Published in final edited form as:
Am J Prev Med. 2014 November ; 47(5): 617–623. doi:10.1016/j.amepre.2014.06.014.

Effects of a Short Messaging Service–Based Skin Cancer Prevention Campaign in Adolescents

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Abstract

Background—Skin cancer prevention emphasizes early adoption and practice of sun protection behaviors. Adolescence represents a high-risk period for ultraviolet radiation exposure, presenting an opportunity for intervention. The ubiquity of mobile phones among teens offers an engaging medium through which to communicate prevention messages.

Purpose—To evaluate a skin cancer prevention intervention using short messaging service (SMS, or text messages) to impact sun-related knowledge, beliefs, and behaviors among adolescents.

Methods—The intervention was conducted in middle school youth (N=113) recruited in April or October 2012. Participants were English speakers, 11–14 years old, routinely carried a mobile phone, and completed a 55-minute sun safety education program. Participants were sent three sun safety–themed SMS messages each week for 12 weeks. Skin and sun protective knowledge, beliefs, behaviors, and post-intervention program satisfaction were collected and analyzed at baseline and end of intervention (April/June 2012; October 2012/January 2013). Paired responses were tested for equality using Wilcoxon signed-rank tests.

Results—Ninety-six students (85%) completed the study. At 12 weeks, significant positive changes were reported for sun avoidance during peak ultraviolet radiation, sunscreen application, wearing hats and sunglasses, and knowledge about skin cancer risk. Participants expressed moderately high satisfaction with the program, and 15% shared messages with family or friends.

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Conclusions—A brief, SMS-based intervention impacted youth skin cancer prevention behaviors and knowledge. Future research will determine whether program effects were sustained at 24 weeks and explore how sun safety parenting practices inform these effects.

Introduction

Skin cancer is the most common and preventable form of cancer in the U.S., with more than 3.5 million cases annually.[1] Prevention targets include reduction of ultraviolet radiation (UVR) exposure through sun avoidance, protective clothing, and sunscreen.[2]

Adolescents are less likely to exercise UVR protection than other age groups.[3] Fewer than 40% practice sun protection regularly, and more than 70% report at least one serious sunburn annually.[4] Although public health guidelines recommend age-appropriate information and behavioral skills training as strategies to enhance teen prevention behaviors,[5] programs have modestly impacted knowledge and awareness[6,7] with few behavioral effects.[8–10] An emphasis on knowledge without adequate focus on behavioral determinants is considered a limitation of earlier work.

Diffusion of innovations theory (DIT) proposes the spread of behavior by four elements: the innovation itself, the social system in which the innovation is promulgated, the communication channel used, and the time in which the diffusion occurs.[11] Consistent with DIT, promotion of behavioral strategies aligned with adolescents' perceived risks and social context should enhance outcomes,[12] while high rates of mobile phone ownership among adolescents[13] present a medium through which prevention may be communicated. Frequency of text messaging (short message service [SMS]) exceeds other forms of mobile communication.[14] Studies have explored the use of SMS to promote healthy eating,[15] physical activity,[16] sexual and reproductive health,[17,18] and smoking cessation,[19] but none have addressed adolescent sun safety. The objective of this study was to test the acceptability and effect of an SMS-based sun safety intervention on adolescents' sun-related behaviors, beliefs, and knowledge.

Methods

Study Population

Participants were recruited from science, health, and physical education classes at three middle schools in Tucson, Arizona. Eligible youth were 11–14 years old, English-speaking, carried an SMS-capable phone, and participated in a 55-minute sun safety program led by university students two weeks prior to recruitment.[20] Recruitment occurred through presentations to youth and written materials for parents. Respondents were encouraged to attend meetings with researchers during which child assent and written parental permission were obtained. The University of Arizona IRB approved the study.

Intervention Development

The intervention was a 12-week, pre–post design with students recruited in spring 2012 (n=61 students enrolled from four classrooms in two schools) and fall 2012 (n=52 students enrolled from five classrooms in three schools).

Informed by skin cancer prevention literature and educational resources,[21] researchers developed 80 messages for SMS delivery. Messages were designed to explain cancer risk, note sun protection benefits, and counter beliefs contrary to public health recommendations through information, reminders, and behavioral strategies. Formative research, using a participatory approach[22] with 59 adolescents (aged 11–14 years), assessed relevance, utility, and youth comprehension of candidate messages, and determined desired delivery frequency. Candidate messages were brought to youth during four focus group sessions. Participants were provided 25 candidate messages for evaluation, printed on separate cards. Participants read the messages aloud, identified words or phrases they did not understand, and rated messages using a 3-point Likert scale where 1 indicated high enthusiasm, 2 indicated modest enthusiasm with necessary revisions, or 3 indicated the message was not viable. Rationales for each rating were discussed. Messages receiving 1 and 2 were retained for the final message library (Table 1).

