 'No' and readable. The finalized version of the profile consists of 45 items in six domains: physical activity, pain, social isolation, emotional status, sleep and energy levels. Items for the profile were weighted using Thurstone pairwise comparisons. NHP was validated using correlation between subjective patient rating and the doctors rating for health status [148]. However,

NHP consists of domains that might be relevant to our study patients it is still considered too long to be included as a part of a survey.

Quality of Well-Being (QWB) scale

The quality of well-being scale was previously known as the Index of well-being that conceptually based on General Health Policy Model [149]. QWB originally designed by Kaplan *et al.* [150] to be administered by an interviewer while a self-administered version was developed at a later stage. In addition, the QWB is different from QWB-SA in weighting and the health status recording period as QWB records in the past 6 days while QWB-SA records over the past 3 days to eliminate recall bias [151]. QWB consist of 71 items that lay in four domains: functional activity, social activity, mobility and symptoms/problems. The score of each item ranges from 0 to 1 where 1 scores for well-being. Again, QWB-SA is considered long as it has been claimed to take about 20 minutes to complete.

Assessment Quality of Life (AQoL)

AQoL is a family of Multiple Attribute Utility Instruments (MAUI) that assesses the QoL as AQoL1 and AQoL 2 and disease specific QoL measure as VisAQoL and PsyAQoL [152]. Items and the conceptual framework differ depending on the instrument. AQoL-6D is the most recent addition to the AQoL family developed by Richardson *et al.* [153] and validated in a community sample by Allen *et al* [154]. The AQoL-6D consists of 20 items while responses recorded on 4-6 Likert-like scale with higher responses indicating a poor QoL. Items for AQoL-6D lay in six domains which are: independence, relationships, mental health, coping, pain and senses. The construct structure validated by factor analysis and also, established convergent validity factors and the total scale score. The AQoL was more highly correlated with OHIP-14 than the EuroQoL-5D [155]. The researcher assessment of

AQoL is the most suitable QoL instrument for use in TMs research compared with other QoL instruments.

Short Form (SF) Health Survey

It's a multi-instrument utility that measure HRQoL. SF-36 version 1.0 was the oldest form of SF that has been developed by Ware, Sherbourne [156]. The SF-36 consists of 36 questions that lay in two supra domains: physical and mental health and eight domains: physical functioning, pain, general health, vitality, social functioning, role emotional and mental health. The SF-36 was improved in their items wording and response reporting (5 levels) in its version 2.0 [157]. Using data from "Medical Outcome Study", from which the SF-36 originates, a shorter version was developed and named the SF-20 while maintaining the same dimensional structure. Furthermore, the SF-20 was shortened to 12 item scale and named the SF-12. The shortest version of the SF Health Survey is SF-8 that consists of 8 item scale where each domain is represented by one item [158]. However, there are limited dental studies that have used the SF-8.

Quality of life index

The Quality of Life Index (QLI) was developed by Ferrans, Powers [159] after adopting QoL definition "person's sense of well-being" measured by person's satisfaction on aspects of their concern. Accordingly, they considered quality of life as a multi-dimensional and critiqued the global quality of life measure as it provides a little information. Despite QoL varies according to individual's values, they considered four main areas that were thought to be important based on literature review. These areas were: satisfaction, self-esteem, function and health, and socio-economic status. Two QLI instruments were developed: QLI- Generic and QLI-Dialysis. The generic QLI consists of 60-items while QLI-Dialysis consists

of 64 items. Items are scored on 6-point Likert like scales ranging from very satisfied to very dissatisfied. Both instruments correlate significantly with the global health measure and have high internal consistency. However, factor analysis reveals four factors differ from the conceptualized ones. In addition, the QLI instrument is considered extensively long as a section in a survey.

EuroQol-5D

Euro-QoL was developed by Euro-QoL Group [160] to act as a measure of health-related quality of life. The Euro-QoL instrument consists of five dimensions and the responses are recorded on a 3-point Likert scale of no problem, some problems and extreme problems. Moreover, it has a VAS on which study participants are asked to rate their general health today towards an imaginable worse to best state. These domains are mobility, self-care, usual activities, pain and anxiety/depression. In 2005, the Euro-QoL Group has introduced EuroQoL-5D-5L, in which the responses are to be reported on a five-point scale and claimed it to be more sensitive to change. The EuroQoL-5D was used as an outcome measure in TMs research.

Oral Health Related Quality of Life (OHRQoL)

The Quality of life aspects related to oral health is known as the oral health-related quality of life (OHRQoL). This approach towards understanding QoL aspects related to oral health is known as the disease specific approach. The OHRQoL disease specific approach is argued to be more detailed and the measures based on this approach are argued to be more precise and sensitive to change. The researcher will provide in the following section some conceptual aspects related to the OHRQoL and a review of some commonly used OHRQoL measures.

Conceptual aspects for OHRQoL

OHRQoL modelling was also a focus for oral health researchers to better understand the concept of OHRQoL and therefore be able to measure it. The majority of the developed OHRQoL models focus on the functional and psycho-social impacts of oral diseases on QoL [161] with only a negative one-way direction and ignoring the positive aspects of good oral health and its impact on QoL. The most reported oral health conceptual model was Locker's oral health model which is based on the impact of biomedical aspects of ill oral health on QoL [162] leading to impairment. In fact, Locker's oral health model is a dental adaptation of the WHO International Classification of Impairment, Disability and Handicap (WHO-ICIDH). The main limitation of the Locker's oral health model is that it ignores the dynamic nature of oral health and psychological aspects of oral health.

To overcome the limitations of the Locker's oral health model, Adulyanon, Sheiham [163] have introduced some revisions. Their revision included psychological factors that are mediated by pain and satisfaction. However, this model did not show how the functional impairment and psychological aspects of oral health affect aspects of daily living and therefore QoL. Gilbert *et al.* [164], in their model, emphasized on the multi-dimensionality of OHRQoL and added the daily activities domain to the OHRQoL model. In addition, some of the other OHRQoL models have a bidirectional relationship to account for the dynamic nature of QoL however, models are limited in addressing the interactive nature of QoL domains. Furthermore, the measure which were based on these models did not address the patients-related aspects and values in the questionnaire since questionnaire development was not always based on qualitative research [165]. In this section, the researcher reviewed and evaluated tools that have been used to assess OHRQoL in third molar patients.

Oral Health Quality of Life Inventory (OH-QoL)

The OH-QoL is a 15-item scale that was developed by John *et al.* [166] to assess the functional status and satisfaction of person's oral health. In their model, they link the objective impact of functional oral health on the perceived satisfaction about individual well-being. Items for this scale were developed based on literature review and expert opinion. The initial instrument consisted of 22 items that was piloted to a sample of $n= 63$ adults. Items that have a weak correlation with the scale total score were reduced to form the final instrument. Items for this scale score on a composite rating based on the question. However, this scale is measuring the functional aspects of oral health but not the QoL related to oral health such as the ability to sleep or impact on coping abilities. In addition, the concept of QoL is collective and this instrument assesses details of the functional aspects and ignores the other psychological and socio-environmental factors. Accordingly, OH-QoL is not suitable for use in the present study.

Geriatric Oral Health Assessment Index (GOHAI)

GOHAI is a 12-item scale that was developed by Atchison, Dolan [167] to assess functional, pain and psychological impacts of oral conditions on the quality of life in older adults. The scale was developed based on literature review, consultation with clinicians and previous work. The process of scale testing was performed first on a small convenient sample before testing on a large scale. GOHAI scores on a 5-point Likert-like scale the frequency of occurring of problems. GOHAI established a convergent validity with single-item self-rated oral health and the number of teeth. However, the scale does not assess quality of life aspects that might be related to our study participants such as anxiety, sleep and mood change.

Oral Health Impact Profile (OHIP-49)

The Oral Health Impact Profile was developed by Slade and Spencer [168] using Locker's conceptual model of oral health [162]. From this model, domains of the questionnaire were generated, and then they used interviews with open ended questionnaires to obtain patient statements on their experiences with oral problems. By analysing these statements and its form, answers were reduced. After that, the 49-item instrument had its items weighted using Thurstone's method of paired comparisons. Statements were converted into questions and its reliability was assessed using Cronbach's reliability coefficient. Finally, the instrument was tested for its validity using "the notion of convergent validity" by comparing it to a 20 month follow up cohort with different patterns of responses to social items. The final OHIP instrument consists of 49 questions that lay within seven domains. These domains are: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Although, OHIP became a popular instrument in assessing oral health related quality of life, its use as a measure of treatment outcome may need some adaptation [169,170].

On the other hand, Baker et al. [171] have argued the construct validity of the OHIP-49 and they carried out empirical testing of its ability to measure Locker's conceptual model. They collected data from an Ontario study of older adults and used its first follow-up phase. They removed the three questions related to dentures and reduced the recall period to three months instead of one year in the original OHIP-49. Validity was examined using Confirmatory Factor Analysis (CFA). Baker et al. have found that OHIP-49 does not fit within Locker's conceptual model. However, by using structural equation modelling with 6-domains, a 22-item revised OHIP was found to have a better fit. This study has a limitation of using secondary data.

Oral Health Impact Profile short form (OHIP-14)

The short form of Oral Health Impact Profile has been developed by Slade, [172] from the original OHIP-49. There was an increasing demand by health researchers to have a shorter form of OHIP to be used in combination with other survey instruments in order to assess dental care outcomes. However, shortening the survey instrument might affect its reliability. By using data collected from a previous study on people over 60, they have eliminated items those related to denture wearing and items left blank. In addition, they selected items that were ranked as FOVO “fairly often/very often” as an indication of severity of oral health problems. The short form of OHIP consists of fourteen questions that lay within the seven domains of the OHIP. Two questions per each OHIP domain. The final OHIP-14 was validated in comparison with the original OHIP-49 in relation to socio-demographics and clinical variables.

McGrath et al, [6] used the OHIP-14 and the OHRQoL-UK to assess the immediate post-operative impact of third molar surgery on the oral health related quality of life. They requested their patients to record their oral health related quality of life on each day of the first seven post-operative days. Results were compared with the pre-operative baseline survey. They have found that there is deterioration in the quality of life in both scales in the first and second post-operative days. The quality of life has improved gradually in the third and fourth post-operative days. On the fifth and sixth post-operative days, there was no significant difference with the pre-operative quality of life. They claimed that this deteriorating is correlated to swelling and trismus. However, they did not indicate if they have changed the OHIP-14 period, as in original OHIP-14 whereas the reference period is twelve months.

The OHIP-14 was also used by Slade *et al.* [173] to assess the impact change of OHRQoL on patients seeking third molar surgery. In their study, they changed the reference period to three months instead of 12 months in the original OHIP-14 to coincide with the post-surgical evaluation period. However, this justification is questionable as patient may seek third molar surgery due to symptoms that occurred a while before seeking treatment due to financial barriers. The study sample consisted of 480 participants. Demographic data were collected. In addition, patients were asked if they have history of extraction, pain, swelling and presence of pathology. The claimed that symptomatic patients have deteriorated OHRQoL in comparison with asymptomatic patients seeking third molar surgery.

The OHIP-14 was popular as a measurement of treatment outcome in oral surgery. Adeyemo et al [174] have used the OHIP-14 to measure the impact of routine non-surgical tooth extraction on the OHRQoL. They provided the OHIP-14 at pre-operative baseline, third and seventh post-operative day. Moreover, Negreiros et al [175] used the OHIP-14 to assess the relation between the position of the third molar and the post-operative oral health related quality of life. They used OHIP-14 as a pre-operative baseline and post-operatively on each of the seven post-operative days. OHIP-14 showed the ability to measure changes in the OHRQoL on each day of the first post-operative week [176].

Oral Health Related Quality of Life-UK (OHRQoL-UK)

The OHRQoL-UK was developed by McGrath, Bedi [177] as a measure of OHRQoL. It was used to assess changes in OHRQoL due to third molar surgery [178]. The instrument consists of 16-item self-reported questionnaire that assess the impact on oral health-related quality of life. However, Deepti et al [179] used the OHIP-14 in conjunction with the OHRQoL-UK, and both were able to capture changes in OHRQoL following TME.

From the comprehensive evaluation of QoL instruments, the researcher can observe the variability in QoL instruments in relation to their conceptual model, domains, items, scoring system and reference period. Therefore, selecting an instrument to measure TME decision-making on QoL was difficult. In addition, there was a limitation for qualitative studies that studied the impact of TME on QoL to be able to choose the relevant QoL measure. Therefore, it might be useful for the researcher to conduct a qualitative study to understand how TMs experience might impact upon QoL. This might improve QoL instrument selection which might be more precise and sensitive to change.

Satisfaction

Patients' satisfaction is considered an important outcome of health care services and was found to have an association with patients' involvement in decision-making [180,181]. The researcher indicated some aspects of satisfaction:

Satisfaction with information provided

Providing health care services with a high level of technical skill to patients will not necessarily result in patient satisfaction. Satisfaction with information was found to be associated with information demand in patients who are ill, educated and have low quality of life [182]. Ader et al. [8] studied the impact of different information modalities on satisfaction with the information provided. They compared satisfaction with information given by three different ways: using interactive disc, video tape and the surgeon only. They found that the interactive disc has the highest satisfaction with the information provided followed by the video tape and the least was the surgeon only. Their study was carried out as a randomized controlled clinical trial. However, the study was of a small sample size (n=22) which significantly affects the generalizability of the study results.

Furthermore, O'Neill et al. [183] studied the impact of using information leaflets on the satisfaction with the provided information. They have carried out their study using a randomized controlled clinical trial. They divided the participants into four different groups. They used information leaflets and wisdom teeth knowledge scores that was designed at an earlier step [184]. They found that providing patients with information leaflets improved their satisfaction with information. Using this complex study design has limited the number of participants in each group and this might impact on the study results.

Patient satisfaction assessment tools

In this section, the researcher explored different tools that were used in the previous literature to assess patient's satisfaction with the provided information:

Olorado-Bonnin et al. [185] have used a Yes/No questionnaire to assess the patient satisfaction with the care provided as a part of their study on the impact of third molar surgery on the quality of life. They carried out their study via a randomized controlled clinical trial where the test group received detailed verbal and written post-operative instructions. Their satisfaction instrument consisted of four questions. These questions focused on the overall satisfaction with the treatment provided, the patient intention to recommend the procedure to somebody else, if the patient would undergo the same procedure again and if the treatment goal was achieved. However, their instrument lacked scaling of satisfaction levels and they could have considered using a Likert type scale instead. Moreover, their instrument lacked assessment of the satisfaction level with the information provided which was part of their clinical trial.

O'Neill et al [183] used a Likert-type scale to assess patient's satisfaction with information over wisdom teeth removal that was provided to them through information leaflets. Their Likert scale consisted of 7-points ranging from strongly disagree to strongly agree. They used two item questionnaires to assess patients' satisfaction. Participants were asked to rate their satisfaction with the information provided over the symptoms that would experience after the surgery and contact information if they developed a problem after the surgery. However, these two questions are not covering all different aspects of satisfaction with the information provided such as procedural information and instructional information that should be provided to patients undergoing this kind of surgical procedure.

Therefore, the researcher might need to develop his own satisfaction scale that assess different aspects of satisfaction such as satisfaction with different formats of information provided, satisfaction with the care provided, satisfaction with the decision and whether the patient will recommend the dentist to their family members or friends as a proxy for the overall satisfaction.

Assessment of patient knowledge about third molar extraction

Assessing the perceived patient knowledge is important in evaluating different modalities of patient information materials. In this section, the researcher explored literature that assessed patients' knowledge for third molar extraction with focus on the modalities used to assess patient knowledge.

Interviews

Brasileiro et al [186] used interviews with a predetermined check list for the main areas of misunderstanding of information based on their clinical experiences. They actively encouraged patients to ask questions over these different domains of third molar surgery and then they assessed participants' knowledge in these areas. They have classified the answers as informed or misunderstanding. However, using this method in assessing patient information is missing the assessment of patients' knowledge over post-operative complications such as numbness, which is medico-legally important.

Short answer quiz

Ader et al. [8] used a short answer quiz to assess the overall patient knowledge about third molar extraction. Their instrument consisted of three short answer quizzes and asked the patient to give two short answers on each of the following: risks of leaving impacted wisdom tooth, common post extraction symptoms and post-extraction complications. Using a randomized controlled clinical trial, they aimed at comparing the effect of different preparatory patient education modalities upon the perceived patient knowledge. The preparatory patient education modalities under investigation were interactive disk, video tape and the surgeon only. Patients were given this quiz immediately before consultation and after they were given patient educational materials according to their group. However, these questions do not assess the perceived knowledge as patients can mention complications as bleeding and infection but miss important ones such as numbness, which is medico-legally important.

Moreover, Ferrús-Torres et al. [9] used a short answer questionnaire to assess the importance of written information given to patients before obtaining informed consent. They asked their

patient to give possible risks of having impacted mandibular third molar surgically removed. The majority of patients were not able to recall information despite having them verbally and in written form. However, the most common risk recalled was paresthesia to lip and tongue. However, they would be able to remember them as they were on the top of the list that was given to them.

True or false questionnaire

Humphris et al. [184] developed a questionnaire to assess changes in the perceived patients' knowledge after giving them a wisdom teeth information leaflet. They generated questions from the information leaflet designed for patients with wisdom teeth problems. Then these questions were reduced according to their ratings. The final instrument consists of 58 items of true or false questions that covered different aspects of wisdom teeth. Their instrument was tested for reliability. However, their instrument showed no significant difference between pre-leaflet and post-leaflet groups. This could be related to the questionnaire being easy for them to answer and it should be able to differentiate between different knowledge levels.

Therefore, the researcher might recommend the need to develop his own assessment tool to examine TMs patients' knowledge, consisting of questions that cover some TMs information domains. The researcher thought that multiple choice questionnaire might be suitable in knowing areas of misunderstanding which might need clinicians to provide patients with explanation.

The association between providing information and anxiety levels for third molar patients

Third molar patients attending out-patients clinics show high levels of dental anxiety when compared with other oral surgery patients [187]. Pre-operative anxiety is associated with the desire for more information [188]. Van Wijk et al. [11] studied the impact of the amount of pre-operative information on the anxiety level in patients undergoing third molar extraction. They reviewed the three available types of pre-operative information. Firstly, procedural information that includes information related to the surgical procedure. Secondly, sensory information, which includes information about what patients are expected to feel during and after the procedure. Thirdly, post-operative instruction: including information to enhance the post-operative recovery. They recruited patients into two groups: the low information and the high information group. They used the Krantz Health Opinion Survey (HOS) to measure the study participants' opinion over health care decisions. These types of information are usually included in the majority of online resources. They observed that patients prefer more information without significant difference on anxiety levels. On the other hand, another study conducted by Kazancioglu *et al.* [189] showed an increase in dental anxiety level in TMs patient after reviewing multi-media information. Due to the lack of consistency among the literature in this area, it is becoming necessary to explore whether providing patients with pre-consultation internet resources might have an impact on TMs patients' anxiety levels.

In order to assess the impact of providing pre-consultation internet guidance on consultation anxiety level, it is becoming important for the researcher to explore some of the commonly used measures. This will enable the researcher to select a dental anxiety and fear measure that is conceptually able to measure dental anxiety and fear. In the following section, the researcher assessed some of the widely used dental anxiety and fear measures.

Tools for measuring dental anxiety

Kleinknecht Dental Fear Scale (DFS)

It was developed by Kleinknecht [190] and originally consisted of 27 items which underwent further reduction to reach 20 items in the final form. Items are not equally distributed across domains. The DFS domains are: avoidance (two items), physiologic reaction (five items), fear of specific stimulus (12 items) and overall fear (1 item). Participants report their responses on a 5-point Likert scale that ranges from no fear to fearful. DFS was the second most widely used measure for dental anxiety and fear [191] and was used by researchers to assess dental anxiety and fear either in relation to dental extractions or TME [192]. Schuurs, Hoogstraten [193] assessed the statistical analysis of several studies used DFS with samples that varied geographically and demographically and found that factor analysis revealed three factors (avoidance, fear from specific stimulus and physiologic reaction) despite, the original construct having four domains that were mentioned earlier. In addition, Armfield [191] mentioned that, DFS provides an explanation of fear to the clinicians rather than measuring the fear itself as 60% of the DFS is related to the fear of specific stimulus. Furthermore, DFS is considered relatively long and may be off-putting especially if combined with other instruments for research purposes.

Dental Anxiety Scale (DAS)

DAS was developed by Corah [194] and became the most commonly used scale to measure dental anxiety and fear [191]. It consists of a four-item questionnaire. The first question requests patients to report their feelings over having a dental visit and their answer is recorded on a 5-point scale. While the other three questions report participants' feelings during receiving dental treatment on five point scales. DAS scores range from 5 to 30.

However, Armfield [191] reported that, answers to questions two to four are not homogenous as it uses a mix of qualitative and quantitative assessments in the same scale. Moreover, it is not based on a theoretical framework.

Modified Dental Anxiety Scale (MDAS)

MDAS was developed by Humphris et al. [195] to overcome some of the original problems with Corah's Dental Anxiety Scale. They added one question related to having local anesthetic injections as they claimed it to be the major driving force for causing dental fear. Accordingly, the modified tool consists of five questions. Moreover, they have standardized the answers to be on homogenous 5-point scales reporting anxiety levels ranging from ('Not anxious', 'Slightly anxious', 'fairly anxious', 'Very anxious' and 'Extremely anxious'). However, it still lacks the theoretical framework as DAS.

Index of Dental Anxiety and Fear (IDAF-4C+)

IDAF-4C+ was developed by Armfield [196] to overcome the psychometric and theoretical limitations of previously mentioned scales. The IDAF-4C is an eight-item instrument that has four domains and the responses are recorded on a 5-point Likert scale ranging from strongly disagree to strongly agree. The IDAF-4C domains have been designed to reflect participants' emotional content and reaction to an external stimulus such as dental treatments. The IDAF-4C main domains are: cognitive, behavioral, emotional and physiological. Moreover, the IDAF-4C has an item that evaluates the anxiety level when the participant is not in control of what is happening. Using Cronbach's alpha, it was found to be reliable. Armfield [197] reported that IDAF-4C is better than single item dental fear (SIDF) and the DAS in revealing clinical impact of dental anxiety and fear. Accordingly, this study will use the IDAF-4C as an anxiety assessment tool because of its multi-dimensionality, its ability to reflect the clinical outcomes of dental fear/anxiety and its strong theoretical framework.

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Chapter 3: Research Methodology

In order to address the research questions and hypotheses, the researcher will need to use different data sources, study designs and analytical techniques. In this chapter, the researcher will provide coverage of the methodologies that were used in this research. The methodologies were classified by the data sources.

The 2013 National Dental Telephone Interview Survey (NDTIS)

The NDTIS is a cross-sectional study that surveys a representative sample of Australia residents. [1]. The NDTIS randomly sample households that have a telephone line as it uses a telephone interview technique. The NDTIS is routinely conducted every 2-3 years since 1994 and serves as a source for national data on use of dental services in Australia [2]. The NDTIS is conducted by the Dental Statistics and Research Unit, the University of Adelaide and receives support from the Australia Government Department of Health and Australian Institute of Health and Welfare. The NDTIS surveys Australians aged 5 years or over using different modules [1]. The 2013 NDTIS will help the researcher to get an insight into wisdom teeth extractions in Australian adults. The 2013 NDTIS data was collected in the period between June 2013 and March 2014. The researcher will provide details about the sampling method, variables collected and will be used in addressing the research questions and hypotheses, and the statistical analysis techniques that will be used.

Methodology of the 2013 NDTIS sampling

The 2013 NDTIS used dual overlapping sampling frames in order to ensure the representativeness of the sample to Australia residents. The sampling frames are as the following:

Random stratified sampling of household listed on the Electronic White Pages

Sampling from this frame was conducted through two stages stratified random sampling of Australian households listed on the Electronic White pages supplied by Australia on the Disc. Sampling from this frame was carried out using a two stages sample design for randomly selecting the households listed on the Electronic White Pages obtained from Australia on Disc 2012 Residential supplied by United Directory System [3]. The sampling from this frame was stratified by Australia's states and territories and then by being a capital city or rest of the state using determined sampling fractions. The randomly selected households were contacted by telephone and asked for adults aged 18 years or over resident in the household and then randomly selecting them based on birthdates. After the selected adult completed an adult questionnaire, they asked about children resident in the household aged 5-17 years. If the household had children, one child was randomly selected to complete the child survey. Only adults aged 18 years or over were included in this study.

Randomly generated mobile telephone numbers

In order to account for households that were not listed on the Electronic White Page, another sampling frame of randomly generated mobile numbers were used. This sampling frame consisted of 20,000 randomly generated mobile telephone numbers supplied by Smartworx.

Establishing contact and survey completion was carried out using the method described earlier. However, sampling from this frame was not stratified due to absence of geolocation information before establishing the contact.

The 2013 NDTIS data quality

The 2013 NDTIS data collected was checked for quality and only usable records were included. The collected data from the dual sampling frames were weighted to reflect the Australia population distribution as per the 2011 Census using socio-demographic characteristics [3].

The 2013 NDTIS variables used in the study

The 2013 NDTIS collected data about individuals' characteristics, their oral health and their use of various dental services. The researcher will only provide details about the variables that will be used in this study:

Socio-demographic characteristics

The NDTIS collects socio-demographic information from participants. This information includes: participant age (in years), sex, highest level of education and total household income. Furthermore, participants were asked "Does your private health insurance provide cover for dental services?" to get information about dental insurance status.

Extractions

The NDTIS asks participants to provide frequencies of different dental treatments the participant received in the last 12 months. Among dental treatments received in the last 12 months, participants were asked to provide an answer to "how many extractions?" After the participant listed different dental treatments received, they were asked to go back to the moment of the extraction. Then participants were asked: "Can you tell me what problem

caused you to have the tooth/teeth extracted?” Reasons provided for extractions: Wisdom teeth, Tooth decayed, Tooth cracked or fractured, filling broken, etc. based on the reported number of TMs extractions, a dichotomous variable was created for receiving multiple TMs extractions.

Self-rated oral health

Participants were asked: “how would you rate your dental health?” using the single-item global self-rated oral health question [4]. Response to this question was reported on a 5-point scale ranging from 1 for ‘Poor’ to 5 for “Excellent”.

Number of days absent from work/school due to dental problems

The number of days absent from work/school due to dental problems will be used as an indicator for the occurrence of post-extraction complication in the adjusted analysis. This question was worded as the following: In the last 12 months, how many days have you stayed away from your (work/place of study) for more than half the day because of any dental problems you had?

Criteria for record selection

The records were included in the analysis if the participants responded ‘Yes’ for the question about the reason for extractions whereas no other extractions reasons were reported. This criterion was estimated to make sure that the number of TMs extraction reported was only for TMs as the question about the number of extractions received in the past 12 months was not specific for TMs.

Data analysis approach for the NDTIS study

Data analyzed using SPSS statistics for Windows v 23.0 [5]. To account for the complex sampling design of the NDTIS, complex samples module [6] was used. In order for the researcher to use the complex samples module, a complex samples plan was provided by the NDTIS data custodian to be used in the analysis. The researcher used the sub-population of those who received TMs extractions in the analysis. Population estimates of those who received TMs extractions were obtained with standard errors of these estimates. Mean and standard deviation of the number of the received TMs extractions and the number of days absent from work/school due to dental problems were calculated. Complex samples general linear models were used to: (1) explore the association between the number of received TMs extractions and being dentally insured; (2) explore the association between receiving single versus multiple TMs extractions and self-rated oral health; and (3) explore the association between receiving TMs extractions when aged 18-25 years of age versus older age group and the number of days absent from work/school due to dental problems.

Findings from the NDTIS suggests that TMs patients might benefit from receiving high quality online information before their TMs consultation to improve TME decision-making. In order to ensure that TMs patients receive high quality information, these resources might be developed by the researcher or using existing ones. Whereas the researcher lacks the resources for producing information in a professional format, it was decided to use the existing resources after identifying those resources of high quality. To the best knowledge of the researcher, there has been no content analysis of online related health information over third molar surgery. Therefore, conducting quality and readability assessment of online consumer health information concerning TMs was necessary.

Quality and readability assessment of online consumer health information concerning wisdom teeth

Content analysis of websites is a method that has been used in different studies [7,8]. This method is also used to evaluate health information websites [9]. Evaluating the advantages and disadvantages of available dental information websites is very significant to the current study. A check was developed in order to undertake a systematic evaluation [10]. Based on findings presented in Appendix XII: Comprehensive review of website content analysis studies, the researcher created a flowchart (Figure 4) that summarized the steps used in the process of systematic evaluation of quality and readability of TMs online resources.

Keywords determination

The researcher selected three keywords to perform the internet search for online health information related to third molar extraction. These keywords were: “wisdom tooth removal”, “Wisdom tooth extraction” and “impacted wisdom tooth problems”. Keyword determination is important as it is known to have an impact on the quality and accuracy of the search outcome as concluded by Fabricant *et al.* [11]. The researcher considered in the process of keyword determination that keywords needed to be familiar to the average patient. For instance, wisdom tooth is commonly used by patients rather than third molar, where the latter is considered a medical terminology.

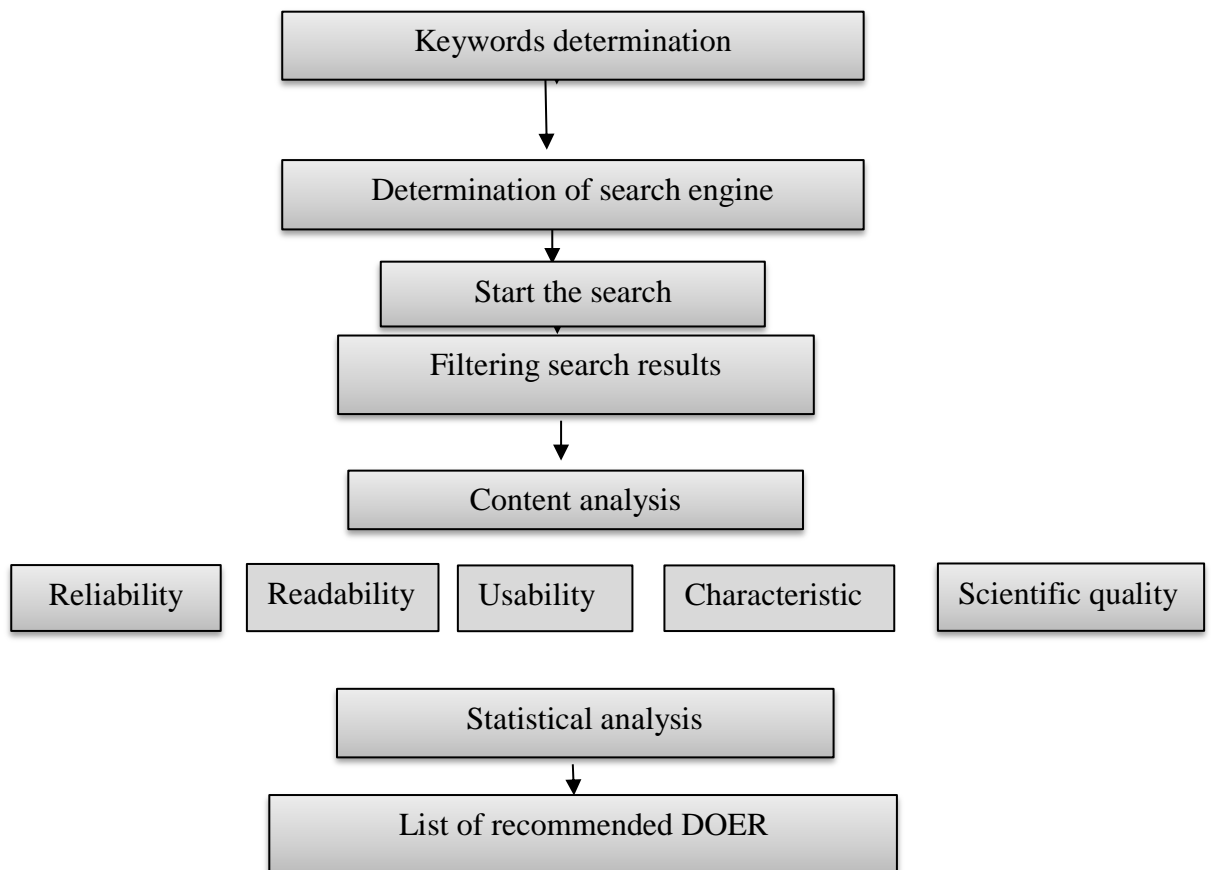


Figure 4: website content analysis flow chart

Selection of search engine

The selection of search engine is found to be an important factor that determine the search output [12]. The researcher selected three of the most frequently used search engines: Google (google.com), Yahoo! (yahoo.com) and Bing (bing.com). The original plan has been to use Dogpile—a Meta search engine as it obtains its search results from another search engines Google, Yahoo and then rank them as specified. It was thought that meta search engine eliminates the duplicate removal step. Despite Dogpile having an advanced search option, it had limited options and this is generalized to the most of Meta search engines. Accordingly, the researcher used the previously mentioned search engines with keywords using Boolean

logic: OR [13]. The search was carried out on the 14th October 2013. For each search engine, advanced search option was used to optimize the search outcome. Google and Yahoo are closely similar in their advanced search options for Boolean logic, domain, location, safe search filter and language selection however, Google is superior as it allows for searching for the keywords in page title. On the other hand, the advanced search for Bing is limited in selecting content location as it has no option for “anywhere” as in Google and Yahoo. Search results were copied to excel files where a separate sheet for each search engine was used to record ranking order. Only 50 results for each search engine were extracted as it is known that patients do not go far beyond the first 25 results [14].

Filtration of search results

The process of filtration of the search results passed through multiple steps. Firstly, all search results that were clearly marked as an advertisement by the search engine were excluded from the search results because their ranking order were affected. Secondly, was to remove the duplicated websites. This process was carried out using Remove Duplicates function in MS Excel 2010. Before this step took place, all website URLs needed to be similar in the way of their reporting as some domains use either “http:”, “http://www.” Or neither of them before the site domain name. Accordingly, the researcher removed “http://” or “http://www.” before the website domain name. Then the duplicated websites were removed so the selected websites reduced from 150 to 132. As all domains accept “http://www.” before the site domain name. All websites domain names were restored using concatenate function in MS Excel. Thirdly, websites were filtered according to their relevance to our study in other words websites that are suitable for providing patient with information regarding third molar problems. This initial relevance scoring was according to presence of different information domains created by the researcher (). Accordingly, websites were categorized into four categories: websites that were to be excluded from the stage of content analysis,

websites of high relevance, websites of medium relevance and websites of low relevance. Websites were to be excluded following the criteria of: totally irrelevant, duplicates that were not removed in the previous step (websites that have different URLs indexing the same content such as Mayo clinic URLs), websites that were duplicates by their web developer (the same content but under different URLs for different practices with different color themes or layout), non-functional URLs , non-English URLs, pure advertisement for the provided services without patient information section, Blog type of content without patient information section (yahoo ask and meta ask), information for tooth extraction not wisdom teeth, medical article, comments/ personal stories without patient information section. The reasons for exclusion were coded in the middle of the initial evaluation process to provide a report describing the common features among the excluded websites. Some of the previously mentioned criteria were imported from previous studies reviewed by the researcher however, the researcher developed more exclusion criteria during the process of filtration. High, medium and low relevance categories were based on the amount of information provided (websites include only few sections as treatment cost or only post-operative care were categorized as low relevance). This step was important to limit the content analysis to a manageable number of websites.

Finally, websites were ranked by their relevance categories and only websites that were found to be of high relevance were selected for the content analysis (n=50). Figure 5 presents the flowchart of websites sample selection.

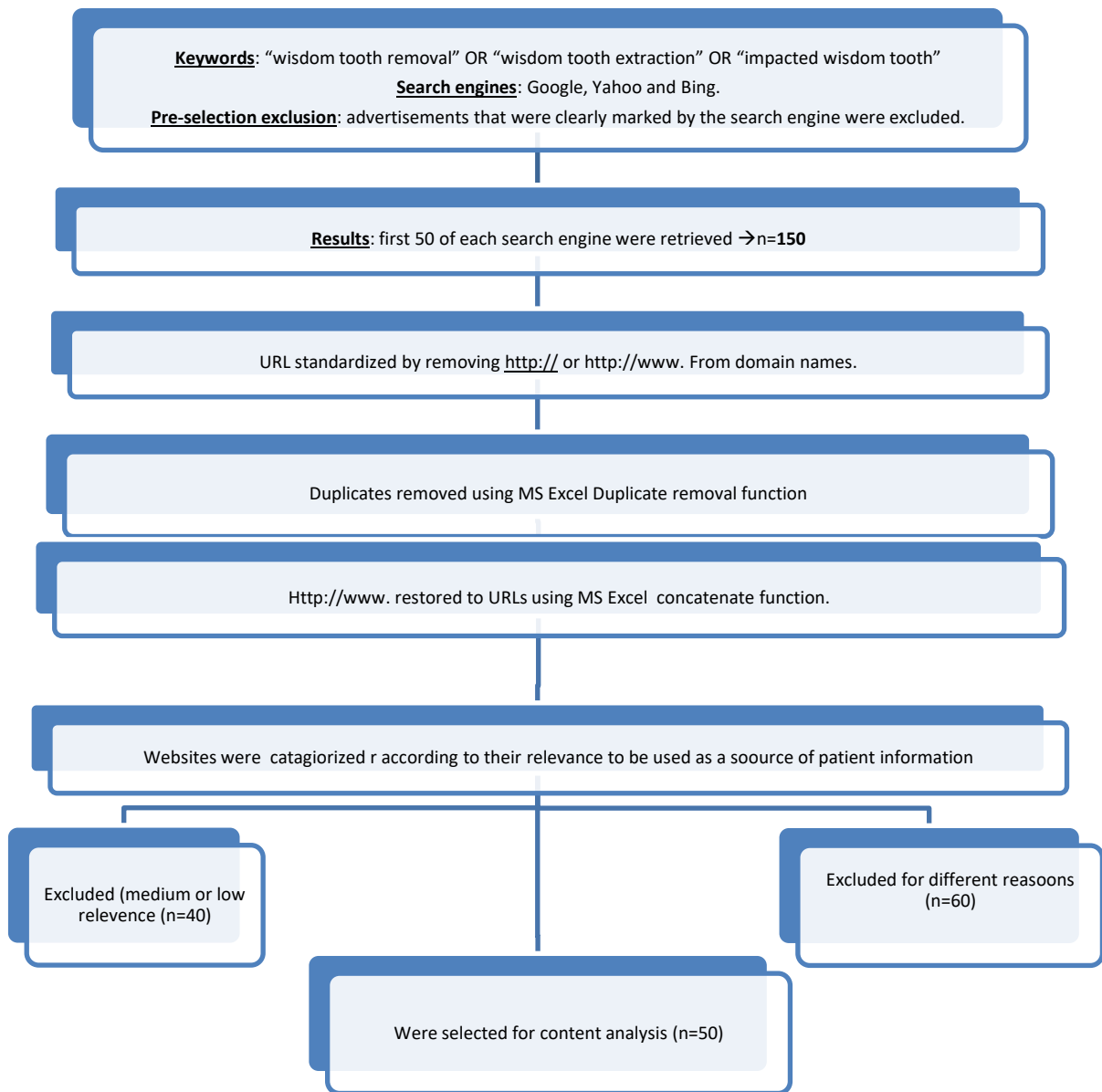


Figure 5: Flowchart of website selection process.

Website evaluation instrument

A battery of items was generated to carry out the content analysis based on literature review, generic instruments that are valid and reliable, and some items were developed by the researcher to fill gap in the available instruments. Appendix VIII: Evaluation criteria for

website content analysis and for the purpose of data collection, and the online form for these criteria was created [15]. The website content analysis was carried out by a sole researcher (K. Hanna)—an approach used before in a similar study [16] and the researcher had the academic qualifications and the clinical experience to carry out this analysis. Criteria for TMs website evaluation are as the followings:

Website characteristics

Affiliation

The characteristics of the health-related websites were specified according to affiliation. This approach has been used by Ni Riordain, McCreary [17] to describe the source of information. The questionnaire is formed to reflect the affiliation of the screened website into: government, educational institute, practice, non-profit organization, commercial, and others to allow for specifying an affiliation that is not mentioned.

Format of the information provided

Internet related patient information could be provided in different formats. These formats have different preferences among the reviewing patients [18]. The researcher used the categories information formats as: paperback on HTML, paper booklet (the researcher classified it as PDF or Word document), flash multimedia with animation, audio, text), audio synchronize with the text. In addition, the researcher added real and cartoon animation as a modality for delivering of internet related health information. Answer to this question was in the form of multiple response set.

Pattern of information communication

Patient related information are delivered in different formats: fact sheet and in the form of question and answer, story and other. This question is important to identify the prevalent pattern of information communication.

Content modification

Some websites allow users to edit its content and accordingly it might impact the quality of the content. Wikipedia is an example of open content website that allows users to edit its content. Accordingly, the researcher collects information about the form of content editing.

Website quality scoring

The main purpose of this study is to provide patients with high quality online resources concerning TMs. Determination of such quality was based on the overall website scoring on a number of scales summed to provide the total website score. These scales are: usability scale, the accessibility scale, the trust scale, readability grade [19], scientific information comprehensives scale, scientific information reporting scale, scientific information referencing scale, scientific information quality scale and online health information credibility scales (Health on the Net [20] and DISCERN [21]).

The Usability Scale

Usability is the website ability to be user friendly and made it easy to find the information that reviewers want. Items for the Usability scale were partially imported from the LIDA instrument [22] with some modifications. Items for the Usability Scale were scored on a 3-point Likert-like scale ranging from 0 to 3. The total Usability Scale score ranged from 4 to

12. The researcher created items that make the website easy to be reviewed by patients.

These items are:

Registration requirements

Websites apply various degrees of restriction toward reviewing its content. This could be: no registration at all, require registration which is free or payable registration. This might impact the ability of the patient to review the content.

Navigability

Navigability is the ability to find where you are in the document. It could be in the form of heading and subheading, home page, etc.

Supports web 2.0 applications

These are groups of applications that allow the user to follow the content and any related updates. It allows users to rate and post their comments so it is available for the other users. In addition it helps in discussing the information and sharing of experiences and improves patients' knowledge [23]. Responses reported as multiple response sets for different web 2.0 applications such as Facebook, Twitter, G+, etc. Based on the summed frequency of these applications per website, it was trichotomized based on percentile distribution.

Website search engine

Effective website search is important to allow easy finding of information. Accordingly, the search facility is recorded either: 1 for no, 2 for yes with external search engine 3 for yes, with built-in search.

The Accessibility Scale

These are groups of features that allow people with disabilities to navigate through these websites. In Australia, it is legally required for all governmental, educational and commercial websites to meet the minimum of Web Content Accessibility Guidelines [24]. There are some online tools for assessing the website accessibility however, they are targeted to the website developers. Accordingly, the researcher selected the ability of the reviewer to change the font size as a proxy for applying these guidelines. A binary variable was created for which it scores 1 for no and 3 for yes to increase the item weight in the total website quality score.

The Trust Scale

Trustworthiness is important for the reviewer to assess the reliability of internet information in making treatment choices. As patients are not experts in the medical field so the presence of trustworthiness is of importance. The Trust Scale is a 4-item binary scale where items are scored 1 for no or 3 for yes. The total Trust Scale scores ranged from 4 to 12. Details for the scale items are as the following:

Is the website displays HoN seal?

HoN Foundation has certified 3000 health related website [25]. Also, this certification is free. Therefore, there is no barrier for certifying the website from the HoN Foundation.

If yes, what is HoN current certification status

HoN toolbar provides the current certification status by searching HoN database. Details are found in the literature review chapter.

Does the website display other quality seals?

As there are other quality seals available other than HoN seal, accordingly details for these seals were recorded.

Planned review date

As the health information is rapidly changing according to the available best evidence, websites need to show their planned review date to show how these websites are maintaining their currency.

Online consumer health information credibility tools

Health on the Net Code (HoNCode)

The HoNCode is an eight principles' code [25 which were used by the researcher to develop a questionnaire] that was used to assess the website credibility. The researcher adopted the 14 questions used by HoN team to apply for an HoN certificate as a guide for item generation [20]. The eight domains for the HoNCode are: authorship, complementary information, maintaining privacy, appropriate referencing of information sources, claim policy, transparent, disclose funding source and clear advertising policy. Response to the questionnaire were recorded on a 3-point scale ranging from 1 for not complying, 2 for partially complying or 3 for fully complying with the HoNCode of conduct. Items details are found in [Appendix VII](#). The total HoNCode score ranged from 14 to 43.

DISCERN

The DISCERN is a 16-item generic instrument that was developed by Charnock [21] to improve the quality of printed consumer health information on treatment choices and was

validated for online information [26]. Details for the DISCERN items groups were described in the literature review and the instrument itself is found in Appendix VII. DISCERN items scores were 1 if the response to the item is a definite no, 2-4 if the response to the item is partial yes and 5 if the response to the item is a definite yes. The total DISCERN scores ranged from 16 to 80.

Readability scores

Mean readability grades

The Readability Studio Professional 2012 [27] automatically provides readability grade estimates for multiple documents. The readability grades estimates provided by this software are: FORCAST, Fry, FOG, Gunning FOG, Raygor estimate and SMOG. These readability grade estimates are calculated based on word/sentence length and number syllables per word [19]. These readability grades are equivalent to the US schooling system. For the purpose of carrying out this process, text from the assessed websites was extracted and saved on word documents assigned an ID for each website. Audio/video materials were transcribed to conduct the assessment. Figure 6 shows a screen shot of the Readability Studio software while obtaining the readability grade estimates.

The Scientific Information Comprehension Scale

It is a 9-item scale developed by the researcher to evaluate the comprehensiveness of each information domain of the Scientific Information Quality Scale shown in . Each information domain was rated on 5-point scale ranging from 1 for difficult to understand to 5 for easy to understand. If the information domain was not reported on the website, it was coded as missing. The total Readability Scale scores ranged from 9 to 45.

Docume...	Flesch Reading Ease	FORCAST	Fry	Gunning Fog	Raygor Estimate	SMOG
ID 01 .docx	68	9.9	8	9.8	8	10.3
ID 02 .docx	65	9.9	9	10.4	8	10.6
ID 03 .docx	61	10.4	10	8.7	9	11.2
ID 04 .docx	58	11.1	10	10.2	10	11.2
ID 05 .docx	64	10	9	10	9	10.7
ID 06 .docx	36	11.2	15	15.8	13	15.9
ID 07 .docx	52	10.9	11	12.2	11	12.8
ID 08 .docx	55	10.7	11	11.3	10	12.2
ID 09 .docx	48	11.2	12	13.3	13	13.9
ID 10 .docx	17	12.5	Text is too ...	15.7	Text is too diffi...	11.2
ID 11 .docx	57	11.1	10	10.3	10	11.3
ID 12 .docx	55	10.5	11	11.7	10	12.3
ID 13 .docx	58	10.5	10	11.4	9	11.8
ID 14 .docx	55	12.5	Text is too ...	11.6	Text is too diffi...	8.8
ID 15 .docx	53	10.9	11	11.6	11	12.5
ID 16 .docx	66	9.7	8	10.1	8	10.7
ID 17 .docx	54	10.7	11	11.4	11	12.3
ID 18 .docx	6	15	Text is too ...	14.5	Text is too diffi...	8.8
ID 19 .docx	57	10.6	10	11.6	10	11.9
ID 20 .docx	73	10.1	Text is too ...	6.9	Text is too diffi...	8.4
ID 21 .docx	56	10.6	10	12.2	10	12.7
ID 22 .docx	47	11.1	13	13.2	12	13.5
ID 23 .docx	57	10.8	10	10.8	10	11.5
ID 24 .docx	54	10.6	11	12	10	12.4
ID 25 .docx	75	9.7	6	7.2	6	8.8

Figure 6: A screen shot of the Readability Studio Professional 2012 while obtaining readability grade estimates

The Scientific Information Quality Scale (SIQ)

Numerical assessment of the scientific quality of information is important to be able to make a judgment on it [28]. No generic instrument could be used for this purpose. Information domains needed by TMs patients to make a decision about their TMs were conceptualized based on literature review and the researcher’s academic knowledge and clinical experience. TMs SIQ domains are reported in . In order to make the evaluation process objective and systematic, a gold standard for TMs online patient information was created by the researcher and presented in Chapter 6. Items for the SIQ scale scored on 5-point scale

ranging from 1 for poor to 5 for excellent. If the information section was missing, it was reported as missing.

The Scientific Information Reporting Scale

It is a 9-item binary scale that was developed by the researcher to quantitatively report the relevance of the website as an information resource for TMs patients. Items for this scale are the domains of the SIQ scale where the item scored 1 if the information domain was reported on the website and 0 if the information domain was not reported. Therefore, the total Scientific Information Reporting Scale scores ranged from 0 to 9.

