

# Reducing Skin Cancer Risk: An Intervention Based on Protection Motivation Theory

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## Abstract

Caucasian college students who intentionally tanned participated in a brief skin cancer intervention based on protection motivation theory (PMT). This intervention targeted skin appearance and consisted of brief lectures, a comprehensive essay, video clips about a young man who died of melanoma, and short discussions. Compared to a waitlist control group, the intervention group showed increases on PMT variables and intentions at post-test. The waitlist group later received the intervention and showed similar increases. Additionally, all but one PMT variable maintained post-test levels at a one-month follow-up. Photographs taken at post-test and at the one-month follow-up were judged by raters blind to the hypothesis. Seventy-two percent of participants were judged to have lighter skin whereas only 16 percent had darker skin. These results provide additional support for theory-based methods for changing maladaptive attitudes and behaviors associated with skin cancer risk.

## Keywords

*preventive health, protection motivation theory, skin cancer*

THE RATES for most cancers have recently begun to level or even decline. However, skin cancer continues to increase by 3 to 5 percent per year despite the fact that it is the most curable, treatable, and preventable of all cancers (American Cancer Society, 1998). To have a greater chance of avoiding skin cancer, individuals must engage in healthy behavior.

Protection motivation theory (PMT; Rogers, 1983; Rogers & Prentice-Dunn, 1997) provides one model for increasing healthy behavior through persuasive communication. To change maladaptive behaviors, people must first detect a threat to their health. Once a threat is perceived, individuals must be given a way to avert the threat posed by continuing the maladaptive behavior. In PMT, this is accomplished through suggestions for how to substitute an adaptive action for the maladaptive behavior.

As can be seen in Figure 1, information about a health threat arouses two cognitive processes: threat appraisal and coping appraisal. Threat appraisal is linked to the maladaptive response (e.g. smoking). Intrinsic rewards (e.g. physical and psychological pleasure) and extrinsic rewards (e.g. peer approval) increase the chance that a maladaptive response will continue. The perceived severity of the threat and perceived vulnerability decrease the chance for a maladaptive response. Thus, the rewards minus the sum of severity and vulnerability indicate the amount of threat experienced by the individual.

Coping appraisal is linked to the adaptive response. It is a person's perceived ability to

cope with and avert a perceived threat. Response efficacy and self-efficacy are factors that increase the probability that an adaptive response will be initiated. Response efficacy is a person's belief that the recommended coping response is effective in avoiding the threat. Self-efficacy is a person's belief that the coping action recommended can be performed successfully by that individual. Response costs are physical (e.g. loss of nicotine) and psychological consequences (e.g. loss of stress relief) that occur when the preventive behavior is enacted. In sum, the amount of coping appraisal experienced is indicated by the sum of response efficacy and self-efficacy minus the response costs.

PMT has proven to be a reliable model to promote healthy attitudes and behaviors. A meta-analysis of the literature on PMT (Floyd, Prentice-Dunn, & Rogers, 2000) found 65 studies that used the model. These studies involved nearly 30,000 participants spread over 20 health domains. All PMT variables were found to have effects of moderate magnitude in the predicted direction. Thus, healthier behavior has been traced to the psychological variables in the model.

### Skin cancer prevention interventions

Early attempts to change maladaptive behaviors linked to skin cancer reported moderate success in educating people about skin cancer (e.g. Jones & Leary, 1994; Katz & Jernigan, 1991; Lombard,

