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Sun safety in young Queensland adults: behaviours, knowledge, and responses to health-based and appearance-based text messages

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ABSTRACT

Objective: High melanoma rates in Queensland, Australia suggest that sun protection campaign message content may require revision. The aim of this experimental study was to explore young Queensland adults' sun-related exposure and knowledge level, before investigating the effectiveness of five health text messages at improving sun protection intentions.

Methods: Ninety-five young adults aged 17 to 24 years participated in the study. Most content was modelled on Protection Motivation Theory. The texts allowed for the comparison of fear appeals with and without efficacy messages, health-versus appearance-based messages, and the exploration of understudied, appearance-based message content alluding to melanoma surgery scarring.

Results: Proportionally, significantly more females (60.34%) sunbathed compared to males [26.47%, χ^2 (1, $n = 92$) = 8.55, $p = .003$, phi = -.33], and females ($M = 16.03$) had significantly greater knowledge levels than males [$M = 12.81$, t(89), –.3.99, $p < .001$, $\eta^2 = .01$]. There was no difference between health and appearance-based messages on participants' sun protection intentions as assessed by the Protection Motivation Theory χ^2 (5, $n = 94$) = 2.97, $p = .704$.

Conclusions: Future research should contribute to the debates surrounding fear appeals and health-versus appearance-based messages with different communication modalities. Health promotion campaigns on sun protection should target message content to audiences.

KEY POINTS

What this topic adds:

(1) Text messages may not be robust enough to distinguish between the effects of appearance and health-based information in determining sun-protective behaviours.
(2) Knowledge about melanoma does not deter young females from sunbathing.
(3) More robust health communication approaches than health text messages are required for testing the Protection Motivation Theory in predicting sun protective behaviours in samples of young adults with high health literacy.

What is already known about this topic:

(1) Queensland Australia is one of the most melanoma susceptible regions of the world.
(2) Many young Australian adults are not practicing sun safety.
(3) Appearance-based approaches are bett er at persuading younger people to protect against the sun than health-based ones.

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Queensland; sun protection; health; appearance; protection motivation theory

Melanoma is the deadliest skin cancer and was projected to be the third most diagnosed cancer in Australians in 2023 (Australian Institute of Health and Welfare [AIHW], 2023a). Among Australians aged 15–24 years, it became the second most diagnosed cancer between 2014–2018 (AIHW, 2023b).

Australians have been exposed to several sun protection campaigns, with SunSmart being the most well-known (SunSmart, n.d.-a). The intent is to increase sun safe attitudes and behaviours by improving public awareness and knowledge (SunSmart, n.d.-b) in the media, schools, workplaces, and the community (SunSmart, n.d.-c). While some studies report decreases in sunburn rates and improvements in Australians' sun protection practices (Tabbakh et al., 2019), others provide mixed conclusions (Glenister et al., 2022; Haynes et al., 2021; Thoonen et al., 2023; Walker et al., 2022). One opinion which all this research shares, however, is that many Australians are not practising sun safety.

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In 2020, Australia was ranked highest worldwide in overall (16,171 cases) and age-standardised (36.6 cases per 100,000 persons) melanoma rates (World Cancer Research Fund [WCRF], (n.d.). In Australia, Queensland has held the highest age-standardised melanoma rates of all states and territories since AIHW data collection began in 1982, with 2019 reporting an age-standardised rate of 77.7 cases per 100,000 persons (AIHW, 2023a). The increased rates in Queensland have been attributed to the high levels of ultraviolet radiation (UVR), a large Caucasian population and an avid outdoor culture (Whiteman et al., 2007). A recent report stated that two million adults and 390,000 children in Queensland received at least one sunburn during 2020 (Queensland Health, 2020). Also in 2020, young adults aged 18–29 years reported more sunburn than any other adult demographic and were 84% less likely to use sun protection compared with adults aged 45–64 years (Queensland Health, 2020). Hence, this young demographic is of particular concern and sun protection campaigns may need improvement.

Research can help sun protection campaigns better target specific audiences by assessing participant characteristics (Barrett et al., 2019). Sun-related behaviours pertaining to UV exposure and the use of sun protection are commonly explored (Barrett et al., 2019; Lee et al., 2014) because the extent of such behaviours helps predict skin cancer risk (Queensland Health, 2023). The type of sun exposure also may influence the campaign style, for example, distinguishing between intentional sun exposure such as that of sunbathers and incidental exposure (Day et al., 2017; Mahler 2015; Persson et al., 2018). Sun-related knowledge is also commonly explored in Australian samples and has been positively associated with increased sun protection (Day et al., 2014; Lee et al., 2014; Sideris & Thomas, 2019). Hence, knowing the sun-related behaviours and knowledge of a target group may result in a more effective campaign.

