

# Increasing the Prevalence of Cervical Cancer Screening in Iran: Effectiveness of a Theory-Based Educational Intervention

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## Research Article

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# Abstract

**Purpose:** The high mortality rate of cervical cancer in developing countries is mainly related to inefficient screening programs. The aim of the present study was, thus, to determine the effect of an educational intervention based on BASNEF model in increasing cervical cancer screening (CCS) in Bandar Deir in the south of Iran.

**Methods:** A quasi-experimental educational intervention was conducted for 202 women (101 in the intervention group (IG) and 101 in the control group (CG)) between 2019 and 2020. The sampling was convenience in type. The required data were collected using a valid and reliable questionnaire in three parts (demographic part, knowledge part, BASNEF constructs). 14 educational sessions were held each taking 60 minutes long at two levels, personal and interpersonal (family members, health workers and healthcare givers). Finally, the follow-up was completed after three months in December 2021.

**Results:** After the educational intervention, a statistically significant difference was observed between the IG and CG in all model constructs ( $p < 0.001$ ). Before the intervention, in the IG, the personal health score was  $4.35 \pm 2.52$ , which was increased to  $5.25 \pm 0.753$  after the educational intervention ( $p < 0.001$ ). However, in the CG, this difference was not statistically significant ( $p < 0.030$ ). 63.4% of women in the IG and 32.7% in the CG underwent CCS and the difference was statistically significant ( $p < 0.001$ ). Attitude, enabling factors and behavioral intention were among the most important predictors of CCS.

**Conclusion:** Our findings showed that the BASNEF-based educational intervention, with limited resources and in a short time, managed to motivate women to undergo CCS. It could maximally remove barriers at both personal and interpersonal levels and provide strategies based on these barriers to achieve a successful screening program.

## Introduction

Uterine cancer is the fourth most common and deadly cancer among women worldwide. [1]. The incidence of cervical cancer in developing countries is disproportionately high (> 80%) [2]. Global Cancer Statistics (2020) showed 604,127 women were diagnosed with cervical cancer worldwide, and about 341,831 women died from the disease mostly in low- and middle-income countries ([3].

The incidence rate of cervical cancer in Iran has been found to be on the rise [4]. In Iran, the incidence rate of the disease is 4.5 per 100,000 persons. Annually, among every 123 women, one is affected with cervical cancer, and among every 100,000 women, nine die of this cancer [5]. The most important risk factors of this disease are pregnancy at a young age, young age at marriage, multiple sexual partners, old cloth sanitary napkins, washing the genitals after sexual intercourse, weakness of the body's immune system, genetic factors, and exposure to certain chemicals [6].

Women with cervical cancer suffer from different clinical problems including social functioning, constipation, diarrhea, severe lymphedema, menopausal symptoms, reduced body image, sexual or

vaginal functioning, anxiety and depression along with difficulties with finance management compared with ordinary female population [7, 8].

Invasive cervical cancer has been identified as a preventable cancer due to its long pre-invasive period, the availability of an appropriate screening program, and the effective treatment of primary lesions [9]. The occurrence of this cancer can be prevented by providing regular screening services [10]. High cervical cancer mortality in developing countries is mainly due to inefficient screening programs, limited access to cervical cancer screening, and low levels of subsequent treatment after abnormal outcomes [11]. Prompt and accurate screening programs are essential for every woman with cervical disease to receive the treatment she needs and to escape an avoidable death [12].

Participation in CCS programs in Iran is far from desired and significantly needs improvement. As for the distribution of CCS practice, social and geographical differences show the need for further research and more comprehensive strategies to reduce the rate of the disease and increase the rate of participation [13].

A main barrier to CCS is the limited knowledge of cervical cancer and screening, followed by the lacking knowledge of the screening sites [10]. Knowledge, attitude and practice of CCS in Iranian women are not satisfactory [14, 15]. In fact, educational interventions can play an important role in promoting CCS behavior in women [16–18]. Theory-based educational interventions have a better chance of success than simple educational interventions because the most effective educational programs are based on theory-based approaches that stem from behavior change models [19]. The existing body of research proved the effectiveness of theory-based educational interventions in increasing the rate of CCS [2, 11, 20]. A systematic review report showed that various interventions aiming to change health behaviors provide an effective basis for the prevention of cervical cancer [16]. A successful educational model of behavior change or creation of a new behavior is BASNEF model. Different studies confirmed the effectiveness of educational interventions based on the BASNEF model in adopting healthy behaviors [21, 22].

BASNEF model, as described by John Hubley, includes beliefs about behavioral outcomes, attitudes toward behavior, subjective norms and enabling factors. This model is a combination of the Precede–Proceed model and expectancy-value theory [23, 24]. The most significant construct in BASNEF model is the behavior change. Beliefs and attitudes are influenced by culture, values, traditions, education, media, and personal experiences. Subjective norms include family, society, social media, and peer pressure. Enabling factors can be income, women’s status, time, and skills [24]. This model can be proposed as a new educational method.

According to this model, a person performs CCS when she understands the adequacy of the benefits and importance of CCS and develops a positive attitude towards this behavior. In addition, she is encouraged by important and influential people to perform CCS. Resources and facilities should be taken into account to facilitate CCS.

