

**Exploring the potential for graphic warning labels to reduce intentions to consume
energy drinks**

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Abstract

The rapid increase in the popularity of energy drinks (EDs), particularly amongst adolescents and young adults, represents a growing public health risk, warranting interventions to reduce consumption of the beverage. The effectiveness of front-of-package (FoP) warning labels in informing consumers and encouraging reduced consumption has been demonstrated for a range of products with adverse health effects. However, the potential of such a strategy to reduce ED consumption requires further investigation. The aim of this study was to compare the relative effectiveness of graphic warning labels depicting weight gain and cardiac effects in reducing intentions to consume EDs in comparison to a control 'no label' condition. Constructs of PMT were explored as mediators of the relationship between exposure to labels and intentions to reduce consumption. A secondary aim was to examine the association between perceived label effectiveness and behavioural intentions. Australian ED consumers aged 18 to 39 years (N = 343) were recruited to participate in an experimental online survey and randomly assigned to view one of three ED packaging/labels. Results indicated that the graphic warning labels did not differentially motivate participants to reduce ED consumption and were perceived as similarly effective. However, there was a significant gender difference in intentions for participants who viewed the cardiac effects label. The findings of this study contributed to the developing evidence base for effective interventions to reduce ED consumption. Future research should explore the motivations underlying ED consumption and the type of messages that will resonate with ED consumers.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

Xiaole Zhu

September 2021

Contribution Statement

In carrying out this thesis project, my supervisors and I collaborated to generate research questions of interest, design the appropriate methodology, complete the ethics applications, and develop the questionnaires for testing. I conducted the literature search and was responsible for coding the online survey. My supervisors and I collaborated to design the graphic warning labels. The South Australian Health and Medical Research Institute (SAHMRI) provided funding for participation incentives and online advertising, application for hosting the online survey and technical assistance. The University of Adelaide's School of Psychology provided the Research Participation system used to recruit first year psychology students. I was responsible for all participant recruitment and testing. My supervisors and I collaborated to code all analyses in SPSS. I wrote up all aspects of the thesis.

Acknowledgement

First and foremost, I would like to sincerely thank my supervisors Dr. Kerry Ettridge, A/Prof. Rachel Roberts and Prof. Caroline Miller. I am extremely grateful for their enormous support and patience over this past year. Their generous advice and guidance throughout this experience were immensely valuable. I would also like to thank the Health Policy Centre at the South Australian Health and Medical Research Institute (SAHMRI) for providing the resources and assistance that made this project possible. Finally, thank you to my family for their constant encouragement and support. Without their backing, I would not be able to overcome all of this year's challenges.

1. Introduction

1.1 An emerging public health concern: Energy drink consumption and its associated health risks

The rapid increase in the popularity of energy drinks (EDs), particularly amongst adolescents and young adults, represents a growing public health risk and a cause for concern (Gunja & Brown, 2012). EDs are carbonated beverages that contain a high amount of caffeine, sugar, and often other stimulant ingredients, including taurine, glucuronolactone, guarana extract, and ginseng, with additional supplements such as amino acids, vitamins B complex, and carbohydrates completing the purportedly beneficial product's list of constituents (Higgins et al., 2010). Typically marketed towards young people, EDs are advertised as functional beverages that improve energy, stamina, athletic performance, and concentration (Al-Shaar et al., 2017). The energy drink market is the fastest-growing sector of the beverage market (Trapp et al., 2020). Sales of the beverage in Australia have more than quadrupled from 2001 to 2010 (Pollard et al., 2015; Food Regulation Standing Committee Working Group, 2013). Along with the United States, Australia has the highest yearly consumption of EDs at approximately 4.2 litres per person (Zest Health Strategies, 2012), this data is out of date and consumption is likely to be higher.

It has been documented in the literature that the frequent consumption of EDs is associated with a wide range of health implications. It is believed that the adverse events are related to the effects of the ingredients (Ali et al., 2015). The main active constituent in EDs is the high levels of caffeine, excessive intake of the substance can result in the effects of caffeine intoxication, which include tachycardia, vomiting, palpitations, arrhythmias, seizures, and exacerbation of psychiatric conditions (Nordt et al., 2012; Richards & Smith, 2016; Wolk et al., 2012). The caffeine content of EDs has also been found to increase the risk of heart disease (Lin, 1983; Wassef et al., 2017). When the high dosage of caffeine is combined with

the other substances found in EDs, the subsequent effect is not always predictable, as evidence suggests that common ED ingredients such as amino acids, stimulants and sodium can interact with caffeine and aggravate its effect (Ali et al., 2015). In fact, reports of ED induced caffeine toxicity and overdose are increasing in Australia, particularly amongst adolescents and young adults (Gunja & Brown, 2012).

Being a type of sugar-sweetened beverage (SSB), EDs often also contain high sugar content comparable to SSBs. As a result, ED consumption is causally associated with tooth decay, weight gain, Type 2 diabetes, metabolic syndrome, cardiovascular disease, hypertension, and stroke (Bernstein et al., 2012; Cohen et al., 2012; Malik et al., 2010a; 2010b; Visram et al., 2016). Evidence also shows that ED intake may lead to dehydration and asthma (Alsunni, 2015; Wee et al., 2020). Additionally, regular or heavy ED consumption has also been linked with general health complaints such as sleep problems, headaches and stomach-aches, the prevalence of which increases with ED intake (Huhtinen et al., 2013; Kristjansson et al., 2014).


Alarmingly, evidence suggests that youth ED consumption also clusters with other health-damaging behaviours, including unhealthy dietary behaviours, as well as illicit and non-illicit substance use including alcohol intake (Nuss et al., 2021; Thombs et al., 2010). Many consumers have been observed to ingest EDs in combination with alcohol. The combined consumption of alcohol and EDs can exacerbate the problems stemming from alcohol abuse. For example, young adults who had consumed alcohol mixed with EDs have been found to be at greater risk of becoming highly intoxicated as well as involved in risk-taking behaviours such as drinking and driving, compared to those who had consumed alcoholic beverages but did not mix them with EDs (Thombs et al., 2010). Moreover, ED co-ingestion with alcohol has also been linked to emergency room visits by males (Seifert et al., 2011).

1.2 The evidence for graphic warning labels

Given that EDs are linked to numerous adverse health effects, reviews of regulatory guidelines and interventions to reduce consumption of the beverage are warranted (Gunja & Brown, 2012). A ‘nudge’ strategy that has been implemented in other areas of public health, which may be applicable for EDs is front-of-package (FoP) warning labels. In Australia, products containing health-damaging substances are required to display some form of health advisory statements (Thomas, 2012). Tobacco is especially subject to strict mandatory labelling and packaging requirements (Australian Competition & Consumer Commission, 2018). According to Competition and Consumer (Tobacco) Information Standard (2011), tobacco products must feature plain packaging with standardised font, and the display of graphic pictorial health warnings to inform consumers of the health effects of tobacco use. While Australia already has, what many would consider one of the worlds’ most stringent regulatory approaches to EDs, it is by far less regulated than other products, such as tobacco. Falling under general food laws, the manufacturing and distribution of EDs in Australia must comply with Standard 2.6.4 of The Australia New Zealand Food Standards Code (Food Regulation Standing Committee Working Group, 2013). This stipulates that EDs must contain no more than 320mg of caffeine per litre, and EDs must display a declaration of the quantity of caffeine per serving size and per 100mL and advisory statements to the effect that: the beverage contains caffeine and certain substances beyond caffeine; is not recommended for children, pregnant or breastfeeding women and individuals sensitive to caffeine; and consumption should not exceed the recommended daily limit (500mL).

However, evidence indicates that current advisory statements which are displayed in small font on the back of packaging, are likely to be insufficient to inform consumers of the health effects of ED consumption. Results of an Australian online survey of 1,992 ED consumers indicated that only 38 per cent accurately reported the maximum daily intake

(Peacock et al., 2016). While the Food Standards Code requires EDs to include caffeine declarations and advisory statements, there is no mandate on the design, size, font or placement of this information, and it can be included in a somewhat hidden manner, along with nutritional information on the back or side of the product (see Figure 1), which is often not attended to and poorly understood by consumers (Mhurchu & Gorton, 2014; Watson et al., 2013). A comprehensive review of 94 studies assessing FoP warning labels on tobacco products has shown that the impact of labels is dependent upon their layout, size, wording and positioning on the product, and that larger, more visible graphic health warnings are significantly more effective than obscure text-only warnings (Hammond, 2011). This finding is consistent with the extensive labelling research involving alcoholic products, which found that due to less-than-optimal designs, awareness of alcohol warning labels continues to be poor (Coomber et al., 2015; MacKinnon et al., 2000; Thomas, 2012).



NUTRITION INFORMATION
Servings per package: 1
Serving size: 500 mL

AVERAGE QUANTITY	PER SERVING	PER 100 mL
ENERGY	986 kJ (236 Cal)	197 kJ (47 Cal)
PROTEIN	0 g	0 g
FAT, TOTAL	0 g	0 g
- SATURATED	0 g	0 g
CARBOHYDRATE, TOTAL	58.0 g	11.6 g
- SUGARS	57.0 g	11.4 g
SODIUM	390 mg	78 mg

COMPOSITION INFORMATION

CAFFEINE	160 mg	32 mg
RIBOFLAVIN (VIT B2)	3.6 mg	0.72 mg
NIACIN (VIT B3)	40 mg	8.0 mg
VITAMIN B6	4.3 mg	0.85 mg
VITAMIN B12	10.0 µg	2.0 µg
TAURINE	2000 mg	400 mg
GINSENG ROOT EXTRACT	405 mg	81 mg
GUARANA SEED EXTRACT	10 mg	2 mg
GLUCURONOLACTONE	10 mg	2 mg
INOSITOL	10 mg	2 mg

PRODUCT CONTAINS CAFFEINE. NOT RECOMMENDED FOR CHILDREN, PREGNANT OR BREAST FEEDING WOMEN, OR PEOPLE SENSITIVE TO CAFFEINE.

ENERGY DRINK CONTAINS: CARBONATED WATER, SUGAR, GLUCOSE SYRUP, ACIDITY REGULATORS (CITRIC ACID, SODIUM CITRATE), NATURAL FLAVOURS, TAURINE, NATURAL COLOURS (ANTHOCYANINS), PANAX GINSENG ROOT EXTRACT, PRESERVATIVES (SORBIC ACID, BENZOIC ACID), CAFFEINE, VITAMINS (NIACIN (B3), VITAMIN B6, RIBOFLAVIN (B2), VITAMIN B12), SALT, INOSITOL, GUARANA SEED EXTRACT, D-GLUCURONOLACTONE, SUCRALOSE, MALTODEXTRIN.

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TOLL FREE NUMBER (AUSTRALIA) 1 800 M ENERGY
TOLL FREE NUMBER (NEW ZEALAND) 0800 M ENERGY

CONSUME RESPONSIBLY - LIMIT DAILY INTAKE TO 1 CAN
STORE IN A COOL DRY PLACE
BEST BEFORE DATE - SEE BASE OF CAN

NUTRITION INFORMATION
Servings per package: 1
Serving size: 500mL

AVE. QUANTITY	PER SERVING	PER 100mL
ENERGY	1024 kJ (246 Cal)	206 kJ (49 Cal)
PROTEIN	0 g	0 g
FAT, TOTAL	0 g	0 g
- SATURATED	0 g	0 g
CARBOHYDRATE, TOTAL	62.0 g	12.4 g
- SUGARS	57.0 g	11.4 g
SODIUM	390 mg	78 mg

COMPOSITION INFORMATION

CAFFEINE	150 mg	30 mg
RIBOFLAVIN (VIT B2)	3.6 mg	0.72 mg
NIACIN (VIT B3)	40 mg	8.0 mg
VITAMIN B6	4.3 mg	0.85 mg
VITAMIN B12	10.0 µg	2.0 µg
TAURINE	2000 mg	400 mg
GINSENG ROOT EXTRACT	405 mg	81 mg
GUARANA SEED EXTRACT	10 mg	2 mg
GLUCURONOLACTONE	10 mg	2 mg
INOSITOL	10 mg	2 mg

PRODUCT CONTAINS CAFFEINE. NOT RECOMMENDED FOR CHILDREN, PREGNANT OR BREAST FEEDING WOMEN, OR PEOPLE SENSITIVE TO CAFFEINE.

