

An intervention based on protection motivation theory in reducing skin cancer risk

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Abstract *Background* Skin cancer is one of the most preventable, curable and treatable of all other cancers. In the past decade, the rates for most cancers, specially the skin cancers increased visibly. Sun exposure is a major causative factor for skin cancer for which prevention is possible. Protection motivation theory (PMT) provides one model for increasing healthy behavior through persuasive communication. We apply this theory for skin cancer prevention behavior.

Materials and methods This was an experimental study. Participants were 360 female students from four high schools in Yazd city, Iran that divided in two groups (180 in case and 180 in control group). A self-report questionnaire was used to assess the variables in the PMT model at pretest, post-test and follow-up. The questionnaire was distributed before the intervention (pre-test) and afterwards (post-test) and following at a 2 month lag. For data analysis ANOVA, T-test, Wilcoxon, Pearson's correlation and coefficient were used.

Results A significant difference between all variables except fear was noted in the case and control groups in follow-up ($p=0.00$). There was significant difference between mean grades score of all of variables in case group, in pre-test and follow up. No significant difference was seen between mean grade scores of variables in control group in pre-test and follow up. There is significant difference between using methods for prevention skin cancer in case and control group after intervention.

Conclusion Results support the effectiveness of a PMT-based intervention to change the attitude and behavior associated with skin cancer risk. Theory-based intervention can motivate people to alert their attitudes and behaviors regarding sun exposure.

Key words

Protection motivation theory, skin cancer.

Introduction

Skin cancer is one of the most preventable, curable and treatable of all other cancers. The best chance in avoiding skin cancer is engaging in healthy behavior.¹

In the past decade the rates for most cancers increased slowly, but the skin cancer increased more by 3% to 5% annually. In the United States, the skin cancer was estimated to be 1000,000 cases annually. Furthermore, the incidence of skin cancer is rising. Between 1973 and 1994, the incidence rate of melanoma increased approximately 4% each year.² In the United Kingdom, the incidence of skin cancer is 100 cases in 100,000 population annually, and the highest incidence is for Australia with about 800 new cases in 100,000 population annually.³⁻⁵ The incidence of skin cancer in Iran is 10-15 new cases in 100,000

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population annually, which in Yazd province is like other parts of Iran.^{6,7}

Skin cancer is not only one of the most common types of cancer in the United States but also one of the most preventable. Sun exposure is a major causative factor for which prevention is possible. Furthermore, excessive sun exposure during childhood is particularly significant factor in future risk of skin cancer. Children are believed to receive three times the annual sun exposure of adults.⁸ It is especially alarming since it is estimated that 80% of a person's lifetime sun exposure occurs before the age of 21.⁹ Previous research on skin cancer prevention focused heavily on the use of sunscreen in preventing non-melanoma skin cancer (NMSC). It had been estimated that the lifetime incidence of NMSC could be reduced by 78% with the regular use of sunscreen during the first 18 years of life.¹⁰ Thus, sun protection methods in addition to sunscreen use need to be taught and emphasized. It seems general awareness about sunscreen application, sun exposure during peak hours, and the correlation between ultraviolet radiation and environmental temperature appear to be lacking.¹¹

Most programs promoting sun protection have involved educational intervention designed to teach people that exposure to sun increases the likelihood of skin cancer and that precautionary measures can reduce this risk.¹² Barriers to achieving sun protection in youth can be divided into physical, psychological or attitudinal and environmental.¹³ Glanz *et al.*¹⁴ developed several guidelines for school program to prevent skin cancer. These guidelines include the following: establishing policies that reduce exposure to UV radiation, providing and maintaining physical environments that support sun safety and that are consistent with the development of other healthy habits, providing health education to teach students the knowledge, attitudes, and

behavioral skills they need to prevent skin cancer at age appropriate level with links to opportunities for practicing sun-safe behaviors, involving family members in skin cancer prevention efforts, including skin cancer prevention knowledge and skills in pre-service and in-service education for school administrators, teachers, physical education teachers and coaches. If sun protective behavior can be established as a habit in early life, less resistance may be encountered with sun protective behavior than if introduced in adolescence as a new behavior that opposes previously established pattern.¹⁵ In recent years, several efforts have been made to educate children at a relatively young age about the harmful effects of the sun and the benefits of wearing sunscreen. These efforts have not always brought about lasting behavioral changes.¹⁶ The failure of educational efforts alone to produce behavioral changes illustrates the need for theory-based research to systematically identify factors that may be effective in promoting sun protective behavior.¹⁷

Protection motivation theory (PMT) provides one model for increasing healthy behavior through persuasive communication.^{18,19} PMT is organized along two cognitive mediating processes: the threat-appraisal process and the coping-appraisal process.

