Psycho-Oncology
Psycho-Oncology **25**: 28–35 (2016)
Published online 11 November 2015 in Wiley Online Library (wileyonlinelibrary.com). **DOI**: 10.1002/pon.4007

Mediation of improvements in sun protective and skin self-examination behaviours: results from the healthy text study

Jannah Baker[1], Linda Finch[1], H. Peter Soyer[2], Alison L. Marshall[1], Peter Baade[3], Philippa Youl[3] and Monika Janda[1]*
[1]*School of Public Health and Social Work, Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, QLD, Australia*
[2]*Dermatology Research Centre, The University of Queensland, School of Medicine, Translational Research Institute, Princess Alexandra Hospital, Brisbane, QLD, Australia*
[3]*Cancer Research Centre, Cancer Council Queensland, Brisbane, QLD, Australia*

**Correspondence to: Queensland University of Technology, School of Public Health and Social Work, Institute of Health and Biomedical Innovation, Victoria Park Road, Kelvin Grove, Queensland, Australia, 4059.*
E-mail: m.janda@qut.edu.au

Received: 30 October 2014
Revised: 21 September 2015
Accepted: 22 September 2015

Abstract

***Objective*: Melanoma is on the rise, especially in Caucasian populations exposed to high ultraviolet radiation such as in Australia. This paper examined the psychological components facilitating change in skin cancer prevention or early detection behaviours following a text message intervention.**

***Methods*: The Queensland-based participants were 18 to 42 years old, from the Healthy Text study ($N = 546$). Overall, 512 (94%) participants completed the 12-month follow-up questionnaires. Following the social cognitive model, potential mediators of skin self-examination (SSE) and sun protection behaviour change were examined using stepwise logistic regression models.**

***Results*: At 12-month follow-up, odds of performing an SSE in the past 12 months were mediated by baseline confidence in finding time to check skin (an outcome expectation), with a change in odds ratio of 11.9% in the SSE group versus the control group when including the mediator. Odds of greater than average sun protective habits index at 12-month follow-up were mediated by (a) an attempt to get a suntan at baseline (an outcome expectation) and (b) baseline sun protective habits index, with a change in odds ratio of 10.0% and 11.8%, respectively in the SSE group versus the control group.**

***Conclusions*: Few of the suspected mediation pathways were confirmed with the exception of outcome expectations and past behaviours. Future intervention programmes could use alternative theoretical models to elucidate how improvements in health behaviours can optimally be facilitated.**

Background

Melanoma has become very common worldwide [1,2]. In Australia, melanoma is the third most common cause of new cancer cases among both men (after prostate and bowel cancer) and women (after breast and bowel cancer), with an estimated 12,510 new cases each year [3].

Intervention programs of skin self-examination (SSE) and sun protective behaviours guided by psychosocial models of behaviour change have reported varying levels of effectiveness [4–7]. More recently, health promotion programs delivery via computer-based or short message service (SMS) have shown promise [8–10]. Understanding the pathways through which behaviour change occurs is important in order to tailor programs effectively. In addition to socio-demographic variables such as gender and socio-economic status [4], social cognitive variables including attitudes, beliefs and perceptions differ widely among individuals and influence responsiveness to health behaviour change programs [11–13].

Social cognitive models such as protection motivation theory and self-efficacy theory have been previously used to design health behaviour interventions [14]. Only a few studies [13,15–21] have examined the role of social cognitive constructs in improving skin cancer prevention, and factors included in these analyses have not been comprehensive of the social cognitive model framework. None of these previous studies explored the mediation pathways for a text message delivered intervention.

This study assessed 18 potential mediators of the effect of the intervention on (a) self-reported SSE and (b) a composite score of sun protective behaviour.

Methods

The Healthy Text study (approved by the Queensland University of Technology's Human Research Ethics Committee, QUT 1100000942) enrolled 546 participants (368 females, 178 males) aged 18 to 42 years from the Queensland electoral and medicare rolls. Participants were randomly assigned to one of three groups: attention control ($n = 183$) – SMS messages encouraging physical activity; intervention group one ($n = 176$) – equal number of

Table 1. Effect of potential mediators to odds ratio estimates of any skin self-examination (SSE) over the past 12 months at 12-month follow-up. The base model for 'SSE group vs Control' compares the odds ratio of performing a SSE over the past 12 months in the SSE intervention group versus the control group, and subsequent rows report how this base odds ratio changes with the addition of one potential mediator to the model and similarly for the 'Sun protect group vs Control' section.