Also, research can contribute to campaign development by evaluating its subcomponents (Bauman and Nutbeam, 2014) including the social cognition theories underpinning message content. Protection Motivation Theory (PMT) (Rogers, 1975, 1983) is one of the more effective at predicting sun safe attitudes and health behaviour, including sun protective practices (Ch'ng & Glendon, 2013; McClendon & Prentice-Dunn, 2001; McMath and Prentice-Dunn, 2005). Importantly, other than Ch'ng and Glendon (2013), no quantitative PMT-based, sun-related study using a Queensland sample could be found, suggesting the need for such research in one of the most melanoma-susceptible regions in the world.

As explained by Maddux and Rogers (1983), PMT describes two cognitive appraisals people make when faced with a threat to their health (e.g., melanoma) and are offered a means to protect against it (e.g., sun protective behaviours). First, the individual undertakes a threat appraisal, where they sum the perceived severity of the threat with their perceived susceptibility to it. Then, the rewards of not engaging in the protective behaviour (*maladaptive response rewards*) are subtracted from that sum. Providing the combined perception of *severity* and *susceptibility* outweighs the maladaptive response rewards, the individual then undertakes a coping appraisal where they evaluate the proposed protective response. Here, they sum their perceived *self-efficacy* to engage in the behaviour with the perceived efficacy of the behaviour itself (*response-efficacy*). They then subtract the costs of engaging in the protective behaviour from the sum. According to PMT, if the threat and coping appraisals are strong enough, the individual has a greater protection motivation (*intention*) to protect themselves. Intention then serves as a useful predictor of future behaviours though current evidence suggests that the intention-behaviour gap is large (Sheeran & Webb, 2016).

The stimulus which precedes the undertaking of the cognitive processes of PMT is a *fear appeal* – a message which instils fear in its audience, prompting attitude and behaviour change (Rogers, 1975). Meta-analytic findings (Tannenbaum et al., 2015) affirm that fear appeals can be effective on their own, but work optimally when paired with an efficacy message.

In the sun protection context, interventions have drawn on *health-based* and/or *appearance-based fear appeal* information (Mahler, 2015). Health-based interventions have been implemented more often than appearance-based interventions in media campaigns such as SunSmart and in research (Mahler, 2015). However, appearance-based interventions have been receiving strong attention in research contexts over the last 20 years (Mahler, 2015). Appearance-based interventions have used educational text, UV photography and photoaging information, or have compared appearance-based educational videos against health-based educational videos (Ch'ng & Glendon, 2013; McMath and Prentice-Dunn, 2005; Persson et al., 2018; Tuong & Armstrong, 2015). McMath and Prentice-Dunn (2005) used essays on the detrimental effects of the sun on appearance, emphasising the importance of sunscreen and reducing sunbathing, along with graphic photos of skin cancer. Large scale meta-analytic reviews (Persson et al., 2018) have strongly supported the efficacy of appearance-based

interventions, reporting decreased sun exposure and increased use of sun protection. Studies in the meta-analytic review by Persson included a pre-test and post-test design to assess the efficacy of the appearance-based interventions. In addition, 17 of the studies used a UV photography intervention. An example of a real-life, appearance-based media campaign is SunSmart's 2004–05 Tattoo campaign. Tattoo was designed for Australians aged 17–24 years and portrayed a young woman with a sizeable melanoma surgery scar. SunSmart (n.d.-a) reported that the campaign was well received, promoting positive attitude changes against tanning.

Recently, SunSmart also released The Two Sides of the Sun commercial on Television in Western Australia in 2021 (Cancer Council Western Australia, 2022). It depicted a young man, panning from one side of his face, which was unblemished, to the other side, which was severely scarred from skin cancer surgery. Even more recently, in late 2023, SunSmart Victoria launched the Don't Let Cancer In campaign, the commercials of which comprised themes of facial surgery scarring (SunSmart, n.d.-d). Given the recency of these commercials, no evaluations on their reach or effectiveness could be found.

There is some evidence in the literature that appearance-based approaches are better at persuading particularly younger people to protect against the sun than health-based ones (Cheng et al., 2019; Mahler, 2015; Owen et al., 2016; Tuong & Armstrong, 2015). This argument is also supported in a recent systematic review which assessed sun protection intervention studies using high school samples and concluded that the most effective interventions were those which went beyond conventional health-based messaging and used alternative approaches like appealing to appearance (McNoe et al., 2021). However, no studies comparing health- and appearance-based interventions emphasising surgical scarring have been found using Queensland young adult samples.

The present study has two aims. The first is to explore the background characteristics of sun-related behaviour and knowledge in a young Queensland adult sample. These insights may help to indicate the level of skin cancer risk in the sample, and their knowledge base, thus informing campaigns targeting this demographic.

