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EFFECT OF A HEALTH BELIEF MODEL-BASED EDUCATIONAL PROGRAM ON KNOWLEDGE AND ATTITUDES TOWARD CERVICAL SCREENING AMONG WOMEN IN ERBIL CITY, IRAQ

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ABSTRACT

Cervical cancer is one of the most common cancers in women worldwide and a cause of high mortality among people.Pap smear screening is an appropriate method to prevent cervical cancer and reduce its mortality. The aim of the present study was effect of an educational program on women's knowledge and attitude regarding cervical screening. Applying health belief model. This study was a quasi-experimental and interventional one among 100 women (50 as the intervention group, and 50 in the control group) referred to five university in Hawler Medicine University, Erbil. An educational intervention based on the constructs of the Health Belief Model was conducted for the intervention group using the program. The information on the intervention and control groups was collected before, immediately after the intervention, and 2 months later using a valid questionnaire. Participants responded to a standard self-report questionnaire. Data collected from the study instrument was coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0 (IBM Corp, Armonk, NY, USA). Before analysis, all data were screened for completeness, missing values, and data entry errors. A significance level of $p \leq 0.05$ (two-tailed) was adopted as the criterion for statistical significance throughout all analyses. For age, the largest proportion of control and intervention participants fell in the 30–40-year age category (60% of total sample).After the educational program, there was a significant improvement in the average responses to the HBM concerning the Pap smear test .In addition, after intervention the rate of doing Pap smear test $p < 0.001$ (highly significant) in intervention group , $p = 0.031$* (statistically significant) in control group.The findings of this study demonstrated that an educational intervention based on the Health Belief Model could create significant and meaningful changes in women's knowledge, attitude, and uptake of cervical screening in Erbil City. competing life priorities, husband disapproval, cost concerns and fear of pain. Within-group analysis also confirmed that almost all Health Belief Model items changed significantly from pre- to post-test in the intervention group except for age which is demographic characteristic and not an attitude that can be modified.*

KEYWORDS: Pap smear, Women, knowledge, Attitude. Health Belief Model.

1. INTRODUCTION

Cervical cancer ranks as the fourth most prevalent cancer among women worldwide, with approximately 660,000 new diagnoses reported in 2022.In the same year, nearly 94% of the 350,000 cervical cancer-related deaths occurred in low- and middle-income countries (1). In 2020, the number of new cases of this cancer was estimated to be 604 000, and the number of deaths due to this disease was 342 000 around the world (2).Globally, cervical cancer is a major health issue. It is the second most prevalent malignancy in women worldwide. Despite being recognized as a preventable disease, cervical cancer continues to be a severe health burden for women in many poor nations due to inadequate screening systems. In low- and middle-income nations, cervical cancer is one of the main causes of death for women. Every year, there are over 500,000 new occurrences of cervical cancer worldwide, with an estimated 85% of those cases occurring in developing nations. An estimated 270,000 women die from the disease, and over 80% of those cases are detected at an advanced stage with poor treatment outcomes (3).In 2022, there were about 350 000 cervical cancer deaths and 660 000 new cases. The highest incidence and mortality rates of cervical cancer are found in low- and middle-income countries (4).It is the most prevalent cancer among women in 28 countries and the primary cause of cancer-related deaths in 42 nations, the majority of which are in Southeast Asia and sub-Saharan Africa (5).The World Health Organization predicts that by 2030, there would be around 474,000 cervical cancer-related fatalities annually, with low- and middle-income countries accounting for 95% of these deaths (2).It's predicted that new cases arise to 908,612 up to 2045 (6).In Iraq, many were done in different cities (Diyala, 2012 2013, 2014, 2015 and Kirkuk 2012) all done on women experience Pap smear and search for relation the causes and risk factors of cervical cancer. Iraqi program proposal for early detection of cervical cancer has begun in 2012, in Baghdad, Basra, and Neinava governorates only. Till now screening of cervical cancer is not applied in governorates in Iraq due to many obstacles, including diminutions of pathologists in Iraq and lack of awareness about the screening and shortage of educational program on this subject (7).

