Turkish Journal of Dental Hygiene
2024, Volume 4, Page No: 36-44

Available online at: www.tsdp.net

ISSN: 3062-3472

Original Article

Investigating the Impact of Education Based on the Model of Pender Health Promotion on the Oral Health Behavior of Cancer Patients

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Received: 14 September 2024; **Revised:** 28 November 2024; **Accepted:** 29 November 2024

ABSTRACT

Oral and dental diseases are one of the most common health challenges in cancer patients, which affects their life quality. This research was conducted with the aim of the effect of education based on Pender's health promotion model on the oral health behavior of cancer patients. This semi-experimental research was done on adult cancer patients. The educational intervention was presented in the form of 6 practical and theoretical training sessions, with a one-week interval between the training sessions based on the Pender health promotion model. The data collection tool was a standard questionnaire based on the constructs of Pender's health promotion model, which was completed in three stages including before the intervention, immediately, and 2 months after the intervention. Data were analyzed in SPSS 23 statistical software using descriptive tests and ANOVA with repeated measures. Based on the results obtained from this study, there was a statistically significant difference between the behavior score before the intervention and after the intervention and the follow-up phase ($P < 0.001$). Also, after the educational intervention, among the constructs of the promotion model of Pender, the constructs of positive emotions, self-efficacy, and interpersonal influencing factors have significantly increased and perceived obstacles have decreased ($P < 0.001$). The findings of this research emphasize the effectiveness of Pender's health promotion model in promoting oral hygiene behavior in adult cancer patients.

Keywords: Oral health behavior, Cancer patients, Education, Pender's health promotion model

How to Cite This Article: Mohammed SL, Salama AM. Investigating the Impact of Education Based on the Model of Pender Health Promotion on the Oral Health Behavior of Cancer Patients. Turk J Dent Hyg. 2024;4:36-44. https://doi.org/10.51847/A0rav6uOXy

Introduction

Cancer is a major global health problem whose prevalence is increasing worldwide. Chemotherapy and radiotherapy are the most common methods for cancer treatment [1-3]. Acute and long-term side effects of cancer treatments have a significant impact on oral and dental health and related quality of life. Patients undergoing chemotherapy often suffer from oral complications including oral/pharyngeal mucositis, pain, dry mouth, and dental caries. In addition, patients undergoing radiotherapy may complain of temporary dry mouth [4, 5]. The incidence rate of oral mucositis in patients treated with chemotherapy and radiotherapy is between 40 and 100% and is related to age, type of tumor, treatment methods, nutritional status, and oral hygiene [3]. In these patients, problems related to the oral cavity may develop during or after treatment, which has negative effects on the care and treatment process [6] and can worsen the patient's general condition and health-related quality of life [7] and lead to hospitalization, the need to use narcotics [4] and prolong the length of stay in the hospital [8] or play a role in causing complications and mortality [6].

Chronic oral diseases can even disrupt the quality of life of survivors, which is often neglected [9]. In addition, oral problems are not well managed in patients with advanced cancer. Health care

professionals do not evaluate most cases of oral problems and more importantly, patients and their caregivers [7] do not report them. In addition, according to the search of the researchers, there is no updated and evidence-based guideline on the management of oral problems in patients with advanced cancer in medicine and dentistry [7]. Considering the impact of oral and dental health in maintaining the quality of life of cancer patients, special attention should be paid to this matter in the care of these patients [1]. A study in Brazil showed that participating in an oral health education program was an effective measure to reduce the incidence of oral mucositis in children with cancer [8]. The International Society of Oral Oncology also pointed out that oral care protocols and patient education are key components of oral mucositis reduction strategies [10]. Teaching patients is a suitable solution to improve their health behaviors, which can increase the quality of life, self-efficacy, and trust of these patients toward sustainable care [11]. It seems that it is important to use appropriate educational methods to achieve the desired results in the matter of care [10] and the first step in educational planning is to choose the appropriate educational model [11]. By choosing the appropriate theory or model, it is possible to identify the key factors involved and determine the correct course of intervention [12, 13].

