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Effects of Family Support on Breast Cancer Patients' Knowledge and Health-Seeking Behaviour Practices in Bangladesh

Abstract

Background: Due to late-stage diagnosis, breast cancer has a high death rate in developing nations and is the most common cancer among women globally. Poor outcomes in Bangladesh are largely caused by a lack of awareness and delays in seeking treatment. The purpose of this study is to evaluate the screening habits and knowledge of breast cancer patients and investigate the impact of social and familial support on their health-seeking behaviours.

Methods: Women who were 18 years of age or older, had a diagnosis of breast cancer or were suspected of having it, and satisfied the inclusion requirements were chosen using a convenience sample technique. Face-to-face interviews with a structured questionnaire were used to gather data. A variety of characteristics, including socioeconomic, medical, and social support variables, were examined in order to evaluate the participants' knowledge and practices surrounding breast cancer. To find relationships between knowledge and practice results, descriptive statistics, chi-square tests, and logistic regression analyses were employed.

Results: Of the 355 participants in this study, 53.52% of patients had good breast cancer knowledge and practice. Better knowledge and practice were significantly correlated with higher income (AOR: 0.87, 95% CI: 0.46–0.94, p 0.001), having access to portable electronic devices (AOR: 1.11, 95% CI: 1.07–4.97, p = 0.022), reporting symptoms (AOR: 5.55, 95% CI: 1.04–5.33, p = 0.041), and feeling uncomfortable (AOR: 2.33, 95% CI: 1.01–5.57, p = 0.039). Patients with alternative therapies (AOR: 0.52, 95% CI: 0.26–0.94, p = 0.043) and those with delayed diagnosis (AOR: 0.42, 95% CI: 0.22–0.79, p < 0.001), on the other hand, were less likely to have good knowledge. While social circle support was adversely correlated with knowledge and practice, family support—especially from spouses—was significantly correlated (AOR: 0.54, 95% CI: 0.26–0.89, p = 0.009).

Conclusion: This study emphasises the significance of early diagnosis, breast self-examination (BSE), and overcoming sociocultural obstacles in order to address the substantial disparities in breast cancer awareness and behaviours in Bangladesh. Although knowledge is influenced by variables including education, income, and access to technology, many patients still lack the courage to seek medical attention. Though its influence is occasionally limited by social conventions, family and social support—particularly from spouses—has a favourable impact on knowledge and habits. Comprehensive awareness programs emphasising education, stigma reduction, and early detection are desperately needed to improve health outcomes in light of the rising rates of breast cancer.

Introduction

The most prevalent cancer in the world to affect women, breast cancer is also one of the main causes of cancer-related mortality [1]. Breast cancer is the most common cancer in women, accounting for two million new cases in 2020 and 11.7% of all cancer cases worldwide [2]. Although breast cancer is detected more often in industrialised countries, emerging countries have a greater death rate from the disease [3]. Nearly 62% of breast cancer-related deaths in 2012 took place in developing nations; in South Asia alone, there were an estimated 200,000

new cases and 97,500 fatalities [4]. Over the previous five years, breast cancer has remained prevalent in Bangladesh at 32.8%, accounting for 69% of female cancer-related deaths [5]. According to a recent study, there were 12,764 new instances of breast cancer discovered in Bangladesh in 2018, with an incidence rate of 22.5 cases per 100,000 women [6,7]. According to research, 50% of individuals with breast cancer pass away as a result of a late-stage diagnosis, underscoring the need of early identification [8].

Breast cancer outcomes are greatly improved by early detection; nevertheless, even in areas with lower incidence rates, delayed discovery frequently results in diagnosis at an advanced stage, which lowers prognosis and increases fatality rates [9]. Lack of knowledge, poor healthcare-seeking behaviour by low-income women, and restricted access to quality healthcare services are the main causes of these delays [10]. Good health literacy supports early medical attention, favourably influences screening behaviour when women recognise early signs and symptoms, and fosters "breast awareness" by educating women about their breasts and how they evolve over time [11,12]. According to research, a lack of awareness and a number of sociodemographic variables cause people to put off getting medical attention because early warning signs and symptoms of breast cancer are frequently disregarded [13].