Outcome Measures

Outcomes were assessed using a self-administered 26-item survey. Nine items assessed typical sun exposure, annual sunburn incidence, frequency of protective behaviors, and intentional tanning behavior.[23] Remaining items assessed physical characteristics related to risk,[24–26] perception of skin cancer risk, readiness to engage in protective behaviors,[27] indoor tanning, beliefs toward tanned skin,[28] and skin cancer knowledge.[20] Participants completed a paper survey at baseline, and a web-based version at 12 weeks. Demographic data and intervention satisfaction were determined.

Statistical Analysis

Analyses were conducted in June 2012 and January 2013 following completion of 12-week data collection. Pre–post comparisons were restricted to participants completing both surveys (n=96). Five items designed to test skin cancer knowledge were multiple choice, with total correct answers summed and analyzed separately as an index. Pre–post differences were tested using Wilcoxon signed-rank tests or paired t-tests. Analyses were completed using SAS, version 9.3 (SAS Institute Inc., Cary NC).

Results

One hundred thirteen participants (60 girls, 51 boys) received 36 SMS messages over 12 weeks (three/week, at 7:30$_{AM}$ or 4:00$_{PM}$) sent by an Android OS software application developed for the study.[29] Study completion rates were 89% (Table 2).

At baseline, 54%–61% of participants reported physical characteristics associated with increased risk (e.g., light hair and eyes, very fair/fair untanned skin). Seventy-five percent reported sunburn in the past 12 months, and 25% reported three or more.

Baseline and 12-week survey responses are shown in Table 2. At baseline, 36.5% reported they wore sunscreen *often* or *always*. Seventeen percent believed a tan made them more attractive (29% disagreed, 54% were neutral). Twenty-three percent thought they were somewhat or very likely to get skin cancer in the future. Gender differences were observed for intentional tanning (79% of girls versus 93% of boys reported rarely or never

intentionally tanning). Sixty-eight percent knew what to wear to cover up from the sun, but only half correctly identified additional strategies to avoid sunburn or indoor tanning risks. Almost 42% knew types of skin cancer, and 25% recognized factors that increased UVR intensity.

At 12 weeks, significant increases were reported for wearing sunscreen (37% to 52%, p=0.001), hats (13% to 15%, p=0.02), and sunglasses (29% to 33%, p=0.02). More participants considered sun avoidance during peak UVR (p=0.02). Wearing long-sleeved shirts, shade seeking, and weekend/day sun exposure improved, cancer risk perception decreased, and positive beliefs toward tanned skin increased; however, these changes were not significant. No changes in intentional tanning behaviors were reported. Although there was a significant increase in overall knowledge (p=0.03), this change was primarily driven by knowledge about skin cancer types.

Fifty-three percent of participants said they would recommend the program to a friend, whereas only 10% did not enjoy receiving SMS messages. Almost 15% reported sharing specific messages with friends or family.

Discussion

Primary prevention remains the most effective strategy for reducing skin cancer risk.[2] In this study, 113 adolescents received SMS messages focused on skin cancer prevention. In contrast to previous studies involving adolescents,[6,8,30–34] participants reported significant behavioral changes. Novel to this study were reports that some participants received, read, and discussed content with others. The potential use of SMS to activate adolescents' engagement around skin cancer prevention is promising, particularly in light of data that suggest significant effects of social networks on health.[35] Although not emphasized in this study, inclusion of peers and parents could enhance participant behavioral change. Previous research suggested higher sun protection behaviors among adolescents who received information and encouragement from parents and teachers compared to those who reported one or no sources of support,[36] and reinforcement of behavior change by multiple sources has successfully impacted sun-related behaviors in primary care and community-based interventions.[37,38] Improvements in adolescent UVR exposure and sunscreen use occurred after a brief, primary care–based counseling session followed by tailored intervention materials delivered by mail[37]; in a community setting, parents, coaches, and teachers served as sun safety role models, resulting in a small but significant impact on protective clothing and sunscreen use by adolescents up to 2 years later.[38]

Similar to previous work,[39] this study was limited by reliance on self-reported outcomes. Further, this was a pilot study with no control group, the sample was not representative, nor were observed changes evaluated as a function of message type or frequency. Changes did not occur across all behaviors targeted by SMS; further research is needed to understand which messages were or were not effective, and why. However, findings from this study suggested that an SMS-based intervention has the potential to affect adolescent sun protection behaviors and skin cancer knowledge. Future research will determine whether these changes were sustained and explore the role of parenting practices on these effects.