Most previous studies explored the increase in CCS with models such as the Health Belief Model and Theory of Planning Behavior [20, 25, 26]. To our knowledge based on the literature review, only one study used BASNEF model in increasing CCS. The study site, sample size, type of educational intervention and its statistical analysis were, however, different from our study [27]. One advantage of BASNEF model is that, unlike other models, it not only considers knowledge, attitude, abstract norms, and intention, but also focuses on another influential factor, namely the enabling factors. As a catalyst, intention turns into actual behavior, and its absence disrupts this process. Therefore, our study has determined the effect of an educational intervention based on BASNEF model in increasing CCS. The results of our research provide researchers with a primary insight into the effectiveness of this model and a basis for comparison with future research using this model.

## Methods

### Study design and population

A quasi-experimental study was conducted with an experiment group. It was carried out in 2019-2020 to evaluate the effectiveness of an educational intervention based on the BASNEF model in promoting CCS behavior among 202 women aged 20-49 years (101 in the IG and 101 in the CG). It was conducted in the south of Iran.

### Setting

The present study was conducted in Deir County in Bushehr Province in the south of Iran. This County is located on the coastal areas of the Persian Gulf, and the capital city is Bandar-Deir.

### Participant Eligibility

The inclusion criteria were the age 20-49 years, being sexually active, not being pregnant, having at least elementary education level, and full consent to participate in the study and training sessions. The exclusion criteria were absence at more than two training sessions, absence at the post-test, history of uterine cancer, hysterectomy and other sexually transmitted diseases, unwillingness to continue participation in the study, and incomplete questionnaires.

### Sample Size Estimation

The sample size was estimated using the following formula:

$$n = \frac{2(z_{1-\alpha/2} + z_{1-\beta})^2 \sigma^2}{d^2} = \frac{2 * (1.96 + 0.84)^2 * (12)^2}{5^2} = 91$$

The sample size in each group was estimated at 91. With an attrition rate of 10% in each group, the final sample size was estimated at 101 (for each group).

## Sampling

Deir County has two comprehensive healthcare centers. In order to prevent the exchange and transfer of information between the intervention and control groups, one of these centers was randomly assigned to the intervention group and the other to the control group. Thus, healthcare center #1 was set as the IG and #2 as the CG. Then, women who met the inclusion criteria were assigned to each group.

## Contents of the Survey Instrument and Scoring System

The questionnaire used in our study included closed-ended questions to be rated on a Likert scale, true, false, or do not know. This questionnaire was divided into three main parts.

The first part contained questions exploring the participants' demographic information including age, education, husband's education, residence, occupation, history of Pap smear testing.

The second part consisted of questions about knowledge of causes, risk factors, prevention and therapeutic alternatives. This part includes 15 three-choice questions. The choices included *True*, *False*, and *I do not know*. Every true answer received a score 1, while a false or don't know received 0.

The third part included BASNEF constructs.

Attitude was assessed with 10 questions. For example, "Pap smear testing is easier than treating the cervical cancer". Subjective norms were evaluated with 16 questions, including "If I go to the doctor for a Pap smear test, my husband will complain". Enablers were assessed with 6 questions. An instance is "The Pap smear test is costly for me". Behavioral intention was evaluated with 5 questions such as "If any threatening symptom emerges (bleeding, unnatural vaginal secretion, etc.), I will see a doctor ASAP".

All items of the subscales were rated on a five-point Likert-type: strongly agree (1 point), agree (2 points), neutral (3 points), disagree (4 points), and strongly disagree (5 points). Each subscale was assessed separately, and the total score was not calculated. Subscale scores were calculated for each participant. Higher scores indicated stronger feelings about a construct.

Healthy behavior (practice) was measured with 6 questions with Yes/No answers. For example, "I regularly have the Pap smear test". A Yes received 1 point and a No received zero.

Another question measured cancer screening behavior (performing Pap smears by women)

## Data quality assurance

We developed the data collection instrument based on a review of related literature. The questions were pretested and structured. All were to be rated as self-reports. Before the main data collection phase, the questionnaire was piloted on 23 women who were similar to the research population on all aspects. Their

feedback was used to revise the questionnaire and facilitate the comprehension and organization of content. These participants were excluded from the main study. Also, the initial draft of the questionnaire was sent to a number of experienced and specialized experts in the field to evaluate readability, simplicity, relevance, and importance. Their opinions were used in the development of the questionnaire. To determine the reliability of the instrument, a test-retest method was used. The questionnaire was given to 20 individuals who had the same conditions as the subjects at a two-week interval and on two occasions. Then, to calculate the test agreement with the retest, the ICC index was calculated. The estimated ICC value was .86; thus, the reliability of the questionnaire was substantiated.

## **Data collection**

In our study, the required information was collected using self-reporting questionnaires. At first, the participants were asked to sign two copies of informed letter of consent, one to be handed over to us and one for themselves. Each participant who expressed her complete satisfaction by the end of the study was given a pre-test questionnaire. After the intervention, the questionnaire was completed again. For illiterate participants, the questions were read by the first author to minimize bias. They were completed based on the participants' answers. The questionnaires were completed at the beginning of the first session, then a follow-up<sup>3</sup> was performed three months after the end of the 14th session. In the CG, pre-test and post-test questionnaires were completed simultaneously with the IG. To identify pre-test and post-test questionnaires, each participant entered the last 4 digits of her mobile phone and age on the questionnaire. It took 20-25 minutes to complete each questionnaire.

