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Bridging the knowledge gap: educational needs of Iranian women for virtual breast cancer prevention: a qualitative study

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Abstract

Background Breast cancer prevention is a globally significant and cost-effective public health priority, particularly in low- and middle-income countries. Empowering women through improved health literacy is a key strategy for reducing the disease burden. However, effective educational programs must be tailored to the specific cultural context and needs of the target community. This study explored the educational needs of Iranian women for a virtual breast cancer prevention program.

Methods A descriptive qualitative design was used from January to July 2022. Purposive sampling with maximum variation was utilized to recruit a sample of 28 participants. Data collection was conducted through semi-structured interviews. Following the method outlined by Graneheim and Lundman, qualitative content analysis was employed to analyze the interview data. MAXQDA 2020 software was used for data analysis. Components of trustworthiness, including credibility, dependability, confirmability, and transferability, were considered.

Results Our findings identified three primary categories: "developing women's scientific, practical, and attitudinal capabilities"; "features of program content"; and "principles of electronic content design". These results offer valuable insights into the educational needs of Iranian women for virtual breast cancer prevention programs.

Conclusions To design an effective virtual program, it is crucial to address all three domains: cognitive, emotional, and psychomotor. Program content should be organized and presented using methods that sensitize women to the importance of breast cancer prevention and motivate them to participate. Furthermore, the program's design should be grounded in evidence-based practices and principles of electronic content design, ensuring cultural sensitivity to the needs of Iranian women.

Keywords Needs, Breast cancer, Prevention, Virtual education program, Qualitative content analysis

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Background

Breast cancer is a significant global health concern, with over 2.3 million new cases diagnosed annually [1]. Furthermore, it ranks as the first or second leading cause of cancer-related death among women in 95% of countries. Approximately 80% of breast cancer fatalities transpire in low- or middle-income nations [2]. Studies in Iran have shown a high prevalence of breast cancer (23.6% among 39,596 patients) [3] and a relatively young average age of diagnosis (46.76 years old) [4]. Compounding this challenge, the peak age of incidence for breast cancer in Iranian women is a decade younger compared to global statistics. Over 20% of breast cancer patients in Iran are diagnosed before the age of 40 [5].

Global guidelines suggest prevention as an imperative priority and a cost-effective approach to curbing the global burden of breast cancer, particularly in low- and middle-income countries with insufficient health personnel specialized in cancer and economic and geographic barriers to breast cancer treatment [6]. Primary and secondary cancer prevention measures can effectively reduce the risk of breast cancer and facilitate early diagnosis [7]. However, Iranian women face several challenges in this regard. Among these challenges are:1) limited access to healthcare due to the high cost of mammograms and time constraints; 2) cultural factors such as misunderstandings about breast cancer risk and religious beliefs; 3) psychological factors like shame and fear of screening results [8–10]; and 4) external crises such as the COVID-19 pandemic, which have led to disruptions in screening services [11].

In the meantime, effective educational programs promote breast cancer screening and overcome socio-cultural barriers in this population according to the target group's needs [12]. The idea of providing virtual training, seeking training with different quality, usability for a large group of learners, accelerating learning, reducing costs, and increasing training efficiency have led most educational centers to use technological capabilities in providing virtual training [13]; they design web-based themes that can be implemented using mobile phones [14–16].

In recent years, there has been a significant increase in the use of the Internet and virtual education programs for accessing information on preventing, controlling, and treating oncological disorders, including breast cancer. This trend is evident in both developed and developing societies [15–18]. Numerous studies have been conducted worldwide to educate women regarding the prevention and early detection of breast cancer. Due to the global development of new communication technologies in recent years, there has been more focus on the use of virtual methods in the implementation of educational strategies to prevent breast cancer [14, 19–22], such as education in social networks (blogs, YouTube, Twitter,

and Facebook) [23], online audio, video, and written training [24], educational applications [25], and training by peer groups [26].