Kurdistan Region, an autonomous region in Northern Iraq, accommodates a population of 8.35 million people and occupies an area around 40.000 square kilometers, with 36 million people living in Iraq (8).It currently covers at least one primary healthcare center, the Maternity Teaching Hospital and some private centers and laboratories in all three governments of the country. However, according to ministry of health in Kurdistan Region, approximately three thousands of Pap smear tests had been done in 2014.However,the Ministry of Health announced a growing number of women who were referred every year, this number yet illustrates a few people who have gotten Pap test (9).The latest guidelines recommend women aged 21 years and sexually active should undertake a Pap smear test every three years (10).Cervical cancer predominantly affects younger women, with 20% of children losing their mothers to this disease (11).Risk factors for HPV infection that can lead to cancer include early initiation of sexual activity, overage pregnancy risk, poor genital hygiene, nulliparity and multiparity, alcohol and tobacco use, poor dietary habits, obesity, immune suppression, long-term use of contraceptives, and a positive family history of cervical cancer (12); (13).A pap smear, also called a pap test is a procedure to test for cervical cancer in women. A pap smear involves collecting cells from the cervix- the lower, narrow end of the vagina. Detecting cervical cancer early with a pap smear gives a greater chance at a cure (14).Pap smear screening was started in the USA in the middle of the 20th century. Cervical cancer, once the most frequent cause of cancer death in women in that country, now ranks 14th because of widespread screening practice (15).A pap smear test has been recommended to be performed once a year for three years, then every three years if the first three ones were negative (16).Pap smear test is a simple, cost-effective, and uncomplicated and harmless method, preferred for screening of cervical cancer (17);(18);(2).Debates about Pap smear are instrumental to promote women's health and expand their awareness about the necessity to care for their reproductive health and adopt proactive initiatives to prevent diseases (19). Lack of regular Pap smear test screening leads to a 2–6 times increase in the risk of cervical cancer. About 70% of women who die from cervical cancer have not done Pap smear test regularly [9]. Using appropriate models and theories is the first step in the process of programming for health education. Based on the different studies results, the HBM is an appropriate educational model. It is a comprehensive model that rather than controlling the disease, is mostly used for its prevention and emphasizes on how one's perceptions cause motivation and movement, and lead to behavior (20).Health Belief Model is one of the first theories of health behaviors developed by Rosenstock and other psychologists in the 1950s, to understand the failure in the uptake of free TB screening services in the United States. It is a framework used to explain and describe health-related behaviors, and as a guiding tool for health behavior interventions. HBM is used to predict health behaviors using five main components: perceived seriousness, perceived susceptibility, perceived benefit, perceived barriers and perceived motivation (21).These components are influenced by several modifying factors that interplay and influence health behaviors. These factors include age, ethnicity, socioeconomic status, level of education, income, cost of treatment, and other. (22) Lack of regular Pap smear test screening leads to a 2–6 times increase in the risk of cervical cancer. About 70% of women who die from cervical cancer have not done Pap smear test regularly [9]. Using appropriate models and theories is the first step in the process of programming for health education. Based on the different studies results, the HBM is an appropriate educational model. It is a comprehensive model that rather than controlling the disease, is mostly used for its prevention and emphasizes on how one's perceptions cause motivation and movement, and lead to behavior (20).

2. METHODS

2.1 Study design

A Quasi-experimental study design carried out through the present study with application of pre-test and post-test. Performed on 100 women who referred to five collage in Hawler Medical University, it was conducted the Kurdistan, to assess effect of an educational program on women's commitment to cervical screening.The samples were randomly divided in two groups (50 in intervention group and 50 in control group).There was no difference between the two groups in age, between 21 to 60 years age, job, and education level.

2.2 Setting of the study

The research was conducted at several collage in Hawler Medical University in Erbil City and Kurdistan Region,Including (Collage of Nursing ,Collage of Medicine,Collage of Pharmacy ,Collage of Dentistry,Collage of Health Science) and Research Center of the University,All women reach around (650) women, the criteria of selecting participants include all employee married women with the age between (21-60)years old , and the exclusion criteria single women.

2.3 Time of conducting the study

The study was conducted from 25 October 2023 to 29. October 2025.Data collected during the period 1st September 2024 to 31 May 2025.

2.4 Sampling technique and sample size

A convenience sampling technique was employed in this study. A purposive sample of 100 women was recruited in total, with 50 participants assigned to each group.The sample size for the study was calculated using the (G*Power) software. The test family chosen was a t-test, specifically focusing on the difference between two independent means. Using an effect size of 0.6, an alpha error probability of (0.05), and a desired power of 0.80, the software calculated that a total of 90 participants were needed. This included 45 participants in each group. The researcher decided to recruit 50 participants for each group, giving a final planned sample size of 100 participants, ensuring sufficient power to detect a meaningful difference between the intervention and control groups. The effect size of 0.6 represented a medium effect, which was considered appropriate for this type of intervention.

