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DELPHI STUDIES

A Delphi study of digital health consensus for improving quality of life among Indonesians with breast cancer

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Abstract
Women with breast cancer in developing countries, such as Indonesia, frequently face high rates of disability and premature death. This is often attributed to delayed diagnosis and limited access to quality care. Consequently, digital health solutions offer promising opportunities to improve clinical outcomes and overall quality of life. However, less consensus exists regarding effective strategies for improving quality of life specifically among patients with breast cancer. This study aimed to identify essential digital health interventions that support holistic nursing care. Furthermore, it sought to assess expert consensus on the feasibility and potential impact of these interventions. To achieve these aims, a two-round Delphi method was employed. This method facilitated the gathering of expert consensus on digital health interventions designed for breast cancer support. The study actively involved 23 experts and 165 stakeholders. Their contributions helped to shape and finalize a comprehensive digital intervention model. This model encompassed psychological, physical, spiritual, and care support domains. Researchers then utilized content analysis to identify key themes emerging from the expert input. Following this, interquartile range (IQR) and median scores were applied to determine the level of consensus. The consensus process identified key domains for digital health interventions. Notably, these domains align with the principles of holistic nursing, including physical, psychological, spiritual, and social dimensions, alongside application usability requirements. Consensus was reached across all dimensions with the exception of the sexuality-related sub-domain. Moreover, experts achieved a general consensus on key intervention areas. However, lower-rated aspects revealed more varied opinions among the experts. Clinical nurses contribute to integrate their clinical insights and emphasizing patient-centered care. Future research should prioritize the development of culturally adaptive and user-friendly applications. Finally, conducting rigorous trials will be crucial to assess the actual impact of digital health interventions on patients' quality of life.

Keywords: Breast cancer, Delphi study, digital health, quality of life, supportive care

Introduction

Breast cancer represents a significant global health concern affecting women (Giaquinto et al., 2024). As the most frequently diagnosed cancer among women, it also stands as a primary cause of cancer-related mortality (Łukasiewicz et al., 2021; Smolarz et al., 2022). Breast cancer is a major global health issue and the second most common cancer, with approximately 2.296.840 new cases diagnosed in women in 2022 (World Cancer Research Fund, 2024). Early detection and treatment advances have improved survival rates, with about 7.8 million women surviving at least five years post-diagnosis (World Cancer Research Fund International, 2024). However, challenges persist, especially in low- and middle-income countries with rising incidence rates (Sung et al., 2021). Continued research and interventions **(Figure 1)** are essential to address these disparities and reduce the global burden of breast cancer (World Cancer Research Fund, 2024). According to the World Health Organization (WHO), breast cancer in Indonesia is the most common that constituting 16.2% of cases (about 66.200), followed by lung cancer at 9.5% (approximately 38.900 cases) (Bray et al., 2018). Indonesia has one of the highest cancer patient numbers globally, with about 408.000 diagnosed cases and nearly 242.000 cancer-related deaths reported in 2022 (Badan Pusat Statistik, 2023). The diagnosis and treatment of breast

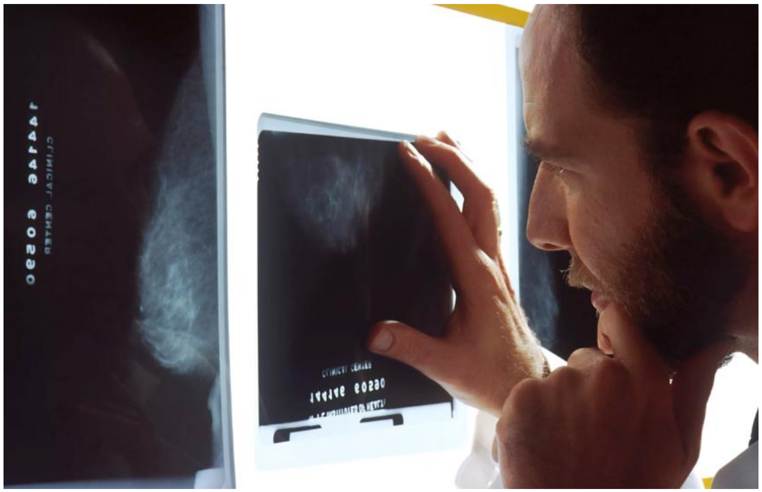

Figure 1. Illustration of breast cancer assessment (Courtesy of www.unsplash.com).

cancer can lead to various challenges, including physical symptoms, emotional distress, changes in body image, and disruptions in daily life. These challenges can have an impact on the health-related quality of life for patient with breast cancer (Gao et al., 2023; Biparva et al., 2024).