The second aim is to determine how young Queensland adults' appraisals of melanoma influence their intentions to engage in sun safe behaviours as a function of five persuasive text messages. The five texts emphasise: PMT's threat appraisal (Condition 1, a health-based fear appeal); PMT's coping appraisal (Condition 2, an efficacy message); a combination of PMT's threat and coping appraisals (Condition 3); appearance concern in relation to melanoma surgery scarring (Condition 4, an appearance-based fear appeal); and a combination of the same appearance concern information with PMT's coping appraisal information (Condition 5). There was also a text which emphasised an unrelated health matter (Condition 6; the control). The testing of these persuasive texts will allow for the comparison of fear appeals with and without efficacy messages, further contributing to the debate on fear appeal effectiveness (Kok et al., 2018). Testing the texts will also allow for the comparison of health-based and appearance-based messages and their respective fear appeals. Finally, testing an appearance-based health message specifically emphasising melanoma surgery scarring may provide an avenue for further research on this understudied type of message content. This study's three hypotheses are -

H1: Participants exposed to all sun protection messages will report greater intentions to protect against the sun compared with participants exposed to the control text message.

H2: Participants exposed to the text messages containing fear appeals combined with efficacy messages (Conditions 3 and 5) will report greater intentions to protect against the sun compared with participants exposed to the other text messages.

H3: Participants exposed to the health message containing appearance concern information combined with coping appraisal information (Condition 5) will report the greatest intentions to protect against the sun compared with participants exposed to all other text messages.

Method

Participants

Ninety-five young adults participated in the study. Participants were aged 17–24 years ($M = 19.91$; $SD = 1.62$). Of the participants, 58 were female (61%) and 34 were male (35.79%). Three participants did not provide their identified gender (3.16%). Of the sample, seven had type I skin (7.40%), 39 had type II skin

(41.10%), 35 had type III skin (36.80%), 10 had type IV skin (10.50%), three had type V skin (3.20%), and none had Type VI skin. One participant did not provide their skin type (1.05%).

Materials and design

Background information items.

The background items concerned identified gender, age, Fitzpatrick skin phototype (Australian Radiation Protection and Nuclear Safety Agency, n.d.) and sunbathing status. The six skin types were Type I (pale white skin, extremely sensitive, always burns); Type II (white skin, very sensitive, burns easily); Type III (light brown skin, sensitive, sometimes burns); Type IV (moderate brown skin, mildly sensitive, burns minimally); Type V (dark brown skin, resistant, rarely burns); Type VI (dark brown-black skin, very resistant, never burns). Sunbathing status was measured by the item "Do you ever sunbathe (spend time outside just to expose your body directly to the sun, e.g., for enjoyment or for a tan)?" and participants were required to respond "Yes" or "No" to this item.

Sun Exposure and Protection Index (SEPI; 16 items).

The SEPI (Detert et al., 2015) was used to examine patterns of UV exposure and protective behaviours among participants. Items were added to the SEPI part I (SEPI I) and part II (SEPI II) regarding the wearing of sunglasses so that all five recommended sun protective behaviours (Cancer Council Australia, n.d.) were present.

Participants responded to the SEPI I using a 5-point Likert scale ranging from (1) never to (5) always. Regarding the SEPI II, participants responded using a six-point Likert-type scale to best reflect their engagement in a given sun protective behaviour. Higher scores indicated a greater propensity to engage in sun protective behaviours. SEPI II items covered the wearing of sunscreen for sun protection, wearing covering clothes, seeking shade from the sun, wearing sunglass for sun protection, and sunbathing.

In terms of reliability, Detert et al. (2015) reported a relatively sound Cronbach alpha coefficient ($\alpha = .69$) in an Australian adult sample ($n = 209$) for SEPI I, and a similar coefficient ($\alpha = .67$) for SEPI II. In the present study, items 7–9 of the SEPI I were removed to improve reliability. Both SEPI scales reported questionable Cronbach alpha values (SEPI I: $\alpha = .65$; SEPI II: $\alpha = .58$), However, as each scale comprised a small number of items (below 10) and Cronbach's alpha is sensitive to the number of items in a reliability analysis, the less sensitive inter-item correlation coefficient was used to interpret their reliability. To this end, SEPI I and II had sound inter-item correlation coefficients (SEPI I: .22; SEPI II: .20). Sound-to-strong inter-item correlation coefficients are denoted by values between .20 and .46 (Pallant, 2016).

Skin Cancer and Sun Knowledge Scale (SCSK; 25 items)

This study used the SCSK (Day et al., 2014) to assess participant knowledge. Regarding modifications, the response options for an item asking when the sun is strongest during a 24-hour period were changed to be consistent with Queensland's average UVR index rating (Australian Radiation Protection and Nuclear Safety Agency, 2021) eight days before the survey's publication. Similarly, the subject of items 24 and 25 was changed from "skin cancer" to melanoma, to better reflect the study. Response options included true/false sets, or a multi-choice style set with one correct answer. The total number of correct responses out of the 25 questions was used. Day et al. (2014) reported acceptable levels of internal consistency reliability (*KR-20* = .69; $n = 514$). The SCSK scale reported an acceptable Kuder-Richardson Formula 20 coefficient of .74 in the current study.