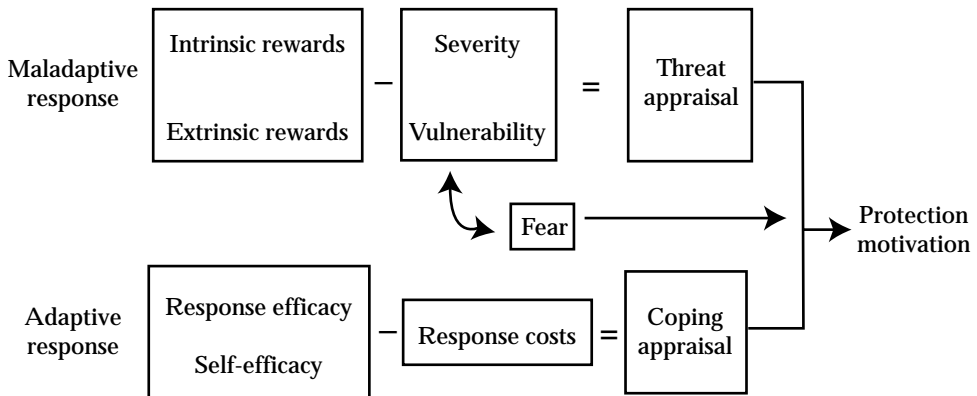


Figure 1. The cognitive mediating processes of protection motivation theory (Rogers & Prentice-Dunn, 1997).

Neubauer, Canfield, & Winett, 1991; Mermelstein & Riesenber, 1992; Prentice-Dunn, Jones, & Floyd, 1997; Rossi, Blais, & Weinstock, 1994). However, changes in adaptive attitudes and behavior were not consistently demonstrated. Furthermore, follow-up assessments of intervention effectiveness were rarely included.

Exceptions to this earlier trend have begun to appear in the literature. For example, Mayer et al. (1997) tested a curriculum that was presented to children at swimming classes by instructors and at home by parents. Although no group differences were found on skin tone or specific daily behaviors, increased use of hats was noted. The researchers noted that the brief time interval between measurements might have been responsible for the lack of differences on skin tone and behaviors. Winett, Cleaveland, Lombard, Russ, and Galper (1997) found more substantial changes in risk-reduction behaviors with a poolside program that targeted lifeguards and patrons. Finally, Mayer et al. (1998) found that a multi-component intervention targeting pharmacists dramatically increased the rates of pharmacists providing counseling to customers about skin cancer prevention.

The current study continued features seen in more recent investigations. First, a theoretically based intervention was expected to have a more pronounced effect on participants than did the largely atheoretical treatments in early studies. Second, a follow-up assessment of skin tone change was included to unobtrusively measure the impact of the PMT intervention. These elements were used in an intervention that targeted young adults, a population with great concerns about appearance and fewer concerns about vulnerability to skin cancer.

Upon completion of the intervention, participants were expected to show changes on the PMT components in the direction suggested by the model. In addition, intervention participants, relative to those in the control group, were expected to express greater intentions to use sunscreen and reduce sunbathing. Finally, intervention participants were expected to have lighter skin tone at one-month follow-up when compared to post-test.

## Method

### *Participants*

Participants were 61 male and female introductory psychology students who received course credit. Caucasians who had tanned intentionally at least once in the past year were recruited. However, individuals who had skin cancer or had family members or friends with skin cancer were excluded due to their presumed greater knowledge about the dangers and risks of sun exposure and how to protect the skin.

Participants were randomly assigned to the waitlist control and intervention conditions. Three participants dropped out before the end of the study, resulting in totals of 30 and 28 in the two conditions, respectively.

### *Measures*

*PMT variables* A self-report questionnaire similar to that used by Prentice-Dunn et al. (1997) was used to assess the variables in the PMT model at pretest, post-test, and follow-up. Individual items were in 10-point Likert format, some in reverse order to control for response set.

At least four items were used for each variable. For example, one reward item was 'Having a tan will increase your self confidence'. A severity item was 'Sunbathing leads to prematurely aged skin'. Vulnerability was illustrated by 'I increase my chances of skin cancer if I deliberately seek a tan', whereas response efficacy was illustrated by 'Using sunscreen will definitely help prevent me from developing skin cancer'. A self-efficacy item was 'I have the willpower to change my sunbathing habits'. Response cost was measured by items such as 'Protecting myself from damaging ultraviolet rays requires a considerable amount of effort'.

