

RESEARCH ARTICLE

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Women's Knowledge, Acceptance, and Willingness to Pay for Mammography in Yogyakarta, Indonesia: A Cross-Sectional Survey

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Abstract

Background: Breast cancer remains the most common cancer among women globally and in Indonesia, with a high burden of morbidity and mortality. In Indonesia, mammography is not yet implemented as a national screening program and is not covered by the national health insurance system. Limited access, high costs, and varying levels of knowledge may influence women's acceptance and willingness to pay (WTP) for screening. This study aimed to assess knowledge, acceptance, and WTP for mammography screening among women in Yogyakarta, Indonesia. **Methods:** A descriptive cross-sectional study was conducted from July to September 2024 among women aged ≥ 25 years in Yogyakarta. Data were collected using a self-administered online questionnaire distributed via Google Forms. The questionnaire assessed sociodemographic characteristics, knowledge, acceptance, and WTP using the contingent valuation method. A total of 428 valid responses were analyzed using descriptive statistics. **Results:** More than half of respondents (58.6%) had low knowledge of mammography screening. However, acceptance of screening was high (93.0%). Willingness to pay varied across payment scenarios, with 60.0% willing to pay out-of-pocket and 87.9% under a co-payment scheme. Interestingly, acceptance decreased to 43.5% when screening was fully funded by the government. The median WTP was IDR 500,000 (USD 32.5), which falls within the acceptable market price range. Key reasons for willingness to pay included early detection and perceived benefits, while high cost and lack of urgency were major barriers. **Conclusion:** Despite limited knowledge, acceptance and willingness to pay for mammography screening were relatively high, particularly under a co-payment scheme. These findings highlight the importance of improving public knowledge and designing financially acceptable screening strategies to enhance participation in breast cancer screening programs in Indonesia.

Keywords: Breast cancer screening, Economic valuation, Knowledge, Mammography, Willingness to pay

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Introduction

Breast cancer remains the most commonly diagnosed cancer among women worldwide. According to the latest global cancer statistics reported by the International Agency for Research on Cancer through GLOBOCAN 2022 Global Cancer Statistics, breast cancer continues to account for the largest proportion of cancer incidence globally. Approximately 2.3 million new cases were reported, representing around 11.6% of all cancer cases, with about 670,000 deaths attributed to the disease worldwide [1]. Breast cancer is the most frequently diagnosed cancer in Indonesia, with 58,256 cases, representing 16.7% of the total 348,809 cancer cases. It is also a major cause of cancer-related deaths, with 22,692

fatalities reported [2]. In the Special Region of Yogyakarta, breast cancer similarly shows the highest incidence, with 9,378 cases (19.27% of all cancer cases), and it is the most common cancer among women, accounting for 30.4% of cases [3]. More than 65% of breast cancer cases are diagnosed among women aged 41–60 years, while only 2.3% occur in those under 30 years. Despite the lower incidence in younger women, this study included participants aged ≥ 25 years to capture early awareness, acceptance, and willingness to pay for screening prior to the peak age of diagnosis. This approach is important in the context of preventive strategies, as increasing awareness at a younger age may support earlier detection and improve long-term outcomes, even though routine mammography screening is generally considered more cost-effective for

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women aged 40 years and above.

The high incidence and mortality of breast cancer in Indonesia, particularly in Yogyakarta, highlight the urgent need for effective early detection through screening. The World Health Organization (WHO) identifies mammography as the gold standard for breast cancer screening due to its proven effectiveness in early detection and improved disease management [4]. However, in Indonesia, mammography has not yet been implemented as a national screening program and is not covered by Badan Penyelenggara Jaminan Sosial (BPJS), Indonesia's national health insurance system [5]. Currently, the Indonesian Ministry of Health recommends early detection through breast self-examination (BSE) and clinical breast examination (CBE) [5, 6].