Acknowledgments

This project is supported by a contract from the National Library of Medicine (NLM), NIH. The NLM was consulted but did not manage the study design, collection, analysis, or interpretation of data, writing of the report, or the decision to submit the manuscript for publication. The authors would like to acknowledge Nirav Merchant and David Parizek at Arizona Research Laboratories at the University of Arizona for their contributions to the software infrastructure and the mobile application used in this study, and Jianhua Hilgaertner for her assistance with data analysis. In addition, the authors would like to thank the teachers at Emily Gray Junior High School, St. Gregory College Preparatory School, and Desert Sky Middle School in Tucson, Arizona, for their help in recruiting youth to this study. Finally, the authors would like to acknowledge Lisa Quale at the Skin Cancer Institute at the University of Arizona Cancer Center, who helped in the development of skin cancer and sun safety messages used for this study.

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Table 1

Intervention content sent through SMS and domain areas

The importance of skin
Your skin is the largest organ in your body and accounts for 15% of your body weight!
Your skin helps to protect, regulates body temperature, and senses touch.
What causes 90% of skin cancer?? Post the correct answer to the Project SASS fb page or projectsass.blogspot.com! [online response]
Types of skin cancer
Everyone is at risk to develop skin cancer! Ask someone if they remembered to apply sunscreen this morning and post their response. [online response]
Skin cancer usually occurs where you get the most sun, such as your neck, hands, ears, nose, eyes, and shoulders.
Your skin is thinnest on the eyelid. Cover up delicate areas of your skin most likely to get sun damage, such as around your eyes and mouth.
The number of skin cancer cases is more than all other cancer cases combined, making it the most common type of cancer.
Three easily preventable skin cancers are: Melanoma, Basal Cell Carcinoma, and Squamous Cell Carcinoma.
Avoid the sun by covering up, seeking shade, and staying inside during the middle of the day when the sun's rays are strongest.
One really bad sunburn doubles your risk of skin cancer when you are older.
Keep your skin young, clear, and beautiful: apply sunscreen daily and wear a hat when you go outside!
Post your favorite sport on our facebook page or blog and tell us how you can protect yourself from the sun while playing! [online response]
Ultraviolet radiation and its consequences
Ultraviolet (UV) Radiation is energy emitted from the sun in the form of rays. UV is responsible for sunburn, tans, and wrinkles.
UVA rays travel deeper into the skin and are constant year-round. UVB are the primary cause of sunburn. UVC are blocked by the earth's ozone layer.
When choosing a pair of sunglasses, look for a pair with UV protection. UV radiation can damage both the outside and inside parts of your eye!
Do you really want premature wrinkles? Then, always wear sunscreen!
UV light weakens your immune system. Your health improves by protecting yourself from the sun.
Preparing for a fun weekend in the sun? Don't forget to bring sunscreen and a hat to avoid sunburn.
Ultraviolet Radiation is affected by latitude, change in seasons, altitude, light reflection, and ozone layer depletion.
The Ultraviolet (UV) index measures the strength of the sun's rays. The higher the UV rating, the higher the risk of sunburn.
Clothing with UV protection, hats, sunglasses, and close-toed shoes will lessen the dangerous rays reaching your skin.
The sun's UV rays are stronger than 20 years ago because the earth's ozone layer offers less protection.
Sunscreens and lotions with SPF wear off during the day because of sweat, oils, dirt, light rays, and routine skin exposure.
What SPF are you wearing today? Post it to our fb page or projectsass.blogspot.com. [online response]
One person dies every hour from melanoma skin cancer in the U.S. and 1 out of 5 Americans develop skin cancer in their lifetime.
Wearing daily moisturizer or sunscreen with at least a 30+ SPF protects your skin from too much sun exposure.
Interested in finding out daily UV radiation levels?? Check out the UV index at epa.gov or find it @ projectsass.blogspot.com.

Sun safety prevention strategies and tanning

Remember the “Shadow Rule.” When your shadow is shorter than you are, always seek shade! The sun's UV rays are strongest between 10am and 4pm.

10 minutes in a tanning bed causes more damage than 30 minutes of playing outside.

Prevent your skin from being described as: “dry, cracked, scaly, blistered, and scarred.” Apply sunscreen daily!

Freckles and tans are both signs of sun damage to your skin!

Tanning beds average 13 on the UV index, which puts you at risk for dry skin, nausea, premature wrinkling, skin infections, and skin cancer.

Find someone who is sun safe—wearing a long sleeve shirt, hat, and sunglasses. Take a pic and post it to projectsass.blogspot.comor fb! [online response]

Your skin cancer risk increases every time you use a tanning bed, tan from natural light, or sunburn.

Most skin cancers are cured if discovered early, so please check your skin for irregular spots. Consult a doctor if you see something.

Remember what ACE stands for?? Avoid, Cover Up, Examine! How can you be an ACE today?

