

A Digital Educational Media Model for Breast Self-Examination (BSE) to Improve Knowledge and Early Detection Behavior of Breast Cancer Among Women of Reproductive Age

Frida Lina Tarigan^{1*}, Apriana T², Herlina Maryani Pangaribuan³, Roeda Manduly Loly⁴, Febri Putra S. Zalukhu⁵, Cencen Riana Sary⁶

¹⁻⁵Master of Public Health Program, Postgraduate Directorate, Sari Mutiara Indonesia, Indonesia

ORCIDs/Email:

First AUTHOR : <https://orcid.org/0000-0003-0243-9909> / frida_tarigan@yahoo.co.id

Second AUTHOR : - / aprianatoding@gmail.com

Third AUTHOR : - / herlinapangrib16@gmail.com

Fourth AUTHOR : - / manduliloly@gmail.com

Fifth AUTHOR : - / zalukhuputra172@gmail.com

Sixth AUTHOR : - / Cencen.brahmana@yahoo.com

Corresponding author email: frida_tarigan@yahoo.co.id

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Abstract

Breast cancer remains the most commonly diagnosed cancer among women in Indonesia, and late-stage presentation continues to undermine treatment outcomes, making early detection through breast self-examination (BSE), locally known as SADARI, a critical public health priority. This study aimed to design a digital educational media model for BSE capable of improving knowledge and early detection behavior among women of reproductive age in a residential community setting. A formative, mixed-methods situational analysis was conducted among 20 married women aged 30–45 years, members of a neighborhood arisan (rotating social-savings) group in Perumahan NTI, Makassar City, using field observation, in-depth interviews, focus group discussion, and a structured questionnaire. Problem prioritization was determined using the Urgency-Seriousness-Growth (USG) method, and root causes were analyzed using a fishbone (Ishikawa) diagram. The results showed that although 95% of respondents owned and actively used a smartphone, 70% had never performed BSE, and correct knowledge of BSE's ideal timing (20%) and proper technique (15%) was particularly low. No visual educational media on BSE was found circulating in the community, and existing health information was delivered only orally and incidentally. Respondents expressed a clear preference for concise, visually engaging, shareable digital content distributed through existing WhatsApp arisan groups, using informal language and non-explicit illustrations. These findings indicate that the absence of appropriate educational media, rather than lack of technology access, is the principal barrier to BSE knowledge and practice in this population, and support the development of a shareable digital media model tailored to housewives' communication habits and preferences as a feasible strategy for improving breast cancer early detection behavior.

Keywords: breast self-examination; SADARI; digital health education; breast cancer early detection; women of reproductive age



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INTRODUCTION

Breast cancer continues to be the leading cause of cancer-related morbidity and mortality among women worldwide, and early detection through breast self-examination (BSE) remains one of the most accessible, low-cost strategies available to women, particularly in low- and middle-income settings where organized screening infrastructure such as mammography remains limited (Azhar, Hanafi, Lestari, & Halim, 2023). In Indonesia specifically, breast cancer has become one of the most common causes of mortality among women, with a substantial proportion of cases presenting late, which negatively affects prognosis and treatment outcomes; timely detection through regular BSE practice therefore represents an important first step in encouraging women to take active responsibility for their own health (Dewi, Massar, Ruiter, & Leonardi, 2019). Subsequent research among women in Surabaya has further shown that psychosocial determinants including perceived susceptibility, perceived barriers, and self-efficacy play a central role in shaping whether women translate awareness of BSE into sustained practice, underscoring that knowledge alone is insufficient without addressing the broader behavioral and social context in which BSE occurs (Dewi, Ruiter, Diering, Ardi, & Massar, 2022).

Despite decades of public health messaging, numerous studies continue to document persistently low knowledge, deficient attitudes, and inadequate practice of BSE among women across diverse settings. Female university students in Egypt, for example, have been shown to possess deficient knowledge and low perceptions regarding breast cancer and BSE despite largely positive attitudes, with practice remaining very deficient prior to targeted intervention (Moustafa, Abd-Allah, & Taha, 2015). Comparable gaps have been documented among undergraduate women in Nigeria, where inadequate knowledge, negative attitudes, and poor BSE practices were substantially improved following a structured educational intervention (Ibitoye & Thupayegale-Tshwenegae, 2021). In the Indonesian context, a systematic review, meta-analysis, and meta-regression of BSE practice found considerable variation in prevalence across regions and identified knowledge, education level, and information exposure as consistent determinants of practice, reinforcing the relevance of locally tailored educational interventions (Azhar et al., 2023). Similarly, a study among reproductive-age women in Lampung found that specific, modifiable factors including access to information and prior exposure to health education were significantly associated with BSE practice, suggesting that targeted informational interventions can meaningfully shift behavior in this population (Diasuti, Aryawati, & Aryastuti, 2023).