The Scientific Information Referencing Scale

It is a 9-item binary scale developed by the researcher to evaluate the adequacy of information referencing on the website. Domains for this scale are the same as the SIQ scale. Items for this scale were scored 1 if the information domain is referenced and 0 if the information domain was not referenced. The total scientific information Referencing Scale scores ranged from 0 to 9.

Reviewer comments

In order to allow the reviewer to provide his qualitative feedback on the reviewed TMs consumer health information websites, an open comment section was included. This section might be useful to comment on the presence of biased/unbalanced information and in which areas. In addition, the researcher might need to comment on the TMs treatment recommendations and factors might affect the information readability.

Data analysis

Quantitative data analysis

Data were analyzed using IBM SPSS Statistics for Windows v 23.0 [5]. Frequencies of websites characteristics were calculated. Means, SDs, and quartile distributions were also calculated for each of the used scales. The internal consistency using Cronbach alpha [29] of each sub-scale was also calculated. Pearson r correlation coefficients were calculated between SIQ scale, DISCERN and HoNCode in an attempt to establish convergent validity [30] for initial validation of the developed SIQ scale. In addition, Pearson r correlation between the mean readability grade produced by the Readability Studio Professional 2012 and the Scientific Information Comprehension Scale (after reverse coding) was measured in an attempt to establish convergent validity. The associations between website affiliation and websites scores were tested using One-Way ANOVA with Tukey's post-hoc tests.

To explore predictors for SIQ scores, linear regression was performed after creating dummy variables for website affiliation groups. A block of website affiliation dummies [31] (model 1) was entered in linear regression, where the "other" group was used as a reference category. In model 2, DISCERN was added, and in model 3, DISCERN was removed and replaced by HoNCode score while controlling for website affiliation. Websites were ranked according to their SIQ score and to their total (unweighted) score. The correlation between the two ranking orders was examined using Spearman's ranking correlation.

Qualitative data analysis for the reviewer's comments

The reported comments were re-read 2 times in order to get a sense of the data before starting the thematic coding [32]. Nvivo 10 [33] was used to facilitate the thematic analysis and descriptive statistics,

Recommended list for high quality TMs online resources

A list of top quality websites was created after websites were ranked according to its total website score. The produced list served as an intervention which was tested in the RCT.

During the phase of reviewing the literature of quality of life and tools used to measure it, the researcher needed to make a decision about which QoL tool to use as an outcome measure when testing the impact of providing patients with internet guidance on participation in decision-making and health outcome. Conceptually the QoL measure to be used in this study needed to be precise and sensitive to change. The researcher became aware of the increased criticism over the current QoL measures (HRQoL or OHRQoL) [4,34,35]. In addition, which approach should be used [36], and which instrument is the most appropriate as an outcome measure needed to be considered in our study since there are variations between QoL instruments in their conceptual framework, domains and items [37]. Since qualitative research is the only way to understand how a disease might impact upon QoL, there is a limitation for such studies related to TMs. Furthermore, conventional qualitative research methods are associated with experimentally induced recall bias [38]. The researcher thought of using real-time qualitative data expressed spontaneously by TMs patients on Twitter—a

social media platform to overcome this issue. The following section details the method used in the Twitter study, which is presented in [Chapter 5](#).

Methodology used in exploring and modelling impacts of third molar experience on the quality of life using Twitter's real-time qualitative data

Twitter is a micro-blog [39] where users of this platform are able share short messages of 140 characters, photos or videos. These messages (tweets) are publicly available and searchable on Google in addition to Twitter. The researcher explained the detailed methodology used for how Twitter qualitative data were used to address the research aims described earlier.

Ethical approval for the Twitter study

The Twitter study was conducted after obtaining ethical approval from the University of Adelaide Human Research Ethics Committee (HREC): approval number H-2015-017 (Appendix II: Ethics approval for Twitter study). Although the tweets are publicly available, it was necessary to ensure that the study follows the Declaration of Helsinki and its updates. The researcher has an obligation not to reveal the Tweeters' identity [40], whereas it was replaced by nick names as shown in Table 6. The approval was obtained for a multi-modal approach including qualitative data analysis of TMs tweets (presented here) and an ongoing TMs patients recruitment to complete an online survey [41] (in progress).

Tweets sampling and data capturing

A global sampling of tweets (in English) containing the keyword “wisdom tooth” published on Twitter during the period between 30th January 2015 to 5th of February 2015 and was carried out using Twitter Advanced Search. The Twitter Application Programming Interface (API) only allows a maximum of 3200 tweets to be captured for free per any search period [42]. The Twitter advanced search finding was captured as a dataset using the NCapture—internet browser plug-in for NVIVO [43]. The captured dataset has the following items: includes: username, tweeter ID, user’s declared location, short biography, tweet text, tweet post time, tweet ID and tweet type. Then the extracted data underwent a multi-step filtering process in MS Excel.

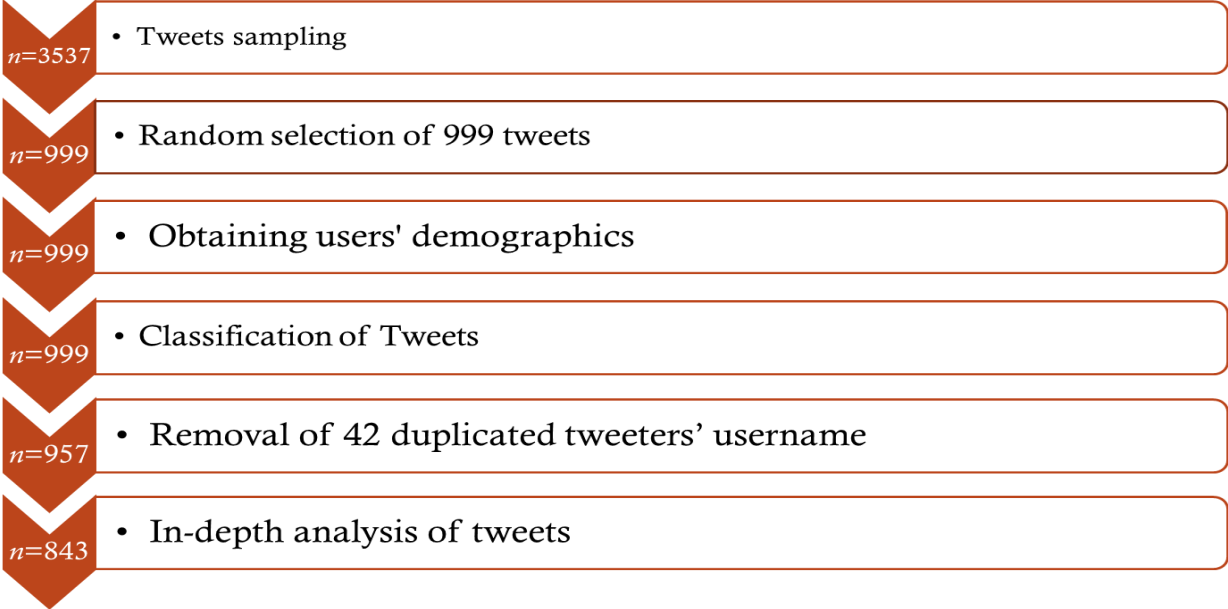


Figure 7: Multi-step Tweets filtering

Filtering of captured tweets

The captured tweets ($n=3537$) underwent a multi-step filtering process in order to get a workable number for tweets to be analysed and to ensure that tweets are relevant to our study (Figure 7). In conventional qualitative research, some scholars argue the use of saturation to determine the sample size and therefore, they proposed some guidelines for the minimum sample size that should be used [44]. However, such guidelines are not available for tweets content analysis as it has recently emerged. The researcher re-read the tweets three times and decided that a random sample of $n=999$ tweets should allow the researcher to reach saturation and is a workable number. In MS excel, a random number was generated in a column next to the tweets data then numbers were sorted in an ascending order and the first $n=999$ tweets were selected.

The captured TMs tweets lack users' demographic information. To overcome this issue, the researcher used a MS Excel add-in to obtain age group and gender information named Textalytic [45]. Figure 8 shows a screen shot of the Textalytic while obtaining cloud-based demographic information for our tweeters that were based on Naïve-Bayes machine learning text classification (note: usernames were masked to maintain confidentiality as per the ethics approval).

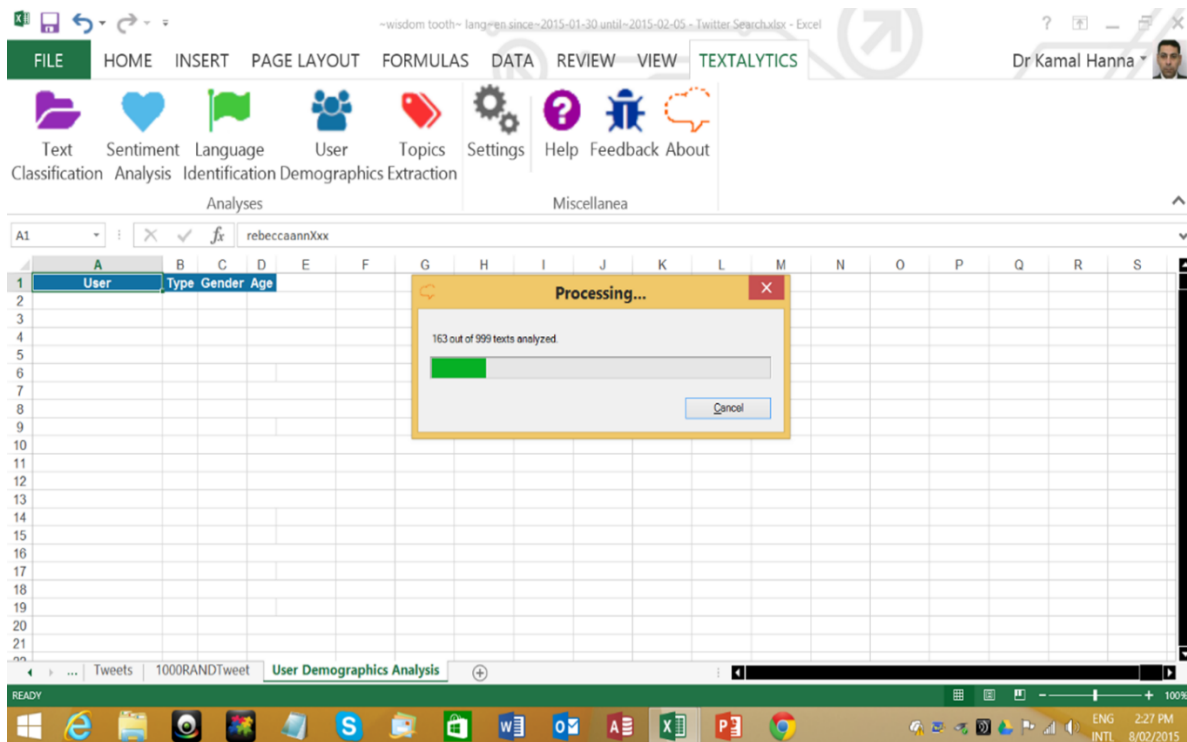


Figure 8: A screen shot of the Textalytic while obtaining a cloud-based tweeters' demographics

After this step, the researcher removed tweets from the same user ID using MS Excel remove duplicate function (n=43). After that process, the researcher classified the tweets' contents into a number of categories based on their nature: real-time reporting of TMs eruption, real-time post-extraction expression, future TMs extraction, recall old experience, inconclusive, not related, another person, commercial and refused advice. Details of this classification are shown in Figure 13: Tweets sample flowchart. This process resulted in n=843 tweets that will be included for thematic analysis.

Twitter data analysis

Thematic analysis for tweets' content

The researcher used the thematic analysis method as described by Braun, Clarke [32] [32] with some degree of flexibility due to the nature of the analyzed data. The tweets content thematic analysis was carried out by K. Hanna for the purpose of consistency and the nature of the project. The first step was to make the researcher familiar with the data which happened during the re-read procedure and by the production of tweets' content word cloud (Figure 9). A combined deductive/inductive approach for the thematic analysis was used to ensure that the main themes are relevant to the study aims while allowing the sub-themes to freely emerge. The three main themes were: Real-time TMs impact on QoL, Real-time pain description and actions that were taken by patients to resolve the TMs suffering. After the coding process, the observed themes were refined before the reporting stage. In addition, the researcher obtained frequencies of the coded themes and the direction of the association between them. For the rigorousness of the coding process the researcher presented an example of tweets and how they were coded into QoL domains in Table 6.

HRQoL tools were: Sickness Impact Profile (SIP) [48], Assessment Quality of Life (AQoL-8D) [49], Nottingham Health Profile (NHP) [50], Short Form health survey (SF-8) [51] and EuroQoL (EQ-5D) [52]. The assessed generic OHRQoL scales were: Oral Health Related Quality of Life-UK (OHRQoL-UK) [53], Oral Health Impact Profile-14 (OHIP-14) [54], Oral Health Quality of Life Inventory (OH-QoL-I) [55], Geriatric Oral Health Assessment Index (GOHAI) [56], Oral Impact on Daily Performance (OIDP) [57], and Dental Impact on Daily Living (DIDL) [58]. Based on the representation of domains of the assessed QoL instrument to the study-identified QoL domains, a percentage of coverage was calculated.

In order to test whether providing TMs patients with pre-consultation internet guidance on participation in decision-making and health-related outcomes, the researcher decided that a RCT design is the suitable design. In the following section, the researcher discussed the methodology used in the RCT which was titled “Engaging Patients in Decision-Making”.

Engaging Patients in Decision-Making: A Randomized Controlled Trial

The randomized clinical trial (RCT) is an experimental study design that is ranked highly in the hierarchy of the level of evidence in clinical studies [59,60]. Figure 10 shows the hierarchy of evidence in clinical studies.

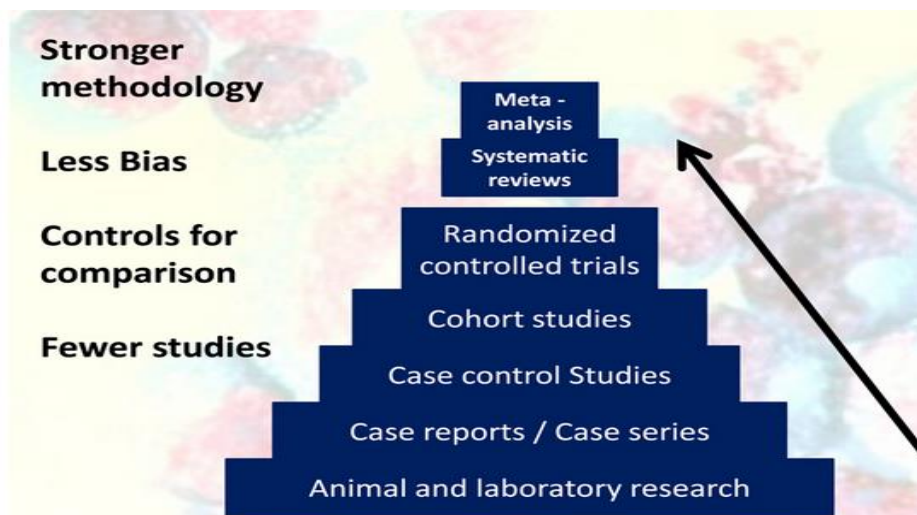


Figure 10: Study designs in clinical studies and its level of evidence⁴

Consolidation statement of reporting trial- patient reported outcomes (CONSORT-PRO)

Randomized controlled trials that are poorly designed are a major source of bias. Accordingly, CONSORT was developed as a guideline for better reporting of RCTs and to

⁴Source: MACQUARIE UNIVERSITY. *Types of study designs in clinical studies* [Online]. Available:

<http://libguides.mq.edu.au/content.php?pid=275601&sid=3485910>.

make it easy to interpret by study's authors [61]. It consists of a 25 item checklist that was published in 1996, revised in 2001 [62] and updated in 2010 [63]. Richards [64] has recommended using CONSORT guidelines to improve reporting of clinical trials in the field of dental public health. In March 2013, CONSORT extended its statement to include trials assessing patient reported outcomes [65]. They have recommended reporting the outcome as primary or secondary in the abstract, describing the hypothesis and domains of patient reported outcomes (PROs), the instrument used to report PROs and evidence of validity and statistical method used to deal with missing data. CONSORT-PRO guidelines were followed in reporting this research RCT.

Participants and setting

Using Adelaide Dental Hospital patient referral information, a list of possible participants who were aged 18 years and over, referred by their community dentist for wisdom teeth consultation (either impacted or not) were identified by the Oral and Maxillofacial Surgery Unit's administrative officer. All potential participants were sent the baseline package (Appendix III: Baseline survey package) that included: South Australia Dental Services' approach letter, participant's information sheet, consent form, complaint procedure information, baseline survey, a flyer for \$10 conditional gift voucher and a reply-paid envelope. The baseline package was sent to participants 2-3 weeks before their TMs consultation. Based on baseline survey data, participants' inclusion and exclusion criteria were checked before making them eligible for randomization. To be included in the study, participants need to sign the informed consent, complete the baseline survey, be aged 18 years and over, have internet access and apart from third molar problems be healthy (ASA I) or have mild systemic disease with no functional limitation (ASA II) [66]. Patients who are not English speakers and have major health problems were excluded from this study.

Operational flowchart for the RCT

The OMFS administrative officer identified potential RCT participants for our study, they were sent the baseline package. Once the signed consent and the baseline surveys were received, the researcher was authorized to access participant's contact details, patient information related to the study and the consultation appointment details. The researcher assessed the eligibility of including each participant against the determined inclusion and exclusion criteria. Eligible participants were then randomized by the study's researcher using an online randomization tool. The randomization was equal arm parallel groups' randomization with variable block sizes. The study group participants received a letter or e-mail (based on contact preference) with links to high quality internet resources before their TMs consultation. On the consultation day, participants were asked to complete their "Before and after Consultation Survey", and clinicians were asked to complete the clinician's survey. These surveys were collected from a designated folder for the study. The researcher was notified with the consultation outcome and the booked date for the surgery if the patient decided to proceed either under LA, LA+IV sedation or GA). After one month from either consultation (for those who decided to not to go for the surgery or after the surgery (for who decided to have the TMs surgical removal) participants were asked to complete a follow-up survey. Figure 11 is showing the operational process for the RCT.

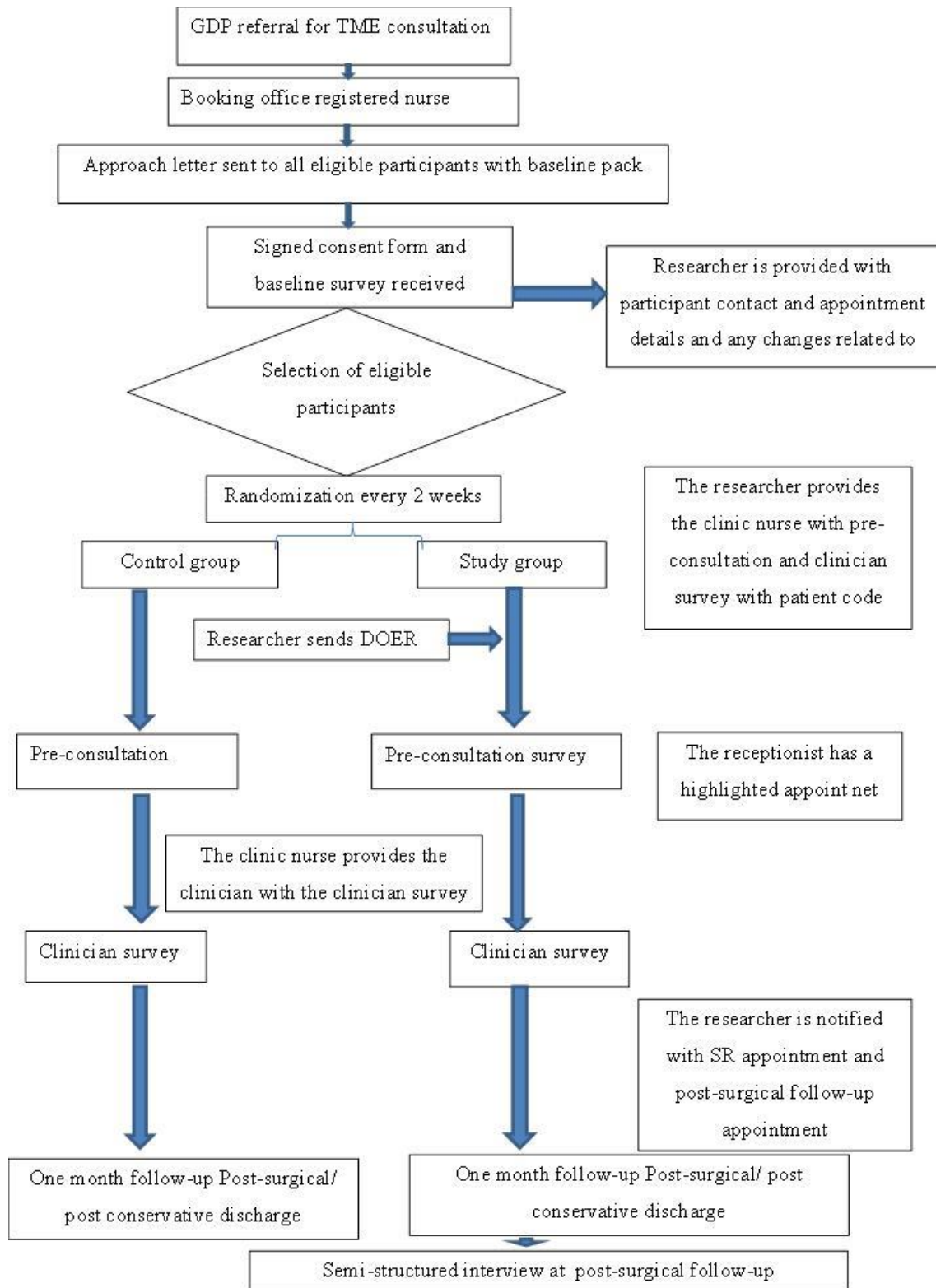


Figure 11: The operational process for “Engaging Patients in Decision-Making” RCT

Ethics approval and trial registration

Human Research Ethics Committees (HREC) approvals

The University of Adelaide HREC approval

The project was approved by the Low Risk Human Research Ethics Review Group (Health Sciences), University of Adelaide with an approval Number: HS-2013-23. The approval has been granted for the period of three years ends on 31 May 2016. A copy of the approval letter is found in Appendix I: Ethics approvals for the RCT.

Royal Adelaide Hospital (HREC) approval

The study National Ethics Application Form (NEAF) Ref: AU/1/F3A7115 underwent full HREC review as a requirement of NHMRC. The study was approved to be conducted at the Adelaide Dental Hospital and the East Adelaide Oral and Maxillofacial Surgery Clinic. The approval number is: HREC/14/RAH/160 which was granted on the 3rd of July 2014 (Appendix: I).

South Australia Dental Services (SADS) Site-Specific Assessment approval

The Site-Specific Assessment (SSA) application form ref: AU/12/AC1816 was approved for the Adelaide Dental Hospital and study operational authorization was granted on 17th July 2014 with authorization ref: 2014-07326/1. For more details see (Appendix: I).

REGISTRATION FOR RCT

The NHMRC requires all clinical trials to be registered on a publicity accessible website. accordingly, the clinical trial was registered on the Australian and New Zealand Clinical Trial Register with ACTRN: [ACTRN12614000593639](#) [67].

Randomization

Participants were enrolled by an independent person (administrative officer at The Adelaide Dental Hospital). Among the available randomization methods for clinical trials [68], the study used a variable block sizes and random seeds for randomization plan generation. The block size depending on the number of respondents to the study invitation [69] received every 1-2 weeks. Only eligible participants were considered for randomization and were assigned a sequential number. The researcher used an online randomization tool (randomization.com) [70]. This website allows for a variable block size randomization with random seed selection. The researcher was concealed to the allocation process as the website allows to enter the sequential participants ID and the researcher cannot predict the allocation because randomization seeds were randomly set by the website each time the randomization plan was generated. This randomization setting allows for equal arm in each randomization block used that allowed for equal arms at any point of participants' recruitment. Participants were randomized into two groups: study group and control group.

The intervention

Participants in the study group were sent a pre-consultation e-mail that contained links to high quality internet resources (Appendix IV: Online resources for wisdom teeth patients). These high quality internet consumer health information concerning wisdom tooth problems

were identified as an outcome of a published quality and readability assessment of these online resources by the researcher and co-authored by the researcher’s supervisors [71].

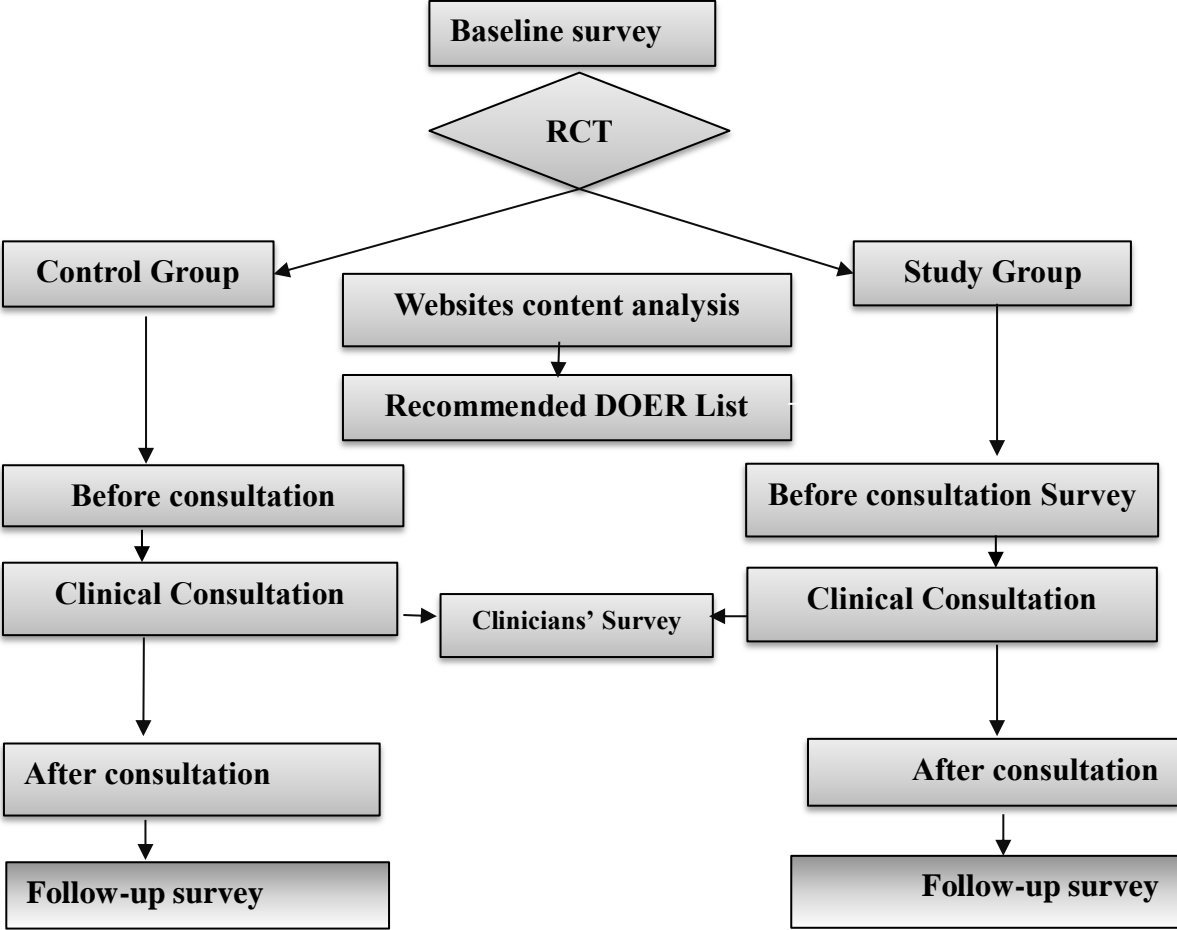


Figure 12: Engaging Patient in Decision-Making RCT flowchart

Sample size

The initial target sample size per each group was 250 participants. This calculation was based on the mean of OHIP-14 (primary outcome) among Australians of mean=5.82 (SD=8.59). In a recent study carried out by Brennan [72] and minimum important difference of OHIP

[73] generated a sample size of $n=47$ per group based on alpha 0.05 and power of 80%. However Brennan *et al.* [74] have reported that, 25% of persons have reported worsening in their oral health mainly due to dental extractions. This will require multiplying the sample by four times resulting in a sample size of ($n+188$ per group). As some of our study participants may not undergo surgical extraction because of a shared clinical decision-making, this will require inflation of sample size to compensate for this percentage or recruit until sample yield is achieved. In addition, this sample size exceeds the required sample size for using EuroQoL-5D as treatment outcomes variable [75].

The researcher performed a sample size calculation based on the collected OHIP-14 scores in this study mean=21.7 ($SD=14.5$) as they were different from the Australian norms. Using an online sample size calculator [76], a total of 186 participants are needed (93 per group) based on significance level (adjusted for sidedness) = 0.025, standard deviation = 14.5, number of patients = undefined, power = 0.8, difference in means = 6.

Data collection instruments and points

Baseline survey

This survey was posted to all eligible participants as a part of the baseline package (Appendix III: Baseline survey package.) that was sent to potential participants 2-3 weeks before their TM consultation. Based on information provided in this survey, a decision was made to include or exclude participants in our study using the criteria described earlier. This Survey is composed of the following components:

Participants' socio-demographic information

Participant's characteristics are important determinants of patients' use of the internet for health information [77], participation in decision-making [78] and health outcomes [79]. The following information were collected:

Age

Age is known to be associated with oral health literacy [80]. In addition, it is associated with increased preference for involvement SDM with a reported decline in the SDM involvement preference in the age of over than 45 years [81-83]. Participants are asked to report their age in years.

Gender

Despite gender having no significant impact on oral health [84] the situation may change when it comes to decision-making in relation to dental treatment. Non dental studies have found that, women are more likely to be prepared for consultation with an increased preference to participate in the SDM process [81,83].

Educational attainment

The level of education is found to be associated with oral health literacy [80,85]. Furthermore, patient educational level is found to be positively associated with the increase in participation in SDM process [81,83,86]. In addition educational level is associated with online health information seeking behavior [87]. Recording of the educational attainment has been formulated to suit the Australian educational system.

Income

Income impact on SDM dyad is important to be analyzed. Patients are required to make some contribution to their treatment costs and the selection of the treatment option is associated with individual's financial capabilities, [84,88]. As our study participants are given different treatment option to choose from if they are going to have the wisdom tooth surgically removed (under LA, IV sedation or GA) with variation in the associated costs. This variation might impact upon the decision-making. Moreover, income is positively associated with dental insurance cover, [89].

Our study participants are given the option of "I do not wish to declare" as an option to avoid missing data. In addition, the researcher has used income categories that are used for income tax rates for the period of 2012-2013 [90].

Dental insurance status

The South Australian state government provides access for eligible adults to have general dental treatment at public hospitals or community dental services. Eligible adults can have dental cover in the form of concession cards, health cards or DVA cards [91]. Non-eligible adults need to pay for their dental treatment directly or indirectly via private health insurance PHI [84]. The majority of Australian adults (80%) have their own PHI [89]. In addition, PHI contribution to treatment costs varies among insurers and their fund benefit policy. Accordingly, dental insurance status might, theoretically, have an impact on the dyadic SDM process.

Participants are asked to specify their dental insurance status as either: Uninsured, public cards (concession, health care or DVA) or private health insurance [91]. Moreover, if the study participants have PHI, and which policy: hospital policy only, general treatment policy only or hospital and general treatment policy [92]. Also, as the amount of fund benefit varies

across insurers for either public cards or PHI [93], participants are asked to provide the amount to which their insurer is willing to contribute to their treatment costs.

Ethnicity

Ethnicity background impacts upon the SDM process [86,94]. The researcher has chosen birthplace as an indicator for ethnicity in the questionnaire. In Australia, birthplace has been used as an indicator for ethnicity since 1871 [95]. Study participants were asked about their birthplace as Australia or other and if other, participants were asked to specify their birthplace country.

Language

Internet related information provided to our study participants was in English; accordingly, it is essential for participants in this study to be a native English speaker or at least have a good level of English language. Australia is a multicultural society, with current figures from Australian Census mentioning that 15% of the Australian population speaks a language other than English at home. Therefore, participants were asked to rate their English language fluency as: Excellent, Very good, Good, Fair or Poor. Participants reported fluency less than good were excluded from our study.

General health

As the general health status might impact the treatment outcome measure, the researcher decided that participants selected for the study needed to be healthy (ASA I) or have a mild health condition (ASA II) that is not affecting their quality of life for example hypertension, mild diabetes, chronic sinusitis, etc. ASA classification of patients undergoing surgical procedures is originally developed by Sakjad et al (1941) with several modifications after it has been adopted by The American Society of Anesthesiology. This approach has been used by researchers in selecting patients for measuring the impact of third molar surgery on their OHRQoL [96,97].

Presence of un-pleasant dental experience:

The impact of adverse previous experience was included in this survey as there has been a strong debate in the literature about its association with high levels of anxiety. While, Heaton *et al.* [98],[99] have concluded no association between unpleasant previous experience on dental anxiety, Acharya [100] has found an association. However, the researcher included this question in the baseline survey to identify whether participants' decision in relation to the anesthetic pathway is related to previous un-pleasant experience. In addition, the researcher through including this question in the pre-consultation survey may provoke dental anxiety.

Participant's decisional role preference

Participants are asked to report their preferences for involvement in making their dental treatment choice. This is important to compare the patient decisional role preference and their decision-making experience and if it acts as a predicting factor for the measure of SDM process. Participants were asked to select the most preferred theme of their decisional role as a "pick one" approach. Items (themes) of this the Control Preference Scale (CPS) which was developed by Degner *et al.* [101]. Chapple *et al.* [88] Validated its transferability of the CPS to dentistry. Items are representing the patient decisional role and have minor adaptation to this study by replacing the word of "doctor" in the original source by the word "dentist". Items are reflecting different roles that range from CPS scores of 5 for "I make the final decision" to 1 for "My dentist makes the final decision".

Internet access

Internet access is our main selection criteria and that our study participants must have access to the internet; and if they do not, they were excluded from the study. As the band width of

accessing the internet varies according to modality used to access the internet and may have a limiting factor on viewing online materials as interactive websites and video. Accordingly participants were asked to specify their line properties: either broadband, mobile internet, Wi-Fi hot spot, a cable or a dial up – as 86% of Australian households have broadband [102]. Device used to access the internet is important as it will have an impact on the materials that could be viewed. Some interactive websites need Adobe Flash Player which could not be installed on some mobile devices or even older versions of tablets or iPads while 80% of Australian households reported having a computer [102]. Therefore, participants were asked to report the most common device used to access the internet. Participants were asked from where they were commonly accessing the internet as this also might limit their internet use. In addition, participants were asked how frequently they are accessing the internet. As this might indicate their ability for using the internet for health related information [103].

Internet use for information

Internet use and information seeking behavior

Participants were asked whether they have used the internet to look for information about a dental procedure. In addition, they were asked to provide details for their dental procedural information seeking. These details included: the search engine used [12] and the used keyword [11] as they affect search outcome. In addition participants were asked to report the affiliation of the websites they have reviewed as website affiliation is associated with information quality [71]. Since the quality of these websites vary, participants might have discussed internet retrieved information with their dentist [104]. Therefore, participants were asked to report the dentist reaction to their request. Additionally, participants were asked whether they recognized one or more online health information quality seals and their meaning. To minimize the false positive response to this question, other internet related

quality seals were included such as Verisign Secure Site. Obtaining such information from our participants are important to understand participants' online information seeking and identifying potential gaps.

e-Health Literacy Scale (EHEALS)

The use of the internet for health information needs certain sets of skills which are the ehealth literacy skills. However, the researcher needed to explore whether the self-reported ehealth literacy were associated with better TMs knowledge. The researcher used the eHEALS which was developed by Norman and Skinner [105] and was widely used. The eHEALS is an 8-item self-reported ehealth literacy skill's attainment and items score on a 5-point scale ranging from 1 for "strongly disagree" to 5 for "strongly agree". Therefore, the total eHEALS score ranges from 8 to 40. Items were self-reported participants' ability to develop search keywords, where to search for information, ability to identify high quality information and their ability to use the information retrieved.

Perceived Online Information Quality Scale (POIQS)

The POIQS is a 5-item scale that was developed by the researcher in order to assess whether the perceived online information quality was associated with the ehealth literacy scores and TMs knowledge among TMs online information seekers. Items for POIQS scored on a 5-point scale ranging from 1 for strongly disagree to 5 for strongly agree. Items for this scale assessed the perceived readability, information understandability, trust, usefulness of information and information quality. The total POIQS scores ranged from 5 to 25.

Third molar knowledge (TMs knowledge)

The assessment of the usefulness of our intervention on patient's TMs knowledge demanded the researcher to develop a TMs knowledge questionnaire. The TMs knowledge is a 5-item

multiple choice questionnaire. It covers some TMs information domains such as reasons for TMs impaction, reason for TMs extraction, anesthetic options, extraction risks and post-operative instructions. If participant's response was correct, it was given the score of 1. If participant's response was incorrect, it was given the score of 0. Therefore, the total TMs knowledge scores ranged from 0 to 5. TMs Knowledge was assessed at baseline and immediately before consultation. TMs knowledge is a secondary outcome. Moreover, participants were asked to report if they have an extraction experience as an adult as this is known to have positive impact on patient knowledge for third molar extraction [106].

The Satisfaction Scale

Patient satisfaction is an outcome measure of the study intervention; accordingly, a baseline satisfaction scale was included in order to compare with the follow-up survey. The Satisfaction Scale is a 7-item scale developed by the researcher to measure patients' satisfaction. Participants were asked to rate satisfaction with the information provided (verbal, leaflet and internet resources), satisfaction with the consultation time, satisfaction with the made decision, satisfaction with the care provided and whether they will recommend their dentist to a family member or a friend. Items for the Satisfaction Survey are measured on a 5-point scale that ranged from 1 for strongly disagree to 5 for strongly agree. The Satisfaction Scale scores ranged from 7 to 35, and were measured as a secondary outcome at baseline and follow-up.

Global general health and oral health

The global oral health question acts as an overall measure of patient perceived oral health [4]. The single-item global oral health measure was used as an instrument to measure change in oral health as an outcome of dental treatment [107,108]. Global oral health is a self-

reported single item question and participants were asked to report their perceived oral health on a 5-point scale ranging from 1 for poor to 5 for excellent. The same principle applied for using the global general health.

The Oral Health Impact Profile-short form (OHIP-14)

The OHIP-14 is a 14-item tool that measures psycho-social impact of dental problems which was developed by Slade [54], as a shorter version of the original OHIP-49. Although the OHIP-14 was not originally designed to be a measure for OHRQoL, it has become widely used as an OHRQoL measure. In addition, OHIP-14 shows responsiveness as an outcome for TMs extraction [109]. The OHIP-14 consists of seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Each one of these domains is represented by two items. Each item measures on 5-point scale ranges from 0 for never to 4 for very often. The total OHIP-14 scores range from 0 to 56. The OHIP-14 is one of the primary outcome measures and was collected at baseline and follow-up.

EuroQoL EQ-5D-5L

The EQ-5D-5L was developed as a measure of health profile by The EuroQol Group [110]. It consists of 5 QoL domains and each domain is represented by one item. Items for the EQ-5D-5L are scored on a 5-point scale range from 0 if they have no problems to 5 if they have extreme problem/unable. The EQ-5D-5L scores range from 0 to 20. It is one of the primary outcome measures and collected at baseline and at follow-up.

Before and after consultation survey for participating patients

This survey (Appendix VI: Before and after consultation survey) was designed to re-assess patients' TMs knowledge and dental anxiety and fear. In order to be able to analyze data, it

was important to know whether participants in the study group have reviewed the provided internet resources. As participants were randomly allocated to either study or control group, participants were given three options: Yes, No (I have been provided with internet resources but I have not reviewed them) or No (I have not been provided with internet related resources). Then participants complete the next two sections of the survey:

Third molar knowledge

Participants were asked to complete TMEs knowledge in order to assess the improvement in patients' knowledge due to our study intervention. This section was asked immediately before consultation using the same questionnaire items used at baseline (secondary outcome).

The Index of Dental Anxiety and Fear (IDAF-4C)

The IDAF-4C which was developed by Armfield [111] has a well-developed theoretical framework that is based on the four main domains: emotional, behavioral, physiologic and cognitive component of fear. This makes the IDAF-4C conceptually better than other anxiety measures which are argued to measure the emotional aspect of fear [121]. The IDAF-4C consists of an eight-item self-reported questionnaire. Items are scored on a 5-point scale ranging from 1 for disagree to 5 for strongly agree. The total IDAF-4C scores range from 8 to 40. The IDAF-4C is a secondary outcome.

Participation in Shared Decision-Making using SDM-9Q-Pt

SDM-9Q--Pt is the patient's version of the dyadic SDM-9Q developed by Kriston *et al.* [112].

It consists of 9-items where patients report their participation in the SDM process on a 6-point scale ranging from 1 for strongly disagree to 6 for strongly agree. Items have been

adapted to be used in this research by substituting the word “My doctor” with “my oral surgeon”. The total scale scores range from 9 to 51. Details of item wording are found in Appendix VI: Before and after consultation survey.

Decisional control experience

Participants were asked to report their decisional role experience—an approach that was used by Chapple et al. [88] using the Control Preference Scale [101] to measure the decisional role experience in the dental field. This question is of importance to measure the difference between the decisional role preference and the perceived decisional experience on the SDM measure and on patient satisfaction.

Clinicians’ survey

The participating clinicians were asked to complete this survey in relation to each study participant (Appendix V: Clinician’s survey). A consent form was obtained from each of the participating clinicians. This survey was completed immediately after consultation and the participating clinicians were asked to place the completed surveys in the folder provided in each clinic. The clinicians’ survey consists of the following sections:

Clinician initials

This is important in order to nesting participants within the clinicians for subgroup analysis. This approach has been used by Scholl *et al.* [113] for analysis of SDM process measurement especially with the use of SDM-9Q.

Reason for referral for TME

There has been a debate through the literature in relation to prophylactic third molar extraction whereas Mettes et al. [114] have not found RCT evidence that reports the quality of life among extraction versus retention of asymptomatic impacted TMs. As our study is

concerned about the impact of providing patients with internet guidance on participation in SDM process to improve the health care outcomes, the researcher included the reason for referral for TME [115] to reach evidence to support this argument. The question for the reason for referral has been formulated from analysis of the indication mentioned by the clinicians for TME by Bataineh et al. [115] and have summarized them into: periodontitis, caries, orthodontics, pathology and prophylactic.

Tooth/Teeth referred for consultation

Participating clinicians were requested to provide information regarding tooth/ teeth for which the patient was for consultation. This is to determine the decision outcome when it is compared to the number of teeth planned for surgical removal.

Consultation outcome

The clinicians were asked to provide details about the consultation outcome. As the decision may vary according to the agreed decisional plan, clinicians were asked to select a decision from a list of possible options as: discharge (no further treatment is required), the decision deferred (due to hesitation or lack of resources by the patient), or surgical removal categories (under either LA, LA+ IV sedation in an outpatient/hospital, or GA either a day case or as a hospital inpatient). Clinicians were given an open answer as other to specify any other alternative which was not mentioned in the choices. This section is important in analysis of the impact of providing patients with internet guidance on the decision outcome (secondary outcome).

Tooth/ teeth decided on surgical removal and their position

The position of impacted third molar might be associated with surgical difficulty that might affect OHRQoL [116]. In addition, the impact of the number of teeth removed might have

an impact on the oral/ general health quality of life. This question allowed us to know whether the intervention provided has an impact on number of TMs decided on extraction. Furthermore, this might allow the researcher to follow-up the retained TMs and their impact on OHRQoL. Several classifications have been used for positioning of third molar. This classification reflecting the surgical difficulty associated with the impacted third molar [117]. The researcher selected two classification systems: angulation of the impacted third molar and its position in relation to the second molar.

Clinician satisfaction

Participating clinicians were asked to rate their satisfaction with the consultation time as an indicator for the efficiency of time usage. Moreover, the clinicians were asked to rate their satisfaction with the patient's TMs knowledge. These items were developed by the researcher and were measured on a 6-point scale that ranged from 1 for completely disagree to 6 for completely agree. These items were secondary outcomes.

Participation in SDM from the clinician's perspective using the SDM-9Q-Doc

The SDM-9Q-Doc is part of the SDM-9Q dyad which was developed by Scholl *et al.* [118]. The SDM-9Q-Doc consists of a 9-item scale which are worded very closely to the patient version. It is a self-reported scale on which the clinicians' responses were recorded on a 6-point scale ranging from 1 for completely disagree to 6 for completely agree. No adaptation was required for the clinician version of SDM-9Q-Doc. The SDM-9Q-Doc ranges from 9 to 51. The SDM-9Q-Doc is one of the primary outcomes.

Follow-up survey

This survey was given to both groups at one month post-operatively for patients who have TME or one month after consultation for patients who have decided not to go for surgery (Appendix VII: Follow-up survey). The determination of the one month period after the TMS is to prevent the immediate post-operative symptoms to have an impact on QoL. The immediate post-operative phase is associated with deterioration in the OHRQoL over the first four post-operative days and gradually improves with no significant difference with the pre-operative scores at the end of the first post-operative week [96,119,120]. Some of the follow-up questionnaires are identical to those in the baseline survey in order to compare with it, however, some items are added to this survey to compare between study and control group treatment outcome and exploring the internet use in case of developing complications. This survey has the following components:

OHIP-14 and EQ-5D-5L

The OHIP-14 was used as a treatment outcome measure by McGrath et al. [120] and Kieffer et al. [109]. The researcher used the reference period of 2 weeks in the follow-up survey to avoid coverage of the post-extraction peak. The EQ-5D-5L reference period was the same (today). Both measures were primary outcomes.

Patient satisfaction

Participants were asked to rate their satisfaction with their TMs visit to Adelaide Dental Hospital. Items were similar to the Satisfaction Survey at baseline. This scale is secondary outcome.

Transitional statement for oral and general health

This is a single item used to report change in oral and general health due to receiving a treatment. It is a comprehensive measure which acts as a gold standard in measuring changes due to providing an intervention [73]. Transitional health statement was recorded on a 5-point scale (worsen a lot, worsen a little, stayed the same, improved a little, improved a lot).

Post-surgical complication and internet information seeking

Patient education is known to have an impact on reducing post-operative complications, especially dry socket [121]. Accordingly, participants were asked to report if they have experienced any post-surgical complications that required them to seek advice before their follow-up date and if so, they needed to provide details of these problems. Participants were asked if they seek more information over the internet for their problems and if they have used the provided internet resources or if they carried out their internet search. In addition, for participants who have not been provided with internet resources, they were given the opportunity to declare if they carried out their own search. Participants were asked to rate the reviewed internet information using the POIQS used in the baseline survey.

Global general health and oral health scoring

As mentioned in the baseline section, global oral and general health provides a comprehensive self-reported statement on participants oral and general health today rather than the descriptive way in either for OHIP -14 [107] or EuroQoL- 5D-5L. It is a secondary outcome measure.

Achievement of the treatment goal

This section will test the achievement of treatment goals.

Data analysis for “Engaging Patients in Decision-Making”

Data collected for “Engaging Patients in Decision-Making” were used in this dissertation in 3 different original papers: Two original papers based on analysis of the collected baseline data and the third paper was based on data analysis for primary and secondary outcomes at the consultation stage of the RCT. In the following section, the researcher detailed the statistical analysis methods used to answer the aims of these studies.

Baseline data analysis

Data analysis methods used in the study outlining internet use, online information seeking behavior and knowledge among third molar patients

Data analysis methods used in this study was outlined in Chapter 8 (paper 4): Internet use, online information seeking behavior and knowledge among third molar patients attending South Australia Dental Services however they are briefly described here. Descriptive statistics were used to explore our participants’ characteristics and χ^2 bi-variate associations were used to explore participants’ characteristics associated with internet use for dental information. In order to explore factors contributing to internet use for dental procedural information, a binomial logistic regression was used. For eHEALS and POIQ Scale, Cronbach Alpha reliabilities were obtained. In order to understand whether the reported eHEALS and POIQS scores were associated with TMs Knowledge among online TMs information seekers, Person correlation coefficients were obtained. To explore whether

different levels of internet use were associated with TMs knowledge scores, One-Way ANOVA was used.

