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Title: User preferences for text message-delivered skin cancer prevention and early detection

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Abstract

Evidence is needed for the acceptability and user preferences of receiving skin cancer-related text messages. We prepared 27 questions to evaluate attitudes, satisfaction with program characteristics such as timing and spacing, and overall satisfaction with the Healthy Text program in young adults. Within this randomised controlled trial (age 18-42 years), 546 participants were assigned to one of three Healthy Text message groups; sun protection, skin self-examination, or attention-control. Over a 12-month period, 21 behaviour-specific text messages were sent to each group. Participants' preferences were compared between the two interventions and control group at the 12-month follow-up telephone interview. In all three groups, participants reported the messages were easy to understand (98%), provided good suggestions or ideas (88%), and were encouraging (86%) and informative (85%) with little difference between the groups. The timing of the texts was received positively (92%); however, some suggestions for frequency or time of day the messages were received from 8% of participants. Participants in the two intervention groups found their messages more informative, and triggering behaviour change compared to control. Text messages about skin cancer prevention and early detection are novel and acceptable to induce behaviour change in young adults.

Keywords

Skin cancer, prevention, health promotion, text messaging, attitudes

Introduction

The incidence of melanoma and non-melanoma skin cancers (NMSC) has been increasing worldwide, constituting a major public health issue.¹ In Australia in 2010, around 700,000 people were treated for NMSC² and 10,500 for melanoma at a cost of greater than \$500 million. Further, around 1,600 deaths from skin cancer are recorded each year. Melanoma is the most common cancer among Australians aged 15 to 44 years.³⁻⁵

Skin cancer primary prevention campaigns using standard (radio, television, newspaper) and social media messaging have resulted in some improvement in preventive behaviours.^{6, 7} Despite often having adequate knowledge and good intentions to protect their skin,⁸ sunburn is still common with almost 72% of people 20 to 30 years of age and 43% of those over 30 years of age being sunburnt at least twice over the past year.⁹ Similarly, the U.S.A. 2010 National Health Survey data reported that 52% of adults aged 18 to 29 years were sunburnt in the past year.¹⁰ Standard media campaigns are also expensive and may not reach their intended audience optimally. Thus, ways of reaching people with flexible and individually tailored messages are required.

Text messaging (also called short-message service [SMS]) has become a popular form of communication world-wide, with greater use among younger and more socially disadvantaged people.^{11, 12} Although most commonly used for social communication,

text messaging has been used in health promotion interventions with positive behaviour changes (e.g., cessation of smoking and increased physical activity).¹³⁻¹⁵ Messages tailored to individuals, have been found to be more efficacious for health behaviour change than untailored messages.^{16, 17} This form of communication may also be more cost-effective than telephone or print-based messaging.^{14, 18} Three studies have used SMS in the context of skin cancer prevention;¹⁹⁻²² however, none evaluated in detail the user experience with such messages. The Healthy Text program included weekly to monthly text messages sent over 12 months.

The aim of this study was to examine the user experience (including spacing and timing of messages) and acceptability of text messages designed to improve sun protection or skin cancer early detection behaviours in young adults (18 to 42 years) with the Healthy Text health promotion program.

Methods

Ethical approval for this study was obtained from the Queensland University of Technology's Human Research Ethics Committee (approval number QUT 1100000942) and the trial was registered with the Australian and New Zealand Clinical Trials register (registration number ACTRN12612000577819). The study was conducted in Queensland, Australia. The study design, participants' baseline characteristics, and quantitative outcomes have been described elsewhere.¹⁸

Participants and recruitment

A random sample of Australian citizens aged between 18 and 42 years from the Queensland electoral roll ($n = 5,000$) and Queensland Medicare registers (i.e., the population wide free health insurance for Australian residents) ($n = 10,000$) were invited to participate via mailed invitation. The eligibility criteria included: Ability to understand sufficient English, to consent, ownership of a mobile telephone, no previous melanoma diagnosis, and agreement to be randomly assigned to one of three intervention groups. Of the 678 (5%) potential participants who indicated interest, 574 (85%) were eligible. After screening for eligibility, participants completed a 20-minute baseline telephone survey including questions on sun protection, skin self-examination, physical activity, skin cancer risk factors and attitudes, behavioural goals and intentions, and basic socio-demographics. Participants were then randomly assigned to one of three text message groups: Sun protection messages, skin self-examination messages, or attention-control (i.e., physical activity) messages. Participants received weekly text messages for a three-month period, followed by monthly text messages for nine months (total intervention period = 12 months). Follow-up telephone surveys were conducted at three- and 12-months.

