

Determinants of Cancer Early Detection Behaviors: Application of Protection Motivation Theory

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ABSTRACT

Background: Cancer is account for 13% of all deaths around the world and is the third cause of mortality in Iran. More than one third of these cases are preventable and about 33% are curable with early detection. The aim of this study was to determine the predictors of cancer early detection (CED) behaviors applying Protection Motivation Theory (PMT).

Methods: In this cross-sectional study, cluster sampling method was employed to recruit 260 individuals of above 20 years old in Yazd, Iran and a researcher designed questionnaire was completed through interviews for each of the respondents. PMT theoretical variables and CED behaviors were the basis of data collection procedure.

Results: Participants acquired 64.47% of the protection motivation, 30.97% of the passive and 45.64% of the active behaviors' possible scores. Theory constructs predicted 19.8%, 15.6% and 9.6% of the variations for protection motivation, passive and active behavior respectively. Protection motivation was responsible for 3.6% of passive and 8% of active behaviors' variations.

Conclusion: Considering the scarceness of CED behaviors and the applicability of PMT in predicting these behaviors, utilization of the PMT's constructs in any interventional programs to accelerate CED behaviors could be an alternate methodological choice in the cancer control initiatives.

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Introduction

Cancer as a worldwide public health problem provokes enormous public anxiety.¹ It is the cause of 13% of the deaths around the world and its burden continues to increase in the next decades.^{2,3} Cancer is the third cause of death in Iran and its mortality was on the rise within the past decades.⁴ Similar to many other Asian countries, the number of national programs that are con-

sistent with WHO guidelines for cancer screening and prevention are scarce in Iran, which leads to delayed cancer diagnosis.^{3,5} Population level screening programs for cancer in Iran, currently is limited to cervical cancer screening at primary health care clinics which is actually poorly adapted by the eligible women.¹ Behavioris central to the etiology, management of cancer screening and its

outcomes may provide several avenues for targeted and sustained interventions.⁶ Preventive measures and CED were pinpointed as the best strategies to intercept cancer burden in many of the WHO's guidelines.¹ CED programs could greatly increase the chances for successful treatment of cancer cases that will consequently decrease cancer related morbidities and mortalities in all nations.⁷⁻⁹ These strategies may lead to successful treatment of the patients by 30% and increase of the survival rates by 95%.^{1,10} There are two major components of CED including education to help early diagnosis and screening by recognizing possible warning signs of cancer and the second is taking prompt actions that might lead to early diagnosis and treatment. Increased awareness of possible warning signs of cancer, in general populations, could have a great impact on the consequences of this terrifying disease.¹¹ Three categories of CED behaviors can be distinguished: 1) Passive detection behaviors (a person becomes aware of a cancer warning sign without a conscious action), 2) Active detection behaviors (a conscious action is adapted to detect cancer warning signs, such as self-examination), 3) Detection behaviors by medical professionals (during a screening program or a medical check-up).¹² Cancer warning signs for CED includes observation of blood in stool and urine, coughing up blood, the appearance of warts or new moles or changes in existing moles, swelling or thickening in the breasts or other parts of body, excruciating cough or hoarseness, a sore that will not heal, indigestion or swallowing problems, changes in bowel habits and unusual weight loss.¹³

The knowledge of people regarding cancer warning signs and use of screening program is inadequate and this inadequacy usually leads to delay in seeking medical help for suspicious signs and symptoms.¹³⁻¹⁵ This is the reason for diagnosis of even many curable cancer cases at their advanced stages in many developing countries.^{11,16}

Protection Motivation Theory (PMT) has been used as a useful framework to predict and intervene on cancer prevention and early detection behaviors.¹⁷⁻²⁰ PMT was originally proposed to provide conceptual clarity to the understanding of

fear appeals and the ways people are trying to protect themselves from a health threat. It describes adaptive and maladaptive coping mechanisms with a health threat because of two appraisal processes: threat appraisal (perceived sensitivity, perceived severity, and perceived rewards) and coping appraisal (perceived self-efficacy, perceived response efficacy, and perceived costs). Thus, fear that is the outcome of these two stages will direct protection motivation and behavior.¹⁸

CED behaviors were investigated in a number of studies using PMT.^{17,19,20} Vadaparampil et al. conducted a study about prostate specific antigen testing among first-degree relatives of prostate cancer patients and have pointed out to the predictive validity of the PMT variables.¹⁹ Inukai and Ninomiya have reported that self-efficacy and perceived consequences of behavioral responses are notable cognitive factors that could influence participation in the mammographic breast cancer screening.²⁰