Behavioral intention items were divided into primary and supplementary categories. Primary intentions were those addressed directly in the intervention (e.g. reducing sunbathing and using sunscreen). Supplementary intentions were actions not covered directly in the intervention (e.g. regularly checking one's body for skin abnormalities). Examples of primary intention items were 'In the future, I intend to stop spending time outside strictly for the purpose of getting a tan' and 'I plan to use a sunscreen of SPF 15 or higher when I am going outside for a

long period of time'. A supplemental intention was represented by 'In the future, I plan to pay more attention to skin cancer awareness messages in the media'.

*Photographs* To control for demand characteristics, photos were taken to assess compliance with the intervention. Following the intervention, a 35-mm photograph was taken of each of the participants to 'document the variety of skin tones present in the study'. The participants were told to return in one month to complete more questionnaires; however, they were unaware that a second photo would be taken. No-one expressed suspicion about the reason given for the return visit. All photos were taken in similar lighting against the same background. Four raters blind to the study hypothesis used a five-point scale to compare skin tones (i.e. extremely lighter, somewhat lighter, no difference, somewhat darker, extremely darker).

### *Intervention*

The intervention was divided into two sessions, separated by 48 hours. Each session lasted 60–75 minutes. In session 1, participants completed the PMT questionnaire (Time 1) and then listened to a brief overview given by the experimenter. Participants next read a five-page essay (adapted from Prentice-Dunn et al., 1997) that contained photos of different types of sun-induced damage to the skin and photos of models on current magazine covers who had light skin tone. The message emphasized how unattractive and unhealthy a person looks with a tan in light of new social norms concerning skin tone. It also stressed the effectiveness of the two recommended behaviors (i.e. eliminating sunbathing and using sunscreen) to prevent sun-induced skin damage and contained information on the ease of sunscreen application.

In groups of 3–4, participants listed ways that college students could avoid the unpleasant consequences of the sun's UV rays. Afterward, each group shared its ideas with all of the participants.

The second session (two days later) began with two videos from the Australian television program, *60 Minutes*, which profiled a young Australian named Marc Marcelis. The first segment (11 minutes) detailed Marc's life after the diagnosis of melanoma and his willingness to help others prevent skin damage. The second

segment (7 minutes) occurs after Marc's death and contains testimonial from people who were helped directly by Marc's campaign.

After the videos, participants discussed possible alternatives to Marc's earlier lifestyle and then designed a campaign for junior high students to convince them to practice sun safe behaviors. The experimenter then gave a brief lecture highlighting the themes of the two sessions. Finally, participants completed the PMT post-test questionnaire (Time 2) and had a photograph taken.

At one-month follow-up, the participants first completed the PMT questionnaire and then were photographed a second time. They were thanked, given \$10, and dismissed.

### *Control group*

The waitlist group completed the study in three sessions. In session 1 (Time 1), participants completed the PMT self-report questionnaire and listened to a lecture on general health topics. The second session for the control group (Time 2) was identical to the first day for the intervention group. The control group then received the intervention, post-test, and follow-up in the same sequence as the original intervention group.

## **Results**

### *Psychometric data*

A coefficient alpha was calculated for the first administration of each of the PMT variable sums, and intentions sums. Values ranged from .65 to .80 except for response costs (.55). These alpha levels were considered satisfactory given the small number of items comprising the scales.

### *Intervention*

*PMT variables* The effectiveness of the intervention was determined by comparing the Time 1 and Time 2 assessments for the intervention condition and the control condition. Using Time 1 scores as a covariate, a MANCOVA revealed a significant multivariate effect between the two groups on Time 2 PMT scores (Wilks' Lambda = .486,  $p < .001$ ). Univariate tests revealed that all PMT means changed in the appropriate direction in the intervention group and

remained essentially unchanged in the control group (all  $ps < .01$ ) (see Table 1). These results suggest that the PMT components were successfully manipulated in the intervention.

*Intentions* An ANCOVA was run on the Time 2 primary intentions sum using Time 1 scores as the covariate (see means in Table 1). As predicted, participants receiving the intervention expressed higher intentions than did those in the control condition ( $F[1,55] = 36.24, p < .001, \eta^2 = .40$ ).<sup>1</sup> An identical pattern of results was observed for the supplementary intentions measure ( $F[1,55] = 36.48, p < .001, \eta^2 = .39$ ).