ENERGY DRINK CONTAINS: CARBONATED WATER, SUGAR, GLUCOSE SYRUP, ACIDITY REGULATORS (CITRIC ACID, SODIUM CITRATE), NATURAL FLAVOURS, TAURINE, NATURAL COLOURS (ANTHOCYANINS), PANAX GINSENG ROOT EXTRACT, PRESERVATIVES (SORBIC ACID, BENZOIC ACID), CAFFEINE, VITAMINS (NIACIN (B3), VITAMIN B6, RIBOFLAVIN (B2), VITAMIN B12), SALT, INOSITOL, GUARANA SEED EXTRACT, D-GLUCURONOLACTONE, SWEETENER (SUCRALOSE), MALTODEXTRIN.

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CONSUME RESPONSIBLY - LIMIT DAILY INTAKE TO 1 CAN
STORE IN A COOL DRY PLACE
BEST BEFORE DATE - SEE BASE OF CAN

Figure 1. Example of current advisory statement on the back of energy drink packaging.

The effectiveness of FoP warning labels at informing consumers and encouraging reduced consumption has been demonstrated by numerous labelling studies spanning a range of products with adverse health effects. There is a body of evidence from international tobacco control studies regarding the effectiveness of health warning messages in reducing the appeal of smoking, and increasing quitting thoughts and intentions (Hammond, 2011; Levy et al., 2017). For instance, one Australian study concerning longitudinal surveys covered in the literature review by Hammond (2011) found that intentions to quit and forgo cigarettes was greater among experimental and established smokers after the implementation of large pictorial health warnings (White et al., 2008), demonstrating the effectiveness of such

intervention in the context of tobacco products. There have also been numerous experimental studies that have investigated the impact of FoP warning labels on SSBs, which warn consumers of the health effects of consumption and/or provide information on nutritional aspects of the beverage. A meta-analysis of 23 studies found that warning labels can be effective at reducing SSB consumption and eliciting psychological responses underlining behaviour change (Grummon & Hall, 2020). Several experiments covered in the review have shown that exposure to warning labels on SSBs can lead to lower SSB selection and purchases. In a randomised controlled trial of 400 adult SSB consumers who visited and purchased an item from a replica convenience store, the participants assigned to a warning label condition had fewer SSB purchases than those assigned to the control (no label) condition (Grummon et al., 2019). This finding is consistent with a study of 2381 parents, which found that warning labels on SSBs improved parents' understanding of the adverse health effects associated with overconsumption and lowered parents' intentions to purchase SSBs for their children (Roberto et al., 2016). Similarly, a randomised online experiment involving 994 participants found that FOP warning labels, including graphic warning, text warning, sugar content and health star rating labels, all significantly reduced the selection of SSBs compared to the control group, with the graphic warning label having the biggest impact (Billich et al., 2018). Given the similarities between SSBs and EDs, ED warning labels are worthy of consideration as a public health intervention to inform consumers and encourage reduced consumption.

Although there has been extensive research on the effect of FoP warning labels to inform consumers and encourage reduced consumption of SSBs, the potential of warning labels to inform consumers and encourage reduced ED consumption requires further investigation. While similar to SSBs, EDs are notably a different beverage, as they contain other ingredients that have been shown to have an adverse effect on health. Parallel to this,

ED consumers and SSB consumers may differ in terms of the motivations underlying their consumption, as EDs and SSBs are marketed differently, with the marketing for EDs revolving around their supposed functional purposes (i.e., sporting), while the marketing for SSBs is more about their recreational use (i.e., having fun with friends; Brownbill et al., 2018). To date, there has been only one peer-reviewed quantitative study that has investigated the potential impact of such an intervention strategy for EDs. In this laboratory-based experimental study involving 36 participants aged 15 to 30 years, participants visited a mock-up convenience store to purchase a beverage under different pricing and label conditions, with either no label, caffeine content labels, or label warning of the health effects of ED consumption (Temple et al., 2016). The results suggest that warning labels that provided information about the caffeine content or health effects of EDs influenced participants' purchasing intentions, such that participants in both the caffeine content label condition and warning label condition, had reduced ED purchases among adolescents. While these results are promising, further studies are required to provide evidence of the potential for warning labels on EDs to inform consumers and encourage reduced consumption.

Current evidence in both tobacco and SSBs indicates that the optimal design of a warning label should include pictures depicting the adverse health effect associated with the consumption of the product. A longitudinal study found that pictorial warning labels on tobacco products elicited greater intentions to quit than plain-text warning labels (Brewer et al., 2016). This finding adds to the extensive tobacco labelling research, which has shown that graphic warning labels are more effective than text-only labels across a variety of quitting outcomes (Hammond, 2011; Noar et al., 2016; Purmehdi et al., 2017). Similarly, graphic warning labels have been shown to be more effective than other FoP labels at reducing the selection of SSBs in experimental settings (Billich et al., 2018). Tobacco labelling studies suggest that graphic warning labels are more effective because they elicit more frequent and

deeper cognitive processing of warning information than text-only labels (Borland, Wilson, et al., 2009; Borland, Yong, et al., 2009). Given the potential for greater effectiveness with the addition of graphic elements, it may be beneficial to examine graphic warning labels in the context of EDs, as the previous ED labelling study has only looked at text-based labels.

1.3 Protection Motivation Theory

Protection Motivation Theory (PMT), developed by Roger (1975), is a theoretical framework that describes the process in which individuals are motivated to protect themselves when faced with a perceived threat (Westcott et al., 2017). The core assumptions of PMT suggest that appraisal of one's risk can motivate individuals to act on that risk (Boss et al., 2015; Floyd et al., 2000). This appraisal includes perceptions of fear, threat appraisal and coping appraisal. In the threat appraisal process, individuals weigh the severity of the threat (perceived severity); and whether they are personally at risk (perceived vulnerability). In the coping appraisal process, individuals assess the degree to which the recommended response will effectively avert the threat (response efficacy); and the degree to which he or she has the capability to do what is required (self-efficacy); as well as any perceived cost incurred by performing the protective action (response costs) (Maddux & Roger, 1983). In experimental studies involving PMT, the independent variable is manipulated through fear appeals, which usually takes the form of messages communicating the potential of threats; thus, intentions as the outcome indicate the effectiveness of these messages (Boss et al., 2015; Floyd et al., 2000).

1.4 Relevance of Protection Motivation Theory in the current study

Literature involving PMT has shown that persuasive messages that evoke fear can motivate people to engage in protective behavioural intentions engendering actual behavioural change (Boss et al., 2015; Pechmann et al., 2003; van Bavel et al., 2019). However, the PMT model has not been applied in the context of ED consumption, and specifically, as a

framework to guide understanding of consumers' reactions when exposed to messages communicating the negative health effects associated with ED consumption. This study draws on key aspects of PMT and investigates the extent to which individuals are differentially motivated to reduce intentions to consume EDs in response to different health effects messaging or warning labels, as compared to viewing no health warning (no label).

The health effects explored in this study include cardiac conditions (depicted as heart palpitations and heart disease) and weight gain. Findings of an experimental laboratory study concerning alcohol pictorial health warning labels suggest that more severe health warnings were perceived as more effective and increased motivation to reduce consumption compared to less severe health warnings (Sillero-Rejon et al., 2018). Similarly, a tobacco labelling study found that the more severe pictorial health warning labels were rated as more believable and more effective (Maynard et al., 2018). In the context of this present experiment, heart palpitations and heart disease may be considered the more severe health effects, as the cardiovascular conditions are considered as having more acute impacts compared to weight gain and will be depicted using a more 'grotesque' medical image. Within the context of PMT, messages communicating the health effects may motivate the protection motivation process and predict engagement in the self-protective behaviour of reducing ED consumption. PMT posits that intentions to reduce ED consumption may be greater if: individuals perceive the observed health threat as having a more severe impact; perceive themselves as more susceptible to the observed health threat; perceive the protective response as effective at averting the threat; have higher self-efficacy of initiating behaviour change; perceive there to be a lower response cost; and experience a greater amount of fear. Therefore, constructs of PMT will be explored as potential mediators of the relationship between exposure to health effects information communicated using graphic warning labels and intentions to reduce ED consumption (see Figure 2). In addition to PMT constructs, this study also assesses possible

covariates including demographic characteristics, as previous ED research has shown that consumer profile can impact intentions to reduce ED consumption (Temple et al., 2016).

Consumption behaviour and knowledge of health effects associated with ED consumption are also included as they may influence PMT variables and subsequently affect intentions.

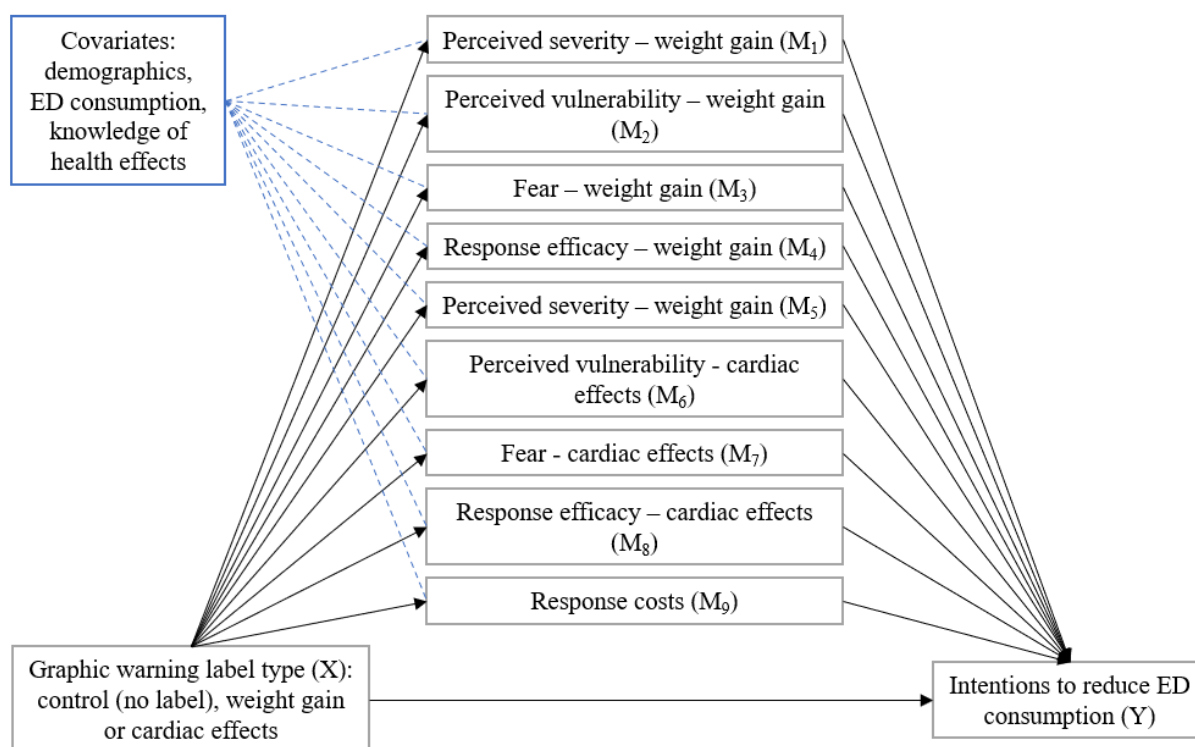


Figure 2. Proposed parallel mediation model featuring constructs of Protection Motivation Theory and potential covariates.¹

1.5 The relationship between perceived effectiveness and intentions to change behaviour

Consumers' perceptions of the effectiveness of health messages, or perceived effectiveness, are often assessed as an indicator of the potential of warning labels or health messages and campaigns to influence beneficial changes in mechanisms underlying longer-term behaviour change. Studies assessing anti-smoking interventions found that perceived effectiveness is predictive of intentions to quit and subsequent behaviour change (Brennan et al., 2014; Morgan et al., 2020). Consistent with these findings, the results of a road safety

¹ M₁ = mediator 1, M₂ = mediator 2, etc.

intervention study revealed that perceived effectiveness of the campaign message was positively associated with reported intentions and behaviours related to drinking and driving (Auzoult et al., 2015). Therefore, it is of relevance to determine consumers' perceptions of the effectiveness of graphic warning labels to explore the potential of such strategy to reduce ED consumption.

