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The Integrated Breast Cancer Educational Program in Indonesia: A Mixed-Methods Study Among Breast Cancer Patients and Survivors in Indonesia

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ABSTRACT

Objective: This study aimed to develop an audience-tailored breast cancer educational program in Indonesia informed by factors associated with delayed breast cancer diagnosis.

Methods: This multiphase mixed-methods study followed a QUAL-QUAN-QUAL sequence. Eligible participants were patients and survivors aged ≥18 years with confirmed breast cancer and no cognitive or communication impairment; caregivers were included in phase 1. Phase 1 used purposive and snowball sampling with deductive matrix-based framework analysis. Phase 2 comprised an online cross-sectional survey and multivariable logistic regression. Phase 3 used multidisciplinary expert interviews to integrate the preceding findings into an educational program.

Results: Twenty-five interview participants and 379 survey respondents were included. Qualitative findings identified knowledge, breast-health behaviors, diagnostic pathways, and social influences as key domains related to delayed diagnosis. Higher knowledge (aOR, 0.87 per 10-point increase; 95% CI, 0.77–0.98) and personal financing (aOR, 0.61; 95% CI, 0.37–0.99) were associated with lower odds of delay, while not performing regular breast self-examination was associated with higher odds (aOR, 2.10; 95% CI, 1.01–4.35). Integrated findings informed an audience-specific educational program tailored for the general public, patients, caregivers, health workers, and health educators.

Conclusion: Delayed diagnosis in Indonesia was associated with knowledge gaps, breast-health behaviors, diagnostic factors, and social factors. These findings informed an audience-tailored educational module to address key barriers to timely diagnosis and to effectively reach the primary target audiences.

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INTRODUCTION

Breast cancer remains a major global health problem, with approximately 2.3 million new cases annually and substantial mortality among women worldwide.[1,2] Although incidence is high in high-income countries, mortality is disproportionately greater in developing countries.[2,3] In Indonesia, breast cancer is the most commonly diagnosed cancer (16.7%) and the second leading cause of cancer-related death.[2]

Early diagnosis is therefore a public health priority. To design effective interventions, it is important to understand the factors contributing to delayed diagnosis. Studies from Asia, including Indonesia, have described knowledge gaps, attitudes, stigma, and access to health facilities.[4] However, Indonesian evidence remains fragmented. Much of this evidence has come from single settings, hospital-based samples, qualitative studies, or studies examining only selected patient-level factors.[4]

An educational program addressing these factors may help reduce diagnostic delays. No single method could capture both the context of diagnostic delay and the relative importance of the candidate factors. Qualitative interviews were needed to explore the experiences and perspectives of patients, survivors,

and caregivers, while a quantitative study was needed to examine related factors in a larger sample.

Therefore, this study aimed to (1) explore factors related to delayed breast cancer diagnosis from the perspectives of patients, survivors, and caregivers; (2) examine the associations between candidate factors and total diagnostic delay; and (3) develop an integrated breast cancer educational program in Indonesia, integrating the findings with multidisciplinary input, for the general public, patients and caregivers, health workers, and health care policymakers.

METHODS

A multiphase mixed-methods study following a QUAL-QUAN-QUAL sequence was conducted in Indonesia from October to December 2021. The preceding systematic review and phase 1 interviews informed the phase 2 questionnaire.[4] Qualitative and quantitative findings were then integrated to identify educational priorities for phase 3, in which multidisciplinary experts refined the draft framework. The initial qualitative and quantitative phases were given equal priority in identifying factors related to diagnosis delay, while phase 3 expert consultation was used to translate the integrated findings into program content. The reporting of this study followed the Good Reporting of a Mixed Methods Study (GRAMMS) recommendations.

Phase 1 - qualitative study

In-depth video-call interviews were conducted using a standardized semi-structured guide. Participants were recruited through a breast cancer patient organization using purposive and snowball sampling. Eligible participants were aged ≥18 years, had pathologically confirmed breast cancer, and had no cognitive or communication impairment. Patients, survivors, and caregivers were recruited independently, with initial contact made by the research team. Subsequently, participants and staff at the organization could refer additional potential participants. Purposive sampling sought variation in diagnostic timing and geography across four subgroups: early- and late-diagnosed patients and survivors and caregivers of each group. Early diagnosis was defined as confirmed diagnosis within 3 months of the first symptom, whereas late diagnosis was defined as diagnosis >3 months.[5–8] A minimum of five participants per subgroup was set initially, with recruitment continuing until no substantively new information emerged within each group.