## **Intervention activities and follow-up**

The educational intervention was made at both personal and interpersonal levels. At the former, the intervention was made on participating women, and at the latter on family members, health workers and caregivers. The relevant questionnaires (knowledge and BASNEF model constructs) were submitted to both groups as a pretest. Then, according to the results, an educational needs assessment was made and the content and method was adapted accordingly. The number of sessions needed for training were decided on. Teaching methods included lecturing, participatory discussion, question and answer, brainstorming, role model, teaching by peers. Training sessions for the intervention group were held in a completely friendly environment in a local mosque, comprehensive healthcare centers for three months. The educational content of each session was designed based on learners' understanding, the use of valid scientific resources, applying professors' and participants' opinions BASNEF model constructs. It should be noted that in order to adjust the enabling factors, we made the required arrangements with comprehensive healthcare centers for sampling, as well as Pasteur laboratory for the test administration. Then, we paid for the sampling and testing. A total number of 14 training sessions (10 at the personal level, and 4 at the interpersonal level) were held in 6 training groups, each session lasting 40-60 minutes with a 10-minute break time. To ensure minimal contamination of participants, women in the IG and CG were selected from two remote health care centers and the chances of communication between the two groups were next to zero. Also, during the intervention program, no training was provided by other

agencies or public trainings in this field in the city. SD tried to reduce the attrition rate once a week by phone-calls (as the follow-up) so that after three months there was no attrition in either group. (Fig. 1)

## **Post intervention activities**

An evaluation was done immediately after the intervention. Three months after the intervention, the same questionnaire was given to the IG. Simultaneously, the CG completed the post-test questionnaire.

The educational intervention covered the following topics.

- 1- General issues about cancers and more specifically about cervical cancer, detailed description of cervical cancer (how people can prevent the risk of cervical cancer, etc.), factors affecting cervical cancer
- 2- Symptoms of the disease, prevention and treatment alternatives
- 3- Benefits of early diagnosis of cervical cancer, introduction of cervical cancer screening test
- 4- Teaching the benefits of cervical cancer screening, time of cervical cancer screening, places for cervical cancer screening.

## **Interventionist training**

The educational intervention was instructed by 1- SD (a health promotion/education researcher experienced in the field of educational interventions based on models of health education and health promotion), 2- A gynecologist with more than 15 years of educational experience 3- A group of peers.

## **Output evaluation**

Knowledge, Attitude, Subjective norms, Enabling factors, Behavioral intention

## **Outcome evaluation**

Cervical cancer screening (whether or not a woman has a Pap smear test)

## **Ethical Considerations**

In order to collect data, we visited the comprehensive healthcare centers with an official introduction letter from the deputy of research. First, we introduced the research objectives in full to in a simple and clear manner. All details of the research were explained and the participants were asked for a voluntary participation. They were then asked not to mention their names. They were also assured of the confidentiality of the information they provided. The research project was approved by the ethics committee of Hormozgan University of medical sciences (#IR.HUMS.REC.1398.112).

## **Data management and analyses**

When the data collection was done, descriptive statistics (frequency, relative frequency, mean and standard deviation) were used to describe participants' age, education, husband's education, and occupation. Kolmogorov-Smirnov test and Levene's test were used to assess the normality of distribution and equality of variances. Among inferential statistics, the independent-sample *T* test was run to compare model constructs and adoption of preventive behaviors in the IG and CG. Paired-samples *T* Test was run to compare the scores of the model constructs before and after the educational intervention in each group. ANCOVA was run to control and adjust for the effect of pre-intervention scores on post-intervention scores. Also, in order to evaluate the effect of each model construct on behavior in the IG, we used Multiple Linear Regression, in which the behavioral constructs were considered as dependent variables and knowledge and the model constructs as independent variables. All analyses were done in SPSS 22.

## Results

### Characteristics of Subjects

The mean and standard deviation of participants' age in the IG and CG were, respectively,  $32.90 \pm 7.27$  and  $32.59 \pm 6.36$  years. The highest frequency of education level in both groups belonged to high school education (44.6% in the IG and 34.7% in the CG). In both groups, the majority were housewives (94.1% in the IG and 82.2% in CG). 27.7% of the CG and 41.6% of the IG had a history of CCS. Other demographic information is summarized in **Table 1**.

### Findings for BASNEF constructs

Before the intervention, the two groups differed significantly in terms of the score of Enabling factor ( $p = 0.024$ ). However, the two groups did not differ significantly in other constructs (of BASNEF model) ( $P > 0.05$ ). After the educational intervention, a statistically significant difference was found between the IG and CG in all constructs ( $p < 0.001$ ). In the IG, before the educational intervention, the personal health score was  $4.35 \pm 5.25$ , which was increased to  $5.25 \pm 0.753$  after the intervention ( $p < 0.001$ ). In the CG, this difference was not statistically significant ( $p < 0.030$ ). **Table 2**.

To control and adjust for the effects of pre-intervention scores, ANCOVA was run. As reported in Table 3, pre-intervention scores as a covariate variable for knowledge constructs (partial  $\eta^2 = .394$ ;  $p < 0.001$ ), attitude (partial  $\eta^2 = .486$ ;  $p < 0.001$ ), social norms (partial  $\eta^2 = .512$ ;  $p < 0.001$ ), enabling factors (partial  $\eta^2 = .442$ ;  $p < 0.001$ ), and intention (partial  $\eta^2 = .442$ ;  $p < 0.001$ ) were significantly effective. It can also be seen, in the same table, that the educational intervention has a significant effect on all model constructs including knowledge (partial  $\eta^2 = .606$ ;  $p < 0.001$ ), attitude (partial  $\eta^2 = .446$ ;  $p < 0.001$ ), social norms (partial  $\eta^2 = .338$ ;  $p < 0.001$ ), enabling factors (partial  $\eta^2 = .644$ ;  $p < 0.001$ ), and behavioral intention (partial  $\eta^2 = .474$ ;  $p < 0.001$ ).