Intervention

Similar to methods used in our previous work promoting physical activity,¹⁵ Healthy Text program messages were designed to target each construct of the social cognitive

theory.^{18, 23} A final list of text messages were recorded in a secure database in preparation for distribution to participants. Messages were personalised with participants' first names, as well as baseline skin cancer risk profile, sun protection, skin self-examination, and physical activity characteristics. Examples of the text messages sent to participants were: "*U shld do a whole body skin check every month. Become familiar with the look of your skin, so u see any changes early. Look 4 changes in moles*" (addressing self-efficacy); "*You brush your teeth each morning, why not put on sunscreen as regularly? Make sure u have some sunscreen handy in the bathroom, or near the front door*" (addressing behavioural capacity).

Data Collection Measures

Assessing attitude towards the text message content and program effectiveness. A series of 20 questions developed by the research team assessed attitudes and opinions about the text message content (5-point Likert scale: 1 = strongly agree to 5 = strongly disagree). Ten of these questions were worded negatively to avoid leading participants to express positive attitudes. The scale had moderate internal consistency, $\alpha = 0.58$. No substantial increases in alpha could have been achieved by eliminating items. All questions are listed in Table 1.

Timing of the text messages. To assess the frequency and timing of the text messages, we asked participants, "thinking back to the text messages you received from us over the past 12 months did you think they were sent too often, not often

enough, happy with how often they were sent, or unsure”? This was followed by an open-ended question to indicate further preferences for the timing of the texts received.

Text message topics. Participants were asked whether they would have preferred text messages about a different health topic, and if yes, which one. Participants were also asked to recall their favourite healthy text SMS.

Open-ended questions. Participants were asked to express in their own words their favourite Healthy Text message. Participants’ overall opinions of the study were assessed using open-ended questions (i.e., “What did you like about the Healthy Texts study?” and “Do you have any other feedback about Healthy Texts?”) and answers were recorded verbatim.

Statistical analysis

Baseline characteristics have been reported previously.¹⁸ Participant responses to the attitude questions were summarised using frequencies and proportions. Survey questions using a 5-point Likert scale (1 = strongly agree to 5 = strongly disagree) were collapsed into three (3) categories for analysis (strongly agree/agree, neutral, disagree/strongly disagree). Differences in proportions of answers between the three groups were assessed using Chi-Square tests, with a difference of 10% or more considered clinically important. For the verbatim responses to the open ended questions (i.e., questions regarding timing of the text messages and recall of the texts message

topics), a coding scheme was developed based on initial reading and re-reading of all participant responses about their attitudes towards the text messages. Participant responses for the questions regarding what they liked about the Healthy Text study were categorised into the five components of the social cognitive theory:²³ 1) Increasing self-efficacy; 2) building behavioural capacity; 3) encouraging observational learning; 4) providing positive reinforcement; and 5) guiding outcome expectations. Two independent raters grouped each response. The two raters then met to discuss the differences and came to a common consensus. If there was still disagreement between ratings a third rater would have been consulted; however, the need for this did not occur.

Results

Demographic characteristics of the sample

Of the 546 participants who completed the baseline interview (control: $n = 183$; skin self-examination: $n = 176$; sun protection: $n = 187$), 512 (94%) completed the 12-month follow-up interview and 501 (92%) answered the attitude questions; hence their data were included here. Participants' baseline characteristics assigned to the three groups were similar and well balanced. The mean age of participants was 32 years (range 18-42 years) and the majority were women ($n = 368$, 66%), and nearly three-quarters had a

high education (college or university degree $n = 390$, 71%). Most lived with a partner ($n = 383$, 75%), and two-thirds had private health insurance ($n = 354$, 65%).