SASS, Students Are Sun Safe; SMS, short messaging service; SPF, sun protection factor; UV, ultraviolet

Table 2

Comparison of pre–post behaviors, beliefs, and knowledge about skin cancer and sun safety of the 96 participants

	Baseline Pre-test		12-week Post-test		
	M	**SD**	**M**	**SD**	***p*-value[a]**
KNOWLEDGE					
3 main types of skin cancer (5 points possible)	3.5	1.5	4	1.3	**0.003**
Factors that can make UVR stronger (5 points)	3.4	1.2	3.3	1.2	0.46
Precautions to take to avoid sunburn (5 points)	4.2	1.1	4.4	1.0	0.2
What to put on to "cover up" from the sun (5 points)	4.5	0.8	4.5	0.8	0.85
Side effects of indoor tanning (5 points)	4.2	1.2	4.4	0.9	0.1
UV index of an indoor tanning bed (1 point)	0.5	0.5	0.6	0.5	0.11
Total knowledge score (26 points possible)	20.39	3.8	21.18	3.2	**0.03**
	n	**%**	***n***	**%**	***p*-value[a]**
BELIEFS					
How likely they think they are to get skin cancer[b]					0.23
Very to somewhat likely	22	22.9	17	18.1	
Neither likely nor unlikely	36	37.5	33	35.1	
Somewhat to very unlikely	38	39.6	44	46.8	
Having a tan makes them more attractive[b]					0.55
Agree to strongly agree	16	16.7	20	21.3	
Neither agree nor disagree	52	54.2	48	51.1	
Disagree to strongly disagree	28	29.2	26	27.7	
Considered finding shade for my protection, 10AM to 4PM[b]					**0.02**
Never thought of using shade	10	10.4	7	7.4	
Thinking of looking for shade	12	12.5	5	5.3	
Going to begin to look for shade	6	6.3	6	6.3	
Sometimes look for shade	38	39.6	39	41.1	
Have used shade to protect myself for a long time	30	31.3	38	40.0	
Considered using sunscreen (SPF 30+)[b]					0.26
Never thought of using	4	4.2	2	2.1	
Thinking of using	9	9.4	13	13.7	
Going to begin	10	10.4	3	3.2	
Started	8	8.3	11	11.6	
Have used sunscreen for a long time	46	47.9	38	40.0	
Have always used sunscreen	19	19.8	28	29.5	
Considered giving up sunbathing[b]					0.32
Never thought of giving it up	11	11.5	10	10.5	
Thinking of giving it up	6	6.3	6	6.3	

	n	%	*n*	%	*p*-value[a]
Going to give it up	2	2.1	1	1.1	
Started to give it up	5	5.2	2	2.1	
Gave it up for long time	5	5.2	6	6.3	
Have never sunbathed	67	69.8	70	73.7	
BEHAVIORS					
Wear sunscreen					**0.001**
Often to always	35	36.5	50	52.1	
Sometimes	34	35.4	26	27.1	
Rarely to never	27	28.1	20	20.8	
Wear shirt that covers shoulders[b]					0.76
Often to always	64	67.4	68	70.8	
Sometimes	20	21.1	13	13.5	
Rarely to never	11	11.6	15	15.6	
Wear hat					**0.02**
Often to always	12	12.5	14	14.6	
Sometimes	20	20.8	28	29.2	
Rarely to never	64	66.7	54	56.3	
Stay in shade[b]					0.53
Often to always	24	25.0	26	27.7	
Sometimes	47	49.0	43	45.7	
Rarely to never	25	26.0	25	26.6	
Wear sunglasses[b]					**0.02**
Often to always	28	29.2	31	33.0	
Sometimes	15	15.6	23	24.5	
Rarely to never	53	55.2	40	42.6	
Spend time in sun to tan					0.12
Often to always	5	5.2	7	7.3	
Sometimes	9	9.4	11	11.5	
Rarely to never	82	85.4	78	81.3	
Typical weekday summer sun exposure[b]					0.09
≤1 hour	23	24.2	29	30.5	
>1 hour but ≤3 hours	47	49.5	45	47.4	
>3 hours but <5 hours	18	18.9	18	18.9	
≥5 hours	7	7.4	3	3.2	
Typical weekend summer sun exposure					0.39
≤1 hour	23	24.0	22	22.9	
>1 hour but ≤3 hours	39	40.6	47	49.0	
>3 hours but <5 hours	24	25.0	19	19.8	
≥5 hours	10	10.4	8	8.3	

Note: Boldface indicates statistical significance.

SPF, sun protection factor; UVR, ultraviolet radiation

[a]Wilcoxon signed-rank test.

[b] Not all teens answered every question during pre- or post-test.