Data analysis methods used in the study outlining the preferences of dental decisional control and associations with quality of life

Data analysis methods used for this study were described in [Chapter 9](#) and were briefly described in this section. In addition to descriptive statistics, the researcher used χ^2 bi-variate associations to explore individual characteristics associated with preferences for dental decisional control. Factors contributing to preferences for decisional control were explored in an adjusted analysis using multinomial logistic regression model. Linear regression models were used to explore the associations between dental decisional control preferences and QoL measures used (OHIP-14 and EQ-5D-5L) in an adjusted analysis.

Consultation stage data analysis

Data collected were analyzed using Intention To Treat (ITT) approach as it is known to preserve randomization [122] however the researcher also performed a supplementary Per-Protocol Analysis (PPA) using the variable detailing the review of the provided information (Before and after Consultation Survey). Missing data were not replaced. The researcher presented participants' flowchart till that stage. Participants' individual characteristics and their baseline measures were compared between groups using χ^2 associations and Independent samples *t*-test to ensure that randomization was successful. For testing, continuous primary and secondary outcome measures since randomization was found to be successful, Independent samples *t*-test was used. For testing the secondary outcomes which were reported on ordinal scales, Mann–Whitney *U*-test was used. Furthermore, the

researcher used linear regression model to explore the association between TMs knowledge scores and participation in SDM after adjusting for RCT group.

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**Chapter 4 (paper1): Wisdom teeth
extractions among Australian adults:
Findings from the 2013 National Dental
Telephone Interview Survey**

Linkage to the body of work

This article is serving as an introduction to current state of third molar extraction in Australia. Previous literature suggests that Australia have seven times the hospitalization rate for wisdom teeth extraction when compared to other countries such as the United Kingdom. In this manuscript, the researcher explored variables associated with numbers of third molar extractions. In addition, we examined whether the number of wisdom teeth extraction is associated with self-rated general health. In addition, we explored whether wisdom teeth extractions at the age of 18-25 years versus older age group is associated with less days absent from work/study as a justification for prophylactic wisdom teeth extraction in young age.

Highlights

- Multiple wisdom teeth extraction was more prevalent than single wisdom tooth extraction.
- Dental insurance and having no tertiary qualification was associated with higher number of wisdom teeth extractions while each year increase in age was associated with fewer wisdom teeth extractions.
- The number of wisdom teeth extractions was not associated with self-rated dental health in the short term (less than 12 month) while it was associated with more days absent from work/ study as a consequence of wisdom teeth surgery.
- Receiving wisdom teeth extractions at 18-25 years versus older age group was not associated with number of days absent from work/study. This might question the use of age as a justification of prophylactic wisdom teeth extraction.

- Dentally insured might be subjected to possible over-management since no benefit for multiple wisdom teeth extraction was observed on self-rated oral health.

Future research direction

- Since current evidence doesn't support the prophylactic extraction of asymptomatic disease-free wisdom teeth, patients might benefit from receiving evidence-based information before consultation to allow time for absorbing and processing the provided information.
- To test the impact of providing evidence-based information upon participation in decision-making and decision outcomes might need to be evaluated in a randomized controlled trial.
- A randomized controlled trial might be needed to study the effect of receiving wisdom tooth extraction at the age of 18-25 years versus older age group upon the number of days absent from work/study as a consequence of wisdom tooth surgery. This might be important for age optimization for wisdom tooth extraction.
- Over-utilization of dental services associated with private dental insurance needs to be explored in Australia.

Statement of authorship

Title of Paper	Wisdom teeth extractions among Australian adults: Findings from the 2013 National Dental Telephone Interview Survey
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input checked="" type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Sambrook P, Armfield J, Jamieson L, Brennan B. Wisdom teeth extractions among Australian adults: Findings from the 2013 National Dental Telephone Interview Survey. <i>Int J Oral & Maxillofac Surg.</i> 2016; XX(X).

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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 to 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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Abstract

Objectives: To identify, over the past 12 months, whether: (1) dental insurance is associated with a higher number of third molar extractions (TME); (2) single versus multiple TME is associated with self-rated oral health; and (3) TME when aged 18-25 years is associated with fewer days absent from work due to dental problems.

Methodology: Australia's 2013 National Dental Telephone Interview Survey data that included: socio-demographics, in the past 12 months: number of extractions, extractions reasons, self-rated oral health and days absent from work due to dental problems.

Results: The majority of TME recipients were female (56.6%, SE=6.0%), aged 18-25 years (63.0%, SE=5.4%), with no tertiary qualification (79.5%, SE=5.4%), with a total annual household income of \geq \$60,000 (58.3%, SE=6.4%), dentally insured (52.6%, SE=6.2%) and received multiple TME (60.9%, SE=8.5%). Number of TME was associated with dental insurance ($B=0.97$: 95% CI: 0.5 to 1.5) and days of work absence due to dental problems ($B=1.10$: 95% CI: 0.26 to 1.94). Receiving single versus multiple TME was not associated with self-rated oral health ($B=-0.25$: 95% CI: -0.76 to 0.25). Receiving TME when aged 18-25 years versus older age groups was not associated with days absent from work due to dental problems ($B=0.48$:95% CI: -0.37 to 2.33).

Conclusion: Dental insurance was significantly associated with number of TME, indicating a possible over-management. Because there were no associations between younger versus older age groups with respect to number of days absent from work due to dental problems, using age as a justification for prophylactic TME might be questionable.

Keywords: Third molar, wisdom teeth, National Dental Telephone Interview Survey, NDTIS, dental insurance, Australia, self-rated oral health, extraction and over-management.

Introduction

Australia has one of the highest rates in the world of hospitalization for third molar extractions [1] which might suggest that they are prophylactically removed. Third molar extractions are performed by an experienced dentist or an oral surgery specialist. In Australia, the majority of dentists work in the private sector [2] while the majority of oral and maxillofacial surgeons work in both private and public sectors [3]. Current figures indicate that 55% of Australians have “general treatment” private health insurance [4] which covers the surgeon fees for third molar surgery, while 47% of Australians have “hospital policy” insurance, which covers the hospitalization and anaesthetist fees for third molar surgery [5]. While third molar patients eligible for public dental services face a long waiting list to be consulted and another waiting list for receiving third molar surgery [6], privately insured third molar patients face almost no waiting list to receive third molar extraction. Although the Australian Dental Association [7] does not refute or support the prophylactic third molar removal, it recommends to leave the decision to patients to decide with their dentist. Considering that clinics are often over-booked [8], third molar patients might be hindered in being adequately informed [9]. Additionally, evidence from a United States study shows that the privately insured are more likely to adhere to their dentist’s recommendation for prophylactic third molar extraction [10]. Furthermore, some dentists are encouraging their patients to use their dental insurance since they have paid for it and to avoid future out-of-pocket payments [11]. Accordingly, it might be argued that the possession of dental insurance might be associated with a higher number of third molar extractions received.

Third molar surgery is the most commonly performed oral surgical procedure [12] and might be performed for several reasons: to eliminate a local problem such as pericoronitis, untreatable decay, periodontitis, association with pathology, facilitating orthodontic treatment or prophylactically to prevent future problems [10]. The current evidence doesn't support the prophylactic removal of asymptomatic disease-free third molars [13,14], with suggestions made for more research to evaluate the impact of retention versus extraction of asymptomatic third molars upon patient-reported outcomes in the short-term and long-term [14]. The lack of evidence that supports prophylactic third molar extraction results in national guidelines in countries such as the United Kingdom [15] that prohibit the prophylactic extraction of asymptomatic disease-free impacted third molars. However, in Australia, it is argued that such guidelines were economically-driven and will defer the problem [16]. Receiving multiple third molar extractions at a very short interval might suggest their prophylactic extraction. Therefore, identifying whether single versus multiple third molar extraction is associated with self-rated oral health might provide some evidence, in the short term (less than 1 year), from a representative population-based study, towards the benefit/risk for prophylactic third molar extractions.

Third molar surgery might be performed across a wide spectrum of age. Some dentists recommend their young adult patients to have their third molars prophylactically removed to get "peace of mind" of developing future infection [17]. In addition, it is argued that age is a risk factor for post-operative complications [18] leading to a prolonged recovery [19]. In contrast, others argue that the occurrence of these complications is attributed to the experience of the surgeon and the patients use of tobacco [20]. Although Tolstunov [21] recommends the extraction of both symptomatic and asymptomatic third molars at age 16-25 years, Santosh [20] argues against the use of age as a reasonable justification for

performing a prophylactic third molar removal. In addition, previous studies indicate that number of third molar extractions is significantly associated with prolonged recovery [19] as a result of increased surgical trauma. Developing problems such as infection before the surgery and/or post-operative complications in older age group will have a reflection on the number of days absent from work/school due to dental problems. Therefore, further exploring the association between the age range in which third molar extractions are received and number of days absent from work/school due to dental problems will help in consolidating the current evidence and optimizing third molar extraction decision-making.

The aim of this study is to identify, over the past 12 months, whether: (1) having dental insurance is associated with a higher number of third molar extractions; (2) receiving single versus multiple third molar extractions is associated with self-rated oral health in the short term; (3) receiving third molar extractions when aged 18-25 years versus older age groups is associated with a fewer number of days absent from work/school due to dental problems.

Methodology

Data sources and ethical approval

This study utilizes data from the 2013 National Dental Telephone Interview Survey (NDTIS) which is a random representative sample of residents of Australia aged 5 years and over who reside in a household that has a telephone line. Data were collected from June 2013 to March 2014. Only records representing adults aged 18 years and over were included in the current analysis. The 2013 NDTIS received ethical approval from the University of Adelaide Human Research Ethics Committee (HS-2013-014).

Sampling method

The 2013 NDTIS sampled Australia's residents using an overlapping dual sample frame design targeting residents in households that have a telephone line. The first sampling frame comprised sampling of households listed on an electronic White Pages obtained from "Australia on Disc, 2012" supplied by United Directory System. Records from this frame were sampled using two stage stratified random sampling approach, where records were stratified by state/territory then by capital city or rest of the state. A specified sampling fraction was used for selecting records from each sub-stratum. The initial telephone contact was with an adult who was aged 18 years or over. To account for residential households that were not listed on the Electronic White Pages, a second sampling frame was used which comprised 20,000 randomly-generated mobile telephone numbers supplied by Sampleworx. The selected records from the mobile sampling frame were not stratified due to the lack of geolocation before establishing the initial contact. The sampling methods resulted in 6340 responses from adults aged 18 years and over with an average response rate of 34.4%. The 2013 NDTIS data were checked for quality and weighted [22].

Variables

The telephone interview asked participants to provide the number of dental extractions they had received over the past 12 months. The reason for such extractions were then asked, for example, wisdom teeth, orthodontic treatment, periodontal disease, etc. Data for this analysis were included if a response of 'yes' was provided for the question pertaining to third molar extraction only. A dichotomous variable was created for multiple third molar extraction, based on the number of third molar extractions received. Other variables included participants' socio-demographics (age in years, gender, total annual household income and highest level of education), dental insurance status and self-rated oral health (a global item

with responses ranging from 1 for 'poor' to 5 for 'excellent'). Participants were asked "In the last 12 months, how many days have you stayed away from work/place of study for more than half the day because of any dental problems you had?".

Data analysis

Data analysis was conducted using the complex samples module [23] in SPSS statistics for Windows v. 23.0 [24]. A specified sampling plan was provided by the 2013 NDTIS data custodian to account for the complex sampling design. The selected subpopulation was participants who responded "Yes" to "had third molar extraction" in the past 12 months. Using the complex sample module, estimates of population size with standard error for these estimates were obtained. Generalized Linear Models were used to identify associations between: (1) dental insurance and third molar extractions; (2) Single or multiple third molar extraction with self-rated oral health (in the short term) and; (3) age (18-25 years versus 26+ years) and days absent from school/work due to dental problems.

Results

The unweighted count for those who responded 'yes' to third molar extraction was $n=120$ participants representing a total population of $n=440026.6$ ($SE=53722.7$) with an estimated prevalence of 25.6% ($SE=2.7\%$) among those who received dental extractions over the past 12 months. The majority of those who received a third molar extraction were in the 18-25 years' age category (63.0%, $SE=5.4$), with a higher proportion of these being female (56.6%, $SE=6.0\%$) (Table 2). A higher proportion of those reporting a third molar extraction did not have a tertiary qualification (79.5%, $SE=5.4\%$) and were living in households with a total income of \geq \$60,000 annually (58.3%, $SE=6.4\%$). Just over half the respondents reporting

third molar extractions had dental insurance (52.6, $SE=6.2\%$). Around 60 percent of participants received multiple third molar extractions during the past 12 months ($SE=5.8\%$).

Dental insurance and low education status were associated with a higher number of third molar extractions when adjusted for gender and annual household income in multivariable modelling (Table 3). Each year increase in age was associated with a lower number of third molar extractions received. After adjusting for age, gender, income, education and dental insurance status, single versus multiple third molar extraction was not associated with self-rated oral health in the short-term (Table 4).

Receiving third molar surgery when aged 18-25 years versus older age groups was not significantly associated with work/school absenteeism when adjusted for in multivariable modelling (Table 5). However, the number of third molar extractions was significantly associated with the number of days absent from work/school due dental problems.

Discussion

Our findings suggest that having dental insurance was associated with increased number of third molar extractions over the past 12 months among Australian dentate adults aged 18 years and over. This indicates that dentally insured adults might be subjected to over-management since there was no significant association between the number of third molar extractions and self-rated oral health. Although number of days absent from work/school due to dental problems was associated with number of third molar extractions, they were not associated with receiving third molar extraction when aged 18-25 years versus older age group.

The observed association between dental insurance status and third molar extractions might be due to the enabling effects of having dental insurance. The pattern of the association between dental insurance and third molar extractions was opposite to what has been previously reported for extractions in general in the Australian population [25]. The observed difference might be due to the reason for extraction, which differs between third molars and other teeth. Extractions other than third molar or for orthodontic treatment are mainly related to untreatable decay or advanced periodontal diseases [26] which are known to be less prevalent among the dentally insured [27]. While a previous Australian study indicates that hospitalization for third molar extraction is associated with socio-economic status [28], we observed that dental insurance was associated with a higher number of third molar extractions independent of where the surgery was performed. Our findings suggest that, on average, having dental insurance was associated with receiving an additional one third molar extraction when compared with the non-insured over the past 12 months. This indicates that the dentally insured might be subjected to a possible over-utilization, which has been suggested in previous reports [1]. Despite insurance cover for third molar extraction varying based on selected policy, type of the chosen health and dental cover, some researchers suggest that dental insurance status makes the majority of patients decide on third molar prophylactic extraction [10]. In fact, some clinicians recommend their patients use their dental insurance cover since they have already paid for it [11]. Some scholars recommend prophylactic third molar extraction when general anesthesia is used if they are not associated with an anatomical risk [29]. In addition, Steed [30] recommends prophylactic removal of the opposing third molar simultaneously in the same operation if there is no anatomic risks to avoid future super-eruption. Private health insurance is reported to have an association with over-utilization of health care system in other countries such as the United States [31] in general and at the dental service-level [32] after adjusting for health status.

Multiple third molar extraction was more prevalent in our sample compared with single third molar extractions. Single versus multiple third molar extraction was found not to have a significant association with self-rated oral health in the short term. This adds to the ongoing argument regarding third molar prophylactic removal [13,14]. These findings might suggest the need to provide third molar patients with pre-consultation evidence-based resources and to investigate the association with third molar decision-making and decision-outcomes (currently in progress [33]), since previous studies indicate that clinics are over-booked [8] which might result in patients being inadequately informed [9].

The observed association between number of third molar extractions and number of days unable to work/attend school due to dental problems that served as a proxy for third molar extraction recovery is consistent with previous reports explained by the increase in surgical trauma [34] and consequently prolonged recovery period [19]. It has been argued that performing prophylactic third molar extraction among those in younger age groups is not justified by the increased risk of developing post-operative dry socket which was found to be associated with lack of clinician experience and patient tobacco use [20]. Our findings suggest the need for further exploration of this area in a randomized controlled trial before making a clinical recommendation, since evidence from smaller studies suggests that patient's age does not significantly contribute to surgical difficulty in third molar removal [34].

A limitation of our study was possible recall bias associated with the extraction event and the reported number of third molar extractions received over the past 12 months [35]. Although our sample is a representative sample of Australia residents, the unweighted count

of those who have received third molar extraction was small. Another limitation might be related to the use of the number of days absent from work/school due to dental problem as a proxy for pre-extraction problems and/or recovery period and the unavailability of data about life-threatening infection. On the other hand, our study has several strengths. It contributes to the field of health care quality by revealing the possibility of over-management that third molar patients might encounter if they have dental insurance. Our study adds to third molar extraction decision-making by identifying the lack of association between multiple versus single third molar extraction and self-rated oral health in the short term.

Conclusion

Being dentally insured versus non-insured was significantly associated with a higher number of third molar extractions reported by Australian adults aged 18 years or over. Receipt of single versus multiple third molar extraction was not significantly associated with self-rated oral health in the short term. This might question the benefit of receiving multiple third molar extractions in the short term which results in a significant increase in the number of days absent from work/school. Based on these findings, it is possible that dentally insured participants might be over-managed in the dental setting, which could expose them to unnecessary risks. Over-management associated with private insurance is discussed for health care services in general and on the service-level for dental procedures. In addition, there might be a need to improve pre-consultation patient understanding of the uncertainty related to prophylactic third molar extraction and investigate how this might affect third molar decision-making and decision-outcomes since previous studies suggest that third molar patients are not adequately informed. Although it is widely believed that performing third molar extraction at the age of 18-25 years reduces risks of developing dentally-related

problems and/or post-operative recovery when compared with an older age groups, we observed no significant association with the number of days absent from work/school due to dental problems. This might question the use of age as a justification for prophylactic third molar extraction. The need for further studies that address age optimization for third molar extraction is recommended.

Acknowledgement

This research was part of the principle author PhD project for which an Adelaide Scholarship International was received. The research received support from The Australian Research Centre for Population Oral Health (ARCPOH), The University of Adelaide. The authors of this study acknowledging the support provided by the Australian Government Department of Health (AGDoH) and the Australian Institute of Health and Welfare (AIHW) to the NDTIS.

Declaration of conflicting interests

The Authors declare that there is no conflict of interest.

Table 2: Subpopulation characteristics of those who have received third molar extraction

	Population Size		N %	
	Unweighted count (<i>n</i> =120)		Estimate	Standard Error
	Estimate	Standard Error	Estimate	Standard Error
Age group				
18-25 Years	277359.3	46194.5	63.0%	5.4%
≥ 26 years	162667.3	25271.8	37.0%	5.4%
Gender				
Male	193656.3	33314.8	44.0%	6.0%
Female	246370.3	40351.3	56.0%	6.0%
Qualification				
No	114747.5	27024.5	26.1%	5.4%
Yes	325279.0	44372.9	73.9%	5.4%
Household income				
< \$60,000	153921.7	31122.5	41.7%	6.4%
≥ \$60,000	153921.7	31122.5	58.3%	6.4%
Whether have private dental insurance				
Yes	203138.7	35145.6	47.4%	6.2%
No	225593.5	38329.0	52.6%	6.2%
Single or multiple third molar extraction				
Single TM extraction	170993.3	29231.7	39.1%	5.8%
Multiple TM extraction	265811.4	43244.1	60.9%	5.8%
Self-rated oral health				
Poor	23299.6	11611.3	5.3%	2.6%
Fair	51650.8	20624.7	11.7%	4.4%
Good	111623.2	28988.1	25.4%	5.6%
Very good	198538.3	33979.6	45.1%	6.1%
Excellent	54914.7	16060.2	12.5%	3.5%
Total	440026.6	53722.7	100.0%	0.0%
			95% Confidence Interval	
	Estimate	Standard Error	Lower	Upper
Mean number of days absent	2.1	0.4	1.3	2.9

Table 3: Complex samples linear regression model for the number of third molar extractions

Parameter	Estimate	95% Confidence Interval		P value
		Lower	Upper	
(Intercept)	2.195	1.483	2.908	<.01
Qualification				
No	1.217	0.546	1.888	<.01
Yes	.000 ^b			
Have a private dental insurance				
Yes	0.972	0.486	1.458	<.01
No	.000 ^b			
Gender				
Male	0.377	-0.267	1.020	.251
Female	.000 ^b			
Age (years)	-0.027	-0.045	-0.009	.003
Total household income	0.000	-0.058	0.059	.990

Subpopulation: Had extraction for wisdom teeth = Yes

a. Model: Number extractions in last 12 months = (Intercept) + qualification + insured + sex + age + income

b. Set to zero because this parameter is redundant.

Table 4: Complex samples general linear model for self-rated oral health

Parameter	Estimate	95% Confidence Interval		P value
		Lower	Upper	
(Intercept)	3.20	2.40	4.00	.013
Gender				
Male	.12	-.34	.59	.604
Female	.000 ^b			
Qualification				
No	-.69	-1.29	-0.10	.022
Yes	.000 ^b			
Have a private dental insurance				
Yes	.45	-.07	.97	.088
No	.00 ^b			
Multiple third molar extractions				
No	-.25	-.76	.25	.325
Yes	.000 ^b			
Age (years)	.00	-.02	.01	.901
Total household income	.04	-.02	.10	.227

Subpopulation: Had extraction for wisdom teeth = Yes

a. Model: Self-rated dental health = (Intercept) + sex + qualification + insured + multiple TM extractions+ age + income

b. Set to zero because this parameter is redundant.

Table 5: Complex samples general linear model for the days absent from work/school due to dental problems

Parameter	95% Confidence Interval			P value
	Estimate	Lower	Upper	
(Intercept)	-0.23	-5.89	5.42	.007
Have a private dental insurance				
Yes	-0.14	-2.08	1.81	.888
No	.000 ^b			
Gender				
Male	-0.49	-2.24	1.25	.579
Female	.000 ^b			
Qualification				
No	-2.51	-4.80	-0.23	.031
Yes	.000 ^b			
Age group				
18-25 years	0.48	-1.37	2.33	.608
≥ 26 years	.000 ^b			
Total household income	0.03	-0.19	0.25	.786
Third molar extraction count	1.10	0.26	1.94	.011
Self-rated oral health	0.03	-0.82	0.89	.942

Subpopulation: Had extraction for wisdom teeth = Yes

a. Model: Number of days missed from work/school/study for more than half a day due to dental problems = (Intercept) + insured + sex + qualif + ageGroup + income + numextct + denthealth

b. Set to zero because this parameter is redundant.

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Chapter 5 (paper 2): Exploring and modelling impacts of third molar experience on quality of life: A real-time qualitative study using Twitter

Linkage to the body of work

The idea of this manuscript came during the stage of survey design which raised an important question: which of the available generic HRQoL measures or disease specific OHRQoL measures is appropriate to be used as an end-point of wisdom tooth research. In addition, the authors found limitations in the literature for qualitative studies that address the impact of wisdom tooth experience upon the QoL. In addition, the conventional qualitative research methods are known to be associated with experimentally induced recall bias. The researcher thought that social media platforms such as Twitter might be used as a source for obtaining real-time qualitative data about how wisdom teeth might impact upon QoL and then compare the study-identified QoL domains with some of the available QoL instruments. Using this approach, the researcher was able to compare QoL instruments on the grounds of their representation to the study-identified QoL domains. In addition, Twitter has a potential for recruiting patients of a specific health condition that was expressed on this platform by sending them a link to join an online survey.

Highlights

- Twitter was useful in obtaining real-time data about how wisdom teeth might impact on QoL. Our study give rise to a new combination of QoL domains.
- The study identified QoL domains were generally underrepresented in the available and widely used QoL instruments.
- Twitter data allowed the researcher to explore actions taken by tweeters as a result of their wisdom teeth experience. Some of these actions might be life threatening such as self-extraction and lucid drugs.

- Patient education needs to include pain management using a combination of over-the-counter medication.
- Using the direction of the association between the study-identified domains, a real-time QoL model of wisdom tooth impact upon QoL was constructed.
- Using real-time data, the researcher was able to observe how QoL domains might interact with each other. An example of this interaction was provided.
- Twitter has a potential for real-time patient recruitment for surveys.

Future research

- The study-identified domains might be used a foundation for developing a new OHRQoL measure that is argued to be more precise and more responsive to change.
- More research is needed to address the phenomena of self-extraction.
- Real-time recruiting via Twitter to join a survey to obtain more structured data (in progress).

Statement of authorship

Title of Paper	Exploring and modelling impacts of third molar experience on quality of life: A real-time qualitative study using Twitter
Publication Status	<input type="checkbox"/> Published <input checked="" type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Brennan D, Sambrook P, Armfield J. Exploring and modelling impacts of third molar experience on quality of life: A real-time qualitative study using Twitter. <i>Int Dent J.</i> 2016; XX(X).

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Contribution to the Paper	Initial conceptualization, preparing ethics application, data collection, thematic analysis, reporting and discussing findings and manuscript writing.		
Overall percentage (%)	85%		
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 to 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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Abstract

Objectives: (1) To explore and model domains for real-time third molars (TMs) impacts on quality of life (QoL); (2) to assess the percentage of coverage of some generic health-related quality of life (HRQoL) and oral health-related quality of life (OHRQoL) instruments to the study-identified TMS QoL domains.

Methodology: A global cross-sectional sample of Tweets containing “wisdom tooth” over 1 week period retrieved 3537 Tweets. After a random quota sampling, classification and filtering, only 843 tweets were included for thematic analysis. TMs QoL model was constructed based on the identified domains’ associations. Domains for the selected generic HRQoL and OHRQoL instruments were plotted against the study-identified domains to calculate percentages of coverage.

Results: The identified QoL domains were: pain (n=348, 41%), mood (n=173, 20%), anxiety and fear (n=54, 7%), enjoying food (n=41, 4%), coping (n=37, 4%), daily activities (n=34, 4%), sleep (n=24, 2%), social life (n=19, 2%), physical health (n=17, 2%), ability to think (n=9, 1%), self-care (n=8, 1%) and sporting & recreation (n=2, <1%). The Assessment Quality of Life instrument (AQoL-8D) covers 87% of TMs QoL domains, while the rest of HRQoL and OHRQoL instruments cover 33%-60%.

Conclusion: This study shows how Twitter might be used to get real-time QoL data which might be used to model how TMs impact on QoL. Although the study-identified TMs QoL domains were, generally, under-represented among the assessed generic OHRQoL instruments, the AQoL-8D covers the majority of them. The study identified QoL domains might be used to develop a new OHRQoL measure for TMs.

Introduction

Health-related quality of life (HRQoL) is an individualized, dynamic, collective interaction between biomedical, psychological and socio-environmental factors that affect the individual's perception of their wellbeing. Third molars' (TMs) eruption symptoms, or recovery from a wisdom tooth extraction, are associated with negative impacts on the oral health-related quality of life (OHRQoL) [1] and general health-related quality of life (HRQoL) [2,3]. These negative impacts occur as a result of physiological changes in response to the inflammatory phase of wound healing triggered by tissue damage (due to either infection or surgical trauma) [4]. These changes result in symptoms such as pain, edema, fever, erythema and loss of function. These symptoms which impact on the individual's perception of health, and consequently their quality of life (QoL) [5,6]. While symptomatic third molars need to be removed, not all patients undergo the surgical removal procedure. Moreover, the decision-making has been found to be influenced by the magnitude of TMs' impact on QoL [7]. Previous studies highlighted the need for more research that investigates retention versus extraction of asymptomatic TMs and their impact on QoL in the short term and long term [8]. Accordingly, QoL has become an important end-point for TMs research, which demands a precise and sensitive QoL measure.

Although generic and disease specific QoL instruments can be used to measure TMs impact on either oral or general HRQoL, a question of which approach (generic or disease specific) should be used remains unanswered. It can be argued that disease specific measures are not comparable with population norms. Moreover, each of the available generic instruments include their own underlying model, domains and questions [9]. Accordingly, understanding

how TMs impacts on QoL and identifying TMs QoL domains will help in selecting an instrument that covers the majority of the identified domains. In the case that the available instruments are not adequate, this would highlight the need to develop a new OHRQoL measure that can accommodate the identified TMs QoL domains. Current knowledge emphasizes that there is a growing criticism over the ability of the available tools to capture a disease impact on QoL [10-12]. As a result of this criticism, there has been an increasing demand for more descriptive studies. Conventional qualitative research methods are based on recalling of a previous experience might limit their findings [13]. On the other hand, Twitter, a social media platform, provides an opportunity to collect real-time qualitative data about how TMs experience might impact on QoL.

Twitter is a microblogging social media interface where users (known as ‘tweeters’) are able to share short text messages of 140 characters each, called a ‘Tweet’. Twitter has been used as a data source for several health-related studies. However, tweets are limited in providing in-depth descriptions due to limitations in the amount of non-structured text that can be used for analysis. Also, there has been a limitation in accessing users’ demographic characteristics [14]. Recently, there was a solution available to extract tweeter’s user demographic characteristics via Textanalytics – a MS Excel add-in, which is based on Naïve-Bayes machine learning text classification. Textanalytics is able to extract cloud-based gender and age group [15]. While ethical/legal issues of using Twitter in medical research have not been thoroughly discussed in academia [16], a guideline was recently recommended by Virginia Tech Institute [17], which includes but is not limited to, avoiding the exposure of user identity and making the study aims publicly available.

This study aimed to: (1) explore and model domains for real-time impacts of TMs experience on QoL; (2) explore actions which were taken to resolve TMs suffering; and (3) assess some generic HRQoL and OHRQoL instruments' percentage of coverage to the study-identified real-time TMs QoL domains.

Methods

Ethical approval

This study obtained approval from the University of Adelaide, Human Research Ethics Committee (Health Sciences): Approval Number: H-2015-017. The University of Adelaide HREC adhere to World Medical Association Declaration of Helsinki, the Australian Code for the Responsible Conduct of Research 2007 and National Health and Medical Research Council (NHMRC) guidelines. As tweets used in this study were publicly available, no consent was required however, tweeters' names must not be displayed in a publication [17]. After the process of tweet capturing and quota sampling, filtering (described in details below) and prior to tweet classification and thematic analysis of tweets' content, tweeters' usernames were de-identified by replacing their usernames with virtual names as shown in Table 6.

Tweets sampling, multi-step tweets filtering and classification

A pragmatic global cross-sectional sample of publicly available tweets was carried out on the 5th February 2015 using Twitter's Advanced Search for "wisdom tooth" containing tweets. The search yielded $n=3537$ tweets which then were extracted as a dataset using

NCapture. Although the concept of saturation in determining the minimum sample size for conventional qualitative research methods is the subject of debate, some guidelines have been suggested [18]. However, no guidelines were available at the time of the study for the minimum sample size of tweets that is required to reach saturation considering that Twitter, as a qualitative research tool, has only recently emerged. In addition, a decision needed to be made to determine a workable sample size for the study and in the meantime, achieve saturation. This required the researcher (K Hanna) to re-read the extracted tweets three times in order to determine the needed tweets' sample size. Based on the outcome of the re-read stage, a random quota sample of 999 tweets was determined to be a workable number that might be initially sufficient to achieve saturation. Using Textanalytics, users' demographics (age group and gender) were obtained. Tweets were then classified according to the nature of their content into categories. Figure 13 illustrates these categories and the sample filtration process. Tweets that report real-time symptoms, real-time post TMs extraction and real-time reporting of future TMs surgery were included for in-depth thematic analysis ($n=843$).

Data analysis

Tweets content coding and thematic analysis

The coding process was performed by a single author (K Hanna) for consistency. Data were analyzed using *NVivo 10* [19]. The coder flexibly applied the thematic analysis method described by [20]. The re-read of tweets' content (described earlier) made the coder familiar with tweets' data. As our study has specific aims, a combined deductive/inductive approach was used. While tweets contents were coded under three main predetermined themes, sub-themes were freely allowed to emerge under these main themes. The main predetermined themes were: TMs real-time impact on QoL, real-time TMs pain description and the reported

actions that were taken to resolve TMs suffering either by patients or healthcare professionals. The identified sub-themes underwent refinements before proceeding to the reporting stage.

Modelling of TMs impact on QoL

The initial modelling stage started by choosing the Wilson and Cleary HRQoL model [5] to act as a starting point for the newly developed model for TMs impact on QoL. Bakas and McLennon [21] recommended that modelling of a disease or a condition that has an impact on QoL should have a starting point before assembling the new model. The study-identified TMs QoL domains and the identified direction of their relationships were used in the assembly of the newly developed real-time TMs QoL model.

Coverage of some selected generic HRQoL and OHRQoL instruments to the study identified real-time TMs QoL domains

To be able to assess coverage extent of generic HRQoL and OHRQoL measures to the identified real-time TMs QoL domains, domains for these instruments were plotted against the study identified TMs QoL domains. Based on the representation of these assessed generic tools to the study identified real-time TMs QoL domains, a percentage of coverage was calculated for each instrument. The selected generic HRQoL tools were: Sickness Impact Profile (SIP) [22], Assessment Quality of Life (AQoL-8D) [23], Nottingham Health Profile (NHP) [24], Short Form health survey (SF-8) [25] and EuroQoL (EQ-5D) [26]. The assessed

generic OHRQoL scales were: Oral Health Related Quality of Life-UK (OHRQoL-UK) [27], Oral Health Impact Profile-14 (OHIP-14) [28], Oral Health Quality of Life Inventory (OH-QoL-I) [29], Geriatric Oral Health Assessment Index (GOHAI) [30], Oral Impact on Daily Performance (OIDP) [31], and Dental Impact on Daily Living (DIDL) [32].

Results

Tweeters' characteristics

Among the analyzed tweets ($n=843$), tweeters' demographic characteristics were obtained for gender: male ($n=750$, 88%), female ($n=97$, 12%) and their main linguistic age group was 15-25 years ($n=269$, 31%).

Thematic analysis of tweets

Real-time domains for TMs impact on QoL

Third molars experience impacted on QoL in a number of ways (Figure 14). Pain was the most frequently reported impact ($n=348$, 41%). TMs experience was found to have an impact on individuals' mood ($n=173$, 20%). The impact on mood was expressed in different ways such as anger ($n=143$, 16%), felt depressed ($n=37$, 4%), or felt happy to have their TMs removed ($n=11$, 1%). Anxiety and fear were reported in $n=54$ (7%) of the assessed tweets and were observed in tweets for TMs symptoms, tweets for future TMs extraction and tweets for post TMs extraction. TMs experience was found to have an impact on tweeters' ability to have their normal food, enjoy their food or even become starved ($n=41$, 4%). Some tweeters expressed that they are not able to cope ($n=45$, 5%). Some tweeters

reported that their TMs experience affected their performance of daily activities either while working or studying ($n=34$, 4%). Tweeters also reported that their TMs experience has impacted their sleep ($n=24$, 2%) and their social life ($n=19$, 2%). Physical health (either sensory or motor) was reported to be affected ($n=17$, 2%). In a very few tweets, some tweeters reported that their TMs experience has impacted on their ability to think ($n=9$, 1%). TMs experience has impacted on self-care ($n=8$, 1%), sporting and recreational activities ($n=2$, <1%). TMs experience was associated with flu symptoms ($n=11$, 1%). Table 6 shows examples of tweets and how they have been coded into QoL themes.

Real-time TMs pain description

Tweets frequently had a combination of pain descriptions in the same tweet. The most frequent pain description was “painful/so much pain” ($n=115$, 33% of reported pain). The second most frequent pain description was “it hurts/it hurts too badly” ($n=95$, 27 % of reported pain). The third most frequent pain expression was “killing/death of me” ($n=63$, 16% of reported pain). Many tweeters used symbolic language, a common online practice, and this was coded under “un-specified”. It was also reported that many tweeters used swear words in describing their pain.

Actions taken to resolve TMs suffering

Many tweeters experiencing TMs claim to have sought professional advice ($n=184$, 21%). However, a few of them reported issues related to access to care mainly: timing ($n=20$, 10% of tweeters who sought professional advice) and financial (cost and insurance) access ($n=3$, 1% of tweeters who sought professional advice). Surprisingly, a few tweeters reported that they were going to perform a self-extraction ($n=12$, 5% of the reported actions), and one of

these tweeters has mentioned doing so with pliers, while another mentioned that his father removed the wisdom tooth by himself. Pain killers, mouth washes, numbing gel and cold application were used for pain relief. There were instances where tweeters reported that they might be better if they used illegal substances ($n=2$, 1% of reported actions). The majority of tweeters who consulted dental health professionals had their TMs removed ($n=103$, 55% of tweeters who visited a dental professional). However, a small number reported inappropriate timing of the operation. Narcotic analgesics and antibiotics were the prescribed therapeutic management.

Real-time TMs QoL model

The constructed real-time TMs QoL model (Figure 15) shows how TMs impacts on QoL and how QoL domains interact in real-time. An example of this interaction was observed in association with severe pain as it affected individuals' ability to cope, sleep, think, mood change and diet modification/starving to avoid pain. Consequently, daily activities, social life, food enjoyment, and physical health were affected.

Assessing the selected generic HRQoL and OHRQoL instruments' percentage of coverage to the study-identified real-time TMs QoL domains.

As shown in Table 2, the percentage of coverage of the selected generic HRQoL instruments to the study-identified real-time TMs QoL domains ranged from 33% to 87%. Among these HRQoL instruments, the 35-item AQoL-8D has the broad coverage to the study-identified TMs QoL domains (87%), while coverage for the NHP and the SIP was 60% each, for the

SF-8 was 40% and for the EQ-5D was 33%. The study-identified domains' coverage of the selected generic OHRQoL instruments ranged from 33% to 60%. The OHRQoL-UK has the broad coverage of 60%, while for the OHIP-14 and the DIDL was 53% each, for the OIIP and the OH-QoL-I was 46% each and for the GOHAI was 33%.

Discussion

This study explored how Twitter might be used to collect real-time qualitative data for TMs experience and its impact on QoL. Twitter allowed the researchers to obtain spontaneous self-reported experience helping to eliminate experimentally induced recall bias associated with conventional approaches in qualitative research [13]. When able to access real-time TMs experience, the study was not only able to identify TMs QoL domains but also to model how these domains interact in real-time. It was found that these interactive domains were under-represented in the current generic OHRQoL instruments. The assessed generic OHRQoL and HRQoL were found to have a limited coverage for real-time impact of TMs on QoL which might be argued to result in the lack of sensitivity to change.

The variation in the calculated coverage to the identified QoL domains among the assessed HRQoL instruments might explain why different HRQoL instruments correlate differently with the same oral health status [33]. Further work is required to develop an OHRQoL instrument that conceptually covers a wider range of QoL domains. The findings from this study might suggest that researchers should seek real-time qualitative data to help them select the appropriate generic instrument that covers the conceptualized QoL domains for the condition of interest and therefore might be more sensitive to change. This finding is important when a research study aims to test the impact of providing a specific intervention on QoL.

The QoL of tweeters who experienced TMs was not only affected by the severity of pain, but also the interaction of pain with other QoL aspects. Such finding is consistent with what has recently been reported on some QoL aspects [2]. Not surprisingly, the severity of the experienced pain was associated with individuals' inability to cope, which consequently affected their mood [34] and inability to think. While the majority of the available generic HRQoL and OHRQoL measures have focused on depression [23,26,28], findings from the present study show that anger was found to be the most frequent type of mood change. This finding suggests that measuring mood change should be more general than specific. Another aspect of mental health was the inability to think, which is observed in association with severe pain. This "inability to think" has emerged as a new QoL domain that affects the individuals' ability to carry out daily activities such as schooling, exams or work. Furthermore, it is now obvious that the complex nature of interacting QoL domains indicates the need for a complex conceptual modelling.

The absence of adequate pain management made some tweeters decide on self-extraction. There have been a few published case-reports of self-extraction [35]. Attempts for self-extraction might result in severe tissue trauma or tooth displacement into a facial space [36]. Although many patients rely on home remedies for pain relief [34], improving patients' access to emergency advice and providing the necessary pain management might reduce the negative impact of TMs experience on QoL. Dental pain might need to be considered as an out-of-hours emergency, even if it is not associated with airway obstruction. In addition, patients' education might need to include how to achieve an adequate pain relief using a combination of over-the-counter pain medications [37]. While it is well known that pericoronitis is associated with flu-like symptoms, some tweeters reported that their TMs

experience was preceded by flu symptoms. This suggests that, the TMs pericoronitis symptoms occurred as an acute exacerbation of a chronic condition, due to the lowered body immunity. Accordingly, improving oral hygiene might prevent, or at least reduce, these symptoms.

The main limitation of the present study was the limited unstructured tweets' content, which makes it difficult to obtain a holistic picture of individual tweeters. In addition, there was a limitation to access tweeters' demographics. However, these limitations were known from the beginning of the research planning and efforts were made to address them by increasing the number of the analyzed tweets beyond the number of actual saturation. Furthermore, researchers used Textanalytics to obtain age group and gender information. These limitations will, however, be overcome in future research by distributing an online survey via Twitter (in progress) or performing a Twitter online interview using private messaging. Although a sole coder is not recommended in qualitative research, data were coded by a single researcher (K Hanna). However, for the purpose of achieving rigorousness of the coding system, it was discussed in a local seminar, and examples of tweets and how they were coded have been provided in this paper (Table 6). In addition, the coder has clinical experience and academic qualifications to conduct the thematic analysis. While the randomly selected tweets might not be a representative sample of patients experiencing TMs problems, there are some indication that twitter users in some countries are representative of these populations in their gender and geolocation [38].

This study shows how Twitter might be used as a data collection tool in exploring the impact of real-time TMs experience on QoL. This tool has a potential in targeting and recruiting participants with a specific health condition in either retrospective or concurrent time frames.

The analysis of real-time qualitative data not only gives rise to a new combination of QoL domains but also to a better understanding of how these domains interact with each other. The available generic OHRQoL tools have a short to medium coverage of the study-identified TMs QoL domains. The inability of OHRQoL measures to cover all TMs' impacts on QoL reduces, theoretically, their sensitivity and validity as an end-point for TMs-related research. The combined set of domains that were identified in this study could be used to develop a new OHRQoL measure, which might be argued to be more precise and sensitive in TMs research. On the other hand, across the assessed HRQoL measures, the 35-item AQoL-8D covers the majority of the study-identified real-time TMs QoL domains. Improving access to emergency dental services might improve TMs pain management and consequently reducing TMs negative impacts on QoL. It might be useful to educate patients about managing their pain and to provide avenues from which they can seek professional advice. Future research might need to address the phenomenon of self-extraction, as such a phenomenon might lead to significant aversive consequences.

Acknowledgement

This piece of research was part of the principle author PhD project for which an Adelaide Scholarship International was received. The research received support from The Australian Research Centre for Population Oral Health (ARCPOH), The University of Adelaide.