Text message conditions

The survey's experimental conditions consisted of six original pieces of text, one of which acted as the control text. Text was chosen over other modalities (e.g., images or video clips) because the use of text allowed for more control over the targeting of the constructs.

Australian government statistics, health websites, and book material were used to inform the persuasive content of PMT-based text conditions (1 through 3). Condition 4 was atheoretical because no prior research could be found which used PMT to design an appearance-based text intervention. For Condition 4, United States (US) government health website content and anecdotal stories from US and Australian online news articles were used. Condition 6 (the control condition) drew on Australian Government material to persuade readers to eat a healthy diet. Participants were randomised to only receive one text condition. Table 1 reproduces the appearance-based fear text message (Condition 4) along with the addition of a coping appraisal message (Condition 5). For the full set of texts with references please refer to the Supplementary Materials file.

In terms of face validity, five undergraduate psychology students at a Queensland university read the texts and rated them on how well they targeted their

Table 1. Health message content for Condition 4 and Condition 5.

Appearance-based fear appeal text (Condition 4):
The removal of a melanoma can result in visible scarring and physical disfigurement. Even when caught early, the surgery will require cutting out a large margin of healthy skin around the cancer, often leaving a scar far bigger than just the mole itself. Skin grafts or similar procedures may also be required, where whole patches of skin are taken from other parts of the body and used to cover the large area of removed tissue (Medline Plus, 2021). An article by Grumman-Bender (2018) for Yahoo Life, told the story of Tracy Callahan, a North Carolina woman with an early stage, mere 3-millimetre-wide melanoma. She required a skin flap procedure (similar to a graft), which left her with an oval-like scar on her leg, approximately 20 centimetres in diameter, and requiring a massive 64 stitches. Some melanomas, if found at a later stage, result in far more scarring. For example, as reported by Bath (2019) for The Northern Daily Leader, when stage 3 melanoma was found in the lymph nodes of New South Wales man, Adam Brook, he was left with a huge 40-centimetre scar requiring approximately 80 stitches running from behind his ear, down his neck and to his armpit (where lymph nodes span the neck and upper body). Even when a melanoma is safely removed, it will likely leave a large and permanent scar.
Appearance-based fear appeal plus coping appraisal text (Condition 5)
Threat information from Condition 4 text followed by
Although big, noticeable scars are a common result of melanoma treatment, melanoma itself is one of the most avoidable cancers. The simple, easy to do, and highly effective recommendations set by the Cancer Council Australia (n.d.) are to "Slip, Slop, Slap, Seek and Slide". Slipping on sun protective clothing is an easy way to protect oneself without having to apply extra sunscreen to the entire body. Slopping on broad spectrum SPF30 (or higher) sunscreen takes only a few moments yet protects against around 96.7% of the harmful UVB sun radiation (Cancer Council Australia, n.d.). Slapping on a broad-brimmed or neck-covering hat acts as a great insurance policy, almost completely protecting the neck and head against melanoma-causing UVB radiation. Seeking Shade is a free, easy, effective, and low-effort step which provides a level of natural shelter from harmful sun radiation. Seeking shade should be considered a supplement to the other steps, rather than an alternative. Finally, sliding on close-fitting, wraparound style sunglasses that meet Australian sun protection standards will absorb more than 95% of UVB radiation reaching your eyes. This will massively reduce the risk of developing melanoma in the eye and sun-related eye deterioration (Sun Smart, n.d.). In summary, to slip, slop, slap, seek, and slide, which takes mere minutes of your time, is something that you can feel self-confident in doing, and is much less financially and emotionally costly than treating melanoma, other skin cancers or even severe sunburn. If done properly, following these recommendations will minimise your risk of melanoma.

intended constructs. A six-point Likert-type scale was used with one representing a complete absence of the construct and six representing a strong presence of the construct. The mean ratings awarded for each text ranged from 5 to 6 indicating a strong presence of the intended constructs.

Appearance and PMT-based scales (32 items)

To test the hypotheses (determine the effectiveness of the experimental texts), the final set of items comprised eight scales gauging attitudes towards melanoma, the sun, and sun protection (See Table 2). The first seven scales were used to assess the listed PMT constructs (severity, susceptibility, maladaptive response rewards, response efficacy, self-efficacy, response costs) and appearance concern; and with the eighth, to establish which condition was the most effective at promoting sun protective intentions. Responses to the appearance and PMT-based scales were made on a 10-point Likert scale of agreement from (1) strongly disagree to (10) strongly agree. Responses on items 3, 7, 11, 13, 14, 18, 25, 28, and 32 were reversed scored before computing a total score. High scores on the appearance and PMT-based items reflected each of the constructs. Table 2 provides sample items for the PMT constructs, appearance concern and sun protective intention items along with the number of items assessing each construct. After removing items 10 (severity scale), 12 (susceptibility scale), and 31 (intention scale) to improve reliability, seven of the eight appearance- and PMT-based scales reported sound-to-strong inter-item correlation coefficients between .20 and .46. The intention scale reported an unsatisfactory inter-item correlation coefficient of .14, indicating that the two items included in the scale produced inconsistent responses.