Penn's Health Promotion Model (HPM) is derived from social cognitive theory [14] and is one of the most widely used models for identifying and changing unhealthy behaviors and promoting health [15]. Considering that Pender's health promotion model is an ecological approach to behavior change and takes into account organizational and social interpersonal factors, it can be useful in identifying effective factors in creating healthy behavior and maintaining it. Therefore, this model can be used as a framework for planning health interventions to improve health promotion behavior [16].

Bandar's health promotion model has three basic components, which include individual experiences and characteristics (previous related behavior and personal factors), cognitions and emotions specific to behavior, perceived self-efficacy, perceived benefits of action, perceived barriers to action, effects between individuals, situational effects, and activity-related effects) and desirable health promotion behavior (commitment to an action plan and immediate competitive demands and preferences) that can influence health promotion behavior [17]. The superiority of the Pender model in the implementation of the health program can be attributed to the fact that the health team is not limited to the field of interventions that reduce the risk of disease. Also, this model gives the health team more and better opportunities to improve the health, functional ability, and quality of life of these patients by examining individuals, families, and communities [18].

Based on the results of a study in Turkey [19], the positive changes observed in the behaviors of early diagnosis of breast and cervical cancer because of nursing interventions show the effectiveness of nursing interventions based on Pender's health promotion model and health belief model [19]. Considering this prediction and the lack of basic information in this field, the present study was done to investigate the impact of education based on the model of Pender health promotion on the oral and dental health behavior of cancer patients.

Materials and Methods

This semi-experimental research was conducted on adult cancer patients. The sample size is based on the lack of similar articles based on the effect size and considering the type 1 error of 0.05, the power of the test is 80%, and the standardized effect size (assuming equal variance to expect an increase of about 4 points in oral health behavior) It was determined to be 0.63 and 0.5 correlation between repeated observations, equal to 40 people.

The research units were selected from among adult cancer patients who met the inclusion criteria by systematic random sampling. The conditions for entering the study included cancer patients over 18 years of age undergoing chemotherapy and radiotherapy, the ability to use smartphones and social media, the absence of speech and hearing problems, the physical and mental conditions suitable for responding, and the consent to participate in the present study. Conditions for withdrawal from the study included unwillingness to continue after filling out the initial consent form, incomplete completion of the questionnaire, and failure to participate in more than one training session. The data collection tool was a standard questionnaire based on the structures of the port health promotion model, which has two parts. The first part includes demographic information and the second part is based on the constructs of Pender's health promotion model, which includes questions related to oral and dental health behaviors (13 questions with a score range of 0-26), perceived self-efficacy scale (10 questions with a range of 0-20), feelings related to behavior (positive feeling subscale with 5 questions with a range of 5-25 and negative feeling subscale with 4 questions with a range of 4-20,

in total, by subtracting the score of the negative feeling part from the positive feeling part, the score The total scale of emotions related to behavior with 9 questions with a range of 15-21), the scale of perceived benefits (7 questions with a range of 7-35), the scale of perceived obstacles (9 questions with a range of 9-27), the scale of interpersonal influencing factors (8 questions with a range of 8-24), the scale of situational influencing factors (4 questions with a range of 0-4), and the scale of commitment to the action plan (2 questions with a range of 0-2). The validity of the questionnaire has been confirmed in a previous study. In the current study, the reliability of the entire questionnaire through Cronbach's alpha coefficient was 0.87, for the structure of oral and dental health behaviors 0.88, the self-efficacy scale 0.82, emotions related to behavior 0.79, perceived benefits scale 0.94, and Perceived barriers were found to be 0.96.