International researchers emphasize the significance of culturally relevant educational materials [27], shared language in a social environment, and multiple interventions for effective breast cancer screening programs [28, 29]. These findings underscore the need for a tailored approach that considers the specific cultural nuances and challenges faced by women; Furthermore, a tailored program can address cultural and social barriers that may hinder women's participation in breast cancer prevention activities [27–30].

While Studies in Iran have explored virtual educational methods [31–33], the specific needs of Iranian women within their cultural context may not have been fully addressed. This gap highlights the importance of conducting a qualitative study to delve into these unique needs. Such a study can provide valuable insights to inform the program design, ultimately empowering women with the knowledge necessary for breast cancer prevention. By addressing the unique cultural context and providing tailored information, such programs can empower women to take control of their breast health and improve outcomes. Therefore, this study employed a qualitative approach to explore the educational needs for a virtual breast cancer prevention program tailored to Iranian women.

Methods

Study design

A qualitative descriptive study was conducted from January to December 2022 at a prominent university in a large Iranian province. This research design was selected for its ability to provide a nuanced exploration of women's points of view regarding the educational needs of a virtual breast cancer prevention program [34]. In addition, we followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist in reporting our research [35].

Participants and recruitment

Purposive sampling with maximum variation was employed to recruit a diverse sample of participants. The study included: (1) healthy Iranian women aged 20–59 years with varying levels of education, (2) women with a history of breast cancer, (3) breast cancer experts (nurses, midwives, doctors, and healthcare staff from screening and mammography centers), (4) information technology experts and (5) health policymakers in cancer prevention.

A total of 28 participants were invited to take part in the study. Interviews were conducted with the participants at a location of choice in their homes or workplaces such as health centers, offices, homes, universities,

hospitals, screening clinics, and ultrasound and mammography centers.

Data collection

Semi-structured interviews relied on a guide with open-ended questions aligned with the study's purpose for women, the healthcare team, and IT experts (see supplemental information).

Examples of questions for women included:

- "What content do you think a virtual breast cancer prevention program should cover?".
- "What kind of content and delivery methods would motivate you to follow breast cancer prevention practices?"

Among the questions related to the healthcare team:

- "In your experience, what types of online content are most effective in motivating women to adhere to breast cancer prevention practices?".
- "What virtual program can help women pay more attention to their breast health?"

Interviews with IT experts explored design considerations for motivating women to engage in virtual breast cancer prevention education. During the interview, probing and clarifying questions such as "Can you explain it more?" and "Can you give an example?" were asked for deeper investigation.

Before each interview, participants were informed about the study's purpose and content, provided with an informed consent document, and allowed to ask questions. Participants were assured that their participation was voluntary and that they could withdraw at any time without consequence. Interviews lasted between 11 and 45 min, an average of 30 min. All face-to-face interviews were audio-recorded and transcribed verbatim by the lead author (NN). To ensure the accuracy of transcriptions, they were reviewed and validated by senior authors (AN & FT). After transcription, the audio recordings were destroyed. Data saturation was achieved when no new information emerged from subsequent interviews [36].

Data analysis

The collected data were analyzed using Graneheim and Lundman's 5-step content analysis approach without predetermined categories [37, 38]. This analysis approach comprised the following 5 steps:

1. Transcription: implementing the interviews' texts.
2. Meaning units: reading the interviews to gain a general understanding.

3. Abstraction: determining the meaning units and initial codes.
4. Sorting the codes: classifying similar initial codes into more comprehensive and general categories.
5. Theme formulation: introducing the categories' main themes.

The analysis was conducted by the lead author (NN), with the support of senior authors (AN & FT) who possesses extensive experiences in qualitative health research. The lead author transcribed the interviews, developed the coding framework, and generated an initial set of themes. Throughout this phase, the research team engaged in frequent discussions to analyze the data and refine the analytical approach. Initial coding emerged from the first two interviews, informing a coding template for subsequent transcripts.

Senior authors (AN & FT) reviewed the codes, categories, and initial themes to ensure their comprehensiveness, coherence, and grounding in the data. Any proposed modifications to the themes were agreed upon by all authors. To manage the data during analysis, MAX-QDA software version 2020 was used.