Procedure

Ethical clearance for the study was given by the University's Human Research Ethics Committee (approval number: H8393). Eligible participants had to be aged 17–24 years; be living in Queensland; have no personal/family history of melanoma; be someone who is out in the sun either deliberately (eg. sunbathing, tanning) or incidentally (eg. for fun, exercising,

Table 2. Appearance- and pmt-based scale names (number of items) and their sample items.

Appearance- and PMT-based scale (number of items)	Sample Item
Appearance concern ($n = 4$)	I would be embarrassed if I had a large scar from melanoma treatment
Perceived severity ($n = 3$)	Melanoma, if not detected early, can be deadly
Perceived susceptibility ($n = 4$)	Being in the sun without protection a handful of times would increase my risk of melanoma.
Maladaptive response rewards ($n = 4$)	Being in the sun without protection makes me feel good.
Response efficacy ($n = 6$)	Wearing protective clothing in the sun would decrease my risk of getting melanoma.
Self-efficacy ($n = 4$)	I know that I can use sun protection consistently.
Response costs ($n = 4$)	Protecting myself from the sun requires a considerable amount of effort.
Intentions ($n = 3$)	In the future, I plan to take more steps to protect myself when I am in the sun.

walking, gardening); and be someone who could improve their current sun protection behaviours. If participants felt they did not meet the criteria they were asked to exit the survey.

This experimental study used a non-probability, convenience sample of participants ($n = 95$). More than half were undergraduate psychology students recruited via Sona Systems (2019) whereby students were awarded two course credit points for participation. More participants were recruited via a Facebook page describing the study. No incentive was given to those who participated via Facebook. Respondents required internet access to complete the survey in their own time. Participants followed a URL which redirected them to the survey website, Qualtrics software, Version 2021. After reading the information form and indicating online consent, participants engaged in the survey. As reported in *Materials and Design*, participants completed the survey in the following order: background information; SEPI I and II; SCSK; were randomised to a text message condition; responded to appearance- and PMT-based scales. The survey instrument comprised 80 items across five sections and took 15–20 minutes to complete.

Statistical analyses

Data were collated on IBM SPSS Statistics, Version 28 (2021) and first screened for errors and missing responses. Of the 113 responses, 11 were removed because fully informed consent was not provided, comprising items at the beginning and end of the survey. Seven more were removed because the age of the respondents was outside the stipulated 17–24 years, leaving 95 usable responses.

Preliminary analyses

Kolmogorov-Smirnov tests suggested that the score distributions on eight of the 10 continuous scales were significantly different from normal (all excluding appearance concern and maladaptive response rewards). As such, non-parametric tests were considered appropriate due to the non-normal distributions. Using G*Power, for an effect size of 0.5 at $\alpha = .05$, and Power of 0.80, a sample size of 102 is considered powered for t-test comparisons of means for normally distributed variables. Given that non-parametric tests, like the Kruskal-Wallis Test and Mann-Whitney U test, are lenient on sample size requirements, the present sample size ($n = 95$) was considered sufficiently powered for use of non-parametric tests and for the t-tests. Because outliers were not extreme, as indicated in the SPSS box plots, they were not removed. There was one extreme outlier in the severity and response efficacy distributions. Both were Winsorised to represent the highest/lowest non-outlier values on their respective variables.

To assess group differences in background variables, non-parametric tests and independent samples t-tests were undertaken. To test the hypotheses, a Kruskal-Wallis Test was conducted.

Results

Descriptive analyses

The first aim of this study was to explore sun-related behaviours and knowledge in the sample. Nine males sunbathed (26.47% of males) and 35 females sunbathed (60.34% of females). A chi-square test for independence (with Yates' Continuity Correction) demonstrated that a significantly greater proportion of females sunbathed compared with males, χ^2 (1, $n = 92$) = 8.55, $p = .003$, $phi = -.33$.

Regarding the SEPI I, a Mann-Whitney U Test found no statistically significant difference between male ($Md = 18.5$, $n = 34$) and female ($Md = 19$, $n = 58$) SEPI I scores (risky UV exposure), $U = 1061.5$, $z = .61$, $p = .539$, $r = .07$.