The guide underwent content validation by public health experts and face validation with 5 to 10 individuals or until saturation was achieved.[5] Interviews were transcribed verbatim, checked against the audio recordings, and analyzed manually using a deductive, matrix-based framework across five prespecified domains; no qualitative software was used. The principal investigator reviewed the matrices, and differences in interpretation were resolved through discussion with reference to the recordings. No independent duplicate coding was undertaken. Trustworthiness was supported through transcript verification, retention of divergent accounts, reflexive discussion, a peer-debriefing session, and study-level triangulation with the preceding systematic review and quantitative findings.

Phase 2 - quantitative study

A cross-sectional study was conducted using a structured questionnaire among patients and survivors with breast cancer through survivor/support groups across Indonesia. The minimum sample size was 364, calculated for 2 independent proportions with a two-sided α of 0.05, 90% power, and a 1:1 allocation. No design effect or nonresponse allowance was added. Eligible respondents were aged ≥18 years, reported pathological confirmation, and had no cognitive or communication impairment. Study information and the Google Forms link were distributed through WhatsApp with eligibility reassessed from the submitted data. Only one response per account was permitted, and email addresses were reviewed for potential duplicates.

The questionnaire was developed from the preceding systematic review and phase 1 findings, reviewed qualitatively by 4 multidisciplinary experts, and then face-tested in 2 rounds with 3 participants. Formal content-validity index, construct-validity assessment, pilot testing, or internal-consistency/reliability testing were not performed. Knowledge and psychosocial numerical scores were weighted and standardized, while lifestyle, breast examination, and health care access were presented as categorical variables. Data were then processed using Microsoft Excel, SPSS version 24, and Stata version 15 for Windows. Data were analyzed using bivariate analysis to assess associations between independent variables (based on phase 1 topics) and the dependent variable (delay vs no delay). The primary outcome was total diagnostic delay, defined as >3 months from earliest breast symptom to pathological confirmation. Variables with $P < .25$ in bivariate analysis or theoretical/clinical relevance were included in multivariable logistic regression. Variables with $P < .05$ were considered independently associated with delayed breast cancer diagnosis in Indonesia. Multicollinearity was assessed using variance inflation factors, and the linearity of the continuous knowledge score in the logit was examined using a Box–Tidwell-type term. Model calibration was assessed with the Hosmer–Lemeshow test. No interactions or clustering adjustments were prespecified.

Phase 3 - qualitative study

A total of 8 experts from 8 disciplines were purposively selected for a single online interview each to provide the perspectives needed for program development. All received the same draft modules based on the integration of the preceding qualitative and quantitative findings. Interviews were transcribed and synthesized inductively in a structured matrix by one research-team member and reviewed by the principal investigators. The broader team revised the modules, prioritizing empirical findings and using expert input to refine content and presentation. The process was an informal

expert consultation rather than a Delphi or other formal consensus method; no consensus threshold was predefined. After the interviews, the research team revised the modules in response to the recommendations received. The revised modules were returned to all experts, who provided verbal approval.

RESULTS

Phase 1 - qualitative findings

Twenty-five participants were interviewed: 6 early-diagnosed patients and survivors, 7 late-diagnosed patients and survivors, 5 caregivers of early-diagnosed patients, and 7 caregivers of late-diagnosed patients. Fourteen participants (56%) were women, 20 (80%) had diploma, undergraduate, or postgraduate education, and 14 (56%) lived in Java. Findings were organized into 5 themes: knowledge, attitudes and behaviors, symptoms experienced, societal stigma, and community myths.

Knowledge

Participants in the late-diagnosed group more frequently reported having heard about signs of breast cancer compared with those in the early-diagnosed group; however, this knowledge was often superficial and insufficient to trigger timely help-seeking. Caregivers of early-diagnosed patients more often described recognizing warning signs and encouraging assessment: "From what I know, breast cancer is quite common, so it is important to have regular breast checks." Early-diagnosed participants could state more breast cancer characteristics and promoted early disclosure to family members. Nevertheless, more than half of the patients in both groups considered pain as the main indicator of cancer.