Previous studies in Yogyakarta have shown that although most women possess good knowledge of mammography as a breast cancer screening method, only a small proportion are willing to undergo screening. This reluctance is mainly attributed to a perceived lack of urgency for screening among asymptomatic individuals, limited access to services, and the relatively high cost of mammography [5]. Consequently, access to mammography remains limited and it is not included in the national health insurance scheme [5]. In Indonesia, breast cancer represents one of the leading contributors to cancer-related healthcare expenditure [7]. However, the benefit package of Badan Penyelenggara Jaminan Sosial (BPJS) Kesehatan does not fully cover all aspects of breast cancer care, requiring patients to bear substantial out-of-pocket costs, including both medical and non-medical expenses [8]. Therefore, this study aimed to assess the level of knowledge, acceptance, and willingness to pay (WTP) for mammography screening in the context of high breast cancer-related healthcare costs and significant out-of-pocket payments. The findings are expected to provide evidence to support the development of breast cancer screening programs, including the potential implementation of co-payment schemes, as well as inform policy decisions to improve financial coverage for breast cancer screening and treatment, ultimately reducing the burden of breast cancer in Indonesia.

Materials and Methods

Study design, sampling, and study population

This study employed a descriptive, cross-sectional, population-based design conducted between July and September 2024 among women aged ≥ 25 years residing in all areas of Yogyakarta, Indonesia. The minimum age of 25 years was selected to capture early awareness, acceptance, and willingness to pay for mammography screening prior to the peak age of breast cancer diagnosis, as explained in the Introduction. Willingness to pay (WTP) refers to the maximum amount an individual is willing to pay for a specific health service or intervention, reflecting the perceived value and affordability of that service. Participants were recruited online using a self-administered questionnaire distributed via a Google Forms link. A non-probability sampling approach with a convenience sampling technique was applied. The

questionnaire was disseminated broadly across five districts in Yogyakarta, with efforts to proportionally reach participants based on the population distribution of each district. Additionally, permission was obtained from various institutions, including community groups, governmental bodies, and private organizations, to facilitate participant recruitment. The inclusion criteria were women aged ≥ 25 years, residing in Yogyakarta, and willing to participate in the study by completing the questionnaire. Exclusion criteria included incomplete questionnaire responses and individuals who did not meet the age or residency requirements.

Data Collection

Yogyakarta consists of five administrative districts. Based on population data from 2023, the number of women aged over 25 years was 1,360,754. Given that the population size was known, the required sample size was determined using Slovin's formula: $n = N / (1 + N(e)^2)$, where N represents the total population and e denotes the margin of error (5%) at a 95% confidence level. Based on this calculation, the minimum required sample size was 400 participants.

Participants were recruited using a convenience sampling approach. Data were collected through a self-administered questionnaire distributed via a Google Forms link, which participants completed independently. The questionnaire link was disseminated through multiple channels, including social media platforms (e.g., WhatsApp, Instagram), community groups, and institutional networks across the five districts of Yogyakarta. A total of 450 questionnaires were distributed, of which 428 were completed and included in the final analysis, yielding a response rate of 95.1%. The questionnaire was adapted and modified from previously validated studies [9–17]. The original English version was translated into Bahasa Indonesia using a forward translation process conducted by bilingual researchers, followed by review and refinement to ensure conceptual equivalence and clarity of meaning. Prior to data collection, the questionnaire underwent validity and reliability testing. Content validity was assessed by experts in social pharmacy with experience in questionnaire development and evidence-based practice. Face validity was evaluated by administering the questionnaire to 30 respondents to ensure clarity and comprehensibility. Reliability was tested using Cronbach's alpha based on pilot data obtained from the same 30 respondents.