PMT is an appropriate model to explain factors that may affect the breast cancer genetic testing intention.²¹ In addition, there are studies that have showed fear as an effective stimulating factor in CED behaviors which is already incorporated in the PMT.^{16,22}

Despite the role CED behaviors might play in cancer prevention and treatment, few studies have considered the passive and active CED behaviors simultaneously¹² and most of the studies in the area are not theory based^{12,13} or have focused just on a single cancer type such as breast cancer.^{17,20}

Due to the existed gap in the research evidence, this study was conducted to determine the predictors of CED behaviors applying PMT as an adequate conceptual framework in Yazd, Iran.

Materials and Methods

Participants and Procedures

This cross-sectional study was carried out in 2013 in the city of Yazd, Islamic Republic of Iran. Cluster sampling was employed to recruit 260 respondents older than 20 years (according to the American Cancer Society guidelines for CED, over 20 years old people should be considered for education and examinations).²³ In order to select

the participants, the city was divided into 13 clusters and from each cluster, 20 eligible people (10 males and 10 females) were interviewed by one of the research team members at their own homes. Eligibility criteria for the study included 1) ages ≥ 20 years old and 2) not being diagnosed as a cancer patient. Ten age groups including 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 and ≥ 65 years old were considered to be included in the study and in order to ensure the participation of people from both sexes in all of the specified age groups, one male and one female participant were recruited from each age groups in the clusters. The required sample size was estimated based on the suggested parameters in the literature,²⁴ where $P = 0.08$, $d = 0.05$ and the study power was decided to be 80%. The mean age of the sample was 44.73 ± 14.79 . Most of the participants were married (85.8%) and had high school diploma (33.5%). About 42% of females were housewife and most of the male participants (35%) were self employed.

Measures

A self-administered questionnaire was designed by the researchers that consisted of socio-demographics variables, CED knowledge, CED behaviors and PMT theoretical constructs.

The reliability coefficients of the scale different sections were calculated by Cronbach α coefficient. Face validity and content validity of the scales different sub sections, were investigated and confirmatory factor analysis using Amos 21 software was performed. In order to confirm content validity of the instruments, a panel of experts, consisting eight scholars in the areas of health behavior and education, reviewed and assessed the questions regarding the appropriateness and relevance of the items, response format and their representativeness of the constructs. The feedbacks received from the experts, which mainly were related to the wording and phrasing of the items, were used to revise and modify the instruments.

A pilot study was conducted to examine the applicability of the instruments and to identify the pros and cons associated with the design. The first draft was prepared following consultation with the

multidisciplinary team. The questionnaire was pilot-tested on 20 respondents. The obtained data were used to estimate the internal consistency of the scales, using Cronbach's Alpha Coefficient. This pilot sample was not included in the final sample.

The total CVR, for all of scales were 1 and confirmatory factor analysis revealed that the questionnaire fits the Iranian sample.

Socio-Demographics variables

The socio-demographics variables included age, gender, marital status (single/ married/ widow), education level (illiterate/ elementary/ secondary/ high school diploma/ collage degree), job (private household/ worker/ employee/ self-employment), number of family members and family monthly income level. Existence of a cancer patient in the respondents' relatives also was asked.

CED Knowledge

Three close-ended questions were used to measure knowledge and the main questions were based on the Knowledge of Cancer Warning Signs Inventory (KCWSI) questionnaire. The KCWSI scale consisted of seven correct symptoms and five incorrect symptoms, to assess whether respondents were able to distinguish cancer symptoms from non-cancer symptoms. An acceptable internal consistency index (alpha coefficient of 0.79) has been reported by Nooijer.¹² Content validity index (CVI) for this scale was 0.97.

CED Behaviors

The CED behavior construct consisted of 3 items; one item was for passive detection behavior (pay attention to cancer warning signs without a conscious action) and 2 items were for active detection behaviors (help-seeking behavior in appropriate time and performing examination for CED). The appropriate time suggested for seeking medical help was at most 1 week after finding blood in stools and/or urine, coughing up blood, appearance of warts or new moles or changes in existing moles, swelling or thickening and 4 weeks for an excruciating cough or hoarseness, a sore that will not heal, indigestion or swallowing problems, changes in bowel habits and unusual weight

loss.¹²Alpha coefficient and CVI for this scale were 0.92 and 0.98 respectively.