Attitudes and behaviors

Most patients reported performing breast self-examination (BSE), but most described irregular practice and nonstandard technique. One of the late-diagnosed patients explained: "At the time, I only checked around the breast itself. The lump was actually at the edge of the breast, just below the armpit, so I did not feel that area when I examined myself. I was not doing it regularly either, not even once a month." Clinical breast examination (CBE) was reportedly more common among late-diagnosed participants. The use of alternative therapies was more frequently reported among late-diagnosed participants.

Symptoms experienced and clinical pathway

Most patients reported a breast lump as the initial symptom. Early-diagnosed participants were more likely to seek information soon after symptom onset due to anxiety, as one patient described: "At first, I thought the breast problem was hormonal or due to an infection because it was painful. I asked a friend who is a cardiologist, and they said that pain is usually not a sign of cancer. Even so, I decided to get it checked promptly." In contrast, many late-diagnosed participants suspected a tumor but delayed care, hoping symptoms would resolve spontaneously. Most survivors reported undergoing excisional biopsy, often requiring decisions regarding mastectomy before definitive diagnosis.

Survivors who underwent excisional biopsy without frozen-section analysis reported requiring a second surgical procedure. Only a small proportion of survivors underwent core biopsy, and these cases were generally from the late-diagnosed subgroup. Most survivors who underwent any biopsy procedure lived in the capital city. Most participants underwent mastectomy, and only one survivor reported being offered a choice between mastectomy and breast-conserving surgery. Participants consistently reported psychosocial support from partners and family, particularly husbands, mothers, and children. Several survivors described lengthy pathways to care, especially in smaller towns where access to surgical oncologists was limited.

Societal stigma

Most survivors and families did not report overt stigma such as exclusion or discriminatory treatment. However, survivors frequently described discomfort with pity and negative assumptions, particularly beliefs that breast cancer patients have limited life expectancy or comments perceived as judgmental despite being presented as supportive.

Myths

Most participants did not personally endorse community myths but discussed myths based on observation and everyday experience. Reported barriers to timely breast examination included cost and fear (diagnosis-related fear, fear of chemotherapy, and fear of mastectomy).

Denial was also common; some individuals expected symptoms to resolve without treatment or believed that treatment was futile because breast cancer was perceived as fatal. Participants also noted fears of being abandoned by husbands, the perception of breast cancer as shameful, and preference for alternative therapies, reinforced by misleading advertisements. Common myths included beliefs that biopsy or surgery causes cancer to spread and that breast cancer results from a person's character or sins (eg, disobedience to parents or husbands). No clear differences were observed between early- and late-diagnosed groups. Qualitative findings are summarized in Figure 1.

Phase 2 - quantitative findings

A total of 379 participants completed the survey. Bivariate results are presented in Table 1. Variables were entered into multivariable logistic regression to identify factors independently associated with delayed breast cancer diagnosis (Table 2). In the final model, factors associated with increased odds of delayed diagnosis included not performing regular BSE (aOR, 2.10; 95% CI, 1.01–4.35). Prolonged diagnostic pathology turnaround (>7 days from biopsy specimen collection to histopathology report) was also associated with a higher point estimate for delayed