In South Asia, little is known about the biology, epidemiology, and environmental causes of breast cancer [14]. The high death rates from breast cancer in Bangladesh are mostly caused by ignorance, restricted access to care, and carelessness on the part of the populace. Reducing morbidity and mortality requires increasing knowledge of the symptoms, indicators, and early detection techniques such mammography, breast self-examination (BSE), and clinical breast examination (CBE). However, there is still a lot of misunderstanding about the causes and risk factors of breast cancer because it is still a topic that is rarely discussed [15]. Delays in seeking care in Bangladesh are partly caused by a lack of knowledge about self-diagnosis and available therapies. Furthermore, women find it difficult to freely disclose their symptoms due to social stigma, which frequently causes them to put off getting medical help until the illness has progressed [5].

The psychological effects of breast cancer are profound, and anxiety is frequently brought on by worries of dying and mastectomy. As they adjust to their diagnoses, patients go through emotional phases and feel overtaken by the changes in their lives. They require assistance during these moments, yet it can be challenging for others to completely comprehend their feelings [16]. Hamilton et al. used grounded theory in a qualitative study to investigate men's attitudes towards their partners' breast cancer and chemotherapy as husbands, fathers, and carers. They discovered two major themes through semi-structured interviews: the emphasis on the partner's illness and providing care, as well as the attempt to keep the family in balance [17].

Since successful care of breast cancer patients and their families rely on a thorough awareness of their requirements, it is crucial to comprehend their experiences in order to offer them with adequate support [18]. The crucial support needs of patients are highlighted by the dual role of friends and spouses as both individuals in pain and supports. For patients and their partners, spousal support is crucial in lowering anxiety and sadness. In order to prevent psychological anguish in patients, family support is essential, but for male partners, friend support is more beneficial [19]. In order to establish successful health promotion efforts that aim to minimise mortality caused by inadequate health-seeking behaviour and insufficient screening services, it is imperative to examine patients' knowledge and habits about breast cancer and screening. The

purpose of this study is to assess the screening behaviours and knowledge of breast cancer patients while investigating the function of social and familial support.

Methods

To ensure better reporting of our epidemiological observational cross-sectional study, we used the STROBE guideline.

Study sites and study design:

Two primary cancer care centres in Bangladesh's capital, Dhaka, participated in a multi-center retrospective cross-sectional study.

Data collection

A convenience sampling technique was used because patient registries were not available. Potential participants were patients who visited these facilities. Participants were invited if they satisfied the study's inclusion and exclusion requirements. Prior to data collection, verbal informed consent was acquired in compliance with the study protocol.

Eligibility criteria

Women 18 years of age and older who had either been diagnosed with breast cancer and referred to our participating centres or who had suspected breast cancer were questioned for this study. Patients were only included if their initial stage was recorded in their medical records or if their original diagnosis was made within six months of staging at our facilities. Trained interviewers who were not engaged in the clinical management of the patients performed in-person interviews with the participants using a structured questionnaire.

Outcome variables:

The study assessed the participants' understanding of and behaviour related to breast cancer risk factors and health-seeking behaviours. Responses to a series of questions pertaining to knowledge and practice were used to evaluate the participants' knowledge and practices. Every right response was worth one point, while every wrong response was worth zero. Respondents were categorised as having "good knowledge" if their scores were at or above the mean, and "low knowledge" if their scores were below the mean [20]. Each of the seven knowledge and practice assessment questions has a reliability coefficient above 70%, as determined by Cronbach's alpha [21].