Attitudes towards the text messages

Overall, the vast majority of participants found the text messages were: Easy to understand (98%), provided good suggestions and ideas (88%), were encouraging (86%), and informative (85%). More than half (56%) of the participants self-reported that the text messages helped them to change their behaviour (Table 1). There were statistically and clinically significant differences between the three groups for eight of the 20 attitude questions (Table 1). A larger proportion of participants in the SSE group (91%) found the messages informative compared to the control group (80%). A larger proportion of participants in both intervention groups (69 and 67%, respectively) perceived the messages to trigger to changing their behaviour compared to control group (54%). A greater proportion of intervention group participants (>20%) found them to be repetitive compared to control participants (12%). Sixty-two percent (62%) of the skin self-examination group reported that the messages provided them with information they were not aware of. A higher proportion of participants in the intervention groups (53% and 43%, respectively) reported worry about melanoma compared to control (25%) (Table 1).

Overall, 197 (39%) participants would have liked to receive text messages about a different health issue. A higher proportion of skin self-examination ($n = 71$, 44%) or

sun protection ($n = 76$, 44%) group participants indicated a preference for messages about other health topics, compared to the control group ($n = 46$, 28%). Just over 1 in 10 participants (13%) in the intervention groups indicated that they would have been interested in receiving messages on physical activity. Others desired messages about healthy eating or dietary advice ($n = 43$, 8%).

Timing of the texts

Overall, 92% ($n = 473$) reported that they were happy with the overall timing of the texts received. Of the 8% participants who answered that they were not happy with the timing, their open-ended answers were categorised into suggestions for the time of day messages could be received (e.g., after 5pm) and suggestions for frequency (e.g., monthly) for analysis. Of the 38 participants who commented, 15 (3%) recommended a more intense frequency of text messaging: *“I think if they would have been more frequent they would have been more beneficial”* (participant# 17844), *“I would have preferred if the messages were more regular...”* (participant# 14850). Others ($n = 9$, 2%) noted that messages would be better received outside of business hours, such as early weekends or night time. In terms of the spacing between the text messages received over the past 12 months, 390 participants (76%) reported that they were happy with how often the text messages were sent. Some participants commented on the differences in spacing of text messages between the first three months (weekly) and subsequent nine months (monthly), with 12 (2%) participants reporting that the

messages were sent too often, such as *“at first the messages were a little too frequent but they did spur me to action”* (participant# 13486). More participants however ($n = 84$, 16%) believed that the messages weren’t sent often enough. Participant# 4667 said that *“the first wave was frequent, but the second wave was not enough”*, participant# 17651 reported that *“they were not sent enough”*.

Recall of text messages

More than half (65%) of the participants were able to recall at least one favourite text message. This was similar between the groups (control: $n = 122$, 67%; skin self-examination: $n = 114$, 65%; sun protection: $n = 116$, 62%). Of the 352 participants who recalled a message, those in the skin self-examination group reported that messages about *“what to look for when checking your moles/spots”* (participant# 3443), *“what skin cancer looks like”* (participant# 16833), and *“encouraging others to check your skin”* (participant# 18899) were favourites. Messages about *“remembering to apply sunscreen”* (participant# 10906, 17788), *“protecting from the sun even when it’s overcast”* (participant# 2960), *“slip slop slap”* (participant# 18311, 19440, 2720, 14668), and *“highest UV [is] in the middle of the day”* (participant# 5348) were favourites among the sun protection group. Messages that were *“personalised and encouraging”* were also recalled by individuals (participant# 2982, 18263).

Social cognitive concepts

The participants' responses to the open-ended question '*what did you like about the healthy texts study?*' were categorised by the raters into the five themes from Bandura's social cognitive theory.²³ Of the 546 who responded, just over half of responses ($n = 304$, 56%) fell into the building behavioural capacity theme. Examples of these responses (Table 2) included obtaining information and receiving reminders.