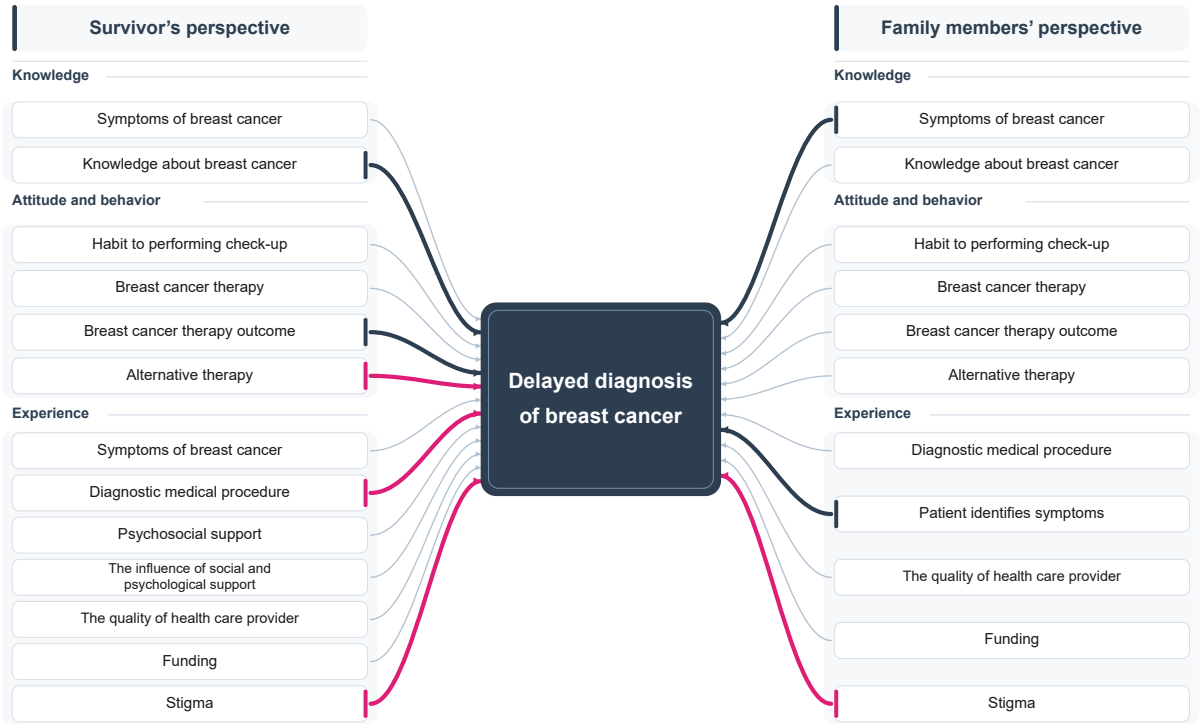


Figure 1. Results of the Analysis of Factors Associated With Delayed Breast Cancer Diagnosis
Thick blue lines indicate factors associated with early diagnosis, whereas thick red lines represent factors associated with delayed diagnosis. Thin blue lines denote factors not associated with either early or delayed diagnosis.

diagnosis, but the evidence was borderline (aOR, 1.56; 95% CI, 1.00–2.43; exact $P = .0501$). Lower odds of delay were observed for unmarried or widowed (aOR, 0.49; 95% CI, 0.27–0.89), higher knowledge score (aOR, 0.87 per 10-point increase; 95% CI, 0.77–0.98), and personal financing (aOR, 0.61; 95% CI, 0.37–0.99).

The model showed no problematic multicollinearity (maximum variance inflation factor [VIF], 1.08), and the linearity assumption for the knowledge score was supported ($P = .66$). Calibration was acceptable (Hosmer–Lemeshow, $P = .47$), while discrimination was modest (area under the curve [AUC], 0.640; bootstrap 95% CI, approximately 0.58–0.70). A small number of observations crossed heuristic leverage or Cook's-distance screening thresholds, but the maximum leverage (0.085) and Cook's distance (0.017) did not indicate an extremely influential observation.

Knowledge gaps were identified regarding signs and symptoms of breast cancer, particularly misconceptions surrounding breast pain, nipple eczema, movable breast lumps, breast enlargement, breast ulcers/bleeding sores, and reddish nipple discharge. Additional misconceptions included beliefs that alternative therapies can complement medical treatment and that breast cancer inevitably leads to mastectomy, is always hereditary, and results in death. Awareness of screening recommendations was limited; 43% of respondents did not know which abnormalities to identify during BSE, and fewer than 25% reported performing CBE regularly. Respondents also demonstrated limited understanding of the role of biopsy in diagnosis and lacked knowledge regarding biopsy types and breast cancer treatment options.

Phase 3 - program development

Educational content was selected by integrating qualitative and quantitative findings rather than statistical significance alone. Factors supported across both phases were carried forward directly. Qualitatively important issues that were not statistically significant could also be retained when they were prominent in participant accounts, supported by the preceding review, clinically relevant, and amenable to education. Expert interviews were used to clarify what each group needed to know, the level of detail required, and how the material should be presented. Recommendations on format were informed by experts in public health, psychology, education, marketing communication, and religion, as well as clinicians involved in breast cancer care. Experts emphasized usability, appropriate language, and a visually appealing layout. Thematic findings from expert interviews are presented in Figure 2.