The questionnaire consisted of four sections. The first section collected participants' socio-demographic characteristics, including age, marital status, educational level, occupation, monthly income, health insurance status, and family history of breast cancer. The second section assessed participants' knowledge of mammography for breast cancer screening using 14 items. The third section evaluated participants' acceptance of mammography screening after being provided with brief information about breast cancer screening and its recommendations. The final section measured participants' willingness to pay (WTP) for mammography screening using open-ended questions based on the contingent valuation method. The contingent

valuation method is an economic technique used to estimate individuals' willingness to pay for a specific good or service by presenting a hypothetical scenario and directly asking respondents their maximum willingness to pay. The questionnaire required approximately 5–15 minutes to complete. Participants' WTP was assessed under different payment scenarios, including co-payment, out-of-pocket payment, and full government coverage. A payment scenario refers to a hypothetical situation presented to respondents that describes how a health service is financed, used to assess their preferences and willingness to pay under different conditions. Co-payment refers to a cost-sharing mechanism in which individuals pay a portion of the service cost while the remaining amount is covered by a third party, such as the government or health insurance. Out-of-pocket payment refers to direct payments made by individuals for healthcare services without reimbursement from insurance or other third-party payers. Fully funded by the government refers to a financing scheme in which the entire cost of a health service is covered by public funds, with no direct payment required from the individual. For respondents who were unwilling to pay, the reasons for their decision were also recorded.

Statistical Analysis

Results were analyzed using Microsoft Excel and SPSS (version 26.0). Sociodemographic characteristics of the participants were summarized using descriptive statistics. Participants' knowledge of mammography screening was assessed using 14 items with three response options: "True", "False", and "Don't Know". Each correct response ("True") was scored as 1, while incorrect or uncertain responses ("False" or "Don't Know") were scored as 0. The total knowledge score was calculated by summing all item scores, with a maximum possible score equal to the total number of questions. The normality of the knowledge score distribution was assessed using the Kolmogorov–Smirnov test. As the data were not normally distributed, the median value was used as the cut-off point to categorize knowledge levels. Participants with total scores $\leq$ median were classified as having low knowledge, while those with scores $>$ median were classified as having high knowledge. The observed knowledge scores ranged from 0 to 14, with a median of 11.00 and a mean score of 9.90 (± 3.83). Accordingly, scores of 0–11 were categorized as low knowledge, while scores of 12–14 were categorized as high knowledge.

Results

Participants' characteristics

A total of 428 women participated in this study. The sample was predominantly composed of younger adult women, with the majority aged 25–45 years. Most respondents were married, had a higher level of education, and were employed, indicating a relatively well-educated and economically active population. In terms of socioeconomic status, over half of the participants were in the moderate-income group, and nearly all respondents reported having health insurance coverage.

Additionally, a considerable proportion of participants reported having a family history of breast cancer. Detailed sociodemographic characteristics are presented in Table 1.

The participants' knowledge of mammography screening

Overall, participants demonstrated varying levels of knowledge regarding mammography screening. While general awareness of mammography as a screening method was relatively high, several gaps were observed in more specific aspects of screening recommendations and procedures. Most respondents were aware of the role of mammography in detecting breast abnormalities and its importance in early detection and mortality reduction. In addition, basic procedural aspects, such as the use of X-rays and breast compression during the examination, were generally well understood.

However, knowledge related to screening guidelines was less consistent. A considerable proportion of participants showed uncertainty regarding the appropriate age to initiate screening and the recommended screening

Table 1. Sociodemographic Characteristics

Sociodemographic characteristics (n=428)	Number of respondents (N)	Percentage (%)
Residence		
Yogyakarta City	95	22.2
Bantul District	114	26.6
Sleman District	168	39.3
Gunung Kidul District	19	4.4
Kulon Progo District	32	7.5
Age range		
25-45 years old	413	96.5
45-65 years old	15	3.5
Marital status		
Not Married (Single/widowed)	160	37.4
Married (Married Woman)	268	62.6
Educational level		
Low (Elementary-Junior-Senior High School)	93	21.7
High (Diploma, Bachelor, Master, Doctoral)	335	78.3
Occupation		
Unpaid working/unemployed	147	34.3
Paid working/employed	281	65.7
Income*		
Low (<IDR 2.000.000)	98	22.9
Moderate (IDR 2.000.000-IDR 7.000.000)	234	54.7
High (>IDR 7.000.000)	96	22.4
Having health insurance (private or public)		
Yes	418	97.7
No	10	2.3
Family history of breast cancer		
Yes	169	39.5
No	259	60.5

*according to the Provincial Minimum Wage (UMP) DI.Yogyakarta Province 2024 IDR 2.125.897,61 and central statistics agency survey (BPS).