Trustworthiness

Guba and Lincoln's (1985) trustworthiness criteria (credibility, dependability, confirmability, transferability) guided the research [39]:

Credibility was established through prolonged engagement (11 months), member checking, and peer debriefing of codes and categories. To ensure dependability, researcher reflexivity minimized bias, and colleagues audited coding to confirm data analysis accuracy. Transferability was maximized through purposeful sampling for participant diversity (age, gender, education, etc.) and detailed reporting of research procedures with participant quotes. Confirmability was ensured through comprehensive documentation of research stages (data collection, analysis) and audit of coding by external researchers.

Results

A total of 28 participants were invited to participate in this study. Tables 1 and 2 show the participants' characteristics by women and experts.

To extract the educational needs of the virtual breast cancer prevention program in Iranian women, 11 subcategories and 3 main categories were obtained after analyzing the data, as follows: 'developing women's scientific, practical, and attitudinal capabilities,' 'features of the program content,' and 'principles of electronic content design'(Table 3).

Table 1 Demographic characteristics of women participating in the qualitative study (*N*=15)

characteristics	classification	number	percentage
Age	20–29	2	13
	30–39	3	20
	40–490	8	54
	50–59	2	13
Level of Education	Primary	3	20
	Diploma/ Secondary	3	20
	University	9	60
Marital status	Single	5	33
	married	8	54
	Divorced	2	13
Residence	City	11	73
	Village	4	27
Employment status	housewife	5	33
	employed	8	54
	Retired	2	13
History of breast cancer	No breast cancer	10	67
	Less than 1 year	2	13
	1 to 2 years	2	13
	More than 2 years	1	7

Table 2 Demographic characteristics of staff and experts participating in the qualitative study (*N*=13)

characteristics	classification	number	percentage
sex	Female	11	85
	Male	2	15
Level of Education	Bachelor's	3	23
	Master's	1	8
	PhD and above	9	69
Occupation	Health center expert	3	23
	Gynecologist and surgeon	3	23
	Social medicine specialist	1	8
	Medical education professor	3	23
	Information systems specialist	3	23

Table 3 Categories and subcategories emerged from the data analysis

Subcategories	Main Categories
Promoting women's awareness	**Developing women's scientific, practical, and attitudinal capabilities**
Improving women's skills	
Efforts to improve women's attitude	
Valid and evidence-based content	**Features of program content**
Applying motivational strategies	
Considering ethical principles	
multimedia	**Principles of electronic content design**
spatial contiguity	
cohesion and coherence	
Segmentation	
content appeal	

1- Developing women's scientific, practical, and attitudinal capabilities

A key component of a successful virtual breast cancer prevention program lies in empowering women. This empowerment is multifaceted and encompasses three subcategories: 'promoting women's awareness, improving women's skills, and 'efforts to improve women's attitudes.

1-1 Promoting women's awareness

Many participants highlighted a concerning underestimation of the importance of learning about breast cancer

prevention. This lack of awareness may contribute to some women neglecting follow-up appointments after an initial diagnosis, potentially delaying crucial monitoring and treatment interventions.

> *"The goal must make the women realize that a danger may threaten them... When women themselves are involved in training ..., it'll be easier to decrease the disease risk in them (H3, Health expert)".*
>
> *"I was negligent... If I had known it earlier..., my life would have been much longer (P2, breast cancer patient)".*

Participants identified five key areas of knowledge crucial for women regarding breast cancer: recognition of warning signs, risk factors, primary prevention methods, early detection strategies, and the potential consequences of both early and delayed diagnosis. This knowledge itself can be a motivating factor to encourage women to perform screening.