Table 3 presents a joint display linking qualitative themes, quantitative associations, expert recommendations, and resulting educational components.

The educational-program framework was organized into audience-specific module outlines. For each audience, the framework specifies the learning objectives, main topics and subtopics, proposed assessments, and

supporting references (Supplementary Table S1).

DISCUSSION

This mixed-methods study identified factors associated with delayed breast cancer diagnosis in Indonesia across predisposing, enabling, and reinforcing domains.

The most consistent finding was that limited knowledge of breast cancer and suboptimal BSE practices were the most prominent factors associated with diagnostic delay. In addition, prolonged diagnostic pathology turnaround showed a borderline association, while sociocultural influences such as family dynamics, alternative therapy use, and persistent myths were only identified as important factors associated with the delay in the qualitative findings.

Knowledge and breast-health behavior

Knowledge-related factors were evident across both qualitative and quantitative phases. Participants described incomplete recognition of warning signs and misconceptions about biopsy, mastectomy,

Table 1. Bivariate Analysis of Factors Associated With Delayed Breast Cancer Diagnosis

Factors	Delayed diagnosis				OR	95% CI	*P* value
	Yes	%	No	%			
Age at diagnosis							
Mean, SD	43.8	7.4	43.8	7.8			>.99
Median (range)	44	28-70	43	18-70			.88
Education							
Low	59	57.28	44	42.72	1.41	0.87-2.28	.15
High	135	48.91	141	51.09	reference		
Income in rupiah (socioeconomic)							
<5 million (low)	84	57.53	62	42.47	1.66	0.87-3.19	.13
5-10 million (low to intermediate)	60	49.18	62	50.82	1.19	0.61-2.31	.61
10-20 million (intermediate to high)	28	45.16	34	54.85	1.01	0.48-2.15	.98
>20 million (high)	22	44.9	27	55.1	reference		
Marital status							
Married	171	53.11	151	46.89	reference		
Unmarried/widowed	23	40.35	34	59.65	0.59	0.32-1.09	.08
Maternity							
Have child	122	52.36	111	47.64	reference		
No child	72	49.32	74	50.68	0.89	0.57-1.37	.56
Age at menarche							
>12 years old	117	51.32	111	48.68	1.01	0.66-1.56	.95
≤12 years old	77	50.99	74	49.01	reference		
Menopausal status							
Yes	27	55.1	22	44.9	1.19	0.62-2.30	.56
No	167	50.61	163	49.39	reference		
Hormonal contraceptive use							
Yes	47	49.47	48	50.53	0.91	0.56-1.49	.70
No	147	51.76	137	48.24	reference		
Hormonal replacement therapy							
Yes	12	70.59	5	29.41	2.38	0.76-8.76	.10
No	182	50.28	180	49.72	reference		
Family history							
Yes	22	50	22	50	0.95	0.48-1.87	.87
No	172	51.34	163	48.66	reference		
Early symptoms							
No symptoms or other symptoms	141	51.27	134	48.73	reference		
Mobile lump	22	56.41	17	43.59	1.23	0.63-2.42	.55
Fixated lump	31	47.69	34	52.31	0.86	0.50-1.49	.60
Knowledge (score)							
Mean, SD	36.7	16.5	40.6	18.1			.03
Breast self-examination							
Yes	15	39.47	23	60.53	reference		

Table 1 (continued)

