

A randomised controlled trial using mobile advertising to promote safer sex and sun safety to young people

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Abstract

Mobile phone text messages (SMS) are a promising method of health promotion, but a simple and low cost way to obtain phone numbers is required to reach a wide population. We conducted a randomised controlled trial with simultaneous brief interventions to (i) evaluate effectiveness of messages related to safer sex and sun safety and (ii) pilot the use of mobile advertising for health promotion. Mobile advertising subscribers aged 16–29 years residing in Victoria, Australia ($n = 7606$) were randomised to the ‘sex’ or ‘sun’ group and received eight messages during the 2008–2009 summer period. Changes in sex- and sun-related knowledge and behaviour were measured by questionnaires completed on mobile phones. At follow-up, the sex group had significantly higher sexual health knowledge and fewer sexual partners than the sun group. The sun group had no change in hat-wearing frequency compared with a significant decline in hat-wearing frequency in the sex group. This is the first study of mobile advertising for health promotion, which can successfully reach most young people. Challenges experienced with project implementation and evaluation should be considered as new technological approaches to health promotion continue to be expanded.

Introduction

Short message service (SMS)—text messages sent via mobile phones—is a highly promising method of health promotion to young people. Young people aged 16–30 years have the highest rate of mobile phone ownership [1]. Mobile phones are usually turned on and within reach during waking hours, if not 24 h a day [1]. Advantages of using SMS for health promotion include the low message cost and the ability to send messages to multiple recipients simultaneously with immediate delivery [2]. Multimedia message service (MMS), which allows transfer of image, video, audio and text, may also be a useful tool for health promotion.

The access, speed and low cost of SMS have led to a variety of health-related applications including appointment, vaccination and medication reminders, disease self-management, diagnostic testing and results and health promotion interventions [2–6]. Health promotion SMS interventions for behaviour change have addressed smoking cessation [7–9], physical activity [10–13], weight loss and weight management [14–16], sexual health [17, 18], sun-screen use [19] and vitamin adherence [20]; most report positive behavioural change attributable to the SMS [7, 9, 10, 12–19]. The only published meta-analysis of using SMS for health promotion found text message programs resulted in a significant increase in

self-reported smoking cessation in the short term [21]. All published trials using SMS for health promotion to date rely on volunteers recruited individually, through community advertising or clinical sites [7–20], which can be time consuming, costly and inefficient. If SMS is to be scaled up for mainstream health promotion—particularly for behaviours that do not provide individuals with an immediate benefit of change (unlike, for instance, smoking cessation)—a simple and low cost method of obtaining a large number of mobile phone numbers is required.

Mobile advertising (advertising delivered directly to mobile phones) offers a novel way to reach a potentially huge number of individuals. The mobile advertising market is growing rapidly, with an estimated increase in market size of 85% in 2009 alone [1]. A British survey of 1500 young people aged 11–20 years found only one-third (32%) were happy to receive advertising on mobile phones—but 71% were happy to receive advertising targeted to their interests, 76% were happy to receive advertising in exchange for discounts or special offers and 82% were happy to receive advertising in exchange for top-up credit [22]. To date, no studies have been conducted that utilise mobile advertising to reach individuals to promote health-related behaviour change.

In this article, we describe a study of the use of SMS for health promotion at a population level. The S⁵ (SMS for safer sex and sun safety) project was designed as a randomised controlled trial with simultaneous brief interventions aiming to improve behaviours around safer sex and sun safety in young people. These behaviours were targeted as young people frequently report exposures (multiple sexual partners, inconsistent condom use, infrequent use of sun protection measures [23, 24]) that place them at risk of significant long-term consequences (infertility as a result of chlamydia infection, melanoma [25, 26]).