1.6 Overview and hypotheses

Though extensive SSB studies have shown that health effects warning labels can modify consumption intentions and behaviours (Grummon & Hall, 2020), few studies have investigated the impact of such interventions on intentions to reduce ED consumption. It is also unknown whether consumers will be motivated to reduce consumption after exposure to graphic health warning labels that communicate the health risk of ED consumption compared to viewing the ED with no warning label, and whether intentions to reduce consumption will differ according to exposure to the two different health effects labels (weight gain vs. cardiac effects). Such findings regarding the most effective message to include on ED warning labels can guide future food and health research and inform the development of health policy interventions. Given that the primary aim of this study is to compare the relative effectiveness of different ED graphic warning labels at encouraging intentions to reduce consumption, this study posits that:

Hypothesis 1: Participants who are exposed to ED packaging displaying graphic warning labels will have greater intentions to reduce consumption than participants exposed to packaging without a warning label.

Hypothesis 2: Participants who view ED packaging displaying the graphic warning label depicting heart palpitations and heart disease will have greater intentions to reduce consumption than those who view the label depicting weight gain.

This study will apply key constructs of PMT to investigate whether the relationship between graphics warning label types and intentions to reduce ED consumption is mediated by the constructs of perceived severity, perceived vulnerability, fear, response efficacy, and response costs. Therefore, this study also proposes that:

Hypothesis 3: Perceived severity, perceived vulnerability, fear, response efficacy, and response costs will be positively correlated with intentions to reduce ED consumption.

Hypothesis 4: Perceived severity, perceived vulnerability, fear, response efficacy, and response cost will be greater for participants who are exposed to ED packaging displaying graphic warning labels than participants exposed to packaging without a warning label.

Hypothesis 5: Perceived severity, perceived vulnerability, fear, response efficacy, and response costs will mediate the relationship between the health effects communicated by ED graphic warning labels and intentions to reduce consumption.

Additionally, since research has shown that perceived effectiveness is correlated with change in behavioural intentions (Auzoult et al., 2015; Brennan et al., 2014; Morgan et al., 2020), a secondary aim is to compare the perceived effectiveness of graphic warning labels depicting weight gain with cardiac effects. This study will also assess the association between perceived effectiveness and intentions to reduce ED consumption, as the usefulness of perceived effectiveness measures depends on their ability to predict the likelihood that a persuasive message will have an impact on outcomes such as behavioural change (Brennan et al., 2014).

2. Method

2.1 Participants

Eligible participants were adults between 18 and 39 years of age who were fluent in English, resided in Australia, had consumed any EDs in the last three months prior to the study, and indicated they or their family members were not employed in the beverage industry. Based on ED consumption levels among participants in a previous study (Pennay et al., 2015), participants of this study were included if they had at least occasional ED consumption, that is, reported ED consumption in the past three months. EDs were defined to participants as ‘...carbonated drinks that contain sugar, caffeine and other stimulant ingredients and supplements, and are considered functional beverages that boost energy levels and concentration. Examples of energy drinks include Red Bull, Monster, Rockstar, V Energy and Mother. Does not include sports drinks such as Gatorade and Powerade.’

Participants were recruited using online advertisement (Appendix A) and snowball sampling (word of mouth/social media sharing). Online recruitment was employed as social media users are likely to be in the target age range. Ads were placed in Facebook newsfeed over a four-week period from the 3rd to 31st of May. Facebook users can elect to participate if they see the advertising and were provided the chance to win one of three \$50 gift vouchers. First year psychology students were also recruited through the University of Adelaide School of Psychology Research Participation System and were granted course credit for taking part in this study. This method of recruitment was employed as it was anticipated that many first-year psychology students would be in the target age range.

2.2 Study design

This study was a between-subject online experiment that compared three exposure conditions. The online survey (Appendix C) was developed and hosted on the web application REDCap (Harris et al., 2009) and could be completed on computers or mobile devices. Before

participants began the survey, they were directed to read the participant information sheet (Appendix B) and indicate informed consent.

Participants were randomly assigned to one of the three ED packaging/label conditions: control group (no label), weight gain, and cardiac (depicted as heart palpitation and heart disease). The graphic warning labels were each put onto an ED can and enlarged above to facilitate readability. Those assigned to the control group were shown an ED can without a graphic warning label. The graphic warning labels were designed to be as similar as possible, using the same dimensions, design, and wording, differing only in the adverse health effects they depicted. All three conditions were presented using the same ED can which was photographed by the researcher. The position and lighting were kept consistent to ensure images closely resembled one another across conditions with the exception of the labels. Random allocation was achieved via a randomisation script in REDCap that automatically generated a random number from one to three, which dictated which ED can was displayed (see Figure 3).



Figure 3. Respective ED can for the control, weight gain and cardiac effects label conditions

2.3 Procedures

Participants accessed the study by clicking the link provided in the Facebook advertisement or the Research Participation system study page, who then clicked through to the welcome screen and were directed to view the study information and indicate informed consent. Participants then completed screening questions to determine their eligibility. Those eligible then continued to complete the main questionnaire, while those who were not eligible were taken to a separate survey end screen, which informed them that they did not meet the specific criteria to participate and thanked them for their interest. Upon starting the main questionnaire, each participant was automatically and randomly allocated to one of the packaging/label conditions. Participants completed questions regarding ED consumption, consumption motivation, awareness of health warning messages, and knowledge of adverse health effects. After responding to these questions, they were shown an image of an ED can, according to their assigned condition. Participants assigned to weight gain or heart palpitation and heart disease conditions were asked questions regarding perceived effectiveness of the label they viewed. All participants answered questions on the measures of perceived severity, perceived vulnerability, and fear relating to both weight gain and the cardiac effects, as well as self-efficacy, response cost, and intentions to reduce ED consumption. Subsequently, participants completed various demographics questions before ending the survey.

2.4 Measures

A full copy of the survey is available from Appendix C.

2.4.1 Energy drink consumption

A total of four items were used to determine participants' frequency and volume of ED consumption. The assessment of ED consumption was based on a question that assessed SSB consumption in a previous SSB study (Miller et al., 2020). The frequency of ED consumption was assessed by asking 'How often do you usually drink any energy drinks?'

Participants responded by choosing one of the five response options: (1) 'Less than once per month', (2) '1-3 times per month', (3) 'Once per week', (4) 'More than once per week', and (5) 'Daily'. As frequent ED consumption is strongly associated with alcohol use (Emond et al., 2014), the frequency of ED consumption with alcohol was also assessed by asking 'On days that you consume energy drinks, do you usually drink alcohol?' Participants responded by choosing one from the three response options: (1) 'No', (2) 'Yes, I combine energy drinks and alcohol', and (3) 'Yes, but I do not combine energy drinks and alcohol'. To measure participants' average daily intake of ED, they were asked 'On days that you consume energy drinks, how much do you usually consume? Include those consumed with alcohol.'

Participants were instructed to enter the number of can/s as applicable in the form of 250mL cans or 500mL cans. Alternatively, participants could provide the volume consumed in millilitres. Similarly, participants were asked 'What is the most amount or number of energy drinks you have ever consumed in one day? Include those consumed with alcohol?' with the same response formats. Based on a previous soft drink consumption study (French et al., 2013), participants were asked their perception of their own ED consumption by asking 'In your opinion, is the amount of energy drinks that you drink during an average week...? and decided whether it was: (1) 'Too much', (2) 'Just right', (3) 'Not enough', and (4) 'Don't know'.

2.4.2 Consumption behaviours and motivations

Participants' reasons for consuming ED and consumption behaviours were assessed. Participants were asked to indicate reasons for consumption from 13 potential reasons, with multiple responses allowed, for example, 'To stay awake or to help concentrate for work or study'. Participants were also asked how often they consumed ED at a number of locations including at home, at work, at the homes of friends or family, at study location, and at a

public event/location by selecting from the response choices: (1) ‘Never’, (2) ‘Seldom’, (3) ‘Sometimes’, (4) ‘Almost always’, and (5) ‘Always’.

2.4.3 Awareness of current advisory statements

Awareness of existing advisory statements on ED packaging were also assessed as a potential covariate. Participants were asked, ‘Are you aware of any existing warning messages on energy drink packaging?’ and responded with either ‘yes’ or ‘no’. If participants indicated ‘yes’, they were instructed to record the message in as much detail as they can remember or write ‘don’t know’ if they were unsure. The written response was coded for correctness.

2.4.4 Knowledge of health effects associated with energy drink consumption

Participants’ perceptions and knowledge of adverse health effects associated with ED consumption were assessed due to their potential effect on intentions to reduce consumption. Perception of the likelihood of health effects was assessed using measures adapted from previous SSB studies, altered to pertain to EDs (Miller et al., 2020). Participants were instructed to rate the extent to which they believed their current and future health was at risk due to the amount of ED they were consuming, with the available response options of: (1) ‘Not at all at risk’, (2) ‘Somewhat at risk’, (3) ‘Moderately at risk’, and (4) ‘Very much at risk’. Participants were also asked ‘If an average adult drank 500ml energy drink every day, how likely are they to have health problems later in life?’ with the responses ranging from (1) ‘Very unlikely’, to (5) ‘Very likely’.

Participants’ knowledge of health effects was assessed through the question ‘Do you know of any illnesses or health effects associated with drinking energy drinks?’ with ‘yes’ and ‘no’ as the response choices. If participants indicated ‘yes’, they rated, from a prompted list in fixed order, the extent to which they perceived various health effects were associated with drinking energy drinks from (1) ‘Not at all’ to (5) ‘A great deal’. The health effects

included tooth decay, weight gain/obesity, Type 2 diabetes, heart or cardiovascular diseases, cancer, depression, high blood pressure, asthma, and dehydration. Immune system dysfunction is not known to have a link with ED consumption but was included to ensure participants were engaging with the question and not assuming all listed illnesses were associated with ED consumption.

2.4.5 Perceived label effectiveness

Participants' perceptions of the effectiveness of the graphic warning labels were assessed by asking whether the ED packaging/label: 'grabs my attention', 'is easy to understand', 'is believable', 'makes me stop and think', 'taught me something new' and 'is relevant to me'. Participants rated their level of agreement with each statement on a scale of (1) 'strongly disagree' to (5) 'strongly agree' with the responses dichotomised to 'nonagreement' (1-3) and 'agreement' (4-5). Similarly, participants were asked to rate how effective the packaging/label is at 'Making people think about the health effects of energy drinks', 'Discouraging people from wanting to drink energy drinks', and 'Overall, how effective is this packaging?' on a scale of (1) 'not at all effective' to (5) 'very effective'. Responses were dichotomised to 'less effective' (1-3) to 'more effective' (4-5) for analysis.

2.4.6 Protection Motivation Theory variables

Measures of PMT variables were based on that of an existing study (Boss et al., 2015) and modified to assess the variables described in the research model of the present study. All questions were rated on seven-point Likert scales instead of five-point scales as seven-point scales were found to provide a more accurate measure of a participant's true evaluation and are more appropriate for online questionnaires (Finstad, 2010). Participants were asked to indicate their level of agreement with a series of statements by selecting from (1) 'Strongly disagree' to (7) 'Strongly agree'. Certain items were reverse scored for analysis. The questionnaire assessed all variables in the PMT model, as described below. Measures of

perceived severity, perceived vulnerability, fear, response efficacy, response costs, and intentions were adapted Milne et al. (2002). Items assessing self-efficacy were adapted from Johnston and Warkentin (2010).