Factors	Delayed diagnosis				OR	95% CI	*P* value
	Yes	%	No	%			
No	179	52.49	162	47.51	1.69	0.81-3.62	.13
Clinical breast examination							
Yes	8	42.11	11	57.89	reference		
No	186	51.67	174	48.33	1.47	0.52-4.31	.42
Lifestyle*							
Good	39	54.93	32	45.07	reference		
Intermediate	109	52.4	99	47.6	0.9	0.53-1.55	.71
Bad	46	46	54	54	0.69	0.38-1.29	.25
Psychosocial support 1**							
Mean, SD	4.12	0.47	4.09	0.44			.58
Psychosocial support 2***							
Mean, SD	3.24	0.52	3.2	0.55			.46
Alternative medicine							
Yes	56	55.45	45	44.55	1.26	0.78-2.05	.32
No	138	49.64	140	50.36	reference		
Access to healthcare							
Hard	55	52.38	50	47.62	1.07	0.66-1.72	.77
Easy	139	50.73	135	49.27	reference		
Healthcare quality (diagnostic pathology turnaround)							
>7 days	81	56.64	62	43.36	1.42	0.92-2.21	.10
≤7 days	113	47.88	123	52.12	reference		
Finance							
Personal	43	44.33	54	55.67	0.69	0.42-1.13	.12
Insurance	151	53.55	131	46.45	reference		

* Lifestyle was assessed by combining fruit and vegetable intake, vitamin D supplementation, smoking status, and obesity.
** Psychosocial support 1 included living conditions and support from partners, family members, and others.
*** Psychosocial support 2 referred to societal stigma.
Abbreviations: CI, confidence interval; OR, odds ratio; SD, standard deviation.
For continuous variables, columns headed "%" contain SDs or ranges, as indicated by the row labels.

Table 2. Multivariable Logistic Regression Analysis of Factors Associated With Delayed Breast Cancer Diagnosis

Factors	Coefficient	SE	aOR	95% CI	*P* value
Unmarried or widowed	-0.717	0.307	0.49	0.27-0.89	.02
Hormonal contraceptive use	-0.239	0.251	0.79	0.48-1.29	.34
Family history of breast cancer	-0.186	0.337	0.83	0.43-1.61	.58
Symptoms					
Mobile breast lump	0.244	0.358	1.28	0.63-2.58	.50
Fixated breast lump	-0.064	0.287	0.94	0.53-1.65	.82
Knowledge score	-0.014	0.006	0.99	0.97-0.99	.03
Not performing regular breast self-examination	0.741	0.372	2.10	1.01-4.35	.046
Lifestyle	-0.22	0.162	0.8	0.58-1.10	.17
Diagnostic pathology turnaround >7 days	0.443	0.226	1.57	0.99-2.43	.051
Personal financing	-0.498	0.252	0.61	0.37-0.99	.048
Constant	0.292	0.496			.56

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; SE, standard error.

chemotherapy, and prognosis, consistent with studies from other Asian settings.[4,9,10] In addition, qualitative accounts also showed that awareness alone did not always translate into appropriate action. Fear of treatment was also frequently reported and may contribute to delayed help-seeking, as also described in a previous study in which participants expressed concerns about body image and marital stability following breast removal.[11] Taken together, these findings emphasize that educational interventions should not only address symptoms and screening but also evidence-based treatment pathways and realistic outcomes to reduce fear-related avoidance.



Figure 2. Thematic Analysis of Expert Interview Findings

Diagnostic pathway and health-service factors

Participants described lengthy diagnostic pathways, limited specialist access, and frequent excisional biopsy. In the quantitative analysis, pathology turnaround of more than 7 days showed a borderline association with delayed diagnosis. In contrast, international clinical guidelines recommend minimally invasive procedures, including ultrasound-guided core needle biopsy, which can be performed in outpatient settings.[12–14]

Behavioral enabling factors were also evident. Not performing regular BSE was associated with increased odds of delay in the quantitative analysis. Qualitative findings indicated that BSE was often performed irregularly or incorrectly, with uncertainty about which abnormalities to recognize. This suggests that BSE-related messages may already exist in the community but remain incomplete or poorly operationalized. Consistent with the Health Belief Model and evidence from India, improved awareness may increase the likelihood of more appropriate BSE and earlier detection.[15,16] These findings support the need to strengthen both breast cancer diagnostic knowledge and practical BSE skills.

Reinforcing factors: family dynamics and social influences

Family and community influences were more complex. Although being unmarried/widowed was associated with lower odds of delay, qualitative accounts emphasized the importance of psychosocial support from partners and family members during the treatment process. This apparent difference may reflect the multiple roles families can play in health-related decision-making rather than a simple protective or harmful effect. Previous Indonesian research has similarly described the influence of family relationships and cultural expectations on help-seeking.[17]

Alternative therapies, stigma, and community myths were prominent in qualitative interviews even though they were not statistically significant in the quantitative analysis. Participants described fears that biopsy or surgery could spread cancer, concerns about treatment, fatalistic beliefs, and reliance on alternative or herbal treatments. Such findings have also been reported in other Asian settings.[18–21] Their qualitative prominence supported their inclusion in the educational program despite the absence of statistically significant quantitative associations.