	Potential mediator				SSE group vs Control					Sun protect group vs Control				
	OR	LL	UL	*P*	OR	LL	UL	*P*	% change	OR	LL	UL	*P*	% change
Base model	—	—	—	—	2.49	1.60	3.87	<0.0001		1.27	0.84	1.91	0.24	
Potential baseline mediators are as follows:														
Age	1.05	1.02	1.08	0.001	2.48	1.59	3.87	0.0001	-0.40	1.28	0.84	1.94	0.27	1.03
BMI	1.05	1.01	1.09	0.006	2.59	1.65	4.05	<0.0001	3.86	1.29	0.85	1.95	0.24	1.82
Plans to reduce risk of skin cancer	1.15	0.98	1.35	0.08	2.50	1.60	3.89	<0.0001	0.40	1.26	0.83	1.90	0.22	-0.71
Plans to check skin for early signs of skin cancer in the future	1.38	1.18	1.62	<0.0001	2.54	1.62	3.99	<0.0001	2.25	1.21	0.80	1.84	0.15	-4.19
Has made an attempt to get a suntan in the past 12 months	1.41	0.84	2.38	0.20	2.40	1.54	3.75	0.0002	-3.54	1.26	0.83	1.90	0.27	-0.55
Uses sun protection mainly to:														
Protect themselves from sunburn	1.24	0.84	1.82	0.28	2.50	1.61	3.90	<0.0001	0.56	1.27	0.85	1.92	0.25	0.63
Prevent premature ageing	0.59	0.25	1.35	0.21	2.52	1.62	3.93	<0.0001	1.29	1.29	0.85	1.95	0.27	1.82
Both of the above	0.99	0.65	1.50	0.96	2.49	1.60	3.87	<0.0001	0.04	1.27	0.84	1.91	0.24	0.08
Believes they are likely to get skin cancer at some time in the future	1.59	1.22	2.07	0.0005	2.47	1.58	3.87	<0.0001	-0.56	1.26	0.83	1.92	0.21	-0.24
Is confident they can check their own skin correctly	1.21	1.13	1.30	<0.0001	2.64	1.68	4.16	<0.0001	6.23	1.25	0.82	1.91	0.17	-1.03
Is confident they will find time in the next 3 months to check their skin	1.21	1.14	1.29	<0.0001	2.78	1.75	4.43	<0.0001	**11.90**	1.26	0.82	1.94	0.15	-0.32
Do you have a regular general practitioner (GP)	1.36	0.90	2.07	0.14	2.54	1.63	3.96	<0.0001	2.09	1.28	0.85	.93	0.24	0.87
Do you regularly visit your GP for health check-ups?	1.35	0.91	2.01	0.13	2.43	1.56	3.79	0.0001	-2.25	1.26	0.83	1.90	0.25	-0.63
Has your doctor ever provided you with information about sun protection?	2.13	1.36	3.35	0.001	2.42	1.55	3.78	0.001	-2.73	1.25	0.83	1.90	0.25	-1.11
Their doctor has shown them how to check their own skin for early signs of skin cancer	2.25	1.44	3.52	0.0004	2.50	1.60	3.91	<0.0001	0.60	1.24	0.82	1.88	0.19	-2.29
Believes that if they regularly protect their skin from the sun they are in danger of not getting enough Vitamin D	1.33	1.13	1.56	0.0005	2.54	1.63	3.98	<0.0001	2.25	1.33	0.87	2.01	0.33	4.66
Believes that exposing their skin to the sun without sun protection contributes to the premature ageing of their skin	0.82	0.63	1.05	0.12	2.46	1.58	3.83	<0.0001	-1.13	1.26	0.84	1.91	0.25	-0.24
Baseline skin self-examination in past 12 months	4.71	3.22	6.90	<0.0001	2.54	1.58	4.07	0.0001	2.05	1.28	0.82	1.98	0.27	0.79
Baseline sun protection score	2.39	1.66	3.46	<0.0001	2.52	1.61	3.97	<0.0001	1.45	1.24	0.81	1.88	0.19	-2.21
Baseline efficacy of PA score	1.28	1.00	1.63	0.05	2.41	1.55	3.76	0.0001	-2.98	1.25	0.83	1.89	0.25	-0.95
Baseline efficacy of SSE score	1.65	1.33	2.04	<0.0001	2.52	1.60	3.96	<0.0001	1.33	1.21	0.79	1.84	0.15	-4.74
Baseline efficacy of sun protection score	1.25	0.97	1.62	0.09	2.46	1.58	3.84	<0.0001	-0.97	1.26	0.83	1.90	0.24	-0.71
Baseline PA support score	1.09	0.90	1.33	0.36	2.47	1.59	3.84	<0.0001	-0.72	1.27	0.84	1.91	0.25	0.08
Baseline SSE support score	1.35	1.15	1.58	0.0003	2.55	1.63	3.99	<0.0001	2.37	1.28	0.85	1.94	0.25	1.26
Baseline sun protection support score	1.74	1.40	2.15	<0.0001	2.45	1.55	3.85	<0.0001	-1.69	1.19	0.78	1.82	0.16	-5.85