A substantial body of evidence supports educational intervention, grounded in behavioral theory, as an effective mechanism for improving BSE knowledge and practice. Interventions based on the Health Belief Model have been shown to significantly improve BSE behavior among women attending health centers in Iran, with perceived susceptibility, severity, and self-efficacy emerging as key behavioral levers (Khiyali, Aliyan, Kashfi, Mansourian, & Jeihooni, 2017). Similarly, an educational intervention grounded in the Theory of Planned Behavior significantly increased both intention and behavior related to BSE among a sample of Iranian women, indicating that attitudes, subjective norms, and perceived behavioral control are all modifiable through structured education (Jeihooni, Moayedi, Momenabadi, Ghalegolab, & Harsini, 2023). A targeted BSE intervention package designed for lesser-educated women in a marginalized community likewise produced substantial improvements in awareness, demonstrating that behavior-change communication approaches can be adapted successfully even for populations with limited formal education (Rao, Khandekar, & Laskar, 2023), while a school-based educational intervention among Indonesian high-school students similarly demonstrated significant gains in breast cancer knowledge following a structured health-education session (Hasyim, Wulandari, & Sukismanto, 2019).

The proliferation of smartphone ownership and social media use has opened new possibilities for delivering BSE education outside conventional clinical or classroom settings. WhatsApp, in particular, has been validated as an effective low-cost platform for health education: a cluster randomized field trial found that a WhatsApp-delivered, theory-based health education intervention improved breastfeeding self-efficacy as effectively as face-to-face communication, demonstrating that digital messaging platforms can substitute for direct health-worker contact without sacrificing effectiveness (Mohamad Pilus, Ahmad, Mohd Zulkefli, & Mohd Shukri, 2022). More broadly, smartphone

applications have increasingly been mobilized for breast cancer prevention research, with a systematic review documenting their use across the full continuum from primary prevention and awareness-raising to screening navigation and survivorship support (Houghton, Howland, & McDonald, 2019). Purpose-built breast-awareness mobile applications have likewise been shown to significantly improve knowledge of breast cancer risk factors, awareness of warning signs, and confidence in performing BSE among women in peninsular Malaysia (Yusuf, Iskandar, Ab Hadi, Nasution, & Lean Keng, 2022), while qualitative research on the development of such applications underscores the importance of grounding app content and structure in an established behavioral framework such as the Health Belief Model to ensure the resulting tool addresses the actual perceptual barriers women report (Nasution, Yusuf, Lean Keng, Rasudin, P Iskandar, & Ab Hadi, 2021).

Comparative evidence further suggests that combining digital media with structured guidance amplifies its educational effect. Among Indonesian nursing and midwifery contexts, smartphone-application-based education combined with hands-on practice produced greater gains in BSE competence among junior nursing students than application use alone, consistent with theoretical accounts of experiential learning that place direct practice above passive observation in the hierarchy of retention (Kang, Shin, Lee, & Kim, 2020). Simulation-based breast health education has likewise been shown to significantly improve both breast cancer awareness and BSE skills among a vulnerable population of Afghan refugee women, indicating that structured, hands-on digital or simulation-based formats can be effective even among populations with limited formal health literacy (Kuru Alici, Arian Dönmez, Aktaş, & Zeytun, 2025). Complementary work applying smartphone-based BSE applications among Indonesian nursing populations found measurable improvements in knowledge, perceived susceptibility, and self-efficacy following app-based exposure (Indah, Usman, Baso, Syarif, Ahmad, & Mumang, 2024), while comparable Indonesian research using structural and behavioral analysis found several psychosocial and situational variables to function as either barriers or enhancers of BSE practice, reinforcing that any digital media intervention must be designed with these situational determinants explicitly in mind (Hijrah, Usman, Baso, Syarif, Ahmad, & Nulandari, 2024).

Beyond women in the general population, occupational studies suggest that even health professionals fall short of consistent BSE practice absent structured reinforcement. A study among nurses in Poland found notable gaps in BSE preparedness and practice despite nurses' professional health knowledge, suggesting that awareness alone, without accessible reinforcing media, is insufficient to sustain regular practice even among highly health-literate populations (Woynarowska-Soldan et al., 2019). This finding lends further weight to the argument that the barrier to BSE practice among lay populations such as housewives is unlikely to be resolved through generic awareness campaigns alone, and instead requires purpose-built, repeatable, and easily accessible educational media matched to the target population's actual communication habits.