Based on the identified factors, an integrated breast cancer educational program was developed to address diagnostic delay by improving access to accurate information on breast cancer prevention, screening, and management. This approach aligns with patient-centered care principles that emphasize community empowerment.[22] Key considerations included ensuring that program content, modules, and delivery met educational standards and religious norms, used language that was understandable to the general public, and addressed psychological aspects relevant to breast cancer patients. Multidisciplinary experts refined the module to ensure the program met established standards. Marketing communication experts improved message clarity, psychologists

supported appropriate and persuasive wording, and religious experts reviewed the language and illustrations for cultural and societal appropriateness.

Limitations

This study has several limitations. The quantitative sample was recruited through patient-support organizations, hospital networks, WhatsApp, and Google Forms, which may have favored participants with better internet access, digital literacy, or stronger engagement with survivor networks. Although respondents came from 26 provinces, 78.4% were from Java and eastern Indonesia was sparsely represented; urban–rural residence was not collected. The inclusion of prevalent patients and survivors also introduces possible survivorship bias, and a response rate could not be calculated because the number of people who received the survey invitation was not recorded.

Several measures relied on participant recall, including symptom onset and pathology turnaround, and pathological confirmation was self-reported in the online survey. The questionnaire was developed for this study and underwent expert review and face-testing, but formal construct-validity and reliability testing were not performed. The qualitative analysis used a predefined framework and one primary analyst, without member checking or a formal audit trail.

Table 3. Joint Display of Qualitative Findings, Quantitative Associations, Expert Recommendations, and Resulting Educational Components

Integrated domain	Phase 1 qualitative findings	Phase 2 quantitative findings	Phase 3 expert recommendations	Resulting educational component
Knowledge and symptom recognition (predisposing)	Knowledge of breast cancer signs was often incomplete. Pain was commonly perceived as a main feature of cancer, and some participants delayed assessment because symptoms were considered temporary or non-serious.	Higher knowledge was associated with lower odds of delayed diagnosis (aOR 0.87 per 10-point increase, 95% CI 0.77–0.98).	Experts recommended clear information on signs and symptoms, breast abnormalities, risk factors, screening, and conditions during pregnancy and breastfeeding.	General public/health educators: breast awareness, warning signs, risk factors, screening, and accessible community education.
Breast-examination behavior (predisposing)	BSE was commonly reported but was often irregular or performed with incomplete technique; participants were also uncertain about which abnormalities should prompt assessment.	Not performing regular BSE was associated with higher odds of delay (aOR 2.10, 95% CI 1.01–4.35).	Experts recommended practical BSE education for the public and competency in clinical breast examination (SADANIS) and referral indications for healthcare workers.	General public: BSE and screening skills. Healthcare workers: SADANIS and appropriate referral.
Diagnostic pathway and health-service factors (enabling)	Participants described lengthy diagnostic pathways, frequent use of excisional biopsy, repeated procedures, and limited access to breast specialists in some areas.	Prolonged pathology turnaround (>7 days) showed a borderline association with delay (aOR 1.56, 95% CI 1.00–2.43; $P = .0501$). Personal financing was associated with lower odds of delay in the primary model (aOR 0.61, 95% CI 0.37–0.99)	Experts emphasized appropriate diagnostic pathways, core biopsy, clear referral indications, current clinical management, and improved diagnostic skills among frontline healthcare workers.	Patients and survivors: understanding biopsy and the diagnostic pathway. Healthcare workers: diagnostic work-up, referral, staging, treatment, and surveillance.
Treatment knowledge, fear, and alternative therapy (predisposing/reinforcing)	Fear of chemotherapy and mastectomy, expectations that cancer was inevitably fatal, and use of alternative therapies were reported, particularly among participants with delayed diagnosis.	Alternative-therapy use was not statistically associated with delay, but knowledge remained independently associated with the outcome.	Experts recommended explaining evidence-based treatment options, the role of biopsy, realistic treatment outcomes, coping with diagnosis, and the appropriate place of alternative and herbal therapies.	Patients and survivors: diagnosis, treatment options, coping, and survivorship. General public: treatment misconceptions and alternative therapies.
Family and psychosocial influences (reinforcing)	Partners and family members were important sources of support, but participants also described family influence on health decisions and concerns about abandonment by husbands.	Being unmarried/widowed was associated with lower odds of delay (aOR 0.49, 95% CI 0.27–0.89). The psychosocial support score itself was not significantly associated with delay.	Experts emphasized educating spouses and other close supporters, providing reliable information to families, and strengthening practical and emotional support.	Caregivers and supporters: supportive roles, shared decision-making, reliable information, and psychosocial support.