2.5 Intervention

The group that was intervened upon received an in-depth education based on the Health Belief Model, which covered cervical screening and its importance, risk factors for cervical cancer, steps in a Pap smear, HPV and vaccine, perceived likelihood and severity of cervical cancer, perceived benefits and barriers to screening as well as action cues. Educational materials including booklets and visual aids were provided. No formal education was provided to the control group during the entire study period.

2.6 Measures

Data were collected through a structured multi-part questionnaire comprising: Part One-socio-demographic (age, marital status, education level, residency); Part Two — 25 knowledge items on cervical screening (scored 0 for incorrect, 1 for correct; maximum score 25); Part Three — 12 attitude items using a 5-point Likert scale; and Part Four — 28 HBM items across five subscales (perceived susceptibility, perceived seriousness, perceived barriers, perceived benefits, and perceived motivation) scored on a 3-point scale (0=disagree, 1=neutral, 2=agree). Negatively worded attitude items were reverse-scored prior to analysis so that higher scores consistently reflected more favorable attitudes.

2.7 Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used for participant characteristics. Paired samples t-tests were used to compare pre- and post-test scores within groups. Independent samples t-tests were used for between-group comparisons. The McNemar test was applied for paired pre/post screening uptake comparisons. Pearson correlation was used to assess knowledge-attitude relationships. Chi-square tests were used for associations between categorical variables. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

3.1 Socio-Demographic and Baseline Characteristics

A total of 100 women participated (50 per group). The 30–40-year age group was most represented overall (60.0%), though the intervention group was more concentrated in this range (76.0% vs 44.0%), and no participants under 30 were present in the intervention group. Diploma holders dominated the control group (88.0%), while the intervention group showed greater educational diversity including primary school (18.0%) and bachelor's degree holders (54.0%). Nearly all participants in both groups were married (96.0% and 92.0% respectively), Muslim (96.0% each), and non-smokers (84.0% and 92.0%). Most resided in urban areas and reported middle-income household earnings. Overweight was the most frequently reported cervical cancer risk factor (28.0% and 32.0%), followed by immune suppression and teenage pregnancy. No participant in either group reported a sexually transmitted infection.

Table 1. Socio-Demographic Characteristics of Study Participants by Group (N = 100)

Variable	Category	Control (n=50) n (%)	Intervention (n=50) n (%)	Total (N=100) n (%)
Age Group	Under 30	16 (32.0)	0 (0.0)	16 (16.0)
	30–40	22 (44.0)	38 (76.0)	60 (60.0)
	41–50	12 (24.0)	9 (18.0)	21 (21.0)
	51–60	0 (0.0)	3 (6.0)	3 (3.0)
Education Level	Primary School	0 (0.0)	9 (18.0)	9 (9.0)
	Diploma	44 (88.0)	14 (28.0)	58 (58.0)
	Bachelor's Degree	6 (12.0)	27 (54.0)	33 (33.0)
Marital Status	Married	48 (96.0)	46 (92.0)	94 (94.0)
	Divorced	2 (4.0)	2 (4.0)	4 (4.0)
	Widowed	0 (0.0)	2 (4.0)	2 (2.0)
Family SES	< 500,000 IQD	10 (20.0)	12 (24.0)	22 (22.0)
	500,000–1,000,000 IQD	36 (72.0)	25 (50.0)	61 (61.0)
	1,000,000–1,500,000 IQD	4 (8.0)	13 (26.0)	17 (17.0)
Residence	Urban	32 (64.0)	40 (80.0)	72 (72.0)
	Rural	18 (36.0)	10 (20.0)	28 (28.0)
Smoking	Yes	8 (16.0)	4 (8.0)	12 (12.0)
	No	42 (84.0)	46 (92.0)	88 (88.0)
Religion	Muslim	48 (96.0)	48 (96.0)	96 (96.0)
	Christian	2 (4.0)	2 (4.0)	4 (4.0)

SES = socioeconomic status; IQD = Iraqi Dinar

3.2 Pre-Intervention Awareness and Screening History

At baseline, more than 90% of participants in both groups had never heard about cervical cancer screening and had never undergone any form of cervical screening. Among the small minority previously screened (10.0% control; 8.0% intervention), Pap smear was the only method reported, and all results were negative. Medical doctors were the most frequently cited sources of health information (68.0% control; 44.0% intervention), followed by friends and mass media.