Women diagnosed with breast cancer face challenges during and after treatment, including high rates of disability from disease progression and the effects of chemotherapy (Kedida et al.,2024). Many survivors experience chronic pain lasting up to three years, particularly in the upper extremities, as well as lymphedema, which affects 14-54% of survivors (Meilani et al., 2022). Psychological challenges are also common, with anxiety and depression stemming from fear of recurrence (Piroth et al., 2022). One in three women reports anxiety disorders more than five years after diagnosis (Bradbury et al., 2019). These psychological issues can create a cycle that weakens health and relationships (Obrero-Gaitán et al., 2022). It is crucial to develop a holistic supportive intervention that reduces negative emotions and improves coping mechanisms regarding disease progression and relapse risk (Badaghi et al., 2024). Developing countries have much higher rates of premature mortality due to delayed diagnosis, limited access to therapeutic services, and a lack of quality treatment and care (Mao et al., 2022). Digital health is a promising option that's being used more and more in healthcare (Siegler et al., 2021). Technology can improve care by enhancing patient-provider communication and encouraging patients to take an active role in their care (Tofighi et al., 2018).

Study shows that digital tools like mobile apps and websites with health education and relaxation exercises can improve quality of life (Çınar et al., 2021). Physical activity content through video games and sports can reduce pain and improve the quality of life for breast cancer patients (Dong et al., 2019). Aerobic exercise and resistance exercise can increase muscle strength in the hands (parallel to the mastectomy area), improve quality of life, and reduce pain (Uhm et al., 2017). Mindfulness through mobile applications can improve quality of life and mental health (Rosen et al., 2018; Spijkerman et al., 2016). A previous study in Brazil used the Delphi technique to validate a breast cancer-related lymphedema app, but mainly consulted experts, not patients (Pacheco et al., 2024). While expert perspectives are valuable, the absence of patient feedback may limit the app's usability and relevance in real-world settings. Additionally, the study emphasized content validation, potentially overlooking critical factors such as functionality, user experience, and technical performance. These limitations highlight the need for future Delphi-based research to incorporate both expert and patient perspectives, ensuring the development of digital health interventions that are not only evidence-based but also user-centered and practical for long-term use. This study employs the Delphi method to reach a consensus among healthcare experts and patients' preferences for holistic digital health strategies for improving quality of life among patient with breast cancer in Indonesia. Integrating a concept of holistic practice is also important in this study. A holistic practice approach emphasizes comprehensive care that extends beyond managing physical symptoms to emotional, social, and spiritual well-being (Thornton, 2019). The holistic nursing paradigm emphasizes caring for the whole person - body, mind, and spirit - within their social and cultural context, integrating concepts of person, health, environment, and nursing (Jasemi et al., 2017).

When applying to digital health, the holistic approach guides the development of interventions that support physical, psychological, social, and spiritual well-being (Welzel et al., 2023). Digital tools like telemedicine, mobile apps, and self-care platforms improve patient education, communication, and quality of life for patient with breast cancer (Ciria-Suarez et al., 2022; Obrero-Gaitán et al., 2022). Despite these advancements, a critical gap remains in understanding how digital health interventions can be effectively incorporated into nursing practice while aligning with holistic care principles. Therefore, the present study aims to identify essential digital health interventions that align with the principles of holistic nursing, assess expert consensus regarding their feasibility and impact, and develop recommendations for integrating these interventions into holistic nursing practice. Integrating digital innovations within nursing practices can improve patient-centered care and enhance the well-being of patient breast cancer in Indonesia. The rationale for exploring expert perspectives is to ensure that digital health interventions are feasible and impactful in real-world clinical contexts (Nasa et al., 2021; Sforzini et al., 2022). It is hoped that the findings of this study can provide valuable insights for the development and implementation of effective digital health interventions for Indonesian with breast cancer.

Method

This study employed a two-round modified Delphi method involving healthcare experts and patients with breast cancer. Patients were included as key stakeholders to ensure that the digital health interventions reflected clinical feasibility and real-world relevance and acceptability. These patients were recruited from the cancer unit of the Bandung District General Hospital. This approach aligns with recommendations from recent literature that emphasize the importance of patient involvement in Delphi studies when the outcomes directly affect their care and experiences (Barrington et al., 2021; Khodyakov et al., 2020; Staniszewska et al., 2017). Patient involvement in Delphi panels enhances the final intervention's relevance, usability, and patient-centeredness. As end users, patients bring lived experiences critical for evaluating the real-world practicality of digital health tools. This inclusive approach has been increasingly adopted in healthcare research and is considered best practice in developing interventions and core outcome sets (Jünger et al., 2017). The Delphi method generally requires 10 to 25 participants (Naisola-Ruiter, 2022; Sforzini et al., 2022). This study included 23 experts which is sufficient for consensus saturation (Keeley et al., 2016). The experts included nurse educators from nursing institutions, mental health nurses, and clergy from the cancer unit of the Bandung District General Hospital **(Figure 2)**. Purposive sampling was used during study. Inclusion criteria included at least one year of experience with breast cancer care in hospital and knowledge of health technology. The only exclusion criterion was unwillingness to participate. For participants from stakeholders, purposive sampling was also used. The sample size was calculated using G*Power with an α of 0.05 and power of 0.95, requiring 138 participants. The sample was increased by 20% to 165 to allow for dropouts (Bujang, 2021). Inclusion criteria were a confirmed breast cancer diagnosis and the ability to use digital devices. Patients with disease-related complications were excluded.