2.4.6.1 Perceived severity

Measures of perceived severity consisted of two items for each of the two health effects. Participants were asked to rate the statements ‘If I were to gain weight, my life will be affected’ and ‘Gaining weight would be unlikely to cause me any major concern’ for weight gain, as well as the statements ‘If I were to develop heart palpitations and heart disease, my life will be affected’ and ‘Heart palpitations and heart disease would be unlikely to cause me any major concerns’ for cardiovascular conditions. Internal consistency of this subscale was acceptable for weight gain ($\alpha = .70$). However, Cronbach’s alpha was low for cardiac effects label conditions at .43.

2.4.6.2 Perceived vulnerability

Measures of perceived vulnerability for weight gain consisted of asking the participants to rate their agreement with the statements ‘My chances of gaining weight are high’ and ‘I am unlikely to gain weight’. For the cardiovascular conditions, participants rated their agreement with the statements ‘My chances of developing heart palpitations and heart disease are high’ and ‘I am unlikely to develop heart palpitations and heart disease’. Internal consistency of this subscale was excellent for weight gain ($\alpha = .90$) and good for cardiac conditions ($\alpha = .82$).

2.4.6.3 Fear

Fear was assessed through four items for each of the two health effects (eight items in total). Participants were asked to indicate the extent to which they agreed they were ‘worried’, ‘frightened’, ‘anxious’, and ‘scared’ about the prospect of gaining weight as well as the

prospect of developing heart palpitations and heart disease. Internal consistency of this subscale was excellent for health effects ($\alpha_{\text{weight}} = .97$; $\alpha_{\text{cardiac}} = .96$).

2.4.6.4 Response efficacy

To assess response efficacy, participants were asked to specify their level of agreement with the statements ‘Reducing my consumption of energy drinks is a good way to reduce the risk of weight gain’ and ‘If I were to cut back on the amount of energy drinks I drink, I would lessen my chance of gaining weight’. Participants also rated the statements ‘Reducing my consumption of energy drinks is a good way to reduce the risk of weight gain’ and ‘If I were to cut back on the amount of energy drinks I drink, I would lessen my chance of developing heart palpitations and heart disease’. Internal consistency of this subscale was good for weight gain ($\alpha = .86$) and excellent for cardiac effects label conditions ($\alpha = .90$).

2.4.6.5 Self-efficacy

Measures of self-efficacy related to perceptions of reducing consumption of EDs consisted of asking participants to indicate their level of agreement with the statements ‘Reducing my consumption of energy drinks is easy’, ‘Reducing my consumption of energy drinks would not bother me’, and ‘I am able to reduce my consumption of energy drinks without much effort’. Cronbach’s alpha of this subscale was low at .40.

2.4.6.6 Response costs

Response costs were assessed by asking participants to rate the statements ‘The benefits of reducing my consumption of energy drinks outweigh the cost’, ‘I would be discouraged from reducing my consumption of energy drinks because it would be too much trouble’, and ‘Reducing my consumption of energy drinks would cause me problems’. Internal consistency of this measure was moderate ($\alpha = .63$).

2.4.6.7 Intentions

Intentions to reduce ED consumption were assessed by simply asking participants to specify their levels of agreement with the statements ‘I intend to reduce my consumption of energy drinks’ and ‘I do not wish to reduce my consumption of energy drinks’. Internal consistency of this measure was good ($\alpha = .86$).

2.4.7 Demographic characteristics

The survey also collected information regarding participants’ demographic characteristics in order to adequately describe the sample, and to use as covariates in the analysis. Participants were asked to report their age, gender, highest qualification, as well as their height and weight, which allowed for the calculation of body mass index (BMI). BMI was calculated by dividing height in kilograms by the square of height in metres, categorised according to classification criteria (World Health Organisation, n.d.) and collapsed into two categories: underweight/normal ($BMI < 25$) and overweight/obese ($BMI \geq 25$) for ease of analysis. Postcodes were also collected and were used to ascertain participants’ socio-economic status according to Socio-Economic Indexes for Areas (Australian Bureau of Statistics, 2018), which ranks areas in Australia according to their relative socio-economic disadvantage scores. Disadvantage deciles were dichotomised into ‘more disadvantaged’ (1-5) and ‘less disadvantaged’ (6-10).

2.5 Power analysis

A priori power analysis was run using G*Power 3.1 (Faul et al., 2007) to calculate the needed sample size. Previous SSB health warning studies that examined purchase intentions as the primary outcome have reported medium effect size (Roberto et al., 2016; VanEpps & Roberto, 2016). Assuming a Type I error rate of $\alpha = .05$, and 80% power to detect differences between groups of medium effect size using ANOVA, a sample size of $N = 300$ participants

was the recruitment target and equally divided between the three exposure groups (n = 100 per group).

2.6 Statistical analyses

Statistical analyses were conducted in IBM SPSS Statistics (Version 27; IBM Corp, 2020). Inspection of data revealed that mean scores of PMT variables did not follow a normal distribution. Data transformation was performed but the distributions did not improve. Statistical analyses were thus carried out using non-parametric methods.

A series of Kruskal-Wallis H tests were performed to investigate whether intentions to reduce ED consumption, as well as perceived severity, perceived vulnerability, fear, response efficacy, and response costs, differed between conditions. Pearson's chi-squared tests were used to examine whether the agreement with perceived effectiveness indications differed between the weight gain and cardiac effects label conditions. Spearman's rho tests were also used to assess the correlations between PMT variables and intentions, and between perceived effectiveness and intentions.

To assess whether PMT variables mediated the relationship between graphic warning label type and intentions to reduce ED consumption, mediation effect was tested using the PROCESS macro for SPSS (Version 3.5; model 4; 5,000 bootstrap samples; 95 per cent confidence intervals; Hayes, 2017). The parallel mediators were perceived effectiveness (weight or cardiac), perceived vulnerability (weight or cardiac), fear (weight or cardiac), response efficacy (weight or cardiac), and response cost. Intentions to reduce ED consumption was recoded into a dichotomous outcome variable to facilitate nonparametric analysis (logistical regression). Age, gender, BMI, socioeconomic status, highest qualification obtained, ED consumption and awareness of health effects were included in the mediation model as covariates.

2.7 Ethical considerations

Ethics approval was provided by the University of Adelaide School's Subcommittee for Human research in the School of Psychology (approval number 21/10). Participation in this study was entirely voluntary, participants could withdraw for any reason at any time before the submission of the survey.

3. Results

3.1 Inspection of data

In total, 657 participants took part in this study, of which 314 were excluded from the analyses as ineligible or incomplete. Of the 343 participants included in the analyses, there were no cases of missing values except for the 1.17% of participants (control $n = 1$, weight $n = 2$, cardiac $n = 1$) who did not provide the postcodes of their residences, which were used to determine their socioeconomic status.

The normality of the data was assessed. Inspection of skewness and kurtosis values, Shapiro-Wilk test results, histograms and QQ-plots indicated that scores of PMT variables did not follow a normal distribution. There were no outliers within PMT variables as assessed by boxplots depicting the scores. Data transformations were performed to attempt to improve the distributions for these variables; however, the distributions were not improved. The data were therefore analysed using non-parametric tests.

3.2 Participant characteristics

Table 1 reports participant characteristics for the whole sample and by label conditions. Of the 343 participants in the sample, 36.74% ($n = 126$) were randomly assigned to the no-label control condition, 30.90% ($n = 106$) were randomly assigned to the weight gain label condition, and 32.36% ($n = 111$) were randomly assigned to the cardiac effects label condition. Table 1 also reports the results of Pearson's chi-square analyses, which indicated that there were no significant differences in participant characteristics between the three conditions.

Table 1

Participant demographics for the total sample, and by label condition (N = 343)

Variable	Total		Label condition						χ^2
	no.	%	Control		Weight		Cardiac		
			no.	%	no.	%	no.	%	
Gender ^a									
Male	178	51.90	67	53.17	59	55.66	52	46.85	3.744
Female	152	44.31	54	42.86	43	40.57	55	49.55	p = .711
Age group									
18-24	231	67.35	84	66.67	66	63.26	81	72.97	2.869
25-39	112	32.65	42	33.33	40	37.74	30	27.03	p = .238
SES quintile ^b									
More disadvantaged	167	48.69	68	53.97	49	46.23	50	45.05	2.150
Less disadvantaged	172	50.15	57	45.24	55	51.89	60	54.05	p = .341
BMI									
Normal/underweight	192	55.98	77	61.11	56	52.83	59	53.15	2.133
Overweight/obese	151	44.02	49	38.89	50	47.17	52	46.85	p = .344
Highest qualification ^c									
Secondary school or less	129	37.61	45	35.71	44	41.51	40	36.04	
Some tertiary/completed vocational training	170	49.56	66	52.38	47	44.34	57	51.35	1.715
Finished university (bachelor's degree or higher)	41	11.95	14	11.11	14	13.21	13	11.71	p = .944

Note. ^a 3.50% of participants (control $n = 4$, weight $n = 4$, cardiac $n = 4$) identified as neither male nor female, and are not included in this analysis. 3% of participants (control $n = 1$) did not declare their gender, and is not included in this analysis.

^b 1.17% of participants (control $n = 1$, weight $n = 2$, cardiac $n = 1$) did not declare the postcodes of their residences, and are not included in this analysis.

^c .87% of participants (control $n = 1$, weight $n = 1$, cardiac $n = 1$) did not specify their highest qualification obtained, and are not included in this analysis.

3.3 Energy drink consumption behaviours and knowledge

Of the 343 participants included in the analyses, 25.07% of participants reported consumption on days that they consume EDs exceeding the recommended daily limit (500mL). Table 3 reports the characteristics of ED consumption behaviour and consumer knowledge. More than one-fifth of the sample reported consuming EDs daily. Less than 40% of the overall sample reported to consumed alcohol on days that they consumed EDs, less than half of whom reported consuming EDs in combination with alcohol. Participants were asked to indicate reasons for consuming EDs from a prompted a list of reasons, with the most frequently selected option being to help stay awake or concentrate for work or study. There were moderate levels of awareness of health effects associated with ED consumption in the sample. Approximately two thirds of participants reported that they were aware of the current advisory statements on ED packaging, with a high proportion of these participants able to correctly or partially correctly recall at least one theme (unprompted). As shown in Table 3, the most frequently recalled theme regarding current advisory statements was related to the recommended daily limit.

Table 2

Consumption frequency, alcohol consumption, reasons for consuming energy drinks, awareness of health effects associated with energy drink consumption and awareness of current advisory statements (N = 343)

	No.	%
Consumption frequency ^a		
Less than once per month	72	20.99
1-3 times per month	78	22.74
Once per week	35	10.20
More than once per week	80	23.32
Daily	78	22.74
Alcohol consumption on days they drink energy drinks		
No	211	61.52
Yes	73	21.28
Yes, combined consumption of energy drinks and alcohol	59	17.20
Reasons for consuming energy drinks ^b		
To stay awake or to help concentrate for work or study	279	81.34
To feel awake in general (not for any specific activity)	239	69.70

For the taste	227	66.18
To cope with a lack of sleep	210	61.22
For going out/partying	155	45.19
To mix with alcohol	154	44.90
To stay awake or alert for driving	128	37.32
To boost energy while playing video games	85	24.78
To increase physical performance	79	23.03
To help sobering up or with hangovers after drinking alcohol	67	19.53
Rehydration	55	16.03
To help lose weight or help keep weight off	37	10.79
Awareness of health effects associated with ED consumption		
No	128	37.32
Yes	215	62.68
Awareness of current advisory statements		
No	105	30.61
Yes	238	69.39
Advisory statement recall ^c		
Correct/partially correct recall	205	86.13
Incorrect recall/don't know	33	13.87
Correct recall of advisory statement themes		
Daily limit	166	48.40
Not recommended for pregnant or lactating women	133	38.78
Caffeine content	62	18.08
Not recommended for children	40	11.66
Not recommended for individuals sensitive to caffeine	39	11.37
Consume responsibly	7	2.04
Incorrect recall of advisory statement themes		
Heart effects	36	10.50
Don't know	21	6.12
Do not consume with alcohol	8	2.33
Other ^d	9	2.62

Note. ^a Percentages may not total 100 due to rounding.

^b Participants could select multiple items.

^c Only participants who have answered 'Yes' to awareness of current advisory statements (68.39%) were asked to recall statements.