Table 2. Distribution of Knowledge Level Among Participants (n=428)

Knowledge Level	Frequency (n)	Percentage (%)
Low Knowledge (≤ 11)	251	58.6
High Knowledge (> 11)	177	41.4
Total	428	100

frequency. Misconceptions were also identified, particularly regarding the ability of mammography to detect all stages of breast cancer. Based on the median cut-off point, a higher proportion of participants were categorized as having low knowledge compared to high knowledge. The detailed distribution of knowledge levels and item-specific responses are presented in Tables 2 and 3.

The participants' acceptance and willingness to pay for mammography screening

Overall, acceptance of mammography screening was high, with the majority of participants expressing willingness to undergo screening. However, willingness to pay (WTP) varied substantially depending on the payment scenario. When participants were required to pay out-of-pocket, the proportion willing to pay decreased compared to initial acceptance. A slight decline was also observed after the introduction of the initial bid price. In contrast, willingness to pay increased markedly under a co-payment scheme, indicating a preference for shared financial responsibility.

Interestingly, acceptance was lower when the screening was fully funded by the government, suggesting that participants may favor partial payment over fully subsidized services. The median WTP for mammography screening was IDR 500,000 (USD 32.5), which falls within the current market price range in Indonesia.

Detailed results of acceptance and WTP across different payment scenarios, as well as the distribution of WTP amounts, are presented in Tables 4 and 5.

Discussion

This study examined the knowledge, acceptance, and willingness to pay for mammography breast cancer screening among women in Yogyakarta, Indonesia. The study population was predominantly composed of younger adult women, with fewer elderly participants. This age distribution highlights the relevance of targeting younger populations, emphasizing the importance of early awareness and preventive strategies for breast cancer screening, particularly among women of reproductive age [18]. Most participants were married. Previous studies suggest that marital status may influence health-related behaviors, including seeking medical advice and participating in routine screening. Married women may have greater social and emotional support, which could facilitate access to healthcare services compared to those who are single or widowed [19].

Education is widely recognized as an important determinant of health behaviors and outcomes. The high proportion of respondents with higher educational attainment may reflect better awareness and understanding of health-related issues, including breast cancer, and potentially greater engagement in preventive healthcare practices. Therefore, educational interventions focusing on breast cancer awareness and screening guidelines remain essential to improve knowledge and participation [20–23]. Employment status is also associated with socioeconomic conditions and access to healthcare. Women who are employed may have better financial capacity to access preventive services, including breast cancer screening. In this study, most respondents were

Table 3. Knowledge Regarding Mammography Breast Cancer Screening

Questions	N (% correct)
1. Mammography is a breast cancer screening method to see whether or not there are abnormalities in breast tissue that could lead to cancer.	386 (90.2)
2. Mammography is taken using X-rays at a slightly higher dose than a chest X-ray but within the safety limit	307 (71.7)
3. Mammography is better performed at the end of the menstrual period week (when the breast's condition is less sensitive)	257 (60.0)
4. Mammography is conducted by gentle pressure on the breast using two plates	307 (71.7)
5. Mammography is the best choice for breast cancer screening	341 (79.7)
6. Deodorant, talcum powder, or lotion better not be used before mammography	282 (65.9)
7. Mammography screening is a reliable method for breast cancer early detection	361 (84.4)
8. Mammography screening should be conducted by every woman above 40 years annually or biennially	254 (59.3)
9. Mammography is the best diagnostic to show irregular micro-calcification, which is the earliest sign of breast cancer	314 (73.4)
10. If there is any evaluation or report, mammograms previously should be reported while going through mammography	331 (77.3)
11. Mammography screening can also be performed in the 20s	271 (63.4)
12. Mammography decreases breast cancer mortality	354 (82.7)
13. Mammography can detect all stadium of breast cancer*	221 (51.6)
14. A physician should first examine a patient presenting with a breast mass and, if necessary, mammography and/or breast ultrasound should be performed	374 (87.4)