PMT theoretical constructs

PMT constructs were measured using 48 items. Perceived vulnerability was measured using five items e.g. “it is possible for me to get cancer” ($\alpha=0.65$, CVI=0.99). Six items were used to measure perceived severity e.g. “if cancer is diagnosed in progressive stage, it will have numerous physical and psychological consequences” ($\alpha=0.86$, CVI=0.98). Self-efficacy was measured by six items e.g. “I can perform required tests and examinations for CED” ($\alpha=0.93$, CVI=1). Besides, six items were used to measure the responses’ cost e.g., “performing required CED tests and examinations are time-consuming” ($\alpha=0.80$, CVI=1). Response efficacy scale consist of eight items e.g. “performing CED tests and examinations, prevent cancer progression” ($\alpha=0.83$, CVI=0.98). For measuring perceived reward four items were used e.g. “no attention to cancer warning signs resulted no worry” ($\alpha=0.82$, CVI=0.98). Fear was measured using six items e.g. “I will be worry about the results, when performing CED required examinations” ($\alpha=0.76$, CVI=1). Finally protection motivation was measured using seven items e.g. “I have decided to pay more attention to my body sign for CED” ($\alpha=0.92$, CVI=1).

All items of PMT constructs, except protection motivation were scored on 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Protection motivation was assessed using a 4-point scale ranging from 1 (not at all) to 4 (sure).

Statistics

SPSS 21 software (Chicago, IL, USA) was used for analysis. Summery statistics and frequency distributions were used to describe and interpret the meaning of data; the differences between PMT constructs by demographic variables were calculated by *t*-test, one-way ANOVA, Mann-Whitney and Kruskal-Wallis tests. Pearson’s and Spearman’s correlation coefficient was used to demonstrate the associations between behavior and the

PMT constructs and multiple linear regression analysis with stepwise method was performed to explain the variation in behavior scores on the basis of the PMT constructs. All of PMT constructs were entered in the regression models and R^2 changes were provided to show the unique contribution of each construct.

Ethical considerations

This study was confirmed by the Research Council and Ethics Committee of the Tarbiat Mo-dares University, Tehran, Iran.

Results

CED Behaviors

Regarding passive behaviors, a low level of attention to the cancer warning signs was observed (Table 1). The respondents reported to be more attentive to coughing up blood and blood in stool and urine, while they were less attentive to unusual weight loss and in digestion or swallowing problems. But about active behavior the majority of the respondents reported that “in the case of discovering those warning signs”, would seek medical help immediately except for changes in warts or moles and their swellings or thickenings. So that about 40% and 26.2% reported that they would not seek help in appropriate time, respectively.

Regarding performing CED tests and examinations, the majority of the study target group declared that in the case of recommendation by a physician, they would perform such tests especially of Pap smear test and endoscopy.

CED Knowledge and PMT theoretical constructs

Means and standard deviations for knowledge and PMT constructs are shown in Table 1. Out of all respondents, 37.7% knew that cancer has warning signs which is recognizable by themselves and 24.6% mentioned swelling and thickening as the signs of cancer.

Table 1: Mean and Standard Deviation scores of PMT variables and CED knowledge and behaviors

Variable	Mean	Standard Deviation	Possible Range	Percent of Acquired Scores
Knowledge	4.44	1.44	0-9	49.33
Perceived susceptibility	14.35	2.43	0-20	71.75
Perceived severity	18.91	3.92	0-24	78.79
Self-efficacy	13.82	3.79	0-24	57.58
Response cost	12.93	4.69	0-24	53.87
Response efficacy	24.57	4.22	0-32	76.78
Perceived reward	7.02	3.31	0-16	43.87
Fear	13.43	4.85	0-24	55.95
Protection motivation	13.54	5.10	0-21	64.47
Passive behavior	11.15	11.85	0-36	30.97
Active behavior	17.80	5.89	0-39	45.64
Threat appraisal	26.24	6.08	0-44	59.63
Coping appraisal	25.46	8.18	0-56	45.46

Among perceived susceptibility items, the mostly agreed item was “all people in every age are at risk of cancer”. Regarding perceived severity, “cancer is a progressive disease with dangerous implications” was the most agreed item.

The most important factor related to the diminishing self-efficacy among respondents was “distinguishing the warning signs of cancer are difficult”. The high costs of tests and examinations for CED and “being worried about the results of such tests and examinations” were the most reported costs of CED behaviors. Among response efficacy items, “doing care for health” and “preventing from cancer progression” was the most reported perceived benefits of CED behaviors.