SSE=skin self-examination, OR=odds ratio, LL=lower limit of 95% confidence interval, UL=upper limit of 95% confidence interval, P=p value, BMI=body mass index, PA=physical activity

DOI: 10.1002/pon

Table 2. Effect of potential mediators to odds ratio estimates sun protection habits (SPH) index score greater than mean value at 12-month follow-up. The base model for 'SSE group vs Control' compares the odds ratio of having a greater than average SPH index in the SSE intervention group versus the control group, and subsequent rows report how this base odds ratio changes with the addition of one potential mediator to the model and similarly for the 'Sun protect group vs Control' section.

	Potential mediator				SSE group vs Control					Sun protect group vs Control				
	OR	LL	UL	*P*	OR	LL	UL	*P*	% change	OR	LL	UL	*P*	% change
Base model					1.76	1.14	2.73	0.05		1.46	0.94	2.24	0.63	
Potential baseline mediators are as follows:														
Age	1.04	1.01	1.07	0.02	1.75	1.13	2.72	0.06	-0.68	1.48	0.96	2.29	0.55	1.86
BMI	1.00	0.97	1.04	0.87	1.75	1.13	2.71	0.05	-0.96	1.44	0.94	2.22	0.65	-0.96
Plans to reduce risk of skin cancer	1.73	1.45	2.05	<0.0001	1.83	1.16	2.90	0.03	3.91	1.44	0.92	2.27	0.75	-0.89
Plans to check skin for early signs of skin cancer in the future	1.38	1.18	1.62	<0.0001	1.77	1.13	2.77	0.03	0.51	1.38	0.89	2.14	0.87	-5.50
Has made an attempt to get a suntan in the past 12 months	0.45	0.26	0.78	0.004	1.94	1.24	3.04	0.02	**10.04**	1.49	0.96	2.30	0.73	2.34
Uses sun protection mainly to:														
Protect themselves from sunburn	0.57	0.38	0.85	0.006	1.77	1.14	2.75	0.05	0.34	1.45	0.94	2.24	0.65	-0.34
Prevent premature ageing	1.36	0.55	3.35	0.51	1.75	1.13	2.72	0.049	-0.57	1.44	0.94	2.23	0.65	-0.82
Both of the above	1.74	1.13	2.66	0.01	1.76	1.13	2.74	0.05	-0.11	1.46	0.95	2.26	0.61	0.41
Believes they are likely to get skin cancer at some time in the future	1.01	0.78	1.30	0.94	1.76	1.14	2.73	0.05	-0.06	1.47	0.95	2.27	0.59	1.10
Is confident they can check their own skin correctly	1.10	1.02	1.18	0.01	1.80	1.15	2.80	0.04	1.87	1.45	0.94	2.24	0.68	-0.48
Is confident they will find time in the next 3 months to check their skin	1.11	1.05	1.18	0.0003	1.82	1.17	2.85	0.03	3.35	1.44	0.93	2.24	0.73	-0.76
Do you have a regular general practitioner (GP)	1.67	1.08	2.56	0.02	1.80	1.16	2.81	0.04	2.27	1.48	0.96	2.28	0.62	1.37
Do you regularly visit your GP for health check-ups?	1.38	0.93	2.05	0.11	1.72	1.11	2.67	0.06	-2.38	1.45	0.94	2.23	0.60	-0.55
Has your doctor ever provided you with information about sun protection?	1.26	0.83	1.93	0.28	1.75	1.13	2.71	0.05	-0.79	1.45	0.94	2.24	0.62	-0.07
Their doctor has shown them how to check their own skin for early signs of skin cancer	1.37	0.90	2.09	0.14	1.77	1.14	2.74	0.04	0.11	1.44	0.93	2.2	0.67	-0.96
Believes that if they regularly protect their skin from the sun they are in danger of not getting enough Vitamin D	1.15	0.97	1.35	0.10	1.77	1.14	2.75	0.05	0.51	1.50	0.97	2.32	0.53	3.16