Multivariate linear regression analysis was used to evaluate the effect of each model construct on behavior. Behavior was the dependent variable, while knowledge and other constructs were the

independent variables. As shown in Table 4, attitude, enabling factors and behavioral intention were the predictors influencing the desired behavior. Adjusted  $R^2 = 0.479$  indicates that this model has managed to explain 47.9% of the behavioral score changes in the IG.

## Discussion

The present study evaluated the effect of an educational intervention developed based on the BASNEF model on promoting CCS behavior. The multivariate regression model ( $R^2 = 0.47$ ) showed that the independent variables integrated within the model (knowledge and BASNEF constructs) predicted 47% of the variance of the dependent variable (performing CCS).

The present findings showed that the designed educational program managed to significantly increase knowledge, BASNEF model constructs and the CCS behavior in women in the IG. Based on multivariate linear regression analytic findings, attitude, enabling factors and behavioral intention were significant predictors of behavior.

The results showed that, after the educational intervention, a significant difference was observed in the mean knowledge score of the IG compared to the CG. Similarly, in other educational interventional studies, it showed to have a significant effect on the mean knowledge score of the IG compared to the CG [5, 27, 28]. In the present study, women's knowledge in the IG became twofold, which indicates the success of educational intervention in removing some misconceptions about the causes, risk symptoms and alternatives for preventing and treating cervical cancer. It should be noted that although the mean knowledge score in the IG was increased, this construct was not able to predict CCS behavior. In other words, women did not undergo CCS despite the knowledge. Similarly, in another study, awareness-raising did not manage to predict a higher CCS behavior [29]. Arguably, although awareness-raising is not directly related to the burden of CCS behavior, it indirectly affects the increasing rate of CCS by affecting other constructs. Knowledge has been mentioned as an important factor in the success of disease prevention programs. Familiarizing participants with the cause of a disease along with an early diagnosis of the disease can be an important step in changing patients' behavior. In this regard, a study in Iran showed that by promoting knowledge about the causes of cervical cancer, and its potential consequences Iranian women can be encouraged to show behaviors that prevent cervical cancer [30].

The present study showed an increase in the mean attitude score of IG compared to the CG. Another study also confirmed this finding, in which the educational intervention affected women's attitude toward CCS [5, 20, 27]. Unlike the present study, in a work of research, the educational intervention did not manage to affect women's attitude [31]. Demographic characteristics, duration and type of educational intervention can be among the possible reasons for this discrepancy. In our study, attitude was one predictor of CCS behavior. It points to the fact that a theory-based and targeted educational intervention managed to raise awareness (increase women's susceptibility to and understanding of the potential consequences of cervical cancer). Controlling barriers such as the cost of screening and knowing the reliable screening sites can positively affect women's attitude. A qualitative study showed that creating a

positive attitude towards screening behavior may encourage Iranian women to engage in cervical cancer prevention behaviors [30].

The mean subjective norms score of the IG increased significantly compared to the control group. Similarly, in other studies, educational interventions managed to affect subjective norms [20, 27]. Although our educational intervention affected subjective norms, this construct did not predict CCS behavior. Contrary to our research, in another study, subjective norms showed to predict CCS behavior of [32]. One possible reason for this discrepancy could be the study design. Because our research was interventional while Moradi's research was cross-sectional. Of note is that the participants selected for training (among women's acquaintances) were not the same people as those popular among the participants. Thus, they did not manage to adequately affect women's behavior. It is suggested in future research to ask each participant to choose an influential person in life so that the educational intervention can prove effective.

In the present research, the mean score of enabling factors in the IG was significantly increased compared to the CG. Similarly, another study showed that the educational intervention was able to increase the mean enabling factors score for CCS [27]. In one study, women who were more aware of screening sites and those who were screened for free were more likely to seek screening services [11]. In addition, enabling factors could predict screening behaviors in women, which was somewhat predictable because, in our study, free CCS and raising women's awareness of screening sites and the like were used to control the enabling factors.

As we found, the IG intended more to show CCS behaviors than the CG. The between-group difference was statistically significant. Similarly, a body of research showed the success of educational interventions in increasing the intention to perform CCS [11, 27, 33]. Contrary to our findings, in another study, educational intervention had no effect on intention to CCS [20]. The difference in the type of theory used can be one reason for divergent findings. In our study, the enabling factors, as a construct within the BASNEF model, were used as a catalyst between intention and actual behavior. It can help change intention to actual behavior. It is noteworthy that not all women who intended to undergo screening underwent it actually. Behavior has been considered by researchers in the present study, so in future research, if all barriers are considered and based on those barriers, resources and facilities (enabling factors) are moderated, we will act to a large extent in turning the intention into a successful behavior.

Our findings showed that the CCS rate in the IG was increased significantly compared to the CG. Women in the IG underwent the Pap smear test almost twice as frequently as women in the CG. In agreement with this finding, some other studies showed that educational intervention can improve CCS behavior [5, 27]. Contrary to our finding, in another study, educational intervention had no effect on CCS behavior [20, 28]. Different socio-demographic characteristics of research populations, educational content and types of model used are among reasons for this discrepancy. The success of this study in improving the acceptance of CCS can be attributed to several facts. First, the population had very little previous knowledge of CCS in the prevention of cervical cancer, which increased significantly after the intervention.