Threat appraisal evaluates the maladaptive behavior. Factors comprising the threat-appraisal process are maladaptive response rewards (intrinsic and extrinsic) and the perception of threat (severity and vulnerability). Rewards will increase the probability of selecting the maladaptive response (not to protect the self or others), whereas threat will decrease the probability of selecting the maladaptive response. The coping-appraisal process evaluates the ability to cope with and avert the threatened danger. Factors comprising the coping-appraisal

process are efficacy variables (both response efficacy and self-efficacy) and response costs. Response efficacy is the belief that the adaptive response will work, that taking the protective action will be effective in protecting the self or others. Self-efficacy is the perceived ability of the person to actually carry out the adaptive response. Response costs are any costs (e.g., monetary, personal, time, effort) associated with taking the adaptive coping response. Response efficacy and self-efficacy will increase the probability of selecting the adaptive response, whereas response costs will decrease the probability of selecting the adaptive response.

The output of these appraisal-mediating processes is the decision (or intention) to initiate, continue, or inhibit the applicable adaptive responses (or coping modes). Thus, the typical dependent variables in research on PMT are measures of behavioral intentions.¹⁹ The purpose of PMT research is usually to persuade people to follow the communicator's recommendations; so, intentions indicate the effectiveness of the attempted persuasion.

Low knowledge and performance of high school teachers of Yazd province that recently published, showed necessity of intervention specially education.²⁰ We design this study for executing the protection motivation theory in students, and then generate to others.

Materials and methods

This was an experimental study. Participants were 360 female students from four high schools in Yazd city, Islamic Republic of Iran, who completed a questionnaire in 2009. The participants were randomly divided in two groups (180 students in case and 180 in control group). The high schools were selected by cluster sampling from the list of high schools in the department of Education of Yazd province. All of students of two high

schools were assigned to the waitlist control groups and two others as intervention group.

A self-report questionnaire was used to assess the variables in the PMT model at pretest, post-test and follow-up. Internal consistency of the questionnaire was calculated by using test-retest technique among 20 similar subjects that were not as original subjects. The overall reliability coefficient range for the questionnaire in test-retest was 0.62-0.85 and for all of participants was 0.66-0.87. Then content-validity was established by 10 experts, who were among academic staff.

Questionnaire designed, based on PMT, consisting of information on individual, social and demographic characteristics and other health-related behavior eight questions and the number of constructs of PMT and minimum and maximum scores of them are given in **Table 1**.

The construct of PMT model was composed of 5-points Likert scale (from 5= strongly agree to 1= strongly disagree).

The questionnaire was distributed before the intervention (pre-test) and afterwards (post-test) and following at a 2 month lag.

The questionnaires were completed before intervention by the two groups. Then, education, as the intervention factor, was given using lecturing, group teaching and performance in three one-hour sessions for intervention group. After education, participants completed the questionnaires and 2 month after intervention, samples completed the questionnaires as follow-up. The education was mainly based on PMT that was carried out by researchers.

Statistical Analysis

All data which were collected were transferred

Table 1 The number of questions of constructs of PMT and minimum and maximum scores of them

Constructs of PMT	No of questions	Minimum scores	Maximum scores
Perceived susceptibility	4	4	20
Perceived threats	5	5	25
Rewards	4	4	20
Threat appraisal	5	5	25
Fear	5	5	25
Self-efficacy	4	4	20
Response efficacy	6	6	30
Response costs	5	5	25
Coping-appraisal	5	5	25
Protection motivation	7	7	35
Behaviour	9	0	12

PMT= Protection motivation theory

directly into SPSS (Statistical Package for Social Sciences). For data analysis, ANOVA, T-test, Wilcoxon, and Pearson's correlation coefficient were used and level of confidence interval was 95%.

Results

Participants were 360 female students from four high schools in Yazd city. The mean age of participants was 16.04±0.975. About 47.8% of subjects had past sunburn history. The data before intervention showed that there was no significant difference between the demographic variables of case and control groups and matching was suitable.

The results showed no significant differences between the mean grades score of variables (perceived susceptibility, perceived threat, rewards, threat appraisal, fear, self-efficacy response efficacy, response costs, coping-appraisal, protection motivation and behavior) in the case and control groups in pre-test, (Table 2).