Possible factors

As independent variables, we analysed socioeconomic, medical, and social support factors to identify knowledge and practice risk factors. Age, geographic location (division), residency (urban or rural), marital status, educational attainment (illiterate, primary, or secondary) of both the patient and their spouse, household monthly income, exposure to mass media (social media, television, and newspapers), access to mass media and portable electronic devices, and medical history, including symptoms, were considered. Other characteristics included cancer stage, first

health facility visits following symptoms, alternative therapies, diagnosis delays, and discomfort (such as arm pain, breast pain, itching, lump, nipple discharge, form changes, skin changes, or ulcerated skin). We also evaluated family support, including who the patient first talked about their health concern, who suggested they see a doctor, fear or discomfort in discussing it with their spouse, and post-diagnosis support from their spouse or social circle. Patient and provider delays from symptom detection to conclusive therapy were considered diagnosis delay [22]. Diagnostic delays were defined as 16 weeks or more in this investigation.

Statistical analysis

Descriptive statistics utilising crosstabs showed categorical variable counts and percentages. Knowledge and practice components were examined using Chi-square and Fisher's exact tests. Risk variables were identified using binary and multivariable logistic regression. The link between knowledge and practices and various factors was first examined using bivariable analysis. Risk factor relationships were examined using unadjusted and multivariable logistic regression models. The logistic regression model was loaded with variables separately in the univariable analysis and all relevant variables concurrently in the multivariable analysis. Results are presented as unadjusted/crude odds ratios (COR) and adjusted odds ratios (AOR) with 95% confidence intervals and 5% significance. All analyses were done in R.

Variable selection

It took two steps to choose variables. The first stage used bivariable analysis (chi-square test) for each independent variable, using a p-value ≤ 0.20 to choose covariates for multivariable models [23,24]. The selected predictor variables were used to create a full multivariable model in the second stage. We utilised a 4.00 variance inflation factor (VIF) cut-off to measure multicollinearity in the final model [25]. All selected variables were included in the final model since their VIF values were below this criterion.

Model performance

The best model's accuracy was assessed using the AUROC curve, sensitivity, specificity, and Hosmer–Lemeshow goodness-of-fit test. Model performance improved with higher AUROC levels. A lower p-value and an area under the ROC curve bigger than 0.50 indicate that the model distinguishes between the two categories [26]. Hosmer–Lemeshow goodness-of-fit tests how well model probabilities match observed outcomes. A Hosmer–Lemeshow test p-value above 0.05 indicates that the model accurately divides observations into outcome categories [27].

Results

This study involving 355 participants, it was found that patients had a slightly higher level of knowledge and practices regarding breast cancer. The results revealed that a majority of respondents (64.67%) were unaware of the symptoms of breast cancer. Additionally, only a small proportion of respondents (11.11%) regularly performed breast self-examinations, and just 11.21% sought medical help immediately after noticing symptoms. Furthermore, the vast majority (95.21%) had never had a breast exam conducted by a healthcare professional before experiencing any breast issues. Awareness of mammography was also low, with only 6.01%

of participants being familiar with the procedure. Regarding personal or family history, 27.92% knew someone close to them who had cancer, but only 9.52% were aware of a family history of breast cancer. In terms of overall knowledge and practice, 53.52% of participants were classified as having "Good" knowledge and practice (mean $\geq$ 1), while 46.48% were categorized as having "Low" knowledge and practice (mean < 1) on breast cancer (Table 1).

In Table 2, the percentage of patients age with good knowledge and practice on breast cancer was 55.26% for those under 40 years, 56.78% for those between 40 and 59 years, and 43.33% for those aged 60 and above. Regarding geographic location, the percentage of patients with good knowledge and practice on breast cancer ranged from 51.92% in Chittagong to 78.57% in Rangpur. For area of residence, 54.18% of rural residents exhibited good knowledge and practice on breast cancer, while 56.38% of urban residents did. A significant difference emerged in the spouse education level category (p = 0.029), patients whose spouses had a secondary or higher education had 59.46% good knowledge and practice, 44.07% in those with spouses with primary education and 59.55% in those with illiterate spouses. In terms of household monthly income, a strong association was found (p = 0.005), patients earning more than 20,000 BDT monthly (71.64%) exhibited highest good knowledge and practice on breast cancer, lowest (44.25%) in those with incomes below 5,000 BDT. Patients with portable electronic devices and mass media access showed better knowledge and practice on breast cancer, with 55.49% (p = 0.027) of those with devices and 59.03% (p = 0.086) of those with mass media access demonstrating good outcomes.