The first round of the survey included baseline information derived from a literature review on digital interventions for supportive care in patients with breast cancer and a survey with open-ended questions. The questions are what are the main symptoms experienced due to the disease and the treatments administered? How does the disease affect the patient's feelings, thoughts, social relationships, spirituality, and daily activities? What kind of support does the patient need, particularly in the form of a digital health application?. Additionally, this initial phase served as an introduction to the study that allowing respondents to familiarize themselves with its objectives and procedures. Participants were also allowed to review and sign the research consent form before completing the survey. Upon providing consent, they completed demographic data collection, which included details such as field of practice, discipline, years of experience, age, gender, education level, and religious affiliation. During the first round of the survey, researchers invited participants from experts to respond to a series of open-ended questions. The questions are what is your approach to supporting the quality of life for breast cancer patients? What suggestions do you have for developing features of a digital intervention application that would support breast cancer patients?. Participants provided their perspectives on key areas, including psychological support, health systems and information, physical needs and daily activities, sexual health needs, patient care and support needs, spiritual needs, and the overall application of digital interventions. The collected responses were analyzed to develop items for ranking in the second round, with experts and stakeholders.

Figure 2. Data collection process by experts (Documented by authors).

The second round of the consensus-building process focused on achieving a shared understanding among experts, practitioners, and stakeholders regarding the components of the digital health intervention model. This collaborative effort culminated in a consensus that leading to the formulation of the final model for digital health intervention as a supportive therapy for patients. Participants received a survey link via email for each round, and data were collected through the Google forms electronic platform. To ensure timely responses, participants were given two to three weeks to complete each round, with two follow-up reminder emails sent at the beginning of each week. While data were collected via forms, several steps were taken to enhance the validity and minimize bias. First, participants were selected through purposive sampling based on clear inclusion criteria to ensure relevant expertise. Second, anonymity was maintained throughout both Delphi rounds to reduce social desirability bias and encourage honest, independent responses. Third, all participants received standardized instructions and definitions to ensure a consistent understanding of the items. Lastly, responses were analyzed using objective statistical methods (e.g., interquartile range (IQR) and median scores) to identify consensus then further reducing the influence of individual bias.

The research instrument was designed based on the findings from the initial round of the Delphi study. Based on the consensus results, this element may be adjusted—either included or excluded. The responses are assessed using a Likert scale with five levels: (1) unnecessary, (2) unimportant, (3) desirable, (4) important, and (5) very important. This scale is utilized to determine the urgency or priority of a variable, sub-variable, or concept within a study or evaluation (Jones et al., 2021). The following explains each level of the scale. Unnecessary refers to the element is deemed irrelevant or entirely non-essential. Respondents perceive that it does not contribute and can be omitted without any adverse impact. Unimportant refers to the element is considered to have minimal relevance. While it may offer some benefits, they are not substantial, and its exclusion is unlikely to affect the overall outcome. Desirable refers to the element is regarded as beneficial and a valuable addition, though not essential. Its inclusion is seen as enhancing value or effectiveness, but it is not strictly necessary. Important refers to the element is considered relevant and crucial. Its presence is deemed significant for achieving the intended objectives or outcomes, and its absence may hinder success or compromise the results. Very Important refers to the element is highly relevant and indispensable. Its inclusion is essential for ensuring the achievement of the desired goals or results, and its absence could lead to failure or diminish success.

The first round of data analysis employed content analysis, following a structured approach. First, researchers engaged in data familiarization by thoroughly reading transcripts and reviewing notes to gain a comprehensive understanding. Next, they defined the unit of analysis, determining what specific domains within the data would be examined. Following this, a coding scheme was developed to categorize the data systematically. Finally, researchers identified themes and patterns, allowing for meaningful interpretation and insight into the findings. This step-by-step process ensured a rigorous and structured analysis of the qualitative data (Elo et al., 2014). Consensus was determined using the IQR which measures the variability of responses by calculating the difference between the 25th and 75th percentile scores (Everink et al., 2020). The consensus among participants was evaluated using measures of dispersion, specifically standard deviation and IQR for each numerical variable (Naisola-Ruiter, 2022; Vestjens et al., 2015). Lower dispersion values indicated a higher level of agreement among participants. If the IQR of an element model was ≤1 and the median score was 4 or 5, the element was deemed important and included in the final set of digital health interventions. Conversely, if the IQR was ≤1 and the median score was 1 or 2, the element was considered unimportant and subsequently excluded (Everink et al., 2020). In cases where the IQR was ≤1, and the median score was 3, participants appeared neutral regarding the importance of the element model. To resolve this, the percentage distribution of ratings was examined. If more participants were assigned a score of 4 or 5 compared to those who rated it as 1 or 2, the element was included in the final set of digital health interventions. However, if the percentage of participants assigning a score of 1 or 2 exceeded those rating it as 4 or 5, the element was excluded from the final model (Everink et al., 2020). Ethical approval was obtained from the Ethics Committee of Universitas 'Aisyiyah Bandung (No.1142/KEP.01/UNISA-BANDUNG/XII/2024).