At the time of study conception, the only known SMS studies addressing safer sex and sun safety issues were the SEXINFO service in San Francisco [27] and our own previous SMS studies of sexual health promotion to young people [17, 18]; we could find none related to sun safety. More recently, Armstrong *et al.* investigated the use of SMS to

increase sunscreen adherence among American adults, finding those who received daily SMS reminders were significantly more likely to apply sunscreen daily compared with those not receiving the messages [19]. Our previous work indicated that SMS was effective for sexual health promotion to young people but relied upon manual collection of mobile phone numbers from individuals [17, 18]; in this project, we aimed to both pilot the use of mobile advertising as a means to reach individuals for health promotion and to evaluate the effectiveness of SMS to increase knowledge and promote beneficial behaviour change related to safer sex and sun safety among young people.

Materials and methods

Trial design

The S⁵ project was designed as a randomised controlled trial with simultaneous brief interventions. The study population was randomised to receive messages about either safer sex or sun safety over a 4-month period. This design allowed the ‘sex’ group to act as a control group to the ‘sun’ group to measure changes in sun safety behaviour over time and the ‘sun’ group to act as a control group to the ‘sex’ group to measure changes in safer sex over time.

Participants

The study population was individuals aged 16–29 years residing in the state of Victoria, Australia who subscribed to a mobile advertising service offered by one of the largest mobile telecommunications providers. In return for receiving mobile advertising, subscribers receive free access to various internet sites on their mobile phones via wireless application protocol (WAP). The telecommunications provider manages the delivery of mobile advertising; third parties are not given subscribers’ mobile numbers. Baseline and follow-up survey data were collected electronically via WAP.

Intervention design

The intervention was based primarily on Weinstein’s Precaution Adoption Process model [28,

29] and incorporated elements from Ajzen's Theory of Planned Behaviour [30] and Bandura's concept of self-efficacy [31].

All text messages were designed prior to the commencement of the broadcast period. The messages aimed to increase knowledge, reinforce protective behaviours, change attitudes and increase perceived behavioural control. To maximise appeal, messages were humorous, short, used informal language and were linked to particular annual events (such as Valentine's Day) where possible. These factors were shown to positively affect message acceptability and impact in our earlier study using SMS for sexual health promotion [32].

Messages were developed by the authors and staff at the Burnet Institute in the target age group and informed by those used in earlier SMS projects [17, 18] and pre-existing sun safety slogans [33]. Where possible, messages for each of the groups were aligned in terms of topic (prevention, consequences, etc.), phrasing and framing to minimise differences other than actual content between the groups.

Initial SMS messages were focus tested with young people recruited via the Monash University Careers website. Four focus groups were held, two with males and two with females, in a central city location. Groups were audio recorded, and all participants provided written informed consent before participating. Participants were presented with a scoring sheet and asked to rate alternate versions of each proposed message on characteristics such as appeal, ease of understanding, emotions solicited and utility. Once participants had rated all messages, a facilitated discussion was held to examine reasons for preference for particular messages and message style, as well as message utility. The overall results of the ranking and the discussions were used to design the final messages for broadcast.

Two MMS were also designed for each intervention group. The concepts for these messages were developed by the authors and graphically designed by the telecommunications provider's technicians. Due to timing constraints, these MMS were designed during the broadcast period and not focus tested.

Intervention implementation

The message broadcast schedule is displayed in Table I. Messages were designed to be sent out approximately fortnightly over the summer period, to maximise relevance to the sun safety group. We had previously found fortnightly message frequency to be appropriate [32]. Messages included an 'opt out' message (supplied by the telecommunications provider) informing subscribers how they could cease receiving mobile advertising messages. Messages were broadcast in the afternoon on the same day and time to each group (with the exception of the broadcast of the first safer sex message, which was delayed by the telecommunications provider). During the intervention period, subscribers may have been receiving advertising messages from other advertisers, in addition to our intervention messages.

Outcomes

The primary outcome measures for the safer sex group were changes in sexual health knowledge, frequency of condom use and proportion recently seeking testing for sexually transmitted infections (STIs). Change in number of sexual partners was a secondary outcome for this group. The primary outcome measures for the sun safety group were changes in the frequency of using sun protection measures (sunscreen, hats, seeking shade, clothing), tanning preferences and belief about risk of skin cancer. Frequency of sunburn over summer was a secondary outcome for this group. Acceptability of the intervention was a secondary outcome for both groups. All outcome measures were dichotomised for statistical analysis.