Table 2. Pre-Intervention Awareness and Practice of Cervical Screening by Group (N = 100)

Variable	Category	Control n (%)	Intervention n (%)	Total n (%)
Heard of Cervical Screening	Yes	5 (10.0)	4 (8.0)	9 (9.0)
	No	45 (90.0)	46 (92.0)	91 (91.0)
Underwent Cervical Screening	Yes	5 (10.0)	4 (8.0)	9 (9.0)
	No	45 (90.0)	46 (92.0)	91 (91.0)
Screening Method	Pap Smear	5 (10.0)	4 (8.0)	9 (9.0)
Screening Result (among screened)	Negative	5 (100.0)	4 (100.0)	9 (100.0)

All screening results among previously screened participants were negative (100%).

3.3 Effect of the Intervention on Knowledge and Attitude Scores

Following the educational program, knowledge scores in the intervention group improved highly significantly (mean increase = 10.04 points; p<0.001), approximately double the improvement observed in the control group (mean increase = 5.84 points; p<0.001).

For attitudes, the intervention group showed a highly significant improvement (mean increase = 15.60 points; p<0.001), while the control group exhibited a statistically significant decline in attitude scores (mean decrease = 5.10 points; p = 0.010), accompanied by a marked reduction in standard deviation, indicating convergence toward less favorable attitudes in the absence of structured education.

Table 3. Comparison of Knowledge and Attitude Scores Between Pre-Test and Post-Test by Group

Group	Variable	Pre-Test Mean ± SD	Post-Test Mean ± SD	Mean Diff.	t (df)	p-value
Intervention (n=50)	Knowledge	11.50 ± 5.80	21.54 ± 5.77	−10.04	−9.64 (49)	**< 0.001*****
	Attitude	35.22 ± 5.14	50.82 ± 7.26	+15.60	−12.58 (49)	**< 0.001*****
Control (n=50)	Knowledge	14.72 ± 5.12	20.56 ± 5.07	−5.84	−6.47 (49)	**< 0.001*****
	Attitude	38.24 ± 11.33	33.14 ± 4.75	−5.10	2.67 (49)	**0.010***

*SD = Standard Deviation; * p < 0.05; *** p < 0.001. Attitude scores were reverse-coded prior to analysis; higher scores reflect more favorable attitudes.*

3.4 Knowledge-Attitude Correlation

Post-test Pearson correlation analysis revealed a statistically significant positive relationship between knowledge and attitude scores in both groups. However, the correlation was considerably stronger in the intervention group (r = 0.873) compared to the control group (r = 0.485), suggesting that the educational program not only improved both constructs independently but created a far tighter and more integrated alignment between knowledge and attitude.

Table 4. Pearson Correlation Between Post-Test Knowledge and Attitude Scores by Group

Group	n	Pearson r	p-value
Control Group	50	0.485	**< 0.001*****
Intervention Group	50	0.873	**< 0.001*****

**** p < 0.001. All correlations are statistically significant.*

3.5 Health Belief Model Constructs — Pre-Test Baseline Comparability

Table 5 shows baseline HBM subscale scores by group. Groups were similar on these variables overall, providing good indication that any differences noted in post-test scores were a result of the educational intervention. The intervention group scored slightly, but significantly higher on perceived susceptibility (p = 0.029), indicating that they were slightly more aware of their risk at baseline. The most troubling finding from these analyses was the ceiling effect found in the control group on all three items measuring perceived seriousness. All control group participants selected the highest possible response option (mean = 2.00, SD = 0.000), while intervention group participants did so less frequently and with more variance (mean = 1.62; p < 0.001). This suggests that emotional distress about cervical cancer was at its highest level among members of the control group prior to any intervention. Perceived barriers were comparable between groups; there was one of eleven items on which groups differed significantly. The control group perceived benefits to be significantly higher than did the intervention group across four of eight items (p < 0.001), while the intervention group scored significantly higher than did the control group on perceived motivation across all three items (p < 0.001). This means that members of the intervention group were more generally motivated to protect their health, while members of the intervention group were less convinced than were members of the control group that screening would help them protect their health at baseline. It is important to take note of these differences as we move into analysis of post-intervention results. Taken together, these baseline differences — particularly the ceiling effect in seriousness and the divergence in benefits and motivation — provide important context for interpreting the post-intervention findings and confirm that the groups, while not perfectly matched, were sufficiently comparable to justify causal interpretation of post-test differences.