Results

This study included a total of 188 participants comprising nurse practitioners, nurse educators, psychologists, technology and multimedia experts, clergy, and patients with breast cancer. The study included 165 patients with breast cancer, primarily in the early elderly (38%) and late adulthood (30%) age groups. Most participants completed senior high school (38%), elementary school (27%), and 67% earned below the regional minimum income. Nearly all participants (99%) identified as Muslim. Cancer was most commonly diagnosed at Stage II (39%) and Stage III (36%), with 44% having the illness for 1–2 years. These findings highlight a predominance of middle-aged individuals, with lower economic backgrounds, and advanced-stage diagnoses, emphasizing the need for healthcare support and socioeconomic interventions for this patient population **(Table 1)**. The table also shows the majority of practitioners and experts were professionals with diploma-level education. Nurse practitioners made up the largest group, highlighting their central role in patient care. The presence of nurse educators, psychologists, technology experts, and clergy suggests a multidisciplinary approach to cancer care. The equal gender distribution reflects diversity, while the uniform religious affiliation aligns with the broader demographic context **(Table 2)**.

In this round, data was collected through open-ended questions focusing on the domains of a digital health intervention model. A total of 23 experts and practitioners participated in responding to these questions. Categories that will serve as sub-domains of the model and themes that will constitute the model's main domains. The qualitative analysis of survey data from table, collected through open-ended questions, identified 21 categories and 6 overarching themes. These findings serve as the foundation for developing the model's domains and sub-domains, which will be further reviewed and validated by practitioners, experts, and stakeholders in the second round **(Table 3)**. In the second round of the Delphi method, researchers refined the domains and sub-domains of the digital health intervention model based on findings from the first round. These were then presented to practitioners, experts, and stakeholders for review. The table presented the domains of digital health intervention supportive therapy for patients with breast cancer, including psychological support, physical and daily activities, spiritual-social support, health systems and information, and the overall application of digital interventions. The presence of these domains indicates that digital health applications can be designed holistically, aligning with the comprehensive paradigm of nursing care as needed by patients with breast cancer in Indonesia **(Table 4)**.

The calculations for the mean, standard deviation (STD), and IQR are presented. The analysis shows a strong negative correlation (-0.93, $p < 0.001$) between mean scores and STD, meaning higher scores had more agreement, while lower scores showed more variability. Mean scores were negatively skewed (-2.14), indicating most responses were high, with a few lower values. STD scores were positively skewed (1.66), suggesting general consistency but some disagreement in certain responses. Kurtosis (4.13 for Mean, 2.13 for STD) indicates peaked distributions with some extreme values. Overall, respondents largely agreed on highly rated questions, while variability increased for lower-rated ones. This suggests a strong consensus on key aspects **(Figure 3)**. Then another figure shows some disagreement in certain responses. Questions Q10 and Q11 have noticeably lower mean scores, Q10 (Mean=3.46, STD=1.05) and Q11 (Mean=3.43, STD=1.04) are identified as outliers which fall below the consensus threshold. This indicates disagreement or mixed opinions among respondents for these questions. The high-consensus questions (green) can be confirmed as widely accepted. Q10 and Q11 need further exploration—potential reasons could include ambiguity in wording, differing perspectives, or controversial content for further study. In this study, Q10 and Q11 would be excluded from the domains **(Figure 4)**.

Discussion

The first round of the Delphi study identified the domains and sub-domains of a digital health intervention model in the form of a mobile application. This model encompasses a holistic intervention approach, addressing physical, psychological, spiritual, and social dimensions, along with application usability requirements to ensure accessibility across different age groups. The findings indicate a general agreement among stakeholders on the acceptance of digital health interventions as a comprehensive supportive therapy. These findings align with prior research emphasizing digital health's role in enhancing self-management and overall health outcomes (Obrero-Gaitán et al., 2022; Pimentel-Parra et al., 2023). However, In the second round of the study, consensus was not reached among practitioners, experts, and users regarding the sub-domain of physical support, specifically concerning sexual health. These results may be attributed to cultural norms in Indonesia, where discussions on this topic are often considered sensitive or taboo (Arnez, 2024). Conservative cultural norms in countries like Malaysia, Iran, and Afghanistan contribute to the stigma surrounding sexual health, mirroring similar challenges faced elsewhere (Bamik, 2018; Khalaf et al., 2014; Roudsari et al., 2013).