^d Other themes relate to ED ingredients (i.e., taurine, phenylalanine), health effects (i.e., blood sugar increase), and overdose.

3.4 Descriptive statistics

Table 2 reports the means, standard deviations, medians, and interquartile ranges for scores on perceived severity, perceived vulnerability, fear, response efficacy (for weight gain and cardiac effects) and self-efficacy, response cost, and intentions for the total sample and by label conditions.

Table 3

Summary of descriptive statistics for scores on measures of Protection Motivation Theory variables for the total sample, and by label condition (N = 343)

Variables	Total				Label condition											
					Control				Weight				Cardiac			
	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>	<i>Mdn</i>	<i>IQR</i>
PS (weight)	5.16	1.50	5.50	2.00	5.24	1.41	5.50	2.00	5.04	1.56	5.50	2.00	5.18	1.56	5.50	2.50
PV (weight)	4.12	1.77	4.00	3.00	4.03	1.70	4.00	3.00	4.33	1.86	4.75	3.50	4.03	1.78	4.00	3.50
Fear (weight)	4.34	1.90	4.75	3.25	4.45	1.81	4.75	2.81	4.24	1.98	5.00	3.75	4.31	1.94	4.75	3.25
RE (weight)	3.81	1.77	4.00	2.50	3.84	1.72	4.00	2.50	3.80	1.88	4.00	3.00	3.79	1.72	4.00	2.50
PS (cardiac)	5.89	1.20	6.00	1.50	5.98	1.13	6.00	1.50	5.86	1.15	6.00	2.13	5.81	1.31	6.00	2.00
PV (cardiac)	3.82	1.54	4.00	2.50	3.72	1.47	4.00	2.00	4.13	1.67	4.00	2.13	3.65	1.45	4.00	2.00
Fear (cardiac)	4.29	1.63	4.50	2.25	4.44	1.45	4.63	2.00	4.37	1.70	4.63	2.31	4.03	1.73	4.00	3.00
RE (cardiac)	4.86	1.53	5.00	2.00	4.07	1.33	5.00	2.00	4.72	1.73	5.00	2.00	4.77	1.54	5.00	2.00
SE	4.87	1.84	5.33	2.66	5.08	1.77	5.67	2.08	4.60	1.84	5.00	2.75	4.89	1.91	5.33	3.67
SC	4.90	1.31	5.00	2.00	5.02	1.32	5.00	1.67	4.76	1.31	4.67	1.67	4.88	1.31	5.00	2.00
INT	3.96	1.74	4.00	3.00	3.97	1.64	4.00	2.13	3.97	1.81	4.00	3.00	3.94	1.80	4.00	3.00

Note. PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost, INT = intentions. Range of scores for all measures: 1-7.

3.5 The potential impact of graphic warning labels on intentions to reduce energy drink consumption

It was posited by Hypothesis 1 that participants assigned to the label conditions would have greater intentions to reduce consumption compared to those in the control condition.

Whereas Hypothesis 2 proposed that participants who viewed the cardiac effects label would have greater intentions to reduce consumption than those who viewed the weight gain label.

A Kruskal-Wallis test indicated that there was no significant difference in intention scores between those in the control condition (Mean rank = 171.77), those in the weight gain label condition (Mean rank = 173.12), and cardiac effects label condition (Mean rank = 171.19; $\chi^2(2, n = 343) = .22, p = .989$), rejecting both Hypothesis 1 and 2.

3.6 Correlations between Protection Motivation Theory variables and intentions to reduce energy drink consumption

It was hypothesised that perceived severity, perceived vulnerability, fear, response efficacy, and response costs will be positively correlated with intentions to reduce ED consumption. Table 4 reports Spearman's rho correlation coefficients between PMT variables and intentions for the total sample. As defined by Dancey & Reidy (2007), there were statistically significant, weak positive correlations (e.g., .3 or lower) between intentions to reduce ED consumption: and perceived severity (weight); fear (weight); perceived severity (cardiac); and perceived vulnerability (cardiac). There were also statistically significant, moderate positive correlations (e.g., between .4 and .6) between intentions and: response efficacy (weight); fear (cardiac); response efficacy (cardiac); and response cost. There were no significant correlations between intentions and perceived severity (weight), and intentions and self-efficacy. Statistically significant correlations between PMT variables and intentions were inconsistent and ranged from weak positive to moderate positive, thus providing partial support for Hypothesis 3.

A further series of Spearman's rho analyses were conducted to explore whether correlations between intentions to reduce ED consumption and PMT variables differed between label conditions. Tables 5, 6 and 7 report the correlation coefficients between PMT variables and intentions for: the control condition (Table 5), the weight gain label condition (Table 6), and the cardiac effects label condition (Table 7), respectively. The correlation between fear (weight) and intentions was stronger in the cardiac effects label condition than in the weight gain label condition and the control condition. The correlations between fear (cardiac) and intentions, and response efficacy (cardiac) and intentions were stronger in the cardiac effects label condition than that observed in the control and weight gain label condition. The correlation between response cost and intentions was also the strongest in the cardiac effects label condition.

Table 4

Whole sample: Correlations (Spearman's rho) between scores on perceived severity (weight), perceived vulnerability (weight), fear (weight), response efficacy (weight), perceived Severity (cardiac), perceived Vulnerability (cardiac), fear (cardiac), response efficacy (cardiac), self-efficacy, response Cost, and intentions (N = 343)

	1	2	3	4	5	6	7	8	9	10	11
1. PS (weight)	-										
2. PV (weight)	.204**	-									
3. Fear (weight)	.579**	.407**	-								
4. RE (weight)	.088	.213**	.171**	-							
5. PS (cardiac)	.343**	.011	.194**	.130*	-						
6. PV (cardiac)	.010	.346**	.073	.244**	-.094	-					
7. Fear (cardiac)	.211**	.220**	.377**	.304**	.341**	.316**	-				
8. RE (cardiac)	.136*	.177**	.224**	.514**	.195**	.292**	.399**	-			
9. SE	-.036	-.115*	-.104	-.082	.125*	-.309**	-.025	-.145**	-		
10. RC	.080	.048	-.036	.147**	.261**	-.064	.217**	.166**	.624**	-	
11. INT	.097	.147**	.161**	.499**	.159**	.204**	.410**	.424**	.090	.425**	-

Note. PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost, INT = intentions.
* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

Table 5

Control condition: Correlations (Spearman's rho) between scores on perceived severity (weight), perceived vulnerability (weight), fear (weight), response efficacy (weight), perceived severity (cardiac), perceived vulnerability (cardiac), fear (cardiac), response efficacy (cardiac), self-efficacy, response cost, and intentions (N = 126)

	1	2	3	4	5	6	7	8	9	10	11
1. PS (weight)	-										
2. PV (weight)	.160	-									
3. Fear (weight)	.524**	.385**	-								
4. RE (weight)	.003	.303**	.113	-							
5. PS (Cardiac)	.196*	.042	.090	.124	-						

6. PV (Cardiac)	-.045	.352**	.141	.224*	-.153	-	-	-	-	-	-
7. Fear (Cardiac)	.051	.121	.331**	.287**	.301**	.232**	-	-	-	-	-
8. RE (Cardiac)	.042	.089	.116	.445**	.050	.244**	.238**	-	-	-	-
9. SE	.011	-.077	-.084	-.040	.165	-.213*	.077	.046	-	-	-
10. RC	.070	.015	-.036	.269**	.255**	-.074	.231**	.217*	.601**	-	-
11. INT	.002	.178*	.070	.538**	.107	.205*	.293**	.354**	.124	.460**	-

Note. PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost, INT = intentions.
* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

Table 6

Weight gain label condition: Correlations (Spearman's rho) between scores on perceived severity (weight), perceived vulnerability (weight), fear (weight), response efficacy (weight), perceived severity (cardiac), perceived vulnerability (cardiac), fear (cardiac), response efficacy (cardiac), self-efficacy, response cost, and intentions (N = 106)

	1	2	3	4	5	6	7	8	9	10	11
1. PS (weight)	-										
2. PV (weight)	.392**	-									
3. Fear (weight)	.622**	.438**	-								
4. RE (weight)	.115	.169	.283**	-							
5. PS (Cardiac)	.271**	.016	.092	.110	-						
6. PV (Cardiac)	.239*	.357**	.164	.345**	.005	-					
7. Fear (Cardiac)	.234*	.284**	.322**	.353**	.274**	.506**	-				
8. RE (Cardiac)	.120	.178	.213**	.579**	.271**	.490**	.438**	-			
9. SE	-.103	-.014	-.153	-.190	.119	-.416**	-.183	-.316**	-		
10. RC	.069	.159	-.108	.050	.324**	-.139	.079	.061	.686**	-	
11. INT	.112	.113	.156	.478**	.169	-.199*	.446**	.390**	.038	.282**	-

Note. PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost, INT = intentions.
* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

Table 7

Cardiac effects label condition: Correlation matrix (Spearman's Rho) between scores on perceived severity (weight), perceived vulnerability (weight), fear (weight), response efficacy (weight), perceived severity (cardiac), perceived vulnerability (cardiac), fear (cardiac), response efficacy (cardiac), self-efficacy, response cost, and intentions (N = 111)

	1	2	3	4	5	6	7	8	9	10	11
1. PS (weight)	-										
2. PV (weight)	.060	-									
3. Fear (weight)	.578**	.400**	-								
4. RE (weight)	.143	.182	.129	-							
5. PS (Cardiac)	.558*	.005	.397**	.163	-						
6. PV (Cardiac)	-.157	.301**	-.111	.178	-.132	-					
7. Fear (Cardiac)	.344**	.252**	.468**	.288**	.430**	.197*	-				
8. RE (Cardiac)	.244**	.289**	.336**	.469**	.277**	.175	.490**	-			
9. SE	-.032	-.233*	-.102	-.014	.070	-.259**	.027	-.182	-		
10. RC	.088	.013	.023	.116	.216*	.063	.326**	.189*	.569**	-	
11. INT	.185	.178	.268**	.477**	.195*	.237*	.497**	.531**	.117	.527**	-

Note. PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost, INT = intentions

* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

3.7 Difference in scores of Protection Motivation Theory variables

Hypothesis 4 stated that perceived severity, perceived vulnerability, fear, response efficacy, and response cost would be greater for participants in the label conditions than those in the control group. Results of Kruskal-Wallis tests presented in Table 8 indicated that there was no statistically significant difference in scores of any of the variables across the three conditions. Therefore, the data did not support the hypothesis.

Table 8

Summary of Kruskal-Wallis statistics for measures of Protection Motivation Theory variables according to experimental condition (N = 343)

	Label conditions						χ^2	<i>p</i>
	Control		Weight		Cardiac			
	<i>n</i>	Mean Rank	<i>n</i>	Mean Rank	<i>n</i>	Mean Rank		
Perceived severity (weight)	126	175.91	106	164.55	111	174.67	.890	.641
Perceived vulnerability (weight)	126	166.09	106	184.91	111	166.38	2.629	.269
Fear (weight)	126	175.77	106	169.36	111	170.23	.295	.863
Response efficacy (weight)	126	172.66	106	171.54	111	171.68	.009	.995
Perceived severity (cardiac)	126	177.80	106	168.60	111	168.66	.724	.696
Perceived vulnerability (cardiac)	126	166.85	106	189.62	111	161.02	5.181	.075
Fear (cardiac)	126	179.87	106	177.74	111	157.59	3.525	.172
Response efficacy (cardiac)	126	184.01	106	165.25	111	164.82	2.985	.225
Response cost	126	182.86	106	159.95	111	171.18	3.102	.211

3.8 Parallel mediation

Hypothesis 5 of this study predicted that perceived severity, perceived vulnerability, fear, response efficacy, and response costs would mediate the relationship between the health effects communicated by ED graphic warning labels and intentions to reduce consumption (see Figure 4). While no statistically significant relationship was found between graphic warning labels and intentions to reduce ED consumption, according to Hayes and Rockwood (2017), it is not necessary for there to be an effect between X and Y to proceed with the mediation analysis. To perform a mediation analysis for variables with a dependent variable that had a non-normal distribution, the dependent variable (intentions to reduce ED consumption) was recoded into a dichotomous outcome variable to facilitate non-parametric statistics (logistic regression). As shown by the results presented in Table 8, label conditions had no direct effect on intentions to reduce ED consumption, there were also no statistically significant mediation effects. Hence, Hypothesis 5 was not supported.