Table 5. Comparison of HBM Subscale Scores Between Control and Intervention Groups — Pre-Test (n = 50 each)

HBM Subscale	Items (n)	Control Mean	SD	Intervention Mean	SD	Mean Diff.	p-value
Perceived Susceptibility	3	1.13	0.55	1.37	0.52	−0.23	**0.029***
Perceived Seriousness	3	**2.00**	0.000	1.62	0.49	+0.38	**< 0.001*****
Perceived Barriers	11	0.80	0.71	0.99	0.68	−0.20	**0.002****
Perceived Benefits	8	1.74	0.44	1.31	0.48	+0.43	**< 0.001*****
Perceived Motivation	3	1.47	0.71	1.80	0.38	−0.33	**< 0.001*****

*Subscale mean = average of all items within the subscale (scored 0–2 per item). Positive mean difference = Control higher; Negative = Intervention higher. 'Significant Items' = number of individual items within the subscale reaching p < 0.05. Ceiling effect: control group scored maximum possible (2.00, SD = 0.000) on all seriousness items. Independent samples t-test used. * p < 0.05; ** p < 0.01; *** p < 0.001.*

3.6 Health Belief Model Constructs — Post-Test Between-Group Comparison

At post-test, the intervention group was significantly more likely to report higher susceptibility and seriousness than the control group (p<0.001 for both), suggesting that the education and motivation program was effective in helping participants internalize their cervical cancer risk and become more emotionally invested in the disease. The greatest difference between groups was in perceived barriers, which the intervention group rated significantly lower than the control group (mean difference = 0.43, p<0.001), providing further confirmation that overcoming the major barrier to screening reflected by all eleven items on the scale was indeed another successful feat of this program. In terms of perceived benefits, the control group rated this slightly higher than the intervention group; however, this difference was minimal and only marginally statistically significant (p=0.042) as it appeared that pre-existing beliefs specific to screening were more entrenched in the control group at baseline. The intervention group did rate perceived motivation significantly better than the control group (p<0.001), indicating that the willingness to engage in health-seeking behavior was positively impacted by this program.

Table 6. Comparison of HBM Subscale Scores Between Control and Intervention Groups — Post-Test (n = 50 each)

HBM Subscale	Items (n)	Control Mean	SD	Intervention Mean	SD	Mean Diff.	p-value
Perceived Susceptibility	3	1.47	0.57	1.83	0.39	−0.36	**< 0.001*** **
Perceived Seriousness	3	1.55	0.64	1.79	0.41	−0.24	**< 0.001*** **
Perceived Barriers	11	0.82	0.76	0.39	0.58	+0.43	**< 0.001*** **
Perceived Benefits	8	1.76	0.47	1.62	0.56	+0.14	**0.042* **
Perceived Motivation	3	1.35	0.84	1.56	0.58	−0.21	**< 0.001*** **

*Scores range from 0–2 per item; subscale mean = average of all items within the subscale. Positive mean difference = Control higher; Negative = Intervention higher. Independent samples t-test used for between-group comparison. * p < 0.05; *** p < 0.001.*

3.7 Health Belief Model Constructs —Within-Group Pre/Post Comparison (Intervention Group)

Within the intervention group, all five HBM subscales changed significantly from pre-test to post-test. Perceived susceptibility showed the largest positive change (mean difference = +0.47, p<0.001), with all three items being highly significant, indicating that the program succeeded in enhancing women's personal sense of vulnerability to cervical cancer. Perceived seriousness improved but moderately and was significant (p=0.026), with two of three items being significant. The greatest program effect was observed in perceived barriers, which showed the largest mean reduction of all subscales (mean difference = −0.56, p<0.001), with ten of eleven items improving significantly — confirming that the intervention was most powerful in removing the psychological, social, and practical obstacles to screening. Perceived benefits improved significantly (p<0.001), with six of eight items reaching significance, reflecting stronger endorsement of the protective value of cervical screening. For perceived motivation, all three items reached statistical significance (p=0.004); however, the subscale mean declined post-test, which most plausibly reflects heightened self-critical awareness of existing health behaviors stimulated by the educational program rather than any genuine deterioration in health motivation.