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

Abbreviation list

TMs: Third Molars

HRQoL: Health Related Quality of Life

OHRQoL: Oral health related quality of life

API: Application Programming Interface

EQ-5D: Euro Quality of Life-5 Dimensions

SIP: Sickness Impact Profile

AQoL-8D: Assessment of Quality of Life

SF-8D: Short Form Health Survey – 8 dimensions

NHP: Nottingham Health Profile

OHIP-14 Oral Health Impact Profile

GOHAI: Geriatric Oral Health Assessment Index

OHRQoL-UK: Oral Health-Related Quality of Life-UK

OIDP Oral Impact on Daily Performance

OH-QoL-I: Oral Health Quality of life Inventory

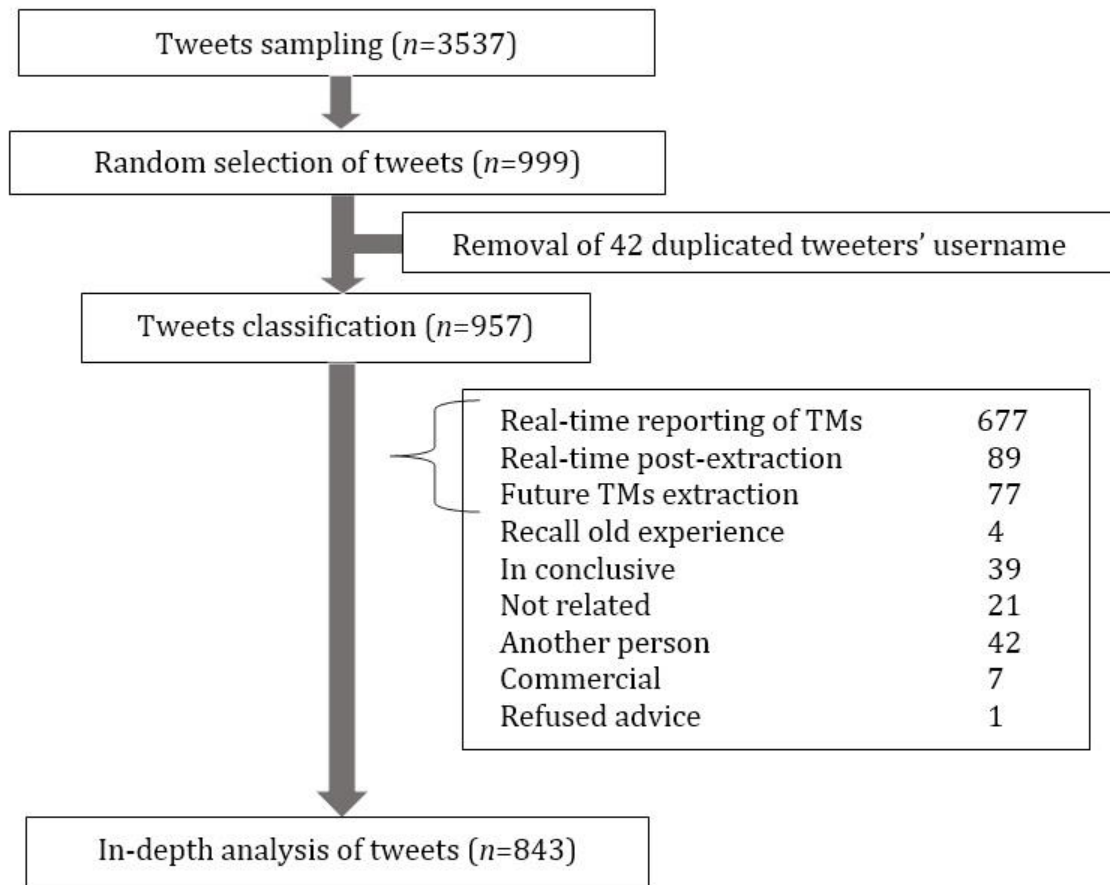


Figure 13: Tweets sample flowchart

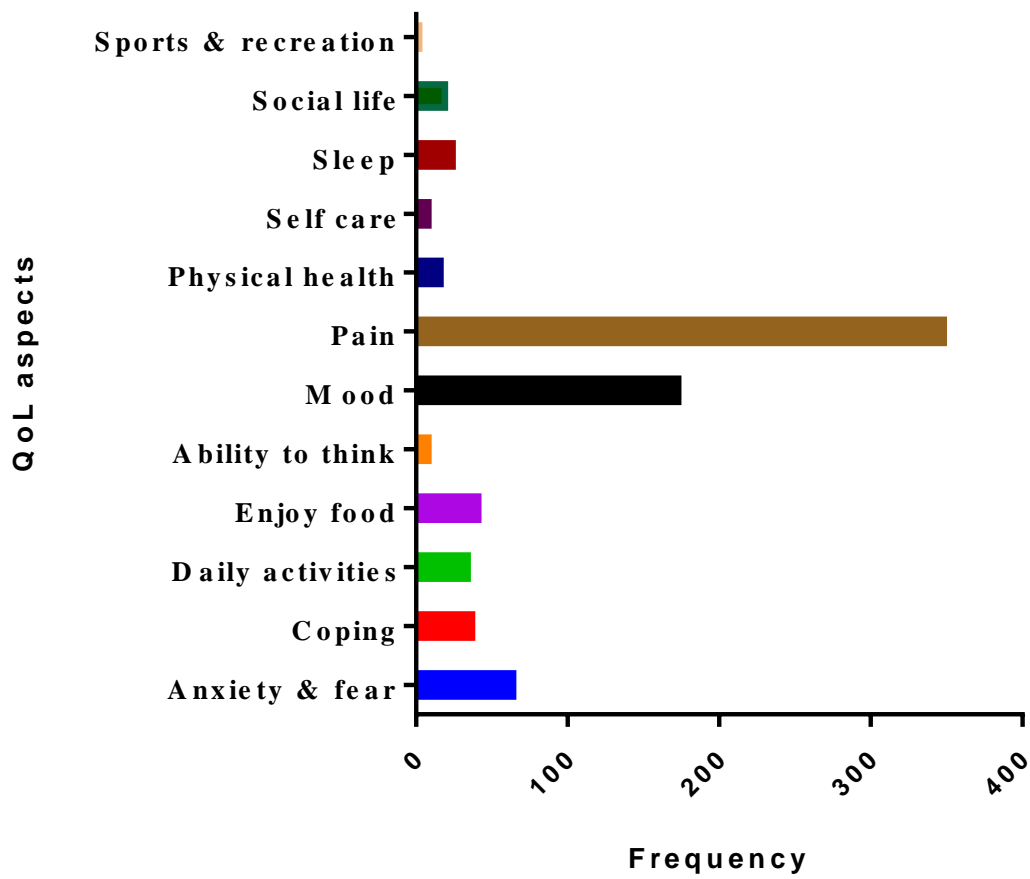


Figure 14: Real-time domains for TMs impact on QoL

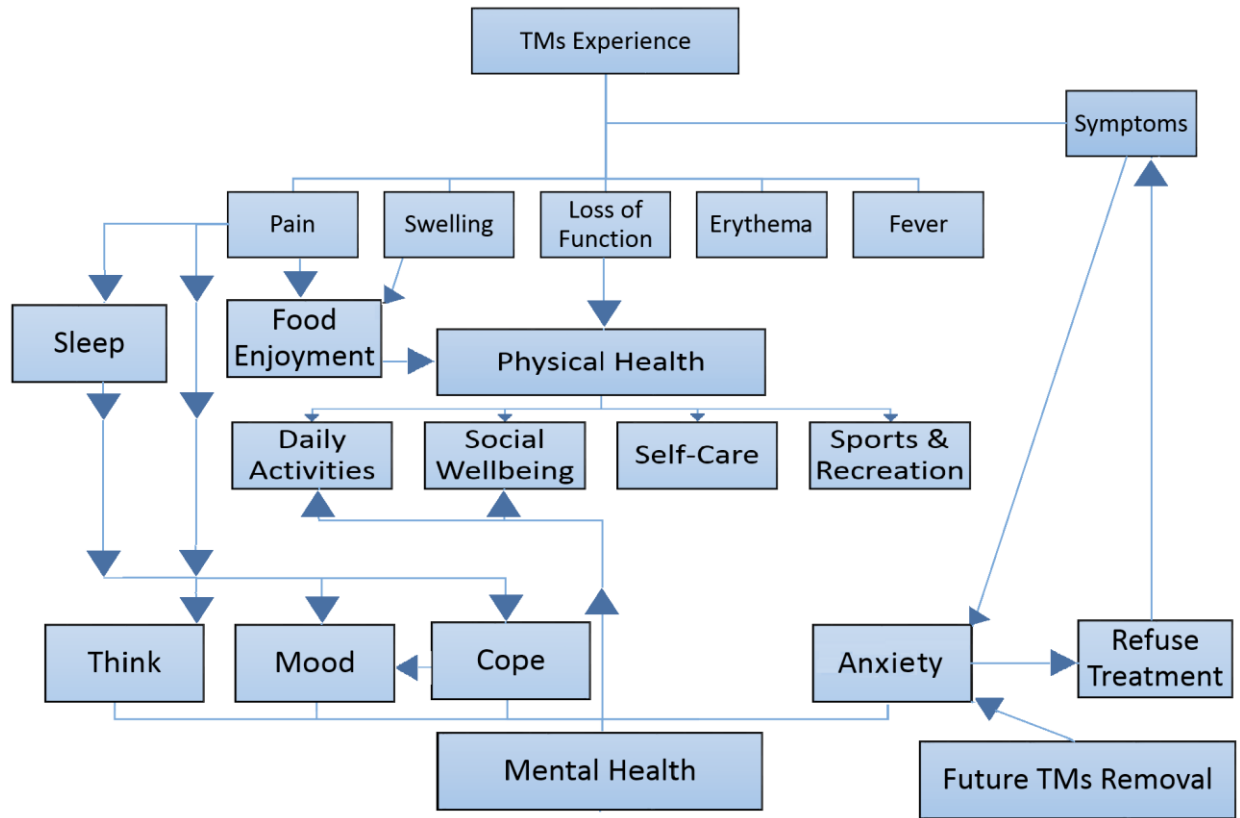


Figure 15: Real-time TMs QoL model

Table 6: Example of tweets and how QoL themes were coded

Tweet	Coded QoL theme
"NEVER GET YOUR WISDOM TOOTH PULLED OUT IF YOU LOVE FOOD" (John)	Enjoy food and Mood
"If never been in so much pain in my whole and I got called into work tomorrow. Absolutely hating life right now" (Peter)	Pain, mood and daily activities
"this wisdom tooth, got me out of sync" (Ali)	Ability to think
"I'm scared I'm boutta get my wisdom tooth pulled out (Rebecca)	Anxiety and fear
"I've been up all night with my wisdom tooth. I'm tired and feel terrible" (Dina)	Sleep
"I wish this wisdom tooth would grow in already I can't handle this pain" (Jack)	Coping
"I can't speak or eat because of this wisdom tooth and I work a double okay" (William)	Functional health, eat and daily activities
"My gums around my wisdom tooth is swollen and I can barely eat, laugh, smile or talk. Someone help" (Sam)	Social life
"Apparently I can't play my clarinet for at least a week after I get my wisdom tooth removed" (Tom)	Sporting & recreation

Table 7: The selected generic HRQoL and OHRQoL instruments' percentage of coverage to the study identified real-time TMs QoL domains

The study Identified domains	Domains for generic QoL instruments ¹					Domains for generic OHRQoL instruments ²					
	EQ-5D	SF-8	AQoL-8D	NHP	SIP	OHIP-14	GOHAI	OHRQoL-UK	OIDP	OH-QoL-I	DIDL
Daily activities	√	√	√	√	√	√	×	√	√	√	√
Eating	×	×	√	×	√	√	√	√	√	√	√
Mental health	Coping	×	×	√	√	×	×	×	×	×	×
	Ability to think	×	×	×	×	×	×	×	×	×	×
	Anxiety	√	√	√	×	√	√	√	×	×	√
	Mood	×	√	√	√	√	√	√	√	√	√
Pain	√	√	√	√	×	√	√	√	×	√	√
Self-care	√	×	√	√	√	×	×	√	×	×	×
Sleep	×	×	√	√	√	×	×	√	√	×	√
Social life	×	√	√	√	√	√	√	√	√	√	√
Physical Health	Mobility	√	√	√	√	√	×	×	×	×	×
	Hearing	×	×	√	×	×	×	×	×	×	×
	Speech	×	×	√	×	√	√	√	√	√	×
	Taste	×	×	×	×	×	√	×	×	√	×
Sporting & recreation	×	×	√	√	√	×	×	×	√	×	√
Percentage of coverage ³	33%	40%	87%	60%	60%	53%	33%	60%	46%	46%	53%
Domain measured but not identified		Energy	Energy Confidence/ Vision	Energy	Alert behavior	self-consciousness relaxation satisfaction		Romantic relationship Breath odor		satisfaction smell	Self-image

¹ HRQoL: EuroQoL (EQ-5D). Sickness Impact Profile (SIP), Assessment of Quality of Life (AQoL-8D), Nottingham Health Profile (NHP), Short Form (SF).

² OHRQoL: Oral Health Impact Profile-14 (OHIP-14), Geriatric Oral Health Assessment Index (GOHAI), Oral Health-Related Quality of Life-UK (OHRQoL-UK), Oral Impact on Daily Performance (OIDP), Oral Health Quality of life Inventory (OH-QoL-I), Dental Impact on Daily Living (DIDL).

³ Percentage of coverage provided here is to show the variability in the representativeness of the assessed instruments to the study-identified TMs QoL domains.

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**Chapter 6: Gold standard for online patient
information concerning wisdom tooth
problems**

Linkage to the body of work

The gold standard for online patient information concerning third molar problems was created in order to be able to have a set of criteria against which the researcher would be able to assess the scientific information quality of online information concerning wisdom teeth.

Highlights

- Creating criteria and gold standard for online dental information concerning wisdom tooth problems.

Future research

- To undertake quality assessment for online health information concerning wisdom teeth problems.

Statement of authorship

Title of Paper	Gold standard for online patient information concerning wisdom tooth problems
Publication Status	<input checked="" type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Published as an appendix in: Hanna K, Brennan D, Sambrook P, Armfield J. Third molars on the Internet: A guide for assessing information quality and readability. Interact J Med Res. 2015; 4(4) PMID: 26443470.

Principal Author

Name of Principal Author (Candidate)	Kamal Hanna		
Contribution to the Paper	Conceptualizing the components of information that patients need to make wisdom tooth treatment choice based on literature review and personal experience in the field. Writing the information in a readable way supported by the best available evidence.		
Overall percentage (%)	85%		
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.		
Signature		Date	25/5/2014

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 to 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	25/5/2014

Gold standard for online patient information concerning wisdom tooth problems

Overview

The wisdom tooth (third molar) is the last tooth to appear in the mouth usually in the age range between 17-25 years. Each individual normally has four wisdom teeth, one at the back of each quadrant of your mouth. Due to its late eruption, often there is a lack of enough room to accommodate them. When they are prevented from reaching their functional position in the mouth, they become “impacted”. The majority of young adults have one or more impacted wisdom teeth [1].

Presentation

During the period when they erupt into the mouth, few patients (about 10%) may develop some minor discomfort while “teething”. If they reached their functional position in your mouth and you maintain your oral hygiene, they are like your back teeth (molars). In a situation where your wisdom tooth attains an abnormal position or there is some difficulty in cleaning them, you may get some gum diseases or decay which may result in pain or recurrent infections, swelling and limitation of your mouth opening. If you have a treatment to straighten your teeth, your orthodontist may decide that, your wisdom teeth might interfere with your orthodontic treatment. However, the best available evidence does not support the responsibility of impacted wisdom teeth for late teen crowding [2,3]. Impacted wisdom teeth are associated with other conditions (12%) such as resorption of roots of adjacent teeth, fluid filled sac (Cyst) or tumors [4].

Diagnosis

Your dentist will be able to advise you about your wisdom teeth or s/he might refer you to an oral surgeon. Your dentist/oral surgeon will need to get your medical and dental history, examine you and request some X-rays (images) of your wisdom teeth – normally a panoramic dental image is sufficient. In some situations, more sophisticated images might be requested depending on the position of your wisdom teeth, and how close they are to important structures [5].

Treatment Options

The decision about a treatment choice is made after thorough evaluation, providing you with information for the available treatment options, risks/ benefits, giving you the opportunity to discuss such information and considering your opinion, before finally reaching a shared decision. In general, if your wisdom teeth are erupted in their normal position, and they do not cause any problem, then there is no need for them to be removed. Symptomatic (problematic) wisdom teeth, either impacted or not, that are associated with pathology or interfere with orthodontic treatment should be removed. If your wisdom teeth are impacted but disease free, the current best available evidence does not support their removal to prevent future problems [2,3,6]. If a decision was made to retain the impacted wisdom tooth/teeth, your oral surgeon may decide to actively monitor them. Complete surgical removal is the commonly used treatment. In some situations where there is high risk if the impacted tooth is completely removed, coronectomy (removing the crown and retaining the roots) might be considered [7]. The majority of surgical removals of third molars are carried out under

local anesthetic in clinics and can be carried out either by your dentist or specialist oral surgeon. However, if you have a history of certain medical problems, your surgeon might decide to refer you to a hospital to have it done there. For patients who have needle phobia or dental anxiety, please refer to anxiety control information section.

Risk and Benefits

Surgical removal of impacted wisdom teeth is associated with some risks. Such risks include pain, bleeding, swelling, limitation of mouth opening and infection. These general risks are temporary and will disappear by the first post-operative week [8], and can be controlled by medications and/or instructions that will be provided to you by your oral surgeon. Surgical removal of lower wisdom teeth is associated with a risk of developing numbness (tingling) of the lower lip and/or the side of your tongue. These risks are associated with how close your lower wisdom tooth is to nerves that supply them with sensation. This tingling sensation occurs due to pressure or injury to these nerves during surgery. Only 0.4-8.4% of people who have the surgery develop this sensation temporarily and this only may last for few days to several weeks [3]. However, in very few cases (up to 1%), this sensation may last longer and become permanent. For the upper wisdom tooth, surgical removal is associated with a risk of developing a communication between your mouth and your nasal sinus. If this happens, the majority will heal by itself with some precautions such as the use of nasal inhalation and avoid nose blowing. However, in a few cases, surgical closure might be considered.

The benefit of removing the problematic wisdom tooth is preventing future problems. However, there is a lack of evidence in the current research that supports the prophylactic

removal of non-problematic disease free impacted wisdom teeth [2,3,9]. The fate of wisdom tooth cannot be predicted, and the incidence of disease free wisdom teeth to develop a cyst/tumor is as low as 1-2% [3].

The procedure of surgical removal of impacted wisdom tooth

After a decision is made for removing your wisdom teeth, your dentist/oral surgeon will need to get your consent for the procedure. This consent is to ensure that you know which teeth are going to be removed, risks/ benefits and post-surgery complications that might occur. An appointment will be given to you for this procedure. You will be given a local anaesthetic injection which is the same as you have when you receive a filling to numb the area up so you do not feel any pain. After your dentist/ oral surgeon makes sure that the area of surgery is completely numbed, your dentist can start the procedure of surgical extraction. Depending on the position of your wisdom tooth, your wisdom tooth extraction can be like any other dental extraction.

If your wisdom tooth is impacted, your dentist/oral surgeon will need to make a cut in your gum to get access to the tooth. The procedure may require your dentist/oral surgeon to use the drill to cut bone around the tooth and/or section the tooth into smaller pieces to facilitate its removal. During this process, you may feel some pressure or vibration. In each case, no pain should be felt. If you feel any unpleasant sensation, raise your hand to your oral surgeon/dentist so they can give you more anesthetic. After the tooth is removed, the area will be flushed and inspected for any sharp edges or remaining tissues. Your dentist/oral

surgeon might stitch your gum usually with dissolving stitches. You will be asked to gently bite on a moist gauze pad for few minutes till the bleeding stops [10].

Post-Operative Care and Recovery

After your surgery, you will be given time to rest in the recovery room to make sure that the bleeding has stopped and you are able to stand and walk. During this time, post-surgery instruction, emergency contacts and/or medication will be provided to you before letting you go home. Also, you might be offered a follow-up appointment. It is preferable if you have escort to drive you home on the day of surgery. If you have your surgery done under general anesthesia (GA) or sedation, you are not allowed to drive.

How Can You Control Post-Operative Complications?

Pain

You will need to take the prescribed analgesics before your anesthetic wears off. You should take your prescribed medication, as instructed, even if you do not feel any problems. Some surgeons use long acting local anesthesia to avoid the peak of post-operative pain, which usually occurs four hours after the surgery. Usually a combination of paracetamol and ibuprofen is effective in relieving pain [11]. However, you should not exceed the daily recommended dose. Your dentist/oral surgeon may prescribe narcotic analgesics. Pain usually decreases with time, and will disappear five days after your surgery. If your pain increased after the first 48 hours following your surgery, it could be a sign of localized inflammation.

Bleeding

After the surgery, you will be expected to have some oozing from the extraction socket. Therefore, you may find your pillow is stained with blood. You should not exercise, drink hot drinks, eat hot food or drink using a straw in the first 24 hours. Try to raise your bed up by 45 degrees to decrease oozing of blood. However, if you notice fresh blood, you can gently bite on a moist gauze pad for a few minutes till active bleeding stops. You can also consider biting gently on a moist tea bag. If these instructions do not stop the bleeding, then you need to contact your dentist/ oral surgeon as per the post-operative instruction sheet provided.

Swelling

Post-operative swelling depends on many factors, such as surgical difficulty, surgical technique, gender and fat distribution. The swelling reaches its maximum after 48 hours, and gradually decreases with time to reach normal by the 5th to 7th day after your operation. Despite some surgeons recommending the continuous application of ice-packs, evidence shows no difference in swelling [12] if ice-packs were not used.

Dry/ Infected Socket

Dry and infected socket are localized complications that might occur after surgical extraction. Dry socket occurs when the formation of blood clot in the socket is prevented by vigorous mouth rinsing, suction of fluids through a straw or smoking. This leads to exposure of nerve endings in jaw bones, which is extremely painful. In the case of an infected socket, the blood clot lyses due to microbial products; and could be treated by irrigating the

extraction socket to clean debris and insert a dressing [13]. This management needs to be repeated by your dentist till your symptoms disappear. In some situations, antibiotics might be prescribed.

Infection

Infection after your surgery may occur and it is manifested by increased pain, swelling, bad taste and odor [14]. If you think that you developed infection, you should contact your oral surgeon. Your oral surgeon may prescribe you antibiotics. Some surgeons prefer to prescribe antibiotics, as a prophylactic, after the surgery to prevent post-operative infection. However, the best available evidence questions the use of prophylactic antibiotics, as they do more harm than good [15].

Your Diet

In the first 24 hours after your surgery, you are advised to have a cold soft diet such as ice-cream, yogurt, jelly or pudding. This diet is gentle on your gums and reduces blood oozing from the extraction site. Try to avoid eating on the operation site for the first few days. After the first post-operative day, you can start having semi-solid diet such as mashed potatoes, eggs or pasta. Avoid rice as it can be trapped under your gums and cause discomfort. You will gradually return to your normal diet after the first post-operative week. Alcoholic beverages should be avoided for at least 24 hours especially if you had general anesthesia/IV sedation, until you stop taking your prescribed analgesics and antibiotics. Smoking should be avoided for the first post-operative week, as it might lead to dislodgement of the formed blood clot and/or delay wound healing.

Anxiety Control and Sleep Dentistry

In case you may feel dental anxiety, fear or phobia; you need to discuss these issues with your dentist/oral surgeon. Your dentist will carry out an assessment process, in order to advise you with the best anxiety control option. There are different techniques that might be used for this purpose. These techniques are ranging from behavioral change, hypnosis to the use of medications. In the case of medications, you need to follow the instructions of your dentist. The levels of anxiety control using medications are:

Conscious sedation

During conscious sedation, you will feel drowsy, but you will be able to communicate with your dentist/oral surgeon, breath normally and maintain your reflexes. There are three types of conscious sedation techniques that are commonly used. This technique provides different sedation depth depending on drug type, dose and route of delivery. These techniques are [16]:

Oral conscious sedation

This sedation is carried out using medication taken by mouth (the same as sleeping pills) which will be provided to you by your dentist/oral surgeon to be taken the night before the surgery and/or shortly before the surgery.

Gas sedation

This type of conscious sedation uses gas inhalation, usually laughing gas that is delivered to you through a mask on your nose.

Intra-venous sedation

A sedative medication will be delivered to you via a small catheter in your hand vein. If you have a needle phobia, ask your dentist/oral surgeon to numb the skin of your hand before the insertion of the intravenous catheter.

General anesthetic (GA)

During general anesthesia, you will be completely asleep. GA will be delivered to you by an anaesthetist. GA needs to be performed at a hospital, normally as a day case. In some situations, patients may be admitted to hospitals, depending on the complexity of their medical history and the procedure [17].

Cost

Wisdom tooth surgery is associated with direct and indirect cost. Direct cost includes the dentist/ surgeon fee. This cost increases if it is associated with sedation or GA, when anaesthetist and hospital/theatre fees are included. The cost you will pay depends on the health system and your insurance status. Check with your dentist/ oral surgeon for more information. The indirect cost includes time off work after the surgery, normally 1.5 – 3 days depending on the surgical difficulty and your ability to recover.

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**Chapter 7 (paper 3): Third molars on the
Internet: A guide for assessing information
quality and readability**

Linkage to the body of work

This paper forms the foundation of the intervention provided to our participants in the RCT. The main reason for conducting this quality and readability assessment for online wisdom teeth resources is the variability in the quality of online health resources in general and also observed in some dental studies. In addition, there was a limitation for studies that carried out quality and readability assessment for online information concerning wisdom tooth problems. To be able to conduct the assessment of the scientific information quality, we needed to develop a tool and initially validate it. Furthermore, we needed to assess the validity of a readability software application to be used in future research and by consumer health information producers. After these steps, we were able to identify a short list of online resources that demonstrated high quality and to be recommended to our study group participants in the RCT before their wisdom teeth consultation

Highlights

- The developed Scientific Information Quality scale showed high internal reliability and established convergent validity with online information credibility tools such as DISCERN and Health on the Net (HoN).
- The scientific information quality and readability varies significantly across different website affiliations.
- Website affiliation explained the majority of variance in the scientific information quality.
- Patients' ability to identify high quality information is questioned.
- The Readability Studio Professional 2012 software was found be valid in assessing information readability.

Future research

- Providing patients with internet guidance might need to be tested as a solution to overcome the issue of variability in online information quality.
- Ehealth literacy interventions might need to focus on improving the patients' ability to identify high quality online health resources.

Statement of authorship

Title of Paper	Third molars on the Internet: A guide for assessing information quality and readability
Publication Status	<input checked="" type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Brennan D, Sambrook P, Armfield J. Third molars on the Internet: A guide for assessing information quality and readability. Interact J Med Res. 2015; 4(4) PMID: 26443470.

Principal Author

Name of Principal Author (Candidate)	Kamal Hanna		
Contribution to the Paper	Initial conceptualization, developing criteria for online information quality assessment, data collection and analysis, reporting and discussing findings and manuscript writing		
Overall percentage (%)	80%		
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.		
Signature		Date	25/5/2014

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 to 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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Original Paper

Third Molars on the Internet: A Guide for Assessing Information Quality and Readability

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Abstract

Background: Directing patients suffering from third molars (TMs) problems to high-quality online information is not only medically important, but also could enable better engagement in shared decision making.

Objectives: This study aimed to develop a scale that measures the scientific information quality (SIQ) for online information concerning wisdom tooth problems and to conduct a quality evaluation for online TMs resources. In addition, the study evaluated whether a specific piece of readability software (Readability Studio Professional 2012) might be reliable in measuring information comprehension, and explored predictors for the SIQ Scale.

Methods: A cross-sectional sample of websites was retrieved using certain keywords and phrases such as “impacted wisdom tooth problems” using 3 popular search engines. The retrieved websites (n=150) were filtered. The retained 50 websites were evaluated to assess their characteristics, usability, accessibility, trust, readability, SIQ, and their credibility using DISCERN and Health on the Net Code (HoNCode).

Results: Websites’ mean scale scores varied significantly across website affiliation groups such as governmental, commercial, and treatment provider bodies. The SIQ Scale had a good internal consistency (alpha=.85) and was significantly correlated with DISCERN ($r=.82, P<.01$) and HoNCode ($r=.38, P<.01$). Less than 25% of websites had SIQ scores above 75%. The mean readability grade (10.3, SD 1.9) was above the recommended level, and was significantly correlated with the Scientific Information Comprehension Scale ($r=.45, P<.01$), which provides evidence for convergent validity. Website affiliation and DISCERN were significantly associated with SIQ ($P<.01$) and explained 76% of the SIQ variance.

Conclusion: The developed SIQ Scale was found to demonstrate reliability and initial validity. Website affiliation, DISCERN, and HoNCode were significant predictors for the quality of scientific information. The Readability Studio software estimates were associated with scientific information comprehensiveness measures.

(Interact J Med Res 2015;4(4):e19) doi:[10.2196/ijmr.4712](https://doi.org/10.2196/ijmr.4712)

<http://www.i-jmr.org/2015/4/e19/>

Interact J Med Res 2015 | vol. 4 | iss. 4 | e19 | p.1
(page number not for citation purposes)

KEYWORDS

DISCERN; health information online; Health on the Net Code; readability; Scientific Information Quality Scale; website affiliation; website content analysis; wisdom teeth

Introduction

Wisdom teeth removal is the most commonly performed oral surgical procedure [1]. In addition to patients needing to make a decision regarding whether or not to remove asymptomatic wisdom teeth [2,3], other decisions need to be made regarding anesthetics options, treatment pathways and associated costs, operation timing, and expected recovery [1]. Patients who undergo third molars (TMs) extraction prefer to receive detailed procedural information [4]. Providing those patients with detailed high-quality information is not only medically and legally important in making an informed decision, but also might improve their participation in the process of shared clinical decision making. This might, in turn, improve patient satisfaction and treatment outcomes [5].

It is not always possible to provide adequate information for patients suffering from TMs problems, because it might be limited by the available consultation time allocated to each patient, given the fact that clinics are often overbooked [6]. The busy nature of oral surgery clinics may hinder surgeons from adequately explaining the provided information, a finding suggested by Ferrús-Torres et al [7]. Lack of sufficient information from professional sources and limitations of information leaflets [8] can result in patients seeking online sources to satisfy their information demands and often before consultation [9]. While the Internet plays an increasing role in dental patient education [10], the quality of online health information varies significantly across websites [11,12]. Therefore, it is argued that clinicians should guide their patients to credible online health resources.

There can be a potential limitation in the current clinical practice in referring patients to high-quality Internet resources due to clinicians' lack of time and/or lack of knowledge [13,14]. In addition, the lack of dentists' ability to discuss the retrieved conflicting Internet-related information with their patients may affect the patient-dentist relationship [10]. To provide patients with guidance in navigating the Internet, clinicians could use the findings from website content analysis studies. However, only a small number of dentally related studies exist and none have covered wisdom tooth problems. The lack of content analysis studies means the absence of an evidence base with which clinicians might be able to guide their patients to credible Internet-based resources. Furthermore, identifying predictors for scientific information quality (SIQ) could make the process of identifying high-quality online resources easier and less time consuming. However, clinicians also need to ensure that the high-quality Internet resources they identify are understandable by their patients.

Understanding health information is a major domain in health literacy, allowing patients to make appropriate health-related

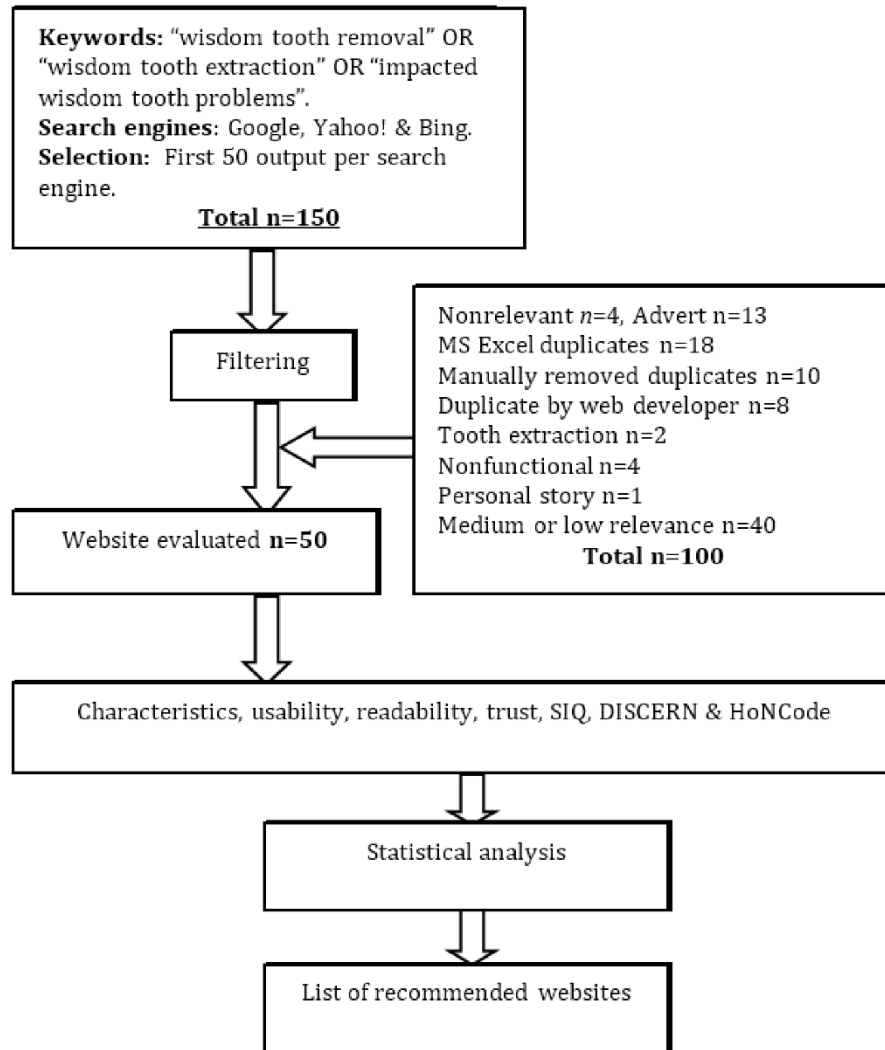
decisions [15]. Patients with higher levels of health literacy have been found to have a better oral health status [16]. To ensure that consumer health information is understandable by the average patient, some health authorities require this information to be at Grade 8 reading level or less (13-14 years of age) [17]. Readability grades are calculated using different readability formulas [18] and are mainly based on word/sentence length and number of syllables per word. These provide a reading grade in relation to the US schooling system, which is set as a reference for readability grading. However, it would be useful to know which of these formulas has the highest association with information comprehensibility. A number of software applications and websites provide a readability-grade estimate for digital documents. Among these software applications, Readability Studio Professional 2012 [19] has been used in some studies [20,21] to calculate readability grades using different formulas. However, readability-grade estimates produced by Readability Studio software need to be assessed for their validity to measure information comprehensibility.

The aims of this study were to (1) develop and validate a scale that measures SIQ; (2) evaluate the quality and readability of online health information concerning TMs problems; (3) validate the Readability Studio Professional 2012 software for measuring comprehensibility of online information; and (4) explore factors that could predict the SIQ of online health information.

Methods**Website Sampling and Filtering**

To identify high-quality online resources, a cross-sectional sample of websites was selected on October 14, 2013, using advanced search options in Google, Yahoo!, and Bing search engines, with output limited to English language, any location, and specific phrases in the page title. The 3 phrases used were "wisdom tooth removal" OR "wisdom tooth extraction" OR "impacted wisdom tooth problems." The first 50 results of each search engine output were selected after excluding websites identified as advertisements. A total of 150 websites were initially included. Websites were then filtered by removing duplicates and were reviewed for their relevance as a source for patient information. During this stage, nonfunctional, nonrelevant news articles or blogs were excluded. If a website was found to be relevant, it was categorized as having high, medium, or low relevance based on reporting the predetermined information sections of the SIQ Scale. Only websites of high relevance, according to this classification, were selected for content analysis. Figure 16 shows the flowchart for website sampling and filtering. This review was conducted by KH for consistency and eliminating the need for providing training.

Figure 16. Website content analysis flowchart.



Characteristics of Website

A number of website characteristics that might have an association with the quality of provided information were determined. Website affiliation (to which organization the website belongs to) was recorded as governmental, educational institute, treatment provider (hospital/medical or dental practice), nonprofit organization, commercial [22], or other group. There was an open section that was then coded into blogs, hub pages, wiki (like Wikipedia), or news. As content editing could play a role in information quality, websites were categorized into either “open access” or “open content” where the type of content editing was reported for coding. Information delivery format

was recorded, as previous research shows the importance of multimedia use to engage patients of low literacy [23]. Information formats were recorded as a multiple response set that included “text within the webpage,” “word/PDF,” “images,” “cartoon animations,” “audio,” “real example,” and “other,” with an open section to enable adding comments, which later were coded into themes. Information communication method was recorded to identify the prevalence of each method. Information communication methods were recorded as a multiple response set that included “fact sheet,” “question and answer (Q&A),” “story,” and “other” with an open section that was coded into other types of information formats.

Website Evaluation

To assess different quality aspects of websites under evaluation, several scales were used [24]. Quality aspects included scales assessing usability, accessibility, trustworthiness, readability grade [18], scientific information comprehensiveness, scientific information reporting, scientific information referencing, SIQ, and online health information credibility (Health on the Net [25] and DISCERN [26]). The sum of these scales formed the website total score, which was considered as a collective measure of website quality.

Usability Scale

The Usability Scale consisted of items that were partially based on the Minervation Tool (LIDA [27]). These items include registration/subscription to review the information, website navigability, and search ability and were given a score that ranged from 1 to 3 for each item based on the response. For Web 2.0 applications support such as Facebook, Twitter, LinkedIn, and G+, responses were collected as a multiple response set to provide a score that was then trichotomized based on percentile distribution. Usability Scale scores range from 4 to 12.

Accessibility Scale

A single-item Binary Scale that was used as a proxy for compliance with Web Content Accessibility Guidelines [28], with scores being 1 for “No” and 3 for “Yes” to increase item weight in the website total score.

Trust Scale

The Trust Scale was developed for this study and comprised a 4-item Binary Response Scale measuring trust in a website. Items for this scale were display of the Health on the Net (HoN) seal [25], as it is the most frequently used online consumer health information quality seal, validity of the HoN seal using the HoN toolbar, display of other quality seals, and display of planned review date as an indication for maintaining information currency. Items for this scale were scored 1 for “No” and 3 for “Yes” to increase the scale weight within the website total score. The scale scores range from 4 to 12.

Mean Readability Grades

Mean readability grades were computed using Readability Studio Professional 2012 that provides readability grades estimates based on 6 different formulas recommended for the health care industry, which are FORCAST, Fry, Gunning Fog, New Fog, Raygor Estimate, and SMOG. Text from websites was extracted to MS Word (Microsoft, Redmond, WA, USA) where they were prepared for evaluation by the software. In addition, videos were transcribed by the author (KH).

Scientific Information Comprehension Scale

The Scientific Information Comprehension (SI Comprehension) Scale was developed specifically for this study. It comprises a 9-item scale that measures the understandability of each section of the scientific information shown in Table 8. Items for this scale were scored on a 5-point Likert-like scale ranging from 1 “difficult to understand” to 5 “easy to understand.” If the item did not exist on the website, it was reported as missing.

Table 8. Evaluation criteria for scientific information quality concerning wisdom tooth problems.

Criteria (assessed on a 5-point Likert-like scale: range from 1 for poor to 5 for excellent)	Description
Overview	Number of third molars (TMs), age of eruption, and etiology of impaction
Presentation	Mild pericoronitis to severe infection of facial spaces, swelling, trismus, periodontitis, decay, cyst, or tumors with incidence. No evidence supports the association between TMs and late teen crowding.
Diagnosis and investigations	Diagnosed by a dentist/oral surgeon, medical and dental history, clinical and radiographic examination, and other radiographs in high-risk TMs
Treatment options	Retain functional TMs, symptomatic TMs with untreatable conditions or associated with pathology should be removed, no evidence supports the removal of asymptomatic impacted TMs, shared decision making. Anesthetic options (local anesthetic, intravenous sedation, or general anesthetic). Pathway (minor oral surgery, hospital day case, or hospital inpatient).
Risk and benefits	Incidence of risks associated with retaining TMs, general surgical risks (pain, bleeding, swelling, etc), anatomical-related risks (numbness of lip or tongue, oroantral fistula), rare risks (tuberosity/mandible fracture)
Surgical procedure	Draping, anesthesia, flap, bone removal, tooth sectioning, tooth removal, socket irrigation, socket inspection, bone filing, suture, and gauze pack
Postoperative care and recovery	Postoperative instructions, how to control pain, bleeding, swelling, infection, and dry/infected socket. Information about diet and oral hygiene. Expected recovery.
Costs associated with the treatment	Depend on pathway: direct cost (surgeon, anesthetize, and/or hospital fees), indirect cost (time off work), insurance information
More information for intravenous sedation and general anesthesia/dental anxiety management	Conscious sedation (oral, inhalation and intravenous sedation), general anesthetic

Scientific Information Reporting Scale

The Scientific Information Reporting (SI Reporting) Scale is a 9-item binary scale that was developed for this study based on reporting information topics, which can be found on the assessed website. Items for this scale were scored 1 if the information section was covered and 0 if the information section was not covered in the examined website. Full scale scores range from 0 to 9. The SI Reporting Scale was used to identify websites of high relevance as a source of information.

Scientific Information Referencing Scale

The Scientific Information Referencing (SI Referencing) Scale is a 9-item Binary Scale that was developed for this study to measure referencing different information sections on the assessed website. Items for this scale were scored 1 if the information section was referenced and 0 if the information section was not referenced, and the full scale scores again range from 0 to 9.

Scientific Information Quality Scale

The SIQ Scale is a 9-item Likert-like scale, which was developed to assess various aspects of information that should be provided to patients, based on literature review and authors' experience in the field (Table 8). Each item was scored on a scale ranging from 1 "poor" to 5 "excellent" against the predetermined criteria for online information concerning TMs problems that was created by this study's authors using the best available evidence (see Multimedia Appendix 1). Domains for this scale included overview (introduction), presentation, diagnosis, treatment options, risks/benefits, procedural information, postoperative care and recovery, costs, and more information about anxiety control. If the item did not exist on the website, it was reported as missing. The SIQ Scale scores range from 9 to 45.

Online Consumer Health Information Credibility Tools

Health on the Net Code Scale

This was a 14-item scale that was developed by authors [24] based on the criteria for providing the HoN seal [25]. Each item had 3 response options, namely, the website was "not complying" with Health on the Net Code (HoNCode) (scored 1), the website was "partially complying" with HoNCode (scored 2), and the website was "fully complying" with HoNCode (scored 3). The HoNCode consists of the following 8 principles: authorship, complementary information, maintaining privacy, appropriate referencing of information sources, claim policy, transparency, disclose funding source, and clear advertising policy. The HoNCode Scale scores range from 14 to 42.

DISCERN Scale

This is a 16-item scale developed by Charnock [26] to assess the credibility of printed consumer health information and was validated for assessment of online consumer health information [29]. Each item was scored 1 for a "definitive no," 2-4 for "partial yes" (based on reviewer's judgment), or 5 for a "definitive yes." The DISCERN items are grouped into 3 main groups: Questions 1-8 are related to reliability of information, Questions 9-15 are related to specific treatment choices, and

Question 16 provides an overall quality assessment of the information. The DISCERN Scale scores range from 16 to 80.

Website Total Score

The website total score was used as a measure of the total website quality. It was calculated as an unweighted sum of website usability, trust, SIQ, scientific information comprehensiveness, scientific information referencing, scientific information reporting, accessibility, DISCERN, HoNCode Scales, and the reverse-coded mean readability grade. The website total scores range from 57 to 222.

Reviewer's Comments

To allow the evaluator (KH) to provide qualitative feedback on the assessed websites, the researcher commented on areas of biased/unbalanced information. In addition, the researcher commented on factors that might affect information readability and the recommended treatment options. These comments were then coded into themes and subthemes for analysis.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows version 22.0 (IBM, NY, USA) [30]. Frequencies of websites characteristics were calculated. Means, SDs, and quartile distributions were also calculated for each scale. The internal consistency using Cronbach alpha of each scale was calculated. Pearson r correlation coefficients were calculated between SIQ Scale, DISERN, and HoNCode. In addition, Pearson r correlation between the mean readability grade and the reverse-coded SI Comprehension Scale was measured in an attempt to establish convergent validity. The associations between website affiliation and websites scale scores were tested using one-way analysis of variance (one-way ANOVA) with Tukey post hoc tests.

To explore predictors for SIQ scores, linear regression was performed after creating dummy variables for website affiliation groups. A block of website affiliation dummies (Model 1) was entered in linear regression, where the "other" group was used as a reference category. In Model 2, DISCERN was added, and in Model 3, DISCERN was removed and replaced by the HoNCode score while statistically controlling for website affiliation. Websites were ranked according to their SIQ score and to their total (unweighted) score. The correlation between the 2 ranking orders was examined using Spearman ranking correlation.

The website reviewer's (KH) comments were analyzed using NVivo 10 [31] where comments were coded into themes and subthemes. These themes included biased/unbalanced information (subthemes included areas of biased/unbalanced information), factors affecting information readability (subthemes included repetition, terminologies use, image labeling), and the recommended treatment options (subthemes included obtaining a second opinion, prophylactic removal of all TMs, removal of only symptomatic ones, removal of symptomatic, and seriously think about asymptomatic ones). Cross-tabulation of codes' frequency by the website affiliation group was obtained for unbalanced/biased information, the recommended treatment and factors affecting information

readability, and then weighted according to the percentage of representation of the website affiliation group within the sample.

Results

Websites Characteristics and Their Usability

Of the 50 websites available for content analysis, a majority of the reviewed websites (54%, 27/50) were related to a treatment provider after adding 1 website to this group from the “educational institute” group that has a teaching hospital attached to it. A total of 7 of the 50 (14%) websites were related to commercial websites, and governmental and nonprofit organizations websites were equally represented (8%, 4/50). There were 7 “other” group websites (hub pages, blogs, news, and wiki, 14%). A combination of text and image was the most commonly used information format (40%, 20/50). Question and answer was the most predominant information communication method either alone (34%, 17/50) or in combination with fact sheets (22%, 11/50).

Most websites were open access (74%, 37/50), and the most common form of content editing was posting comments (14%, 7/50). All websites were accessible without either registration or subscription. A majority of websites were judged easy to navigate (62%, 31/50) while slightly above half of the websites (52%, 26/50) had no search facility. Facebook (23% of Web 2.0 applications, 28/121) and Twitter (20% of Web 2.0 applications, 24/121) were the most commonly used Web 2.0 applications.

Scientific Information Quality

The developed SIQ Scale had good internal consistency (Cronbach alpha=.85). Furthermore, the SIQ scores were

significantly correlated with DISCERN scores ($r=.81, P<.01$) and HoNCode ($r=.38, P<.01$). Less than 25% of the evaluated websites had SIQ scores above 75% of the maximum scale score. The overview section was the most reported information section, whereas the cost information section was the least reported.

Information Credibility Tools

DISCERN had high internal consistency (Cronbach alpha=.91) whereas that for HoNCode was slightly lower (Cronbach alpha=.80). DISCERN and HoNCode were significantly correlated with each other ($r=.71, P<.01$) and both scales were significantly correlated with the SIQ Scale (as mentioned earlier).

Association of Website Affiliation With Website Score

One-Way ANOVA showed a significant association between website affiliation and SIQ ($F_{4,45}=4.8, P<.01$), DISCERN scores ($F_{4,45}=4.8, P<.01$), and HoNCode score ($F_{4,45}=8.8, P<.01$). SIQ had an observed power of 90% or over for each of them and had moderate effect size estimates. Website affiliation was also significantly associated with the other scales (Usability, Trust, SI Referencing, and SI Comprehension) except for the mean readability grade where no significant difference was found. Tukey post hoc tests showed that the SIQ mean scores of the “other” website affiliation group was significantly lower than commercial websites ($P<.01$) and governmental website ($P=.01$). Table 9 shows the significant association of websites scales mean scores and total score with website affiliation groups.

Table 9. Quality and readability scores by website affiliation.

	Website affiliation ^a										P-value significance
	Commercial		Treatment provider		Government		Nonprofit organization		Other		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Scientific Information Quality (SIQ)	32.6 _a	9.5	26.0 _a	7.8	34.8 _a	10.9	29.0 _a	9.8	17.0 _b	7.3	.01
DISCERN	62.3 _a	9.3	46.0 _b	10.7	59.3 _a	17.6	61.8 _a	12.1	44.1 _b	13.5	<.01
Health on the Net Code	35.4 _a	4.3	26.8 _b	3.7	35.3 _a	2.5	35.8 _a	4.9	30.7 _a	7.8	<.01
Mean readability grade	10.3 _a	0.9	10.6 _a	1.4	10.4 _a	3.7	11.3 _a	2.9	9.0 _a	2.7	.34
SI Comprehension	9.9 _{a,c}	1.3	12.8 _b	2.6	9.8 _{a,b,c}	2.2	13.5 _{a,b}	7.6	8.3 _c	4.5	.01
SI Referencing	10.6 _a	2.4	9.1 _b	0.5	9.8 _{a,b}	0.5	11.8 _a	3.1	10.1 _{a,b}	2.3	.01
Trust	5.0 _a	1.4	4.1 _b	0.4	4.8 _{a,b}	1.0	4.5 _{a,b}	1.0	4.0 _b	0.0	.03
Usability	10.3 _a	1.4	8.4 _b	1.1	10.5 _a	0.6	9.8 _a	1.3	10.4 _a	1.4	<.01
SI Reporting	16.9 _a	1.6	16.2 _a	1.4	17.0 _a	2.0	16.3 _a	2.2	13.9 _b	2.1	.01
Accessibility	1.0 _a	0.0	1.1 _a	3.0	1.5 _b	0.6	1.0 _a	0.0	1.0 _a	0.0	.02
Total score	153.8 _a	26.1	114.3 _b	22.3	152.6 _a	29.9	144.9 _a	26.9	114.0 _b	25.4	.02

^aValues in the same row and subtable not sharing the same subscript are significantly different at $P<.05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.

Predictors for Scientific Information Quality

Linear regression models (Table 10) showed that website affiliation alone (Model 1) significantly explained 21% of the adjusted R^2 of SIQ scores. Governmental websites had the highest (B) coefficients ($B=17.75, P<.01$) in comparison to the “other” group that was set as a reference category. After controlling for website affiliation (Model 2), DISCERN scores were found to be significantly associated with the highest SIQ

($B=.60, P<.01$). Because DISCERN and HoNCode are measuring a close construct, DISCERN was removed from the regression equation and replaced by HoNCode in Model 3. While controlling for website affiliation, HoNCode was found to significantly predict the SIQ ($B=.63, P=.02$). A regression residual scatter plot showed a random distribution while the P-P plot of the observed and the predicted values of the SIQ scores showed a good model fit (data not presented).

Table 10. Scientific Information Quality score prediction models.^a

Model	Unstandardized coefficients		95% CI for B		Standardized coefficients Beta	<i>t</i>	Significance (<i>P</i> value)	Model summary		
	<i>B</i>	Standard error	Lower bound	Upper bound				Adjusted R^2	R^2 change	Significance <i>F</i> change
1 Constant	17.00	3.16	10.64	23.36		5.38	<.01	.21	.28 ^b	.01
Commercial	15.57	4.47	6.58	24.57	.58	3.49	<.01			
Treatment provider	8.96	3.53	1.85	16.08	.48	2.54	.02			
Governmental	17.75	5.24	7.20	28.30	.52	3.39	<.01			
Nonprofit organization	12.00	5.24	1.45	22.55	.35	2.29	.03			
2 Constant	-9.50	3.16	-15.87	-3.14		-3.01	<.01	.76	.51 ^c	<.01
Commercial	4.68	2.71	-0.77	10.13	.17	1.73	.09			
Treatment provider	7.83	1.96	3.87	11.79	.42	3.99	<.01			
Governmental	8.68	3.05	2.55	14.82	.25	2.85	.01			
Nonprofit organization	1.43	3.09	-4.80	7.66	.04	0.46	.65			
DISCERN	0.60	0.06	0.48	0.72	.85	10.09	<.01			
3 Constant	-2.45	8.49	-19.56	14.67		-0.29	.76	.29	.09 ^d	.02
Commercial	12.59	4.41	3.70	21.47	.47	2.85	.01			
Treatment provider	11.43	3.50	4.38	18.48	.61	3.27	<.01			
Governmental	14.88	5.11	4.59	25.17	.43	2.91	.01			
Nonprofit organization	8.81	5.14	-1.54	19.16	.26	1.72	.09			
Health on the Net Code Scale	0.63	0.26	0.11	1.16	.39	2.45	.02			

^aThe “other” website affiliation group was used as a reference category.

^b R^2 change for Model 1: It is change from a null model.

^c R^2 change for Model 2: It is a change from Model 1.

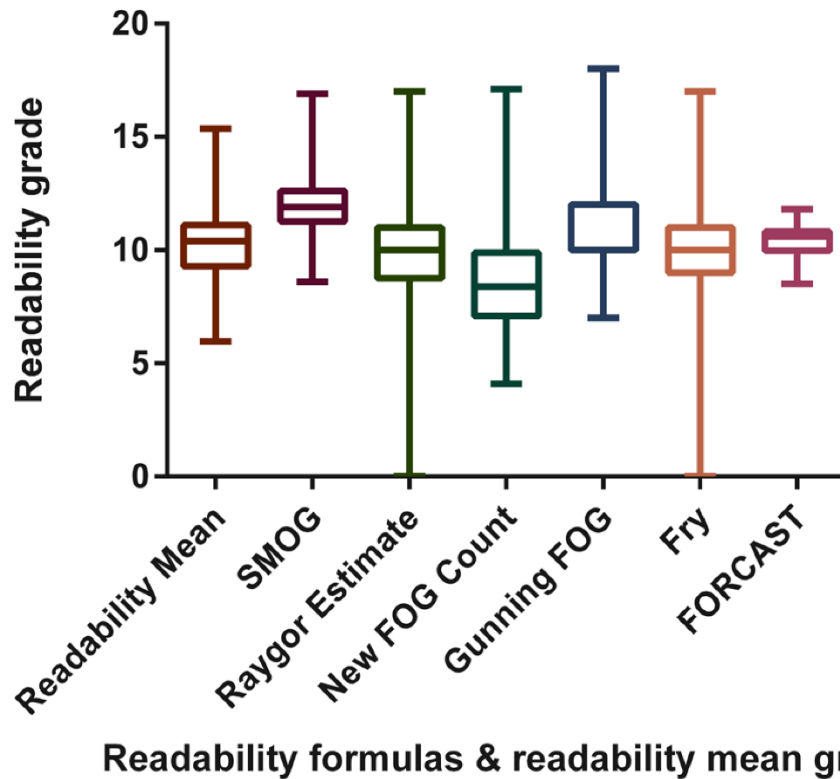
^d R^2 change for Model 3: It is a change from Model 1.