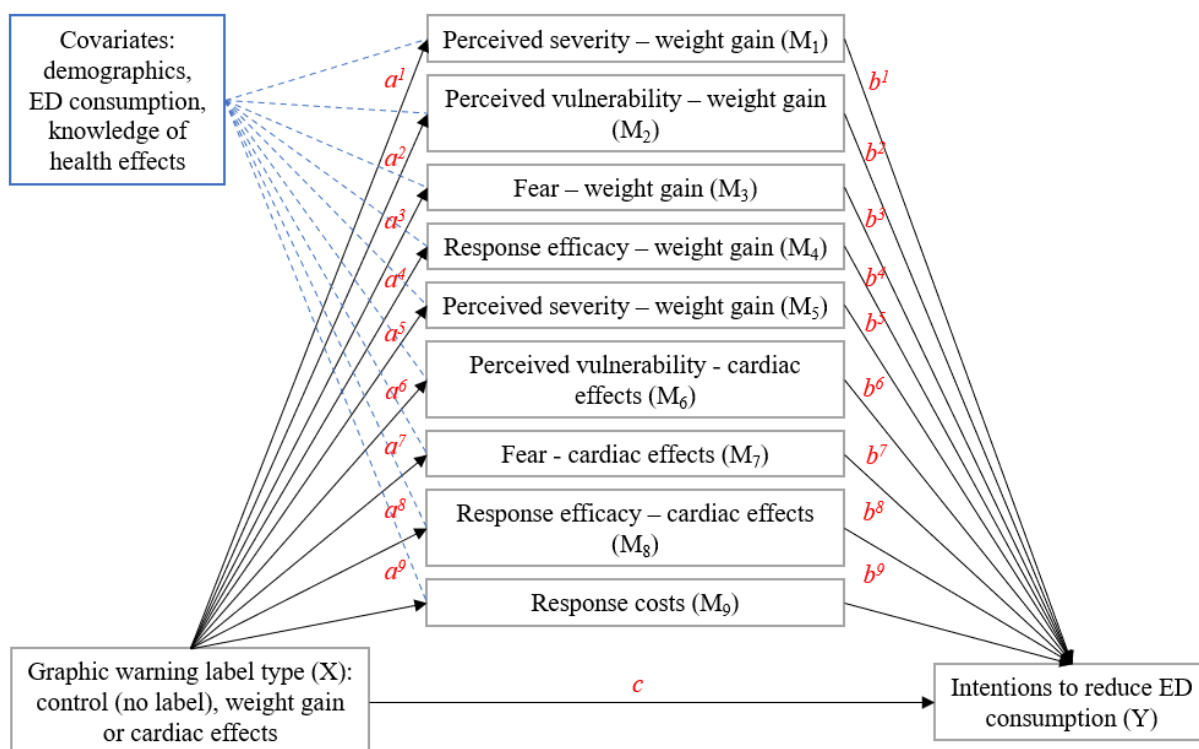


Figure 4. Parallel mediation model for direct and indirect pathways

Table 9

Mediation parameter estimates for unstandardised direct and indirect effects (N = 339)

Path	Model	β	SE	95% CI [LLCI, ULCI]
Direct				
<i>c</i>	X – Y	.276	.173	[-.064, .616]
Indirect				
<i>a</i> ¹	X – PS (weight gain)	-.057	.100	[-.253, .139]
<i>a</i> ²	X – PV (weight gain)	-.049	.101	[-.247, .149]
<i>a</i> ³	X – Fear (weight gain)	-.100	.123	[-.341, .141]
<i>a</i> ⁴	X – RE (weight gain)	-.061	.115	[-.288, .165]
<i>a</i> ⁵	X – PS (cardiac effects)	-.097	.078	[-.250, .056]
<i>a</i> ⁶	X – PV (cardiac effects)	-.027	-.098	[-.219, .166]
<i>a</i> ⁷	X – Fear (cardiac effects)	-.229*	.106	[-.439, -.020]
<i>a</i> ⁸	X – E (cardiac effects)	-.166	.101	[-.365, .032]
<i>a</i> ⁹	X – RC	-.111	.076	[-.261, .039]
<i>b</i> ¹	PS (weight gain) – Y	.052	.129	[-.201, .305]
<i>b</i> ²	PV (weight gain) – Y	-.015	.109	[-.229, .199]
<i>b</i> ³	Fear (weight gain) – Y	.046	.115	[-.180, .272]
<i>b</i> ⁴	PE (weight gain) – Y	.407**	.103	[.205, .610]
<i>b</i> ⁵	PS (cardiac effects) – Y	-.156	.140	[-.431, .119]
<i>b</i> ⁶	PV (cardiac effects) – Y	.005	.113	[-.218, .228]
<i>b</i> ⁷	Fear (cardiac effects) – Y	.264*	.117	[.034, .493]
<i>b</i> ⁸	RE (cardiac effects) – Y	.278*	.133	[.017, .539]
<i>b</i> ⁹	RC – Y	.889**	.178	[-.469, .032]
<i>ab</i> ¹	X – PS (weight gain) – Y	-.003	.018	[-.050, .026]
<i>ab</i> ²	X – PV (weight gain) – Y	.001	.013	[-.029, .031]
<i>ab</i> ³	X – fear (weight gain) – Y	-.005	.021	[-.056, .034]
<i>ab</i> ⁴	X – RE (weight gain) – Y	-.025	.051	[-.134, .073]
<i>ab</i> ⁵	X – PS (cardiac effects) – Y	.015	.024	[-.022, .075]
<i>ab</i> ⁶	X – PV (cardiac effects) – Y	-.000	.013	[-.031, .023]
<i>ab</i> ⁷	X – Fear (cardiac effects) – Y	-.061	.043	[-.167, .000]
<i>ab</i> ⁸	X – RE (cardiac effects) – Y	-.046	.040	[-.146, .007]
<i>ab</i> ⁹	X – RC – Y	-.099	.081	[-.284, .040]

Note. β = regression coefficient, SE = standard error, 95% CI (LLCI, ULCI) = 95% confidence interval (lower limit confidence interval, upper limit confidence interval).

X = graphic warning label type (control, weight gain or cardiac effects), Y = intentions.

PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, RC = response cost.

* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

3.9 Perceived effectiveness of graphic warning labels

An exploratory aim of this study was to compare participants' perceptions of the effectiveness of the two labels. A comparison was performed to assess whether there was a significant

difference in the percentage of participants reporting agreements with perceived effectiveness indications between label conditions. Five-point Likert scaled responses were transformed into dichotomous outcomes (agreement and nonagreement). Table 10 reports the results of Pearson's chi-squared tests for participants reporting agreement with perceived effectiveness indications, which indicated that there was a statistically significant difference in the proportion of participants who reported to agree with the statement 'This packaging grabs my attention,' with the cardiac effects label condition having a higher percentage. There were no significant differences in agreement for the other perceived effectiveness indicators between label type.

Table 10

Summary of Pearson's chi-squared statistics for participants reporting agreement with perceived effectiveness indications according to label conditions (N = 217)

	Label conditions				χ^2	<i>p</i>
	Weight		Cardiac			
	<i>n</i>	%	<i>n</i>	%		
This packaging...						
... grabs my attention	59	55.66	81	72.97	7.099	.008
... is easy to understand	100	94.34	99	89.19	1.891	.169
... is believable	59	55.66	64	57.66	.186	.666
... makes me stop and think	39	36.79	55	49.55	3.594	.058
... taught me something new	33	31.13	33	29.73	.050	.822
... Is relevant to me	36	33.96	41	36.94	.210	.647
How effective would this packaging be in the following ways?						
Making people think about the health effects of energy drinks.	37	34.91	52	46.85	3.196	.074
Discouraging people from wanting to drink energy drinks.	26	24.53	39	35.14	2.907	.088
Overall, how effective is this packaging?	31	29.25	34	30.63	.050	.824

Note. Participants assigned to the control condition (n = 126) did not respond to perceived effectiveness measures, and are not included in this analysis.

A secondary exploratory aim was to examine the association between perceptions of the effectiveness of the graphic warning labels and intentions to reduce ED consumption. As shown in Table 11, Spearman's rho correlation coefficients indicated that there were

statistically significant weak positive to moderate positive correlations between measures of perceived effectiveness and intentions to reduce ED consumption. More specifically, the perceptions that the labels prompted participants to ‘stop and think’ and would be effective at making people think about the health effects of EDs, at discouraging consumption and being overall effective, were moderately associated with participants’ intentions to reduce consumption.

Table 11

Summary of correlations (Spearman’s rho) between perceived effectiveness measures and intentions to reduce ED consumption according to label condition (N = 217)

	Label condition		
	Total	Weight	Cardiac
This packaging...			
... grabs my attention	.219**	.232*	.216*
... is easy to understand	.045	-.050	.131
... is believable	.283**	.302**	.268**
... makes me stop and think	.488**	.521**	.469**
... taught me something new	.283**	.321**	.243*
... is relevant to me	.286**	.322**	.258**
How effective would this packaging be in the following ways?			
Making people think about the health effects of energy drinks.	.405**	.456**	.374**
Discouraging people from wanting to drink energy drinks.	.417**	.464**	.378**
Overall, how effective is this packaging?	.433**	.488**	.386**

Note. Participants assigned to the control condition ($n = 126$) were not asked to respond to perceived effectiveness measures as they did not view a label, and are not included in these analyses.

* Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

3.10 Exploratory subgroup analyses

As previously reported, results indicated that graphic warning labels had no significant effect on intentions to reduce ED consumption. Further exploratory analyses were conducted to identify potential differences in intentions scores among subgroups. A series of Kruskal-Wallis tests were performed for selected demographic and consumption variables. As shown

in Table 12, there was a statistically significant difference among gender subgroups in the cardiac effects label condition, with female participants having higher mean rank intention scores than male participants.

Table 12

Summary of Kruskal-Wallis statistics comparing differences in intention scores according to label conditions among subgroups (N = 343)

	Label conditions								
	Control			Weight			Cardiac		
	<i>n</i>	Mean Rank	χ^2	<i>n</i>	Mean Rank	χ^2	<i>n</i>	Mean Rank	χ^2
Gender ^a									
Male	67	59.40	.316	59	49.20	.852	52	48.00	3.832
Female	54	62.78	<i>p</i> = .574	43	54.65	<i>p</i> = .356	55	59.67	<i>p</i> = .050
Age									
18-24	84	62.93	.061	66	49.06	3.687	81	58.39	1.671
25-39	42	64.63	<i>p</i> = .804	40	60.83	<i>p</i> = .055	36	49.55	<i>p</i> = .196
SES quintile ^b									
More disadvantaged	68	66.29	1.245	49	53.82	.178	50	57.04	.216
Less disadvantaged	57	59.08	<i>p</i> = .264	55	51.33	<i>p</i> = .673	60	54.22	<i>p</i> = .642
Highest qualification ^c									
Secondary school or less	45	67.51		44	53.48		40	58.70	
Some tertiary/Completed vocational training	66	61.66	1.524	47	53.23	.093	57	54.75	.999
Finished university (bachelor's degree or higher)	14	54.82	<i>p</i> = .467	14	50.71	<i>p</i> = .954	14	48.92	<i>p</i> = .607
BMI									
Normal/Underweight	77	62.43	.173	56	52.16	.228	59	56.93	.107
Overweight	49	65.18	<i>p</i> = .678	50	55.00	<i>p</i> = .633	52	54.94	<i>p</i> = .744
Consumption frequency ^b									
Non-daily consumers	94	63.73	.015	87	53.56	.002	84	58.32	1.819
Daily consumers	32	62.81	<i>p</i> = .901	19	53.24	.967	27	48.78	<i>p</i> = .177
Knowledge of health effects									
No	54	57.90	2.256	36	49.15	1.102	38	54.54	.120
Yes	72	67.70	<i>p</i> = .133	70	55.74	<i>p</i> = .294	73	56.76	<i>p</i> = .729

Note. ^a 3.8% of participants (control *n* = 5, weight = 4, cardiac = 4) identified as neither male nor female, or did not declare their gender, and are not included in this analysis.