Table 3 (continued)

Integrated domain	Phase 1 qualitative findings	Phase 2 quantitative findings	Phase 3 expert recommendations	Resulting educational component
Stigma, myths, and community beliefs (reinforcing)	Participants described pity, fatalistic beliefs, shame, fear that biopsy or surgery could spread cancer, and moral explanations linking cancer to personal wrongdoing.	Perceived societal stigma was not significantly associated with delay quantitatively, indicating complementarity rather than direct quantitative confirmation.	Experts recommended directly addressing stigma, myths, misinformation, and alternative-therapy beliefs and adapting messages to culturally appropriate, understandable language.	General public and caregivers: myth and stigma correction. Health educators: accessible, visual and nondigital materials for community outreach.

Finally, the quantitative phase was cross-sectional; therefore, the observed relationships should be interpreted as associations rather than causal effects. In addition, because the phase 2 questionnaire was developed from the preceding systematic review and phase 1 findings, quantitative assessment was limited to factors identified or prioritized earlier, and other potentially relevant factors may have been underrepresented.

The present study ends with the development of the educational-program framework. Although the revised modules were reviewed and verbally approved by the participating experts, they were not implemented or evaluated in the phases reported here. We therefore cannot draw conclusions about feasibility, acceptability, effectiveness, or effects on knowledge, health-seeking behavior, or diagnostic delay. These outcomes require prospective evaluation in the populations and settings for which the framework is intended.

CONCLUSIONS

This study identified patient, health service, and sociocultural factors associated with delayed breast cancer diagnosis in Indonesia. Qualitative findings highlighted gaps in knowledge, breast-health behaviors, diagnostic pathways, family influences, stigma, myths, and alternative therapy use, while the quantitative analysis identified associations particularly with knowledge, BSE, marital status, and diagnostic factors. These integrated findings, together with multidisciplinary expert input, informed the development of an audience-tailored breast cancer educational framework for the general public, patients and caregivers, health care workers, and relevant health-system stakeholders. Further studies are needed to evaluate its feasibility and effectiveness in practice.

ETHICAL CONSIDERATIONS

This research complies with the ethical principles outlined in the Declaration of Helsinki and was reviewed and approved by the Research Ethics and Community Health Service Committee of Faculty of Public Health of University of Indonesia with ethical clearance number Ket-550/UN2.F10.D11/PPM.00.02/2021. Informed consent was obtained from all participants before participation in the study.

DATA AVAILABILITY

Derived data supporting the findings are available from the corresponding author upon reasonable request.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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AI DISCLOSURE

ChatGPT (OpenAI) was used to edit the language and improve the structure and clarity of the manuscript. No content related to study design, data collection, data analysis, or interpretation was generated by the tool. No identifiable patient information or confidential data were entered into the tool. All final wording and scientific content were reviewed and approved by the authors, who take full responsibility for the manuscript.

AUTHOR CONTRIBUTIONS

FBS: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. AB: Conceptualization, Methodology, Writing – review & editing. SSP: Conceptualization, Methodology, Writing – review & editing. DA: Conceptualization, Methodology, Writing – review & editing. HGH: Conceptualization, Methodology, Formal analysis, Writing – review & editing. RCRAP: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing. ADW: Conceptualization, Methodology, Investigation, Data curation, Writing – review & editing. All authors contributed to interpreting the findings, approved the final version, and accepted accountability for the work.

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