Similarly, a Mann-Whitney U Test found no difference between male ($Md = 27$, $n = 34$) and female ($Md = 24$, $n = 38$) SEPI II scores (propensity/readiness to protect against the sun), $U = 755.5$, $z = -1.87$, $p = .062$, $r = -.19$.

For the SCSK, which had a maximum possible score of 25, participants responded to approximately 59.54% of knowledge items correctly ($M = 14.89$, $SD = 3.95$). Females ($M = 16.03$, SD = 3.29) had significantly higher skin cancer and sun knowledge scores than males ($M = 12.81$, SD = 4.34; t(89), –3.99, $p < .001$, η 2 = .01).

There were eight SCSK items to which the majority of participants responded incorrectly. These items, shown in Table 3, tested knowledge regarding UVR, common tools for sun protection, and skin cancers in general.

To assess the effect of the persuasive texts, scores on the appearance- and PMT-based scales were compared between participants in the persuasive conditions and those in the control condition. A total of 17 statistical tests were conducted for this purpose. Of the 17, 13 were Mann-Whitney U Tests for comparisons involving non-normally distributed variables and four were independent samples t-tests for those involving normally distributed variables. Each of the text

Table 3. SCSK items to which most participants responded incorrectly.

Item	N of participants giving incorrect responses	Percentage of incorrect responses
What is the most common form of skin cancer?	87	91.6%
What type of clothing usually blocks more UV radiation from the sun?	83	87.4%
People should stay out of the sun if their shadows are shorter than their bodies	77	81.1%
DNA damage to the skin caused by the sun can be repaired by:	76	80%
What does SPF30 mean?	72	75.8%
A tan is a sign that the skin is damaged	57	60%
The only way a person can get melanoma is from too much exposure to the sun	49	51.6%
UV (ultraviolet) radiation from tanning booths is safer than UV radiation from the sun	48	50.5%

Table 4. Descriptive statistics and test statistics (mann-whitney U tests and independent samples T-tests) comparing the theoretically relevant scores on the appearance- and PMT-based constructs between the persuasive text conditions and the control condition.

	Appearance- and PMT-based constructs						
Statistic/s	Appearance concern	Severity	Susceptibility	Maladaptive response rewards	Response efficacy	Self-efficacy	Response costs
Control text condition							
M (SD)	24.00 (6.46)	17.18 (2.98)	25.59 (4.29)	16.65 (7.47)	47.65 (6.73)	32.26 (4.53)	18.00 (7.66)
Threat appraisal text condition							
M (SD)	–	17.08 (2.53)	23.25 (6.03)	16.62 (5.03)	–	–	–
Test statistics	–	$U = 117.00$, $z = .28$, $p = .780$, $r = .05$	$U = 122.00$, $z = .90$, $p = .369$, $r = .16$	$t(28) = -.01$, $p = .990$, $\eta^2 = -.002$	–	–	–
Coping appraisal text condition							
M (SD)	–	–	–	–	48.32 (6.68)	32.16 (6.46)	15.58 (6.38)
Test statistics	–	–	–	–	$U = 154.00$, $z = -2.40$, $p = .811$, $r = -.04$	$U = 150.50$, $z = -.35$, $p = .725$, $r = -.06$	$U = 194.50$, $z = 1.05$, $p = .294$, $r = .18$
Combined threat and coping appraisal text condition							
M (SD)	–	16.65 (2.78)	26.47 (3.41)	15.44 (6.19)	48.65 (4.97)	32.59 (4.82)	15.35 (6.01)
Test statistics	–	$U = 164.00$, $z = .68$, $p = .494$, $r = .12$	$U = 130.00$, $z = -.51$, $p = .612$, $r = -.09$	$t(31) = -.51$, $p = .617$, $\eta^2 = .03$	$U = 133.00$, $z = -.40$, $p = .690$, $r = -.07$	$U = 139.50$, $z = -.17$, $p = .862$, $r = -.03$	$U = 178.50$, $z = 1.18$, $p = .240$, $r = .21$
Appearance concern text condition							
M (SD)	26.36 (8.14)	–	–	–	–	–	–
Test statistics	$t(29) = .90$, $p = .376$, $\eta^2 = .03$	–	–	–	–	–	–
Combined appearance concern and coping appraisal text condition							
M (SD)	26.29 (7.61)	–	–	–	49.50 (4.24)	32.79 (5.49)	18.00 (5.87)
Test statistics	$t(29) = .91$, $p = .187$, $\eta^2 = .03$	–	–	–	$U = 133.50$, $z = .58$, $p = .560$, $r = .10$	$U = 132.50$, $z = .54$, $p = .588$, $r = .10$	$U = 117.50$, $z = -.06$, $p = .952$, $r = -.01$

There are no reported test statistics for the control condition because it served as the reference group against which the groups of the persuasive text conditions were compared. For the control condition, the reported mean (SD) scores should be used as a comparison point against the mean (SD) scores for the persuasive conditions. The reported test statistics indicate whether the appearance- and PMT-based construct scores differed between the persuasive conditions and the control. Not all construct scores were compared between the persuasive conditions and the control; only those theoretically relevant to the given persuasive condition. For example, for the threat appraisal condition, tests were conducted to assess differences relative to the control on the severity, susceptibility, and maladaptive response rewards constructs. Because the threat appraisal text was not concerned with the other appearance- and PMT-based constructs (i.e., appearance concern, response efficacy, self-efficacy, and response costs), no other comparisons were made (denoted by dashes).