Sexuality remains a taboo subject in Eastern cultures, particularly in Indonesia, where open discussions on this topic are often avoided. In Indonesia, discussions about sexuality are often suppressed due to religious values, social conservatism, and the perceived inappropriateness of such topics especially among women (Baas, 2019; Platt et al., 2018). Individuals frequently experience discomfort, uncertainty, and embarrassment when engaging in these conversations (Arnez, 2024). Studies highlights that Indonesian society experiences difficulty in addressing sexual issues that often expressing confusion and apprehension when engaging in such discussions (Nurachmah et al., 2018; Situmorang, 2024). This reluctance reflects broader cultural norms in Eastern societies, where conversations about sexuality are generally considered inappropriate or sensitive (Baas, 2019; Platt et al., 2018; Arnez, 2024). Similarly, sex education in Indonesia is predominantly entrusted to teachers or religious leaders, while families seldom engage in such discussions (Solehati et al., 2021). As a result, conversations about sexuality are rarely expressed in social settings, contributing to a lack of open discourse on the subject. This contributes to a broader cultural silence that limits the inclusion of sexual health in clinical care discussions. In this context, the involvement of nurses is critical in supporting open conversations (Azar et al., 2022). As frontline health professionals, they are positioned to introduce culturally sensitive education, offer empathetic support, and promote holistic care such as sexual health (Lu et al., 2022). With appropriate training and support, nurses can help normalize sexual health concerns and empower patients to seek guidance in a safe and respectful environment (Jamshidi et al., 2025).

The patient group in this study displays variability in demographics, education, socioeconomic status, illness stage, and duration. Similarly, the sociodemographic profiles of participants within the practitioner and expert groups exhibit considerable variation. Nevertheless, a predominant religious affiliation exists, primarily among Muslims. Religion can shape patient perspectives on illness, healing, and health behaviors. While religious norms may reinforce taboos around sexuality, they can also foster a sense of meaning, spiritual resilience, and a holistic view of health when integrated appropriately (Koh, 2018; Ubale & Abdullah, 2015). A consensus necessitates acknowledgment of various domains—physical, psychological, social, and spiritual—alongside requisite application criteria. Achieving consensus in a Delphi process requires comprehensive evaluation across all health domains: physical (Physical and daily activities), psychological (managing negative emotions), social, and spiritual support, including Short motivational life lectures, Stories and lessons from cancer survivors, and daily motivational quotes for cancer patients. Furthermore, the mobile applications meet user needs in daily life. Our findings are consistent with studies above that highlight the influence of health literacy, perceived usefulness, and personal relevance on digital health adoption. Also, these observations corroborate prior research indicating that digital health acceptance is shaped by individuals' understanding of their condition and treatment and their overall health awareness (Birkmeyer et al., 2021; Kwee et al., 2022). Additional acceptance factors include engaging and personalized content, social networking capabilities, and a secure, user-friendly interface (Birkmeyer et al., 2021; Kwee et al., 2022).

Table 1. Characteristics of patients with breast cancer.

Profiles	Frequency (n)	Percentage (%)
Age		
Late teens 17 – 25 years	2	1%
Early adulthood 26 – 35 years	12	7%
Late adulthood >35 – 45 years	49	30%
Early elderly >45 – 55 years	62	38%
Late elderly >55 years	40	24%
Education		
Elementary school	45	27%
Junior high school	34	21%
Senior high school	62	38%
College	24	14%
Economic Status		
Less than the regional minimum income	110	67%
Equal to the regional minimum income	44	27%
More than the regional minimum income	11	6%
Religion Affiliation		
Islam	164	99%
Christian	1	1%
Cancer Stages		
Stage I	37	22%
Stage II	64	39%
Stage III	59	36%
Stage IV	5	3%
Illness period		
<1 years	53	32%
1-2 years	73	44%
>2 years	39	24%

Nurses can facilitate these outcomes by guiding patients in digital literacy, encouraging engagement, and offering continuous support (Alotaibi et al., 2025; Pal et al., 2023). Though most digital health studies have primarily focused on technological and individual aspects, limited attention has been given to other health-related factors, levels, and theoretical frameworks (Aljohani & Chandran, 2021). Additionally, there has been a lack of consideration for the cultural context under examination as mentioned by Aljohani & Chandran's study. In contrast, our findings suggest that within the Indonesian context, digital health content should prioritize the dissemination of health information and adopt a holistic approach to overall health status with integrating local cultural values. Nurses educate and promote holistic health by integrating physical, emotional, social, and spiritual care, while respecting local cultural values to ensure effective communication and community engagement in health promotion. (Nair & Adetayo, 2019; Tosun & BENEFITS Group, 2021).