Freeing up the screening program was one enabling factor and theoretical and purposeful training through peers, gynecologist and experienced health education specialist were among other reasons that can be brought. In addition to success in promoting the acceptance of CCS, it is noteworthy that a number of women in the IG did not undergo screening despite the training. Arguably, the participants' demographic characteristics may have influenced whether or not they intended to go for the CCS. For instance, one study reported misconceptions about old age and menopause as the potential reasons for reducing women's susceptibility to cervical cancer. It could adversely affect their screening behavior [34].

## Limitations and Strengths

This study had several limitations that need be mentioned. It was quasi-experimental in design and used a convenience sampling method. Because participants were not randomly assigned to the IG and CG, interpretation of the results should be done with caution. The pre-test, post-test and selection of the matched control group partially made up for this limitation.

This research was conducted in a southern province of the country, which may not represent the total population of Iran, but the results can, with caution, be generalized to the southern cities of Iran with similar cultural contexts. Contamination between the two groups was another potential limitation of this study. Possibly, participants in the IG had access to the intervention information through acquaintances and women in the IG. However, the statistically significant between-group differences largely removed this bias. The strengths of this study are the inclusion of a matched control group, interpersonal educational intervention (intervention by important and influential people, empowering resources), and inclusion of a three-month follow-up. The present study, in a short time with minimal facilities, managed to provide important information to policy makers in adopting cervical cancer preventive behaviors. These results could potentially be used in similar settings to increase the rate of low-resource CCS.

## Recommendations for further research

In our study, though a number of women in the IG received a type of educational intervention in similar circumstances, they did not perform a Pap smear test as expected. Probably, the barriers to successful CCS may be beyond participants' and researchers' control. In another study, from a wide list of reasons for not screening for cervical cancer, the majority of women selected the *other* option. It shows that the options listed were not comprehensive enough and the barriers were more than already anticipated and enlisted [11]. It seems that more comprehensive and multi-level educational interventions can better manage to change women's behavior. Thus, it is recommended to assess a research population's educational and cultural needs before any interventional measures, because behavioral and environmental factors might impede women from the CCS. These factors need to be identified to guide the design of systematic and effective educational interventions at different levels (personal and interpersonal). Qualitative research can help further identify barriers to screening in the target population so as to overcome them. It is also suggested that future research use ecological models that take into account environmental factors in addition to individual factors to further increase the rate of CCS.

## Conclusion

Our findings showed that a low-cost educational intervention is capable of promoting CCS behavior. The educational intervention positively affected women's health behavior by affecting the BASNEF model. Maximizing barriers at both personal and interpersonal levels and providing strategies based on these barriers can help achieve a successful screening program. In particular, we call for the implementation of targeted training programs within the framework of health education and health promotion models to increase the rate of CCS.

## Abbreviations

**CG:** Control group

**IG:** Intervention group

**CCS:** Cervical cancer screening

**CC:** Cervical Cancer

## Declarations

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### Authors' contributions

SD and ZH performed wrote the frst draft of the manuscript as part of her master's project. SH.M supervised the analysis data. R.M, T.A and A.A contributed to the development of the manuscript All authors read and approved the fnal manuscript.

### Funding

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### Availability of data and materials

The datasets used and/or analyzed during the study are available from the corresponding author on reasonable request

### Ethics approval and consent to participate

The performed study's protocol was following the principles of the declaration of Helsinki and the Nuremberg Code and approved by the Ethics Committee of Hormozgan University of medical sciences.

The project approval number is (#IR.HUMS.REC.1398.112). An oral and written informed consent was obtained for each participants in this study.

### Consent for publication

Not applicable.

### Competing interests

The authors declare that they have no competing interests.

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## References

1. Momenimovahed Z, Salehiniya H: **Cervical cancer in Iran: integrative insights of epidemiological analysis.** *BioMedicine* 2018, **8**(3).
2. Sumarmi S, Hsu Y-Y, Cheng Y-M, Lee S-H: **Factors associated with the intention to undergo Pap smear testing in the rural areas of Indonesia: a health belief model.** *Reproductive Health* 2021, **18**(1):1-10.
3. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F: **Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries.** *CA: a cancer journal for clinicians* 2021, **71**(3):209-249.
4. Rezaianzadeh A, Dehghani SL, Mousavi M, Rezaeianzadeh R: **The incidence of uterus cancer in Iran: a systematic review.** *Women's Health Bulletin* 2017, **4**(1):1-4.
5. Ghalavandi S, Zarei F, Heidarnia A, Beiranvand R: **A blended educational intervention program on Pap-test related behavior among Iranian women.** *Reproductive Health* 2021, **18**(1):1-9.
6. Kashyap N, Krishnan N, Kaur S, Ghai S: **Risk factors of cervical cancer: a case-control study.** *Asia-Pacific journal of oncology nursing* 2019, **6**(3):308.
7. Thapa N, Maharjan M, Xiong Y, Jiang D, Nguyen T-P, Petrini MA, Cai H: **Impact of cervical cancer on quality of life of women in Hubei, China.** *Scientific reports* 2018, **8**(1):1-9.
8. Shirali E, Yarandi F, Ghaemi M, Montazeri A: **Quality of life in patients with gynecological cancers: A web-based study.** *Asian Pacific Journal of Cancer Prevention: APJCP* 2020, **21**(7):1969.

