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Systematic Review (Pages: 6017-6029)

Application of Health Belief Model in Prevention of Osteoporosis among Primary School Girl Students

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Abstract

Background: Osteoporosis is the most common metabolic bone disease. Prevention of osteoporosis during childhood and adolescence is an important issue in World Health Organization. The purpose of this study was to investigate application of health belief model in prevention of osteoporosis among primary school girl students, in Fasa city, Fars Province, Iran.

Materials and Methods: In this quasi-experimental study, 140 primary school girl students who were randomly divided into groups, experimental (n=70) and control (n=70) in Fasa city, Fars Province, Iran, were selected in 2015. A questionnaire consisting of demographic information, Health Belief Model (HBM**)** constructs was used to measure nutrition and walking performance for prevention of osteoporosis before, immediately after intervention and four months later. Data were analyzed using SPSS version 19.0 software.

Results: The mean age of students was 11.45±1.13 and 11.25±1.60 years old in the Experimental and the control group, respectively. Immediately and Four months after the intervention, the mean scores of the HBM components (Perceived susceptibility, Perceived severity, Perceived benefits, Perceived barriers, Self-efficacy, Internal cues to action), and nutritional and walking performance in experimental group was better than the control group (P<0.001).

Conclusion: The findings of the present study confirmed the practicability and effectiveness of the Health Belief Model based educational program in promoting behaviors about prevention of osteoporosis. Hence, these models can act as a framework for designing and implementing educational interventions for the osteoporosis prevention.

Key Words: Health Belief Model, Prevention, Osteoporosis, Students, Nutritional Status.

*Please cite this article as: Khani Jeihooni A, Askari A, Kashfi SM, Khiyali Z, Kashfi SH, Safari O, et al. Application of Health Belief Model in Prevention of Osteoporosis among Primary School Girl Students. Int J Pediatr 2017; 5(11): 6017-29. DOI: **10.22038/ijp.2017.25144.2130**

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Received date: Jul. 15, 2017 ; Accepted date: Aug .12, 2017

1- INTRODUCTION

Osteoporosis is a disease characterized with decreased bone density and or loss of bone microstructure, which can lead to an increased risk of fracture (1). It is estimated that more than 200 million people worldwide have osteoporosis, and that one in three women and one in five men are at risk of osteoporotic fractures (2). There is a high prevalence of osteoporosis and vitamin D deficiency in Iran (3, 4). In a meta-analysis study in Iran, the overall prevalence of osteoporosis in lumbar spine was 0.17 and that of osteopenia was 0.35 (5). Since bone density decreases with age, special consideration should be given to preventing this disease. Prevention of osteoporosis can be implemented at any age. However, because 40–45% of the bone mass develops in early adulthood, prevention is most effective if done in childhood and adolescence (6-8).

In addition, if people develop and commit to lifestyles that support strong bones when they are adolescents or young adults, they increase the likelihood that they will have healthy bones throughout their lives (9). The findings of different studies suggest that high-calcium diet and exercise among adolescents have been very effective in preventing osteoporosis, particularly among women (7, 10-15). Osteoporosis is preventable and an important point in preventing the disease is to modify thinking, lifestyle, and daily habits in such a way that improve the quality of life and efficiency of individuals (16-19). Thus, teaching preventive behaviors such as physical activity and correct nutrition as a simple and efficient method can help us prevent the disease and promote and maintain our health (20, 21). In line with such a purpose, identifying factors affecting behavior change can make changes easier. Therefore, in order to investigate factors affecting the adoption of osteoporosis preventive behaviors among primary school girl students, it is essential to use models that identify factors affecting behavior. Based on Health Belief Model (HBM), people change their behavior when they understand that the disease is serious, otherwise they might not turn to healthy behaviors (22). Previous studies confirmed the effectiveness of Health Belief Model (HBM) in the education of osteoporosis (23, 24). The structures of the HBM model include Perceived Severity, Perceived Susceptibility, Perceived Benefits, Perceived Barriers, Modifying Variables, Cues to Action and Self-efficacy (19). Perceived Susceptibility was used to evaluate primary school girl student's perception about the extent to which they are at risk of osteoporosis. Also, their Perceived Severity of osteoporosis complications was measured. The sum of these two factors is the primary school girl student's perceived threat of the disease.