*Combined data* The effects of the intervention were also examined using the entire sample of 58 participants. Consistent with our hypotheses, participants expressed significantly higher primary intentions ( $M = 32.09, SD = 7.5$ ) after receiving the PMT intervention (pretest  $M = 24.8, SD = 8.7$ );  $t[57] = 9.04, p < .001, r^2 = .53$ ). A similar pattern emerged for supplementary intentions ( $p < .001, r^2 = .38$ ).

*Follow-up*

Of the 58 participants who completed treatment, 32 (55 percent) returned after one month for another round of assessments. Those who failed

to return did not differ significantly from those who did return on the PMT variables and intentions sums taken at post-test (all  $ps > .25$ ). When a sample of the non-returners was phoned, no single theme was present in their reasons given for not appearing. None expressed a reluctance to come to the assessments.

*PMT variables and intentions* Repeated measures ANOVAs revealed a pattern of the PMT variable changing significantly in the appropriate direction from pretest to post-test and then failing to change significantly from post-test to follow-up (see Table 2). The sole exception to this trend was self-efficacy. As predicted, perceived self-efficacy increased significantly as a result of the immediate intervention. However, it declined significantly to the pretest level at the follow-up assessment.

*Photographs* Four independent raters blind to the hypotheses judged the two photos for each individual. An alpha calculated across the raters revealed a value of .81. Three of the item (i.e. rater)-total correlations ranged from .71 to .78; however, the correlation for a fourth rater was .29. Excluding this judge's ratings increased the alpha to .88. An average of the three retained raters' judgements was then calculated.

Table 1. PMT and intentions means across experimental conditions (n = 58)

	Time 1	Time 2
Control (n = 30)		
Vulnerability	39.8 (5.7)	39.7 (5.5)
Severity of threat	47.9 (6.2)	47.3 (6.5)
Rewards	37.6 (5.6)	37.0 (5.7)
Response efficacy	28.7 (4.7)	29.0 (5.5)
Self-efficacy	26.3 (6.9)	23.5 (6.4)
Response costs	19.8 (6.4)	20.3 (5.3)
Primary intentions	24.2 (7.6)	24.9 (8.7)
Supplementary intentions	21.6 (5.0)	22.4 (5.4)
Intervention (n = 28)		
Vulnerability	41.3 (5.8)	44.2 (4.0)
Severity of threat	48.7 (7.2)	52.7 (5.4)
Rewards	36.9 (6.3)	31.4 (8.3)
Response efficacy	28.4 (5.9)	32.3 (5.6)
Self-efficacy	26.9 (5.6)	29.0 (5.9)
Response costs	20.5 (6.5)	17.0 (6.0)
Primary intentions	24.8 (9.0)	32.7 (6.8)
Supplementary intentions	22.5 (6.2)	29.0 (5.1)

Standard deviations are shown in parentheses

Table 2. PMT and intentions means for follow-up sample ( $n = 32$ )

	<i>Pretest</i>	<i>Post-test</i>	<i>Follow-up</i>
Vulnerability	39.3 (5.5)	44.1 (4.2)	43.9 (4.8)
Severity of threat	47.0 (6.8)	51.7 (5.5)	52.0 (5.2)
Rewards	38.4 (5.0)	33.7 (7.1)	33.9 (6.5)
Response efficacy	28.1 (5.7)	31.7 (5.3)	31.9 (5.1)
Self-efficacy	25.4 (6.3)	28.1 (6.2)	25.7 (6.0)
Response costs	21.4 (6.5)	17.4 (5.8)	17.8 (6.1)
Primary intentions	22.7 (8.1)	32.6 (7.5)	31.7 (8.0)
Supplementary intentions	20.6 (4.9)	28.6 (5.5)	27.3 (5.2)

All post-test scores are significantly different from the respective pretest score ( $p < .05$ )