Table 2. Characteristics of healthcare professionals.

Profiles	Frequency (n)	Percentage (%)
Age		
<30 years	7	30%
30-35 years	8	35%
>35 – 40 years	3	13%
>40 years	5	22%
Education		
Diploma	10	43%
Bachelor	5	22%
Magister	6	26%
Doctor	2	9%
Profession		
Nurse practitioners	14	60%
Nurse educators	3	13%
Psychologists	2	9%
Technology and multimedia experts	2	9%
Clergy	2	9%
Work experience		
≤ 5 years	12	52%
5 - 10 years	5	22%
>10 years	6	26%
Gender		
Female	10	43%
Male	13	37%
Religious Affiliation		
Islam	23	100%
Christian	0	0%

A scholarly agreement in this study has developed concerning the importance of particular dimensions within the scope of breast cancer patients. These dimensions cover physical, psychological, spiritual, and social aspects. They also include usability criteria for apps, with 19 categories and 5 themes that enhance self-management skills. Following prior investigations conducted in Iran that established a mobile application aimed at self-management, encompassing five principal themes: information acquisition, lifestyle regulation, psychological governance, symptom alleviation, and adaptability to change (Mohammadzadeh et al., 2022). Previous research findings align with this study's results, indicating various domains of supportive therapy for breast cancer patients (Obrero-Gaitán et al., 2022; Suhayono et al., 2020). Psychological support may include relaxation techniques (Çınar et al., 2021). Psychoeducational methods and strategies rooted in cognitive or behavioral therapy (Ardizzone et al., 2022). Social support to enhance breast cancer patients' quality of life can be facilitated through various communication platforms, such as chat services, telephone consultations, group meetings, and internet-based video conferencing (Tan et al., 2023).

Table 3. Qualitative data analysis.

Comments	Categories	Themes
"There needs to be more educational content about emotional control in short video content or short text"	Control negative emotions	Psychological support
"Intervention support through self-therapy supports the patient's psychological health"	Self-help education in writing and video	
"The provision of assistance in the form of reinforcement of self-image and the facilitation of the fulfillment of sexual needs"	How to fulfill sexual needs	Sexual need support
"The mobile application customizes information about sexual needs based on the patient's age and relationship status, ensuring personalized support and relevant resources"	Sexual needs according to age	
"In Indonesia, religious sermons are regarded as a form of spiritual enrichment, a practice that is recognized and embraced by various religious traditions"	Religious sermon	Spiritual support
"Including a daily motivation section would be beneficial for encouraging and uplifting users in their daily lives"	Daily Motivational Quotes	
"These stories contain the wisdom of life and tales of survival".	Positive stories	
"Education on the disease, and the cancer trajectory should be provided to enhance patient awareness and self-care"	Information about cancer	Daily activities support
"Guidance on diet and nutrition for cancer patients should be included to help families provide proper nutritional support at home"	Information about diet/nutrition	
"The application should include practical recipes for healthy meals tailored to the nutritional needs of cancer patients"	Menu and recipe information	
"Breast cancer patients undergoing treatment should engage in the following suitable sports"	Types of exercise for cancer patients	
"Health education should be provided in an audiovisual format to enhance engagement and accessibility for patients"	Information accompanied by video	
"The application should provide comprehensive information on pain management and cancer treatment to support patient care and decision-making"	Cancer treatment	Patient care and support needs
"The application should include information on the signs and symptoms of treatment side effects, along with guidance on what patients and families should do to manage them effectively"	Dealing with the side effects of treatment	
"The application enables seamless communication between patients, families, and healthcare professionals for better support and care coordination"	Communication with health professionals	
"The application includes a communication forum for cancer survivors to connect, share experiences, and support one another"	Peer group	
"The application features a simple and user-friendly menu for easy navigation"	User-friendly and simple to navigate	Requirements for mobile application
"The mobile application comes with clear instructions on how to use it"	Guidelines for use	
"The mobile application includes daily activity monitoring, tracking both physical progress and mental-spiritual well-being"	A daily monitoring menu	
"The application includes a help menu for user support and guidance"	A help menu	
"The application ensures data confidentiality, providing a safe and ad-free experience for users' comfort and security"	Safe and comfortable	

Table 4. Instruments results from Delphi's first round.