First, an informed consent form was completed, and then the research units before the educational intervention completed a standard questionnaire based on the constructs of the Pender health promotion model. It should be mentioned that the researcher completed the questionnaire in the form of questions for people who could not read and write. After completing the questionnaire, the educational content was based on the constructs of Pender's health promotion model (emotions related to behavior, self-efficacy, perceived benefits, perceived barriers, interpersonal influencing factors, influencing factors, and state of commitment to the action plan) [20]. The format of 6 theoretical and practical training sessions was presented by an expert dentist (from the research team). The duration of training in each session was 2 hours and the interval between training sessions was one week. The method of teaching theory was in the form of lectures, group discussions, showing movies, and sending messages in virtual space **(Table 1)**. Practical training was provided through mollage for these patients. In addition, an educational booklet (based on all the taught materials) was prepared and provided to the patients. In the virtual space, to have a greater impact on people's awareness and attitude, new content was sent in the form of messages every few days. Then, the participants were asked to read the material and send their opinions about it. After the end of the educational intervention and two months after the educational intervention, the questionnaire was completed again. It should be mentioned that the research units were assured that the results of the research will be published in general and their details will be confidential. Participation in the project was not mandatory and they could withdraw from participating in the research whenever they wanted, and the training did not have any complications or risks for them. After completing the project, they could refer to a dentist (one of the research team members) for possible follow-up of oral and dental problems.

Table 1. Titles and activities of theoretical and practical training sessions on oral and dental health behavior of cancer patients

Training sessions	Educational titles	How to teach
Session 1	Anatomy and physiology of the mouth and teeth, injuries caused by complications of chemotherapy and radiotherapy in the mouth and teeth	Speech
Session 2	Showing the oral care educational film and feedback from the educational film and the discussion of research units in the field of brushing teeth and its obstacles and talking about the benefits of brushing teeth	Educational video and group discussion
Session 3	Training on mollage using dental floss, toothbrush, and special brushes	Training on mollage in a practical way
Session 4	Practicing brushing and flossing under the supervision of a dentist	Practical
Session 5	Practice and repeat practical work	Practical
Session 6	Answering patients' questions and clarifying ambiguities	Group discussion

SPSS version 23 software was utilized for data analysis. First, the data normality was checked using the Kolmogorov-Smirnov test, and according to the normality of the data, parametric tests were used. Descriptive tests of percentage, frequency, mean, standard deviation, and analytical test of variance analysis with repeated measures were used. A significant level of less than 0.05 was considered.

Results and Discussion

Out of 40 participants, one person was excluded from the study due to non-continuous participation in training sessions, and the final analysis was performed on the data collected from 39 participants.

Based on the results of the current study, the average age of the participants was 48.69 ± 8.95 years. The

majority of participants were female, married, and in the age range between 40 and 50 years. The duration of cancer in most people was between 5-8 years and the most common type of cancer was breast cancer. Other results related to demographic information are provided in **Table 2**.

Table 2. Demographic specifications of cancer patients

Variable name		N	%
Gender	Female	34	87.2%
	Male	5	12.8%
Age range (Years)	< 40	7	17.9%
	40-50	18	46.2%
	> 50	14	35.9%
Marital status	Single	1	2.6%
	Married	36	92.3%
	Widow	2	5.12%
Number of children	Without children	1	2.6%
	1	16	41%
	≥ 2	22	56.4%
Level of education	Illiterate	4	10.3%
	Elementary	12	30.8%
	Middle	5	12.8%
	High school	5	12.8%
	Diploma	10	25.6%
	University	3	7.7%
Job	Worker	4	10.3%
	Employee	4	10.3%
	Freelance	3	7.7%
	Retired	26	66.7%
Duration of cancer (Years)	< 5	14	35.8%
	5-8	15	38.4%
	≥ 9	10	25.8%
type of cancer	Breast	29	74.4%
	Colon	3	7.6%
	Lymphoma	2	5.1%
	Blood	1	2.6%
	Larynx	1	2.6%
	Tongue	1	2.6%
	Womb	1	2.6%
	Ovarian cyst	1	2.6%

Based on the results of ANOVA with repeated measurements, there was a statistically significant difference between the average behavior scores before the intervention, after the intervention, and during the follow-up phase ($P < 0.001$). The average behavior score after the intervention has increased significantly compared to before the intervention, but this value has decreased slightly in the follow-up phase compared to the post-intervention phase, but it is still significant compared to the pre-intervention phase ($P < 0.001$) (**Table 3**).