9. Taneja N, Chawla B, Awasthi AA, Shrivastav KD, Jaggi VK, Janardhanan R: **Knowledge, Attitude, and Practice on Cervical Cancer and Screening Among Women in India: A Review.** *Cancer Control* 2021, **28**:10732748211010799.
10. Abiodun OA, Olu-Abiodun OO, Sotunsa JO, Oluwole FA: **Impact of health education intervention on knowledge and perception of cervical cancer and cervical screening uptake among adult women in rural communities in Nigeria.** *BMC public health* 2014, **14**(1):1-9.
11. Coronado Interis E, Anakwenze CP, Aung M, Jolly PE: **Increasing cervical cancer awareness and screening in Jamaica: Effectiveness of a theory-based educational intervention.** *International journal of environmental research and public health* 2016, **13**(1):53.
12. **New recommendations for screening and treatment to prevent cervical cancer**  
[<https://www.who.int/news/item/06-07-2021-new-recommendations-for-screening-and-treatment-to-prevent-cervical-cancer>]
13. Amin R, Kolahi A-A, Jahanmehr N, Abadi A-R, Sohrabi M-R: **Disparities in cervical cancer screening participation in Iran: a cross-sectional analysis of the 2016 nationwide STEPS survey.** *BMC Public Health* 2020, **20**(1):1-8.
14. Mousavi F, Shojaei P, Aryan H: **Knowledge, attitudes, and practice related to Papsmear test among Iranian women.** *Int J Womens Health Wellness* 2018, **4**(076):2474-1353.
15. Abedian Z, Dormohamadi M: **Investigating awareness, attitude and practice of women who referred to health centers of Mashhad city toward Pop smear.** *The Iranian Journal of Obstetrics, Gynecology and Infertility* 2013, **15**(36):22-28.
16. Naz MSG, Kariman N, Ebadi A, Ozgoli G, Ghasemi V, Fakari FR: **Educational interventions for cervical cancer screening behavior of women: a systematic review.** *Asian Pacific journal of cancer prevention: APJCP* 2018, **19**(4):875.
17. Akinola A, Constance MS: **Impact of educational intervention on cervical cancer screening uptake among reproductive age women.** *2021* 2021, **8**(4):8.
18. Hou S-l: **Stage of adoption and impact of direct-mail communications with and without phone intervention on Chinese women's cervical smear screening behavior.** *Preventive medicine* 2005, **41**(3-4):749-756.
19. Abbaspour A, Jalili Z, Shojaeizadeh D: **Study the effect of education based on the theory of planned behavior in the prevention of AIDS among addicts.** *Iranian Journal of Health Education and Health Promotion*:61-70.
20. Sarvestani MH, Jeihooni AK, Moradi Z, Dehghan A: **Evaluating the effect of an educational program on increasing cervical cancer screening behavior among women in Fasa, Iran.** *BMC Women's Health* 2021, **21**(1):1-8.
21. Shahnazi H, Koon PB, Abd Talib R, Lubis SH, Dashti MG, Khatooni E, Esfahani NB: **Can the BASNEF model help to develop self-administered healthy behavior in Iranian youth?** *Iranian Red Crescent Medical Journal* 2016, **18**(3).

22. Alizadeh G, Shahnazi H, Hassanzadeh A: **Application of BASNEF model in students training regarding cutaneous leishmaniasis prevention behaviors: a school-based quasi experimental study.** *BMC infectious diseases* 2021, **21**(1):1-9.
23. Hubley J: **Communicating health: an action guide to health education and health promotion:** Macmillan; 1993.
24. Shahbazi A, Moghadam ZB, Maasoumi R, Saffari M, Mohammadi S, Montazeri A: **Effect of a Health-Education Program Based on the BASNEF Model of Overall Sexual Health Satisfaction and Satisfaction with Quality of Sexual Relationship among Women with Infertility.** *International Journal of Women's Health* 2020, **12**:975.
25. Babazadeh T, Nadrian H, Rezakhani Moghaddam H, Ezzati E, Sarkhosh R, Aghemiri S: **Cognitive determinants of cervical cancer screening behavior among housewife women in Iran: An application of Health Belief Model.** *Health care for women international* 2018, **39**(5):555-570.
26. Samami E, Seyedi-Andi SJ, Bayat B, Shojaeizadeh D, Tori NA: **The effect of educational intervention based on the health belief model on knowledge, attitude, and function of women about Pap smear test at Iranian health centers: A randomized controlled clinical trial.** *Journal of Education and Health Promotion* 2021, **10**.
27. Hanifi M, JALILI PZ, Tavakoli R: **The Effects of an Educational Intervention Based on the BASNEF model on Promoting Cervical Cancer Preventive Behaviors among women.** 2018.
28. Rosser JI, Njoroge B, Huchko MJ: **Changing knowledge, attitudes, and behaviors regarding cervical cancer screening: The effects of an educational intervention in rural Kenya.** *Patient education and counseling* 2015, **98**(7):884-889.
29. Chirayil EI, Thompson CL, Burney S: **Predicting human papilloma virus vaccination and pap smear screening intentions among young Singaporean women using the theory of planned behavior.** *Sage Open* 2014, **4**(4):2158244014554961.
30. Khazaee-Pool M, Yargholi F, Jafari F, Ponnet K: **Exploring Iranian women's perceptions and experiences regarding cervical cancer-preventive behaviors.** *BMC women's health* 2018, **18**(1):1-14.
31. Valdez A, Napoles AM, Stewart SL, Garza A: **A randomized controlled trial of a cervical cancer education intervention for Latinas delivered through interactive, multimedia kiosks.** *Journal of Cancer Education* 2018, **33**(1):222-230.
32. Moradi Z, Moradi P, Khani Jeihooni A, Dehghan A: **Factors associated with Pap smear implementation among women referring to healthcare centers in Fasa, Iran: an application of theory of planned behavior.** *J Educ Community Health* 2017, **4**(1):51-58.
33. Dehdari T, Hassani L, Hajizadeh E, Shojaeizadeh D, Nedjat S, Abedini M: **Effects of an educational intervention based on the protection motivation theory and implementation intentions on first and second pap test practice in Iran.** *Asian Pacific Journal of Cancer Prevention* 2014, **15**(17):7257-7261.
34. Chan CW, Choi KC, Wong RS, Chow KM, So WK, Leung DY, Lam WW, Goggins W: **Examining the cervical screening behaviour of women aged 50 or above and its predicting factors: a population-based survey.** *International journal of environmental research and public health* 2016, **13**(12):1195.