> *"A particularly illustrative case involved a 25-year-old woman with two young children who succumbed to advanced breast cancer two years after her initial diagnosis. Early detection through a simple breast examination could have potentially altered the course of her illness and improved her health outcomes" (E2, Education expert).*

Participants in the study identified a lack of awareness as a major barrier to breast cancer screening, particularly among high-risk individuals. This lack of awareness encompassed both the existence and services offered by screening and referral centers. Additionally, participants highlighted a deficit in knowledge regarding risk factors among the high-risk population, which hindered early detection efforts. To address these barriers, participants advocated for risk-stratified educational interventions. They proposed targeted training programs to bridge knowledge gaps and provide effective follow-up measures, with a particular emphasis on psychological support for high-risk women.

> *"At the very beginning of the program, identify the high-risk group and predict what training should this high-risk group receive and what training those with lower risks should receive. (H4, Genetic expert)".*

1-2 Improving women's skills
Participants emphasized the importance of incorporating several key elements into the program:

- Skill development: Training in breast self-examination techniques.
- Knowledge acquisition: Education on recognizing different types and characteristics of breast masses during self-examination.
- Prompt diagnosis: The importance of timely follow-up with diagnostic procedures upon noticing any symptoms.
- Streamlined referral system: A clear and accessible referral process within the program for further evaluation if needed.
- Self-examination adherence: The implementation of a self-examination reminder program to promote consistent practice.

> *"Consider programs that encourage women to self-exam and make them pay attention to this task, especially if it's accompanied by tracking their menses (H2, Health worker)".*

Participants underscored the significance of lifestyle modifications for primary breast cancer prevention. They emphasized the need for educational programs that equip women with strategies to: (1) Manage stress and anxiety: Techniques for stress management and emotional well-being were identified as crucial components, (2) Improve diet and physical activity: The program should address healthy eating habits and promote regular physical exercise.

Furthermore, participants highlighted the importance of tailored interventions for high-risk individuals, particularly those with a strong genetic predisposition. Educational programs should specifically address modifiable risk factors relevant to this population.

> *"An important aspect of breast cancer prevention is controlling women's stress and anxiety, especially in those who have the BRCA1 gene...., so they learn how to prevent cancer by controlling environmental factors (H4, genetic expert)".*

1-3 Efforts to improve women's attitude
This study identified three key areas for enhancing women's attitudes towards breast cancer prevention through a virtual educational program:

1) Empathy development: participants emphasized the importance of fostering empathy for breast cancer sufferers. This could involve incorporating narratives or testimonials from survivors to highlight the emotional and social impact of the disease.

> *"Ever since I saw the suffering of my sister who was diagnosed with breast cancer, especially during che-*

motherapy, I became sensitive to myself and I go for a checkup every 6 months, I read the page of the doctor ... every night and... (w2, 54 years old woman).

2) Motivation by healthcare professionals: the study suggests leveraging the influence of medical staff within the program. This could involve incorporating messages from doctors or nurses encouraging participation in screening programs.

"To change women's behavior, you need to change their attitude to succeed. One of the steps that can be useful for women is to hear about the risk of cancer from the experts (E3, Education expert)".

3) Addressing misconceptions: The findings highlight the need for the program to address common misconceptions surrounding breast cancer (such as the harmfulness of mammography, and the disease's spread during the biopsy) and its prevention.

"It is very important to dispel the fear of women for mammography. For example, they say, doctor, I go for a mammogram once a year, I see X-rays,... there is no harm, or if I take a biopsy, it won't spread? (H1, breast surgeon).

Furthermore, participants indicated the potential value of incorporating positive reinforcement strategies. This could involve showcasing success stories of women who have benefited from early detection through screening programs.

"The successful experience of peers in the screening process causes other people to follow them unconsciously. When a person explains how she has passed the situation and done it, it doesn't take long, or it doesn't cost any. It can encourage others to do more screening (E7, Education expert)".

2- Features of program content
This main category encompassed three subcategories for effective virtual program development: 'valid and evidence-based content', 'applying motivational strategies', and 'considering ethical principles'.

2-1 Valid and evidence-based content
Participants stressed content needs expert review by breast cancer specialists for accuracy and use of up-to-date resources from reputable organizations. Additionally, assessing content from the target audience's perspective (face validity) is crucial to ensure it's understandable and relevant.