Information Readability Grades and Comprehension

The mean (SD) readability grade (Figure 17) was 10.3 (1.9). Nonprofit organization websites had the highest mean readability grade, whereas the “other” websites had the lowest mean readability grade (Table 9). There was no significant difference in the mean readability grade among website affiliation groups. One-way ANOVA of readability grade estimates (FORCAST, Fry, Gunning Fog, New Fog Count, Raygor Estimate, and SMOG) grouped by website affiliation showed no significant difference except for FORCAST, which was found to be

significantly different ($F_{4,45}=3.2, P=.02$). Figure 17 shows box plots of 6 different readability grades and the mean readability grade calculated using Readability Studio. After reverse coding of the Scientific Information Comprehension Scale scores, the New FOG readability grade has the highest significant association with it among the used readability formulas ($r=.48, p<.01$). In addition, the reverse-coded SI Comprehension Scale scores were found to be significantly correlated with the mean readability grade produced by Readability Studio Professional 2012 ($r=.45, P<.01$).

Figure 17. Box plot of readability grades and mean readability grade.



Websites' Ranking

Websites were ranked according to their SIQ scores. Results showed that the Bupa-UK website [32] had the highest SIQ, followed by that of the NHS-UK [33]. Ranking websites according to their total unweighted scoring showed that Bupa-UK had the highest total score followed by Animated-Teeth [34]. Spearman ranking correlation between both ranking orders were significantly correlated ($r=.81, P<.01$).

Analysis of Reviewer's Comments

The comment section was analyzed using thematic analysis. Biased or unbalanced information provided was coded. TMs and late teen crowding were the most frequently reported biased information (41% of reported biased/unbalanced information, 13/31). Forcing patients to undergo "sleep dentistry" (16% of reported biased/unbalanced information, 5/31) was an example of unbalanced information, where information providers limited the anesthetic options to general anesthesia or sedation without providing local anesthetic as an option. The treatment provider group was associated with the highest frequency of biased/unbalanced information (74% of reported

biased/unbalanced information, 23/31), which was also confirmed by the weighted frequencies of biased/unbalanced information across different website affiliation groups.

Comprehensibility of information was affected by the use of terminologies without explanation (28% of reported readability issues, 10/35), and/or the use of illustrations that were incorrectly labeled (5% of reported readability issues, 2/35), or inadequately labeled (5% of reported readability issues, 2/35), or sometimes not relevant at all (11% of reported readability issues, 4/35). In addition, poor information presentation and organization (11% of reported readability issues, 5/35) played an important role in the ability of finding information. Furthermore, repetition was found in some of the reviewed websites (11% of reported readability issues, 5/35).

The most frequently reported treatment option was the removal of symptomatic wisdom teeth and to seriously consider removal of asymptomatic ones (30% of reported treatment options, 7/23), while 4 websites (17% of reported treatment options) recommended the prophylactic removal of all wisdom teeth to "get peace of mind." A number of websites (28% of reported treatment options, 6/23) recommended the removal of only

symptomatic ones. There were instances where patients were advised to get a second opinion (17% of reported treatment options, 4/23) before making a treatment choice related to their wisdom teeth. Coronectomy (removing the crown and retaining the root) as a treatment option for high-risk wisdom teeth was rarely mentioned.

Discussion

Preliminary Findings

In this study, we aimed to provide a guide to assess the quality and readability of online health information with an application on Internet-related information concerning TMs problems using a scale developed for this purpose. The study also identified a shortlist of high-quality resources that might be recommended by clinicians to patients having TMs problems. Because online resources are dynamic, the researchers explored predictors for SIQ that might be used for a quick and easy identification of high-quality online resources.

To identify high-quality resources, a search was carried out using 3 common search engines (Google, Yahoo!, and Bing), and 3 keywords thought to be used by an average patient. While some authors have claimed that patients do not normally go beyond the first 25 results [35], the number of websites included per search query ranged from 10 to 100 websites. Accordingly, we decided to include the first 50 websites per search engine query. The number of websites remaining for thorough evaluation in this study was considered reasonable according to existing literature where the websites included for final analysis ranged from 21 [36] to 67 [37] with a mean of 38 websites per study. In addition, the observed power for the association between website affiliation and website scores was found to be high.

Internet information was delivered using mainly question and answer format either alone or together with fact sheets. Preferences of dental patients in relation to information delivery format need further investigation as there is a knowledge gap in the existing literature in this area. In addition, treatment providers should consider using online forums on their websites supported by health professionals to allow for a better engagement with patients [38]. Despite the importance of multimedia use in patient education [23], a combination of text and images was the most commonly used method of presenting information. There were instances where images were not related to the discussed topic, or were inadequately or incorrectly labeled. It is argued that the use of multimedia is associated with high costs due to professionalism, especially if these websites are for small businesses. Efforts should be made by professional and public health organizations to make multimedia available with permission to use at a reduced or no cost. A majority of websites used Facebook and Twitter as social media for sharing of online information. While many people search for information on the Internet for a family member or a friend [9], information sharing is currently powered by using social media.

Evaluating the quality of scientific information was challenging, especially with the lack of reliable and valid assessment tools.

In addition, evaluating the scientific content requires a person who has extensive knowledge in the field. This paper demonstrated that the newly developed SIQ Scale has a high internal consistency and also displayed convergent validity with information credibility tools (DISCERN and HoNCode), which can be used by other researchers. Website affiliation was found to have a significant association with SIQ, usability, accessibility, trust, DISCERN, and HoNCode.

Linear regression models were used to explore the predictors for SIQ. The importance of this step is to make clinicians spend less time and effort to identify high-quality Internet resources, where no content analysis study is available. Website affiliation was able to significantly predict SIQ. Among different groups of website affiliation, governmental websites were found to be associated with the highest predicted SIQ score compared with the reference category. Credibility indicators—either DISCERN or HoNCode—were able to significantly predict SIQ after statistically controlling for website affiliation. A majority of variance in SIQ scores were explained by website affiliation and DISCERN. This finding is important because it might not only improve clinicians' ability to identify high-quality online resources but also improve patients' ability to find these resources by reviewing the governmental websites in light of DISCERN criteria.

Among the reviewed websites, the recommended treatment options were a reflection of the clinical uncertainty related to asymptomatic wisdom teeth [39]. Despite the lack of evidence supporting prophylactic removal of disease-free asymptomatic impacted wisdom teeth [3], there was a tendency to recommend the removal of asymptomatic wisdom teeth to prevent future problems. Conversely, some websites recommended the removal of only symptomatic third molars. Because of the uncertainty regarding asymptomatic wisdom teeth, some websites advised patients to obtain a second opinion. These findings suggested that clinicians should discuss this uncertainty with their patients before making a shared decision, because patients themselves might be confused due to conflicting information [10]. In addition, some websites were not providing patients with evidence-based information; for example, many websites recommended continuous application of ice packs postoperatively despite the best available information from randomized controlled trial evidence, which showed no significant difference on postoperative edema, pain, and trismus when compared with no intervention [40]. Clinicians have a responsibility to apply the current best evidence in the shared decision-making process to reach a decision that is ethical, and in the best interest of the patient. Although cost is known to provoke anxiety for dental patients [41], it was found to be the least reported information. This suggests that providing cost estimates on websites could be useful in avoiding/reducing potential anxiety related to treatment costs.

Among the used readability-grade estimates, the New FOG readability grade was the most powerful in predicting scientific information comprehensibility. The significant correlation between the mean readability grade and Scientific Information Comprehension Scale score suggested convergent validity and consequently that the Readability Studio software could be used to assess information comprehensibility. In this study, the

estimated mean readability grade was higher than Grade 8 as recommended by some health authorities [17]. Attention should be paid to provide information in a way that is patient centered.

The strong and significant correlation between websites' ranking according to their SIQ and their ranking according to total scoring suggested that websites associated with the SIQ were also associated with other quality aspects such as readability, usability, trust, and credibility. Such results suggest that future research might focus on the SIQ Scale, readability-grade estimate, and DISCERN to limit the evaluation process.

The main limitation of this study lay in 2 main areas: sampling bias and examiner bias that were known to the researchers when conducting data collection and analysis. However, effort was made to minimize their impact by using predetermined assessment criteria and to statistically validate the measurements used. In addition, websites were evaluated by the main author who has appropriate academic qualifications and clinical experience—an approach that has been used in previous research [42]. With regard to sampling bias, the retrieved websites were limited to the keywords that were used and search engines on a certain day.

The strengths of our study were (1) the contribution to the field of health informatics such as the development and initial validation of the SIQ Scale and the validation of Readability Studio Professional 2012; (2) contribution to current clinical practice by providing a shortlist of high-quality websites (however, clinicians need to consider the dynamic nature of online resources); (3) the development of criteria for patient information concerning wisdom tooth problems (see [Multimedia Appendix 1](#)), which might be used as an information sheet covering all areas of wisdom teeth removal and using the best

available evidence; (4) use of a statistical approach to analyze website data that has not been used previously in these kind of studies, such as convergent validity, linear regression using dummy variables, and thematic analysis of open comment section using NVivo 10; and (5) the validation of a readability software application that could be used in future research. The SIQ Scale [24] demonstrated some evidence of both reliability and validity in assessing the SIQ; hence, it might be usable in future research related to the assessment of online health information.

Conclusion

This study provides clinicians with guidance in assessing Internet resources for patients suffering from wisdom tooth problems. However, clinicians may apply similar techniques when recommending websites to patients who suffer from other dental problems. Consumer health information providers should consider evidence-based information, use of multimedia, and information readability during the process of information production. Readability Studio Professional 2012 was found to be valid as a software application for assessing comprehensibility of online health information. Website affiliation and DISCERN were found to play a major role in the prediction of SIQ. Governmental websites were associated with the highest prediction for SIQ. DISCERN and HoNCode as online information credibility tools were significantly able to predict the SIQ. In instances where no guidance is available, patients could review governmental websites in light of DISCERN criteria to identify high-quality information. The developed SIQ Scale had high internal consistency and established convergent validity, suggesting its use in the future to assess the SIQ of online dental information.

Acknowledgments

This paper was part of the principal author's PhD research project, for which an Adelaide Scholarship International was received. The research received support from the Australian Research Centre for Population Oral Health, The University of Adelaide.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Criteria used for evaluating scientific information quality concerning wisdom teeth problems.

[\[PDF File \(Adobe PDF File\), 92KB - ijmr_v4i4e19_app1.pdf\]](#)

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Abbreviations

ANOVA: analysis of variance
HoN: Health on the Net
HoNCode: Health on the Net Code
SIQ: scientific information quality
SI Comprehension: Scientific Information Comprehension
SI Referencing: Scientific Information Referencing
SI Reporting: Scientific Information Reporting
TMs: third molars

Edited by G Eysenbach; submitted 19.05.15; peer-reviewed by S Pentecado, A Allam; comments to author 08.07.15; revised version received 20.07.15; accepted 22.07.15; published 06.10.15

Please cite as:

*Hanna K, Brennan D, Sambrook P, Armfield J
 Third Molars on the Internet: A Guide for Assessing Information Quality and Readability
 Interact J Med Res 2015;4(4):e19
 URL: <http://www.i-jmr.org/2015/4/e19/>
 doi: [10.2196/ijmr.4712](https://doi.org/10.2196/ijmr.4712)
 PMID:*

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**Chapter 8 (paper 4): Internet use, online
information seeking behavior and
knowledge among third molar patients
attending South Australia Dental Services**

Linkage to the body of work

The findings of our previous online information quality assessment concerning wisdom teeth argued that patients might not be able to identify high quality internet resources for wisdom teeth and therefore, might affect their knowledge about the topic. There was a limitation in the literature about patients' use of the internet for a specific dental topic and how internet use is associated with their knowledge. In addition, findings from our study presented in paper 1 revealed that multiple wisdom teeth extractions were more prevalent than single wisdom tooth extraction in Australia. Evidence, although it is from other countries, suggests that wisdom teeth patients are not adequately informed despite receiving standard care patient education. The Internet might fill the gap in informing wisdom teeth patients. Therefore, collecting and interpreting information about online information seeking behavior is important in making recommendations that might increase the usefulness of the internet as an adjunct information source to the current standard care patient education.

Highlights

- In contrast with what might be believed about the Internet use by public dental patients, the majority of our participants were internet-ready before attending their wisdom teeth consultation.
- Having an active decisional control preference and attainment of higher education was significantly associated with seeking internet information.
- However, the level of internet use for dental procedural information was not associated with their knowledge about wisdom teeth.

- On close examination of our participants' online information seeking behavior, the majority were able to specify how they searched for information however, they were not able to recognize online health information quality seals.
- When combining findings from this study with findings from paper 4, patients might need to be provided with internet guidance.
- The validity of the eHealth Literacy Scale (eHEALS) might add to the criticism already raised about it, as it failed to establish convergent validity with wisdom teeth knowledge scores among wisdom teeth online information seekers—an important outcome for online information seeking.

Future research

- Ehealth literacy interventions might need to be developed and evaluated in regard to improving the patients' ability to identify high quality online health resources.
- Providing patients with internet guidance might need to be evaluated in improving patients' knowledge about a specific topic, before consultation, and examine how this might affect the decision-making experience.
- Future developments in ehealth literacy measures might need to focus on actual ehealth literacy skills testing rather than self-reported skills attainment.

Statement of authorship

Title of Paper	Internet use, online information seeking behaviour and knowledge among third molar patients attending South Australia Dental Services
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input checked="" type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Sambrook P, Armfield J, Brennan D. Internet use, online information seeking and knowledge among third molars' patients attending South Australia Dental Services. <i>Patient Educ Couns.</i> 2016; XX

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Contribution to the Paper	Initial conceptualization, study design, ethical approvals, RCT registration, data collection and analysis, reporting and discussing findings and manuscript writing		
Overall percentage (%)	80%		
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.		
Signature		Date	25/05/2016

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 to 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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Abstract

Background: While Australians are searching the Internet for third molar (TM) information, the usefulness of online sources might be questioned due to quality variation. This study explored: (1) internet use, online information seeking behavior among TM patients attending public dental services and (2) whether patients' TM knowledge scores are associated with the level of internet use and eHealth Literacy Scale (eHEALS) scores.

Methods: Baseline survey data from the "Engaging Patients in Decision-Making" study were used. Variables included: socio-demographics, internet access status, online information seeking behavior, eHEALS, the Control Preferences Scale (CPS) and TM knowledge.

Results: Participants ($n=165$) were mainly female (73.8%), aged 19-25 years (42.4%) and had "secondary school or less" education (58.4%). A majority ($n=79$, 52.7%) had sought online dental information which was associated with active decisional control preference ($OR=3.1$, $P=.034$) and higher educational attainment ($OR=2.7$, $P=.040$). TM knowledge scores were not associated with either the level of Internet use ($F_{(2, 152)}=2.1$, $P=.094$, $\eta^2=.031$). or the eHEALS scores ($r=.147$, $P=.335$).

Conclusion: The internet prepared patient" phenomena exists among public TM patients and was explained by preference for involvement in decision-making. However, Internet use was not associated with better TM knowledge. Providing TM patients with internet guidance might be an opportunity to improve TM knowledge.

Keywords: third molar, online information seeking, ehealth literacy, eHEALS, the eHealth Literacy Scale, internet, the Control Preferences Scale and CPS.

Introduction

Australia is considered one of the top three countries in the world in searching for third molar (TM) information on the internet [1] however, little is known about the usefulness of the Internet as an information source for TM patients. While the current available evidence does not support or refute prophylactic TM removal [2,3], Australia's elevated hospitalization rates for TM extraction might suggest TM prophylactic extractions [4]. This creates pressure on Australian health services in general and more specifically on the public health services which is indicated by the prolonged waiting list for TM extractions [5]. In Australia, the Australian Dental Association [6] encourages patients to discuss the decision about prophylactic TM removal with their treating clinicians which, indeed, needs TM patients to be adequately informed. Furthermore, patients undergoing TM removal need to make other decisions such as selecting the treatment pathway and the anaesthetic option [7]. Therefore, providing TM patients with high quality information [8], besides its medico-legal importance [9], might facilitate patient participation in clinical decision-making.

While healthcare professionals remain the most trusted and reliable information source [10,11], patients are getting information from a variety of other sources [11]. The current clinical practice in informing TM patients is conducted through verbal information and information leaflets. Patients' ability to absorb and process the provided verbal information might be limited by the amount of allocated consultation time for each patient [8,12]. Additionally, patients with low health literacy levels may pretend to be adequately informed when communicating with their health professionals [13]. Furthermore, healthcare professionals are aware of the limitations of information leaflets in relation to their readability and information content [14]. The inadequacy of information supplied by

professional sources [15], might explain the observed difficulty of TM patients to recall the provided information [12].

It is understandable that a lack of adequate information from professional sources may drive patients to seek online information to satisfy their demand for information [11]. Although dental healthcare professionals were urged to be ready for discussing online information during consultation [16], there is a limitation in the available dental studies that explain the phenomena of the Internet-prepared patient. A non-dentally-related study observed an association between the pre-consultation online information seeking with the frequency of internet use and decisional autonomy [17]. This might not be applicable to users of public dental services since they are socio-economically disadvantaged [18] which might limit their use of the internet for health information [19]. In addition, addressing the association between the internet use for information about a specific dentally-related topic (such as TM) and patients' understanding about this topic is currently limited. Considering that online information quality varies significantly across websites in general [20] and more specifically for TM [21], it is becoming important to understand TM online information seeking behaviour. This might help to identify the usefulness of the internet as an adjunct information source to fill the gap in informing TM patients. In addition, this might help us to revise recommendations to improve the outcome of online information seeking.

Seeking online health information requires patients to have an additional set of skills called eHealth literacy [22] which includes the individual's ability to access the internet, computer use, ability to use search engines, ability to develop a search keyword strategy and to differentiate between high and low quality information. Assessment of eHealth literacy has been conducted using an observational approach or self-reported measures [23] such as the

eHealth Literacy Scale (eHEALS) [24]. Online dental information content analysis studies have questioned patients' ability to identify high quality online information [21,25]. However, this argument has only been supported by the observed variability in the online information quality rather than by patient reported data. Accordingly, identifying the association between eHEALS scores and patients' knowledge about a specific topic might provide evidence which is currently lacking in the available literature.

Accordingly, the objectives of this study were to explore: (1) internet use for dental procedural information and online information seeking behaviour among TM patients attending public dental services; (2) whether patients' TM knowledge is associated with: different levels of internet use for dental procedural information; and the eHEALS scores (among TM online information seekers).

Methods

Data source and ethical approvals

Data were obtained from the baseline survey of “Engaging Patients in Decision-Making” trial. The trial is registered on the Australian and New Zealand Clinical Trial Register ANZCTR: ACTRN12614000593639 [26]. The study received ethical approval from the Low Risk Human Research Ethics Committee (HREC), The University of Adelaide (HS-2013-023). In addition, the trial was approved by the Royal Adelaide Hospital (HREC) with an approval number: HREC/14/RAH/160. Operational approval of the study's Site Specific Assessment (SSA) was obtained from The South Australian Dental Services (SADS) with an approval number 2014-07326/1.

Participants and setting

Participants recruited for this study were adults aged 18 years or over, with internet access and referred by their dentist to the Department of Oral and Maxillofacial Surgery, Adelaide Dental Hospital for consultation regarding their TM. Participants were recruited by the department administrative officer after checking the referral letters against the selection criteria. Participants were invited using an invitational letter, 2–3 weeks prior to their TM consultation. The mailed letter included a SADS approach letter, participant information sheet, consent form, baseline survey ([Appendix III: Baseline survey package](#)), flyer for A\$10 gift voucher conditional on participation and a reply-paid envelope. No reminders were sent due to lack of sufficient time between the invitation and the consultation appointment.

Data collection instruments

Socio-demographic characteristics

Participants were asked to provide their socio-demographic information such as age (years), gender, educational attainment, individual income level, employment status, occupation, private health insurance status, health cards held by the participant, place of birth as a proxy for ethnicity and participants' contribution to their TM treatment costs.

The Control Preferences scale (CPS)

The CPS was developed by Degner, Sloan and Venkatesh [27] and was validated for its transferability into dentistry [28]. Participants were asked to select only one theme that reflects their preferred role in making a dental treatment choice. Participants were provided with five themes of the CPS and were scored as follows: 'I make the final decision about

which treatment I will receive' scores 5; 'I make the final selection after seriously considering my dentist's opinion' scores 4; 'My dentist and I share the responsibility for the decision about which treatment is the best for me' scores 3; 'My dentist makes the final decision about which treatment will be used but has seriously considered my opinion' scores 2 and 'I leave all decisions regarding my treatment to my dentist' scores 1. Based on the scale scores, 3 dental decisional control preference (DDCP) categories were created: "passive" (for scores 1 or 2), "collaborative" (for score 3) or "active" (for scores 4 or 5). Such an approach has been used previously [29].

Internet access

Participants were asked to provide details about their internet access status. These details included: whether the participant had internet access. In addition, we collected information about the type of internet connection (such as high speed cable or mobile internet), the device used to access the internet, frequency of internet access and the most common place for accessing the internet.

Online dental procedural information seeking

Data were collected about online information seeking including whether participants had used the Internet for getting information about a dental procedure. If the participants' response was 'Yes', they were asked to provide their search keyword to identify whether they had specifically searched for TM information. This specific wording and question sequence was used to obtain the information without inducing contamination to our trial control group. The provided search keyword was then coded into a binary response for TM search. For the purpose of getting the level of internet use for dental procedural information, a joint variable was created that consisted of 3 categories: 'No internet use for dental

procedural information’, ‘internet use for dental procedural information not specific to TM’ and ‘internet use for information specific to TM procedure’. Other details about the online information seeking included: the search engine that was used and affiliations of the reviewed websites. To explore our participants’ ability to identify high quality online information, they were asked to circle one or more online health information quality seals they recognized and to report the purpose of the circled figure. For the purpose of preventing false positive responses, the figure used contained some internet quality seals not related to online health information quality such as the VeriSign Secure Site ([Appendix III](#)).

The eHealth Literacy Scale (eHEALS)

The eHEALS is an 8-item self-reported scale developed by Norman and Skinner [24] to assess an individual’s skills to use internet with the correct keyword, to distinguish high quality information from low quality and how confident they feel about the identified information. The scale is scored on a 5-point Likert scale ranging from 1 for “strongly disagree” to 5 for “strongly agree”. The eHEALS total scores range from 8 to 40.

Perceived Online Information Quality (POIQ Scale)

The POIQ scales is a 5-item scale that was developed by the study authors to assess participants’ perceptions about the reviewed online information in relation to its trustworthiness, readability, usefulness, understandability and their judgment about its overall quality. Items were scored on a 5-point Likert scale ranging from 1 for “Strongly disagree” to 5 for “Strongly agree”. The total POIQ Scale scores range from 5 to 25.

TM Knowledge

The TM Knowledge score was measured using a multiple-choice questionnaire developed by the study's authors to test participants' understanding of TM. The developed questionnaire covers different areas of information such as aetiology, the most frequent reason for TM extraction, anaesthetics options, risks associated with TM surgery and post-operative care (Appendix). If the participant's response was found to be correct, the item was given the score of 1. If the participant's response was found to be incorrect, the item was given the score of 0. Thus, the total TM Knowledge scores range from 0 to 5.

Data analysis

Data were analysed using SPSS for Windows v 23.0 [30]. Associations between participants' characteristics and online dental procedural information seeking were explored using Pearson Chi-Square (χ^2). A binary logistic regression model for online dental procedural information seeking behaviour was conducted to explore variables which might be associated with this behaviour. Cronbach alpha reliabilities for eHEALS and POIQ Scale were calculated. To explore the associations between eHEALS, POIQ and TM Knowledge scores among TM online information seekers, Pearson r correlations were obtained. To identify whether different levels of online dental procedural information seeking were associated with TM Knowledge scores, One-way ANOVA was performed.

Results

Participants' characteristics

Participants ($n=165$) were mainly females ($n=121$, 73.8%) while the largest age group comprised 19-25 years ($n=76$, 42.4%). The majority of the study participants had 'secondary school or less' education ($n=94$, 58.4%) followed by 'Certificate/Diploma' ($n=39$, 24.2%) and 'higher education' ($n=28$, 17.4%). The majority of our study participants earned 'less than \$20,000 annually' ($n=110$, 70.1%) and just under half of them were 'unemployed' ($n=79$, 47.6%). The majority of the study participants did not have access to private health insurance ($n=145$, 89.5%). The majority of our study participants were born in Australia ($n=145$, 89.5%) and a large percentage of them had a preference for an active decisional role in making a dental treatment choice ($n=71$, 44.1%). Table 11 shows more detailed participant's characteristics by their internet use for seeking dental procedural information.

Internet access and associations with internet use for dental procedural information

All participants who were included in this study had access to the Internet. The majority of our study participants accessed the Internet via mobile internet ($n=97$, 66.0%) while 33.3% accessed the internet via high speed cable. Participants reported accessing the Internet mainly at home ($n=137$, 93.2%). The most frequently reported devices used to access the Internet were Tablets/smart phones ($n=64$, 43.5%) and laptops ($n=61$, 41.5%). The majority of the study participants claimed to access the internet 'many times a day' ($n=107$, 72.3%).

However, there was no statistically significant association between internet access variables and seeking online dental procedural information (not presented).

Online information seeking behaviour

More than half of our participants claimed to use the internet to get dental procedural information ($n=79$, 52.7%) in the last 12 months. Online dental procedural information seeking was found to be significantly associated with educational attainment ($\chi^2=6.8$, $P=.022$) and dental decisional control preferences (DDCP) ($\chi^2=7.4$, $P=.024$) as shown in Table 11. In a binary logistic regression model for dental procedural information seeking, having a higher educational attainment ($OR=2.7$, $P.04$) and an active DDCP ($OR=3.1$, $P.034$) were significant predictors (Table 12). Almost half of online dental procedural information seekers ($n=46/79$, 58.2 %) have provided a search keyword specific for TM procedure. Dental practices websites ($n=32$, 26.2%) were the most commonly reviewed while government sponsored websites were reviewed to a lesser extent ($n=29$, 22.8%). Only 30.3% of online dental procedural information seekers were able to recognise one or more online health information quality seals whereas, only 15 of them were able to specify the purpose of these quality seals as online health information quality seals. The most frequently reported reason for seeking online dental procedural information was to help them in making a treatment choice ($n=26/79$, 32.9%).

The association between eHEALS, POIQ Scale and TM Knowledge scores among TM online information seekers

Among TM online information seekers, the 8-item eHEALS had a mean of 26.2 ($SD=4.8$) and showed high internal consistency (Cronbach alpha=.89) (Table 13). The 5-item POIQ Scale had a mean of 19.1 ($SD=3.5$) and it also showed high internal consistency (Cronbach alpha=.88). The TM Knowledge score had a mean of 3.0 ($SD=.9$). There was a positive, strong and significant correlation between eHEALS and the POIQ Scale scores ($r=.78$, $P<.01$) (Table 13). On the other hand, there was no statistically significant association between TM Knowledge scores and either eHEALS scores ($r=.147$, $P=.335$) or POIQ Scale scores ($r=.003$, $P=.854$).

The association between the level of internet use for dental procedural information and TM Knowledge scores

One-way ANOVA for the TM Knowledge scores across the three levels of internet use for dental procedural information showed no statistically significant difference with a minimal effect size ($F_{(2, 152)}=2.1$, $P=.094$, $\eta^2=.031$).

Discussion

Findings of this study suggest that the internet is used as a source for information among users of public dental services who, traditionally, were believed to have limitations in using the Internet for health information [19]. In addition, this study found that active dental decisional control preference and higher educational attainment were significant predictors for pre-consultation online dental procedural information seeking. However, the level of internet use for dental procedural information was not significantly associated with a better TM understanding. This limits the usefulness of the Internet as an adjunct source of information.

Examining the collected details about participants' online information seeking behaviour, the majority of them seemed to have the computer skills needed for getting online health information. This was indicated by their ability to name a search engine, provide a valid search keyword and their familiarity with affiliations of the websites they reviewed. However, we observed their inability to recognise online health information quality seals. This might question their ability to identify high quality online resources. Although dental practice and governmental websites were frequently reviewed and known to have high quality regardless of displaying quality seals [21], online information seekers have the tendency to review several websites with different affiliations and quality [21]. This might explain why internet use was not associated with better TM Knowledge scores. In addition, the observed lack of association between either: eHEALS or POIQ Scale scores and TM Knowledge scores among TM online information seekers, quantitatively, might confirm this finding. Identifying high quality online resources is a known issue generally [20] and more

specifically for TM online information [21] due to the wide variability in information quality across websites.

Providing patients with internet guidance might help online information seekers to access high quality online information. Although internet guidance was suggested to overcome the observed variability in online information quality [21,25], data obtained from the study's participants suggest that it might be needed as a solution at the individual (micro) level. A population-based (macro) level solution might include introducing ehealth literacy intervention programs to improve online information seekers' ability to identify high quality online information. It is worth stressing the suggested need for global action by the World Health Organization towards online health information quality [31]. Providing ehealth literacy interventions needs a precise and sensitive ehealth literacy measure to serve as an end-point for ehealth literacy intervention research. The eHEALS, which was used in this study as a measure for ehealth literacy, failed to establish convergent validity with TM Knowledge — an outcome of online information seeking. This adds to the reported criticism over the validity of eHEALS [32]. Therefore, future ehealth literacy instrument development might need to focus on actual testing of ehealth literacy skills rather than self-reported skills attainment.

The significant association between active dental decisional control preference and online dental procedural information seeking might explain the phenomena of the Internet prepared patient as our participants claimed using the internet helped them in making treatment decisions. The phenomena of the Internet prepared patient which was observed here was also reported in a previous study [33] without providing an explanation. However, clinicians have been urged to be prepared for this phenomena when communicating with their patients [16].

Although patient-dentist communication is currently conducted through verbal information and information leaflets, the majority of our participants claimed not to have received information leaflets. Dentists are reminded that information leaflets, despite their limitations, are still considered part of the standard care for patient education.

The main limitation of this study is the small sample size due the low response rate associated with mail recruitment for studies targeting a population with similar characteristics [34]. Although higher response rates are known to be associated with other recruitment methods such as emails and social media advertisement [34], application of such approaches was not possible in this study. The present study reported estimates of effect size which is independent of the sample size [35] in an attempt to overcome this issue. In addition, the generalisability of the study findings pertains to a sample that consisted of public sector dental patients. These patients are socio-economically disadvantaged making them eligible to receive government supported dental services [18]. On the other hand, the study has several strengths. It contributes to patient education theory by highlighting gaps in online information seeking and suggesting some solutions at the micro and macro levels. Understanding the drivers for online information seeking might not only make clinicians appreciate this behaviour but also, assist them with actively discussing this information with their patients. This might improve patient-dentist communication. The study contributed to research methods through the questionnaire design and highlighting the limitations of the eHEALS which might be considered in future ehealth literacy research.

Conclusion

This study found that a majority of TM patients attending public dental services sought online dental procedural information before consultation. Online dental procedural information seeking was significantly associated with participants' active dental decisional control preference and attainment of a higher education. This might explain the phenomena of "the internet prepared patient" that was reported here and in other studies. In addition, the study found that different levels of internet use for dental procedural information was not significantly associated with their TM understanding. Online dental procedural information seekers were unable to recognise online health information quality seals which might limit their ability to identify high quality online health information. Improving patients' ability to identify high quality information might be enabled via introducing ehealth literacy interventions or providing patients with internet guidance. The observed lack of association between eHEALS and TM Knowledge scores among TM online information seekers adds to the concerns raised about the validity of eHEALS. Future research focusing on ehealth literacy measures' development might need to consider actual ehealth skills testing rather than self-reported skills attainment.

Acknowledgement

This paper was part of the principle author's PhD research project, for which an Adelaide Scholarship International was received. The research received support from Australian Research Centre for Population Oral Health (ARCPHO), The University of Adelaide.

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

Abbreviations

ANZCTR: Australian and New Zealand Clinical Trial Register

ANOVA: Analysis of Variance

CPS: The Control Preferences Scale

DDCP: Dental Decisional Control Preferences

eHEALS: e-Health Literacy Scale

HREC: Human Research Ethics Committee

POIQ Scale: Perceived Online Information Quality Scale

RCT: Randomized Controlled Trial

TM: Third Molar

Table 11: Participants' characteristics and their online dental procedural information seeking

	Seek online dental procedural information		Chi-square association		
	<i>n</i> =165 Valid %	Yes Valid %	Value	df	Sig.
Age group					
18 years or less	14.6%	34.8%	4.2	3	.237
19-25 years	42.4%	54.7%			
26-36 years	30.4%	61.0%			
36 years and over	12.7%	50.0%			
Gender					
Female	73.8%	55.3%	1.0	1	.322
Male	26.2%	45.7%			
Level of education					
Secondary school or less	58.4%	44.6%	6.8	2	.033*
Certificate or diploma	24.2%	59.5%			
Higher education	17.4%	71.4%			
Income					
Less than \$20,000	70.1%	49.0%	2.9	2	.239
\$20,000 and less than \$30,000	19.7%	61.3%			
\$30,000 or more	10.2%	69.2%			
Employment status					
Unemployed	47.6%	44.8%	3.8	2	.152
Student	30.1%	55.1%			
Employed	22.3%	64.7%			
Place of birth					
Australia	89.5%	51.1%	1.8	1	.182
Outside Australia	10.5%	68.8%			
Dental Decisional Control Preference					
Passive	18.6%	33.3%	7.4	2	.024*
Collaborative	37.3%	49.1%			
Active	44.1%	64.2%			
Who pay for your TMs treatment					
Patient pay all expenses	11.4%	47.4%	2.7	3	.435
Patient pay some	16.9%	52.0%			
Patient pay none	20.5%	41.4%			
Not specified	51.2%	58.4%			

Table 12: Logistic regression model for online information seeking for dental procedural information

	B	S.E.	Wald	df	Sig.	OR	95% CI for OR	
							Lower	Upper
Age (year)	0.01	0.02	0.29	1.00	0.588	1.01	0.97	1.06
Gender (male)	-0.30	0.43	0.48	1.00	0.490	0.74	0.32	1.73
Education ¹			4.25	2	.120			
Higher education	1.01	0.49	4.23	1.00	0.040	2.73	1.05	7.13
Certificate/ diploma	0.18	0.44	0.17	1.00	0.677	1.20	0.51	2.84
Dental Decisional Control Preferences ²			5.38	2.00	0.068			
Collaborative	0.48	0.53	0.84	1.00	0.359	1.62	0.58	4.55
Active	1.14	0.54	4.52	1.00	0.034	3.12	1.09	8.92
Constant	-1.02	0.74	1.92	1.00	0.165	0.36		

1: Reference category for education is “secondary school or less”

2: Reference category for dental decisional control preferences is “Passive”

Table 13: The association between eHEALS, POIQ and TMs Knowledge among TM online information seekers

	N of Items	Alpha	Mean	Std. Deviation	Pearson Correlation	POIQ Scale	TM Knowledge
eHEALS	8	.89	26.2	4.8	Pearson Correlation	0.776**	0.147
					Sig. (2-tailed)	0.000	0.335
POIQ Scale	5	.88	19.1	3.5	Pearson Correlation	1	0.028
					Sig. (2-tailed)		0.854
TM Knowledge	5	N/A	3.0	.9	Pearson Correlation	0.028	1
					Sig. (2-tailed)	0.854	

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**Chapter 9 (paper 5): Preferences for dental
decisional control and associations with
quality of life among third molar patients
attending South Australia Dental Services**

Linkage to the body of work

This manuscript was produced to report the prevalence of different decisional control preferences among wisdom teeth patients attending South Australia Dental Services. In addition, we explored individual characteristics associated with preferences for dental decisional control. Furthermore, we tried to explore the association of patients control in decision-making with quality of life—an important end point for health service research. This paper might show the benefit for enhancing patients' participation in decision-making. Although this study was not able to establish a causal inference for the relationship between patients' involvement in decision-making and quality of life, it forms an important milestone in the field of dental decision-making. This is because of the limitation of dental studies that address this field of research.

Highlights

- In contrast to what might be expected from findings in medical literatures, public dental patients preferred to be involved in decision-making either actively or collaboratively.
- Being a female patient and/or having college or higher education was associated with active decisional control preference. This might improve patient-dentist communication by making clinicians more sensitive to patients' desire for control.
- When patients reported that they preferred to be involved in making their dental treatment choice (either actively or collaboratively), it was found to be associated with a better oral health-related quality of life compared with participants who

preferred to be passive in their decisional control. This might suggest the need for enhancing patients' involvement in decision-making.

- Although we didn't observe an association between dental decisional control preferences and health-related quality of life, the positive direction of the association between patient preferences for involvement (either actively or collaboratively) versus participants who were passive might suggest further exploration.

Future research

- The causal association between dental decisional control preferences might need further exploration.
- Further exploration of the association between dental decisional control preference and health related quality of life. By combining findings from paper 2 and paper 4, the researcher recommends the use of different instruments other than EuroQoL 5D-5L such as the 35 item Assessment Quality of Life (AQoL).

Statement of authorship

Title of Paper	Preferences for dental decisional control and associations with quality of life among third molar patients attending South Australia Dental Services
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input checked="" type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Sambrook P, Armfield J, Brennan D. Preferences for dental decisional control and associations with quality of life among third molar patients attending South Australia Dental Services. Community Dent Oral Epidemiol. 2016; xx.

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Name of Principal Author (Candidate)	Kamal Hanna		
Contribution to the Paper	Initial conceptualization, study design, ethical approvals, RCT registration, data collection and analysis, reporting and discussing findings and manuscript writing		
Overall percentage (%)	80%		
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.		
Signature		Date	20/7/2016

Co-Author Contributions

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

- iv. the candidate's stated contribution to the publication is accurate (as detailed above);
- v. permission is granted for the candidate to include the publication in the thesis; and
- vi. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Abstract

Objectives: To explore: (1) the prevalence of dental decisional control preferences (DDCP) among public third molar (TM) patients and associated individual's characteristics, and (2) the association between DDCP and quality of life (QoL).

Methodology: Participants were adult public dental patients with internet access referred to the Adelaide Dental Hospital for TM consultation. Collected data included socio-demographic variables, the Control Preferences Scale (CPS), the Oral Health Impact Profile (OHIP-14) and the EuroQol EQ-5D-5L.

Results: 163 participants were included, the majority aged 19-25 years ($n=67$, 42.4%), being female ($n=120$, 73.6%), having "secondary school or less" education ($n=94$, 58.4%) and having low-income ($n=110$, 71%). Active DDCP was the most prevalent ($n=71$, 44.1%) followed by collaborative ($n=60$, 37.3%) while the least being passive ($n=30$, 18.6%). Gender ($\chi^2=6.01$, $P=.050$) and education ($\chi^2=6.99$, $P=.030$) were associated with DDCP. In a multinomial logistic regression model for DDCP, females were more likely to have active DDCP ($OR=2.73$, $P=.042$) as were participants who had tertiary education ($OR=2.72$, $P=.043$). In a linear regression model for OHIP-14, active DDCP ($B=-6.4$, $P=.048$) and collaborative DDCP ($B=-6.6$, $P=.040$) were associated with less impact on oral health-related QoL.

Conclusion: Adult public patients preferred to be involved (either actively or collaboratively) in dental decision-making. Understanding that being a female and/or having tertiary education were associated with active DDCP might improve patient-dentist communication. The positive association between patients' involvement in decision-making and oral health-related QoL might support the benefit for enhancing patients' involvement in decision-making.

Keywords: decision control preferences (DCPs), health outcomes, oral health-related quality of life, OHRQoL, health-related quality of life, HRQoL, OHIP-14, EQ-5D-5L, the Control Preference Scale, CPS.

Introduction

Dental decision-making is an interactive form of dentist-patient communication and information sharing which aims to allow an evidence-based treatment choice that respects the patients' beliefs and values. Recently, there has been a shift in the health professional-patient relationship from a paternalistic relationship to an informed relationship until 1998 when the concept of shared decision-making (SDM) was firstly introduced in the United States [1,2]. Several factors contribute to SDM including the current clinical practice, clinical uncertainty and the patient preference for decisional control [3]. Patients preferences for decisional control might be in the form of being active, collaborative or passive [4]. Actively Involving patients in decision-making is becoming necessary not only for moral reasons but also due to the practicing of evidence-based health care and the increase in the available treatment options [5]. This has made the patient's involvement in treatment decisions a cornerstone for providing patient-centered care [6]. There are limited dentally-related studies that explore preferences for decisional control in dental patients.

Decisional control preferences are known to be associated with some individual's characteristics. A medically-related review by Say *et al.* [7] showed that educational attainment, the increase in age to a certain limit and being a female were associated with active decisional control. On the other hand, the same review concluded that low-income patients were more likely to have a passive DCP. Accordingly, it might be argued that public dental patients are more likely to be passive in their dental decisional control since the majority are health care cards holders and of a low-income [8]. However, the recent increase in health information access enabled by the internet, individualism and consumerism [9] might have an effect on DDCP of public dental patients. It might be beneficial to understand

DDCP among a specific group of public dental services users such as third molar (TM) patients and factors contributing to these preferences.

The benefits of involving TM patients in decision-making might include the improvement of the decision quality and the reduction in decisional conflict. For example, there is a lack of evidence to support the prophylactic removal of asymptomatic impacted TM [10], while the current Australian figures suggests that they are prophylactically removed [11] whereas, Australia has seven times the hospitalization rate for TM extraction compared with countries such as the United Kingdom. In addition, patients themselves might obtain inconsistent recommendations regarding TM extractions from the Internet [12,13] which might be a potential source of decisional conflict. It might be possible to eliminate decisional conflict when patients are involved in treatment decision-making [14-16]. Understanding the individual's characteristics contributing to DDCP might help the clinicians' sensitivity to give their patients' desired DDCP which is currently limited in the available dental literature.

When patients are involved in decision-making, they are more likely to adhere to the treatment recommendations, are more informed, are more satisfied with the decisions, and are able to make high quality decision [17,18] which might improve health outcomes. Among health outcomes, quality of life (QoL) has become an important end-point for health services research [19]. However, few studies have explored the association between DDCP and QoL among public dental patients. When using QoL as an outcome for dental research, Brennan, Spencer [20] recommend to combine the generic Health related QoL (HRQoL) with the disease specific oral health-related QoL (OHRQoL) measures to capture different QoL elements. Therefore, it might be useful to explore whether DDCP is associated with QoL using this dual approach.

The aims of this study were to: (1) explore the prevalence of different DDCP among public TM patients and to explore individual's characteristics which might be associated with DDCP; and (2) explore the association between DDCP and quality of life (OHRQoL and HRQoL).

Methods

Data source and ethical approvals

Data used in this study were sourced from the baseline survey of the “Engaging Patients in Decision-Making” study. This trial received ethical approvals from Low Risk Human Research Ethics Committee (HREC), The University of Adelaide (HS-2013-23) and the trial's National Ethics Application Form (NEAF) Ref: AU/1/F3A7115 was approved by the Royal Adelaide Hospital (HREC) with an approval number: HREC/14/RAH/160. For the trial to be carried out at Adelaide Dental Hospital, a Site-Specific Assessment (SSA) was obtained from South Australian Dental Services (SADS) with an approval number 2014-07326/1. The trial was registered on the Australian and New Zealand Clinical Trial Register with a registration number: ACTRN12614000593639 [21].

Participants and setting

Participants were recruited from patients eligible to receive public dental services provided by SADS and were referred by their public dentist for TM consultation. For inclusion, participants needed to be aged 18 years or over and have access to the internet. Participants were recruited by the department of Oral and Maxillofacial Surgery administrative officer at

the ADH. Participant recruitment was carried out using an invitation package which included a SADS approach letter, participants' information sheet, consent form, baseline survey, a reply-paid envelope and a flyer of \$10 for a conditional gift voucher on participation.

Data collection instruments

Participants' socio-demographic characteristics

Participants were asked to provide their socio-demographic information such as age (years), gender, educational attainment, individual's income level, employment status, occupation, private health insurance (PHI) status, health cards held by the participant, participants' contribution to their TM treatment costs and place of birth as a proxy for ethnicity.

The Control Preferences scale (CPS)

The CPS was developed by Degner et al. [4] and it was validated for its transferability into dentistry [22]. Our participants were asked "Please select only one theme that reflects your preferred role in making a dental treatment decision". Participants were provided with 5 themes of the CPS which reflect the individual's preferred role in making a treatment decision. The CPS themes and their scores were: "I make the final decision about which treatment I will receive" scores as 5, "I make the final selection after seriously considering my dentist's opinion" scores as 4, "My dentist and I share the responsibility for the decision about which treatment is the best for me" scores as 3, "My dentist makes the final decision about which treatment will be used but has seriously considered my opinion" scores as 2 and "I leave all decisions regarding my treatment to my dentist" scores as 1. Based on the scale

scores, 3 categories: were created: passive (for scores 1 or 2), collaborative (for score 3) or active (for score 4 or 5) DDCP. Such an approach has been used before [23].

Health-related quality of life using EuroQoL EQ-5D-5L

The EQ-5D-5L is a 5-item HRQoL measure which was developed by The EuroQol Group [24] as a measurement of health profile. Each item represents a QoL domain. These domains are: mobility, self-care, pain, anxiety and daily activities with reference period “today”. Each item is scored on a 5-point scale ranging from 0 for “I have no problems” to 4 for “I have extreme problems”. The total EQ-5D-5L score ranges from 0 to 20. The Euro QoL Group claims that this 5-level response scale is more sensitive than the previously used 3-level scale (EQ-5D-3L).

The Oral health-related quality of life using Oral Health Impact Profile-Short Form (OHIP-14)

The OHIP-14 is a 14-item scale [25], a shorter version of the original OHIP-49, which is based on Locker’s conceptual model for oral health and adapted from the World Health Organization framework for impairment [26]. The OHIP-14 consists of seven domains where each domain is represented by 2 items. Domains for the OHIP-14 are: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. The OHIP-14 has been used previously as an endpoint for TM research [27]. Items for the OHIP-14 are scored on a 5-point scale ranging from 0 for “Never” to 4 for “very often”. The total OHIP-14 scores range from 0 to 56. The reference period was “over the past 12 months”.

The Single-item global rating of oral health and global general health

The single-item global oral health measure was developed by Locker, Allen [28] as a self-rating for oral health status. The response on “rate your oral health” is scored on a 5-point scale ranging from 5 for “Excellent” to 1 for “Poor”. The self-rated general health measure uses the same scoring system for the single-item self-rated oral health.

Data analysis

Data were analyzed using SPSS statistics for Windows V 23.0 [29]. To explore associations between participants’ characteristics and DDCP, χ^2 associations were calculated. Furthermore, this association was explored in an adjusted analysis using multinomial logistic regression model for DDCP. Scales mean, SD, reliability were calculated and convergent validity of these scales were tested. To explore the association between DDCP among other covariates, a multivariable linear regression model for each of the selected QoL measures was conducted.

Results

Participants’ characteristics

A total of 163 responses were included after excluding 2 participants due to a large number of missing information. The majority of our participants were females (n=120, 73.6%) and the largest age group comprised those aged 19-25 years (n=67, 42.4%). The majority of our participants had a “secondary school or less” level of education (n=94, 58.49%), while “tertiary education” was less prevalent (n=67, 41.6%). Nearly half of our participants were

unemployed (n=76, 46.6%) and the majority of them earning “less than \$20,000” annually (n=110, 71%). Nearly half of our study participants preferred an active decisional control (n=71, 44.1%) followed by collaborative DDCP (n=60, 37.3%) while a few (n=30, 18.6%) preferred to be passive. Table 14 shows more details about our participants’ characteristics.

The association between individual’s characteristics and DDCP

DDCP was significantly associated with both gender ($\chi^2=6.01$, $P=.050$) and educational attainment ($\chi^2=6.99$, $P=.030$) as shown in Table 14. In order to explore contributing factors to DDCP, a multinomial logistic regression model for DDCP was performed with “Passive” DDCP as the reference category. It was found that females were more likely to have an active DDCP ($OR=2.73$, $P=.042$). In addition, having tertiary education was more likely to be associated with having an active DDCP ($OR=2.72$, $P=.041$), as shown in Table 15.