Online baseline and follow-up surveys were used to collect the outcome measures. The questionnaires collected brief information about demographics, sexual health knowledge and behaviour and usage frequency of sun protection measures and tanning preferences. The follow-up questionnaires also included questions relating to the SMS received and sunburn history over summer. The questionnaires were based on survey instruments used to collect data from young people recruited

Table I. Messages broadcast^a

Date sent	Event	Sun safety group	Safer sex group
1 Friday, 19 December 2008	Christmas period	Rudolph the Red Nose Reindeer left his hat and sunscreen @ home ☺ Happy holidays! http://vline.com.au/s/s5	On the first day of xmas my true love gave to me??? Most people with STIs have NO symptoms ^{b,c}
2 Thursday, 1 January 2009	New years day	Make a NY resolution u can keep: protect your skin from sunburn this summer. Sunburn now, melanoma later?	Make a resolution! Get a test when changing partners. Chlamydia can cause infertility
3 Friday, 16 January 2009	Summer	Skin damage MMS (Photo of girls face; magnifying glass passes over face and shows damage being caused by the sun. Text appears 'Don't BBQ your skin this summer'. UV rays cause wrinkles, blotches & increase your risk of skin cancer)	Partner risk MMS (Scrolling image of two people's feet protruding from a bed with text above 'Do you know who you're sleeping with?' with the text 'Your partner may have had partners, who've had partners' appearing as feet scroll. Then text appears 'Use Condoms. Get Tested')
4 Monday, 26 January 2009	Australia day	Enjoying the outdoors is Australian. Tanning shouldn't be. We have the world's highest rate of skin cancer.	Its no drama to get checked out 'down under'. Urine tests can check for the most common STIs.
5 Saturday, 14 February 2009	Valentines day	Roses are red, lobsters are redder. With a hat + shirt your skin will feel better. Happy Valentines Day!	Roses are red, daises are white, use a condom if you get lucky tonight. Happy Valentines Day!
6 Friday, 6 March 2009		A tan = skin in trauma. Protect your skin use a hat, shirt, sunscreen, sunnies and shade.	Summer loving, having a blast! Summer loving? Get an STI-test fast (easy, quick, painless) ^c
7 Friday, 20 March 2009		Tanning MMS (Video of female on a beach; camera zooms inside her body to show cells becoming cancerous due to sun exposure. Voice over describes the damage and closes with 'there is nothing healthy about a tan')	Testing MMS ^c (Text 'Chlamydia' appears at top of screen, followed by an animation of urine jar filling with 'easy to test' at top. Then two tablets fall into the screen with easy to treat appearing. Final screen displays 'Chlamydia just requires a urine test ... and if you're infected its just two tablets to clear it')
8 Friday, 3 April 2009	Footy season	Odds of your team drawing this weekend 100:1! Odds of melanoma 19:1! Don't bet on it: cover up in the sun.	Odds Demons win the flag 126:1, odds a friend has an STI 20:1. Don't bet on it: Most people have no symptoms. ^c

^aAll messages also contained an opt out message at the end (for detail, see Materials and Methods).

^bThe broadcast of this message was delayed by the mobile advertising provider until Monday, 22 December.

^cThe original message intended for these dates were not broadcast; these messages include changes insisted on by the telecommunications provider.

at music festivals [34] and to monitor sun exposure and sun protection [35]. The baseline survey was conducted in early December 2008, before the broadcast of the first message and the follow-up survey in May 2009, after the broadcast of the last message. All survey data were stored on secure

network drives at the Burnet Institute, to which only the researchers had access.