Because the score distributions for the severity, susceptibility, response efficacy, self-efficacy, and response costs scales were non-normal, Mann-Whitney U Tests were conducted to compare them with those of the control condition. Because the score distributions for the appearance concern and maladaptive response rewards scales were normal, independent samples t-tests were used to compare them with those of the control condition. For Mann-Whitney U Tests, medians and interquartile ranges are the appropriate descriptive statistics to report. However, only means and standard deviations are reported in the table to allow for ease-of-interpretation.

conditions (threat, coping appraisal, threat and coping appraisal, appearance concern, appearance concern and coping appraisal) did not differ when compared to the control condition on PMT constructs of severity, susceptibility, maladaptive response rewards, self-efficacy, response efficacy or response costs. See Table 4 for a tabulated summary of results from the 17 statistical tests, and descriptive statistics.

Test of hypotheses

Before testing the hypotheses to determine whether significant differences in intention existed across participants in the conditions as per the second aim of the study, chi-square tests for independence confirmed that two of three categorically scored background variables were controlled for in the hypothesis test (gender: χ^2 (5, $n = 92$) = 2.00, $p = .850$, $phi = .15$; sunbathing status: χ^2 (5, $n = 95$) = 5.05, $p = .410$, $phi = .23$). Skin type yielded a non-significant result, χ^2 (5, $n = 94$) = 24.62, $p = .216$, $phi = .51$, however, 63.30% of cells had a cell count of less than five cases, violating a key assumption of the test. Hence, it could not be ascertained whether skin type was controlled for. Kruskal-Wallis Tests indicated that three continuous variables were also controlled for (SEPI I: χ^2 (5, $n = 95$) = 8.24, $p = .143$; SEPI II: χ^2 (5, $n = 95$) = 4.03, $p = .546$; SCSK: χ^2 (5, $n = 94$) = 4.89, $p = .430$).

Upon inspection of scores on the intention scale, participants in each condition displayed a strong intention to protect against the sun, with mean intention scores ranging from 15.54 to 17.29 of a possible 20. A Kruskal-Wallis Test was conducted to test the three hypotheses. No statistically significant differences in intention to protect against the sun were detected across any of the conditions, χ^2 (5, $n = 94$) = 2.97, $p = .704$, thus providing no support for hypotheses 1, 2 or 3.

Discussion

With respect to the first aim, the descriptive analyses presented some notable findings and group differences. Over one quarter of males sunbathed, and close to two-thirds of females sunbathed. Significantly more females sunbathed than males, a finding which is supported by previous research (Day et al., 2014; Sideris & Thomas, 2019).

However, knowledge about the harmful effects of the sun and of skin cancer was generally average for males and mildly above average for females, with most participants appearing to lack knowledge regarding how UVR affects the body to cause skin cancer, crucial sun protection practices like wearing dark clothing and understanding sunscreen labels, and the prevalence of different skin cancers. If such a heavy exposure to sun protection campaigns existed, one would have expected knowledge levels to be greater for both genders. Finally, gender comparisons also revealed that females had significantly greater knowledge scores than males, a finding which is supported by previous research (Lee et al., 2014; Sideris & Thomas, 2019).

With respect to the second aim, the results did not support H_1, that all the persuasive texts would elicit increased intentions to protect against the sun compared to the control. A possible explanation for the absence of score differences in sun protective intentions between participants in the persuasive text conditions and those in the control condition, is the likely high lifetime exposure of participants to SunSmart campaigning. It is entirely possible that a large proportion of the sample had been conditioned to perceive skin cancer as negative and dangerous, as the mean score distributions suggested. H_2, which hypothesised that Condition 3 (combined threat/coping appraisal text) and Condition 5 (combined appearance concern/coping appraisal text) would be the most effective at increasing intentions, was also unsupported. Finally, the results did not support H_3, which predicted that Condition 5 would have the most positive impact on intentions compared to all other conditions.