In medical history, 56.88% of individuals with symptoms had good knowledge and practice on breast cancer and only 14.29% of individuals without symptoms had the same outcome (p < 0.001). First health facility visit showed that 61.05% of patients who first visited a private clinic had good knowledge and practice and lowest 46.67% of those who not visited government or private hospitals. Patients who consumed alternative remedies were less likely to have good knowledge and practice on breast cancer, as only 47.71% of those who used alternative remedies exhibited, where 60.45% of those who did not, with a significant p-value of 0.028. Patients who experienced delays in diagnosis showed a trend toward poorer knowledge and practice (57.73% good knowledge in delayed diagnosis and 42.86% in no delay, p = 0.017). Among all patients, 24.58% had good knowledge and practice on breast cancer, while 22.62% did not who feel any discomfort experience (p = 0.043) (Table 2).

In the category of family and social support, for those who were recommended to consult with a doctor, 70% of individuals who made the recommendation themselves and had good knowledge and practice on breast cancer followed by, 54.68% from husband, 53.57% from neighbor, 58.57% from sons or daughters, and 53.49% from others, respectively. Regarding the fear or discomfort in talking to a spouse about the issue, 59.26% of individuals who felt uncomfortable had good knowledge and practice on breast cancer and 54.98% had same outcomes who are not in fear to share and comfortable (p = 0.046). When considering spousal support after diagnosis, 57.02% of individuals who received support from their spouse had good knowledge and practice on breast cancer, while, a lowest amount (47.83%) of those who did not receive support (p = 0.025). Among all patients, a large amount (62.50%) did not receive support from their social circle and had lower knowledge and practice (Table 2).

The highest proportion of patients expressing no fear or discomfort in discussing their breast cancer problems with their spouse was observed in Rangpur (100%), while the lowest was in Barisal (68.18%). Regarding support from spouses after diagnosis, the highest was in

Mymensingh (96.55%), and the lowest was in Barisal (77.27%). For support from their social circle, the highest was in Sylhet (100%), while the lowest was in Barisal (56.00%) (Figure 1).

In the adjusted model (Table 3), various socioeconomic characteristics affected breast cancer knowledge and practice odds. Compared to those 60 or older, those 40-59 and under 40 had 1.25- and 1.35-times higher odds of good knowledge and practice. Rangpur patients were more than four times more likely than Barisal patients to have good knowledge and practice (AOR: 4.05, 95% CI: 0.64–8.25). Illiterate patients had 66% lower likelihood of competent knowledge and practice than those with secondary or higher education (AOR: 0.34, 95% CI: 0.12–0.97, p = 0.046). Patients earning less than 5000 BDT per month had a 13% lower likelihood of displaying strong knowledge and practice compared to those earning over 20,000 BDT (AOR: 0.87, 95% CI: 0.46–0.94, p 0.001). Patients with access to portable electronic devices and mass media had 1.11- and 1.90-times greater odds of good knowledge and practice, respectively (AOR: 1.11, 95% CI: 1.07–4.97, p = 0.022) and (AOR: 1.90, 95% CI: 0.44–2.84).