The association between dental decisional control preference (DDCP) and OHRQoL using the OHIP-14

The OHIP-14 mean score was 21.7 ($SD=14.5$) and the OHIP-14 scores were significantly correlated with global self-rated oral health ($r=-.33$, $P<.01$). In a multivariable linear regression model for the OHIP-14 and after statistically controlling for age, gender, educational attainment and individual’s income, having an active dental decisional control preference DDCP ($B=-6.40$, $P=.048$) or collaborative DDCP ($B=-6.66$, $P=.040$) were

significantly associated with less impacts on OHRQoL. Table 16 shows the association between DDCP and the OHIP-14.

The association between DDCP and the EQ-5D-5L

The EQ-5D-5L mean score was 3.1 ($SD=2.5$) and the EQ-5D-5L scores were significantly correlated with the single-item global self-rated general health ($r=-.34$, $P<.01$). In a multivariable linear regression model for the EQ-5D-5L and after statistically controlling for age, gender, educational attainment and individual's income, it was found that either active or collaborative DDCP was not significantly associated with a better HRQoL when compared with passive DDCP. Table 17 shows the multivariable linear regression model for EQ-5D-5L.

Discussion

In this study, we found that there was a wide preference among our participants for involvement in making their dental treatment choices either actively or collaboratively. The preference for active involvement in treatment decision-making was significantly associated with being a female and/or having tertiary education. The preference of our participants for involvement (either actively or collaboratively) in dental treatment decision-making was significantly associated with less impact on their OHRQoL. While the observed association between DDCP and HRQoL was not statistically significant, the positive direction of the association could be tested in further studies with greater statistical power in order to verify this potential relationship.

The observed high prevalence for more involvement in dental decision-making was found to be different from the evidence suggested by medically-related studies investigating DCP among disadvantaged adults. This might be attributed to the difference in the complexity of the condition as patients tend to prefer to be involved in treatment decision-making when the condition is not critical [30]. Furthermore, medically-related studies indicated that frequent visiting is associated with an increase in the preference for involvement in decision-making [9] – a finding which might need to be considered for DDCP. There has been an increased tendency for patients to participate in clinical decision-making [31] which is advocated for in Australian healthcare policies as an integral part of patient-centered care [6]. The prevalence of high involvement preference in decision-making might also be attributed to decreased clinician-patient power distance enabled by the increased access to health information [32].

Not surprisingly, female participants were more likely to prefer greater involvement in determining their own treatment than were males. This was found to be consistent with a review that included medical studies for DCP [7]. Alden et al. [9] believed that females compared to males have more life-experience which might explain this phenomenon. Also, the observed association between educational attainment and active DDCP is understandable considering that clinical decision-making is an interactive communication process and literacy level is known to be of importance. Although evidence from medical studies suggests that being on a low-income, in general, is associated with a preference for a passive decisional control [7], findings from our study suggest that this association was weak and insignificant.

When our participants reported, they have a preference for involvement in their dental treatment decision-making, it was found to be positively associated with OHRQoL. Street et al. [17] argued that when patients are involved in clinical decision-making, it improves the quality of the decision, and in turn the health outcomes. Findings of our study might provide some evidence to support the possible benefit for involving patients in dental decision-making in order to improve their OHRQoL. Although the association between patients' involvements in dental decision-making was not significantly associated with HRQoL, it demonstrated a positive direction of the association. The lack of significance in this association in relation to the EQ-5D-5L might be due to the difference in domains measured by this instrument theoretically [33] which results in a difference in the correlation strength between different HRQoL measures with the same oral health status [34]. The reference period of "today" for the EQ-5D-5L versus a longer reference period was known to underestimate the impact of a specific condition on HRQoL [35] which might be of an effect.

This study has some limitations related to the sample size due to the low response rate associated with these kinds of studies targeting young disadvantaged adults. However, the sample size is relatively larger than the sample size reported in similar studies [30]. In addition, the study was not able to make an inference about the causal association between DDCPs and QoL. However, the way in which the CPS was worded might suggest that our participants adopted the selected role in their previous dental treatment decision-making. Another limitation is the generalizability of our findings which is limited by the specified sampling frame. On the other hand, this study has several strengths. It contributes to the field of dental decision-making by revealing the positive association between active DDCP and QoL. In addition, we determined the individual's characteristics associated with DDCP. This is important to improve clinical practice by not only changing what might be believed

before about DDCP for public dental patients but also improving clinicians' sensitivity to the desired DDCP for their patients. The clinician ability to encourage their patients to take the desired DDCP might improve their patients' QoL. Arriving at these findings was enabled by the study design that were used.

Conclusion

In contrast with what was traditionally believed for public dental patients in relation to their preference for a passive role in decision-making, the majority of our participants preferred to be involved in making their dental treatment choices. Being a female and/or having a tertiary education was more likely to be associated with a preference for an active decisional control. No doubt that the best way to find out the patient's preferred DDCP is for the clinicians to ask their patients however, understanding the patients' characteristics associated with DDCP might enable clinicians to be more sensitive to their patients' desire for decisional control. It was found that participants who preferred to be involved in dental treatment decision-making (either actively or collaboratively) have less impact on their OHRQoL when compared with participants who have a passive DDCP. Although this positive association was maintained in regards to HRQoL, it was not found to be statistically significant. This might suggest the need for future studies with a larger statistical power or using a different HRQoL instrument to explore this association further since, QoL domains captured by EQ-5D-5L is limited. Findings from this study might support the need for clinicians to enhance their patients' involvement in decision-making to improve their quality of life.

Acknowledgement

This paper was part of the principle author's PhD research project, for which an Adelaide Scholarship International was received. The research received support from Australian Research Centre for Population Oral Health (ARCPOH), The University of Adelaide.

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

Abbreviations

ADL: Adelaide Dental Hospital

ANZCTR: Australian and New Zealand Clinical Trial Register

CPS: The Control Preferences Scale

DCPS: Decision control preferences

DDCP: Dental Decisional Control Preference

HREC: Human Research Ethics Committee

HRQoL: Health-related Quality of Life

OHIP-14: Oral Health Impact Profile –short form

OHRQoL: Oral Health-Related Quality of Life

RCT: Randomized Controlled Trial

SADS: South Australia Dental Services

SDM: Shared Decision-making

TMs: Third Molars

Table 14: Participants characteristics and its association with their decisional control preference

	n	%	Decisional Control Preference						χ^2 association		
			Passive		Collaborative		Active		χ^2	df	Sig.
			n	%	n	%	n	%			
Age group											
18 years or less	23	14.6%	5 _a	21.7%	9 _a	39.1%	9 _a	39.1%	2.63	6	.854
19-25 years	67	42.4%	15 _a	22.7%	22 _a	33.3%	29 _a	43.9%			
26-36 years	48	30.4%	6 _a	12.8%	21 _a	44.7%	20 _a	42.6%			
36 years and over	20	12.7%	4 _a	20.0%	7 _a	35.0%	9 _a	45.0%			
Gender											
Female	120	73.6%	17 _a	14.4%	44 _{a, b}	37.3%	57 _b	48.3%	6.01	2	.050*
Male	43	26.4%	13 _a	30.2%	16 _{a, b}	37.2%	14 _b	32.6%			
Education											
Secondary school or less	94	58.4%	22 _a	23.7%	38 _{a, b}	40.9%	33 _b	35.5%	6.99	2	.030*
Tertiary education	67	41.6%	8 _a	11.9%	22 _{a, b}	32.8%	37 _b	55.2%			
Employment status											
Unemployed	76	46.6%	16	21.6%	27	36.5%	31	41.9%	1.655	4	.799
Student	50	30.7%	7	14.0%	18	36.0%	25	50.0%			
Employed	37	22.7%	7	18.9%	15	40.5%	15	40.5%			
Individual's income											
Less than \$20,000	110	71.0%	24 _a	22.0%	39 _a	35.8%	46 _a	42.2%	1.59	2	.451
\$20,000 or more	45	29.0%	6 _a	13.3%	17 _a	37.8%	22 _a	48.9%			
Private health insurance											
No	145	89.5%	28 _a	19.4%	53 _a	36.8%	63 _a	43.8%	0.60	2	.742
Yes	17	10.5%	2 _a	11.8%	7 _a	41.2%	8 _a	47.1%			
Who pay for your TMs treatment expenses											
Patient pay all	19	11.7%	3 _a	15.8%	6 _a	31.6%	10 _a	52.6%	2.98	6	.812
Patient pay some	28	17.2%	4 _a	14.3%	12 _a	42.9%	12 _a	42.9%			
Patient pay none	34	20.9%	9 _a	26.5%	13 _a	38.2%	12 _a	35.3%			
Not specified	82	50.3%	14 _a	17.5%	29 _a	36.3%	37 _a	46.3%			
Place of birth											
Australia	145	89.5%	28 _a	19.4%	50 _a	34.7%	66 _a	45.8%	3.78	2	.151
Outside Australia	17	10.5%	2 _a	11.8%	10 _a	58.8%	5 _a	29.4%			

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column proportions. Cells with no subscript are not included in the test. Tests assume equal variances.¹

1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

*. The Chi-square statistic is significant at the .05 level.

Table 15: Multinomial logistic regression model for dental decisional control preferences ^a

DDCP		B	Std. Er	Wald	df	Sig.	OR	95% CI for OR	
								Lower Bound	Upper Bound
Collaborative	Intercept	-0.36	0.88	0.16	1.00	.685			
	Age (years)	0.01	0.03	0.24	1.00	.623	1.02	0.96	1.08
	Gender (female)	0.62	0.48	1.66	1.00	.197	1.86	0.73	4.75
	Education ^b								
	Tertiary education	0.31	0.51	0.36	1.00	.546	1.36	0.50	3.68
	Individual income ^c								
	[\$20,000 or more	0.39	0.58	0.44	1.00	.506	1.47	0.47	4.58
Active	Intercept	-0.33	0.90	0.14	1.00	.713			
	Age (years)	0.00	0.03	0.01	1.00	.915	1.00	0.94	1.06
	Gender (female)	1.00	0.49	4.14	1.00	.042	2.73	1.04	7.17
	Education ^b								
	College or higher education	1.00	0.49	4.11	1.00	.043	2.72	1.03	7.14
	Individual's income ^c								
	\$20,000 or more	0.45	0.58	0.61	1.00	.435	1.57	0.50	4.90

^a the reference category for DDCP is: Passive.

^b the reference category for education is: Secondary school or less.

^c the reference category for individual's income is: Less than \$20,000.

Table 16: Linear regression model for OHIP-14

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	21.35	4.60		4.64	.000
Age (years)	0.40	0.15	0.22	2.65	.009
Gender (male)	-10.44	2.62	-0.32	-3.98	.000
Education ^a					
Tertiary education	-3.88	2.37	-0.13	-1.64	.104
Individual income ^b					
\$20,000 or more	-2.32	2.69	-0.07	-0.86	.389
Dental decisional control preference ^c					
Collaborative	-6.66	3.22	-0.22	-2.07	.040
Active	-6.40	3.20	-0.22	-2.00	.048

^a the reference category for education is “secondary school or less”

^b the reference category for income is: “less than \$20,000”

^c the reference category for dental decisional control preference is “Passive”

Table 17: Linear regression model for EQ-5D-5L

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.67	.79		3.39	.001
Age (years)	.06	.02	.20	2.58	.011
Gender	-1.35	.46	-.24	-2.92	.004
Education ^a					
Tertiary education	-.47	.42	-.09	-1.12	.262
Individual's income ^b					
\$20,000 or more	.05	.13	.03	.35	.724
Dental decisional control preference ^c					
Collaborative	-.77	.57	-.15	-1.35	.180
Active	-.99	.57	-.19	-1.74	.084

^a the reference category for education is "secondary school or less"

^b the reference category for income is: "less than \$20,000"

^c the reference category for dental decisional control preference is "Passive"

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Chapter 10 (paper 6): The impact of providing third molar patients with a pre-consultation internet guidance on their knowledge, anxiety, decision-making and consultation outcomes: A pilot randomized controlled trial

Linkage to the body of work

Findings of our previous study that explored TME among Australian adults suggested they received multiple TME in a very short period of time with no association with self-rated oral health. In addition, Australia is one of the top three countries in the world for searching for TMs on Google however, our findings suggested that internet use did not improve their TM knowledge. Since we identified that TMs online information quality significantly vary and patients have difficulty in identifying high quality internet resources, the researcher attempted to provide TMs patients with internet guidance to improve information access. The researchers argue that providing this internet guidance might improve TMs knowledge and therefore, might improve patients' participation in TME decision-making. In addition, this intervention might have an association with consultation outcomes. In addition, the researcher aimed to explore whether providing information is associated with dental anxiety since, previous evidence of such similar interventions was not consistent. These hypotheses were examined in a randomized controlled trial.

Highlights

- Patients' TMs knowledge level is associated with participation in decision-making from the patients' and the clinicians' perspectives.
- The provided intervention did not improve our participants' TMs knowledge and therefore no association was observed on participation in decision-making and consultation outcomes.
- TMs patients significantly reported high levels of dental anxiety regardless of the group allocation when compared with Australian norms. This might need clinicians' attention.

- The intervention provided did not significantly increase our patients' anxiety level which might consolidate the previous evidence.
- The decision for having TME under general anesthesia was associated with the number of TME rather than dental anxiety.

Future research

- More research is needed to develop online educational materials designed for patients with low-literacy. This is to improve information uptake by this group of patients.
- Further research is needed to analyze the decision for having TME under general anesthesia with higher statistical power to explore it further.

Statement of authorship

Title of Paper	The impact of providing third molar patients with a pre-consultation internet guidance on their knowledge, anxiety, decision-making and consultation outcomes: A pilot randomized controlled trial
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input checked="" type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Hanna K, Sambrook P, Armfield J, Brennan D. The impact of providing third molar patients with a pre-consultation internet guidance on their knowledge, anxiety, decision-making and consultation outcomes: A pilot randomized controlled trial, drafted manuscript

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Contribution to the Paper	Initial conceptualization, study design, ethical approvals, RCT registration, data collection and analysis, reporting and discussing findings and manuscript writing		
Overall percentage (%)	80%		
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.		
Signature		Date	25/08/2016

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 to 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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Abstract

Objectives: To identify whether providing third molar (TMs) patients with a pre-consultation internet guidance has an effect on: (1) Primary patient reported outcomes PRO: Participation in shared decision-making (SDM); (2) Secondary PRO: Pre-consultation TMs knowledge, dental anxiety, clinicians' satisfaction, count of TMs referred for extractions.

Methodology: Equal arm, parallel groups randomized controlled trial (RCT) titled "Engaging Patients in Decision-Making". Participants were community dental patients aged 18 years and over, with internet access and had been referred for TMs consultation. Study group participants received a pre-consultation high quality internet resources identified in a previous study. Participation in SDM was measured after consultation by the dyadic SDM: SDM-9Q-Pt for patients and SDM-Doc for clinicians. TMs knowledge and the Index of Dental Anxiety and Fear IDAF-4C were collected before consultation. Clinicians' satisfaction with patients' knowledge, consultation time and count of TMs decided on extraction were collected during consultation.

Results: 120 participants were randomized into 60 participants per group. No significant difference in participants' characteristics and their baseline measurements were observed between groups. Among the randomized participants, n=37 of the study group and n=35 of the control group were followed at consultation. TMs knowledge was significantly associated with SDM-9Q-Pt ($B=1.77$, 95% CI: .04, 3.42, $P=.045$) and SDM-9Q-Doc ($B=1.26$, 95% CI: .16, 2.36, $P=.028$). Our intervention did not significantly improve TMs knowledge $t(68) = -.32$, $P=.753$, $\eta^2=.0018$). This resulted in no difference in SDM-9Q-Pt $t(64) = 1.76$, $P=.083$, $\eta^2=.046$) and SDM-9Q-Doc $t(75) = -.78$, $P=.436$, $\eta^2=.008$). The IDAF-4 scores were significantly higher than Australian norms (mean=17.00, $SD=9.01$, 95% CI: 16.17, 20.46). The provided intervention did not significantly increase the IDAF-4C scores

$t(68) = -.32, P = .753, \eta^2 = .003$). No difference was observed in clinicians' satisfaction with consultation time, patients' knowledge and the count of TMs decided on for extraction.

Conclusion: Patients' knowledge is a significant domain for participation in decision-making. The intervention provided did not improve participants' TMs knowledge and therefore, no change was observed on the specified PRO. Clinicians might need to consider the high levels of dental anxiety among TM patients.

Trial registration: Australian and New Zealand Clinical Trial Register
ACTRN12614000593639

Keywords: third molars, internet guidance, decision-making, SDM-9Q, dental anxiety, Index of Dental Anxiety and Fear, IDAF-4C, extraction, patient education, randomized clinical trial, RCT

Introduction

Clinical decision-making is an interactive collaboration between clinicians and their patients to make a decision about a treatment. Involving patients in decision-making is important not only because of moral reasons but also there is a rise in the available treatment options that require patients to make choices consistent with their beliefs and based on the best available evidence [1]. There is an increase in the bulk of evidence, in the medical literature suggesting the benefits of patients' involvement in decision-making such as improving the decision quality, reducing decision conflict and improving health outcomes [2]. This made health care providers consider shared decision-making (SDM) as a corner stone in patient-centered care [3]. SDM is multi-dimensional that involves several factors such as information provision, decisional control preference and uncertainty [4]. Third molar patients need to make several decisions such as type of anesthetic, treatment pathway and whether to remove their asymptomatic TMs [5]. Recent evidence from an Australian study suggests that TMs involve prophylactic removal cause pressure on the health care system, with associated risks and costs [6]. This necessitates providing patients with high quality information that has the potential for improving patients' involvement in decision-making [7].

The current clinical practice in educating TMs patients is conducted through verbal communication and information leaflets. However, the use of this standard care patient education approach showed limitations in adequately informing TMs patients [8]. Ferrús-Torres *et al.* [9] attributed this to the busy nature of oral surgery clinics. The internet might be useful as an adjunct information source as the majority of TMs patients sought online dental information [10]. However, patients' inability to identify high quality information [10] and the variability in TMs online information quality [11] might limit the usefulness of

the Internet as an information source. Therefore, it might be argued that providing TMs patients with a pre-consultation internet guidance might overcome these limitations and improve TMs patients' access to high quality internet-based information [12]. Improving access to high quality information, before consultation, might improve TMs patients' knowledge and consequently their involvement in TMs decision-making.

TMs patients attending oral and maxillofacial surgery out-patients' clinics shows high levels of dental anxiety when compared with other oral surgery patients [13]. In addition, there was no consistency in the literature regarding the impact of providing patients with multi-media format— such multi-media are available in online resources. For example, Tanidir *et al.* [14] did not observe an impact of providing multi-media TMs information on dental anxiety while Kazancioglu *et al.* [15] observed a significant impact. Therefore, understanding the impact of providing patients with online information that contains multimedia on their anxiety level at consultation is of importance.

Accordingly, the aim of our study is to identify whether providing TMs patients with a pre-consultation internet guidance has an effect on participation in shared decision-making, TMs knowledge, pre-consultation anxiety level and TMs consultation outcomes.

Materials

Trial registration and ethical approvals

The Engaging Patients in Decision-Making RCT is registered on the Australian and New Zealand Clinical Trial Register (ANZCTR) with a registration number: ACTRN12614000593639[12]. The study received ethical approval from the Low Risk

Human Research Ethics Committee (HREC), The University of Adelaide (HS-2013-23). In addition, the study obtained ethical approval from Royal Adelaide Hospital (HREC) with an approval number: HREC/14/RAH/160. The study's Site Specific Assessment (SSA) was approved by The South Australian Dental Services (SADS) with an approval number 2014-07326/1.

Sample size

Sample size calculation based on the collected OHIP-14 scores (primary outcome of the RCT) in this study mean=21.7 ($SD=14.5$) as they were different from the Australian norms. Using an online sample size calculator [16], a total of 186 participants are needed (93 per group) based on significance level (adjusted for sidedness) = .025, standard deviation = 14.5, power = 0.8, difference in means = 6.

Participants recruitment and setting

Participants recruited for this study were adults aged 18 years or over, with internet access and referred by their dentist to the Department of Oral and Maxillofacial Surgery, Adelaide Dental Hospital for consultation regarding their TMs. Participants were recruited by the department administrative officer after checking the referral letters against the selection criteria. Participants were invited using an invitational letter, 2-3 weeks prior to their TMs consultation. The mailed letter includes the South Australian Dental Services' (SADS) approach letter, participant's information sheet, consent form, baseline survey, flyer for A\$10 conditional incentive on participation and a reply-paid envelope. No reminders were sent because of the lack of sufficient time between the invitation and the consultation appointment. Figure 18 shows the RCT flowchart. For recruiting the participating clinicians,

the principal author provided them with the clinicians' information sheet and the study was verbally explained to them. Participating clinicians were requested to sign the clinician's consent form.

Data collection instruments and time points

Participants received the baseline survey as part of the baseline package and it included details about the participants' demographics, decisional control using the Control Preference Scale (secondary outcome), TMs knowledge (secondary outcome). At consultation, there are two surveys: the clinician's survey and the patient's before and after consultation survey. The clinician's survey includes: reasons for referral for TMs extraction, number of teeth referred and decided on for extraction (secondary outcome), satisfaction with consultation time and patient knowledge (secondary outcome) and participation in shared decision-making SDM-9Q physician version (primary outcome). The before consultation patients' survey included patients' adherence to intervention, dental anxiety and fear using Index of Dental Anxiety and Fear IDAF-4C (secondary outcome), TMs knowledge (secondary outcome). The after consultation, patient's survey included patient's decisional control experience (secondary outcome) and patient's participation in shared decision-making using SDM-9Q patient version (primary outcome).

Randomization and blinding

On receiving the signed consent form and the completed baseline survey, participants were checked against our selection criteria. If the participants met our selection criteria, they were assigned a sequential number. Participants were then randomized using an online randomization tool which is currently becoming an acceptable randomization tool in clinical trials [17]. Randomization.com [18] is an example of these online randomization tools which

was used in this study. The recruitment process was an ongoing process, and we used equal arm, parallel groups' randomization with variable block sizes [19]. Participants were allocated as per the assigned group generated from the randomization scheme based on their sequential number. Although the fields needed for generation of the randomization scheme was carried out by K. Hanna, group allocation could not be predicted as we used random seeds for each generated randomization scheme. Clinicians were blinded to the group allocation however, participants were not blinded to the allocation group due to the nature of the intervention.

The intervention

Participants in the study group received a list of high quality online resources based on website content analysis. Details for TMs websites content analysis and the list for high quality TMs websites were detailed in a previous publication [11]. This resource list was emailed or mailed to the study group participants before (at least 2-3 days) their consultation appointment (Appendix IV: Online resources for wisdom teeth patients).

Primary and secondary outcome measures

Dyadic SDM-9Q (primary outcome)

The SDM-9Q is a dyadic measure of SDM that measures the process from both patients' and clinicians' perspective. The patient's version of the SDM-9Q was developed by Kriston *et al.* [20]. It consists of 9-items representing different stages of SDM and items are measured on a 6-point Likert-like scale ranging from 1 for completely disagree to 6 for completely

agree. The clinician version was developed by Scholl *et al.* [21] while keeping wording close to the patient version. The total SDM-9Q ranges from 9 to 51.

Decision control experience using the Control Preferences Scale (CPS) (secondary outcome)

The CPS was developed by Degner *et al.* [22] and it was validated for its transferability to dentistry [23]. The CPS consists of 5 themes that reflect the individual's control in making a treatment decision. Score of the CPS ranges from 1 for "I leave the final decision to my oral surgeon" to 5 for "I make the final decision about which treatment I will receive".

Pre-consultation TMs Knowledge (secondary outcome)

It is a multiple-choice questionnaire that was developed by the study authors to test participants' understanding of TMs at baseline and immediately before consultation. The developed questionnaire covered different areas of information such as etiology, the most frequent reason for TMs extraction, anesthetic options, risks associated with TMs surgery and post-operative care. If the participant response was found to be correct, the item was given the score of 1. If the participant response was found to be incorrect, the item was given the score of 0. Thus, the total TMs Knowledge scores range from 0 to 5.

Pre-consultation anxiety using Index of Dental Anxiety and Fear IDAF-4C (secondary outcome)

The IDAF-4C was developed by Armfield [24] to overcome the psychometric and conceptual limitations of the available dental anxiety and fear measures. It consists of eight items representing four domains: cognitive, behavioral, emotional and physiological. Each

item is measured on a 5 point Likert-like scale ranging from 1 for disagree to 5 for strongly agree. The total IDAF-4C scores range from 8 to 40.

Clinician satisfaction with consultation time, patient knowledge (secondary outcome)

Each of these scales was a single-item scale where responses were recorded on a 6-point Likert-like scale range from 1 for completely disagree to 6 for completely agree. These items were developed by the study's authors.

Number of TMs extractions

The number of TMs referred for extraction and the number of TMs decided on for extraction was recorded in the clinician survey.

Data analysis

Data were analyzed using SPSS statistics for Windows v. 23.0 [25]. Data were analyzed using the Intention To Treat (ITT) approach as it is known to better preserve randomization than the per protocol approach [26]. Participants' baseline characteristics and measures were compared across the RCT groups using the Independent samples t-test and χ^2 associations. Independent sample *t*-test was used to compare group continuous measures. For ordinal scales, Mann–Whitney *U*- test was used for group comparisons. To identify the association between patients' TMs knowledge and participation in SDM, linear regression was used. To explore the association between the choice of general anesthesia and dental anxiety, binary logistic regression was used.

Results

Participants characteristics

Participants' recruitment was carried out during Oct 2014 to Jan 2016. A total of n=174 responses was received. After checking participants' eligibility for inclusion in our study, only n=120 were randomized. The main reason for exclusion was the baseline survey and consent received after the consultation appointment n=27. Other exclusion reasons were detailed in Figure 18. After exclusion, each participant was given a sequential number which was used for generating the randomization plan by the randomization.com website. Among the n=120 who were randomized, the largest age category comprised those aged 19-25 years of age (n=53, 46.5%). The majority of participants were female (n=88, 74.6%) and had secondary school or less education (n=66, 56.9%). Nearly half of our participants were unemployed (n=57, 47.1%) and most earned less than \$20,000 annually (n=78, 69.0%). Table 18 shows detailed participants characteristics. Sixty participants were randomly allocated for each group and no significant difference was observed in participants' characteristics between groups as shown in Table 18. In addition, no baseline differences were observed in participants' TM knowledge (secondary outcome) and decisional control preference (secondary outcome) between RCT groups as shown in Table 19.

Among the 60 participants allocated for the study group, n=37 participants completed the before and after consultation survey and n=41 had the clinician's survey completed while n=37 participants had a complete consultation stage record. Among the n=60 participants allocated to the control group, n=36 participants had a complete before and after consultation survey and n=37 had the clinicians' survey completed while n=35 of them had a complete consultation stage records. Figure 18 shows the RCT participants' flowchart. The main

reason for loss of follow-up at the consultation stage is that participants failed to attend their appointment. No significant difference between groups in individual characteristics of those loss of follow-up at the consultation stage. No adverse events were reported.

Primary outcomes

The mean SDM-9Q-Pt was $m=41.9$ ($SD=9.1$) and this showed high internal consistency ($\alpha=.88$) while for SDM-9Q-Doc mean= 38.8 ($SD=6.0$) and it showed high internal consistency ($\alpha=.95$). The difference in mean scores of SDM-9Q-Pt between the control group (mean= 44 , $SD=9$) and the study group (mean= 40 , $SD=9$) was not statistically significant $t(64) = 1.76$, $P=.083$, $\eta^2=.046$). In addition, the difference in mean scores of the SDM-9Q-Doc between the control group (mean= 38 , $SD=5$) and the study group (mean= 39 , $SD=7$) was not statistically significant $t(75) = -.78$, $P=.436$, $\eta^2=.008$) as shown in Table 20. When linear regression was used for SDM, patients' TM knowledge scores were significantly associated with SDM-9Q-Pt ($B=1.77$, 95% $CI: .04, 3.42$, $P=.045$) and SDM-9Q-Doc ($B=1.26$, 95% $CI: .16, 2.36$, $P=.028$).

Secondary outcome

In general the IDAF-4C scores reported for our sample (mean= 17.00 , $SD=9.01$, 95% $CI: 16.17, 20.46$) were significantly higher than the Australian norms for the IDAF-4C (Mean= 14.40 , $SD=7.71$, 95% $CI: 13.93, 14.86$) [27]. The difference in mean scores of the IDAF-4C between the control group (mean= 18 , $SD=10$) and the study group (mean= 19 , $SD=8$) was not statistically significant $t(68) = -.32$, $P=.753$, $\eta^2=.0018$). The difference in mean scores of TMs knowledge between the control group (mean= 3 , $SD=1$) and the study group (mean= 3 , $SD=1$) was not statistically significant $t(68) = .67$, $P=.507$, $\eta^2=.006$).

Furthermore, the difference in mean number of TMs decided on for extraction between the control group (mean=3, SD=1) and the study group (mean=3, SD=1) was not statistically significant $t(60) = -1.64, P = .106, \eta^2 = .043$ as shown in Table 20. A supplementary per-protocol analysis was performed (not presented) and showed no statistically significant difference in the mean scores for these outcomes.

The difference in median score of the decisional control experience between the control group (median=3) and the study group (median=3) was not statistically significant ($P = .825$) as shown in Table 21. In addition, no statistically significant difference in median score of the Satisfaction with Consultation Time and the Satisfaction of the Patient Knowledge was observed between the RCT groups as shown in Table 21.

Discussion

Findings of our study suggests that patients' pre-consultation knowledge was found to have an association with participation in shared decision-making from both patients' perspective measured by SDM-9Q-Pt and the clinicians' perspective measured by SDM-9Q-Doc. However, the intervention provided in our RCT was not effective in improving our participants' TMs Knowledge which resulted in no observed difference in SDM. Providing TMs patients with a pre-consultation online resources did not significantly increase their dental anxiety and fear measured by the IDAF-4C. It worth noting that the reported IDAF-4C scores were significantly higher than Australian norms for the IDAF-4C scores [27] in both groups. No difference was observed between groups in relation to their decisional control experience, clinician satisfaction with consultation time, clinician satisfaction with patient knowledge and the number of TMs decided on extraction.

Patients' knowledge about a specific topic such as TMs was not only medico-legally important for TMs patients but also has an association with patients' involvement in decision-making. This finding suggests the importance of improving patients' knowledge to improve their engagement and participation in TMs decision-making. Improving patients' knowledge is argued to improve patients' participation in decision-making [28]. In this study, we were able to measure patients' knowledge about TMs and how it was positively associated participation in decision-making. This finding is consistent with studies indicating the multi-dimensionality of shared decision-making where knowledge is one of its dimensions [29].

Although dental education interventions that was found to be effective in improving participants knowledge [30], these interventions were delivered by the health care professionals. Providing this kind of education in oral surgery clinic might be limited by the busy nature of surgical clinics [31]. The intervention evaluated in this study was argued to improve TM patients' information retention [8] and to overcome the issue of quality variation in online TMs information [11]. However, the quantitative evaluation of the impact of the provided intervention on TMs patients' knowledge was found to be ineffective. The uptake of the provided intervention might be affected by wide prevalence of low education level in our sample [32]. Future research in patient education interventions delivered through the internet might need to consider patients' individual factors in tailoring the intervention.

Providing TMs patients with a pre-consultation internet guidance did not significantly increase levels of dental anxiety and fear for the study group participants. This finding might consolidate the previous evidence suggested in previous studies for the use of multi-media

in informing TMs patients [13,14]. Oral surgeons providing TMs patients with consultation might need to consider the significant high levels of dental anxiety and fear compared with Australian norms [27] when communicating with their patients. High levels of dental anxiety and fear was reported in a previous study that explored dental anxiety among oral surgery patients [13]. However, the selection of general anesthetic option was not associated with the IDAF-4C scores but rather the count of TMs decided on for extraction.

The main limitation of our study is related to the small sample size yielded from the specified recruitment period despite the provision of momentary incentives. To overcome this issue, the researcher reported effect sizes which are independent of the sample size [33]. The other limitation is related to the generalizability of our finding since our participants are health cards holders who more likely to be less educated. On the other hand, this study has several strengths. It contributes to the field of patient education and decision-making by revealing the positive association between patients' TMs knowledge and participation in decision-making. It also contributes to clinical practice by identifying the significant high levels of dental anxiety among TMs patients.

Conclusion

Findings of our study suggest that patients' knowledge is significantly associated with participation in decision-making from patients' and the clinicians' prospective. This finding might improve patient-clinician communication by enhancing patients' knowledge. However, the intervention provided in this study did not significantly improve patients' TMs knowledge and consequently participation in decision-making. Although the majority of our study group participants claimed they have reviewed the provided pre-consultation internet

guidance, their education attainment might form a barrier for the uptake of the provided information. Providing TMs patients with a pre-consultation internet resources that contain multi-media did not significantly increase the anxiety levels for our study group participants. This might consolidate the evidence retrieved from studies that used multi-media to inform TMs patients. However, TMs patients, in general, reported significant high levels of dental anxiety and fear compared with Australian norms. This finding might need to be considered by the oral surgeon when communicating with their patients. In contrast to what might be believed about the association between dental anxiety and making general anesthetic choices, general anesthetic choice is more likely to be associated with the count of TMs extracted rather than dental anxiety level. Further research is needed to develop an intervention that can improve TMs knowledge among this group of patients.

Acknowledgement

This paper was part of the principle author's PhD research project, for which an Adelaide Scholarship International was received. The research received support from Australian Research Centre for Population Oral Health (ARCPOH), The University of Adelaide.

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

Abbreviations

ANZCTR: Australian and New Zealand Clinical Trial Register

ANOVA: Analysis of Variance

DCPs: Decisional Control Preferences Scale

eHEALS: e-Health Literacy Scale

HREC: Human Research Ethics Committee

POIQ Scale: Perceived Online Information Quality Scale

RCT: Randomized Controlled Trial

TMs: Third Molars

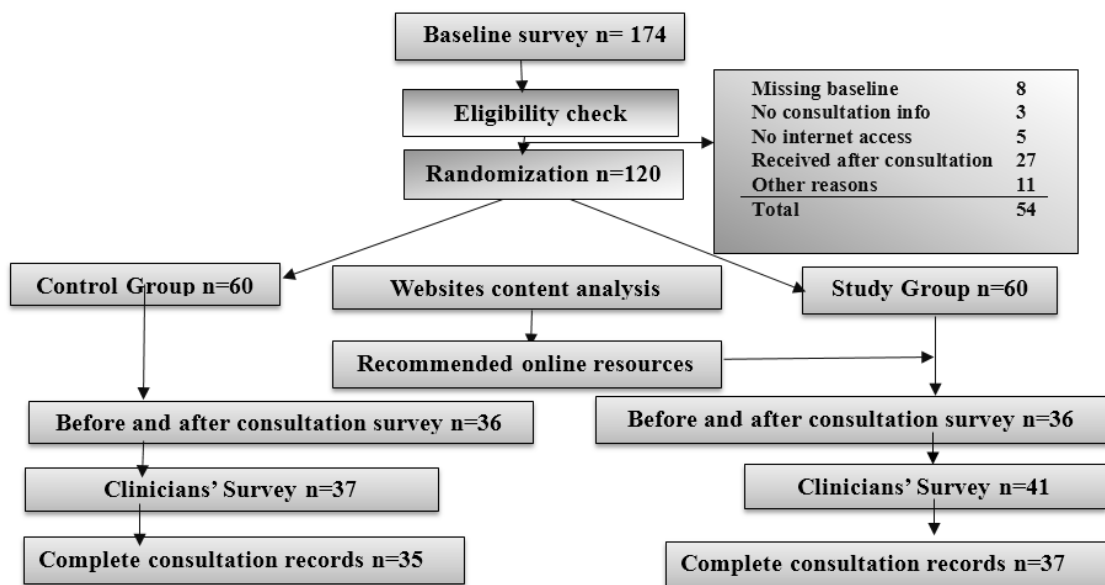


Figure 18: Engaging Patients in Decision-Making" trial flowchart

Table 18: RCT participants' characteristics and homogeneity between groups

	RCT group						Chi-square	df	Sig.
	Count	%	Control group		Study group				
			Count	%	Count	%			
<i>n</i> =120	100%	60	50.0%	60	50.0%				
Age group									
18 years or less	17	14.9%	8 _a	47.1%	9 _a	52.9%	3.940	3	.268 ^a
19-25 years	53	46.5%	24 _a	48.0%	26 _a	52.0%			
26-36 years	35	30.7%	20 _a	58.8%	14 _a	41.2%			
36 years and over	9	7.9%	2 _a	22.2%	7 _a	77.8%			
Gender									
Female	88	74.6%	41 _a	48.8%	43 _a	51.2%	.181	1	.671
Male	30	25.4%	16 _a	53.3%	14 _a	46.7%			
Level of education									
Secondary school or less	66	56.9%	32 _a	50.0%	32 _a	50.0%	.049	2	.976
Certificate or diploma	28	24.1%	13 _a	48.1%	14 _a	51.9%			
Higher education	22	19.0%	10 _a	47.6%	11 _a	52.4%			
Employment status									
Unemployed	57	47.1%	26 _a	47.3%	29 _a	52.7%	.260	2	.878
Student	40	33.1%	20 _a	52.6%	18 _a	47.4%			
Employed	24	19.8%	12 _a	50.0%	12 _a	50.0%			
Private health insurance									
No	107	91.5%	50 _a	48.5%	53 _a	51.5%	.479	1	.489 ^a
Yes	10	8.5%	6 _a	60.0%	4 _a	40.0%			
Who pay for your TMs treatment									
Patient pay all expenses	15	12.4%	7 _a	46.7%	8 _a	53.3%	1.092	3	.779
Patient pay some	22	18.2%	12 _a	57.1%	9 _a	42.9%			
Patient pay none	24	19.8%	13 _a	54.2%	11 _a	45.8%			
Not specified	60	49.6%	26 _a	45.6%	31 _a	54.4%			
Income									
Less than \$20,000	78	69.0%	36 _a	48.6%	38 _a	51.4%	.073	1	.786
=> \$20,000	35	31.0%	18 _a	51.4%	17 _a	48.6%			

Table 19: RCT baseline measurement

	RCT group					
	Mean	SD	Control group		Study group	
			Mean	SD	Mean	SD
EuroQoL global QoL BL	70	20	71 _a	19	69 _a	21
OHIP-14 BL	22	15	22 _a	16	21 _a	14
EuroQoL-6D-5L BL	3	3	3 _a	2	3 _a	3
Satisfaction with dentist BL	27	5	27 _a	6	27 _a	5
TMs knowledge test BL	3	1	3 _a	1	3 _a	1

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.

Table 20: RCT independent sample *t*-test for primary and secondary outcome measures at consultation stage

	RCT group				t-test for Equality of Means			
	Control group Mean	SD	Study group Mean	SD	<i>t</i>	<i>df</i>	Sig.	Eta Squared
SDM-9Q-Pt	44	9	40	9	1.76	64.00	.083	.046
SDM-9Q-DOC	38	5	39	7	-0.78	75.00	.436	.008
IDAF-4C	18	10	19	8	-0.32	68.00	.753	.001
TMs knowledge FL	3	1	3	1	0.67	68.00	.507	.006
TMs decided on extraction	3	1	3	1	-1.64	60.00	.106	.043

Table 21: Mann-Whitney U test for decisional control experience, satisfaction with consultation time and satisfaction with patient knowledge:

	Decisional Control Experience	Satisfaction with consultation time	Satisfaction Pt knowledge
Mann-Whitney U	546.500	598.500	700.000
Wilcoxon W	1074.500	1264.500	1366.000
Z	-.221	-1.620	-.442
Asymp. Sig. (2-tailed)	.825	.105	.659

a. Grouping Variable: RCT group

Table 22: An exploratory predictor model for selecting general anaesthesia for TMs extraction.

	B	S.E.	Wald	df	Sig.	OR	95% CI for OR	
							Lower	Upper
Age (years)	-.056	.076	.552	1	.457	.945	.815	1.096
Gender (male)	-.461	1.011	.208	1	.648	.631	.087	4.574
Educational attainment ¹								
College or higher education	-.715	.852	.704	1	.401	.489	.092	2.599
Private health insurance (yes)	-.990	1.469	.454	1	.500	.372	.021	6.614
RCT group (study group)	-.355	.798	.198	1	.656	.701	.147	3.349
Count of TMs decided on extraction	1.475	.499	8.718	1	.003	4.369	1.642	11.629
IDAF-4C	.105	.057	3.394	1	.065	1.110	.993	1.241
Constant	-4.409	2.929	2.267	1	.132	.012		

¹Reference category for educational attainment is: secondary school or less education

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Chapter 11: General discussion

In this piece of research, the researcher attempted to get more understanding about the use of the internet as an adjunct information source to the current standard of care for patient education. For this purpose, the researcher selected a specific dental topic to limit the study which was wisdom teeth extractions. This topic was selected by the researcher for variety of reasons: Australia is the top third country in the world for internet searching for “wisdom tooth” on Google [1], and the high rate of hospitalization for wisdom teeth extractions in Australia [2]. This high hospitalization rate creates pressure on the health care system and is associated with increased costs and risks. In addition, further researching third molars is a continuation of the researcher’s interest. The researcher addressed the research question in six different original articles that were linked to each other to get a holistic picture. In each of these studies, the researcher provided an overview of the literature concerned with the topic addressed, set up clear aims, used different study designs and mixed research methods, collected his own data (in five of the original papers) or used secondary data (in one original paper), in analyzing, reporting and discussing these research findings.

In the first original journal article, the researcher addressed the current state for wisdom teeth extractions in Australia, what are the factors contributing to the number of the received wisdom teeth extractions, whether there is a benefit in receiving multiple TMs extractions on self-rated oral health and whether age is a reasonable justification for prophylactic wisdom teeth extraction. For the purpose of addressing these questions, the researcher conducted a secondary data analysis of Australia’s 2013 NDTIS [3]. The researcher performed a subgroup analysis of those who received TM extractions in the past 12 months using complex samples generalized linear models. Findings of this study shows that multiple TM extractions was prevalent whereas the number of the received TMs extractions was associated with the possession of dental insurance without improving the self-rated oral

health in the short-term. When these findings are combined with each other, it might be argued that, the dentally insured might be subjected to over-management that resulted in a possibility of increasing the number of days absent from work/school. Over-management associated with dental insurance was reported on the service-level in some countries such as the US [4]. Therefore, the researcher wanted to improve TMs extraction decision-making.

TMs extraction decision-making, in Australia, is left to patients to decide with their clinicians without supporting or refuting the prophylactic TMs extraction [5]. However, for patients to participate in TMs extraction decision-making, they need to be adequately informed with the best available evidence [6]. The available evidence suggests that the provided standard care for patient education has a limitation in adequately informing TMs patients [7] which might be attributed to the busy nature of surgical clinics [8]. Therefore, preparing patients for TMs consultation by providing them with high quality internet resources might need to be tested given that fact that the majority of Australian households have access to the internet [9].

The researcher decided to use a RCT to test for the efficacy of the use of the internet to provide information to TMs patients before consultation. However, the quality of Internet resources is known to vary significantly across websites which might affect the usefulness of the internet as an information source [10]. It was decided to use the available online resources to direct patients to high quality TMs information resources due to materialistic resource limitations. Therefore, the researcher needed to conduct quality and readability assessment for online health information concerning TMs.

The researcher used a systematic approach in reviewing the online TMs information by creating a gold standard for patients' information concerning TMs. This gold standard was created using the best available evidence and the researcher's experience. The researcher highlighted the limitation of the available consumer health information credibility tools such as DISCERN and HoNCode in assessing the scientific information quality since they were not developed for this purpose. Therefore, it was necessary to develop and initially validate a new tool for assessing the scientific information quality. The newly developed tool (the SIQ Scale) was found to be reliable and established convergent validity with DISCERN and HoNCode—a common way of initial validation using instrument measuring a close construct [11]. The quality assessment of the TMs online information significantly varied across websites which is consistent with previous literature in medicine and dentistry [12,13]. This might limit the usefulness of the Internet as an information source. Therefore, it was necessary to determine factors contributing to the SIQ to improve the patients' ability to find high quality information.

When the researcher was able to model the scientific information quality, the researcher was able to identify that website affiliation and information credibility measured by DISCERN predicted the majority of variance in the scientific information quality. This approach was not used in similar studies which enabled the researcher to recommend to patients the following: where no content analysis is available, patients might review governmental websites while using the DISCERN criteria to identify high quality online information. However, the TMs online information assessment for quality and readability has limitations in the number of websites considered for full evaluation and the use of a single reviewer. These limitations were addressed in the journal article. Findings of this article drove the researcher to further explore the online information seeking for TMs patients and whether

the use of the internet can make a difference on patients' understanding about TMs. In addition, the variability in online information quality drove the researcher to test whether providing TMs patients with internet guidance might improve patient' knowledge, anxiety level, participation in decision-making and consultation and health care outcome.

Among health care outcomes, no doubt that QoL has become an important end-point for health service research [14] which made the researcher have QoL in focus of the present study. During the phase of our RCT survey design, the researcher needed to make a decision about which of the available generic HRQoL or OHRQoL instruments were able to capture TMs impact on QoL in a precise manner and shows potential sensitivity to change. With limited qualitative studies that address the impact of TMs on QoL, there was a demand to explore this area further. The researcher decided to use an unconventional qualitative research method by sampling real-time Twitter data of tweeters who expressed their TMs experience. This approach is argued by the researcher to eliminate experimentally induced recall bias associated with conventional qualitative research methods [14]. When real-time Twitter data were used, the researcher was able to understand not only how TMs might impact on the QoL but also to observe how QoL domains are interacting with each other in real-time.

The thematic analysis [15] for the captured tweets allowed the researcher to code into domains the impacts of TMs experience on QoL and to compare the representation of this combination of domains in the commonly used QoL measures. This approach revealed that the study-identified QoL domains are under-represented in the widely used QoL measures. This adds to the current criticism raised over the ability of the available HRQoL or OHRQoL measures [16-18]. The observed variability in the representation of QoL domains among

instruments might provide an explanation of why QoL instruments correlate differently with the same oral health status [19]. The present study offered a foundation for developing a new OHRQoL measure for TMs research that is argued to be precise and sensitive to change. Although the representativeness of the assessed measures found that the AQoL measures the highest cover for the study-identified QoL domains, including the 35-item AQoL as an outcome measure in the RCT was not possible as it might result in survey fatigue.

Another finding from the Twitter study that we observed an overall better coverage of the used HRQoL when compared with OHRQoL. The potential explanation of this observation might be based on three main reasons. Firstly, the generic OHRQoL used in this study were developed to measure functional and psychosocial impacts of oral diseases [20] and not primarily developed to measure OHRQoL. Secondly, the used OHRQoL measures were originally developed for older adults with domains mainly related to impacts of tooth loss which might not be relevant to the participating young adults such as the OHIP-14, GOHAI, OIDP [21-23]. However, these measures were used successfully in different populations. Thirdly, the used HRQoL, although they were developed based on the biomedical/psychological aspects of ill-health, the majority included a broader range of QoL domains and were not limited to a specific age group.

Although using qualitative data from Twitter might have some limitations in obtaining demographic information, these limitations were known and accounted for in the study design. The researcher has re-read the captured tweets to determine the number of tweets that need to be included in the in-depth thematic analysis. There were no guidelines available for determining the minimum sample size for tweets that need to be included to reach saturation as outlined for other qualitative research approaches [24]. In addition, the researcher attempted to overcome the lack of demographic information by using an Excel

plug-in named Textalytic [25] to obtain these information. However, the researcher provided a solution for future research by using Twitter as a sampling frame to recruit participants by sending a link to complete an online survey (currently in progress).

The RCT that the researcher carried out was designed to answer the research hypotheses and questions. The researcher recruited the study participants from a group of public dental patients who might be believed not to have a limited use of the Internet for oral health information as was the case for medical patients in the same population [26]. In addition, this group of community dental patients might be believed to be passive role in decision-making as was the case for medical patients of similar characteristics [27]. Although the researcher obtained a multicenter HREC approval for the RCT, conducting the trial in private practices was not feasible due to conflict of interest. In addition, the researcher experienced a low response rate and attempted to overcome it using \$10 momentary incentives. However, this approach did not significantly improve the response rate. Further research is needed in developing and testing methods to improve response rates in RCTs targeting disadvantaged adults.

The researcher used the baseline data in two original papers. The 1st paper addressed the Internet use and online information seeking behavior and association with their TMs understanding. In this study, the researcher found that among RCT study participants who had access to the internet, the majority have used the internet for dental procedural information, before consultation, which might be in contrast with evidence retrieved from medical [28] and dental [29] studies. However, these studies did not provide an explanation for the phenomena of the internet-ready patients. The researcher found that the educational attainment and the preference for an active decisional control was associated with internet

use for dental procedural information. This finding might provide an explanation for the phenomena of the internet-ready patient. However, the researcher observed no association of the level of internet use for procedural information and their understanding about TMs. This patients' reported finding was reported by the researcher to be expected [30] as a result of significant quality variation across websites. Therefore, it was necessary to identify gaps in patients' online information seeking in order to provide recommendations that improve the usefulness of the internet as an adjunct information source.