Participants also mentioned increasing self-efficacy as an important aspect of the study (overall $n = 57$, 31%). Providing positive reinforcement (overall $n = 38$, 22%) was more commonly mentioned by the control ($n = 14$, 8%) and sun protection ($n = 16$, 9%) groups than the skin self-examination ($n = 8$, 5%) group. Others (overall $n = 46$, 8%) felt that the messages were guiding their outcome expectations.

Discussion

This paper evaluated attitudes towards health-related text messages, satisfaction with program characteristics such as timing of the texts received, as well as overall satisfaction with the Healthy Text health promotion program. The findings demonstrated the acceptability and good recall of text messages to promote skin cancer prevention and early detection outcomes in young adults. The use of mobile phone technology may offer a highly efficient means of rapidly reaching wide and diverse populations. Participants reported that the text messages acted as reminders and

motivated them to adopt healthy routines and behaviours. The vast majority of participants rated the messages as informative, easy to understand, encouraging, and providing good suggestions and ideas. Messages which described what to look for when checking moles/spots, encouraging others to check your skin, and reminders to protect your skin from the sun were examples of favourite messages. The timing and spacing of the text messages was rated positively by most participants; however, participants feel that they would have liked to receive a more intense regime of messages. In future programs more flexible selection of number of messages per week according to people's preferences could be trialled to ascertain whether this could further improve treatment effect.

Fjeldsoe¹⁴ reported that tailoring messages to personal and health circumstances was important for program success. DeVries and colleagues¹⁷ internet-based program which used individualised health communication messages to improve sunscreen use also reported that a proactive approach was more suited to reach various groups and more likely to be successful. In the future, improving the flexibility which personalised mobile telephone text messages are delivered could increase their acceptability further.^{16, 18-20, 24}

In respect to Bandura's social cognitive theory, messages containing factual information and specific reminders about important aspects of the health behaviours were recalled by participants as important barriers of behaviour change, followed by

increasing self-efficacy (i.e., providing confidence in performing certain behaviours). Meta-analyses have shown greater effects for theory-based interventions^{16, 25} are also increasingly focussing on improving people's self-efficacy more broadly rather than just specific health behaviours.²⁶ While the overall attitudes were positive, a higher proportion of participants within the two skin cancer intervention groups reported greater worry about the possibility of developing melanoma. This may not necessarily be a negative outcome of the intervention. A reverse u-shaped association between level of concern about a health problem and preventive action has been reported previously.²⁷ Moderate levels of worry are optimal and tend to motivate individuals to increase positive health behaviours.^{28, 29} However, very low or very high concern may limit people's capacity to take advantage of preventive health actions and it's important not to scare people too much with high anxiety provoking messages.

Limitations of this trial include that the overall response rate was low, with only 5% of people contacted agreeing to participate. The low response rate may impact on the estimates of acceptability of the intervention, with individuals interested in receiving text messages being more likely to rate their messages more highly than non-participants.³⁰ However, this is quite common in text message interventions and the ability to recruit many willing people is still a very attractive feature. Due to the geographical location for this study (i.e., Queensland only), the findings may not be representative of the entire Australian or Caucasian populations in other countries. A

larger sample could be used in future studies to investigate whether there are attitudinal or behavioural differences among people from certain age or cultural groups.

One inherent issue with assessing the impact of text messages is that no data was collected on whether the message was actually actively processed. Delay in reading messages could affect the impact of the text messages especially if the suggested behaviours were time related (e.g., the coming weekend). Interventions that require participants to actively respond to messages or that allow participants to customise the message schedule to suit their daily lives may lead to greater health behaviour change.¹⁶ Further testing of the program and length of time may help answer the question of efficacy, while avoiding fatigue of messaging.¹⁶

In summary, text messaging via mobile phones offers a unique method of providing highly relevant, personalised, and timely information to individuals that can impact their skin cancer related prevention behaviours. This study demonstrates the acceptability of automated text messaging to promote healthy behaviours among those who first agreed to receive them as part of this study and provides details to optimistic delivery of future programs aimed to reduce the burden from skin cancer.