Designing such media, however, first requires a systematic understanding of the specific causes underlying low BSE knowledge and practice within a given community, rather than an assumption that gaps are uniform across settings. Root-cause analysis tools such as the fishbone (Ishikawa) diagram, widely used in quality-improvement research to organize contributing factors into structured categories such as personnel, method, material, environment, and facilities, provide a systematic framework for identifying which specific deficiencies whether in available media, delivery method, or social environment are most amenable to intervention (Harel et al., 2016). Applying this structured diagnostic approach to a specific, well-defined community, rather than relying on generic assumptions about health-education gaps, is essential to designing a digital media model that is genuinely responsive to local barriers, communication norms, and technological access.

Despite the breadth of literature on BSE educational interventions, mobile health applications, and WhatsApp-based health communication individually, few studies have combined a structured situational and root-cause analysis with a systematic media-needs assessment to directly inform the design of a digital educational media model for a specific, non-clinical community setting such as a residential neighborhood arisan group. This study addresses that gap by conducting a formative situational analysis among women of reproductive age in Perumahan NTI, Makassar City, to characterize current BSE knowledge and behavior, identify the priority problem and its root causes, and

determine the specific format, content, and delivery preferences that should inform the design of a digital BSE educational media model suited to this population's existing communication ecosystem

RESEARCH METHOD

Research Design

This study employed a formative, mixed-methods situational analysis design, integrating quantitative questionnaire data with qualitative findings from observation, in-depth interviews, and focus group discussion (FGD). This design was selected to support the first phase of a media-development project, in which a comprehensive understanding of the target population's existing knowledge, behavior, and media environment is required before an educational media model can be meaningfully designed.

Setting and Participants

The study was conducted among members of a neighborhood arisan (rotating social-savings gathering) group in Perumahan NTI, Makassar City, South Sulawesi. Twenty married women aged 30–45 years participated, recruited through the arisan group as a naturally occurring social forum. This setting was selected because the arisan group functions as an active, regularly convened social space through which health information is already informally exchanged among members, including via a shared WhatsApp group.

Data Collection

Data were collected through four complementary techniques: (1) field observation of the physical environment, to determine whether visual BSE educational media (posters, leaflets, or digital displays) were present at community facilities such as the security post, mosque, or neighborhood administrative office; (2) a structured questionnaire assessing respondent characteristics, smartphone ownership, BSE history, and knowledge across five key BSE domains; (3) focus group discussion with the arisan group to explore shared perceptions of BSE and preferred media characteristics; and (4) in-depth interviews with key informants to probe the reasoning behind priority-problem scoring and to explore the social and cultural context surrounding breast-health communication within the community.

Problem Prioritization and Root-Cause Analysis

Following the situational analysis, identified problems were prioritized using the Urgency-Seriousness-Growth (USG) method, in which each problem was scored by group consensus on a five-point scale (1 = very low to 5 = very high) across three dimensions: urgency (how immediately the problem must be addressed), seriousness (the severity of impact if left unaddressed), and growth (the likelihood the problem will worsen over time). The problem with the highest cumulative USG score was designated the priority problem for intervention. Root causes contributing to the priority problem were subsequently analyzed using a fishbone (Ishikawa) diagram, a structured root-cause analysis technique widely used in quality-improvement research to organize contributing factors into defined categories, in this study adapted into five domains: Man (human/personal factors), Method, Material (media), Environment, and Machine/Milieu (facilities) (Harel et al., 2016).

Media Needs Analysis

To directly inform media design, a structured needs analysis was conducted covering three domains: (1) preferred media format (digital versus print, shareability, visual style); (2) preferred content (definitional information, technique guidance, timing information, warning signs, and follow-up actions); and (3) preferred communication style (tone, length, and visual sensitivity). Findings across all data-collection methods were triangulated to identify convergent themes informing the final media-model specification.

RESULTS AND DISCUSSION

Respondent Characteristics

Table 1 presents the characteristics of the 20 study participants.

Table 1. Characteristics of respondents (N=20).