Table 4. Acceptance and Willingness to Pay Scenarios for Mammography Breast Cancer Screening (n=428)

Acceptance and Willingness to Pay (WTP) Scenarios	Frequency (n)	Percentage (%)
Acceptance		
Yes	398	93.0
No	30	7.0
Before offering the initial bid price		
Yes	272	63.6
No	156	36.4
Payment out of pocket		
Yes	257	60.0
No	171	40.0
Co-payment Scheme		
Yes	376	87.9
No	52	12.1
Fully paid by the government		
Yes	186	43.5
No	242	56.5

Table 5. The Amount of Willingness to Pay for Mammography Screening in Out of Pocket and Co-Payment Scenario

		Out of pocket		Co-payment
		IDR	USD	%
WTP	Mean (SD)	707,253 (±503,462)	45.9 (±32.7)	41.6 (±24.6)
	Median	500,000	32.5	50
	Range	50,000-1,500,000	3.2 – 97.5	5-100

categorized in the moderate-income group, followed by low- and high-income groups. Previous studies have indicated that occupational and income factors may influence participation in screening programs and willingness to pay for such services [9, 11, 13, 14, 16, 17, 20, 22–26].

Nearly all participants reported having either private or public health insurance. This finding is consistent with national data from BPJS, which indicates that universal health coverage in Indonesia reached approximately 95% in 2023. Such high insurance coverage may indicate relatively good access to healthcare services, including preventive care, and may help reduce financial barriers to early detection. A substantial proportion of participants reported having a family history of breast cancer. This finding is consistent with the high incidence of breast cancer in Yogyakarta, where it is the most common cancer among women. Family history is a well-established risk factor for breast cancer, and this may influence health behaviors, including awareness and willingness to pay for mammography screening [3, 9, 11, 13, 16, 20, 22, 24, 27–29].

The findings of this study revealed an interesting pattern in participants' acceptance and willingness to pay (WTP) for mammography screening. Although overall acceptance of screening was high, willingness to pay varied depending on the payment scenario. Notably, a higher proportion of participants preferred a co-payment scheme compared to a fully government-funded program.

This finding may be explained by the perception of value and quality associated with paid healthcare

services. Previous studies have shown that individuals may perceive services that require some level of personal financial contribution as being of higher quality compared to those provided entirely free of charge. In addition, co-payment mechanisms may increase a sense of personal responsibility and engagement in health-related decision-making, which can positively influence acceptance of preventive services [30, 31].

Furthermore, trust and perceived efficiency of publicly funded healthcare services may also play a role. In some settings, fully subsidized services are often associated with longer waiting times, limited availability, or perceived lower service quality, which may reduce public preference despite the absence of direct costs [32].

In the context of Indonesia, where out-of-pocket payments remain common despite high health insurance coverage, individuals may be more accustomed to sharing healthcare costs. This may explain why a co-payment scheme was more acceptable compared to a fully government-funded option [33].

A substantial proportion of respondents (58.6%) were categorized as having low knowledge of mammography screening. This finding is consistent with previous research conducted in Saudi Arabia, which reported that many women have limited knowledge of breast cancer screening methods [34]. Higher levels of knowledge have been associated with better understanding and utilization of mammography, whereas insufficient knowledge may hinder appropriate use of screening services [35]. In this study, several gaps in knowledge were identified at the item level. For instance, a considerable number of respondents

incorrectly believed that mammography can detect all stages of breast cancer, indicating a misunderstanding of the limitations of the screening method. In addition, uncertainty was observed regarding the recommended age and frequency of screening. These findings suggest that while general awareness of mammography exists, more specific and practical knowledge related to screening guidelines and limitations remains inadequate.