The perceived benefits and barriers that refer the individual's analysis about the benefits of adopting preventive behaviors of osteoporosis such as diet and walking and about potential barriers to preventive behaviors of osteoporosis were investigated. These, alongside student's perceived ability to carry out preventive behaviors; their Cues to Action (the incentives that affect student within and outside the family such as friends, doctors, health care providers, media and educational resources); their fear of osteoporosis complications and their sense of inner peace as a result of seeking preventive behaviors are factors affecting student's decision to comply with preventive behaviors of osteoporosis. Considering what said above, this study aimed to measure HBM constructs regarding eating behaviors and physical activity in the prevention of osteoporosis among primary school girl students.

2- MATERIALS AND METHODS

2.1. Study design and procedure

The study was a quasi-experimental, prospective intervention research in 2015. The research population being 140 five grade primary school girl students who were randomly divided into groups, experimental (n=70), and controls (n=70). Sample size was estimated based on a previous study by Ghaffari et al. (25), 70 subjects were estimated to be needed in each group.

2.2. Participants

The samples were selected from two schools by random sampling. The local ethics review committee of Fasa University of Medical Sciences approved the study protocol (ID number: 93135). All participants gave written informed consent before participation. Participants had no risk factors for osteoporosis and complications of this condition, were willing to participate in study and had no limitations in physical movement and diet. After selecting the experimental and control groups, the pre-test questionnaire was administered to two groups. These people were present from the beginning to the end study. Student's Education by researchers was done. The researchers developed the program of the sessions and the materials. The intervention for the experimental group included eight educational sessions of 55 to 60 minutes of speech, group discussion, questions and answers, as well as posters and educational pamphlets, film screenings and PowerPoint displays by researchers.

The details of the training sessions are presented in **Table.1**. Immediately after the intervention, both groups completed the questionnaire. To preserve and enhance the activity of the experimental group, they also attended monthly sessions so that the researchers could follow-up their activities. Four months later, the questionnaire was completed by both groups (experimental and control).

2.3. Study Instrument

The questionnaire used in this study was developed based on the Health Belief Model. The questionnaire includes the following parts: The first part includes questions on structures of the Health Belief Model. questionnaire include: 23 questions on knowledge (scores of 0 to 23); 4 questions on perceived susceptibility scores of 4 to 20 (the student's opinion about chances of getting osteoporosis); 6 questions on perceived severity scores of 6 to 30 (about complications due to osteoporosis); 8 questions on perceived benefits scores of 8 to 40 (about the benefits of preventive behaviors of osteoporosis, such as physical activity and calcium intake); 7 questions on perceived barriers scores of 7 to 35 (including barriers to physical activity and consumption of calcium-rich foods), 4 questions on self-efficacy scores of 4 to 20 (including the ability to do exercises and observe proper diet); one question on external cues to action (resources including family and friends, doctors and health workers, mass media, books and magazines that encourage the subjects towards prevention behaviors of osteoporosis); and 3 questions on internal cues to action scores of 3 to 15; all questions are based on the standard 5-point Likert scale ranging from strongly disagree to strongly agree (scores of 1 to 5). Scores of questions on external cues to action are calculated as cumulative frequency.

The second section consists of questions on nutritional performance and exercise, i.e. walking. Performance questions consist of 14 questions about the type and amount of food consumed during the past week (score of 0 to 14). Exercise questions include 21 questions on the duration and type of walking (easy, moderate and heavy) during the last week based on received guidelines (score from 0 to 21). The subjects' performance was assessed via self-report method. To evaluate the

validity of the questionnaire items, the item effect size higher than 0.15 and content validity ratio above 0.79 were considered and based on the exploratory factor analysis, they were classified into nine factors. In order to determine face validity, a list of the items was checked by 30 students with demographic, economic, social and other characteristics similar to those of the targeted population. In order to determine the content validity, twelve specialists and professionals (outside the team) in the field of health education and health promotion (n=10), orthopedic (n=1), and biostatistics (n=1) were consulted. Then, based on the Lawshe's table, items with higher Content Validity Ratio (CVR) value (than 0.56 for 12 people) were considered acceptable and were retained for subsequent analysis. The calculated values in this study for the majority of items were higher than 0.70.