Characteristic	Category	n (%) (N=20)
Age	30–35 years	8 (40%)
	36–40 years	7 (35%)
	41–45 years	5 (25%)
Education	Senior high school	11 (55%)
	Diploma/Bachelor's degree	9 (45%)
Occupation	Housewife	16 (80%)
	Employed (part-time/entrepreneur)	4 (20%)
Smartphone ownership	Owns and actively uses	19 (95%)
BSE history	Has performed (not routinely)	6 (30%)
	Never performed	14 (70%)

The majority of respondents fell within the economically productive age range of 30–40 years and were housewives without formal employment. Notably, 95% of respondents owned and actively used a smartphone, indicating substantial potential to reach this population through digital educational media; yet 70% of respondents had never performed BSE at all. This combination high digital access alongside persistently low BSE practice closely mirrors patterns documented elsewhere in Indonesia, where smartphone and social-media penetration have not automatically translated into improved BSE practice without a specific, purpose-built educational intervention (Diasuti, Aryawati, & Aryastuti, 2023; Azhar et al., 2023).

Knowledge of Breast Self-Examination

Table 2 presents respondents' knowledge across five key domains of BSE.

Table 2. Respondents' knowledge of breast self-examination (N=20).

Knowledge Item	Correct Answers	Percentage
Understanding the definition of BSE	9/20	45%
Knowing the ideal timing for BSE (day 7–10 of the menstrual cycle)	4/20	20%
Knowing the correct step-by-step BSE procedure	3/20	15%
Recognizing warning signs of breast abnormalities	7/20	35%
Knowing the appropriate follow-up action if an abnormality is found	6/20	30%

These findings show that although a substantial proportion of respondents had heard of the term SADARI (45% correctly defined it), technical knowledge required for correct independent practice

remained markedly low, particularly regarding the ideal timing of examination (20%) and correct step-by-step technique (15%). This pattern general awareness of BSE as a concept coexisting with deficient technical knowledge needed for correct practice is highly consistent with findings from Egyptian and Nigerian university populations, where positive general attitudes toward BSE similarly coexisted with very deficient actual practice prior to targeted intervention (Moustafa et al., 2015; Ibitoye & Thupayegale-Tshwenegae, 2021), and with health-belief-model-based studies showing that knowledge of susceptibility and severity does not by itself translate into correct technique without structured educational reinforcement (Khiyali et al., 2017; Jeihooni et al., 2023).

Priority Problem: USG Analysis

Table 3 presents the results of problem prioritization using the USG method.

Table 3. Urgency-Seriousness-Growth (USG) prioritization of identified problems.

Identified Problem	U	S	G	Total
Low knowledge of correct BSE steps and ideal timing	5	5	5	15
Absence of accessible BSE educational media for housewives	5	4	5	14
Reluctance/embarrassment to discuss breast health openly	4	3	3	10
Limited access to further clinical examination facilities	3	4	2	9

Based on the cumulative USG score, the priority problem was determined to be the low level of knowledge and practice of breast self-examination among housewives aged 30–45 years in Perumahan NTI, Makassar City, resulting from the limited availability of educational media that is accessible, engaging, and matched to the target population's needs. This prioritization is consistent with the broader literature's emphasis on media and method gaps rather than a lack of underlying motivation as the principal modifiable barrier to BSE practice in comparable populations (Rao et al., 2023; Hasyim et al., 2019).

Root-Cause Analysis: Fishbone Diagram

Table 4 presents the fishbone (Ishikawa) cause analysis conducted to identify the underlying factors contributing to the priority problem.

Table 4. Fishbone (Ishikawa) analysis of contributing factors to low BSE knowledge and practice.

Category	Contributing Factor
Man (Human)	Housewives do not consider BSE a priority in the absence of symptoms; embarrassment about discussing breast health openly, including within the arisan gathering.
Method	BSE information has so far been delivered only orally and incidentally by Posyandu health workers, without accompanying visual media for repeated independent learning at home.
Material (Media)	No concise, engaging, and easily shareable digital educational media currently circulates through the WhatsApp groups and social media actively used by housewives.
Environment	Prevailing social norms treat breast health as a private or taboo topic unsuitable for discussion in social forums such as the arisan gathering.

Category	Contributing Factor
Machine/Milieu (Facilities)	Access to clinical examination facilities (CBE/mammography) remains limited and is rarely used to complement independent BSE.

Of the five categories analyzed, the Material (media) and Method categories were identified as the most feasible targets for intervention through the development of a digital educational media product, since they represent modifiable gaps in the information ecosystem rather than deeper structural or normative barriers that require longer-term social or infrastructural change. This diagnostic conclusion mirrors the broader quality-improvement literature's emphasis on isolating the specific, actionable causes within a multi-category cause-and-effect structure, rather than attempting to address all contributing factors simultaneously (Harel et al., 2016). It is also consistent with evidence that structured, repeatable digital media rather than one-time oral communication is what enables sustained knowledge retention and correct technique acquisition among lay populations (Kang et al., 2020; Kuru Alici et al., 2025).