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Declaration of Conflicting Interests

All authors declare no conflicts of interest, except H. Peter Soyer who is a shareholder of e-derm consult GmbH and MoleMap by Dermatologists Ltd Pty. He provides teledermatological reports regularly for both companies.

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Table 1. Attitudes and opinions of the text messages divided by intervention group

	Attention control n = 165		Skin self- examination n = 163		Sun protection n = 173		Chi square statistic	df	P-value
Do you think the messages sent...	N	(%)	N	(%)	N	(%)			
...were informative ^a							11.74	4	0.019*
Strongly agree/ agree	132	(80.0)	148	(90.8)	148	(85.5)			
Neutral	13	(7.9)	9	(5.5)	6	(3.5)			
Disagree/ strongly disagree	20	(12.1)	6	(3.7)	19	(11.0)			
...were annoying ^a							3.98	4	0.409
Strongly agree/ agree	14	(8.5)	14	(8.6)	22	(2.7)			
Neutral	14	(8.5)	12	(7.4)	8	(4.6)			
Disagree/ strongly disagree	137	(83.0)	137	(84.0)	143	(82.7)			
...provided good suggestions and ideas ^a							7.27	4	0.122
Strongly agree/ agree	142	(86.1)	152	(93.3)	148	(85.5)			
Neutral	7	(4.2)	6	(3.7)	9	(5.2)			
Disagree/ strongly disagree	16	(9.7)	5	(3.1)	16	(9.2)			

<i>...were difficult to understand^a</i>							5.41	4	0.248
Strongly agree/ agree	1	(0.6)	5	(3.1)	1	(0.6)			
Neutral	2	(1.2)	1	(0.6)	1	(0.6)			
Disagree/ strongly disagree	162	(98.2)	157	(96.3)	171	(98.8)			
<i>...were relevant to me^a</i>							3.52	4	0.474
Strongly agree/ agree	109	(66.1)	119	(73.0)	128	(74.0)			
Neutral	18	(10.9)	17	(10.4)	15	(8.7)			
Disagree/ strongly disagree	38	(23.0)	27	(16.6)	30	(17.3)			
<i>...were a good trigger for changing my behaviour^a</i>							11.53	4	0.021*
Strongly agree/ agree	89	(53.9)	112	(68.7)	116	(67.1)			
Neutral	24	(14.5)	18	(11.0)	25	(14.5)			
Disagree/ strongly disagree	52	(31.5)	33	(20.2)	32	(18.5)			
<i>...served as a reminder^a</i>							8.83	4	0.065
Strongly agree/ agree	135	(81.8)	150	(92.0)	155	(89.6)			
Neutral	8	(4.8)	3	(1.8)	5	(2.9)			
Disagree/strongly disagree	22	(13.3)	10	(6.1)	13	(7.5)			
<i>...were too repetitive^a</i>							10.59	4	0.032*
Strongly agree/ agree	21	(12.7)	43	(26.4)	39	(22.5)			
Neutral	14	(8.5)	11	(6.7)	16	(9.2)			
Disagree/ strongly disagree	130	(78.8)	109	(66.9)	118	(68.2)			
<i>...were overloaded with information^a</i>							6.25	4	0.182