Questionnaires were completed on subscribers' mobile phones via WAP. Subscribers in our population (aged 16–29 years and residing in Victoria) were sent an SMS advertising the survey. Banner

advertisements for the survey were displayed on the telecommunications WAP home site (that subscribers use when accessing the internet on their mobile phones) to individuals in our study population (Fig. 1) Subscribers clicked on the link in the SMS or banner advertisement to access the survey WAP site. Eligible subscribers who had not completed the survey a week after the invitation were sent a reminder SMS. Subscribers received AUD\$5 mobile credit per completed questionnaire. To encourage subscribers to complete both questionnaires, those who completed the baseline questionnaire were offered AUD\$10 mobile credit to complete the follow-up questionnaire. As this trial was conducted outside an artificial trial setting, we expected that only a proportion of the total population would complete the questionnaires.

Sample size

Previous studies have shown around 7% of young people are tested for chlamydia each year [36]. To detect a 5% increase in STI testing rates in the safer sex group compared with the control (sun) group with a two-sided 5% significance level and a power of 90%, a sample size of 761 individuals per group was necessary. However, as the study aimed to reach a population via mobile advertising, and the response rate to the questionnaires was unknown, we included all available participants in the analysis.

Randomisation and blinding

The randomisation was performed by the telecommunications provider, who assigned groups by listing participants' mobile phone numbers in numerical order and assigning alternate numbers to each group. No blinding was performed.



Fig. 1. Banner ad advertising the survey on the telecommunication provider's WAP site.

Statistical methods

Initially we planned to compare baseline and follow-up measure of the primary outcomes both overall (as a population) and within individuals who completed both questionnaires (repeated measures analysis). Unfortunately, due to a technical error by the telecommunications provider, the baseline data did not contain information about which group individuals were assigned to, making the first analysis impossible. Thus, we performed follow-up only analysis, to compare responses on the follow-up survey between the two groups, as well as repeated measures analysis involving individuals who completed both questionnaires.

Differences in proportions between groups at baseline were assessed using the chi-square test. Differences in the retained proportion in each group during the intervention and completing the follow-up survey were investigated using a two-sample test of proportion. For each outcome, we investigated the association between the outcome variable and group assigned to using logistic regression. All results were also adjusted for potential confounding factors identified *a priori* [age, sex and if ever had sex (for the sex outcome variables)]. The Hosmer and Lemeshow goodness of fit was used to assess each model fit. All reported *P* values are two-tailed and for each analysis *P* = 0.05 was considered significant. All analyses were performed using STATA version 10.1 [37].

Ethics

Ethics approval for this study was obtained from the Human Research Ethics Committees of The Cancer Council Victoria and Monash University.

Results

Participation

On the 1st of December 2008, there were 7606 individuals aged 16–29 years residing in Victoria receiving mobile advertising from our telecommunications provider. These subscribers comprised our study population and were randomised to receive

the intervention; 3803 subscribers were assigned to receive messages about safer sex and 3803 were assigned to receive messages about sun safety (Fig. 2) Over the 4-month broadcast period the number of subscribers receiving the messages fluctuated, as individuals unsubscribed (and re-subscribed) to receive mobile advertising. At the study midpoint, the provider informed us that for the broadcast of the fifth message there were 3380 individuals remaining in the safer sex group and 3441 individuals remaining in the sun safety group ($P = 0.02$). They were unable to provide equivalent data at the conclusion of the broadcast period.

The WAP banner advertising the baseline survey was displayed 46 193 times (impressions) during the first 2 weeks of December 2008. These impressions, and the SMS advertising the survey, resulted in 2034 hits to the WAP site hosting the survey. Complete impression data were not provided for the follow-up survey.