Limited knowledge of breast cancer screening is a well-recognized barrier to participation in screening programs [35]. The sources of information reported by participants in this study may partly explain this issue. Most respondents indicated that they obtained information from social media, the internet, and personal networks such as friends and family. While these channels are easily accessible, they may not always provide accurate or comprehensive health information. This pattern is consistent with the rapid growth of social media use in Indonesia. In 2024, the number of social media users reached approximately 191.4 million, representing 68.9% of the total population, with platforms such as WhatsApp, Instagram, Facebook, and TikTok being the most widely used. Similarly, a systematic review conducted in the United States found that interpersonal communication, including discussions with friends and family, plays a significant role in shaping knowledge and attitudes toward breast cancer screening [36]. These findings highlight the need for more structured and reliable health education strategies to improve specific knowledge related to mammography screening, particularly regarding its limitations and recommended use.

Women's decisions to undergo mammography screening may also be shaped by psychological factors, including health beliefs and emotional coping mechanisms. Perceptions regarding the severity of breast cancer and individual susceptibility can influence the likelihood of engaging in preventive behaviors such as screening. Individuals who perceive themselves to be at risk or who recognize the importance of early detection may be more inclined to participate in mammography screening. In addition, proactive coping strategies may be associated with greater engagement in preventive health practices. Perceptual factors, such as perceived barriers and self-efficacy, can also play an important role in shaping screening behavior. Furthermore, several barriers to mammography uptake have been reported, including fear, anxiety, worry, religious beliefs, fatalistic attitudes, financial constraints, and feelings of embarrassment [37].

The median willingness to pay (WTP) for mammography screening was IDR 500,000 (USD 32.5), which falls within the acceptable market price range in Indonesia. Several factors were reported to influence participants' willingness to pay, with the most common reasons including the intention for early detection to prevent disease severity (41.7%), belief in the benefits of mammography screening (41.0%), and the perception that the screening cost was affordable (17.3%). In addition, some respondents indicated that willingness to pay may be related to greater health awareness and the desire for faster access to healthcare services. Among respondents who were unwilling to pay, the most frequently reported

barrier was the high cost of screening (43.0%), followed by a perceived lack of urgency (37.8%) and limited access to screening facilities (19.2%). Other factors contributing to unwillingness included fear of undergoing the procedure, perceived complexity of the screening process, and the expectation that such services should be covered by the national health insurance system (BPJS).

This study has several limitations that should be considered. The use of convenience sampling and online data collection may have introduced selection and response bias. Therefore, caution is needed when interpreting the findings, particularly in terms of their representativeness and generalizability to the wider population or different settings. In conclusion, despite the overall level of knowledge being categorized as low, the acceptance of mammography screening among women in Yogyakarta was relatively high. Willingness to pay (WTP) was also notably higher when screening was offered under a co-payment scheme, even among participants with limited knowledge of the procedure. These findings suggest the need for targeted interventions to improve knowledge and support informed decision-making, particularly in the context of implementing sustainable breast cancer screening programs.

Author Contribution Statement

Anietta Ramadhani: Data gathering, Analysis, and Drafting of manuscript. Susi Ari Kristina: Supervisor, Questionnaire's content validator, Corresponding author. Vo Quang Trung: Co-supervisor, Questionnaire's content validator. Kanza Amalina Rosyida: Drafting and Revising the manuscript.

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Declarations:

This study was conducted as part of a master's thesis in the Master of Pharmacy Management Program, Faculty of Pharmacy, Universitas Gadjah Mada.

Ethical Declaration

This research had approved Ethical Clearance from the Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, with document reference number KE/FK/1139/EC/2024.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article

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