^b 1.17% of participants (control n = 1, weight = 2, cardiac = 1) did not declare the postcode of their residences, and are not included in this analysis.

^c .87% of participants (control n = 1, weight = 1, cardiac = 1) did not specify their highest qualification obtained, and are not included in this analysis.

^b Responses were dichotomised to form 'non-daily consumers' and 'daily consumers'.

4. Discussion

The need for interventions to reduce ED consumption is a relatively recent public health agenda. Whilst FoP warning labels have been widely implemented in the context of SSB and tobacco studies (Grummon & Hall, 2020; Hammond, 2011; Levy et al., 2017), the support for the impact of such a strategy on ED consumption is limited. This study added to the evidence base for interventions to reduce ED consumption by comparing the relative effectiveness of graphic warning labels communicating the different adverse health effects associated with ED consumption (weight and cardiac effects) in reducing consumption intentions in an experimental setting among a sample of Australian ED consumers.

4.1 The potential impact of graphic warning label types on intentions to reduce energy drink consumption

The primary aim of this study was to determine the potential impact of graphic warning labels on intentions to consume EDs by comparing the relative effectiveness of different health messages, as compared to no warning label. The hypotheses that graphic warning labels would elicit greater intentions than the control condition (no label) and that the label depicting cardiac effects would be more effective than depicting weight gain were not supported. The results indicated that exposure to graphic warning labels did not result in greater intentions to reduce ED consumption than viewing no label. Hence, there was not a direct relationship between graphic warning label type and intentions to reduce ED consumption, and neither label type was more effective than the other. These findings were not consistent with that of previous SSB studies, which found that warning labels significantly reduced the selection of SSBs compared to the control condition (Billich et al., 2018; Grummon et al., 2019; Roberto et al., 2016), and that different health messages varied in terms of their impact the choice of SSBs (Mantzari et al., 2018).

The lack of a difference in intentions to reduce ED consumption between graphic warning labels can be partially attributed to the fact that the results of this study were generated from an experimental setting and may not be a realistic reflection of the effectiveness of graphic warning labels for EDs in the real world. Participants assigned to the experimental conditions were only briefly exposed to the health messages, while the evidence suggests that extended exposure to labels should produce a more accurate impression of their effectiveness (Strahan et al., 2002). In a similar vein, the lack of a relationship between graphic warning label types and intentions to reduce ED consumption found in this study does not necessarily suggest that FoP labelling would be ineffective at positively influencing consumption behaviour, as rarely does an intervention operate on its own in the real world. Instead, successful campaigns to motivate behaviour change are multidimensional. Whilst individual interventions can be effective in an experimental setting, the coordination of different strategies can exhibit powerful synergy and achieve greater success in health promotion (Warner, 2000). Since ED consumption is a relatively novel public health concern, messages in the real world that communicates the adverse effects of EDs is uncommon, this could play a part as FoP warning label is only one factor of a multifaceted approach to informing consumers and encouraging reduced consumption.

Despite FoP warning labels having the potential to reduce the intended selection of SSBs (Billich et al., 2018; Grummon et al., 2019; Roberto et al., 2016), a possible explanation for the lack of an impact on intentions to reduce consumption for EDs is that ED consumers are different from SSB consumers. More specifically, there may be unique drivers underlying ED consumption that makes ED consumers more resistant to health messages. While similar to SSBs, consumers perceive the EDs as functional products that serve practical purposes. Tobacco control research suggests that motives underlying smoking may prevented attempts at cessations (Fidler & West, 2009). Similarly, the sample of ED consumers involved in this

study reported various reasons for consuming the beverage. More than 80% of the participants reported having used EDs to help concentrate for work or study, more than 60% reported having used it to feel awake in general and cope with a lack of sleep. Higher percentages of the participants reported these functional purposes than recreational purposes, including ‘for the taste’ and ‘going out/partying’, as their reason for consuming EDs. This may have inhibited motivations to reduce ED consumption and mitigated the potential impact of the graphic warning labels.

4.2 Perceived severity, perceived vulnerability, fear, response efficacy, and response costs as mediators of the relationship between graphic warning label type and intentions to reduce energy drink consumption

This study also explored constructs of PMT through a parallel mediation model. It was anticipated that perceived severity, perceived vulnerability, fear, response efficacy, and response costs would mediate the relationship between graphic warning label type and intentions to reduce ED consumption. However, the findings did not support this hypothesis as graphic warning label type had no direct or indirect effects on intentions to reduce ED consumption. The absence of mediation effects can be partially attributed to the inconsistent associations between PMT variables and intentions to reduce ED consumption. The hypothesis that perceived severity, perceived vulnerability, fear, response efficacy, and response costs will be positively correlated with intentions was only partially supported. There was no association between perceived severity of weight gain and intentions for the whole sample. The strength of the associations present ranged from weak to moderate. When divided by conditions, the associations were once again inconsistent in terms of significance and correlation strength. Another potential explanation is the low internal consistencies for measures of perceived severity, response costs and self-efficacy, indicating that items within these subscales may not have measured the same constructs they were purposed to measure.

Furthermore, whilst there is strong support for PMT (Boss et al., 2015; Pechmann et al., 2003; van Bavel et al., 2019), the model only describes its components and does not specify the relationship between variables, meaning that the use of a parallel mediation model to explore PMT constructs may not have accurately portrayed their interactions.

4.3 Graphic warning label depicting cardiac effects more effective for female participants

ED research has shown that intentions to reduce ED consumption varied with consumer profile (Temple et al., 2016). Results of exploratory subgroup analyses, when divided by label conditions, indicated that intentions to reduce ED consumption were higher for female participants who viewed the cardiac effects label. This finding is consistent with several previous studies regarding the effects of gender on health information processing, as this gender difference can be explained by the fact that women are more likely to engage with nutrition labels and health information on food packaging than men (Rasberry et al., 2007; Satia et al., 2005; Su et al., 2015). Similarly, women are also more receptive than men to health messages (Ek, 2015). Moreover, the difference in intentions to reduce ED consumption between male and female participants is potentially due to women being more health-conscious than men, as female participants are more likely to avoid food products due to perceived un-healthiness (Bärebring et al., 2020).

4.4 Perceived effectiveness of graphic warning labels

A secondary aim of this study was to compare participants' perceptions of the effectiveness of the different graphic warning label types, as perceived effectiveness was found to predict intentions and subsequent behaviour change in the context of anti-smoking interventions (Brennan et al., 2014; Morgan et al., 2020). The results of this study were partially consistent with these findings, as apart from the perception that the labels are 'easy to understand', there were weak to moderate associations between measures of perceived

effectiveness and intentions to reduce ED consumption. Overall, the graphic warning labels depicting weight gain and cardiac effects were perceived as similarly effective apart from a significantly larger portion of participants in the cardiac effects label condition who agreed that the label grabbed their attention, which may explain why intentions to reduce ED consumption did not differ between label types.

Participants' perceptions of the effectiveness of the graphic warning labels provided insight into how they would be received by consumers in terms of understandability and acceptability. The fact that around 90% of participants exposed to either label agreed that they were easy to understand was promising. On the other hand, only around half of the sample exposed to either label thought that they were believable. This finding suggests that a warning label communicating the presence of health effects alone may not be adequate in convincing the participants and that consumers may need to understand the science behind a health message in order to believe it. Additionally, only around a third thought that either label was relevant or taught them something, which hints at the possibility that the messages communicated by both labels did not resonate with consumers. Hence their lack of significant impacts on intentions compared to no label.

4.5 Strengths and limitations

This study had several strengths. Firstly, the inclusion of a control group allowed for the comparison between experimental labels and no-label. The study was adequately powered. Inspection of data indicated that randomisation was successful with no significant differences in demographic characteristics between conditions. Additionally, measures of PMT constructs were adapted from existing studies (Boss et al., 2015; Johnston & Warkentin, 2010; Milne et al., 2010). Internal consistencies were excellent apart from the subscales for perceived severity, response costs and self-efficacy. Potential response biases were somewhat mitigated by the fact that the study is an online self-administered survey.

Conversely, this study was not without methodological limitations. A notable limitation of this study was the inclusion of only adult participants aged 18 to 39, while a considerable portion of ED consumers are adolescents (Nuss et al., 2021). This study had also employed a convenience sample. Participants were recruited online using Facebook and the University of Adelaide School of Psychology Research Participation System. The sample may not be nationally representative as online recruitment restricted this study to those who self-select to participate (self-selection bias). However, the primary purpose of this study was to compare the relative effectiveness of different graphic warning labels and not to establish population parameters. Furthermore, the outcome variable in this study was intentions to reduce ED consumption, which may not translate to actual behaviour change.

4.6 Practical implications and recommendations for future research

This study has several implications for the development of effective interventions to promote positive behaviour change regarding ED consumption. The results indicated that graphic warning labels depicting weight gain and cardiac effects did not differentially influence intentions to reduce ED consumption for the overall sample. Parallel to these findings, participants' perceptions of the effectiveness of the two labels were similar apart from one indicator. While the results did not provide support for the effectiveness of graphic warning labels in comparison to no label, neither does it invalidate the strategy in the context of interventions to reduce ED consumption, as the findings of previous research suggest that health communication alone is not enough to produce actual behaviour change (Beaudoin et al., 2007; Gill & Boylan, 2012). Hence, a 'whole system' approach incorporating interventions at many levels should be adopted (Jackson-Morris, 2020; Warner, 2000), one that encompasses policies, environmental modifications such as increasing health literacy and regulating the costs and availability of the products.

As previously discussed, the absence of an effect for graphic warning labels can be partially explained by ED consumers being different from consumers of other products, that FoP health messaging as an intervention on its own is not enough to motivate them to engage in positive consumption behaviours. This study briefly looked at the motivations for ED consumption. A future research direction is for qualitative studies to explore the drivers underlying ED consumption and the messages that might resonate with ED consumers. Further quantitative studies could benefit from a longitudinal design, as longer and repeated exposures in controlled experimental settings can give a more comprehensive idea of the impact of warning labels (Strahan et al., 2002). Investigations into the types of warning labels that might help consumers understand the science behind health messages are required. Future research should also examine the potential impact of graphic warning labels on ED consumption among adolescents, who make up a notable portion of ED consumers (Nuss et al., 2021). This study explored constructs of PMT as mediators of the relationship between graphic warning labels and intentions to reduce ED consumption. However, the simple parallel mediation model may not have adequately described the interactions between variables. The algebraic relationships between PMT constructs could be investigated further by conducting a path analysis.

4.7 Conclusion

This study explored the potential impact of FoP warning labels on ED consumption by comparing the relative effectiveness of different health messages in reducing intentions to consume EDs. The results from a randomised experimental online survey involving an Australian sample of 343 adult ED consumers indicated that, overall, graphic warning labels did not influence intentions. There was, however, a significant gender difference for those who viewed the label depicting cardiac effects. The potential for FoP warning labels to reduce ED consumption requires further investigations. The findings of this study revealed directions

for future research and contributed to the growing evidence base, one that will inform the development of effective health policy interventions to encourage reduce consumption of EDs.

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Appendix A: Texts and Image Used in Facebook Advertisement

Can you spare 15-30 minutes to help us in our research?

Energy drinks help many people get through their day by providing a boost of energy. But how much do people know about these caffeinated beverages?

We are looking for people aged between 18 and 39 years who have consumed any energy drink in the last three months to participate in our survey on knowledge, attitudes and behaviour in relation to energy drink consumption.

By taking part in our study, you will be in the running to win 1 of 3 \$50 Coles/Myer gift vouchers.



Appendix B: Participant Information Sheet



PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Knowledge, attitudes and behaviour in relation to energy drink consumption

PRINCIPAL INVESTIGATOR: Dr Kerry Ettridge

STUDENT RESEARCHER: Xiaole Zhu

STUDENT'S DEGREE: Bachelor of Psychological Science

Dear Participant,

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

What is the project about?