The overall reliability of the instrument based on the Cronbach's alpha, was 0.87. Cronbach's alpha was 0.86 for knowledge, 0.71 for Perceived susceptibility, 0.82 for Perceived severity, 0.79 for Perceived benefits, 0.82 for Perceived barriers, 0.79 for Self-efficacy, 0.77 for Cues to Action, respectively. Since the alpha values calculated for each of the structures studied in this research were higher than 0.7, the reliability level of the instrument was considered acceptable. The conceptual framework of the proposed model is illustrated in **Figure.1**.

2.4. Study analysis

Data analysis was carried out through SPSS 19.0 software package (SPSS Inc., IBM, Chicago, IL, USA), using the Chi-square test, independent t-test, Mann–Whitney, and repeated measurement ANOVA. Demographic variables were compared between two groups with the Chi-square test. Comparison between the constructs of HBM, nutrition performance, and walking performance during the time was done with repeated measurement ANOVA, followed up with Bonferroni post-hoc test separately in groups. Constructs of HBM, nutrition performance, and walking performance were also compared between two groups with an independent t-test. P-value less than 0.05 were significant.

Table-1: The Details of the Training Sessions

Sessions	Details	Time
First session	Introduction to osteoporosis and its symptoms, complications and diagnosis.	60 Min
Second session	A 50-year-old female diagnosed with osteoporosis and had a fracture was invited as a model and talked to the subjects about osteoporosis and its risk factors, symptoms, complication and diagnosis.	55 Min
Third and fourth sessions	The role of nutrition in preventing osteoporosis, benefits and barriers of diet, following dietary recommendations, self-efficacy in observing proper diet, and recording activities in the specified forms.	120 Min
Fifth and sixth sessions	The role of exercise, and appropriate exercises; the role and importance of walking, its benefits, barriers types, and self-efficacy, and recording the duration of walking in specified forms.	120 Min
Seventh session	The session was held with the presence of at least one family member and the role of family members in making, facilitating, and providing suitable food and walking program was explained.	55 Min

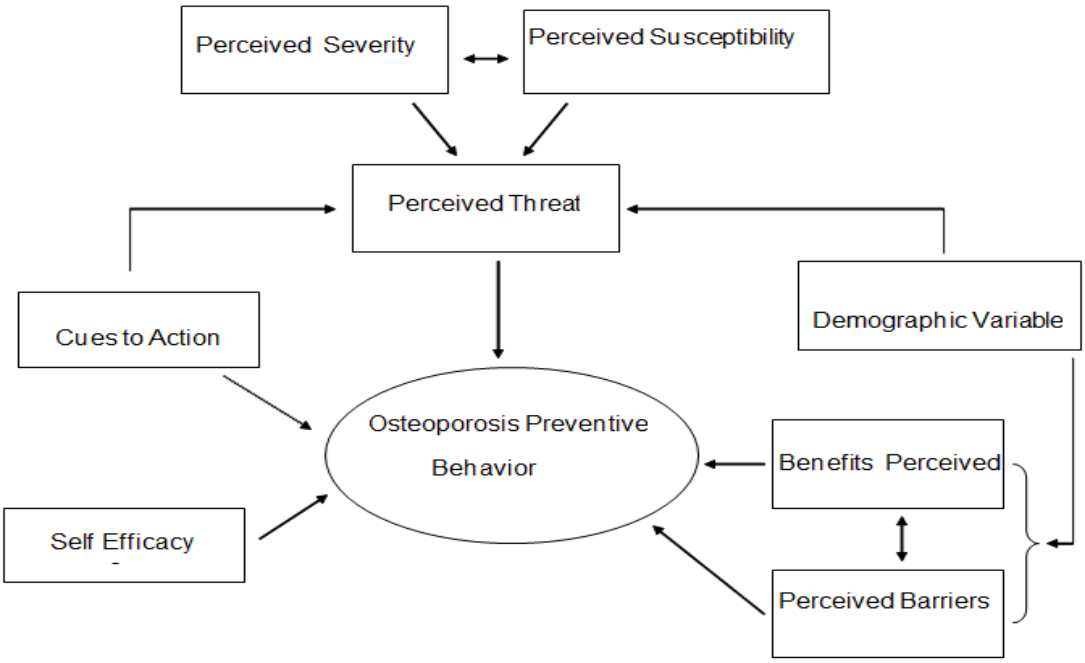

Fig.1: Conceptual framework of this study.