"What you produce should be reviewed several times and provided to experts. One word may be very common from your point of view, but in society, that word or expression may be interpreted differently (E6, Education expert)".

2-2 Applying motivational strategies
Participants emphasized the importance of incorporating motivational strategies to enhance user engagement in the virtual program. Key strategies identified included: tailoring content to diverse learning styles such as utilizing various media formats (e.g., videos, infographics), novelty and interactivity such as employing creative content presentation methods (e.g., scenarios) and reinforcement and reminders such as implementing reward systems for active participation and incorporating educational reminders.

"To change women's behavior, you have to change their attitude and sensitize them by showing the consequences of the disease and the following problems. It can be a story by a patient who would say (E4, Education expert)".

2-3 Considering ethical principles
Participants emphasized the paramount importance of adhering to ethical principles throughout program development. This includes ensuring responsible and ethical use of all visual content, encompassing images, replicas, and moulages. Furthermore, strict measures must be implemented to safeguard user privacy during video content creation and dissemination.

"You have very good pictures that are even on replicas or moulages, and you can display them with no ethical problem; your cultural context accepts it and has no limits (H3, Heath expert)".

3- Principles of electronic content design
This main category consisted of five subcategories: observing principles of 'multimedia', 'spatial contiguity', 'cohesion and coherence', 'segmentation', and 'content appeal'. This main category involves the principles and topics related to electronic content design. By adhering to these principles, virtual program developers can create engaging and user-friendly experiences.

3-1 Multimedia
The participants in the present study mentioned the observance of the multimedia principle, including the simultaneous presentation of images and words to create

mental, verbal, and visual patterns and establish communication between them, as one of the principles of electronic content design.

"We can upload the content in various types, in a voice, text, or image, so that the audience can use whichever they wish (w5, Information systems specialist)".

3-2 Spatial contiguity

One of the other issues raised by the participants was observing the principle of spatial contiguity, including using strategies for mental recovery, particularly the placement of words and images simultaneously and adjacently.

"You must bring the content in such a way that there is a complete connection between the images and the written text. Not that the text says one thing and the image another (H2, Health worker)".

3-3 Cohesion and coherence

Ensuring the learners' familiarity with the main and key concepts and features of the educational subject, presenting key contents and general plan of the content parts, establishing a connection between the presented images and the educational objectives, and considering the appropriate time to present the contents were among the issues raised by participants in order to observe the principle of cohesion and coherence.

If you are going to present a topic in two or more media, you must have a specific map that shows each section in what way or ways you want to show it (E4, Education expert).

3-4 Segmentation

Presenting the content in short (micro-learning) based on the segmentation principle was another issue that the participants emphasized. Dividing the content into smaller sections can assist the comprehensibility of the presented content and allow the audience to select parts of the program's content based on their needs.

Microlearning should be used,... while the content should be presented in a related manner and in different sections, so that it is clear that the woman wants to receive only a part of the content... (H3, Education expert).

3-5 Content appeal

The program participants emphasized following the principles to create more appeal in the program's content. Refraining from excessive use of written text and using movies and animations to provide better learning, using polite conversational phrasing and expression instead of formal style, and emphasizing the visual content presentation were among other imperative issues.

"It should be in such a way that when the audience opens it, it attracts her.... Most of the images should be used. Content should be in large font. It repeatedly guides you to enter the next content step by step (W9, 45 years old woman).

Discussion

In the present study, participants pointed out that one of the foremost components in designing a virtual breast cancer prevention program was the need for scientific, practical, and attitudinal empowerment of women regarding breast cancer prevention. The present study, along with previous research [40–43], highlights significant challenges women face regarding breast cancer prevention. These include low awareness of preventive methods and the presence of false health beliefs. For example, Zahnd et al. (2019) found that lack of awareness and misconceptions were key obstacles to screening among Black women in the US [44]. The study by Hasani et al. (2023) further emphasizes the critical role of cultural sensitivity in program design [40]. Their research with Iranian women identified low awareness of breast cancer risk factors as a key barrier to self-care. This finding aligns with the concerns raised by participants in our study regarding the inadequacy of existing information sources (media and written health information). These limitations, as noted by participants, hinder women's ability to take an active role in their health and healthcare decisions [45]. Therefore, it is concluded that the importance of adapting breast cancer prevention programs for different communities and populations, particularly addressing cultural contexts, is unavoidable.