Believes that exposing their skin to the sun without sun protection contributes to the premature ageing of their skin	0.68	0.52	0.89	0.005	1.73	1.11	2.70	0.06	-1.64	1.47	0.95	2.27	0.57	0.82
Baseline skin self-examination in past 12 months	1.67	1.17	2.39	0.005	1.70	1.09	2.65	0.07	-3.46	1.42	0.92	2.20	0.65	-2.20
Baseline sun protection score	12.50	7.47	20.9	<0.0001	1.97	1.19	3.28	0.04	**11.80**	1.57	0.96	2.58	0.61	7.97
Baseline efficacy of PA score	1.31	1.02	1.69	0.03	1.72	1.10	2.67	0.06	0.93	1.44	0.93	2.22	0.62	-1.10
Baseline efficacy of SSE score	1.45	1.17	1.79	0.0006	1.71	1.10	2.67	0.05	-2.89	1.38	0.89	2.14	0.78	-5.15
Baseline efficacy of sun protection score	2.35	1.73	3.18	<0.0001	1.72	1.09	2.70	0.07	-2.61	1.43	0.92	2.24	0.65	-1.72
Baseline PA support score	1.23	1.01	1.50	0.04	1.74	1.12	2.71	0.06	-1.13	1.45	0.94	2.24	0.61	-0.21
Baseline SSE support score	1.33	1.13	1.57	0.0006	1.79	1.15	2.80	0.04	1.76	1.47	0.95	2.28	0.62	1.31
Baseline sun protection support score	1.49	1.22	1.82	<0.0001	1.69	1.08	2.64	0.06	-4.25	1.37	0.88	2.12	0.79	-6.05

SSE=skin self-examination, OR=odds ratio, LL=lower limit of 95% confidence interval, UL=upper limit of 95% confidence interval, P=p value, BMI=body mass index, PA=physical activity

DOI: 10.1002/pon

messages encouraging SSE; or intervention group two ($n=187$) – sun protection messages [22,23]. Each participant completed baseline questionnaires before randomisation, received weekly SMS over the next 12 weeks (3-month assessment), then monthly SMS for a further nine months prior to completing a 12-month follow-up questionnaire ($n=512$, 94%). Message content was designed according to social cognitive theory [24]. Text messages were personalised with participants' first name, baseline skin cancer risk profile, sun protection, SSE or physical activity characteristics (Appendix A).

Main outcome measures

The main outcome measure for SSE was as follows: 'Just within the past 12 months, have you or someone who is not a doctor, such as your spouse or partner, deliberately checked any part of your skin for early signs of cancer'?

For sun protection behaviour, the main outcome measure was the sun protection habits (SPH) index described by Glanz *et al*. [25]: a composite score composed of seven questions about sun protective behaviours measured by a 4-point Likert scale. Scores were averaged to create the SPH index. For the mediation analysis, the SPH index was dichotomised at the mean observed value of 2.49.

Potential mediators

Baseline variables were included in the mediation analysis according to the social cognitive model described by Bandura [24]. Variables fell into one of six categories: (a) demographic information, (b) self-efficacy, (c) perceived environmental opportunity, (d) social support, (e) goal-setting and (f) outcome expectations (variables and response scales are listed in Appendix B).