Researchers from the South Australian Health & Medical Research Institute (SAHMRI) and the University of Adelaide are conducting a survey to gather information on people's knowledge, attitudes and behaviour in relation to consuming energy drinks. This information will be used to guide future food and health research and inform the development of health policy interventions.

Who is undertaking the project?

This project is being conducted by Xiaole Zhu. This research will form the basis for Honours Degree of Bachelor of Psychological Science at the University of Adelaide under the supervision of Dr Kerry Ettridge, Professor Caroline Miller and Associate Professor Rachel Roberts. Project funding will be provided by SAHMRI.

Why am I being invited to participate?

You are being invited as you are adults between the age of 18 to 39 years, currently living in Australia, possess the ability to read in English and consume energy drinks at least occasionally.

What am I being invited to do?

You are being invited to participate in an online survey. Participation will involve completing a questionnaire where you will be asked to answer a series of questions by selecting the appropriate answer from a list of options. The questionnaire will assess knowledge, attitudes and behaviours in relation to energy drink consumption.

How much time will my involvement in the project take?

The questionnaire will take approximately 15 minutes. You will not be recontacted for research purposes in the future. To reimburse for your time, you may enter a draw to receive one of three \$50 Coles/Myer gift vouchers upon completion of the survey.

Are there any risks associated with participating in this project?

You may be inconvenienced by giving up time to complete the survey. You may contact the researchers in the unlikely event that you encounter issues or have concerns about the project. Any adverse events will be immediately reported to the Human Research in the School of Psychology Subcommittee convener and any instructions given by the review board will be abided.

What are the potential benefits of the research project?

There are no immediate benefits to the participants. However, this project may help to develop a better understanding on adult's knowledge, attitudes and behaviour in relation to energy drink consumption.

Can I withdraw from the project?

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

What will happen to my information?

The survey is anonymous and no personally identifiable information will be accessible to the researchers. Standard procedures for protecting the data set will be used. The data will be stored securely on a server at SAHMRI for a minimum of 5 years after the completion of the project and will be password protected, after which all use of the data will be complete, and the data will be destroyed.

The project will be written up as an Honours thesis for assessment purposes and publication in peer reviewed journal articles. The abstracts will be submitted for presentation at conferences. No individuals will be identifiable in any publications or conference presentations.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Who do I contact if I have questions about the project?

If you have questions or problems associated with the practical aspect of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult:

Lead researcher in charge of the project – Dr Kerry Ettridge
Phone: [REDACTED]
Email: [REDACTED]

What if I have a complaint or any concerns?

This study has been approved by the Subcommittee for Human Research in the School of Psychology. This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the convener of the Subcommittee for Human Research in the School of Psychology.

[REDACTED]
[REDACTED]

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

If I want to participate, what do I do?

If you wish to participate and have read through the study info, click 'yes' on the survey welcome screen to indicate consent, and you will proceed to the questionnaire.

Yours sincerely,

Dr Kerry Ettridge
Xiaole Zhu
Professor Caroline Miller
Associate professor Rachel Roberts

Appendix C: Online Survey

Survey screener

Click the link below to download a copy of the participant Information sheet.

Click 'yes' if you agree to participate and would like to complete the survey.

By Clicking the 'yes' button below you agree to the following statements:

- I have read and understood the participant information provided above
 - I have been given the contact details of the researchers and have been invited to contact them for further information or with any questions
 - I understand that my participation is completely voluntary and I can withdraw from the study at any time
 - I understand that any information that might potentially identify me will not be used in any published material
 - I understand that the information may be used for future research purposes if needed, including additional data analysis by researchers granted access to the data
 - I consent to participate in the study as outlined to me
- Yes
- No

[End Page]

1. Are you a first-year psychology student participating to receive course credit?

- Yes
- No

[If answered 'Yes' for Q1]

1a. Please enter your unique identity code (RPS number)

1b. Please enter your student ID number (e.g., a1234567).

2. What is your age?

- 18 to 24 years
- 25 to 39 years
- 40 to 60 years
- 60 years plus

3. Are you currently residing in Australia?

- Yes
- No

4. Are you fluent in English?

- Yes
- No

Energy drinks are carbonated drinks that contain sugar, caffeine and other stimulant ingredients and supplements, and are considered functional beverages that boost energy levels and concentration. Examples of energy drinks include Red Bull, Monster, Rockstar, V Energy and Mother. Does not include sports drinks such as Gatorade and Powerade.



5. Have you consumed any energy drinks in the past three months?

- Yes
- No

6. Do you, or anyone in your family, work in the beverage industry?

- Yes
- No

[End page]

Energy drink consumption

1. How often do you usually drink any energy drinks?

- Less than once per month
- 1-3 times per month
- Once per week
- More than once per week
- Daily

2. On days that you consume energy drinks, how much do you usually consume? Include those consumed with alcohol?

Please enter the number of can/s as applicable or total millilitres (ml) consumed. The standard small cans are 250ml. The standard large cans are 500ml.

(250ml can/s)

(500ml can/s)

Or the volume consumed in ml

3. What is the most amount or number of energy drinks you have ever consumed in one day? Include those consumed with alcohol?

Please enter the number of can/s as applicable or total millilitres (ml) consumed. The standard small cans are 250ml.

The standard large cans are 500ml.

(250ml can/s)

(500ml can/s)

Or the volume consumed in ml

4. How often do you usually drink any alcohol?

- Daily
- More than once per week
- Once per week
- 1-3 times per month
- Less than once per month
- Never

5. On days that you consume energy drinks, do you usually drink alcohol?

- No
- Yes, I combine energy drinks and alcohol
- Yes, but I do not combine energy drinks and alcohol

6. How often do you usually drink the following packaged drinks:

	Daily	Weekly	Monthly	Less than monthly	Never
Soft drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Artificially sweetened (diet) soft drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flavoured mineral water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bottled water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. In your opinion, is the amount of energy drinks that you drink during an average week...?

- Too much
- Just right
- Not enough

- Don't know

8. Have you ever consumed energy drinks for the following reasons?

Select all that apply.

- To stay awake or to help concentrate for work or study
 To stay awake or alert for driving
 To boost energy while playing video games
 To feel awake in general (not for any specific activity)
 To cope with a lack of sleep
 For going out/partying
 To mix with alcohol
 To help sobering up or with hangovers after drinking alcohol
 For the taste
 To increase physical performance
 To help lose weight or help keep weight off
 Rehydration
 Other

[If answered 'Other' for Q8]

8a. Please specify

9. How often do you consume energy drinks at the following locations?

	Never	Seldom	Sometimes	Almost always	Always
At home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At the homes of friends and/or family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At study location (e.g., university, TAFE, college)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a public event/location (e.g., shopping centre, nightclub, concert)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Awareness of current advisory statements

10. Are you aware of any existing warning messages on energy drink packaging?

- Yes
 No

[If answered 'Yes' for Q10']

10a. Please record in as much detail as you can remember about these messages. If you are unsure, please write "don't know".

Knowledge of health effects

11. To what extent do you believe that your current health is at risk due to the amount of energy drink that you are consuming?

- Not at all at risk
- Somewhat at risk
- Moderately at risk
- Very much at risk

12. To what extent do you believe that your future health at risk due to the amount of energy drink that you are consuming?

- Not at all at risk
- Somewhat at risk
- Moderately at risk
- Very much at risk

13. If an average adult drank 500ml energy drink every day, how likely are they to have health problems later in life?

- Very unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Very likely

14. Do you know of any illnesses or health effects associated with drinking energy drinks?

- Yes
- No

[If answered 'Yes' for Q14]

14a. To what extent are the following health effects associated with drinking energy drinks?

	Not at all	Very little	Somewhat	Quite a bit	A great deal
Tooth decay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weight gain/obesity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Type 2 Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart or cardiovascular diseases/conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Depression	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
High blood pressure (hypertension)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Asthma	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dehydration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Immune system dysfunction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Warning label evaluation

You will now be shown the packaging of a can of energy drink and asked some questions.

[A random image selection is generated; participants will only see one packaging/label: control, weight gain and cardiac effects (heart palpitations and heart disease)]





[Skipped if viewed the control]

15. This packaging...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
... grabs my attention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is easy to understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is believable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... makes me stop and think	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... taught me something new	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is relevant to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[Skipped if viewed the control]

16. This packaging makes me feel...

	Not at all	Very little	Somewhat	Quite a bit	A great deal
... anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

energy drinks
would not bother
me

I am able to

reduce my
consumption of
energy drinks
without much
effort

The benefits of

reducing my
consumption of
energy drinks
outweigh the cost

I would be

discouraged
from reducing
my consumption
of energy drinks
because it would
be too much
trouble

Reducing my

consumption of
energy drinks
would cause me
problems

Demographics questions

1. Can you please tell me your age in years?

2. What is your gender?

- Male
- Female
- Other
- Prefer not to say

3. What is the postcode of your residence?

4. What is your height?

Please record your height without shoes in centimetres. If unsure, please indicate your best guess.

5. What is your weight in kilograms?

Please record your weight when undressed in the morning. If unsure, please indicate your best guess.

6. Do you consider yourself to be...?

- An acceptable weight
- Underweight
- Overweight
- Don't know
- Prefer not to say

7. What is the highest qualification you have obtained?

- Some primary school
- Finished primary school
- Some secondary school
- Finished secondary school
- Some tertiary education (e.g., university, TAFE, college)
- Finished vocational training/received qualification (apprenticeship, certificate or diploma)
- Finished university training/received qualification (bachelor's degree)
- Finished higher degree university training/received qualification (PhD, masters, graduate diploma)
- Don't know
- Prefer not to say

8. Does your work currently include evening or night shifts at least some of the time?

- Yes
- No

9. Have you ever been told by a doctor or other health professional that you have the following:

	Yes	No
Type 2 Diabetes	<input type="radio"/>	<input type="radio"/>
Heart disease	<input type="radio"/>	<input type="radio"/>
Arthritis or gout	<input type="radio"/>	<input type="radio"/>
Depression	<input type="radio"/>	<input type="radio"/>
Lung conditions such as Asthma or COPD (Chronic Obstructive Pulmonary Disease)	<input type="radio"/>	<input type="radio"/>
Tooth decay	<input type="radio"/>	<input type="radio"/>
Sleep conditions such as insomnia, snoring or sleep apnoea	<input type="radio"/>	<input type="radio"/>

9a. If yes for Type 2 Diabetes: are you currently taking medication for this condition?

- Yes
- No

9b. If yes for Depression: are you currently taking medication for this condition?

- Yes
- No

9c. If yes for Sleep conditions: do you use a CPAP (Continuous positive airway pressure) machine?

- Yes
- No

[END SURVEY]

Thank you for your participation. Click the link below to download a copy of the participant information sheet.

Please click "submit" to submit your survey responses. You will then have the option of entering the draw to win one of three \$50 vouchers.

We thank you for your participation.

Separate survey to collect otherwise individually identifiable data

Are you a first-year psychology student participating to receive course credit?

- Yes
- No

[if answered 'Yes']

1a. Please confirm your unique identity code (RPS number)

Please confirm your student ID number (e.g., a1234567).

[If answered 'No']

Please enter your email address if you wish to enter a draw to win one of three \$50 Coles/Myer gift vouchers. You will be notified by email if you have won.

[End page]

Thank you for your participation.

To register your interest in receiving a copy of the findings of the research you can contact SAHMRI either by phone 08 8218 4092 or by email info@sahmri.com.

This research is carried out in compliance with the Privacy Act and the Australian Privacy Principles, and the information you have provided will only be used for research purposes only. SAHMRI's Privacy Policy is available via their website (www.sahmriresearch.org/privacy-policy) which contains details about how to access or correct your information, how to make a complaint and how that complaint will be handled.

The study also has ethics approval from the University of Adelaide's Subcommittee for Human Research in the School of Psychology. If you wish to speak with an independent person regarding a concern or complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the convener of the Subcommittee for Human Research in the School of Psychology on [REDACTED].