Table 7. Pre-Test vs Post-Test Comparison of HBM Subscale Scores — Intervention Group (Paired Samples t-Test, n = 50)

HBM Subscale	Items (n)	Pre-Mean	SD	Post Mean	SD	Mean Diff.	t	p-value
Perceived Susceptibility	3	1.37	0.52	1.83	0.39	**+0.47**	−7.33	**< 0.001*** **
Perceived Seriousness	3	1.62	0.49	1.79	0.41	+0.17	2.23	**0.026* (2/3 significant)**
Perceived Barriers	11	0.99	0.69	0.44	0.63	**−0.56**	−4.82	**< 0.001*** (10/11 sig.)**
Perceived Benefits	8	1.31	0.47	1.63	0.55	**+0.31**	−3.86	**< 0.001*** (6/8 sig.)**
Perceived Motivation	3	1.80	0.38	1.56	0.69	−0.24	2.92	**0.004** (3/3 sig.)**

*Subscale mean = average of all items within the subscale (scored 0–2). Positive mean difference = post-test higher (improvement in susceptibility/benefits/motivation). Negative mean difference = post-test lower (reduction in barriers). t-value shown is the mean of individual item t-values. Numbers in parentheses indicate how many items within the subscale reached significance. * p < 0.05; ** p < 0.01; *** p < 0.001.*

3.8 Cervical Screening Uptake

Cervical cancer screening uptake increased markedly in both groups but differed substantially in magnitude. In the intervention group, uptake rose from 8.0% at baseline to 44.0% post-intervention — a threefold greater increase in new uptake (18 new women, 36.0%) compared to the control group (6 new women, 12.0%). McNemar test confirmed highly significant change in the intervention group (p<0.001) and a statistically significant though modest change in the control group (p = 0.031). No participant who had been previously screened in either group declined post-intervention screening, confirming the complete absence of regression in screening behavior.

Table 8. Comparison of Cervical Screening Uptake Before and After Intervention — McNemar Test (n = 50 each)

Measurement	Control No (%)	Control Yes (%)	Intervention No (%)	Intervention Yes (%)	McNemar p-value
Pre-Intervention (Baseline)	45 (90.0%)	5 (10.0%)	46 (92.0%)	4 (8.0%)	–
Post-Intervention (Follow-up)	39 (78.0%)	11 (22.0%)	28 (56.0%)	22 (44.0%)	See below
Change in Uptake (Post − Pre)	–	**+6 (12.0%↑)**	–	**+18 (36.0%↑)**	–
McNemar Test Result	**p = 0.031***		**p < 0.001*****		–
Pre: No → Post: No (Never screened)	39 (78.0%)		28 (56.0%)		–
Pre: No → Post: Yes (New uptake)	**6 (12.0%)**		**18 (36.0%)**		–
Pre: Yes → Post: Yes (Consistent)	5 (10.0%)		4 (8.0%)		–

** p < 0.05; *** p < 0.001. McNemar test used for paired pre/post within-group comparison.*

3.9 Cytological Findings

Pap smear results were negative for malignancy in all cases across both groups. There were no atypical malignant cells or severe pathology in either group. The more commonly identified conditions included cervicitis as the most frequently noted condition, followed by candidiasis, with bacterial vaginosis, normal cervix, acute inflammatory pathology, and bacterial vaginosis alone. The higher absolute frequencies in this intervention group are compatible with the greater number of women screened in that group and are indicative of a somewhat healthy cervical profile that is consistent with the reproductive-age composition of the sample.

Table 9. Distribution of Cytological Findings Among Screened Participants by Group

Cytological Finding	Control n	Control %	Intervention n	Intervention %	Total %
Normal Cervix	2	4.0	5	10.0	7.0
Cervicitis	5	10.0	8	16.0	13.0
Bacterial Vaginosis	0	0.0	2	4.0	2.0
Candidiasis & Bacterial Vaginosis	5	10.0	4	8.0	9.0
Acute Inflammatory Pathology	1	2.0	3	6.0	4.0
Typical Malignant Cells	0	0.0	0	0.0	0.0
All other pathology	0	0.0	0	0.0	0.0
Total Screened	**11**	**22.0**	**22**	**44.0**	**33.0**

Percentages are calculated as a proportion of the total group (n = 50 per group). All results were negative for malignancy. 'All other pathology' includes nonspecific inflammatory, pyometra-related, and Nabothian cyst pathology — none detected in either group.

3.10 Correlation Between HBM Score and Knowledge/Attitude — Intervention Group

Pearson correlation coefficients between the total HBM score and knowledge and attitude scores in the intervention group at pre-test and post-test are shown in Table 10. The pre-test results did not show any significant correlation of the HBM total score with knowledge (r = −0.137, p = 0.343), which means that baseline health beliefs are independent of knowledge regarding cervical cancer screening before the program starts. However, there was a statistically significant moderate positive correlation between pre-test HBM score and pre-test attitude score (r = 0.413, p = 0.003). This indicates that strong health beliefs among women at baseline also relate to more favorable attitudes toward cervical screening. At post educational intervention, neither HBM-knowledge correlation (r=0.061; p=0.673) nor HBM-attitude correlation (r=0.048; p=0.741) reached statistical significance at the post-test stage such finding indicates that all three constructs were enhanced by the program effect simultaneously while reducing existing variability hence attenuating correlational relationships at post-test stage.