The findings of the analysis of variance with repeated measures showed that there is a statistically significant difference between the average self-efficacy score before the intervention, after the intervention, and during the follow-up phase ($P < 0.001$). The average self-efficacy after the intervention had increased significantly compared to before the intervention, but this value showed a slight decrease in the average score

in the follow-up phase compared to the post-intervention phase, but there was still a statistical difference compared to the pre-intervention phase. It was significant (P < 0.001) (**Table 3**).

Based on the findings of the analysis of variance with repeated measures, there was a statistically significant difference between the average score of positive feelings before the intervention, after the intervention, and during the follow-up phase (P < 0.01). The mean score of positive feelings after the intervention had increased significantly compared to before the intervention. The average score of this variable in the follow-up phase had decreased slightly compared to the post-intervention phase, but it was still significant compared to the pre-intervention phase (P < 0.05). Based on the results of the analysis of variance with repeated measures, there was a statistically significant difference between the mean score of negative feelings before the intervention, after the intervention, and during the follow-up phase (P < 0.01). The mean score of negative feelings after the intervention was significantly reduced compared to before the intervention. The average score of this variable in the follow-up phase had increased slightly compared to the post-intervention phase, but it was still significant compared to the pre-intervention phase (P < 0.01). In the intervention group, based on the results of repeated measures analysis of variance, there was no statistically significant difference between the average perceived benefits before the intervention, after the intervention, and during the follow-up phase (P> 0.05). In the intervention group, based on the results of the analysis of variance with repeated measures, there was a statistically significant difference between the average variable score of perceived obstacles before the intervention, after the intervention, and the follow-up stage (P<0.05) and the average variable score Perceived barriers after the intervention were significantly reduced compared to before the intervention.

The results of the analysis based on the findings of the analysis of variance with repeated measures showed that the average variable score of interpersonal influencing factors increased significantly, after the intervention compared to before the intervention (P < 0.05). The mean score in the follow-up phase did not change much compared to the post-intervention phase, but it showed a significant difference compared to the pre-intervention phase (P < 0.05) (**Table 3**).

Table 3. The mean and standard deviation of the model of Pender health promotion before and immediately and two months after the intervention in cancer patients

Variables	Before the intervention (Mean ± SD)	After the intervention (Mean ± SD)	Follow-up phase (Mean ± SD)	Significant level (Repeated Measures ANOVA)
Behavior	25.82 ± 4.57	32.41 ± 4.24	29.79 ± 3.72	F = 38.85, df = 2, p = 0.000
Self-efficacy	20.76 ± 4.96	27.17 ± 4.08	25.46 ± 3.73	F = 36.13, df = 2, p = 0.000
Positive feeling	14.25 ± 4.97	19.02 ± 5.29	17.23 ± 4.98	F = 33.41, df = 2, p = 0.000
Negative feeling	15.56 ± 3.90	13.30 ± 5.81	14.58 ± 5.14	F = 18.60, df = 2, p = 0.000
Perceived benefits	26.07 ± 6.48	27.10 ± 5.76	26.87 ± 6.18	F = 1. 40, df = 2, p = 0.255
Perceived barriers	19.76 ± 4.67	17.02 ± 6.24	17.89 ± 5.99	F = 5. 02, df = 2, p = 0.009
Interpersonal influencing factors	12.23 ± 2.64	13.46 ± 3.40	13.17 ± 3.24	F = 6. 48, df = 2, p = 0.003