# Tables

**Table 1**

**Comparison of demographic variables between the research groups**

category	IG		CG		p value*
	Number	Percentage (%)	Number	Percentage (%)	
(M, SD)Age	32.90±7.27	-	32.59±6.36	-	0.750
Education					0.324
Elementary	21	%20.8	19	18.8%	
Intermediate	21	20.8%	25	24.8%	
High school	45	44.6%	35	34.7%	
Collegiate	14	13.9%	22	21.8%	
Husband's education					0.950
Primary	19	18.8%	21	20.8%	
Secondary	29	28.7%	31	30.7%	
Diploma	24	23.8%	23	22.8%	
Academic	29	28.7%	26	25.7%	
Residence					1
Urban	70	69.3%	70	69.3%	
Rural	31	30.7%	31	30.7%	
Occupation					0.009
Housewife	95	94.1%	83	82.2%	
Working outside home	6	5.9%	18	17.8%	
Previous screening					0.631
Yes	28	27.7%	25	24.7%	
No	73	72.3%	76	75.3%	

\* Chi-square test

**Table 2**

**Comparison of the BASNEF constructs between the two research groups before and after the intervention**

Variable	GroupTime	IG Mean ± SD	CG Mean ± SD	P-value*	* Independent T-test; ** Paired T-test
<b>Knowledge</b>	Baseline	±3.345.36	±3.156.47	0.006	<b>Table 3</b>
	3-months follow-up	±1.5410.95	±3.096.70	0.000	
	P-value**	0.001	0.206		
<b>Attitude</b>	Baseline	±6.1828.26	±5.5127.55	0.531	<b>Covariance Analysis of BASNEF constructs</b>
	3-months follow-up	±5.2934.19	±5.0927.14	0.000	
	P-value**	0.000	0.170		
Subjective norms	Baseline	±9.8742.88	±8.7441.98	0.556	<b>Table 4</b>
	3-months follow-up	±6.4550.42	±8.2742.54	0.000	
	P-value**	0.000	0.276		
Enabling factor	Baseline	±5.6013.30	±5.4914.91	0.024	<b>Multivariate regression analysis of the predictors of behavior in the intervention group based on the model constructs</b>
	3-months follow-up	±3.1122.22	±4.8114.81	0.000	
	P-value**	0.002	0.637		
Behavioral intention	Baseline	±3.7114.16	±3.0013.89	0.516	
	3-months follow-up	±2.2117.64	±2.9513.81	0.000	
	P-value**	0.000	0.615		
Personal health	Baseline	±5.254.35	±1.184.31	0.808	
	3-months follow-up	±.7535.25	±.924.46	0.000	
	P-value**	0.000	0.030		

Variables	Source	Sum of Squares	df	Mean Square	Statistic F	p-value	Partial Eta Squared
Knowledge	<b>Before intervention</b>	445.398	1	445.398	122.015	.000	.394
	<b>intervention</b>	1057.158	1	1057.158	289.604	.000	.606
	error	686.267	188	3.650			
	R Squared = .656 (Adjusted R Squared = .652 )						
Attitude	<b>Before intervention</b>	2480.820	1	2480.820	179.879	.000	.486
	<b>intervention</b>	2107.335	1	2107.335	152.799	.000	.446
	error	2620.399	190	13.792			
	R Squared = .651 (Adjusted R Squared = .647 )						
Subjective norms	<b>Before intervention</b>	5322.463	1	5322.463	197.573	.000	.512
	<b>intervention</b>	2587.758	1	2587.758	96.059	.000	.338
	error	5064.563	188	26.939			
	R Squared = .621 (Adjusted R Squared = .617 )						
Enabling factor	<b>Before intervention</b>	1390.170	1	1390.170	150.636	.000	.442
	<b>intervention</b>	3175.929	1	3175.929	344.137	.000	.644
	error	1753.448	190	9.229			
	R Squared = .697 (Adjusted R Squared = .694 )						
Behavioral intention	<b>Before intervention</b>	576.167	1	576.167	150.280	.000	.442
	<b>intervention</b>	656.873	1	656.873	171.330	.000	.474
	error	728.452	190	3.834			
	R Squared = .638 (Adjusted R Squared = .634 )						

Variables	B	95.0% Confidence Interval for B		Standardized Coefficients Beta	t	p-value
		Lower Bound	Upper Bound			
knowledge	-.060	-.144	.024	-.123	-1.423	.158
Attitude	.040	.011	.069	.281	2.757	.007
Subjective norms	.004	-.015	.024	.038	.453	.652
Enabling factor	.196	.138	.253	.625	6.743	<0.001
Behavioral intention	.167	.099	.235	.490	4.868	<0.001
Adjusted R Square=0.479		.507= R Square				