The current findings of a lack of difference between text message conditions (health-based with or without efficacy messages) on intentions to protect against the sun is inconsistent with research reporting that fear appeals without efficacy messages are effective but tend to work best when combined with efficacy messages (Tannenbaum et al., 2015). The findings are also inconsistent with research demonstrating the effectiveness of both health-based (Mahler, 2015) and appearance-based interventions (McNoe et al., 2021; Persson et al., 2018) in the sun protection context. The present findings are more consistent with some studies which have reported no effect between a health and appearance-framed message on sun-protective intentions (Sontag & Noar, 2017) or use of sunscreen (Hevey et al. 2010). Christensen et al. (2014) did not find long-term effects of a photo condition on UV protection while the health condition was more effective in increasing initial intentions.

These differences in findings from previous studies may be due to differences in the nature of the health communication strategies. This study used text messages in preference to other modalities (e.g., images or video clips) because the use of text allowed for more control over the targeting of the Protection Motivation

Theory constructs. The text messages could also reference the information provided. In the present study a one-time text read by participants may not have been robust enough to impact sun-protection intentions compared to studies which used photo images in addition to health messages (McMath and Prentice-Dunn, 2005). It must be acknowledged that meta-analytic reviews (Persson et al., 2018) have only found small effect sizes for appearance-based interventions in affecting sun protective intentions and behaviours, with photo-imaging combined with photoaging information having larger effect sizes. Moreover, many of the studies in the review by Persson et al. (2018) which found support for appearance-based interventions, included pre-post intervention research designs. In McMath and Prentice-Dunn's (2005) study which used 9–11 page essays as the experimental manipulation of threat and coping appraisal, respondents with a high need for cognition were more likely to have sun-protective intentions. Individuals low on the need for cognition may respond more to graphic images than text messages. Health psychologists working in the arena of skin cancer prevention may need to consider tailoring campaigns to person variables for more effective impact in changing risk behaviours.

Another explanation for the current study's findings concerns the sample which consisted predominantly of university students who would be expected to have greater health literacy than young adults without tertiary education. Even so, knowledge about the effects of the sun on skin cancer was not high, and females sunbathed more than males. This is concerning given that Queensland has one of the highest age-standardised rates of melanoma and high rates of ultraviolet radiation.

Limitations

One limitation relates to the use of text messages as the communication strategy. Respondents may have found the text messages to be lengthy. Long paragraphs of text may be difficult to persuade young people even with incorporation of theoretical constructs such as an efficacy message. Use of explicit photo images of surgical scarring may have resulted in differences in intentions to protect against the sun as predicted by Protection Motivation Theory.

Another limitation pertains to the sample composition which consisted mostly of females, leaving males underrepresented. While statistical analyses confirmed that gender was controlled for across the conditions, the smaller number of males may have hindered the opportunity to make sound general conclusions about the cohort.

The study, although using an experimental design within a survey, only gauged intentions rather than subsequent behaviours as a measure of health message effectiveness. The sample's small size also likely contributed to the lack of normality observed across eight of the 10 continuous variable distributions (Pek et al., 2018). These non-normal score distributions required the use of non-parametric tests, which are underpowered compared to their parametric alternatives (Pallant, 2016).

Future directions

Two findings from the analysis of participants' behaviour and knowledge characteristics warrant further investigation. Sunbathing continues to be practised by almost a quarter of the males and well over half of the female participants. These statistics are concerning given that the largest proportion of the sample had light, Type II skin which is highly susceptible to melanoma (Brenner & Hearing, 2008), and that Queensland has the highest melanoma rates in Australia (Australian Institute of Health and Welfare, 2023a). Secondly, basic content knowledge about sun exposure, sun protection, and skin cancer was absent despite the likely heavy lifetime exposure to sun protection campaigns in the media and schools. Studies using larger, gender-balanced samples of this demographic, seeking more background detail such as where participants encounter sun protection knowledge, should be conducted to test the results discussed here, and better understand choices made and gender differences evident.

Given that our findings indicate that text-based appeals may not have maximum impact on sun-protective intentions, future research may wish to consider whether other communication strategies such as SMS messages that are sent to cell phones repeatedly over time, multi-media messages with images or videos of scarring may be better at predicting intentions to reduce sun exposure. Future research may also consider using pre-test and post-test designs to test the efficacy of such strategies on intentions to engage in sun-protective behaviour.

Conclusion

Despite Queensland having one of the highest melanoma rates in the world, little research is available on the type of message content delivered in sun safety campaigns to which young Queensland adults, a high-risk group, best respond. The present study's aims

were to further develop our understanding of this demographic's sun-related behaviour and knowledge, and to quantify their attitudinal responses to five styles of persuasive sun protection text messages. The hypotheses were unsupported and the interventions had no effect on participants' sun protection intentions.

Continued research is required to further the debate on fear appeal effectiveness; to determine which of health- or appearance-based sun protection interventions is superior; and to establish whether alluding to surgery scarring is a useful type of intervention content. Use of more robust communication strategies in addition to text messages is advocated. The results also invite an audit of the content knowledge presented in sun protection campaigns and an analysis of the gender appeal of individual campaigns.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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