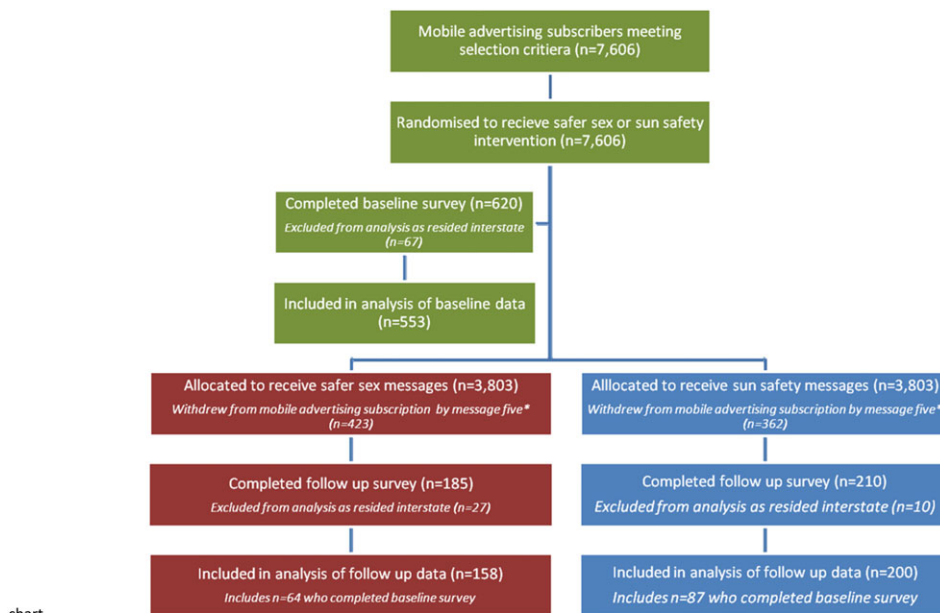
From the 7606 individuals enrolled at baseline, we received 620 (8.2%) completed baseline and

395 (5.2%) completed follow-up surveys. In total, 760 (10.0%) individuals completed one or both surveys (Fig. 2) After excluding individuals who reported residing interstate, there were 553 baseline surveys and 358 follow-up surveys (158 from the safer sex group versus 200 from the sun safety group, $P = 0.02$) available for analysis. One hundred and fifty-one individuals completed both the baseline and the follow-up surveys (Fig. 2).

Population characteristics

Data provided by the telecommunications provider showed our overall study population ($n = 7606$) was 55% male with 100% residing in Victoria (based on postcode supplied at mobile phone activation). The population was evenly distributed between those aged 16–24 years and 25–29 years.

Sixty percent of those completing the baseline questionnaire were male (Table II). The median age of baseline participants at 1 December 2008 was 25.3 years (range 17.9–29.9 years). Just over three-quarters (78%) reported residing in metropolitan



chart

* This was the last message for which the telecommunications provider was able to provide us with subscriber information

Fig. 2. Participant flow.

Melbourne. To verify randomisation was successful, we examined if there were any differences between the sex and sun groups at baseline in regards to age, gender, region of residence (metropolitan Melbourne or regional Victoria) and skin type (Table II). No significant differences were observed.

Safer sex outcomes

Follow-up only analysis ($n = 358$) showed that participants who received the sex messages had significantly higher sexual health knowledge than those who received the sun messages (Table III). Individuals who received the sex messages were also less likely to report having multiple or new sex partners and were more likely to report always using condoms with new partners at follow-up (Table III).

In the repeated measures analysis ($n = 151$), those who received the sex messages ($n = 64$) tended to be more likely to improve their sexual health knowledge from baseline to follow-up compared with those who received the sun messages

[odds ratio (OR) 1.9, 95% confidence interval (CI) 1.0–3.8, $P = 0.06$]. After adjusting for age, gender and reporting a sexual partner in previous 6 months, this trend remained but was not statistically significant [adjusted odds ratio (AOR) 1.8, 95% CI 0.9–3.5, $P = 0.1$]. There were no significant differences observed between groups in frequency of STI testing, improvement in condom use or reduction in partner numbers between time points.

Sun safety outcomes

In the follow-up only analysis ($n = 358$), no significant differences were detected between the sun and sex groups in tanning preferences, frequency of use of sun protection measures (hats, sunscreen, shade, clothing), belief about risk of skin cancer (Table IV) and frequency of sunburn over summer.