No*	Questions	Dimensions
Q1	Strategies for independently managing negative emotions such as worry, fear, and anger	Psychological support
Q2	Managing negative emotions through written and video formats	
Q3	Information regarding cancer and its trajectory is presented in a manner that is accessible and comprehensible	Health systems and information
Q4	Engaging information, supplemented with images or videos, enhances comprehension and retention	Physical and daily activities
Q5	Dietary support for cancer recovery	
Q6	Simplified and engaging diet information	
Q7	Example menu and food preparation for cancer patients	
Q8	Physical activity recommendations for cancer patients	
Q9	Exercise demonstration videos for cancer patients	
Q10	Addressing the sexual health needs of breast cancer patients	
Q11	Accessible and engaging sexual health information	
Q12	Cancer treatment and care information	Health systems and information
Q13	Managing treatment side effects at home	
Q14	Cancer patient support groups and forums	
Q15	Communication platforms for healthcare engagement	
Q16	Short motivational life lectures	Spiritual and social support
Q17	Stories and lessons from cancer survivors	
Q18	Daily motivational quotes for cancer patients	
Q19	User-friendly health applications	Overall application of digital interventions
Q20	Application with user instructions	
Q21	High-quality application content	
Q22	Protection of personal data and privacy	
Q23	Daily health monitoring feature	
Q24	Help and support menu	
Q25	Safe and comfortable user experience	

*Q=Question.

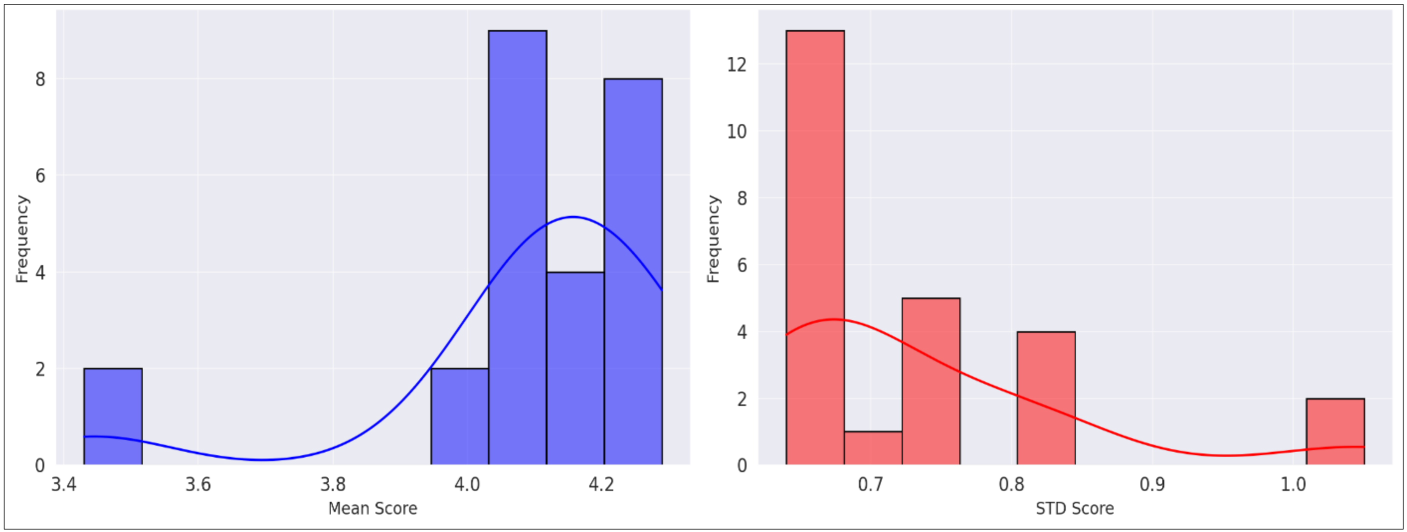

Figure 3. Mean and STD score.

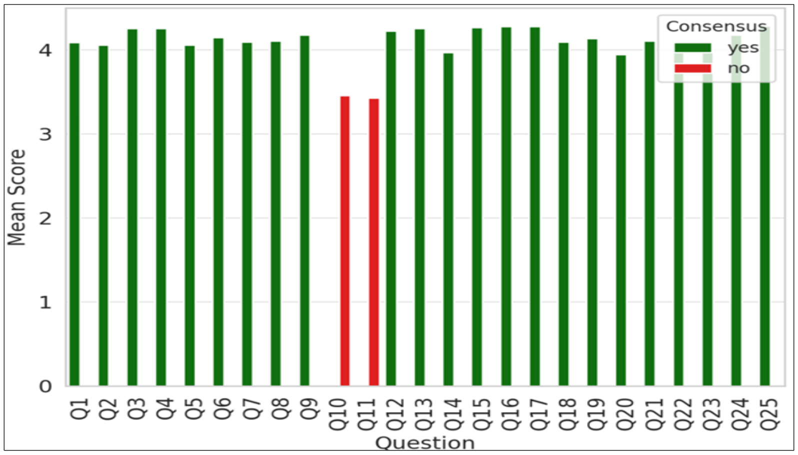

Figure 4. Consensus results.