Participants in the present study emphasized the importance of developing evidence-based materials for the virtual breast cancer prevention program. This aligns with the findings of Wollmann et al. (2021) who reviewed the information needs of online healthcare users [46]. Their study highlighted that users value accurate and fact-based information with clear attribution of sources.

Both our study and Wollmann et al. (2021) emphasize the importance of providing non-contradictory information presented in a balanced and neutral format. This ensures users receive reliable and trustworthy information that weighs the risks and benefits of various

interventions.In the study by Wollmann et al., the non-contradiction of information in a balanced and neutral format was emphasized by experts, while the present study also recommended the use of evidence-based electronic content design principles. Overall, it is concluded that by prioritizing the use of evidence-based information and user-centered design principles, virtual breast cancer prevention programs can effectively educate and empower Iranian women to make informed decisions about their health.

The present study and previous research (e.g., Wollmann et al., 2021) highlight the importance of building user trust in virtual breast cancer prevention programs. Several studies indicate that users are wary of websites that use exaggerated language (e.g., miracle cures, exciting news) [47, 48]. This suggests that virtual programs should avoid sensationalized claims and focus on providing clear, concise, and objective information. A 2022 review by Zhang et al. examining the impact of health information framing on user trust highlights the negative effects of exaggerated language on user perception [49]. This aligns with the concept of information credibility, which is essential for building user trust. Virtual programs should strive to present information that is: (1) accurate and evidence-eased, (2) transparent (Clear about the sources of information and any potential biases) and (3) authentic (presented in a genuine and trustworthy manner). Incorporating interactive resources can further enhance user trust and engagement. This might include features such as: quizzes and self-assessments, Q&A sections with healthcare professionals and personalized risk factor calculators [49–51].

However, in the present study, the participants' lack of trust in websites with miraculous cures or exciting news, which resulted in users' suspicion of health information, was taken into account. Therefore, it is concluded that by prioritizing credibility, transparency, and interactivity, virtual programs can foster a sense of trust and empower women to become active participants in their breast health education.

The present study underscores the critical role of sensitization in designing effective breast cancer education programs for women. Participants highlighted the lack of accurate understanding regarding breast cancer and the importance of timely screening referrals. This finding aligns with previous researches [52, 53] that identifies negligence and limited understanding of breast cancer risks as significant barriers to screening among Iranian women. They believed that most women lacked an accurate understanding of breast cancer and the importance of timely referral for screening. In several studies, negligence [10, 54] and lack of understanding of the risks and complications of breast cancer [55, 56] have been mentioned as obstacles to screening and self-care to prevent

this disease. According to the health belief model, in order to perform health behavior, individuals need first to perceive the threat of the problem (perceived susceptibility), then understand the severity of the threat and the seriousness of its complications (perceived severity) and with the positive signs received from the environment (practice guide), believe its usefulness and feasibility and take action; therefore, to educate women, they should be sensitized about the risk of breast cancer [57, 58]. Some studies have mentioned that to sensitize women, the six constructs of the health belief model, including severity and seriousness of breast cancer (for instance, side effects of treatment or mortality rate), susceptibility (prevalence and mortality rate), benefits (benefits of a preventive method or early diagnosis), and barriers (self-care challenges or treatment barriers) should be included in educational programs for breast cancer prevention [59].

The present study participants emphasized the crucial role of specialists and healthcare workers in sensitizing women about breast cancer. They highlighted the importance of healthcare professionals introducing the risk factors and the necessity of screening. This aligns with findings by Thomas et al. [45] who identified limitations in patient education within the Iranian healthcare system due to overcrowded clinics. Their study suggests that time constraints often lead to superficial information exchange, and many doctors don't encourage routine examinations. Consequently, women may not be aware of their rights or the importance of preventive measures.