3- RESULTS

This study aimed to investigate application of health belief model in prevention of osteoporosis on 140 primary school girl students, in Fasa city, Fars Province, Iran. The mean age of students was 11.45±1.13 and 11.25±1.60 years old, respectively; the mean household size of students was 3.44±1.72 and 3.72±1.34 in the experimental and the control group, respectively. Based on the Chi-square test, there was no significant difference between the two groups in father's education (P = 0.22), mother's education (P = 0.11), occupation (P = 0.08), father's Job (P = 0.10), mother's Job (P = 0.21), history of osteoporosis in the family (P = 0.24) (**Table.2**). The results showed that before the intervention there was no significant difference between experimental and control groups in terms of knowledge (P=0.523), perceived susceptibility (P=0.245), perceived severity (P=0.255), perceived benefits (P=0.916), perceived barriers (P=0.352), self-efficacy (P=0.565), internal cues to action (P=0.322) and nutrition (P=0.452) and walking performance (P=0.612). However, immediately after the intervention and four months later, the experimental group showed a significant increase compared to the control group in all of the foregoing scales except for perceived barriers (P<0.001).

On structural barriers, the experimental group showed a significant decrease compared to the control group (**Tables 3 and 4**) (P<0.001). **Table.5** shows the distribution of external cues to action for osteoporosis, before, immediately after and four months after the intervention. The number of cues used, especially family and friends, immediately after the intervention and four months after the intervention increased as compared to before the intervention (*Please see the table.5, in end of paper*).

Table-2: Demographic characteristics of the students in the Experimental and control groups

Variables		Experimental group		control group		P-value*
		Number	Percent	Number	Percent	
Father's education	Illiterate	1	1.40	0	0	0.22
	Primary School	4	5.71	7	10	
	Secondary School	16	22.86	17	24.29	
	High School Diploma	32	45.71	32	45.71	
	Associate Degree or Higher	17	24.29	14	20	
Mother's education	Illiterate	2	2.85	1	1.43	0.11
	Primary School	7	10	8	11.43	
	Secondary School	21	30	20	28.57	
	High School Diploma	28	40	27	38.57	
	Associate Degree or Higher	12	17.15	14	20	
Family Income	>1,000,000 Rials	48	68.57	45	64.28	0.08
	<1,000,000 Rials	22	31.43	25	35.72	
Father's Job	Employee	36	51.42	38	54.28	0.10
	Non-Employee	34	48.58	32	45.72	
Mother's Job	Housewife	58	82.85	55	78.57	0.21
	Employee	12	17.15	15	21.43	
History of osteoporosis in the family	Yes	8	11.43	7	10	0.24
	No	62	88.57	63	90	

* Chi-square Test.

Table-3: Comparison of means scorers of the students' knowledge and HBM constructs about osteoporosis in the two groups, studied pre-, immediately and Four months after the intervention

Variables	Experimental (n =60)			Control (n =60)			P-value
	Mean	SD	P-value	Mean	SD	P-value	
Knowledge							
Pre- intervention	6.35	2.22		7.12	2.41		0.523
Immediately after the intervention	9.42	14.1	<0.001	7.55	2.32	<0.001	<0.001
Four months after the intervention	16.31	2.11	<0.001	8.10	2.48	<0.001	<0.001
Perceived Susceptibility							
Pre- intervention	8.11	2.11		7.92	1.24		0.245
Immediately after the intervention	11.25	2.35	<0.001	8.15	1.43	<0.001	<0.001
Four months after the intervention	16.25	2.39	<0.001	8.95	2.01	<0.001	<0.001

Perceived Severity							
Pre- intervention	9.23	2.21		9.32	1.45		0.255
Immediately after the intervention	12.95	3.14	<0.001	9.21	1.65	<0.001	<0.001
Four months after the intervention	20.12	4.84	<0.001	10.32	2.45	<0.001	<0.001
Perceived Benefit							
Pre- intervention	14	3.72		13.85	2.69		0.916
Immediately after the intervention	19.55	4.51	<0.001	14.45	2.92	<0.001	<0.001
Four months after the intervention	28.95	5.21	<0.001	15.32	3.33	<0.001	<0.001
Perceived Barrier							
Pre- intervention	26.22	4.11		25.65	4.34		0.352
Immediately after the intervention	19.25	4.07	<0.001	24.11	4.52	<0.001	<0.001
Four months after the intervention	12.94	3.55	<0.001	23.35	4.84	<0.001	<0.001
Self -efficacy							
Pre- intervention	8.01	1.50		7.91	2.14		0.565
Immediately after the intervention	11.84	2.32	<0.001	8.92	2.39	<0.001	<0.001
Four months after the intervention	16.07	2.74	<0.001	9.95	2.47	<0.001	<0.001
Internal Cues to Action							
Pre- intervention	5.45	1.71		5.82	1.55		0.322
Immediately after the intervention	8.05	1.92	<0.001	6.75	1.72	<0.001	<0.001
Four months after the intervention	13.21	1.24	<0.001	7.40	1.28	<0.001	<0.001

SD: Standard deviation.