All post-test–follow-up comparisons are non-significant, except for self-efficacy ( $p < .05$ )

Standard deviations are shown in parentheses

Of the 32 individuals photographed, 23 (71.9 percent) were judged to have lighter skin tone after one month, 4 (12.5 percent) were rated as having no change, and 5 (15.6 percent) were judged to have darker skin. A frequency comparison of those whose skin had lightened ( $n = 23$ ) with those whose skin had not ( $n = 9$ ) revealed a significant difference  $\chi^2[1] = 6.13$ ,  $p < .01$ .<sup>2</sup> These results corroborate the attitude and intention evidence of the effectiveness of the PMT-based treatment.

## Discussion

These results support the effectiveness of a PMT-based intervention to change the attitudes and behaviors associated with skin cancer risk. As such, they add to the growing body of research (e.g. Mayer et al., 1997, 1998, Winett et al., 1997) that theory-based interventions can motivate people to alter their attitudes and behaviors regarding sun exposure. They are also in keeping with recent evidence that addressing both threat and coping information facilitates greater adaptive changes (Jackson & Aiken, 2000).

While the study directly targeted primary intentions such as eliminating sunbathing and using sunscreen, it is also important that intentions not addressed directly in the treatment (e.g. body self-examination and attention to media messages) were found to increase. This further shows the strength of the intervention and the broad range of its effects.

The way in which the information was conveyed to the participants may have had an effect on the responses of participants. Turrisi,

Hillhouse, and Gilbert (1998) suggested that when targeting appearance-based behaviors (i.e. sunbathing), the use of positive framed messages is appropriate. Indeed, such gain framing has been found to be particularly effective when the targeted health behaviors are preventive in nature (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999).

### *Longitudinal effectiveness*

While the post-test results were compelling, the most encouraging finding of this investigation came from the follow-up sessions. Although the relative stability of intentions suggests that the intervention had a lasting effect, the photographs provided a less reactive measure of the intervention's impact. Anecdotal evidence also corroborates the effectiveness of the intervention. After the final intervention session, three participants voluntarily notified the experimenter that they had made appointments with a dermatologist. Another had already seen a dermatologist about suspicious skin marks.

### *Future research*

This study should be repeated at different times of the year to rule out seasonal explanations for the observed skin tone changes.<sup>3</sup> In addition, follow-up assessments should compare an intervention group with one left untreated so that a more comprehensive assessment of the treatment effectiveness can be made.

The decrease of self-efficacy at follow-up in our study may indicate that participants had difficulty following the recommended actions. It may also indicate the beginning of an overall

decline in treatment effectiveness. Therefore, longer follow-up intervals should be included in subsequent studies to assess whether or not all PMT variables decline to pretest levels and, if so, how quickly. Interventions can then be designed with some PMT variables receiving greater attention to maintain the adaptive behaviors over longer periods.

Gender differences should also be assessed. As we had only a few males in our sample, we did not check for differences in responses to various aspects of the PMT messages.

In conclusion, this investigation confirms Prentice-Dunn et al.'s (1997) belief that media messages and health campaigns should focus on motivating people rather than just delivering the facts about skin cancer. The relatively low time demand and expense of this and other interventions (e.g. Mayer et al., 1997, Winett et al., 1997) make them appropriate for settings such as school, church, or civic groups in which health educators have greater control over message presentation and audience participation.

## Notes

1. Although one might logically increase sun exposure as a result of increased sunscreen use, our sample responded to the intervention with decreased intentions to tan and increased intentions to use sunscreen when outdoors.
2. Means on the follow-up measures of the PMT variables were in the predicted directions. The two groups were most different on the coping appraisal, with participants whose skin had become lighter having higher response efficacy, higher self-efficacy, and lower response costs than did those whose skin had not changed or had become darker.
3. This study was conducted in September 1999. Surveys and observations on our campus reveal that students actively seek a tan until late October, when the weather begins to cool. Average daily high temperatures during the study period were in the typical range of 83–93°F. Ninety percent of the days had full sun, also typical for September.

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