The importance of effective communication between healthcare providers and women is further supported by Peterson et al. (2016) systematic review [60]. Their analysis demonstrates that clear communication regarding the significance and necessity of screening increases women's participation in breast cancer screening programs. However, effective communication goes beyond simply encouraging or recommending screening. As Peterson et al. (2016) emphasize, it's vital to: (1) discuss the importance and necessity of screening with the patient, (2) identify potential barriers to screening faced by the patient, (3) explain the various screening methods available and (4) involve the patient in the decision-making process regarding screening.

By acknowledging the critical role of healthcare professionals and implementing effective communication strategies, virtual breast cancer education programs can be further strengthened. Encouraging open dialogue between women and healthcare providers can empower their to overcome existing barriers and make informed decisions about their breast health. This collaborative approach, coupled with the educational elements of the virtual program, can significantly contribute to increased awareness and participation in breast cancer screening programs among Iranian women.

In this study, the participants believed that in order to enhance the efficiency of education, the principles of electronic content design, including multimedia, spatial contiguity, cohesion and coherence, segmentation, and content appeal, should be observed. Hillen, quoted by Nigman, has taken into account six elements in designing education based on multimedia tools, which include structuring the content, using educational media, paying attention to the layout and appearance of the software and website, motivating learners, and respecting ethical principles. These elements must be taken into consideration in the design and production of virtual education content. In the design of electronic content, it is recommended to use multimedia tools and scenarios to create situations similar to real situations and guide learners to cognitive clinical levels. Using practical examples, applying cognitive strategies such as repetition and practice, highlighting important content, elaboration (summarization and visualization), organization (conceptual mapping and framing of content), and emphasizing the principles of adaptive learning in effective education for the students are recommended. Moreover, in designing electronic content, compliance with intellectual property rights is also important [61]. In 2021, a study was conducted by Syed Younes to investigate the effectiveness of using e-learning adapted to artificial intelligence during the COVID-19 pandemic on the development of creative skills for designing digital content among students. This study showed that strengthening various cognitive and functional aspects of learning and maximizing creative skills for designing digital content could lead to optimal learning [62]. The results showed that in both studies, the importance of virtual education and digital technologies in improving individuals' knowledge and awareness of health have been emphasized despite being investigated in two different population groups. Therefore, it is inferred that virtual education and e-learning can be practical tools for developing skills, enhancing awareness, and increasing individuals' performance in different fields. For the optimal use of these methods, it is of particular importance to follow the principles of electronic content design and adapt them to the purpose of education.

Conclusions

This study contributes valuable insights into the educational needs of Iranian women for designing effective virtual breast cancer prevention programs. The findings highlight the importance of addressing all three learning domains: cognitive (knowledge), emotional (attitudes, beliefs), and psychomotor (skills). To achieve optimal effectiveness, virtual programs should incorporate content across these domains, utilizing appropriate methods to sensitize women, motivate continued program engagement, and address misconceptions and negative attitudes. Additionally, the program's content and design should be evidence-based and tailored to the cultural context of Iranian women, adhering to best practices for electronic content design.

Furthermore, the program's design can be adapted for use in communities with similar cultural, social, and economic structures beyond Iran. Sharing these findings and the resulting virtual program with healthcare officials within the Iranian Ministry of Health and Medical Education could contribute significantly to national efforts in improving women's health and breast cancer prevention awareness.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12905-024-03392-6.

Supplementary Material 1

Data availability
The datasets generated and/or analyzed during the current study are not publicly available due to the principle of confidentiality in qualitative studies but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval for this study has been obtained by the ethics committee affiliated with Isfahan University of Medical Sciences, Isfahan, Iran (no. IR.MUI.NUREMA.REC.1400.174). Informed consent was obtained from all study participants. For illiterate study participants, informed consent was obtained from their legal guardians.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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