Statistical methods

Bivariate logistic regression models were fitted to each outcome with SMS group as a predictor variable. These models were then expanded to also include one of the potential mediators. The extent to which a variable (e.g., baseline self-efficacy) explained improvements in SSE or sun protection behaviours was determined by the change-in-estimate method [26]. The percentage change in the odds ratio (OR) was calculated according to the formula [(adjusted OR – unadjusted OR)/(unadjusted OR – 1.00)] × 100. The change to the OR of the intervention groups versus the control groups as a result of adding each potential mediator variable into the model was compared. If more than one mediator was found, these were then added in a stepwise approach until the maximal change from the base model was observed. There is a paucity of literature describing formal tests of mediation for binary outcomes. However, a change in the OR from the original model of more than 10% as suggested for the change-in-estimate method [26] was considered to be clinically significant and taken as an indication of a mediating effect. All analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA).

Results

Baseline characteristics have been reported previously [22,23]. Results from the models for the outcomes variables are reported in Tables 1 and 2, respectively. At the 12-month follow-up, the outcome expectation of being confident of finding time in the next 3 months to check their skin was a significant mediator for SSE in the past 12 months in the skin self-examination group, with a change in the OR for that group compared with the control group of 11.9%. All other baseline variables examined resulted in a change in the OR from the base model of $<10\%$. Models for SSE at any time in the past and SSE in the past 3 months showed similar results, with being confident of finding time in the next 3 months to check their skin identified as the only mediator (data not shown).

For the SPH index at the 12-month follow-up, two significant mediators were identified: (a) the outcome expectation of having made an attempt to obtain a suntan in the past 12 months, with a change in the OR for the skin self-examination group versus the control group of 10.0% and (b) higher baseline SPH index, with a change in the OR for the skin self-examination group versus the control group of 11.8%. When both were added into the same model, the OR percentage change for the baseline SPH index was 19.6%.

Conclusions

This study found that outcome expectation of being able to find time in the next 3 months to check their skin mediated the intervention effect on SSE behaviour at 12-month follow-up. It was also found that the outcome expectation of having made an attempt to obtain a suntan in the past 12 months and baseline SPH index were mediators of sun protective behaviour at 12-month follow-up. The latter was the more important mediator, as shown by the increase in percentage change from 11.8 to 19.6%. The baseline SPH index reflects the degree of self-efficacy for using sun protection, which is in line with social cognitive model predictions and confirms other findings that outcome expectations and self-efficacy play a major role in adopting new health behaviours or increasing those already performed [27]. These results confirm the importance of building healthy habits as it appears easier to further improve a health behaviour already established as part of a person's routine than to build a completely new behaviour [28].

DOI: 10.1002/pon

Different to results reported from mediation analyses by others [15,21], this study did not confirm social support as a mediator of SSE. In contrast, Robinson *et al*. [16] reported that a higher quality relationship with a partner was a mediator of higher self-efficacy for SSE. However, the present study used a different measure of social support and may have missed the social support aspects most relevant for SSE. Future research could determine how relevant others could best support people at risk of skin cancer to conduct SSE and whether those specific social support parameters have a direct impact on future behavioural performance.

In our study, threat information affected behavioural intentions somewhat more than coping information. The current intervention may not have been intensive enough however, with only 21 text messages sent over 1 year, to result in a significant increase in participants' self-efficacy or confidence in performing SSE. Previous studies with different populations have indicated that more intensive or face-to-face interventions may lead to a greater change in SSE behaviour [29–32]. Future studies could include vivid (but not overpowering) illustrations of the effect of sun damage on the skin, or partner-relevant messaging, to complement the short messages when texting. Similar to findings reported by Craciun *et al*. [18], the current study found one component intrinsically determined by one's self-efficacy – the baseline SPH index – to be a mediator for sun protective behaviour. However, different to this report, the current study did not find goal-setting to be a significant mediator. This suggests that self-efficacy may be a key predictor of behaviour change more distal than planning. According to social cognitive models, intervening on motivational variables (self-efficacy, outcome expectations and perceived threat) would have a flow-on effect to all intermediate variables (intention and planning) and thus, on outcome behaviour.