A significant difference was noted between all variables mentioned, in the case and control groups in follow up test ($p=0.00$) except fear ($p=0.06$). There was significant difference between mean grades score of all of variables in case group in pre-test and follow up ($p=0.001$) and for fear ($p=0.04$). No significant difference was seen between mean grades

score of variables in control group in pre-test and follow-up ($p>0.05$).

The results in Table 3 show the distribution of mean grade scores of constructs of PMT in pre-test, post test and follow up, that mean grade scores of some of constructs of PMT decreased in follow up in comparison to post-test.

The data in Table 4 reveals that the behavior of participants in using the methods for prevention the skin cancer in case group after intervention was better than control group. There is significant difference between using methods for prevention skin cancer in case and control group in follow up ($p=0.02$).

Discussion

This study confirms the feasibility of applying the PMT to predict and understand the intention of students to implement and follow practical activities in long term, with a view to in prevent skin cancer risk.

The PMT provides a means to understand the intention, behaviors and educational needs of populations and, therefore, can be used as a practical tool to develop effective intervention strategies and change the attitudes and behaviors associated with skin cancer risk.²¹⁻²³ Jackson *et al.*²⁴ revealed that threat and coping information in PMT facilitates greater adaptive

Table 2 The comparison of mean grades score of constructs of protection motivation theory before and after intervention in case and control groups

Variables	Groups	Pre-test	Follow-up test	P value
Perceived susceptibility	Case (n=180)	12.77 ±3.59	15.88 ± 2.9	0.001
	Control(n=180)	13.11±3.21	13.25±2.08	
	p value	0.339	0.001	0.109
Perceived threat	Case	17.71±4.06	20.51±4.72	0.001
	Control	18.04± 3.92	17.98±3.93	
	p value	0.437	0.001	0.465
Rewards	Case	10.59±3.38	8.85±3. 55	0.001
	Control	9.86 ±3.69	10.3±3.69	
	p value	0.058	0.002	0.084
Threat appraisal	Case	-19.81±7.89	-27.55 ±7.87	0.001
	Control	-20.22±7.49	-21.55 ±7.49	
	p value	0.083	0.001	0.566
Fear	Case	17.18 ±3.23	18.41±3.11	0.041
	Control	16.94± 3.69	16.73 ±3.76	
	p value	0.513	0.061	0.379
Self-efficacy	Case	14.83±3.2	16.09±3.03	0.001
	Control	14.98±2.77	14.85 ±2.95	
	p value	0.622	0.001	0.237
Response -efficacy	Case	21.63 ±3.65	23.96±3.42	0.001
	Control	21.58±3.75	21.56 ±3.74	
	p value	0.887	0.001	0.876
Response -costs	Case	15.25±3.75	13.91 ±3.04	0.001
	Control	14.06±3.59	14.2 ±3.49	
	p value	0.200	0.41	0.088
Coping-appraisal	Case	21.13±6.7	26.15±6.76	0.001
	Control	22.49±6.89	22.42±6.89	
	p value	0.074	0.001	0.142
Protection motivation	Case	27.11±3.98	28.76±3.96	0.001
	Control	27.05±4.08	26.96±4.14	
	p value	0.891	0.001	0.103
Behavior	Case	3.92±1.82	6.47±2.64	0.001
	Control	4.04±2.02	3.88±1.94	
	p value	0.571	0.001	0.09

Table3 Protection motivation theory and intention means for follow-up

Variables	Pre-test	Post-test	Follow-up
Perceived susceptibility	12.77 ±3.59	16±3.2	15.88 ± 2.9
Perceived threat	17.71±4.06	19.87±4.02	20.51±4.72
Rewards	10.59±3.38	8.87±3. 81	8.85±3.55
Threat appraisal	-19.81±7.89	-12.42 ±5.43	-27.55 ±7.87
Fear	17.18 ±3.23	17.56±3.24	18.41±3.11
Self-efficacy	14.83±3.2	18.31±3.24	16.09±3.03
Response efficacy	21.63 ±3.65	23.45±3.59	23.96±3.42
Response costs	15.25±3.75	13.36 ±3	13.91 ±3.04
Coping-appraisal	21.13±6.7	28.4±7.7	26.15±6.76
Protection motivation	27.11±3.98	27.85±4.34	28.76±3.96
Behavior	3.92±1.82	-	6.47±2.64

change. The results of this study identified several basic educational needs of participants which increase their knowledge and motivate change in their behavior for prevention of skin cancer risk.