Strongly agree/ agree	7	(4.2)	2	(1.2)	6	(3.5)			
Neutral	1	(0.6)	6	(3.7)	4	(2.3)			
Disagree/ strongly disagree	157	(95.2)	155	(95.1)	163	(94.2)			
<i>...reminded me of spam^a</i>							1.47	4	0.832
Strongly agree/ agree	28	(17.0)	31	(19.0)	38	(22.0)			
Neutral	14	(8.5)	12	(7.4)	13	(7.5)			
Disagree/ strongly disagree	123	(74.5)	120	(73.6)	122	(70.5)			
<i>...provided me with information I was not aware of^a</i>							17.61	4	0.001*
Strongly agree/ agree	69	(41.8)	101	(62.0)	74	(42.8)			
Neutral	15	(9.1)	12	(7.4)	19	(11.0)			
Disagree/ strongly disagree	81	(49.1)	50	(30.7)	80	(46.2)			
<i>...were encouraging^a</i>							3.78	4	0.437
Strongly agree/ agree	140	(84.8)	138	(84.7)	154	(89.0)			
Neutral	13	(7.9)	16	(9.8)	8	(4.6)			
Disagree/ strongly disagree	12	(7.3)	9	(5.5)	11	(6.4)			
<i>...made me feel that changing my behaviour is achievable^a</i>							4.63	4	0.328
Strongly agree/ agree	123	(74.5)	134	(82.2)	134	(77.5)			
Neutral	17	(10.3)	12	(7.4)	11	(6.4)			
Disagree/ strongly disagree	25	(15.2)	17	(10.4)	28	(16.2)			
<i>...helped me change my behaviour^a</i>							8.52	4	0.074
Strongly agree/ agree	80	(48.5)	91	(55.8)	111	(64.2)			

Neutral	26	(15.8)	23	(14.1)	20	(11.6)			
Disagree/ strongly disagree	59	(35.8)	49	(30.1)	42	(24.3)			
<i>...were repeating what I already know^a</i>							11.75	4	0.019*
Strongly agree/ agree	94	(57.0)	78	(47.9)	105	(60.7)			
Neutral	29	(17.6)	21	(12.9)	17	(9.8)			
Disagree/ strongly disagree	42	(25.5)	64	(39.3)	51	(29.5)			
<i>...did not contribute to changing my behaviour^a</i>							2.21	4	0.697
Strongly agree/ agree	50	(30.3)	42	(25.8)	45	(26.0)			
Neutral	17	(10.3)	13	(8.0)	14	(8.1)			
Disagree/ strongly disagree	98	(59.4)	108	(66.3)	114	(65.9)			
<i>...made me increase my physical activity^a</i>							22.84	4	0.000**
Strongly agree/ agree	78	(47.3)	37	(22.7)	55	(31.8)			
Neutral	17	(10.3)	23	(14.1)	20	(11.6)			
Disagree/ strongly disagree	70	(42.4)	103	(63.2)	98	(56.6)			
<i>...made me worry about melanoma^a</i>							36.71	4	0.000**
Strongly agree/ agree	41	(24.8)	87	(53.4)	74	(42.8)			
Neutral	9	(5.5)	16	(9.8)	15	(8.7)			
Disagree/ strongly disagree	115	(69.7)	60	(36.8)	84	(48.6)			
<i>...made me worry about heart disease^a</i>							1.14	4	0.888
Strongly agree/ agree	27	(16.4)	22	(13.5)	29	(16.8)			
Neutral	8	(4.8)	10	(6.1)	8	(4.6)			

Disagree/ strongly disagree	130	(78.8)	131	(80.4)	136	(78.6)			
...made me worry about diabetes ^a							12.16	4	0.016*
Strongly agree/ agree	31	(18.8)	12	(7.4)	24	(13.9)			
Neutral	6	(3.6)	9	(5.5)	14	(8.1)			
Disagree/ strongly disagree	128	(77.6)	142	(87.1)	135	(78.0)			

^a Variables have 2 or more missing values

*significance $p < .05$

**significance $p < .001$

Table 2. Examples of responses according to social cognitive theory

Responses	Participant ID Number
Building behavioural capacity	
<i>"It has been really informative, gives me a different perspective on the issues"</i>	1467
<i>"Reminded me when I normally wouldn't think about it..."</i>	1514
Increasing self-efficacy	
<i>"The messages were encouraging and they make people aware of the need to exercise"</i>	19425
<i>"They reminded me to exercise and helped motivate me"</i>	37
Encouraging observational learning	
<i>"It is a good way to encourage younger people to be healthy"</i>	15162
Providing positive reinforcement	
<i>"[I] liked being involved...[it] reinforced [my] decisions"</i>	5787
<i>"I liked to be reminded by text even though most of the information I already knew"</i>	17887
<i>"I found them to be useful..."</i>	29
Guiding outcome expectations	
<i>"Good initiative...something different and focused health information"</i>	4642