Several previous studies have examined daily activities and healthy lifestyle practices that contribute to improved quality of life, including physical exercise, recreational gaming, and nutritional management (Obrero-Gaitán et al., 2022). Spiritual support for breast cancer patients to improve their quality of life includes spiritual group support (Zamaniyan et al., 2016), prayer, and spiritual intervention (Avcı & Çavuşoğlu, 2025; Cengiz et al., 2023). The implications for nursing practice are vital in breast cancer care that sometimes proving as critical as surgery, radiation, or chemotherapy in managing life-threatening complications (Obrero-Gaitán et al., 2022). From a nursing perspective, care goes beyond medical interventions and includes emotional, psychological, and practical support throughout the patient experience to improve quality of life (Lee et al., 2023). Nurses are key providers of holistic care to promote self-management among patients with breast cancer (Harmer, 2018; Tawfik et al., 2023). Digital health tools can enhance this role by providing accessible, personalized, and continuous support (Humayun & Callins, 2024; Ibrahim et al., 2022; Shaffer et al., 2023). Integrating nursing insights into the design of such tools can ensures that interventions are compassionate and responsive to patient needs. These tools can support patients with breast cancer by enabling self-care, alleviating symptoms, and enhancing daily functioning, especially for patients dealing with long-term treatment effects (Kirsch et al., 2024; Lim et al., 2023).

Supportive therapy is crucial in breast cancer care that complementing treatments like surgery and chemotherapy to manage complications and improve well-being (Obrero-Gaitán et al., 2022). It is essential for both curative and palliative care for the group of patients (Yanez et al., 2023). From a nursing perspective, care extends beyond medical interventions to include emotional, psychological, and practical support throughout the patient's experience (Pacheco et al., 2024). Nurses are key providers of holistic care who actively promoting self-management and maintaining quality of life, especially for those with breast cancer (Tawfik et al., 2023). Digital health tools, when aligned with nursing values, can enhance this role by providing accessible, personalized, and continuous support (Humayun & Callins, 2024; Ibrahim et al., 2022; Shaffer et al., 2023). Integrating nursing insights into the design of such tools ensures that interventions are compassionate and responsive to patient needs. For patients with breast cancer patients, these tools can empower self-care, reduce symptom burden, and improve daily functioning (Pacheco et al., 2024). This highlights the importance of involving both nurses and patients in developing and evaluating digital interventions.

This study employed the Delphi method to achieve expert consensus that drawing on a wide range of multidisciplinary perspectives. Through this iterative process, it proposed a holistic digital intervention model that is grounded in both empirical evidence and theoretical insights. Involving practitioners, patients, and subject-matter experts enriched the development process to ensure that the findings is practically relevant (Cebrián-Cuenca et al., 2024; Mason et al., 2022). However, cultural taboos surrounding sexuality posed a barrier to open discussion that affecting the level of consensus within the physical support domain. Additionally, the findings are context-specific, with limited generalizability beyond settings similar to Indonesia. The underrepresentation of male participants may have constrained the depth of insight into sexual health needs. Moreover, the study's reliance on self-reported qualitative data introduces the possibility of bias in participant responses.

Conclusion

This Delphi study successfully identified key domains and specific digital health interventions deemed important by experts and stakeholders for improving the quality of life of Indonesian women with breast cancer. The strong consensus achieved across physical, psychological, spiritual, and social support domains, alongside usability requirements, underscores the potential of digital health to address the holistic needs of this population. While the sexuality-related sub-domain revealed divergent opinions, the overall findings provide valuable guidance for the development of sensitive and user-friendly digital tools. The research highlights the crucial role of interdisciplinary collaboration, particularly involving clinical nurses, in shaping effective digital health strategies for addressing the challenges of breast cancer. Future studies should prioritize translating these consensus-driven recommendations into practical digital health applications. Subsequently, rigorous evaluations through both small and large trials are needed to assess their impact on patient outcomes and quality of life within the Indonesian context.

Author's declaration

The authors made substantial and significant contributions to the conception and design of the study; they also read and approved the final manuscript.

AI statement

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Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

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Authors' insight

Key points

- The study specifically investigates the potential of digital health interventions to address the needs of Indonesian women with breast cancer.
- The primary outcome of interest is improving the quality of life for these patients and reducing the mortality rate in the future.
- The study employs the Delphi method, a structured communication technique, to gather and synthesize expert opinions.

Emerging nursing avenues

- What specific types of digital health interventions were explored in the Delphi study to improve the quality of life of Indonesian women with breast cancer?
- What level of consensus was achieved among the experts regarding the feasibility and potential impact of the identified digital health interventions on this specific population?
- How does the study consider the unique cultural, socioeconomic, and healthcare infrastructure context of Indonesia?

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