In the repeated measures analysis ($n = 151$), those who received the sun messages ($n = 87$) were significantly less likely to report at follow-up that their hat-wearing frequency had decreased since baseline compared with those who received the

Table II. Baseline characteristics

	Sex group		Sun group		P-value
	n	%	n	%	
Total^a	158	100	200	100	
Gender					
Female	62	39.2	81	40.5	0.81
Male	96	60.8	119	59.5	
Age (as of 1 December 2008)					
16–19 years	7	4.4	14	7.0	0.27
20–24 years	67	42.4	70	35.0	
25–29 years	84	53.2	116	58.0	
Skin type^b					
Just burn	50	31.6	61	30.5	0.78
Burn then tan	61	38.6	86	43.0	
Just tan	38	24.1	45	22.5	
Nothing—born with dark skin	9	5.7	8	4.0	
Region of residence					
Metropolitan Melbourne	133	84.2	164	82.0	0.59
Regional Victoria	25	15.8	36	18.0	

^aThis includes all individuals who completed the follow-up questionnaire and are included in subsequent data analysis. Responses at follow-up were used to extrapolate their characteristics at baseline where the baseline questionnaire was not completed. If individuals moved during the intervention period, their region of residence details may not be accurate.

^bThis measure refers to what happens to an individual's skin if they are exposed to the sun for 30 min at the beginning of summer for 30 min.

Table III. Safer sex outcomes—analysis using follow-up surveys only

	Sun (control) group (n)	Sex (intervention) group (n)	Unadjusted			Adjusted ^a		
			OR	95% CI	P-value	OR	95% CI	P-value
Overall	200	158						
Sexual health knowledge (three questions)								
Not all questions correct	174	128	1.0			1.0		
All questions correct	26	36	1.9	1.1–3.4	0.02	2.0	1.1–3.5	0.02
Sexual partner/s, past 6 months								
No	26	20	1.0			1.0		
Yes	174	138	1.0	0.6–1.9	0.92	1.0	0.5–1.8	0.94
Reported sexual partner, past 6 months	174	138						
STI test, past 6 months								
No	144	107	1.0			1.0		
Yes	30	31	1.4	0.8–2.4	0.25	1.1	0.4–2.9	0.90
Always use condoms, past 6 months								
No	117	98	1.0			1.0		
Yes	55	38	0.8	0.5–1.4	0.44	0.8	0.5–1.3	0.42
Multiple sexual partners, past 6 months								
No	111	102	1.0			1.0		
Yes	63	36	0.6	0.4–1.0	0.06	0.6	0.3–1.0	0.03
Always use condoms if have multiple partners, past 6 months								
No	39	21	1.0			1.0		
Yes	24	15	1.2	0.5–2.7	0.73	1.2	0.5–2.8	0.69
New sexual partner, past 3 months								
No	80	79	1.0			1.0		
Yes	94	59	0.6	0.4–1.0	0.05	0.6	0.4–0.9	0.03
Always use condoms with new sexual partner/s, past 3 months								
No	47	19	1.0			1.0		
Yes	47	40	2.1	1.1–4.2	0.03	2.2	1.1–4.2	0.03

^aAdjusted for age, gender and if reported sexual partner in past 6 months.

sex messages (OR 0.5, 95% CI 0.2–1.0, $P = 0.05$). This relationship strengthened when age and sex were adjusted for (AOR 0.4, 95% CI 0.2–0.9, $P = 0.02$). There were no significant differences observed between groups in frequency of wearing hats, skimpy clothing, seeking shade or tanning preferences.

SMS acceptability

Just under half of the participants reported on the follow-up questionnaire that they found the messages interesting or entertaining (48%), with 39% reporting they learnt something from the messages and 19% reported they showed the messages to others. Twenty-two percent reported they found the messages annoying.

Participants who received the sex messages tended to be less likely to report they learnt something from the SMS (AOR 0.6, 95% CI 0.4–1.0, $P = 0.05$) and significantly more likely to report they found the messages annoying (AOR 1.9, 95% CI 1.1–3.2, $P = 0.01$) compared with those who received the sun messages. There was no difference between groups in reporting they found the messages interesting or entertaining or showing messages to others.