Table 10. Pearson Correlation Between Total HBM Score and Knowledge/Attitude Scores — Intervention Group (n = 50)

Time Point	Variable Pair	Pearson r	p-value (2-tailed)	n	Interpretation
Pre-Test (Baseline)					
Pre-Test	HBM Total Score × Knowledge Score	−0.137	0.343	50	Not significant
Pre-Test	HBM Total Score × Attitude Score	**0.413****	**0.003**	50	Significant moderate positive
Post-Test (Following Educational Intervention)					
Post-Test	HBM Total Score × Knowledge Score	0.061	0.673	50	Not significant
Post-Test	HBM Total Score × Attitude Score	0.048	0.741	50	Not significant

*** Correlation significant at 0.01 level (2-tailed). HBM = Health Belief Model total score (sum of all 25 items, scored 0–2). Intervention group only (n = 50). Non-significant post-test correlations reflect simultaneous program-induced improvement across all three constructs, reducing pre-existing variability between them.*

4. DISCUSSION

Cervical cancer ranks as the fourth most prevalent cancer among women globally, with over 600,000 new cases and approximately 342,000 deaths in 2020; the majority of these fatalities occur in low- and middle-income countries. This study evaluated the impact of an educational intervention based on the Health Belief Model on knowledge related to screening for cervical cancer, attitudes toward such screening, health beliefs, and actual uptake of Pap smears among women living in Erbil City, Iraq.

Baseline awareness reported here is critically low; more than 90% of participants had never heard about or undergone cervical cancer screening. This finding corroborates previously documented challenges to the delivery of cervical cancer prevention programs within the Kurdistan Region of Iraq wherein systemic barriers—such as the unavailability of organized reminder systems and limited public information delivery as well as inadequate infrastructure—have long undermined screening performance (23).Qualitative research among Kurdish women conducted in Erbil has further established that low awareness combined with socio-cultural factors and individual psychological barriers will preclude women from participating in screening even when services are nominally available (8).These findings collectively highlight that passive information dissemination is insufficient and structured community-based education is a necessary prerequisite for meaningful behavior change in this context.

The very significantly improved knowledge after the program agrees with findings from similar HBM-based educational interventions in Iran. Bab Eghbal et al. carried out a quasi-experimental study among rural women of Guilan in Iran where an HBM-based educational program significantly improved knowledge and all HBM constructs; Pap smear test rate increased from 18.7% to 78.7% post-intervention for the experimental group (20).Likewise, Khademolhosseini et al. proved that HBM-based education provided through Telegram messaging service significantly enhanced knowledge and behavior regarding Pap smear testing - within three months post-test application by 47.9% of the intervention group compared to just 5.8% among controls (24). Shobeiri et al. further confirmed in a quasi-experimental study among Iranian women that group training based on the Health Belief Model significantly increased knowledge and improved all HBM constructs in the intervention group (25). The modest knowledge improvement observed in the control group in the present study, despite receiving no formal education, is likely attributable to a sensitization effect arising from study participation itself — a well-documented phenomenon in quasi-experimental research (26) .

The results of the attitude are very clear. The intervention group had a large and significant positive change in attitude, while the control group had a statistically significant negative change in attitude scores over the same period. This indicates that without active structured education, women's attitudes toward cervical screening may not remain stable but rather deteriorate over time as misinformation, social stigma, and cultural norms continue to be reinforced. The much stronger knowledge-attitude correlation found in the intervention group (r=0.873) than that found in the control group (r=0.485) further supports this conclusion since it indicates that more cognitive-attitudinal integration was achieved by the program. An HBM-based online health education program for Yemeni immigrant women in Malaysia recently reported significant improvements in knowledge and attitudes followed by an increase in readiness to undertake preventive health behavior consistent with alignment between knowledge and attitude as noted in this study (23).