Table-4: Comparison of mean scores of nutrition and walking performance regarding osteoporosis prevention

Variables	Experimental			Control			P-value [b]
	Mean	SD	P-value [a]	Mean	SD	P-value	
Nutrition Performance							
Pre- intervention	4.22	1.32		5.14	2.01		0.452
Immediately after the intervention	7.40	1.76	<0.001	5.60	1.68	<0.001	<0.001
Four months after the intervention	11.91	1.91	<0.001	5.82	1.73	<0.001	<0.001
Jogging Performance							
Pre- intervention	7.02	3.41		6.94	2.35		0.612
Immediately after the intervention	12.22	3.45	<0.001	7.33	2.24	<0.001	<0.001
Four months after the intervention	18.95	2.26	<0.001	8.66	2.48	<0.001	<0.001

P-value[a]: Comparison with first evaluation (RM ANOVA – Bonferroni post hock); P-value[b]: Comparison between experimental and control group (t-test for evaluation and Mann-Whitney for difference).

4- DISCUSSION

In this study, a health education program based on the HBM appears to have been more effective in changing the behaviors of primary school girl students to reduce the risk for osteoporosis. Based on the results, there were significant differences between mean scores of knowledge before, immediately after and four months later the intervention in the experimental group. The knowledge scores in this group increased significantly after the intervention. This is consistent with results of Nejati et al. (26), Chan et al. (27), Ghaffari et al. (25), Winzenberg et al. (28) and Wafaa Hassan et al. (29). Although the mean score of knowledge significantly increased in the control group as well, there was a significant difference between the mean scores of knowledge for the two groups. The increase in knowledge and other constructs can be the participants' access to information as well as their participation in the training course held about diseases. The increase in knowledge score in the intervention group is significant and deserves consideration.

There was a significant difference between perceived susceptibility of the two groups four months after the intervention. This can be attributed to the effects of the intervention on the subjects' perceived susceptibility. In other words, after the intervention, most students believed they were at risk for osteoporosis. This is consistent with results of Tussing et al. (30), Dohney et al. (31), and Ghaffari et al. (25). After intervention the perceived severity of the experimental group significantly increased compared to the control group. This is consistent with results of Khorsandi et al. (32), and Hazavehei et al. (33). However, the perceived severity in Tussing et al. (30) and Sanaei Nasab et al. (34), showed no significant increase after the intervention. Therefore, it seems we need stronger interventions such as educational films about the side-effects of osteoporosis and perhaps talks by osteoporosis patients. The mean scores for perceived benefits showed greater increase in the experimental group than in the control group immediately after and four months after the intervention. Ebadi Fard Azar et al. (34) showed that the construct of perceived benefits of physical activity in the intervention group significantly increased after training, but this was not true for the control group. This is consistent with the findings of the present study. In the study by Mehrab Beik et al. on the prevention of osteoporosis among women with low socioeconomic status, perceived benefits showed a significant increase after the intervention (36). The increase in the perceived benefits can be the result of an emphasis in training on walking and diet, physical and psychological benefits of walking and the role of nutrition in preventing osteoporosis.

The results of this study showed no significant difference between the two groups before intervention in terms of barriers. However, the difference was significant in immediately and four months after intervention for the experimental groups. In other words, the educational interventions significantly reduced barriers to proper diet and walking and thereby reduced the risk of osteoporosis.

In the study of Anderson et al. (37) and Khorsandi et al. (32), perceived barriers of the study population regarding calcium intake and physical activity decreased after intervention. The mean scores of self-efficacy in the present study showed that before intervention, both groups had low ability to control diet and walk. After the intervention, the mean score of self-efficacy increased significantly in the experimental group. This is consistent with the results of Seldak et al. (20), Tussing et al. (30) and Piaseu et al. (38), but is inconsistent with those of Jessup et al. (39).