Limitations of the current study are that participants' preference for the allocated text message group was not assessed, but may have affected their level of self-efficacy and motivation in performing the recommended behaviour, and thus, overall intervention effectiveness. The trial had a low recruitment rate (4.5%) similar to other text messaging interventions and the participants were probably more ready to accept text-delivered health advice than the general population. Furthermore, baseline SPH index was a significant mediator of sun protective behaviours at 12-month follow-up, and this could mean that a greater change could be obtained in this sample than among the general population with lower levels of sun protection. Finally, the impact of text messaging may have diminished over time and longer studies are needed to assess this. Strengths of the study include its randomised design, comparison to an attention-control group and the low attrition.

In conclusion, this study provides some insight into the psychosocial mechanisms that mediate intervention effect on SSE and sun protective behaviours. Further studies could specifically target the planning aspects and social support components found to be important in mediating sun-safe behaviour but not sufficiently impacted by the present intervention.

Acknowledgements

The study was funded by research grant Cancer Australia (1011999).

Conflict of interest

M. J. (#1045247), A. M. (#553000),and P. B. (#1005334) are funded by separate National Health and Medical Research Council (NHMRC) Career Development Award; P. Y. by a NHMRC Early Career Fellowship (#1054038). All authors declare no conflicts of interest, except H. P. S. who declares skin cancer related ownership and consultancies.

Appendix A. SMS examples

Social Cognitive Theory Construct	Text Message
Increasing self-efficacy	<Participant Name>, if you are a little bit worried about a skin spot you've found call your GP now 2 get it looked at. HealthyTexts
Building behavioural capacity	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. HealthyTexts
Encouraging observational learning	Hi <Participant Name>. Remember people who exercise are setting a good example for others. Your friends will want to join you. HealthyTexts
Providing positive reinforcement	When your skin gets 2 much sun it loses is ability to repair itself. Avoid sun spots & wrinkles by being sun safe now. Slip, Slop, Slap to age well. HealthyTexts
Guiding outcome expectations	Busy lately <Participant Name>? You can add on some squats to your exercise program, do some while waiting for the kettle to boil. HealthyTexts

DOI: 10.1002/pon

Appendix B. Overview of variables used in mediation analysis – social cognitive model

	Response scale	*M*	[SD]
Demographics			
Age		31.87	6.20
BMI		25.24	5.16
Self-efficacy			
Baseline sun protection score		2.49	0.50
Baseline skin self-examination in past 12 months	50%		
I can participate in regular physical activity if:	1(Strongly agree)-5(Strongly disagree)	3.74	0.72
I am tired			
I am in a bad mood			
I feel that I do not have the time			
I am on holiday			
It is raining or very hot			
I have to do it alone			
I can participate in regular skin self-examination if:	1-5	3.07	0.86
I do not have a mirror			
I have not examined my skin for a while			
I feel that I do not have the time			
I am on holiday			
I am uncertain what to look for			
I have no one to help me			
I can participate in regular sun protection if:	1-5	4.06	0.68
It's overcast			
I am not going out for long			
I feel that I do not have the time			
I am on holiday			
I am looking pale			
I am the only one who is sunsafe			
When outdoors, how often do you do each of the following?	1(Rarely/Never) – 4(Always)	2.49	0.50
I wear a shirt with sleeves			
I wear sunglasses			
I stay in the shade			
I use sunscreen			
I limit my time in the sun during midday hours			
I wear a hat			
I stay under an umbrella			
Perceived environmental opportunity			
Do you have a regular general practitioner (GP)	77%		
Do you regularly visit your GP for health check-ups?	71%		
Has your doctor ever provided you with information about sun protection?	23%		
Has your doctor ever showed you how to check your OWN skin for early signs of skin cancer	24%		
Social support			
How often have your family or friends said or done the following during the past 12 weeks:	1(Never) – 5(Very often)	2.70	0.91
Gave you encouragement to engage in exercise			
Offered to exercise with you			
Helped plan activities around your exercise			
Took over chores so you had more time to exercise			
Exercise themselves			
How often have your family or friends have said or done the following during the past 12 weeks:	1-5	3.03	1.12
Gave you encouragement to use sun protection			
Offered to also protect their skin			
Helped plan sun protection			
Offered to assist with sun protection			
Protected their own skin from the sun			
How often have your family or friends have said or done the following during the past 12 weeks:	1-5	1.87	0.95
Gave you encouragement to examine your skin			
Offered to also examine their skin			
Helped plan your skin examination			
Offered to assist with skin examination			
Examined their own skin			