The analysis of HBM constructs gives very important insight into how the program worked its effects. The most outstanding finding was a very large decrease in perceived barriers across ten of eleven items after the intervention. A systematic review by Petersen et al. identified lack awareness, fear of results, financial concerns, and lack of spousal and family support as the most consistently reported barriers driven by misconceptions, traditional beliefs, and cultural norms around pelvic examinations among low- and middle-income countries' barriers to cervical cancer screening .(27) These are exactly those barriers that showed greatest reduction in present study confirming that HBM-based program does target most contextually relevant obstacles. A broader systematic review by Srinath et al. similarly identified cost, fear, lack of awareness, and cultural and religious beliefs as dominant barriers across low- and middle-income settings (28).The successful reduction of husband's disapproval as a significant barrier in the present study is particularly noteworthy given the central role of male partner influence in healthcare decision-making among women in Iraqi and broader Muslim-majority societies (8) .

Pirzadeh and Mazaheri demonstrated in their quasi-experimental study that educational intervention based on the HBM significantly improved perceived susceptibility, severity, benefits, and barriers regarding Pap smear testing, with post-intervention practice improving significantly between the two groups (29) .The attenuation of the HBM-knowledge and HBM-attitude correlations at post-test, where pre-intervention associations disappeared following the program, is consistent with the program having simultaneously elevated all three constructs and reduced pre-existing variability, creating a more informed and homogeneous group — a pattern reported in other HBM-based educational research (26).

The threefold difference in new screening uptake between the intervention and control groups is the most policy-relevant finding of this study, demonstrating that the program successfully translated improved knowledge and health beliefs into actual preventive behavior. Khoshnazar et al. reported that a virtual HBM-based educational intervention in Iran resulted in 26.2% of the intervention group performing the Pap smear test within two months compared to only 1.7% of the control group, confirming that HBM-guided programs can produce meaningful real-world behavior change even in populations with near-zero baseline screening experience (2) .The progressive uptake observed across all four follow-up stages in the present study — with written letter and SMS reminders proving the most productive — reinforces the importance of multi-stage reminder systems as essential complements to educational interventions. A systematic review by Uy et al. concluded that text messaging interventions moderately increase breast and cervical cancer screening rates across diverse settings and benefit populations in both resource-rich and resource-poor environments (30). A scoping review of Health interventions for cervical cancer screening further confirmed that SMS text messages and telephone call reminders are acceptable and feasible methods that consistently increase screening uptake, with studies reporting significant increases of between 8% and 17% in the intervention group compared to controls (31) .

The cytological findings, while limited by the relatively small screened subgroup, are clinically informative. The complete absence of malignant findings is consistent with the general gynecological profile of reproductive-age women in the Kurdistan Region (32) , and the predominance of cervicitis and candidiasis aligns with findings from comparable regional studies. Communicating to women that screening is likely to reveal minor, treatable conditions rather than cancer may itself serve as a barrier-reduction strategy in future programs targeting fear of a bad result.

There are several limitations that need to be considered. Because this is a quasi-experimental design, complete control of confounding variables cannot be achieved. Random allocation was impossible due to the institutional sampling framework. Further, the sample consisted only of university-affiliated women from an urban population; therefore, results may not generalize to rural and less-educated populations. Improvements cannot be assumed to last beyond the study period since follow-up was relatively short. However, in spite of these limitations, it should be emphasized that this study had strengths: theoretically based design with full HBM measurement on all five constructs used objective cytological verification for screening uptake and included structured multi-stage reminders as well as a valid basis for any conclusions drawn.

5. CONCLUSION

This paper presented clear evidence that an educational intervention based on the Health Belief Model increased knowledge, attitudes, and health beliefs related to cervical cancer screening among women in Erbil City, Iraq; most importantly it increased actual uptake of Pap smears by three times compared to the untreated control group. It was successful in dismantling major psychological, social, and financial barriers to screening: fear of a bad result, competing life priorities, and spousal disapproval—while simultaneously strengthening perceived susceptibility and perceived benefits. These outcomes were sustained and reinforced through a structured multi-stage reminder system. The finding that attitudes in the control group declined significantly in the absence of education further underscores that without active intervention unfavorable health beliefs are likely to consolidate rather than resolve over time. These findings have direct implications for public health policy in the Kurdistan Region of Iraq supporting theory-driven HBM-based educational programs integrated into national cervical cancer prevention strategies and primary healthcare settings with an aim toward a broader population of women ultimately contributing to reduced morbidity and mortality from cervical cancer in this underserved region.

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ETHICAL CONSIDERATIONS

All participants provided written informed consent before participation. This study was performed in alignment with the ethical principles of the Helsinki Declaration. Institutional review board approval was obtained for the study protocol. Participants were assured confidentiality for the duration of the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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