Mostly reported perceived rewards of not performing CED behaviors was “feeling of comfort and being healthy”. Besides, mostly agreed item in fear scale was “I am worry about having cancer”.

The study of protection motivation items revealed that, only 7.3% of participants had intention to perform cancer diagnosis examinations.

CED Behaviors by Demographic variables

In examining CED behaviors by demographic variables, there was no statistically significant differences regarding the active behaviors amongst the subgroups but mean score of passive behavior was higher in males than females ($P=0.015$), in sin-

gles than married and widowed participants ($P=0.024$). A significant negative correlation was also observed between passive behavior score and age ($P=0.01$). In addition, the respondents with lower level of education ($P=0.0001$) and family income level ($P=0.01$) had lower passive behavior score. The respondents who had a cancer patient in their relatives showed better passive behavior, than those who have not ($P=0.003$).

Relations of CED Behaviors and PMT theoretical constructs

Applying Spearman's correlation coefficient test, protection motivation had statistically significant positive correlations with perceived susceptibility ($P=0.05$, $r=0.139$), self-efficacy ($P=0.01$, $r=0.315$), response efficacy ($P=0.01$, $r=0.263$) and coping appraisal ($P=0.01$, $r=0.327$). In addition, there was statistically negative association between protection motivation and perceived reward ($P=0.01$, $r=-0.328$).

Passive behavior's score has shown a statistically significant positive correlations with knowledge ($P=0.01$, $r=0.284$), perceived susceptibility ($P=0.01$, $r=0.175$) and protection motivation ($P=0.05$, $r=0.128$) but negative correlations with perceived severity ($P=0.01$, $r=-0.168$), response cost ($P=0.01$, $r=-0.262$), perceived reward ($P=0.01$, $r=-0.175$) and fear ($P=0.01$, $r=-0.207$).

Positive correlations were also observed between active behavior and perceived severity ($P=0.01$, $r=0.186$), self-efficacy ($P=0.01$, $r=0.172$), response efficacy ($P=0.05$, $r=0.125$) and protection motivation ($P=0.01$, $r=0.287$). Finally, there was a negative correlation between active behavior and perceived reward ($P=0.05$, $r=-0.135$).

Multivariate analyses

According to multiple regression analysis, perceived reward, response efficacy, self-efficacy and fear were found to be main predictors of protec-

tion motivation that accounted for 19.8% of the variation and perceived reward was the most powerful predictor. Moreover, threat appraisal and coping appraisal accounted for 12.8% of the protection motivation variation however; coping appraisal was the more powerful predictor.

Besides, 15.6% and 3.6% of passive behavior were predicted by the PMT constructs and protection motivation (Table 2) and they also accounted for 9.6% and 8% of the variation of active behavior respectively (Table 3).

Table 2: Regression analysis of PMT variables and CED knowledge as predictors of passive behaviors

Predictors	R ² Change	R ²	R	P. value
Knowledge	0.081	0.081	0.285	0.0001
Response cost	0.053	0.134	0.366	0.0001
Perceived reward	0.013	0.147	0.383	0.050
Perceived severity	0.004	0.151	0.388	0.279
Perceived susceptibility	0.004	0.155	0.393	0.276
Self-efficacy	0.001	0.156	0.395	0.546
Response efficacy	0.0001	0.156	0.395	0.735
Fear	0.0001	0.156	0.395	0.952
Protection motivation	0.036	0.036	0.189	0.002

Table 3: Regression analysis of PMT variables as predictors of active behaviors

Predictors	R2 Change	R2	R	P. value
Self-efficacy	0.029	0.029	0.171	0.006
Perceived severity	0.028	0.057	0.239	0.007
Perceived reward	0.021	0.077	0.278	0.018
Fear	0.008	0.085	0.292	0.145
Knowledge	0.006	0.091	0.302	0.184
Perceived susceptibility	0.004	0.096	0.309	0.290
Response cost	0.001	0.096	0.310	0.670
Response efficacy	0.0001	0.096	0.310	0.950
Protection motivation	0.079	0.079	0.282	0.0001

Discussion

Main aim of the current study was to explore determinants of CED behaviors based on the PMT. The results indicated applicability of this model as a conceptual framework to explain reasons of people engagement in the CED activities.

The study findings also showed that most of the respondents did not know cancer-warning signs and they only mentioned to the swelling or thickening as the cancer signs. Similar with this findings, in other studies^{13,24,25} it was also reported

that knowledge of people about cancer warning signs was low. One of the reasons for low awareness level about signs and symptoms of cancer might be focus of the health education and promotion programs mainly on life style changes (primary prevention) and ignoring individuals' education about CED, which is a secondary prevention measure. Low CED knowledge and misunderstandings may affect directly healthy behaviors or indirectly through reducing self-efficacy.