External cues of action are social factors included in the HBM and refer to perceived social pressures leading to doing or not doing a behavior. These external cues alongside internal ones led the students towards osteoporosis prevention behaviors. In this study, external cues for the subjects included family, friends, doctors, and health workers. In immediately after and four months after the intervention external cues such family increased. They have an influential role as a source of information and support for eating and walking behaviors. The mean score for the internal cues to action significantly increased after intervention in the experimental group compared to the control. This is consistent with results of Khorsandi et al. (32) and Ebadi Fard Azar et al. (35).

In this study, before the intervention, there was no significant difference between the mean score of students on osteoporosis prevention behaviors and both groups had low performance in maintaining proper diet and walking. Immediately after and four months after the intervention, the mean performance score of the students in the intervention group significantly increased compared to controls. This shows the positive effects of the education on student's performance. Hazavehei et al. also reported an increase in walking and calcium intake in the intervention group after the intervention (33).

In a study by Wafaa Hassan et al. on 100 female students using the HBM, the students' performance on calcium intake and exercise after the intervention showed a significant increase compared to before (29). This is consistent with study of Karimzadeh Shirazi et al. on the effects of physical activity education in prevention of osteoporosis among women 40 to 65 years old based on Trans-theoretical Model (40). The study by Tarshizi et al. showed that the subjects' physical activity levels before the training was not appropriate. However, by applying the HBM training in the experimental group, a significant difference was observed in this area (41). In the study by Mehrab Beik et al., a significant difference was reported between the level of physical activity after the intervention in the experimental and control group. This is consistent with the present study, but no significant difference was observed between the mean daily calcium and vitamin D intake before and after training. The intake levels were unsatisfactory (36).

The results of this study are consistent with results of Khorsandi et al. (32), Wallace et al. (42) and Ebadi Fard Azar et al. (34). Study of Shojaezadeh et al. showed that there was a significant increase in calcium intake in the second phase, but in the third stage (three months after the intervention) calcium intake decreased (43). The results of this study show the effectiveness of the intervention program based HBM model and the importance of educational interventions to improve osteoporosis prevention behaviors.

4-1. Limitation

The limitations related to this research project include its sampling method. Simple random sampling is selecting research participants on the basis of being accessible to the researcher. Another concern about such data centers on whether subjects are able to accurately recall past behaviors. Cognitive psychologists have warned that the human memory is fallible and thus the reliability of self-reported data is tenuous on some items (42). Also, this study done only on girls and suggests that future studies should be done on both genders.

5- CONCLUSIONS

The results of this study showed that although the belief Health can enhance the knowledge, perceived susceptibility,

understanding the risks of disease and interests and obstacles to the proper conduct of the preventive role most important, but it seems to change Behavior, especially long-term behaviors and the behaviors that Socioeconomic factors are interdependent, and failure To sort these issues should also be considered. Further studies should have more comprehensive interventions on the structures of calcium intake benefits and barriers and use other behavioral change theories.

6- CONFLICT OF INTEREST

There was no conflict of interests in this article.

7- ACKNOWLEDGMENTS

We are grateful to school teachers and primary school girl students for their cooperation. This research has been supported by Fasa University of Medical Sciences.

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Table-5: Distribution of external cues to action regarding osteoporosis prevention

Variables	Before Intervention				P-value	Immediately After Intervention				P- value	Four Months After the Intervention				P- value
	Experimental		Control			Experimental		Control			Experimental		Control		
	Number	%	Number	%		Number	%	Number	%		Number	%	Number	%	
Physicians and Health Personnel	18	25.71	17	24.28	0.532	18	25.71	18	25.71	0.450	19	27.14	19	27.14	0.965
Families and Friends	30	42.85	29	41.42	0.441	35	50	30	42.85	0.048	38	54.28	30	42.85	0.042
Books	10	14.28	11	15.71	0.522	9	12.85	10	14.28	0.540	10	14.28	9	12.85	0.855
Journals and Publications	4	5.71	4	5.71	0.825	2	2.85	4	5.71	0.352	2	2.85	5	7.14	0.420
Radio and Television	7	10	8	11.42	0.635	5	7.14	7	10	0.120	1	0.01	6	8.57	0.081
Patients	1	0.01	1	0.01	0.528	1	0.01	1	0.01	0.612	0	0	1	0.01	0.312
Total	70	100	70	100		70	100	70	100		70	100	70	100	