## Figures

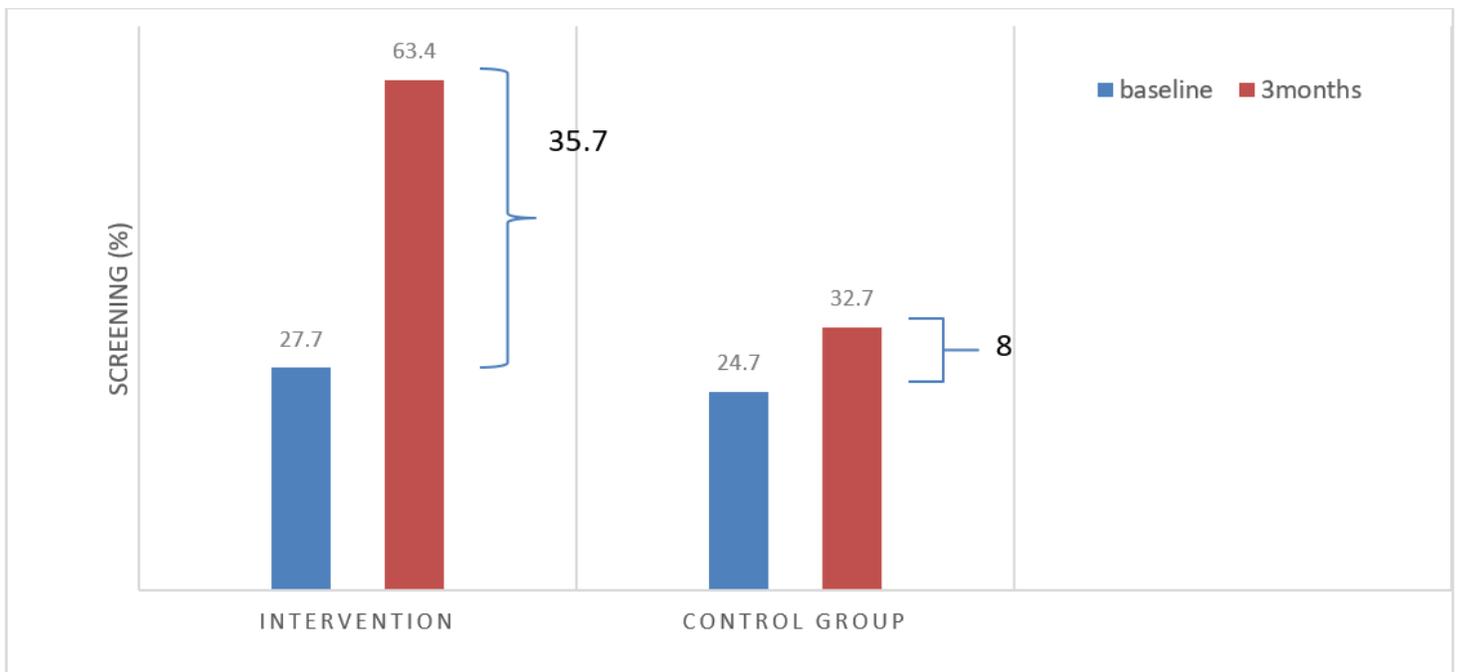


Figure 1

Comparison of CCS between the two groups before and after the intervention

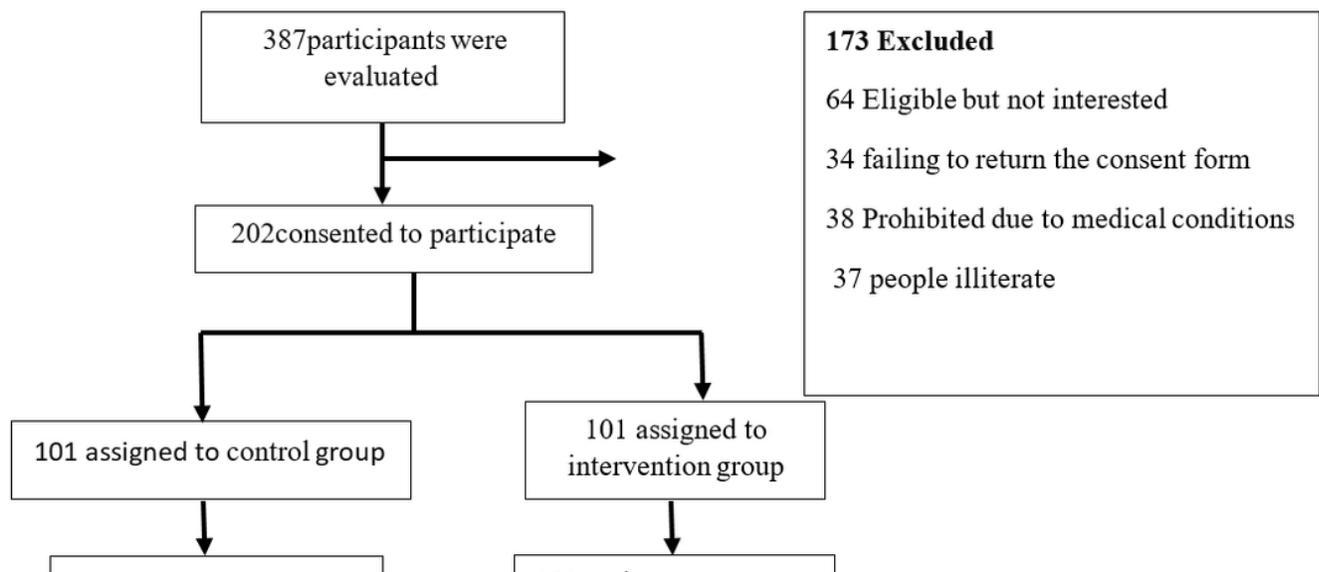


Figure 2

Intervention profile

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