Consistent with previous studies^{2,13,20} the respondents' behavior was inappropriate

especially in relation to the signs that are common in simple disease such as indigestion or swallowing problems or those diseases that cause no pain or discomfort such as unusual weight loss. Besides, about performing CED tests as previous studies proposed^{2,16,26} participants stated that they need medical recommendation to do these tests especially for unknown and expensive ones such as Pap smear test and endoscopy. Providing information about these tests during the routine training programs in health care systems is necessary, and health professionals should be persuaded to recommend such tests to their clients if necessary.

The study participants generally obtained higher scores in active behavior in comparison with passive behavior, which is consistent with the previous studies.¹ This result might be an indication of a major problem that is not paying sufficient attention to the warning signs of cancer and therefore; significance of more attention to the passive behaviors. If at the first step of the CED measures, i.e. attention to cancer warning signs, an improvement takes place, other CED behaviors could increase in a larger extent.

According to the findings, in spite of having proper knowledge about importance of detecting cancer in the early stages, costs of CED was one of the main barriers of engaging in CED behaviors especially among women of low socio-economic group. Costs of screening programs could affect CED as well as help-seeking behaviors^{25,27,28} Extending coverage of health insurances to include these tests or free screening plans within the routine primary health care delivered by health system, at least for low-income people, may alleviate this limitation considerably. Moreover educational interventions may emphasize on enormous costs of cancer diagnose and treatment in progressive stages compared to the negligible costs of CED tests. This can be shown by introducing the patients who encountered financial difficulties due to the enormous costs of their developed cancer.

As expected, an excessive fear of cancer and related tests' results was seen among the respondents, which may be due to the insufficient knowledge or ambiguity about cancerous diseases

and their related tests and examinations or existed misconceptions such as incurability of cancer. This fear may be reduced by joining individuals, who saved from cancer by early detection/intervention, as lay persons in implementing educational programs.

According to the results, passive behavior decreased by increase of age, which is consistent with the findings of the previous studied.^{2,13} This is while by increase of age, people are generally at a greater risk of cancer. The level of education was also an influential factor on passive behavior. Several studies have demonstrated the key role of this factor on CED behaviors.^{13,14,29} Planning of focused intervention program for older persons with lower education therefore; could be pivotal e.g., through family physicians as interpersonal channels.

Participants who had relation with cancer patients, especially with patients whose cancer was detected too late, had better passive behaviors. Such a finding was also reported in the other studies.^{14,30,31} Introducing such patients and their problems which mainly resulted from delayed detection may be effective in increasing people's perceived susceptibility towards cancer warning signs. The patients may be introduced through mass media- programs that will cover a large number of audiences.

The observed significant correlations between protection motivation and theory constructs and coping appraisal and also, the positive association between behavior and protection motivation as well as the other theory constructs could be considered as initial evidences to support PMT assumptions as it was also suggested earlier.²

Regression analysis result showed that coping appraisal and perceived reward were the most powerful predictors of protection motivation. In most of the previous studies that used protection motivation theory, coping appraisal was a more powerful predictor than threat appraisal.³² In Helmes's et al. study²¹, perceived reward, perceived severity and response cost predicted intention to perform genetic tests for breast cancer. Similar results were reported in other studies.^{33,34}

Considering the role of perceived rewards in predicting protection motivation and conse-

quently, its indirect influence on behavior, it is probable that by reducing subjective rewards of not performing CED behaviors (including feeling comfortable, not being worried and etc.) the cancer protective behaviors will increase. This could be achievable through reduction of stress and anxiety associated with performing these behaviors.

Based on the findings, knowledge and response cost had an important role in predicting passive behavior and, also, self-efficacy had a significant role in predicting active behavior which is consistent with the results found in previous studies.^{26,35,36} Considering the role of these predictors for performing passive and active behaviors, it could be suggested that in line with conducting educational programs to increase knowledge and self-confidence, practical measures must be taken to decrease the cost of performing these behaviors.

Conclusion

Considering the low level of CED behaviors among the study participants and the applicability of PMT in predicting those behaviors, interventional programs that try to accelerate CED behaviors are suggested to pay more attention to the significant identified predictors of the outcome variable in the study to increase chance of success in reaching cancer prevention programs' goals.

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