The mean for grade scores of threat appraisal that evaluates the maladaptive behavior, as one of the constructs of PMT in the case group after intervention was suitable. The coping-appraisal process as one of other constructs of PMT that evaluates the ability to cope with and avert the

threatened danger increased after intervention in case group (21.13 ± 6.7 to 26.15 ± 6.76). These two constructs showed that participants in case group after intervention were motivated to prevent skin cancer risk, but not in the control group. The results of our study are similar to the results of some other studies.²²⁻²⁵ After analyzing the follow-up results and comparing with pre-test, the most encouraging finding of this investigation came from the follow-up sessions, as the mean grade scores of protection motivation from 27.11 ± 3.98 in pre-test increased to 28.76 ± 3.96 in follow-up, and mean grade scores of behavioral intention increased from 3.92 ± 1.82 in pre-test to 6.47 ± 2.64 in follow-up. These results suggest that the intervention had a lasting effect. Findings of this study are consistent with the observation of McClendon *et al.*²⁶ who recommend that intervention-based PMT improves patients' intentions to prevent and control their skin cancer risk.

The mean for grade scores of perceived susceptibility, as one of the constructs of PMT in both the case and control groups was more than average but in case group increased after intervention and reached from 12.77 ± 3.59 to 15.88 ± 29 with significant difference ($p=0.001$).

The results of our study are similar to the results of Beranth²⁷ and Tan.²⁸ Tan described that the patients did not prevent the complications of their diabetic foot, because their perceived susceptibility was low.

Perceived susceptibility of participants increased in the case group, suggesting that education may have influenced patient behavior. These results are consistent with the findings of Beranth²⁷ and the finding of a study in India²⁹ which revealed that increasing the perceived susceptibility in patients, helps to prevent and control their diabetic foot

complications. Results of a study in the USA revealed that, low perceived susceptibility is the reason for patients not caring for their health.³⁰

It has been shown that perceived threat, as another construct of PMT, can be used to prevent and control disease. The mean grade scores of participants in the case and control groups before intervention were low, similar to the results of the study by Driver *et al.*³¹ which showed that the rate of amputation of foot in participants was high. The perceived threat of patients of the case group in both studies increased after intervention. This decreased foot amputation by 84% in the Driver study. Our data about perceived threat are similar to the results of Ghofranipour and Shojaee Zade³² who showed that increase of perceived threat could prevent and control brucellosis. The result of a research that was carried out by Vickie³³ showed that amputation rate in diabetic patients, with low perceived threat, was higher than others.

Many studies revealed that sunburn is a significant risk for melanoma.^{34,35} Using the PMT theoretical framework appears to be a helpful tool to allow participants to recognize skin cancer risk (sunburn, freckles and ...) or threat appraisal. By providing coping information, for example sun protection information, one can facilitate positive health behaviors potentially preventing sunburn. Our intervention improved participant's sun protection behaviors at 2 months after intervention: more participants in case group reported avoiding the sun and limiting exposure during midday hours and using a sunscreen sun protection factor (**Table 3**) but not in control group. These results are same as the results of Norman *et al.*³⁶ The mean grade scores of behavior of case group before intervention was 3.92 ± 1.82 out of 12, that increased to 6.47 ± 2.64 after intervention. There is significant difference between

Table 4 Methods used for preventing skin cancer risk in case and control groups in follow up.

Methods	Case group N (%)	Control group N (%)	P value
Sunscreen	124 (68.9)	76 (45)	0.02
Sunglasses	47 (26.1)	20 (11.8)	0.001
Gloves	24 (13.3)	3 (1.8)	0.001
Hat	45 (25)	12 (7.1)	0.001
Clothes	54 (30)	25 (14.8)	0.001
Anything	4 (2.2)	38 (22.5)	0.001

behavior of participants before and after intervention in case group ($p=0.001$), but no significant difference in control group ($p=0.09$) and the mean grade scores of control group decreased after intervention (4.04 ± 2.02 and 3.88 ± 1.94 respectively, before and after intervention).

The self- efficacy of case group increased in post-test and decreased at follow-up (mean grade scores of case group in pre-test, post-test and follow-up, respectively was 14.83 ± 3.2 , 18.31 ± 3.24 and 16.09 ± 3.03). The decrease of self-efficacy at follow-up in our study may indicate that students had difficulty in following the recommended action. It may also indicate the beginning of an overall decline in treatment effectiveness. Similar results were reported by Brain *et al.*³⁷ Overall, our results support the effectiveness of a PMT-based intervention to change the attitude and behavior associated with skin cancer risk. Theory-based intervention can motivate people to alert their attitudes and behaviors regarding sun exposure.

Limitation

In this study, we were unable to actually see the behavior for preventing skin cancer risk, as we used self-reporting for data collection of this parameter.

Our study was on female students, an exploration of gender difference is needed.

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