This research aimed to determine the effectiveness of education based on Pender's health promotion model (health belief model) on the oral health behavior of cancer patients. The results of this study showed that the educational intervention based on the model of Pender's health promotion improved health behaviors regarding oral and dental care in cancer patients so the mean behavior score after the intervention was significantly higher than before. The intervention had increased, but this value in the follow-up phase (two months after the intervention) had decreased a little compared to the post-intervention phase, but it still had a significant increase compared to the pre-intervention phase. It seems that the reason for the decrease in the follow-up time compared to the intervention time was due to the increase in the intervals of sending text messages during the follow-up compared to the intervention time, which was shorter, as well as the decrease in face-to-face contact with patients, which led to a decrease in social learning and motivational factors. In line with the current study, the findings of a study conducted in Thailand among the elderly showed that the oral health promotion program based on the health belief model improved the behavior and oral health status of the elderly with breast cancer [21]. The distinguishing feature of this study is that in the aforementioned study, only the research units were elderly people with breast cancer, but in this study, the impact of education based on the model of Pender's health promotion and health belief model in different

cancers and at ages above 18 years has been investigated. In addition, the results of a study conducted in Turkey showed that nursing interventions that were conducted by group health education based on the health promotion model and the health belief model, as well as brochures, video screenings, and telephone reminders, had a positive effect on early cancer detection behaviors [22].

Regarding oral hygiene self-efficacy, the results of this research revealed that the educational intervention had a positive effect on the average self-efficacy score in cancer patients, and the average self-efficacy score after the intervention increased significantly compared to before the intervention. Although in the follow-up phase, this amount decreased slightly, in this phase, compared to before the intervention, there was a significant increase. The reason for the decrease in the self-efficacy score in the follow-up phase compared to the intervention can be the lack of participation in the group discussion and the effect of the film during the educational intervention, which was in the form of encouraging text messages during the follow-up. It also seems that the effect of educational videos on self-efficacy is greater than that of text messages. According to the results of a study in Thailand, after the intervention based on the health belief model, the elderly with breast cancer had more self-efficacy in preventing oral diseases [21].

In addition, the results of the study in China showed that based on the model of Pender's health promotion, the higher the self-efficacy patients with colorectal cancer have, the higher their physical activity level [23]. The average score of positive feelings towards performing oral and dental hygiene behaviors after the intervention had increased significantly compared to before the intervention. The average score of this variable in the follow-up phase had decreased slightly compared to the post-intervention phase, but it was still significant compared to the pre-intervention phase. The researchers think that the reduction of the positive feeling score after the follow-up compared to the time of the intervention may be related to the reduction of practice and repetition during the follow-up. Because the intervention was accompanied by watching the film, and due to the reduction of the effect of the drama film in the follow-up period, the positive feeling score decreased. The results of a study in Thailand showed that six months after the implementation of the oral health promotion program based on the health belief model, the elderly with breast cancer have a higher perceived sensitivity than before the intervention in the prevention of oral diseases [21]. The results of a study in Hong Kong also indicated that there is a significant relationship between emotions and the occurrence of periodontal diseases and their prevention mechanisms [24]. Positive emotions can be the basis for maintaining or continuing correct behavior. Therefore, in health education interventions for breast cancer patients, it is important to pay attention to emotional and emotional aspects such as enjoying brushing teeth, feeling of doing useful work, and feeling increased self-confidence.

The mean score of negative feelings after the intervention had significantly decreased compared to before the intervention. The average score of this variable in the follow-up phase had increased slightly compared to the post-intervention phase, but it was still significant compared to the pre-intervention phase. It seems that the increase in the score in the follow-up phase compared to after the intervention is due to the decrease in the incentives of the family members. Therefore, it may be necessary that in addition to the patients, their caregivers should also be present in the training sessions.