Discussion

This study is the first to report on the use of mobile advertising to deliver health promotion messages; a true ‘mass marketing’ approach that can be easily

Table IV. Sun safety outcomes—analysis using follow-up surveys only

	Sex (control) group (n)	Sun (intervention) group (n)	Unadjusted			Adjusted ^a		
			OR	95% CI	P-value	OR	95% CI	P-value
Total	158	200						
Preference for a dark tan								
No	144	180	1.0			1.0		
Yes	14	20	1.1	0.6–2.3	0.72	1.1	0.6–2.4	0.72
Believe about risk of skin cancer								
No	66	83	1.0			1.0		
Yes	91	116	1.0	0.7–1.5	0.95	1.0	0.6–1.5	0.98
Hat-wearing frequency^b								
Never/rarely/sometimes	113	137	1.0			1.0		
Usually/always	45	63	1.2	0.7–1.8	0.54	1.2	0.7–1.9	0.47
Sunscreen (SPF 30+) wearing frequency^b								
Never/rarely/sometimes	94	123	1.0			1.0		
Usually/always	64	77	0.9	0.6–1.4	0.70	0.9	0.6–1.4	0.64
Frequency of seeking shade^b								
Never/rarely/sometimes	98	124	1.0			1.0		
Usually/always	160	76	1.0	0.7–1.5	1.0	1.0	0.6–1.5	0.99
Frequency of wearing deliberately wearing skimpy clothing^{b,c}								
Never/rarely/sometimes	121	155	1.0	1.0		1.0		
Usually/always	37	45	0.9	0.6–1.6	0.84	1.0	0.6–1.6	0.85

^aAdjusted for age and gender.

^bWhen outside on a sunny day during summer for more than an hour between 11 a.m. and 3 p.m.

^cHosmer and Lemeshow goodness of fit $P = 0.04$.

scaled up, with population size only limited by the number of subscribers to the channel chosen for delivery. We used an innovative study design with simultaneous brief interventions to concurrently evaluate the use of SMS to promote beneficial change related to safer sex and sun safety. Consistent with our similar earlier studies [17, 18], this study showed SMS is a useful tool for sexual health promotion to young people. We were unable to identify a benefit from the sun safety messages, but this may be due to the challenges experienced during intervention implementation.

As individuals—and particularly young people—continue to increase their use of mobile phones, it is important that health promotion practitioners explore how this technology can be exploited to reach the largest possible audience. Mobile advertising offers a way of placing health promotion content on mobile phones, much as space is purchased by health promoters in ‘traditional’ media such as TV, radio and billboards. The advantage of mobile advertising is

that messages can be sent directly to the target audience at a specified time with guaranteed message delivery. In addition, it is relatively simple to then access the same population for evaluation purposes; although not all will participate in the evaluation (as with evaluations of interventions in traditional media, where only a proportion are sampled), the intervention will still reach a large group of individuals.

Our analysis suggests our messages had a positive impact on knowledge and behaviour related to safer sex. Consistent with our earlier similar studies, we observed an increase in knowledge among individuals exposed to safer sex messages. We also observed a significant decrease in the number of sexual partners reported by our intervention group, which we have observed previously among males. Unlike our earlier studies, we did not detect an effect of the messages on STI testing. This may be because this study comprised fewer messages and a shorter time period, the challenges in intervention

implementation or differences in characteristics between study populations (compared with the previous studies [17, 18], this population was older, included more males and had a higher proportion residing in metropolitan areas, having an STI test in the past 6 months and reporting a new sexual partner). Certainly, our inability to distinguish the group to which participants were assigned at baseline and the small numbers who completed both questionnaires limited our analysis, but it is heartening that despite these challenges, using SMS for sexual health promotion among young people is consistently successful in changing knowledge and (to some extent) behaviours. The current Australian Sexually Transmissible Infections Strategy aims to increase knowledge, increase testing and reduce the incidence of chlamydia [38]; text messaging is one tool that could be employed to help meet these aims.