In order to find an explanation of why internet use might not be associated with TMs knowledge, the researcher examined the online information seeking behavior of the study's participants. Participants were found to lack the ability to recognize the provided online health information quality seals or determine the purpose for its use. Combining this finding with the observed variability in scientific information quality might provide an explanation for why the internet is not useful in improving patients' understanding about a specific topic such as TMs. Therefore, the researcher suggested that, providing patients with internet guidance might improve the usefulness of the internet as an adjunct information source on the short-term micro level. In addition, the researcher stressed a previous recommendation for global action of the WHO towards online health information quality [31]. Furthermore, ehealth literacy intervention might be needed to improve the individual's ability to identify high quality information. However, there is a need for developing a new ehealth literacy measurement approach that can focus on actual ehealth skills testing rather than self-reported skill attainment. This is important in evaluating the outcome of ehealth literacy interventions. Since internet use was associated with dental decisional control preference, it was necessary to explore it further.

The 2nd original paper based on data obtained from the baseline survey was carried out to explore the prevalence of decisional control preferences and the individual characteristics associated with these preferences and whether involvement in decision-making is associated with health outcomes such as QoL. The researcher observed a high preference for involvement in dental decision-making either actively or collaboratively which is in contrast with what might be believed about public dental patients (similar to evidence from medical studies [27]). Furthermore, the researcher observed that the characteristics of being female and/or having a higher education were more likely to be associated with a preference for an active decisional control in making a dental treatment choice. To the knowledge of the researcher, this is one of the emerging studies in the dental field that has explored this area and the findings are consistent with the medical literature. It was also observed in medical studies that there has been an increased preference for more active role in participation in decision-making. This increased preference for involvement in decision-making was attributed to decreased patient-clinician power distance.

Understanding the extent for patients' preferences for decisional control and individual characteristics associated with these preferences might enable clinicians to be more sensitive to patients' desire for decisional control which might improve patient-clinician communication. In addition, the study explored whether patients' preference for decisional involvement in decision-making is associated with QoL measured using the OHIP-14 and EQ-5D-5L. The selection of these QoL measures was at a very early stage of this research due to the need to obtain multiple HRECs approvals and the selection was based, at this stage, on the reported success of their use in TMs research. The researcher observed a positive and clinically important [32] association between patient preference for involvement in decision-making either actively or collaboratively and OHRQoL. This

finding might suggest the benefit for enhancing patients' involvement in decision-making. While patients' involvement in decision-making is known to affect patient-reported outcomes through a number of pathways such as improving patients adherence to treatment recommendation, improving the quality of the decision, and reducing decisional conflict and consequently improving health [33,34]. The researcher acknowledges the limitation in identifying the causal association between patients' involvement in decision-making and QoL at this stage of research due to the experienced delay in collecting the follow-up stage surveys attributed to the long waiting list for receiving TMs extractions at public dental services [35].

The researcher did not observe a statistically significant association between patients' preferences for decisional control and the HRQoL measure that was used (EQ-5D-5L) although there was a positive direction of the association. This might suggest the need for further exploration as the EQ-5D-5L has been found to have limitations in adequately covering QoL domains— a findings from the Twitter study [36]. This limitation in conceptual coverage might be responsible for the lack of a significant association. As indicated earlier, these findings were available to the researcher after conducting the RCT. Therefore, the researcher might suggest that future research should focus on studying how a condition impacts on QoL should conceptualize the conditions impact on QoL to help them select the appropriate generic instrument that covers the majority of QoL domains. This approach might help future research in selecting the instrument that is more precise and sensitive to change.

The online randomization tool used in this study [37] allowed the researcher to carry out an equal arm, parallel groups randomization of variable block sizes. This randomization method was found to be suitable for the steady flow of participants recruited in this study. Online

randomization is getting popular in clinical trials and we observed that it is a valid randomization tool since, no significant difference in individual characteristics and baseline measures was observed between groups. The researcher recommends the use of this tool in future RCTs.

When the researcher was able to explore the association between patients' TMs knowledge and participation in SDM from the patients' perspective and clinician's perspective, it was found to be significantly associated. This highlights the importance of enhancing patients' knowledge to improve participation in SDM since it was found to be a significant domain. This finding was enabled by actual testing of patients' knowledge about a specific topic which was lacking in the study that reported the validation of the dyadic SDM-9Q [38,39]. However, the proposed solution of providing TMs patients with a pre-consultation internet guidance to high quality resources was not found to be effective in improving patients' TMs knowledge. This lack of effect in improving TMs patients' knowledge resulted in the observed lack in improvement in participation in SDM.

The provided internet resources that was used in our study were of high quality and have an acceptable readability level. However, no significant difference was observed between groups and the effect sizes were minimal [40] in both intention to treat analysis and in the supplementary per-protocol analysis. This might be explained by the uptake of the information provided being affected by our participants' level of education [41] as the majority of our participants had secondary school or less education. Patients of low literacy levels are found to experience difficulties in comprehending online health information [42]. Future research in developing online health information for TMs patients might need to

consider the literacy level of TMs patients to improve their information uptake from these online resources.

The level of dental anxiety was not significantly increased by providing the Internet guidance that includes multi-media whereas previous evidence was not consistent [43,44]. The levels of dental anxiety reported by our participants were significantly higher than the Australia population norms of the IDAF-4C [45] when interpreting the 95% confidence intervals of the mean IDAF-4C scores in both groups. This might suggest that attending TMs consultation provokes dental anxiety which needs to be considered by the consulting oral surgeons. Reassurance by the consulting oral surgeon might be considered together with adequate explanation of what the patient might experience in the consultation to reduce the anxiety levels.

This research contributes to dentistry in several aspects. It contributes to the field of health care quality by revealing the possible over-management that TMs patients might be exposed to if they are dentally insured. In addition, this research contributes to theory by modelling how TMs might impact on QoL in real-time and revealing how QoL domains interacts with each other. This research contributes to ehealth patient education theory by modeling factors contributing to quality of online consumer health information and revealing the lack of patients' ability to identify high quality information. Additionally, this research was able to provide an explanation of the phenomena of the Internet-ready patient. Another contribution to patient education theory is the lack of efficacy of providing patients with internet guidance in improving the knowledge about TMs suggesting the need for considering patients' literacy level during information production to improve the information uptake. Furthermore, this

study contributes to the theory of the relationship between the involvement of dental patients in decision-making and health care outcomes such as QoL.

It contributes to the field of TMs extraction decision-making by identifying the lack of benefit of receiving multiple TMs extractions on self-rated oral health in the short-term. In addition, this study questioned the use of age as a justification for prophylactic TMs extractions since receiving TMs extractions when aged 18-25 years versus older age group did not significantly increase the number of days absent from work/school due to dental problems — an indicator for post-extraction complications. Additionally, our study shows that patients' knowledge is important in participation in shared decision-making. Clinicians providing dental services to community dental patients might need to consider that community dental patients prefer to be involved in making their dental treatment choices. This finding was in contrast to what might be widely believed about this group of patients. Our study provided an understanding of individual characteristics contributing to community dental patients' preference for decisional control.

Understanding patients' characteristics associated with preferences for involvement in decision-making might contribute to improving patient-clinician communication by making clinicians more sensitive to their patients' desire for decisional control. In addition, our study improves the clinician-patient communication in community dental setting by revealing the wide prevalence of patients' preference for involvement in decision-making which drives patients to seek online information before consultation. The argued contribution to improving patients-dentist communication might lead to improvements in the current community dental practice. Furthermore, highlighting that patients attending TMs consultation reported significant high levels of dental anxiety compared to Australia

population norms might be important for the clinicians to provide reassurance and adequate explanation to TMs patients. This might reduce the level of TMs patients' anxiety levels and therefore improve clinical practice.

This piece of research contributes to research methods by conceptualizing the domains for consumer health information concerning TMs, developing and initial validation of the Scientific Information Quality scale. The method used in modeling factors contributing to the scientific information quality was not used in the previous similar studies. This piece of research validated a readability software application named The Readability Studio Professional 2012 [46] which will help consumer health information producers. Another contribution to research methods is the novel approach used to model TMs impact on QoL by using real-time and spontaneous Twitter data. This method also allowed identification of interactions between QoL domains. The researcher used Twitter as a recruitment frame through which patients were approached and requested to complete an online survey. This piece of research used different study designs and statistical methods to address the research hypotheses and questions.

In addition of the study's contribution to theory, clinical practice and research methodologies; this study highlighted some areas of research that need further exploration. There is a need for further research in exploring the impact of retention versus prophylactic extractions of asymptomatic impacted TMs in the long-term. In addition, there is need for RCT to further explore the use of age as a justification for preventing post-extraction complication on patient reported outcomes. When QoL is used as an end-point for TMs research, the researcher recommends the use of the QoL domains identified in the Twitter study as a foundation for developing a new OHRQoL for TMs research which may be more

precise and sensitive to change. In case such instrument development and validation was not possible, the researcher recommends the use of the 35-item AQoL in TMs research as it has high conceptual coverage for TMs domains.

Further research is needed to develop ehealth literacy interventions to improve the patients' ability to identify high quality online information since the majority of patients are searching for information on the internet. Testing of the efficacy of ehealth literacy interventions needs a precise ehealth literacy measure that can assess the actual ehealth literacy skill not the self-reported ehealth literacy skills attainment. Furthermore, more research is needed to develop high quality online information resources that are developed for patients with low-literacy and testing the patients' uptake of this information.

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Appendices

Appendix I: Ethics approvals for the RCT



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RESEARCH BRANCH
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND
INTEGRITY

BEVERLEY DOBBS
EXECUTIVE OFFICER
LOW RISK HUMAN RESEARCH ETHICS REVIEW
GROUP (FACULTY OF HUMANITIES AND SOCIAL
SCIENCES AND FACULTY OF THE PROFESSIONS)
THE UNIVERSITY OF ADELAIDE
SA 5005
AUSTRALIA
TELEPHONE +61 8 8313 4725
FACSIMILE +61 8 8313 7325
email: beverley.dobbs@adelaide.edu.au

19 June 2013

Associate Professor D Brennan
School of Dentistry

Dear Associate Professor Brennan

ETHICS APPROVAL No: HS-2013-023
PROJECT TITLE: **The Impact of Patient-Centered Dental Open Educational Resources (DOER) on
Enhancing a Shared Clinical Decision-making and Effective Health Care
Outcomes**

I write to advise that the Low Risk Human Research Ethics Review Group (Faculty of Health Sciences) has approved the above project. The ethics expiry date for this project is **31 May 2016**.

Ethics approval is granted for three years subject to satisfactory annual progress and completion reporting. The form titled *Project Status Report* is to be used when reporting annual progress and project completion and can be downloaded at <http://www.adelaide.edu.au/ethics/human/guidelines/reporting>. On 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; and
- the project is discontinued before the expected date of completion.

Please refer to the following ethics approval document for any additional conditions that may apply to this project.

Yours sincerely


Dr John Semmler
HREC Convenor on behalf of the
Low Risk Human Research Ethics Review Group (Faculty of Health Sciences)



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SA 5005
AUSTRALIA
TELEPHONE +61 8 8313 4725
FACSIMILE +61 8 8313 7325
email: beverley.dobbs@adelaide.edu.au

Applicant: Associate Professor D Brennan

School: Dentistry

Application/RM No: 16495

Project Title: **The Impact of Patient-Centered Dental Open Educational Resources
(DOER) on Enhancing a Shared Clinical Decision-making and Effective
Health Care Outcomes**

Low Risk Human Research Ethics Review Group (Faculty of Health Sciences)

ETHICS APPROVAL No: HS-2013-023

APPROVED for the period: 30 May 2013 to 31 May 2016

This study is to be conducted by Dr Kamal Hanna, PhD Candidate.

Dr John Semmler
HREC Convenor on behalf of the
Low Risk Human Research Ethics Review Group (Faculty of Health Sciences)



Government of South Australia
SA Health

Date: 3 July 2014

Human Research Ethics Committee :-
Meeting held on: 22 May 2014

Protocol: "The impact of patient-centered dental open educational resources (DOER) on enhancing a shared clinical decision-making and improving health care outcomes."

Central Adelaide Local Health Network
ROYAL ADELAIDE HOSPITAL

North Terrace
Adelaide SA 5000
Tel: +61 8 8222 4000
Fax: +61 8 8222 5939
ABN 80 230 154 545

www.rah.sa.gov.au

Research Ethics Committee

Level 3, Hanson Institute

Tel: (08) 8222 4139

Fax: (08) 8222 3035

Email: rah.ethics@health.sa.gov.au

TO WHOM IT MAY CONCERN

Please be advised of the above Protocol approval by the Royal Adelaide Hospital Research Ethics Committee. It is the policy of both the RAH Research Ethics Committee & Investigational Drug Subcommittee that the names of the regular members of these Committees are not released.

The general makeup of the Committees is as listed below (effective at the above Meeting review date):

Research Ethics Committee

Male – Chairperson, Hospital Scientist employee Royal Adelaide Hospital

Female – One Qualified Lawyer

Male – One Layman

Female – One Laywoman

Female – One Laywoman, Philosophy, University of Adelaide

Male – One Minister of Religion

Male – One Counselling Professional.

Female – One Nurse, employee Royal Adelaide Hospital

Male – Clinician, Graduate of Medicine, employee SA Pathology

Male – Clinician, Graduate of Medicine, employee SA Pathology

Male – Clinician, Graduate of Medicine, employee SA Pathology

Male – Clinician, Graduate of Medicine, retired employee SA Pathology

Female – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Female – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Female – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Male – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Male – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Male – Clinician, Graduate of Medicine, employee Royal Adelaide Hospital

Investigational Drug Subcommittee

Chairperson - Senior Staff Specialist in Clinical Pharmacology, Royal Adelaide Hospital.

Three senior members of the University of Adelaide, Department of Clinical Pharmacology.

Two members of the Royal Adelaide Hospital, Pharmacy Department.

Three members of the Royal Adelaide Hospital, Clinical Pharmacology.

Chairman, Research Ethics Committee.

The REC composition is in accord with the guidelines for Institutional Ethics Committee composition as set out in the NHMRC National Statement on Ethical Conduct in Human Research (2007).

The committee is serviced by me (undersigned) in my role as Executive Officer.

Proxy members have been appointed to assure that there is full representation at all meetings.

Please be advised that no Investigators of the abovementioned study were present at either the Investigational Drugs Subcommittee Meeting or the Research Ethics Committee Meeting, at the time of discussion or recommendations.

The Hospital's Research Ethics Committee is governed by the NHMRC National Statement on Ethical Conduct in Human Research (2007).

Yours sincerely,

(

Mrs Heather O'Dea
Executive Officer, RESEARCH ETHICS COMMITTEE



Government of South Australia
SA Health

Central Adelaide Local Health Network
Royal Adelaide Hospital Human Research Ethics Committee
Level 3, Hanson Institute, IMVS Building
Royal Adelaide Hospital
North Terrace
Adelaide, South Australia, 5000
Telephone: +61 8 8222 4139
Fax: +61 8 8222 3035
Email: rah.ethics@health.sa.gov.au

Approval Date: 3 July 2014

Dr K Hanna
PhD Candidate
Australian Research Centre for Population Oral Health
School of Dentistry
UNIVERSITY of ADELAIDE

Dear Dr Hanna,

HREC reference number: HREC/14/RAH/160

Project Title: **“The impact of patient-centered dental open educational resources (DOER) on enhancing a shared clinical decision-making and improving health care outcomes.”**

RAH Protocol No: 140514.

Chief Investigator: A/Prof David Brennan

Thank you for submitting the above project for ethical and scientific review. This project was first considered by the Royal Adelaide Hospital Human Research Ethics Committee at its meeting held on 22 May 2014. I am pleased to advise that your protocol has been granted full ethics approval and meets the requirements of the *National Statement on Ethical Conduct in Human Research*. The documents reviewed and approved include:

- **NEAF Application: AU/1/F3A7115 Sites covered by this approval:**
 - Royal Adelaide Hospital
 - East Adelaide Oral and Maxiofacial Clinic
- **Protocol: Adelaide 2013**
- **Patient Information Sheet, Version 3, 3 July 2014**
- **Consent Form, 18 April 2014**
- **Clinicians Information Sheet, 18 April 2014**
- **Introduction Letter, 19 April 2014**
- **Baseline Patient Education Survey, 3 July 2014**
 - Clinicians' Survey, 3 July 2014
 - Pre-consultation Patient Education Survey, 3 July 2014
 - Follow-up Patient Education Survey, 3 July 2014
- **RAH Policy: Audit and Quality Assurance, Version 1.1, 12 January 2014**
- **Contacts for Information on Project & Independent Complaints Procedure, 18 April 2014**
- **Semi Structured Interview Form, 19 April 2014**

Please quote the RAH Protocol Number allocated to your study on all future correspondence.

GENERAL TERMS AND CONDITIONS OF ETHICAL APPROVAL:

- For all clinical trials, the study must be registered in a publicly accessible trials registry prior to enrolment of the first participant.
- Adequate record-keeping is important. If the project involves signed consent, you should retain the completed consent forms which relate to this project and a list of all those participating in the project, to enable contact with them in the future if necessary. The duration of record retention for all clinical research data is 15 years.
- You must notify the Research Ethics Committee of any events which might warrant review of the approval or which warrant new information being presented to research participants, including:
 - (a) serious or unexpected adverse events which warrant protocol change or notification to research participants,
 - (b) changes to the protocol,
 - (c) premature termination of the study

Cont.../2

- The Committee must be notified within 72 hours of any serious adverse event occurring at this site.
- Approval is valid for **5 years** from the date of this letter, after which an extension must be applied for. Investigators are responsible for providing an annual review to the RAH REC Executive Officer each anniversary of the above approval date, within 10 working days, using the Annual Review Form available at: <http://www.rah.sa.gov.au/rec/index.php>
- The REC must be advised with a report or in writing within 30 days of completion.

Should you have any queries about the HREC's consideration of your project, please contact Mrs Heather O'Dea on 08 8222 4139, or rah.ethics@health.sa.gov.au .

You are reminded that this letter constitutes ethical approval only. You must not commence this research project at a SA Health site until separate authorisation from the Chief Executive or delegate of that site has been obtained.

This Committee is constituted in accordance with the NHMRC's *National Statement on the Ethical Conduct of Human Research* (2007).

The HREC wishes you every success in your research.

Yours sincerely,



**A/Prof A Thornton
CHAIRMAN
RESEARCH ETHICS COMMITTEE**



SADS Ref: 2014-07326/1

17 July 2014

Dr Kamal Hanna
c/- ARCPOH
122 Frome Street
Adelaide, SA 5000

Dear Kamal,

Project title:

**The Impact of Patient-Centered Dental Open Educational Resources (DOER)
on Enhancing a Shared Clinical Decision-Making and Improving Health Care Outcomes**

Central Adelaide Local Health Network

SA Dental Service

Evaluation and Research Unit

Postal Address

GPO Box 864

Adelaide SA 5001

Tel 08 8222 9080

Fax 08 8222 9098

andrew.chartier@health.sa.gov.au

www.sadental.sa.gov.au

HREC reference number: HREC/14/RAH/160 (Approved 03/07/14 – RAH HREC)

NEAF reference number: AU/1/F3A7115

SSA reference number: AU/12/AC1816 (Authorised 17/07/14 SADS)

RE: Research Project Approval Granted

Thank you for submitting an application for authorisation of this project. I am pleased to inform you that authorisation has been granted for this study to commence at the following site(s): **OMFS Unit, Adelaide Dental Hospital.**

The following conditions apply to the authorisation of this research project. These are additional to those conditions imposed by the Human Research Ethics Committee that granted ethical approval to this project:

Please note the following conditions of authorisation:

1. Authorisation is limited to the site/s identified in this letter only.
 - a. **OMFS Unit clinics and offices, Adelaide Dental Hospital, SA Dental Service**
Access to survey study participants, view and collect notations of relevant data via staff and participant questionnaires, as per HREC application, is granted.
2. Project authorisation is granted for the term of your project outlined in HREC approval (HREC/14/RAH/160) – five (5) years maximum, without resubmission for extension, with record/data retention required for 15 years.
3. The study must be conducted in accordance with the conditions of ethical approval provided by the RAH HREC, SA Health policies, and in conjunction with the standards outlined in the *National Statement on Ethical Conduct in Human Research (2007)* and the *Australian Code for the Responsible Conduct of Research (2007)*.
4. The Coordinating Principal Investigator is responsible for notifying the institution (SA Dental Service) via this Research Governance Officer of any changes to the status of the project within a timely manner:
 - a. Proposed amendments to the research protocol or conduct of the research which may affect the ethical acceptability of the project, and which are submitted to the HREC for review, are copied to this research governance officer;
 - b. Proposed amendments to the research protocol or conduct of the research which only affects the ongoing site acceptability of the project, are to be submitted to this research governance officer;
 - c. Proposed amendments to the research protocol or conduct of the research which may affect both the ongoing ethical acceptability of the project and the site acceptability of the project are to be submitted to this research governance officer after a HREC decision is made.
5. A copy of this letter should be maintained on file by the Coordinating Principal Investigator as evidence of project authorisation.
6. If University personnel are involved in this project, the Principal Investigator should notify the University before commencing their research to ensure compliance with University requirements including any insurance and indemnification requirements.
7. Notification of completion of the study at this site is to be provided to this Research Governance Officer.

Please consult with Dr Paul Sambrook, Head of Unit, OMFS, Adelaide Dental Hospital and Ms Denise Page, Unit Business Manager OMFS, ADH, to discuss access availability and operational matters in relation to participant recruitment, and the distribution of informed consent and questionnaire material.

Should you have any queries about the consideration of your project and SSA, please contact me in my role as SA Dental Service RGO. The SSA ID (AU/12/AC1816) should be quoted in any correspondence about this matter.

Yours sincerely

Dr Andrew Chartier
Director, Evaluation and Research Unit, SADS Research Governance Officer, SA Dental Service
Ph: 8222 9080 Email: Andrew.Chartier@health.sa.gov.au

SSA_AU-12-AC1816 Approval Letter_SADS_Hanna_K_SharedClinicalDecision_170714.doc

Appendix II: Ethics approval for Twitter study



RESEARCH BRANCH
OFFICE OF RESEARCH ETHICS, COMPLIANCE
AND INTEGRITY

LEVEL 7, 115 GRENFELL STREET
THE UNIVERSITY OF ADELAIDE
SA 5005 AUSTRALIA

TELEPHONE +61 8 8313 5137
FACSIMILE +61 8 8313 3700
EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

5 February 2015

Professor D Brennan
School of Dentistry

Dear Professor Brennan

ETHICS APPROVAL No: H-2015-017

PROJECT TITLE: Real-Time impact of third molar on the quality of life: A multimodal approach using Twitter

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health Sciences) and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* involving no more than low risk for research participants. You are authorised to commence your research on **05 Feb 2015**.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled *Project Status Report* is to be used when reporting annual progress and project completion and can be downloaded at <http://www.adelaide.edu.au/ethics/human/guidelines/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; and
- the project is discontinued before the expected date of completion.

Please refer to the following ethics approval document for any additional conditions that may apply to this project.

Yours sincerely,

Sabine Schreiber
Secretary, Human Research Ethics Committee
Office of Research Ethics, Compliance and Integrity



RESEARCH BRANCH
OFFICE OF RESEARCH ETHICS, COMPLIANCE
AND INTEGRITY

LEVEL 7, 115 GRENFELL STREET
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EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

Applicant: Professor D Brennan
School: School of Dentistry
Project Title: Real-Time impact of third molar on the quality of life: A multimodal approach using Twitter

The University of Adelaide Human Research Ethics Committee
Low Risk Human Research Ethics Review Group (Faculty of Health Sciences)

ETHICS APPROVAL No: H-2015-017 **App. No.:** 0000019786

APPROVED for the period: 05 Feb 2015 to 28 Feb 2018

Thank you for your responses dated 29.1.2015, 3.2.2015 and 5.2.2015 to the matters raised.

Please note if a follow up survey is to be conducted (as outlined in the survey preamble) details of this will need to be provided to the HREC Secretariat for approval prior to this taking place.

This study is to be conducted by Dr Kamal Hanna, PhD student.

Sabine Schreiber
Secretary, Human Research Ethics Committee
Office of Research Ethics, Compliance and Integrity

Appendix III: Baseline survey package



You are invited to participate in

Engaging Patients in Decision-Making

Researchers at the Australian Research Centre for Population Oral Health (ARCPHO), the University of Adelaide would like to invite you to take part in this study. You will find all information about our study and how to participate in the enclosed information sheet.

What will you get from participating in our study?

Our study is looking at improving your engagement in the decision-making process and how your engagement will impact the outcome of the healthcare services you receive. In an appreciation for the time spent in completing the study surveys, we would like to offer you **\$10 voucher**.

When will you get the \$10 voucher?

When we receive the completed baseline survey and signed consent form, we will process your \$10 gift voucher and we will give it to you when you see your oral surgeon.

\$10

Coles Group &
Myer
Gift Card



Government of South Australia
SA Health

Central Adelaide Local
Health Network
Statewide Services

SA Dental Service

Oral & Maxillofacial Surgery Unit
Adelaide Dental Hospital
Frome Road
Adelaide SA 5000

Postal Address
GPO Box 864
Adelaide SA 5001

Tel 08 8222 8225
Fax 08 8313 4402

sadental@health.sa.gov.au
www.sadental.sa.gov.au

Re: Improving patient engagement in shared clinical decision making process using different formats of health information

University of Adelaide Human Research Ethics Committee approval number: HS-2013-023.

Researchers at the Australian Research Centre for Population Oral Health, University of Adelaide are conducting a project to improve participation in shared decision-making in dental practice. The researchers are looking for patients who have been recently referred to the Adelaide Dental Hospital because of their wisdom tooth problems, otherwise healthy, aged 18 years or over, English speakers and internet users.

Our records show that you are eligible to participate in the above research project. Accordingly, we would like to invite you to participate in this study. You will find more details about this research project and how to participate in the information sheet provided. Please be advised that privacy and confidentiality of your information has been maintained. Only if you agree to be part of this study will your details be passed on to the researchers.

If you choose to participate, please follow the instructions provided in the information sheet. If you choose not to participate, your decision will not affect your care. However, it will be appreciated if you would be able to participate in this research project.

Thank you in advance for your anticipated cooperation in this matter.

Kind regards

Administration Officer
Oral & Maxillofacial Surgery Unit
SA Dental Service

Researchers at the Australian Research Centre for Population Oral Health (ARCPOH), the University of Adelaide, are undertaking a research project to improve patient engagement in shared clinical decision-making, using different formats of health information. We are looking for patients who have been recently referred to the Department of Oral and Maxillofacial Surgery, Adelaide Dental Hospital, for consultation regarding their wisdom tooth problems. Also, we want our participants to be aged 18 years or over, internet users and English speakers.

How could you participate in this study?

To be able to participate in this study, you need to sign the enclosed consent form, fill in the baseline survey and send them to us in the provided pre-paid envelope. This survey collects some baseline information before you see your specialist oral surgeon. The survey includes: your background, your understanding of wisdom tooth problems, how you look for health information on the internet and how your wisdom tooth problems have affected your oral and general health. Answering this survey will take about 10-15 minutes. You have the option not to answer any question if you choose.

What will happen next?

After we receive the signed consent form together with the completed baseline survey, we will decide, based on our selection criteria, whether you can participate in our study. Selected participants will be randomly allocated to either a study group or a control group. All participants will receive standard care health education (verbal information and leaflets). Participants in the study group will receive guidance from the study researchers in surfing the internet for information concerning wisdom tooth problems.

Who could you contact if you have any problem in completing the survey?

Dr Kamal Hanna is more than happy to assist you with completing the survey should you have any questions. His contact details are: Tel: (08) 8313 5626, e-mail: kamal.hanna@adelaide.edu.au.

Is there anything more you need to know?

Yes, you will be asked to complete a consultation survey, while you are waiting in the hospital to see your specialist oral surgeon, which will only take about 5 minutes to complete. This consultation survey aims to assess some aspects related to your wisdom tooth consultation. In a month's time, after your treatment, you will be asked to complete a follow-up survey. This follow-up survey will ask about your thoughts regarding the health services provided to you and if these services have improved your quality of life. The follow-up survey will take about 10 minutes to complete. Furthermore, we will ask your specialist oral surgeon to provide us with some information regarding your wisdom tooth, your understanding of your wisdom tooth problems and the decided treatment plan. In addition, Dr Kamal Hanna may interview you about the provided health information. If you are selected for the interview, you will be contacted to see whether you are willing to be interviewed and, if so, an interview will be arranged by phone or at the Adelaide Dental Hospital. The interview is expected to take no more than 20 minutes. If you kindly agree, your interview will be audio recorded; and the interview recording will be deleted once the interview information is extracted.

Protection of your confidentiality

Your answers are confidential; no information that identifies you will be given to anyone except as required by law. Moreover, if you choose not to participate, your decision will not affect your care. However, your participation is much appreciated. If you are selected for an interview, your name will be replaced by our study ID to protect your confidentiality.

Does this study have ethics approvals?

Yes, the University of Adelaide Human Research Ethics Committee approved this study, with an approval number: HS-2013-023. In addition, this study is approved by the Human Research Ethics Committee of the Royal Adelaide Hospital.

Is this study registered on a publicly accessible website?

Yes, this study is registered on the *Australian and New Zealand Clinical Trial Register*, as required by the Ethics Committee. A description of this clinical trial is available on www.anzctr.org.au. This website does not include information that can identify you. At most, the website will include a summary of our study results. You can search this website at any time.

In this envelope you will find:

- | | | |
|----------------------|---|----------------------|
| 1) Information Sheet | 2) Independent Complaints Procedure Sheet → (at the back of this Information Sheet) | |
| 3) Consent Form | 4) Baseline Survey | 5) Pre-paid envelope |

Thank you,

Dr David Brennan
Associate Professor

Dr Jason Armfield
Associate Professor

Dr Paul Sambrook
Consultant Oral & Maxillofacial Surgery

Dr Kamal Hanna
PhD Candidate

This document is for people who are participants in a research project.

CONTACTS FOR INFORMATION ON PROJECT AND INDEPENDENT COMPLAINTS PROCEDURE

The following study has been reviewed and approved by the University of Adelaide Human Research Ethics Committee:

Project Title:	Improving patient engagement in shared clinical decision making process using different formats of health information.
Approval Number:	HS-2013-023

The Human Research Ethics Committee monitors all the research projects which it has approved. The committee considers it important that people participating in approved projects have an independent and confidential reporting mechanism which they can use if they have any worries or complaints about that research.

This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (see <http://www.nhmrc.gov.au/publications/synopses/e72syn.htm>)

1. 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 project co-ordinator:

	Contact 1	Contact 2	Contact 3	Contact 4
Name:	Dr David Brennan	Dr Jason Armfield	Dr Paul Sambrook	Dr Kamal Hanna
Position:	Associate Professor	Associate Professor	Consultant OMFS	PhD Candidate
Phone:	+61 8 8313 4046	+61 8 8313 4050	+61 8 8303 5112	+61 8 8313 5626

2. If you wish to discuss with an independent person matters related to:
 - making a complaint, or
 - raising concerns on the conduct of the project, or
 - the University policy on research involving human participants, or
 - your rights as a participant,

contact the Human Research Ethics Committee's Secretariat on phone (08) 8313 6028 or by email to hrec@adelaide.edu.au

3. This study has been reviewed by human research ethics committee of Royal Adelaide Hospital. You can contact the Executive Officer on +61 8 8222 4139.

CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:
Research Project Title: Improving patient engagement in shared clinical decision making process using different formats of health information
Ethics Approval Number: HS-2013-023
2. The research project was fully explained to my satisfaction in the information sheet provided. My consent is given freely.
3. Although I understand that the purpose of this research project is to improve the quality of medical care, it has also been explained that my involvement may not be of any benefit to me.
4. 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.
5. I understand that I am free to withdraw from the project at any time and that this will not affect medical advice in the management of my health, now or in the future.
6. If selected and wish to participate in an interview, I agree to the interview being audio recorded.
Yes No
7. I agree to the researcher to request some information from my oral surgeon related to the study.
8. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Participant to complete:

Title _____ First Name _____ Last Name _____
Postal address _____

City _____ Post Code _____ State _____
Email Address _____ Phone _____

Wisdom Tooth Consultation Date _____

Signature _____ Date _____

About this survey

This survey is designed to collect baseline information about how your wisdom tooth problems are impacting your oral and general health, how you look for health information, your knowledge about wisdom tooth problems, and your preference for involvement in making treatment choices. To help us in understanding the information you provide, we also need to collect some information about your background. You have the option to not answer any question if you choose.

How long will it take to complete this survey?

It will take about 10–15 minutes to complete.



Completing the survey

This example will guide you on how to complete this survey.

How do you rate the following?

The information provided to you by your dentist.

Excellent	Good	Fair	Poor	N/A
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The person completing this survey has rated the dentist provided information as “Good”.

Who should you contact if you want any help in completing this survey?

Dr. Kamal Hanna, at the Australian Research Centre for Population Oral Health on: (08) 8313 5626 or e-mail: Kamal.Hanna@adelaide.edu.au



What do I need to do after completing this survey?

Please, send this survey back to us together with the signed consent form in the pre-paid envelope provided.



For Office Use Only

Participant code:

Date received:

Section A: Your background

A01. Age (please record you age in years in the box below)

A02. Gender

- Male Female

A03. Educational level

- Year 7 or less Year 8 Year 9
 Year 10 Year 11 Year 12 (matriculation)
 Certificate or Diploma University Degree Post graduate studies

A04. Income level

- Less than \$20,000 \$20,000 to less than \$30,000 \$30,000 to less than \$40,000
 \$40,000 to less than \$50,000 \$50,000 to less than \$60,000 \$60,000 to less than \$70,000
 \$70,000 to less than \$80,000 \$80,000 or above

A05. Currently, are you:

- Student Employed Unemployed and looking for work
 On home duties Unemployed and not looking for work Don't know

A06. How do you describe your current occupation:

- Professional Technician & trade worker Community & personal service worker
 Sales Clerical & administrative worker Machine operator
 Laborer Manager Don't know
 Other, please specify →

A07. Which card(s) are you covered by?

- Pensioner Concession Card Health Care Card Commonwealth Seniors Health Card
 Department of Veterans Affairs treatment GOLD card Department of Veterans Affairs treatment WHITE card None
 Other cards →

A08. Do you have private health insurance?

- No. Go to A10 Yes, please specify the insurance company → Go to A09

A09. Which policy do you have for your private health insurance?

- Hospital policy only General treatment only Hospital & general treatment

A10. Will the Government or an insurance fund pay any part of the expenses for your wisdom tooth treatment?

- I pay all expenses Insurance pay some, patient pay some Insurance pay all, patient pay none
 Government pay some, patient pay some Government pay all, patient pay none Don't know
 Other payment arrangement →

A11. Country of birth			
<input type="checkbox"/> Australia	<input type="checkbox"/> Outside Australia, please specify →	<input type="text"/>	
A12. English fluency Please rate your English fluency			
	Excellent	Good	Fair
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A13. Apart from your wisdom tooth problems, do you consider yourself fit and healthy?			
<input type="checkbox"/> Yes	<input type="checkbox"/> No →	<input type="text"/>	
Please give details above			
A14. Have you ever had unpleasant experiences with your previous dental visits?			
<input type="checkbox"/> No	<input type="checkbox"/> Yes →	<input type="text"/>	
Please give details above			

Section B: Your preference in making a dental treatment decision	
B01. Please <i>select only one theme</i> that reflects your preferred role in making a dental treatment decision	
<input type="checkbox"/>	I make the final decision about which treatment I will receive.
<input type="checkbox"/>	I make the final selection after seriously considering my dentist's opinion.
<input type="checkbox"/>	My dentist and I share the responsibility for the decision about which treatment is the best for me.
<input type="checkbox"/>	My dentist makes the final decision about which treatment will be used but has seriously considered my opinion.
<input type="checkbox"/>	I leave all decisions regarding my treatment to my dentist.

Section C: Your internet access		
C01. Do you have an access to the internet?		
<input type="checkbox"/> Yes	<input type="checkbox"/> No. If 'No', please go to Section F	
C02. How do you access the internet?		
<input type="checkbox"/> Cable/high-speed	<input type="checkbox"/> Dialup/slow connection	<input type="checkbox"/> Mobile/wireless internet
C03. Where do you commonly access the internet?		
<input type="checkbox"/> Home	<input type="checkbox"/> Work	<input type="checkbox"/> Others/Public places
C04. Which device do you commonly use to access the internet?		
<input type="checkbox"/> Desktop PC	<input type="checkbox"/> Laptop	<input type="checkbox"/> Tablet/Smartphone
C05. How often do you access the internet?		
<input type="checkbox"/> Many times a day	<input type="checkbox"/> No more than a few times a day	<input type="checkbox"/> A few times or less a week
<input type="checkbox"/> A few times a month	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Not sure

Section D: Your Internet use for health information					
D01. Have you ever used the Internet to look for information about a dental procedure?					
<input type="checkbox"/> Yes <input type="checkbox"/> No (go to section F)					
Please rate your experience of using the Internet for health information	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
D02. I know what health resources are available on the Internet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D03. I know where to find helpful health resources on the Internet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D04. I know how to find helpful health resources on the Internet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D05. I know how to use the Internet to answer my questions about health.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D06. I know how to use the health information I find on the Internet to help me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D07. I have the skills I need to evaluate the health resources I find on the Internet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D08. I can tell high quality health resources from low quality health resources on the Internet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D09. I feel confident in using information from the Internet to make health decisions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D10. Which search engine do you commonly use?					
<input type="checkbox"/> Google <input type="checkbox"/> Yahoo <input type="checkbox"/> Bing					
<input type="checkbox"/> Ask <input type="checkbox"/> Other. Please specify → <input type="text"/>					
D11. What keywords did you use? → <input type="text"/>					
D12. Were the websites you reviewed mainly belonging to:					
<input type="checkbox"/> Dental practices <input type="checkbox"/> Educational institute <input type="checkbox"/> Government sponsored					
<input type="checkbox"/> Professional associations <input type="checkbox"/> Social media <input type="checkbox"/> Commercial					
<input type="checkbox"/> Non-profit organizations <input type="checkbox"/> Other. Please specify → <input type="text"/>					
D13. Rate the Internet information you identified	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
D13a. Easy to read	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D13b. Useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D13c. Easy to understand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D13d. Of good quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D13e. Trustable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D14. If you have any positive or negative comments regarding the internet related oral health information you obtained, please explain below:					
<input type="text"/>					
<input type="text"/>					
<input type="text"/>					

D15. From the figures below, please *circle* any figure(s) that you are able to recognize.



D16. Choose only one figure you circled, and explain what does this figure mean to you?

Section E: How did your dentist interact with online health information you got?

E01. Have you tried to discuss Internet-related health information with your dentist?

Yes No (Explain)→

Go to E02. Go to E04.

E02. What response have you had from your dentist?

Detailed response (Explain) Brief response (Explain) None. Any given reasons?

E03. Why did you look for information over the internet?

I feel information provided to me by my dentist was not sufficient.

To help me in making a treatment choice.

Looking for advice for self-diagnosis to avoid going to the dentist.

Other; please specify →

E04. Has your dentist ever recommended any website to you for your wisdom tooth problems?

No Yes. Please specify below.

Section F: Your health

Please rate your:	Excellent	Very good	Good	Fair	Poor
F01. General health.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F02. Dental health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section I: Your oral health related quality of life

This section is designed to evaluate the impact of your wisdom tooth problems on your oral health related quality of life

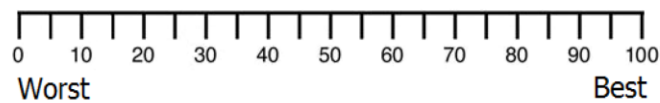
How often, in the <u>past 2 weeks</u>,	Very Often	Fairly often	Occasionally	Hardly ever	Never
I01. have you had trouble <i>pronouncing any words</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I02. have you felt that your <i>sense of taste</i> has worsened because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I03. have you had <i>painful aching</i> in your mouth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I04. have you found it <i>uncomfortable to eat any foods</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I05. have you <i>felt tense</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I06. have you been <i>self-conscious</i> because of your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I07. has your <i>diet been unsatisfactory</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I08. have you had to <i>interrupt meals</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I09. have you found it <i>difficult to relax</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I10. have you been a bit <i>embarrassed</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I11. have you been a bit <i>irritable with other people</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I12. have you had <i>difficulty doing your usual jobs</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I13. have you felt that life in general was <i>less satisfying</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I14. have you been <i>totally unable to function</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section J: Your general health

Under each heading, please tick one response that has described your health **today**

J01	Mobility	<input type="checkbox"/> I have no problems in walking about <input type="checkbox"/> I have slight problems in walking about <input type="checkbox"/> I have moderate problems in walking about <input type="checkbox"/> I have severe problems in walking about <input type="checkbox"/> I am unable to walk about
J02	Self-care (washing and dressing)	<input type="checkbox"/> I have no problems washing or dressing myself <input type="checkbox"/> I have slight problems washing or dressing myself <input type="checkbox"/> I have moderate problems washing or dressing myself <input type="checkbox"/> I have severe problems washing or dressing myself <input type="checkbox"/> I am unable to wash or dress myself
J03	Usual activities (housework, family, and leisure)	<input type="checkbox"/> I have no problems doing my usual activities <input type="checkbox"/> I have slight problems doing my usual activities <input type="checkbox"/> I have moderate problems doing my usual activities <input type="checkbox"/> I have severe problems doing my usual activities <input type="checkbox"/> I am unable to do my usual activities
J04	Pain & discomfort	<input type="checkbox"/> I have no pain or discomfort <input type="checkbox"/> I have slight pain or discomfort <input type="checkbox"/> I have moderate pain or discomfort <input type="checkbox"/> I have severe pain or discomfort <input type="checkbox"/> I have extreme pain or discomfort
J05	Anxiety & depression	<input type="checkbox"/> I am not anxious or depressed <input type="checkbox"/> I am slightly anxious or depressed <input type="checkbox"/> I am moderately anxious or depressed <input type="checkbox"/> I am severely anxious or depressed <input type="checkbox"/> I am extremely anxious or depressed

J06. We would like to know how good or bad your health is **today**, by marking an X on the scale below:



Thank you for completing our survey

Please send it back to us with the signed consent form in the pre-paid envelope provided.

Appendix IV: Online resources for wisdom teeth patients



Engaging Patients in Decision-Making
Internet Resources for Wisdom tooth problems



Dear

We are pleased to advise you that you have been selected as a participant in our study as per the received signed consent form and the set eligibility criteria. In addition, you were randomly allocated to our study group, where you will receive a guidance in surfing the internet for information regarding your wisdom tooth problems. Here, you will find some of the high quality resources that we would like you to review before your wisdom tooth consultation appointment. The provided internet resources are complementary and not intended to replace a medical advice.

Recommended internet resources for wisdom tooth problems:

1. Bupa.co.uk available at:
<http://www.bupa.co.uk/individuals/health-information/directory/w/wisdom-teeth-removal>
2. Animated teeth.com available at:
http://www.animated-teeth.com/wisdom_teeth/t1_wisdom_tooth.htm
3. MayoClinic.org available at:
<http://www.mayoclinic.org/diseases-conditions/wisdom-teeth/basics/definition/con-20026676>
4. NHS.UK available at:
<http://www.nhs.uk/Conditions/Wisdom-tooth-removal/Pages/Introduction.aspx>
5. WebMD.com available at:
<http://www.webmd.com/oral-health/guide/wisdom-teeth>

What will happen at your wisdom tooth consultation appointment?

On your consultation appointment, you will meet a specialist oral surgeon who will take your medical and dental history, examine you and might request x-rays. Your specialist will provide you with the treatment options and a treatment decision be made after considering your preferences. Based on the decided treatment plan, your health care card and/ or your private health insurance status, you will be advised with how much you need to contribute to your treatment costs.

Kind regard

Dr Kamal Hanna
BDS, MRCSEd, MSc.(Oral Surg.), Egy Board OMFS, PGDip. of Laser
PhD Candidate
Australian Research Centre for Population Oral Health (ARCPOH)
School of Dentistry
THE UNIVERSITY OF ADELAIDE
SOUTH AUSTRALIA 5005
Tel: (+61)(08) 8313 5626 e-Mail: Kamal.Hanna@adelaide.edu.au

Appendix V: Clinician's survey

Researchers at the Australian Research Centre for Population Oral Health (ARCPOH), the University of Adelaide, are undertaking a research project to improve patient engagement in clinical shared decision-making, using different formats of health information. Our study is a randomised controlled clinical trial. All participating patients will receive standard health care patient education (verbal information and leaflets). Participants in the study group will receive guidance from our researchers in surfing the internet for information concerning wisdom tooth problems.

We would like you to evaluate each participant's involvement in the process of clinical shared decision-making, the consultation outcomes and your satisfaction with the consultation time, on the provided clinician's survey. You have the option to not answer any question if you choose.

Does this study have ethics approvals?

Yes, the University of Adelaide Human Research Ethics Committee approved this study, with an approval number: HS-2013-023. In addition, this study is approved by Human Research Ethics Committee of the Royal Adelaide Hospital.

How could you participate in this study?

Each clinician needs to sign the *Consent Form*, and send it back to us in the pre-paid envelope provided. When you review our study participants, please complete the clinician survey for each patient and put each completed survey in an envelope then insert it in our study folder in your clinic. On the clinician survey, patient identity is replaced by our study ID, to protect their confidentiality. For each participating patient in our study, a copy of his/ her consent form and a clinician survey can be found in the identified envelope.

What is the clinician survey?

The survey collects some information about our participants' wisdom teeth problems and your assessment of their overall understanding concerning these problems. Moreover, we want you to rate the patient participation in the shared decision-making, your satisfaction with consultation time and how the consultation time is used. This survey will take about 5 minutes to complete per participating patient.

Who should you contact if you have any problem in completing the survey?

Dr Kamal Hanna is more than happy to answer your questions. His contact details are: Tel: (08) 8313 5626, e-mail: kamal.hanna@adelaide.edu.au

Is anything more do you need to know?

Yes, your answers are confidential; no information will be given to anyone. Your participation in this study is voluntary and you can opt-out at any time by informing the contact person for the study. However, your participation is much appreciated.

In this envelope you will find:

- 1) Information Sheet
- 2) Independent Complaints Procedure Sheet (at the back of Information Sheet)
- 3) Consent Form
- 4) Pre-paid envelope

Thank you

Yours' sincerely

Dr David Brennan
Associate professor

Dr Jason Armfield
Associate Professor

Dr Paul Sambrook
Consultant Oral & Maxillofacial Surgery

Dr Kamal Hanna
PhD Candidate

This document is for people who are participants in a research project.

CONTACTS FOR INFORMATION ON PROJECT AND INDEPENDENT COMPLAINTS PROCEDURE

The following study has been reviewed and approved by the University of Adelaide Human Research Ethics Committee:

Project Title:	Improving patient engagement in shared clinical decision making process using different formats of health information.
Approval Number:	HS-2013-023

The Human Research Ethics Committee monitors all the research projects which it has approved. The committee considers it important that people participating in approved projects have an independent and confidential reporting mechanism which they can use if they have any worries or complaints about that research.

This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (see <http://www.nhmrc.gov.au/publications/synopses/e72syn.htm>)

1. 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 project co-ordinator:

	Contact 1	Contact 2	Contact 3	Contact 4
Name:	Dr David Brennan	Dr Jason Armfield	Dr Paul Sambrook	Dr Kamal Hanna
Position:	Associate Professor	Associate Professor	Consultant OMFS	PhD Candidate
Phone:	+61 8 8313 4046	+61 8 8313 4050	+61 8 8303 5112	+61 8 8313 5626

2. If you wish to discuss with an independent person matters related to:
 - making a complaint, or
 - raising concerns on the conduct of the project, or
 - the University policy on research involving human participants, or
 - your rights as a participant,

contact the Human Research Ethics Committee's Secretariat on phone (08) 8313 6028 or by email to hrec@adelaide.edu.au

3. This study has been reviewed by human research ethics committee of Royal Adelaide Hospital. You can contact the Executive Officer on +61 8 8222 4139.




CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:
Research Project Title: Improving patient engagement in shared clinical decision making process using different formats of health information
Ethics Approval Number: HS-2013-023
2. The research project was fully explained to my satisfaction in the information sheet provided. My consent is given freely.
3. Although I understand that the purpose of this research project is to improve the quality of medical care, it has also been explained that my involvement may not be of any benefit to me.
4. 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.
5. I understand that I am free to withdraw from the project at any time and that this will not affect me, now or in the future.
6. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet

Clinician to complete:

Title _____ First Name _____ Last Name _____
Postal address _____

City _____ Post Code _____ State _____
Email Address _____ Phone _____
Signature _____ Date _____

About this survey						
This survey is designed to collect some clinical information in relation to patients participating in our study. In addition, this survey collects some information about the decision outcomes and your satisfaction with the consultation time. Your patient has signed the consent form for releasing medical information related to this study. You have the option to not answer any question if you choose.						
How long does it take to complete this survey?						
It will take about 5 minutes to complete						
						
Completing the survey						
This example will guide you on how to complete this survey.						
How do you rate the following?	Completely disagree	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Completely agree
I'm satisfied with my patient knowledge about wisdom tooth extraction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The consultant completed this survey and rated the above statement as "Somewhat agree".						
Who should you contact if you want any help in completing this survey?						
You can call <i>Dr. Kamal Hanna</i> , at the Australian Research Centre for Population Oral Health on: (08) 8313 5626						
						
What do I need to do after completing this survey?						
Please, put each completed survey in an envelope then insert it in our study folder in your clinic.						
						

For Office Use Only	
Participant code:	<input type="text"/>
Date received:	<input type="text"/>

01. Clinician' initials

02. Please select the reason/s for referring the patient for third molar consultation

- Recurrent infection Untreatable decay Periodontitis
 Associated with pathology Prophylactic Orthodontic treatment
 Other; please specify →

03. Please circle which tooth (teeth) was (were) referred for consultation

8	8
8	8

04. Decision outcomes

04A. Discharge (no further treatment is required)

04B. Decision deferred due to

04Ba. Needs time to think about it

04Bb. Lack of resources by the patient

04Bc. Other; please specify →

04C. Surgical removal

04Ca. LA

04Cb. LA+ IV sedation

04Cb1. Outpatient MOS

04Cb2. Theater

04Cc. GA

04Cc1. Day case

04Cc1. Hospital inpatient

05. Please circle tooth (teeth) planned for surgical removal and their position

8	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	8
8	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	<input type="checkbox"/> Mesioangular <input type="checkbox"/> Class A <input type="checkbox"/> Distoangular <input type="checkbox"/> Class B <input type="checkbox"/> Vertical <input type="checkbox"/> Class C <input type="checkbox"/> Horizontal	8

06. How do you rate the following?	Completely disagree	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Completely agree
06A. I'm satisfied with the consultation time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
06B. I'm satisfied with my patient's knowledge about wisdom tooth problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>




07. The consultation time was mainly used for:

- Providing information Requesting investigations Patient examination
 Consenting the patient Clerking the patient Other →

Your shared decision-making experience						
08. How do you rate the following?	Completely disagree	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Completely agree
08A. I made it clear to my patient that a decision needed to be made.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08B. I wanted to know exactly from my patient how s/he wants to be involved in making the decision.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08C. I told my patient that there are different options for treating his/her wisdom tooth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08D. I precisely explained the advantages and disadvantages of the treatment options to my patient.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08E. I helped my patient understand all the information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08F. I asked my patient which treatment option s/he prefers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08G. My patient and I thoroughly weighed the different treatment options.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08H. My patient and I selected a treatment option together.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08I. My patient and I reached an agreement on how to proceed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you
Please put each completed survey in an envelope, then insert it in our study folder in your clinic.

Appendix VI: Before and after consultation survey

About this survey						
Part 1 of this survey (to be completed before your consultation) is designed to re-assess your knowledge about wisdom tooth problems. Furthermore, it evaluates your feelings for having a treatment in relation to it. Part 2 of this survey (to be completed after your consultation) is designed to assess your participation in the process of decision-making and your decisional role experience. You have the option not to answer any question if you choose.						
How long does it take to complete this survey?						
It will take about 5 minutes to complete						
						
Completing the survey						
This example will guide you on how to complete this survey						
How do you rate the following?	Completely disagree	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Completely agree
I'm satisfied with the information leaflet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The patient completed this survey and rated the above statement as "Somewhat agree".						
Who could you contact if you want any help in completing this survey?						
You can call <i>Dr. Kamal Hanna</i> , at the Australian Research Centre for Population Oral Health on: (08) 8313 5626						
						
What do I need to do after completing this survey?						
Please, put this survey in the envelope provided and hand it to the receptionist.						
						

For Office Use Only	
Participant code:	
Date received:	

Part 1: To be completed before your consultation

Section A: Your access to the online health information

Have you reviewed the internet resources provided regarding wisdom tooth problems?

- A1. Yes
 A2. No; I have been provided with resources but I have not reviewed them
 A3. No; I have not been provided with internet resources

Section B: Your feelings about seeing your oral surgeon.

How much do you agree with the following statements?	Disagree	Agree a little	Somewhat agree	Moderately agree	Strongly agree
B1. I feel anxious shortly before going to the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2. I generally avoid going to the oral surgeon, because I find the experience unpleasant or distressing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B3. I get nervous or edgy about upcoming oral surgeon visits.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B4. I think that something really bad would happen to me if I were to visit an oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B5. I feel afraid or fearful when visiting the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B6. My heart beats faster when I go to the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B7. I delay making appointments to go to the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B8. I often think about all the things that might go wrong prior to going to the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C: Your understanding of wisdom teeth extraction

This section is designed to re-assess your understanding of your wisdom teeth problems. Please answer the following questions by selecting the right answer.

C01. A wisdom tooth is said to be “impacted” when:

- C1a. not enough room to come into the mouth
- C1b. erupt in a wrong place
- C1c. erupt as an extra tooth
- C1d. erupt with a wrong shape

C02. The most common reason for wisdom tooth extraction is:

- C2a. orthodontic treatment
- C2b. associated pathology
- C2c. repeated infections
- C2d. food packing

C03. Wisdom tooth could be removed under:

- C3a. local anesthesia
- C3b. local anesthesia + Intra venous sedation
- C3c. general anesthesia
- C3d. Any of them

C04. After the surgical removal of your lower wisdom tooth, what is the problem that might last for weeks or may be longer?

- C4a. Discomfort
- C4b. Swelling
- C4c. Tingling and/or numbness lower lip or tongue
- C4d. Jaw stiffness

C05. Within the first 24 hours after extracting your wisdom tooth, you need to avoid:

- C5a. hot drinks (such as tea or coffee)
- C5b. exercise
- C5c. vigorous mouth rinsing
- C5d. All of them

Part 2: To be completed after your consultation

Section D: Your experience in making a treatment choice

Please *select only one theme* that reflects your experience in making a treatment choice in relation to your wisdom tooth/teeth with your oral surgeon:

- I made the final decision about which treatment I will receive.
- I made the final selection after seriously considering the opinion of my oral surgeon.
- My oral surgeon and I shared the responsibility for the decision about which treatment is the best for me.
- My oral surgeon made the final decision about which treatment to be used but seriously considered my opinion.
- I left all decisions regarding my treatment to my oral surgeon.

Section E: Your involvement in in the treatment decision




Nine statements related to the decision-making in your Adelaide Dental Hospital consultation in relation to your wisdom tooth are listed below. For each statement, please indicate how much you agree or disagree.

How much do you agree with the following statements?	Completely disagree	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Completely agree
E01. My oral surgeon made it clear that a decision needs to be made.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E02. My oral surgeon wanted to know exactly how I want to be involved in making the decision.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E03. My oral surgeon told me that there are different options for treating my wisdom tooth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E04. My oral surgeon precisely explained the advantages and disadvantages of the treatment options.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E05. My oral surgeon helped me understand all the information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E06. My oral surgeon asked me which treatment option I prefer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E07. My oral surgeon and I thoroughly weighed the different treatment options.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E08. My oral surgeon and I selected a treatment option together.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E09. My oral surgeon and I reached an agreement on how to proceed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you

Please hand this survey back to the receptionist in the pre-paid envelope provided

Appendix VII: Follow-up survey

About this survey					
This survey is designed to collect data on your last experience with the Oral and Maxillofacial Surgery outpatient clinic, Adelaide Dental Hospital. This survey will let us know how satisfied you are and if there has been any improvement in your health after having a treatment at the hospital. You have the option to not answer any question if you choose.					
How long does it take to complete this survey?					
It will take about 10 minutes to complete					
					
Completing the survey					
This example will guide you on how to complete this survey					
How do you rate the following?	Excellent	Good	Fair	Poor	N/A
The information provided to you by your oral surgeon.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The person completing this survey has rated the information provided by the oral surgeon as "Excellent".					
Who could you contact if you want any help in completing this survey?					
Dr. Kamal Hanna, at the Australian Research Centre for Population Oral Health on: (08) 8313 5626, e-mail: Kamal.Hanna@adelaide.edu.au					
					
What do I need to do after completing this survey?					
Please, send this survey back to us in the pre-paid envelope provided.					
					

For Office Use Only	
Participant code: <input type="text"/>	Date received: <input type="text"/>

Section A: Your satisfaction					
Please rate your satisfaction with your visit to the Adelaide Dental Hospital in relation to your wisdom tooth problems	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
A01. I'm satisfied with the verbal information provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A02. I'm satisfied with information leaflet provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A03. I'm satisfied with internet resources provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A04. I'm satisfied with the care provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A05. I'm satisfied with the consultation time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A06. I'm satisfied with the decision made.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A07. I will recommend the Adelaide Dental Hospital to my family members and friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section B: Your health					
Please rate <u>today</u> your:	Excellent	Very good	Good	Fair	Poor
B01. General health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B02. Oral health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C: Your information seeking					
C01. Did you have the wisdom tooth surgery?					
<input type="checkbox"/> Yes Go to C02.					<input type="checkbox"/> No Go to section D.
C02. Did you experience post-extraction problems for which advice was sought?					
<input type="checkbox"/> No. Go to section D.					<input type="checkbox"/> Yes; please provide the problem details → Go to C03.
C03. Did you seek information over the internet for your post-extraction problems?					
<input type="checkbox"/> No (go to section D)					
<input type="checkbox"/> Yes, using the provided resources.					
<input type="checkbox"/> Yes, using my own search despite being provided with internet resources.					
<input type="checkbox"/> Yes, using my own search as no internet resources have been provided to me.					
} Go to C04					
C04. Rate the internet information you obtained:	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
C04a. Readable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C04b. Useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C04c. Easy to understand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C04d. Of good quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C04e. Trustable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section D: Your treatment goal	
D01. On the scale provided, please mark the degree of attainment of treatment goal by putting X on the scale	
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Please record the percentage</div>	

Section E: Your oral health related quality of life					
This section is designed to evaluate the impact of wisdom tooth treatment decision on your oral health related quality of life					
How often, in the <u>past 2 weeks</u>, ...	Very Often	Fairly often	Occasionally	Hardly ever	Never
E01. have you had trouble <i>pronouncing any words</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E02. have you felt that your <i>sense of taste</i> has worsened because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E03. have you had <i>painful aching</i> in your mouth?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E04. have you found it <i>uncomfortable to eat any foods</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E05. have you <i>felt tense</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E06. have you been <i>self-conscious</i> because of your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E07. has your <i>diet been unsatisfactory</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E08. have you had to <i>interrupt meals</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E09. have you found it <i>difficult to relax</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E10. have you been a bit <i>embarrassed</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E11. have you been a bit <i>irritable with other people</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E12. have you had <i>difficulty doing your usual jobs</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E13. have you felt that life in general was <i>less satisfying</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E14. have you been <i>totally unable to function</i> because of problems with your teeth, mouth or dentures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section F: How has your wisdom tooth treatment impacted your health?					
Statement of change in your health due to treatment at the Adelaide Dental Hospital					
Please rate the change due to treatment	Worsened a lot	Worsened a little	Stayed the same	Improved a little	Improved a lot
F01. on your general health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F02. on your oral health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section G: Your health <u>today</u>		
G01	Mobility	<input type="checkbox"/> I have no problems in walking about <input type="checkbox"/> I have slight problems in walking about <input type="checkbox"/> I have moderate problems in walking about <input type="checkbox"/> I have severe problems in walking about <input type="checkbox"/> I am unable to walk about
G02	Self-care (washing and dressing)	<input type="checkbox"/> I have no problems washing or dressing myself <input type="checkbox"/> I have slight problems washing or dressing myself <input type="checkbox"/> I have moderate problems washing or dressing myself <input type="checkbox"/> I have severe problems washing or dressing myself <input type="checkbox"/> I am unable to wash or dress myself
G03	Usual activities (housework, family, and leisure)	<input type="checkbox"/> I have no problems doing my usual activities <input type="checkbox"/> I have slight problems doing my usual activities <input type="checkbox"/> I have moderate problems doing my usual activities <input type="checkbox"/> I have severe problems doing my usual activities <input type="checkbox"/> I am unable to do my usual activities
G04	Pain & discomfort	<input type="checkbox"/> I have no pain or discomfort <input type="checkbox"/> I have slight pain or discomfort <input type="checkbox"/> I have moderate pain or discomfort <input type="checkbox"/> I have severe pain or discomfort <input type="checkbox"/> I have extreme pain or discomfort
G05	Anxiety & depression	<input type="checkbox"/> I am not anxious or depressed <input type="checkbox"/> I am slightly anxious or depressed <input type="checkbox"/> I am moderately anxious or depressed <input type="checkbox"/> I am severely anxious or depressed <input type="checkbox"/> I am extremely anxious or depressed
G06. We would like to know how good or bad your health is <u>today</u> , by marking an X on the scale below		

Answer this section *only* if you have reviewed the provided internet resources

Section H: The provided internet resources and your treatment					
Do you agree or disagree with the following: Internet resources provided to me have:	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
H01. Improved my understanding about wisdom tooth problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H02. Improved my communication with the oral surgeon.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H03. Changed my decision regarding having the procedure for non-problematic wisdom teeth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H04. changed my decision regarding the anaesthetic option	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H05. improved my post-operative coping ability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you
Please send it back to us in the pre-paid envelope provided.

Appendix VIII: Evaluation criteria for website content analysis

Evaluation Criteria for Website Content Analysis

Essential Information

1. **Website name** _____
2. **URL** _____

Website characteristics

3. **Website affiliation**
 Educational Institution Hospital or medical practice
 Commercial Non-for-profit Organization
 Government Other (specify)→
4. **Format of the information provided**
 Webpage (HTML, ASP etc) PDF/ Word document Carton animation
 Image Audio only Real example video
5. **How information is communicated?**
 Fact sheet Personal story Question & answer Other (specify)→
6. **Content editing**
 Open access Open content (Explain more)→

Usability

7. **Subscription/Signing-up to view the content**
 No registration Yes, and it is free Yes, but require fees
8. **Easy to navigate?**
 Yes Somewhat Yes No (explain)→
9. **Supports web 2.0 applications?**
 None Facebook Twitter
 Youtube RSS Others
10. **Can you search for information on this website?**
 No Yes, with built-in search Yes, by external search

Accessibility

11. **Are you able to change the font size?**
 Yes No

Trustworthiness

12. **Does the website display HoN seal?**
 Yes No
13. **If yes, is the HoN certification is still valid?**
 Yes No
14. **Does the website display other quality seals?**
 No Yes (specify)→
15. **Does the website display the planned review date?**
 Yes No

16. Readability scores

- 16A. Flesch Reading Ease _____
16B. Flesch-Kincaid Reading Grade _____
16C. FOG _____
16D. SMOG _____
16E. Automated Readability Scores _____
16F. Familiarity Measure Grade _____

17. Scientific quality

Item	Reported Yes/ No	SIQ	Referenced Yes/ No	Comprehension
17A. Overview of wisdom teeth problems	Yes/ No		Yes/ No	_____
17B. Presentation symptoms	Yes/ No		Yes/ No	_____
17C. Diagnosis and investigations	Yes/ No		Yes/ No	_____
17D. Treatment options	Yes/ No		Yes/ No	_____
17E. Risk and benefits	Yes/ No		Yes/ No	_____
17F. Information related to the surgical procedure	Yes/ No		Yes/ No	_____
17G. Post-operative care and recovery	Yes/ No		Yes/ No	_____
17H. Costs associated with the treatment	Yes/ No		Yes/ No	_____
17I. More information for IV sedation and GA/ dental anxiety management	Yes/ No		Yes/ No	_____

18. Current Comply with Health on the Net Code

Please rate each item code either 1 not, 2 partially, or 3 fully complying.

Item	Rate
18A. A person is named as editor or principal author	<input type="checkbox"/>
18B. It shows the author is medically qualified or not	<input type="checkbox"/>
18C. It is not replacing HCP advice	<input type="checkbox"/>
18D. Website mission	<input type="checkbox"/>
18E. Intended audience	<input type="checkbox"/>
18F. Privacy policy regarding e-mail, medical and personal information.	<input type="checkbox"/>
18G. Respect legal requirement of country of origin	<input type="checkbox"/>
18H. Last modification date	<input type="checkbox"/>
18I. Information form external source	<input type="checkbox"/>
18J. Risk/ benefit of treatment choice is supported by references	<input type="checkbox"/>
18K. Valid contact details	<input type="checkbox"/>
18L. Clear funding source	<input type="checkbox"/>
18M. Clear advertising policy	<input type="checkbox"/>
18N. For banner exchange, clarify relation with other websites.	<input type="checkbox"/>

19. DISCERN

Please rate each item code either 1 not, 2-4 partially, or 5 fully complying
Item

Rate

- | | |
|---|--------------------------|
| 19A. Are the aims clear? | <input type="checkbox"/> |
| 19B. Does it achieve its aims? | <input type="checkbox"/> |
| 19C. Is it relevant? | <input type="checkbox"/> |
| 19D. Is it clear what sources of information were used to compile the publication (other than the author or producer)? | <input type="checkbox"/> |
| 19E. Is it clear when the information used or reported in the publication was produced? | <input type="checkbox"/> |
| 19F. Is it balanced and unbiased? | <input type="checkbox"/> |
| 19G. Does it provide details of additional sources of support information? | <input type="checkbox"/> |
| 19H. Does it refer to areas of uncertainty? | <input type="checkbox"/> |
| 19I. Does it describe how each treatment works? | <input type="checkbox"/> |
| 19J. Does it describe the benefits of each treatment? | <input type="checkbox"/> |
| 19K. Does it describe the risks of each treatment? | <input type="checkbox"/> |
| 19L. Does it describe what would happen if no treatment is used? | <input type="checkbox"/> |
| 19M. Does it describe how the treatment choices affect overall quality of life? | <input type="checkbox"/> |
| 19N. Is it clear that there may be more than one possible treatment choice? | <input type="checkbox"/> |
| 19O. Does it provide support for shared decision-making? | <input type="checkbox"/> |
| 19P. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices | <input type="checkbox"/> |

20 Comments

**Appendix IX: Research activities,
presentations, teaching activities and awards
during the PhD period**

The researcher carried out several research activities during his PhD and they are summarized as the following:

Original journal articles at different stages of the publication process:

1. Original journal article 1: Hanna K, Sambrook P, Armfield J, Jamieson L, Brennan B. Wisdom teeth extractions among Australian adults: Findings from the 2013 National Dental Telephone Interview Survey. (Submitted to *Int J Oral & Maxillofac Surg.* 2016).
2. Original journal article 2: Hanna K, Brennan D, Sambrook P, Armfield J. Exploring and modelling impacts of third molar experience on quality of life: A real-time qualitative study using Twitter. (Accepted for publication in *Int Dent J.* 2016).
3. Original journal article 3: Hanna K, Brennan D, Sambrook P, Armfield J. Third molars on the Internet: A guide for assessing information quality and readability. *Interact J Med Res.* 2015; 4(4) PMID: 26443470.
 - a. Appendix: Hanna K, Brennan D, Sambrook P, Armfield J. Gold standard for online patient information concerning wisdom tooth problems. In Hanna K, Brennan D, Sambrook P, Armfield J. *Third molars on the Internet: A guide for assessing information quality and readability.* *Interact J Med Res.* 2015; 4(4) PMID: 26443470.
4. Original journal article 4: Hanna K, Sambrook P, Armfield J, Brennan D. Internet use, online information seeking and knowledge among third molars' patients attending South Australia Dental Services. Submitted to *Patient Educ Couns*, 2016.
5. Original journal article 5: Hanna K, Sambrook P, Armfield J, Brennan D. Preferences for dental decisional control and associations with quality of life among third molar

patients attending South Australia Dental Services. Submitted to Community Dent Oral Epidemiol, 2016.

6. Original journal article 6: Hanna K, Sambrook P, Armfield J, Brennan D. The impact of providing third molars' patients with a pre-consultation internet guidance on their knowledge, anxiety, decision-making and consultation outcomes: A pilot randomized controlled trial (draft).

Other related publication:

7. 3.Hanna K, Brennan D, Sambrook P, Armfied J. 2014. The Impact of Guiding Patients Suffering from Wisdom Tooth Problems through Dental Open Educational Resources (DOER) on Enhancing Shared Clinical Decision-Making and Improving Health Care Outcomes: A Randomized Controlled Trial. [Online]. Australian and New Zealand Clinical Trial Register. Available: <https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=366415>
Archived at: <http://www.webcitation.org/6SflQXds0>

The researcher presented his research findings in local seminars within the University of Adelaide, national and international conferences. In addition, the researcher discussed some of the key literatures used in his research in journal club activity at the Australian research Centre for Population Oral Health (ARCPOH). The details of these presentation are as the following:

Local research presentations:

1. Hanna K, Brennan D, Sambrook P, Armfield J. The Impact of Patient-Centered Dental Open Educational Resources (DOER) on Enhancing a Shared Clinical Decision-Making and Improving Health Care Outcomes', Research Proposal

- presented at Integrated Bridging Program IBP Seminar, University of Adelaide, Adelaide; 2013.
2. Hanna K, Brennan D, Sambrook P, Armfield J. The Impact of Patient-Centered Dental Open Educational Resources (DOER) on Enhancing a Shared Clinical Decision-Making and Improving Health Care Outcomes', Research Proposal presented at Dental School Postgraduate Research Day, University of Adelaide, Adelaide; 2013.
 3. Hanna K, Brennan D, Sambrook P, Armfield J. The Quality and Readability of Online Health Information Concerning Wisdom Teeth Problems, ARCPOH Seminar, the University of Adelaide; 2014.
 8. Hanna K, Brennan D, Sambrook P, Armfield J. Real-Time Impact of Third Molar Experience on Quality of Life: A Qualitative Study Using Twitter, ARCPOH Seminar, the University of Adelaide; 2015.
 9. Hanna K, Brennan D, Sambrook P, Armfield J. Why do dentists need to provide patients with guidance in surfing the internet? School of Dentistry Research Day. Adelaide: The University of Adelaide; 2015.
 10. Hanna K, Sambrook P, Armfield J, Brennan D. Dental decisional control preferences and associations with quality of life among third molars patients attending South Australia Dental Services, ARCPOH Seminar, The University of Adelaide; 2016.
 11. Hanna K, Sambrook P, Armfield J, Jamieson L, Brennan D. Wisdom teeth extractions among Australian adults: Findings from the 2013 National Dental Telephone Interview Survey. *School of Dentistry Research Day*. Adelaide, Australia: The University of Adelaide; 2016.

National and international conferences:

12. Hanna K, Brennan D, Armfield J, Sambrook, P. The Quality and Readability of Online Health Information Concerning Wisdom Teeth Problems, poster presentation for Colgate competition at the 54th Annual Scientific Meeting of the International Association for Dental Research Australian & New Zealand Division, Brisbane, 2014.
13. Hanna K, Brennan D, Armfield J, Sambrook, P. The Quality and Readability of Online Health Information Concerning Wisdom Teeth Problems, Oral presentation at the 54th Annual Scientific Meeting of the International Association for Dental Research Australian & New Zealand Division, Brisbane, 2014.
14. Hanna K, Brennan D, Sambrook P, Armfield J. Evaluating impacts of third molars experience on QoL using Twitter. Oral presentation at the 55th Annual Scientific Meeting of the International Association for Dental Research Australian & New Zealand Division. Dunedin, New Zealand, 2015.
15. Hanna K, Brennan D, Sambrook P, Armfield J. Dental decisional control preferences and associations with quality of life among third molar patients attending South Australia Dental Services. Oral presentation at the 2016 Primary Health Care Research Conference. National Convention Centre, Canberra, 2016.

Journal club discussions

16. Journal Club Discussion on 2013: Scholl I, Kriston L, Dirmaier J, Harter M. Comparing the nine-item Shared Decision-Making Questionnaire to the OPTION Scale - an attempt to establish convergent validity. *Health Expect.* Nov 26 2012.

17. Journal Club Discussion on 2014: Nascimento T, DosSantos M, Danciu T, et al. Real-time sharing and expression of migraine headache suffering on Twitter: a cross-sectional infodemiology study. *J Med Internet Res.* 2014; 16 (4): e96.
18. Journal Club Discussion on 2015: Noguera A, Yennurajalingam S, Torres-Vigil I, et al. Decisional control preferences, disclosure of information preferences, and satisfaction among Hispanic patients with advanced cancer. *J Pain Symptom Manage.* 2014; 47 (5): 896-905.
19. Journal Club Discussion on 2016: Merolli M, Gray K, Martin-Sanchez F, Lopez-Campos G. Patient-reported outcomes and therapeutic affordances of social media: findings from a global online survey of people with chronic pain. *J Med Internet Res.* 2015; 17 (1): e20.

Travel awards

The researcher was awarded travel grants to present his research findings at national and international conferences. The details of the travel awards are as the following:

1. Colgate Travel Award to present a paper at IADR-ANZ 54th meeting, Brisbane 2014.
2. The School of Dentistry Eustace Travel Grant International to present a paper at IADR-ANZ 55th meeting, Dunedin 2015.
3. The School of Dentistry Eustace Travel Grant to present a paper at the 2016 Primary Health Care Research Conference, Canberra, 2016.

Teaching activities

EBD1 DSP1 workshops for 2014 and 2015, 2016. EBD1 DSP2 workshops for 2015.

Marking for Community Dentistry 2013.

Appendix X: Poster presentation

HANNA, K., BRENNAN, D., SAMBROOK, P. & ARMFIELD, J. 2014. Quality and Readability of Online Information concerning Wisdom Tooth Problems 54th Annual Scientific Meeting of the International Association for Dental Research Australian & New Zealand Division Brisbane, Australia

Background

The majority of young adults need to make a decision whether or not to remove their third molars (TMs). Patients usually claim that they do not get enough information from professional sources. Therefore, they surf the internet to satisfy their information demands. However, the quality of internet information varies significantly across websites. Directing patients, suffering from wisdom tooth problems, to high quality online information is not only medically important, but also could enable better engagement in shared decision-making.

Objectives

- 1) Developing a tool that measures the scientific information quality (SIQ)
- 2) Conducting a quality evaluation of websites concerning wisdom tooth problems
- 3) Assessing whether readability software (Readability Studio Professional 2012) might be reliable in measuring information comprehensiveness
- 4) Exploring predictors for the scientific information quality (SIQ) scale.

Methodology

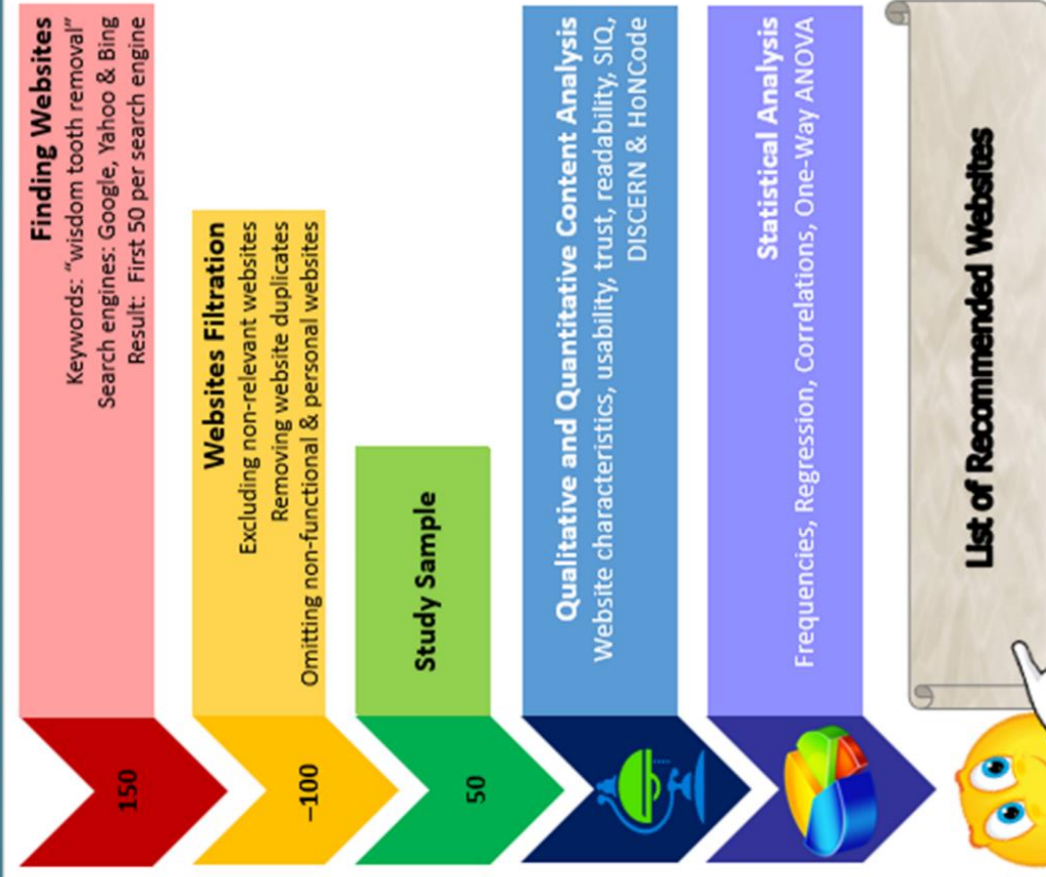


Figure 1: Flowchart for website content analysis

Main findings

- 1) Significant association of website affiliation with website subscale scores

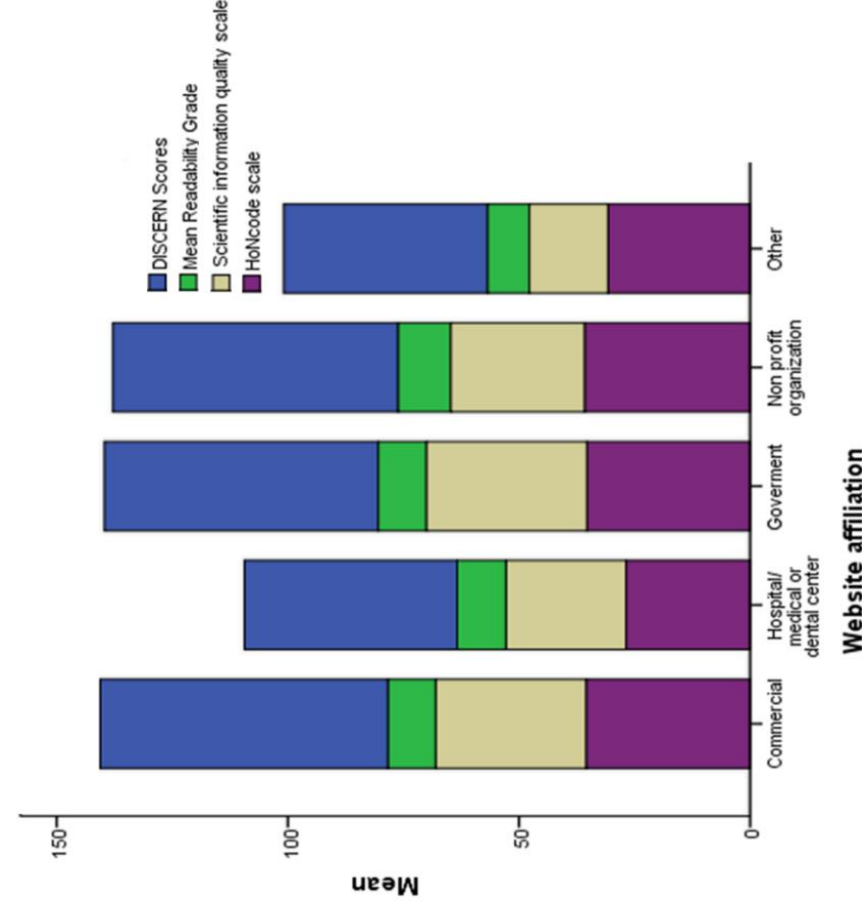


Figure 2: Significant association of website affiliation with website subscale scores

Main findings (cont.)

- 2) Information readability and validation of Readability Studio Professional

The mean readability grade (10.3, SD=1.9) was above the recommended level, and was significantly correlated with the scientific information comprehension scale ($r=0.45$, $P<0.01$), which provides evidence for convergent validity.

- 3) Predictors for scientific information quality (SIQ)

In linear regression models, website affiliation and DISCERN explained 78% of SIQ adjusted variance, where governmental websites were associated with the highest predicted SIQ scores. In addition, after statistically controlling for website affiliation, HoNCode is significantly predicted the SIQ.

- 4) Biased information weighted frequencies associated with website affiliation

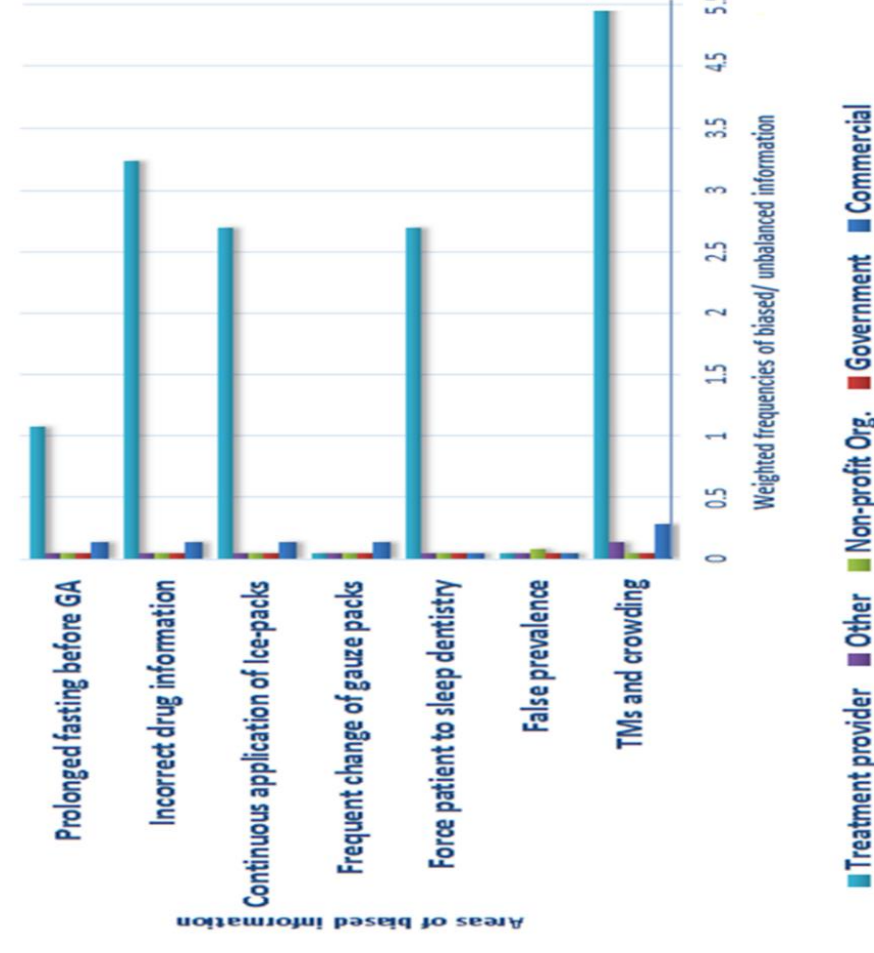


Figure 3: Weighted frequencies of coded biased information associated with website affiliation

- 5) Website ranking

Websites were ranked according to their SIQ scores. Results showed that Bupa.co.uk has the highest SIQ followed by nhs.uk. Ranking websites according to their total un-weighted scoring showed that Bupa.co.uk had the highest total score followed by animatedteeth.com. Spearman ranking correlation between both ranking orders were significantly correlated ($r=0.81$, $P<0.01$).

- 6) Reliability and initial validity of SIQ scale

The SIQ scale had good internal consistency (Cronbach's $\alpha=0.85$). Furthermore, the SIQ scores were significantly correlated with DISCERN scores ($r=0.81$, $P<0.01$) and HoNCode ($r=0.38$, $P<0.01$) which suggests convergent validity

Conclusion

The developed SIQ scale was found to be reliable and initially valid. Website affiliation, DISCERN and HoNCode are significant predictors for the quality of scientific information. The Readability Studio software estimates are associated with scientific information comprehensiveness measures. Consumer health information providers should consider providing evidence-based information, information readability and the use of online forum during the process of website development.

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Appendix XI: Systematic evaluation of decision-making instruments

Instrument & Author	Conceptual framework/ Domains	Development & statistical approach	Items	Response	Prospective	Comments
The OPTION scale Elwyn <i>et al.</i> [1]	Based on L/R and qualitative research Domains: Problem identification. Professional equipoise. Option formulation. Finalizing decision.	18 item generated Pilot study: 5 GPs and on no-clinical. Item reduction. Piloting again with two other instruments using audio recorded consultations and 2 non-clinical raters. Refinement: 12 item instrument.	The clinician identifies a problem(s) needing a decision-making process. The clinician states that there is more than one way to deal with an Identified problem ("equipoise"). The clinician lists "options" including the choice of "no action" if feasible. The clinician explains the pros and cons of options to the patient (taking "no action" is an option. The clinician checks the patient's preferred information format (words/numbers/visual display). The clinician explores the patient's expectations (or ideas) about how the problem(s) are to be managed. The clinician explores the patient's concerns (fears) about how problem(s) are to be managed. The clinician checks that the patient has understood the information. The clinician provides opportunities for the patient to ask questions. The clinician asks for the patient's preferred level of involvement in decision making. An opportunity for deferring a decision is provided. Arrangements are made to review the decision (or the deferment).	5-points Likert scale ranging from strongly agree to strongly disagree	How clinicians involve patients in SDM from rater view	Nicolai <i>et al.</i> [2] raised: Criticize its uni-dimensionality. Internal reliability is low for decision making purposes. Not suitable for individual assessment. Failed convergent validity.
CollaborATE Elwyn <i>et al.</i> [3]	Domains: HCP provides information and patient understand that information. Decision considers patient believes and values. Patient reference elicitation (added after cognitive interview stage	Item generation (based on Literature review). Two stages of cognitive interview. Piloting the instrument.	How much effort was made to help you understand your health issues? How much effort was made to listen to the things that matter most to you about your health issues? How much effort was made to include what matters most to you in choosing what to do next?	10-points Likert scale ranging from 1: No effort to 10: every effort	Patient self-reported	Quick and easy to use in clinical practice. Ignored some aspects as the control preferences Needs further validation and testing.
Decisional conflict scale (DCS) statement format O'Connor [4]	From decisional conflict construct. Domains: Uncertainty. Factors contributing to uncertainty. Effectiveness perception of SDM	Item generation Validation u	The decision is hard for me to make. I'm unsure what to do. In this decision. It is clear what choice is best for me. I'm aware of the choices. I feel I know the benefit of --- I feel I know the risks of --- I need more information and advice on the choices. I know how important is the benefit of I know how important the risk of --- It's hard for me to decide if the benefits are more important to me than risks. I feel pressure from others to make the decision.	-5-points Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).	Patient self-reported	O'Connor (2010) claims, it's the most widely used scale. Long specially if combined with other instruments. Acceptable reliability and validity.

Instrument & Author	Conceptual framework/ Domains	Development & statistical approach	Items	Response	Prospective	Comments
			I have the right amount of support from others. I feel I have made an informed choice. My decision shows what important for me. I expect to stick with my decision. I'm satisfied with the decision.			
Decisional Conflict Scale- Question format in O'Connor [5]	The construct for decisional conflict Domains: Informed. Values clarity, Support, Uncertainty. effective excision	No information.	Wording change to be in questionnaire format	5-points Likert scale The construct for decisional conflict	Patient self-reported	O'Connor has claimed that it is easier than the statement format, however, no prove has been mentioned.
Decisional Conflict Scale- Low Literacy O'Connor (2010)	the same as DCS questionnaire format	No information	10 items instrument Low literacy version 6 items from the original DCS has been removed. Removed items: 6, 12, 13, 14, 15, and 16.	3 response category Yes, No, Unsure	Patient self-reported	It shorter and fewer responses to choose from. However, there has been no improvement in terms of readability as the questionnaire remains unchanged.
The SURE scale Legare et al. [6].	Based on Ottawa Decision Support Framework. Domains: Uncertainty. Being informed, Values clarity. Support	Item generation. Two clinical settings Reliability: Cronbach alpha Uni-dimensionality: factor analysis (PCA)s Construct validity: Pearson correlation between the SURE & DCS	4 items: Sure of myself, Understand information, Risk-benefit ratio, Encouragement.	Risk-benefit ratio. Encouragement	Patient self-reported	Cronbach alpha=0.54 Ignored effectiveness of decision domain. Validated [7]
The Provider Decision Process Assessment Instrument (PDPAI) Dolan [8]	The theoretical framework of decisional conflict of O'Connor [4].	Adapted DCS to match HCP prospective. Piloted to two settings Statistical approach: Face validity by direct feedback. Pearson correlation Convergent validity: (PDPAI) with satisfaction	12 items The decision was hard to make. I was unsure what treatment would be the best. It was clear what treatment would be the best. On making decision, I felt I know enough about the treatment alternatives. I had troubles in making the decision because either unknown or not in literature. When I made the decision, it was hard to decide if the benefits of available treatments are more important than the risks. It was easy to identify all the consideration that affect the decision. I totally understand the patient views regarding the important issues in making the decision. I believe that, the patient fully understands the risks and benefits of the treatment I prescribes. I believe that the patient will comply with the treatment requirement.	5-points Likert scale Ranging from strongly agree to strongly disagree.	Health care provider prospective	They have used satisfaction with the decision to establish convergent validity while actual decision making is not always optimum decision.

Instrument & Author	Conceptual framework/ Domains	Development & statistical approach	Items	Response	Prospective	Comments
			<p>I'm satisfied with the decision that was made.</p> <p>I'm satisfied that the process used to make the decision was good as it could be.</p>			
Dyad Decisional conflict scale (Dyad-DCS) Legare et al. [9]	Decisional conflict scale theoretical framework	Combining data from RCT of using current patient DCS and PDPAI scale. Using ICC, they were able to capture agreement with SDM intervention. Difference on patient and PDPIA scores as dependent variable in multi-regression analysis.	By combining data from DCS patient version and the provider version PDPIA.	Each scale: either patient DCS or PDPAI retain its original characteristics of responses.	Dyadic self-report (patient and HCP)	Low ICC despite good reliability scores of each scale. Further research is required to develop analytical technique for the dyad, number and nature of dyadic items.
The 9-item Shared Decision Making Questionnaire (SDM-Q-9) Kriston et al. [10]	<p>Theoretical framework: Patient and HCP are involved. Information exchange in both ways. Disclosure of existence of treatment alternatives. Equality and actively bringing ideas to make the decision. 9 steps have been developed to represent this conceptual framework.</p>	<p>26 core item generated by authors. Overcome the ceiling effect of SDM-Q by using 6-point Likert scale. Instrument piloted with other instrument measuring use of health care, satisfaction, preference of decision making. Sample: development and test samples. Statistical approach: Using classical test theory instead of Rasch test theory in statistical analysis as SDM occurs in phases not collectively. Differential Item functioning between subgroups. Instrument finalization: Rating of items by 2 independent authors. Item acceptance by item response rate. Principle component analysis & selecting factor loading on one item. Internal consistency using alpha. Item selection by two authors. Subgroup reliability, cross validation</p>	<p>The final instrument consists of 9-items, each item represents a step for SDM. These items are:</p> <p>My doctor made clear that a decision needs to be made.</p> <p>My doctor wanted exactly to know how I want to be involved in making the decision.</p> <p>My doctor told me that there are different options for treating my medical condition.</p> <p>My doctor precisely explained the advantages and disadvantages of</p> <p>My doctor helped me to understand all the information.</p> <p>My doctor asked me which treatment option I prefer.</p> <p>My doctor and I thoroughly weighted different treatment options.</p> <p>My doctor and I selected treatment option together.</p> <p>My doctor and I reached an agreement how to proceed.</p>	6-point scale from "completely disagree" (0) to "completely agree" (5).	Patient self-reported	Does not assess the decisional uncertainty. Insignificant correlation with the OPTION scale [11].
The Shared Decision Making Questionnaire – physician version (SDM-Q-Doc) Scholl et al. [12].	It relies on the same conceptual model for SDM-Q-9	Adaptation of SDM-q-9 to reflect the physician prospective and keep wording close to SDM-Q-9.	It consists of 9 items: I made it clear to my patient that a decision needs to be made.	6-points Likert scale ranging from completely disagree to completely agree.	Physician self-reported.	Variability of inter class correlation. Among physicians.

Instrument & Author	Conceptual framework/ Domains	Development & statistical approach	Items	Response	Prospective	Comments
		<p>Sampling: used in conjunction with SDM-Q-9.</p> <p>Statistical approach: Inter-item correlation and internal consistency for the whole instrument.</p> <p>Computing item difficulty and discrimination.</p> <p>Confirmatory factor analysis.</p> <p>Subgroups differential item functioning.</p> <p>Clustering patients to physicians and measuring ICC></p>	<p>I wanted to know exactly from my patient, how s/he wants to be involved in making the decision.</p> <p>I told my patient that there are different options for treating her/his condition.</p> <p>I precisely explained the advantages and disadvantages of the treatment options.</p> <p>I helped my patient to understand all the information.</p> <p>I asked my patient which treatment option s/he prefers.</p> <p>My patient and I thoroughly weighted different treatment options.</p> <p>My patient and I selected a treatment option together.</p> <p>My patient and I reached an agreement on how to proceed.</p>			

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Appendix XII: Comprehensive review of website content analysis studies

Dimension	Date	area	keyword	Search engine	Ordering of results	exclusion	selection	Generic quality tools	Scientific content	results
[1]	Nov 2010	Orthodontic extractions	Orthodontic extractions	Google yahoo	High rank Most visited in US	Duplicates Links to articles. Require registration.	Top 50/ each search engine	UDA Flesch reading ease test		21/100 were included. Top British orthodontic society.
[2]	Apr 2008	Head & neck cancer	Head & neck cancer	Google	First 100 and categorized by affiliation	Duplicated Non-functional. Book review	First 100	DISERN JAMA HON seal		33/100 were included
[3]		Mouth guard	Mouth protection. Mouth guard. Gum shield.	Google Yahoo MSN	Frist 10 results of each query.	Broken link. Relevance to search. Require membership.	Frist 10 results of each query	HON code toolbar	Scientific knowledge on MG. Reliability score Both adapted by the authors from previous studies.	39/ 223 Top is health Canada Then ADA
[4]	Mar 1998	orthodontics	Orthodontics. orthodontic	AltaVista Lycos Yahoo	Frist 100	Not relevant. Not found. Not in English	Frist 100 of each search engine.		Developed own tool	Evaluation based on sources of information, however no website mentioned.
[5]		Oral cancer	Oral cancer Mouth cancer Tongue cancer	Midline Plus Google Yahoo				Information Quality Tool (IQT)	Survey developed to assess the content	24 English and 24 Spanish. English IQT of 74.7 and content 51.5 Spanish IQT 48.8 and content: 25.9
[6]	Nov 2006	Cleft lip and palate	Cleft lip Cleft palate Family	Google Yahoo Windows live	25 of each search	Irrelevant duplicates	First 25 each query	Flesch Reading ease score Flesch-Kincaid score. FOG scores	Developed their own tool to assess the content.	recommended MedlinePlus Readability at eighth level.
[7]	May 2010	orthognathic surgery	Orthognathic surgery Jaw surgery	Google	First 100	Duplicates News Discussion group Video feeds	Top 100	DISCREN		25/ 100 analyzed. Combine Wikipedia with Baoms.org.uk
[8]	TMD	April 2011	Temporoman dibular disorders Temporoman dibular joint disorders	Google Yahoo	First 100 common between both search engines	Non-English Duplicates Non-functional Need registration	First 100	DISCREN HON JAMA The Google Toolbar's PageRank feature	Website type Check points: disease summary, etiology, diagnosis, treatments options, complications, prognosis). Reviewer Panel have 5 years of experience with TMD and compare to peer review information.	67/ 100 were analyzed. Medium reliability scores and poor content scores. No website in mentioned.

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