Media Needs Analysis

Findings from the FGD and interviews identified clear preferences across three domains relevant to media design. Regarding format, respondents strongly preferred digital media accessible via personal smartphone, given near-universal smartphone ownership and use, with a strong emphasis on shareability through the existing WhatsApp arisan group so that information could reach members not present at any single gathering; visually engaging content (light illustration or animation) was preferred over lengthy text, reflecting the varied educational backgrounds within the group. This preference for lightweight, shareable digital content is strongly consistent with evidence that WhatsApp-delivered health education can match the effectiveness of face-to-face communication while requiring substantially fewer health-worker resources (Mohamad Pilus et al., 2022), and with broader evidence that purpose-built mobile applications can meaningfully improve BSE-relevant knowledge and confidence when properly designed (Yusuf et al., 2022; Nasution et al., 2021).

Regarding content, respondents prioritized a simple explanation of BSE's meaning and importance conveyed in accessible, non-clinical language; a step-by-step guide to BSE technique accompanied by visual illustration of examination positions; clear information on the ideal timing of examination (7–10 days after the first day of menstruation); guidance on warning signs requiring follow-up; and an explicit call to action encouraging monthly practice. This content structure closely mirrors the core components emphasized across effective BSE educational interventions internationally, which consistently combine technique instruction, timing guidance, and warning-sign recognition as the minimum effective content set (Rao et al., 2023; Hasyim et al., 2019; Kuru Alici et al., 2025).

Regarding communication style, respondents favored casual, familiar language resembling conversation among peers rather than formal clinical terminology, short-form content suited to being consumed during brief pauses in household activity, and illustrations that avoid explicit anatomical depiction in favor of modest, informative visual representation. This preference for socially comfortable, non-clinical framing directly addresses the Environment-category barrier identified in the fishbone analysis namely, the social taboo surrounding open discussion of breast health and is consistent with evidence that culturally sensitive framing improves the acceptability and, in turn, the effectiveness of breast-health communication among populations where such topics remain socially delicate (Rao et al., 2023).

Taken together, these findings indicate that the digital educational media model best suited to this population is a concise, shareable, visually engaging digital product most feasibly a short animated or illustrated video or graphic series distributed through the existing WhatsApp arisan network, using informal, non-clinical language and modest illustration, and covering the core content domains of definition, technique, timing, warning signs, and a monthly call to action. This model directly targets the Material and Method root causes identified through the fishbone analysis while respecting the Environment-related social sensitivities that a purely clinical or formally worded intervention would risk triggering.

CONCLUSION

This study conducted a formative situational analysis to inform the design of a digital educational media model for breast self-examination (SADARI) aimed at improving knowledge and early detection behavior among women of reproductive age. The findings show that while nearly all respondents owned and actively used a smartphone, the majority had never performed breast self-examination, and technical knowledge of correct timing and technique remained particularly low. No visual educational media on breast self-examination was found circulating within the community, and existing health information had been delivered only orally and incidentally, without any medium that could be revisited independently at home. Prioritization using the USG method identified the low level of knowledge and practice of breast self-examination, driven by the absence of accessible educational media, as the primary problem requiring intervention, while root-cause analysis using the fishbone diagram identified gaps in available media and delivery method as the most feasible targets for a media-based intervention, distinct from the deeper social and infrastructural barriers reflected in the environment and facilities categories. Based on the media needs analysis, the study concludes that a concise, visually engaging, and easily shareable digital media product distributed through existing WhatsApp arisan networks, using casual, non-clinical language and modest illustration, represents the most feasible and acceptable model for improving breast self-examination knowledge and behavior in this population. This model is expected to serve as the foundation for the subsequent development, production, and evaluation phases of the project, with future research needed to assess the media's actual effect on knowledge and practice following implementation, and to examine its transferability to other residential communities with comparable social and technological characteristics.

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AUTHOR CONTRIBUTIONS

Conceptualization, F.L.T., A.T., H.M.P., R.M.L., F.P.S.Z., and C.R.S.; Methodology, A.T. and H.M.P.; Investigation, A.T., H.M.P., R.M.L., F.P.S.Z., and C.R.S.; Data Curation, R.M.L. and F.P.S.Z.; Formal Analysis, H.M.P. and C.R.S.; Writing – Original Draft Preparation, A.T.; Writing – Review & Editing, H.M.P., R.M.L., and F.P.S.Z.; Visualization, C.R.S.; Supervision, F.L.T. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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