We observed limited impact of the messages on behaviours related to sun safety. The only observed difference between groups was a lower proportion of those in the sun group reporting a decrease in hat-wearing over summer. We are unable to ascertain if the limited impact of our messages was due to difficulties experienced with study implementation and evaluation or if the approach trialled may be less successful for sun protection than sexual health. Certainly, awareness and knowledge of sun protection measures is high among young Australians [39], with prominent and consistent sun protection campaigns in schools and media [35,40–42], unlike sexual health where knowledge is low [43, 44] and campaigns sporadic [45–48]. Thus, the messages related to sun safety may not be providing individuals with different information from what they have already been exposed to, and therefore have limited utility. Additionally, when designing the sun safety messages, we found it difficult to design messages that were funny, entertaining and/or had a different approach from ‘standard’ health promotion messages, all factors that we have previously found important for recall and impact of messages related to safer sex [32]. Nevertheless, further exploration of how SMS could be used to promote sun safety is still warranted, particularly in the context

of a recent study that found SMS was successful in increasing daily use of sunscreen [19]. It would be worthwhile investigating whether broadcasting messages at different times (e.g. earlier in the summer period or mornings rather than afternoons) would be a more successful approach for this behaviour.

Compared with our previous studies of using SMS for sexual health promotion [17, 18], far fewer individuals found the messages entertaining or interesting and fewer showed the messages to others. This could be a reflection of the differences between the messages used in this study and those used in our previous research; some of the safer sex messages were censored by the provider, and (as noted earlier) we found designing appealing sun safety messages difficult. It may also reflect the context in which messages in this study were delivered, as these individuals were accustomed to receiving advertising on their mobile phones, thus our messages were less of a ‘novelty’ and may not have been noticed amongst the other advertising. Including a sign off (e.g. Love the Burnet Institute/Cancer Council) as originally intended may have added credibility [32], and helped differentiate the messages from other advertising, but was not possible due to space restrictions.

This study had several limitations. Firstly, we were unable to fully implement our brief intervention as intended due to restrictions imposed by the telecommunications company and technical difficulties. This may have altered intervention effectiveness. Secondly, due to the nature of the recruitment it is difficult to determine if the 10% of participants who completed the surveys are representative of all those who received the messages. We were unable to ascertain differences between subscribers who did and didn’t complete the evaluation questionnaires, but those completing the baseline survey were very similar age and gender to the overall study population. However, we were unable to assess differences between groups at baseline in relation to safer sex and sun safety behaviours. In addition, the small number of completed questionnaires limited the data analysis possible, the conclusions that could be drawn from the intervention and resulted in insufficient statistical

power to detect the expected increase in STI testing. Use of more attractive incentives (e.g. prizes or larger payments) and additional promotion may have increased the survey participation rate. Thirdly, a number of individuals who completed the follow-up questionnaire reported receiving messages for the group to which they were not assigned. We attempted to verify these reports by contacting a subset of individuals once survey data had been examined in detail (August 2009) but were unable to clearly ascertain if contamination in groups had occurred. All statistical analyses were conducted based on both group assignment and the messages individuals stated they had received, and no major differences were observed. Fourthly, the baseline survey data did not contain a record of individuals' group assignment, limiting the analysis and interpretation of intervention effects. Fifthly, mobile advertising via SMS may be less successful in the few jurisdictions (e.g. the United States) where individuals are charged to receive incoming messages. However, previous SMS-based interventions to promote behaviour change in the United States have not reported cost to be a barrier [8, 16, 19]. Finally, all data were self-reported and subject to recall and social desirability biases [49, 50].

In conclusion, mobile advertising is an exciting new medium in which health promotion practitioners can accurately target and reach millions of individuals. We have repeatedly demonstrated that text messaging is an effective means of sexual health promotion to young people. While we should continue to explore how mobile advertising can be exploited for health-related purposes, we need to be mindful that the necessary involvement of a commercial provider brings its own difficulties and challenges. In a global context of greatly increased use of new technologies, we must continue exploring new avenues in which to deliver, and evaluate, health promotion to our audiences.

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Conflict of interest statement

None declared.

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