(Continues)

DOI: 10.1002/pon

Appendix B. (Continued)

	Response scale	*M*	[SD]
Goal setting			
Plans to reduce your risk of skin cancer?	1(Not at all) – 4(Very much so)	2.45	1.10
Check your skin for early signs of skin cancer in the future?	1-4	2.42	1.15
Outcome Expectations			
Believes they are likely to get skin cancer at some time in the future	1(Not at all likely)-4(Already been diagnosed)	2.03	0.70
Confidence that you can check your own skin correctly	1(not at all confident)-10(highly confident)	4.62	2.56
Confidence that you will find the time in the next 3 months to check your own skin	1-10	5.96	3.14
Have you made an attempt to get a suntan in the past 12 months?	15%		
Use sun protection mainly to protect yourself from sun burn or to prevent premature ageing	1(Sunburn) 72% 2(Ageing) 4% 3(Both) 23%		
If I regularly protect my skin from the sun I am in danger of not getting enough Vitamin D	1(Strongly agree)-5(Strongly disagree)	3.36	1.10
Exposing my skin to the sun without sun protection contributes to the premature ageing of my skin	1(Strongly agree)-5(Strongly disagree)	1.67	0.69

M, mean; *SD*, standard deviation

References

1. World Health Organisation. Skin cancers: how common is skin cancer? 2015. Available at: http://www.who.int/uv/faq/skincancer/en/index1.html (Accessed 15 September 2015).
2. Ferlay, J, Soerjomataram, I, Ervik, M, *et al.* GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. 2013. Available at: http://globocan.iarc.fr (Accessed June 30 2014).
3. Australian Institute of Health and Welfare (AIHW) and Australasian Association of Cancer Registries (AACR). Cancer in Australia, an overview. 2012. Available at: http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129542353 (Accessed 30 June 2014).
4. Stanton WR, Janda M, Baade PD, Anderson P. Primary prevention of skin cancer: a review of sun protection in Australia and internationally. *Health Promot Int* 2004;**19**(3):369–378.
5. Guide to Community Preventive Services. Preventing skin cancer: education and policy approaches. 2015. Available at: http://www.thecommunityguide.org/cancer/skin/education-policy/index.html (Accessed 15 September 2015).
6. Guide to Community Preventive Services. Preventing skin cancer: community-wide interventions. 2015. Available at: http://www.thecommunityguide.org/cancer/skin/community-wide/index.html (Accessed 15 September 2015).
7. Guide to Community Preventive Services. Preventing skin cancer: interventions targeting parents and caregivers. 2015. Available at: http://www.thecommunityguide.org/cancer/skin/parents-caregivers/index.html (Accessed 15 September 2015).
8. Armstrong AW, Watson AJ, Makredes M, Frangos JE, Kimball AB, Kvedar JC. Text-message reminders to improve sunscreen use: a randomized, controlled trial using electronic monitoring. *Arch Dermatol* 2009;**145**(11):1230–1236.
9. Gold J, Aitken CK, Dixon HG, *et al.* A randomised controlled trial using mobile advertising to promote safer sex and sun safety to young people. *Health Educ Res* 2011;**26**(5):782–794.
10. Aneja S, Brimhall AK, Aneja S, *et al.* Computerized interactive educational tools used to improve use of sun-protective clothing and sunscreen: a randomized controlled study. *Arch Dermatol* 2012;**148**(11):1325–1327.
11. Hardeman W, Johnston M, Johnston D, Bonetti D, Wareham N, Kinmonth A. Application of the theory of planned behaviour in behaviour change interventions: a systematic review. *Psychol Health* 2002;**17**(2):123–158.
12. Weinstein ND. Testing four competing theories of health-protective behavior. *Health Psychol* 1993;**12**(4):324–333.