In the present study, in the intervention group, there was no statistically significant difference between the average perceived benefits before the intervention, after the intervention, and during the follow-up stage. However, the results of a study in China on the correlation of physical activity in patients with colorectal cancer based on the health promotion model showed that the greater the perceived benefits of physical activity, the better the level of physical activity [23]. In addition, in a study conducted in Thailand, after intervention in elderly patients with cancer based on the health promotion model, they had a better understanding of the benefits of preventing oral diseases [21]. The reason for the non-alignment of the results with the present study could be that most of the participants in the present study had breast cancer. Since the breast is a female organ and is related to the sexual issues of the patients, and amputation (mastectomy) involves the patient's mind in the future of his life, the benefits of preventing oral and dental diseases in such conditions have not been obvious to the patients. Based on this, the average score of perceived obstacles variable after the intervention had significantly decreased compared to before the intervention. The reason for the reduction of perceived barriers can be due to social learning and the transfer of positive feelings during the film screening and group discussion. Based on the results of a study in Thailand, after the intervention, elderly patients with cancer had a better understanding of the obstacles in preventing oral diseases [21]. In a study in Turkey, at the end of nursing interventions using the model of Pender's

health promotion, there was a significant decrease in the understanding of the inhibiting factors in the field of early detection of breast and cervical cancer in the intervention group [19]. In addition, the results of the study in China showed that the lower the perception of obstacles in patients with colorectal cancer based on the model of health promotion, the higher the level of physical activity [23], which was in line with the findings of the present study. In addition, in some studies, lack of time for dental care has been reported as a major obstacle [25-28]. This finding emphasizes the importance of paying attention to providing appropriate solutions and strategies to deal with these obstacles in educational opportunities.

The findings of the analysis revealed that the average variable score of interpersonal influencing factors increased significantly, after the intervention compared to before the intervention. However, the mean score in the follow-up phase did not change much compared to the post-intervention phase. This could be due to disconnection between patients during follow-up by the communication channel established for patients. The results of a study in China based on the health promotion model showed that in patients with colorectal cancer, social support has a positive correlation with physical activity, but this difference was not statistically significant, which indicates that social support may have a small effect on activity [23]. To optimize educational interventions, specialists should create a suitable platform for oral and dental hygiene in the elderly by emphasizing skills such as self-expression, and empathy, and encouraging group support.

The limitation of the study is the lack of comparison with the control group (not having a control group in the study) and the use of a self-report data collection method. Therefore, to increase the reliability of the data in future studies, it is suggested to use clinical indicators such as dental plaque to more accurately examine the relationship between behavioral factors and oral health, over a longer period. Investigate the effect of the intervention during the follow-up period.

The findings of this study emphasize the effectiveness of Pender's health promotion model in promoting oral hygiene behavior in cancer patients. Health professionals can use Pender's health promotion model to describe and design educational interventions to improve oral health and prevent periodontal diseases in patients with cancer and other chronic diseases. It is suggested to solve the oral and dental health problems of cancer patients, especially in the radiotherapy and chemotherapy stage, provide the necessary training based on the Pender health promotion model, shorten the intervals of sending text messages during follow-up, and make face-to-face calls especially increase during chemotherapy and radiotherapy. In addition, in addition to the training manual, the training video should also be given to the people undergoing chemotherapy and radiotherapy so that they can use the training video after the intervention.

Conclusion

This research was conducted with the aim of the effect of education based on Pender's health promotion model on the oral health behavior of cancer patients. Based on the results obtained from this study, there was a statistically significant difference between the behavior score before the intervention and after the intervention and the follow-up phase. Also, after the educational intervention, among the constructs of the promotion model of Pender, the constructs of positive emotions, self-efficacy, and interpersonal influencing factors have significantly increased and perceived obstacles have decreased. The findings of this research emphasize the effectiveness of Pender's health promotion model in promoting oral hygiene behavior in adult cancer patients.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

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