13. Mahler HI, Kulik JA, Butler HA, Gerrard M, Gibbons FX. Social norms information enhances the efficacy of an appearance-based sun protection intervention. *Soc Sci Med* 2008;**67**(2):321–329.
14. Armitage CJ, Conner M. Social cognition models and health behaviour: A structured review. *Psychol Health* 2000;**15**(2):173–189.
15. Hay JL, Oliveria SA, Dusza SW, Phelan DL, Ostroff JS, Halpern AC. Psychosocial mediators of a nurse intervention to increase skin self-examination in patients at high risk for melanoma. *Cancer Epidemiol Biomarkers Prev* 2006;**15**(6):1212–1216.
16. Robinson JK, Stapleton J, Turrisi R. Relationship and partner moderator variables increase self-efficacy of performing skin self-examination. *J Am Acad Dermatol* 2008;**58**(5):755–762.
17. Adams MA, Norman GJ, Hovell MF, Sallis JF, Patrick K. Reconceptualizing decisional balance in an adolescent sun protection intervention: mediating effects and theoretical interpretations. *Health Psychol* 2009;**28**(2):217–225.
18. Craciun C, Schuz N, Lippke S, Schwarzer R. A mediator model of sunscreen use: a longitudinal analysis of social-cognitive predictors and mediators. *Int J Behav Med* 2012;**19**(1):65–72.
19. Craciun C, Schuz N, Lippke S, Schwarzer R. Facilitating sunscreen use in women by a theory-based online intervention: a randomized controlled trial. *J Health Psychol* 2012;**17**(2):207–216.
20. Stolzel F, Seidel N, Uhmann S, *et al.* A school-based program covering cancer-related risk behavior. *BMC Public Health* 2014;**14**:392.
21. Jackson K, Aiken L. A psychosocial model of sun protection and sunbathing in young women: the impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychol* 2000;**19**(5):469–478.
22. Janda M, Youl P, Marshall AL, Soyer HP, Baade P. The HealthyTexts study: A randomized controlled trial to improve skin cancer prevention behaviors among young people. *Contemp Clin Trials* 2013;**35**:159–167.
23. Youl P, Soyer HP, Baade P, Marshall AL, Finch L, Janda M. Can skin cancer prevention and early detection be improved via mobile phone text messaging? A randomised, attention-control trial. *Prev Med* 2015;**71**:50–56.
24. Bandura A. *Social foundations of thought and action: a social cognitive theory*, Prentice Hall International Inc.: Englewood Cliffs, N. J, 1986xiii;617.
25. Glanz K, McCarty F, Nehl EJ, *et al.* Validity of self-reported sunscreen use by parents, children, and lifeguards. *Am J Prev Med* 2009;**36**(1):63–69.

26. Greenland S. Modeling and variable selection in epidemiologic analysis. *Am J Public Health* 1989;**79**(3):340–349.
27. Schwarzer R. *Self-efficacy: Thought control of action*, Hemisphere Pub. Corp: Washington, 1992xiv;410.
28. Falk M, Anderson CD. Influence of age, gender, educational level and self-estimation of skin type on sun exposure habits and readiness to increase sun protection. *Cancer Epidemiol* 2013;**37**(2):127–132.
29. Auster J, Hurst C, Neale RE, *et al.* Determinants of uptake of whole-body skin self-examination in older men. *Behav Med* 2013;**39**(2):36–43.
30. Weinstock MA, Risica PM, Martin RA. Melanoma early detection with thorough skin self-examination: the "Check It Out" randomized trial. *Am J Prev Med* 2007; **32**(6):517–524.
31. Janda M, Baade PD, Youl PH, *et al.* The skin awareness study: promoting thorough skin self-examination for skin cancer among men 50 years or older. *Contemp Clin Trials* 2010;**31**(1):119–130.
32. Janda M, Neale RE, Youl P, Whiteman DC, Gordon L, Baade PD. Impact of a video-based intervention to improve the prevalence of skin self-examination in men 50 years or older: the randomized skin awareness trial. *Arch Dermatol* 2011;**147**(7):799–806.

DOI: 10.1002/pon