In terms of medical history, patients with symptoms had more than five times the odds of strong knowledge and practice (AOR: 5.55, 95% CI: 1.04–5.33, p = 0.041). Alternative medicine users had 48% lower odds of competent knowledge and practice (AOR: 0.52, 95% CI: 0.26–0.94, p = 0.043). Patients with delayed diagnosis had a 58% reduced likelihood of competent knowledge and practice (AOR: 0.42, 95% CI: 0.22–0.79, p 0.001). However, individuals who experienced discomfort had over twice the odds (AOR: 2.33, 95% CI: 1.01–5.57, p = 0.039) of having strong breast cancer knowledge and practice (Table 3).

Family support increased the likelihood of breast cancer awareness and practice by 2.39 times for patients who felt uncomfortable sharing their health difficulties with their spouse (AOR: 2.39, 95% CI: 1.03–4.79, p = 0.046). After diagnosis, spousal support increased the likelihood of good knowledge and practice by 21% (AOR: 1.21, 95% CI: 1.11–2.91, p = 0.036). However, patients who got social assistance were 46% less likely to display strong knowledge and practise (AOR: 0.54, 95% CI: 0.26–0.89, p = 0.009) (Table 3).

This study's amended model passed the Hosmer and Lemeshow goodness-of-fit test. Tables 4 and Figure 2 show that AUROC values of 74.46% indicated an adequate classification accuracy.

Discussion

In this study, a significant portion of patients lacked awareness of breast cancer symptoms and did not regularly perform breast checks or seek immediate medical attention upon noticing symptoms. These findings align closely with a previous study, which reported that only half of the respondents recognized a breast mass as a key symptom of breast cancer [28]. A general lack of confidence in the healthcare system, fueled by personal experiences or negative portrayals in the media, led many patients to avoid seeing a healthcare professional [29]. Awareness of mammography and its importance was also limited, with many patients unfamiliar with the procedure. Similar to our findings, Osime et al. reported only 35% mammography awareness among civil servants, while Akinola et al. found a 40.5% awareness level in a hospital sample [30,31].

Few patients knew someone close to them who had cancer, and even fewer knew about breast cancer or had a family history. A study of urban women in Ahmedabad indicated that few realised that family history increased breast cancer risk [32]. Another Bangladeshi

university female student study indicated that those with a close relative with breast cancer knew the Breast Self-Examination (BSE) process better [33]. Our study found that slightly over half of patients had good breast cancer knowledge and practice. A Saudi Arabian poll found that 50% of participants had relevant knowledge [34]. However, some research found lower knowledge [35,36]. For instance, a Bangladeshi study indicated that over half of participants knew nothing about breast cancer risk factors [15,37].

In this study, spouse education, household monthly income, use of portable electronic devices, patient symptoms, use of alternative remedies, diagnosis delay, discomfort, fear of sharing the problem with a spouse, and support from spouses and social circles were significantly associated with breast cancer knowledge and practice. Patients under 40 and 40-59 had higher likelihood of good knowledge and practice than those 60 or older. Although not statistically significant, Rangpur patients had higher likelihood of good knowledge and practice than Barisal patients. The percentage of good knowledge and practice was slightly greater in urban areas than in rural areas. Similar to our findings, an Indian investigation revealed no correlation between demographic characteristics and breast cancer knowledge [38]. A comprehensive study by Pengpid and Peltzer of 24 low- and middle-income countries found significant geographical variance in BSE awareness [39].

In this study, education level was a significant factor, with illiterate patients having lower odds of demonstrating good knowledge and practice regarding breast cancer compared to those with secondary or higher education. Women with postgraduate degrees had a significantly higher mean knowledge score, which is consistent with findings from other studies [35,36]. A study conducted in Bangladesh found that the number of years spent studying was significantly associated with knowledge about breast cancer symptoms, risk factors, and treatment options, indicating that higher education levels are linked to better breast cancer awareness [33]. Regarding income, patients with household incomes below 5,000 BDT were less likely to exhibit good knowledge and practice compared to those with incomes above 20,000 BDT. This aligns with previous studies showing that women from higher income backgrounds are more aware of screening and exhibit better knowledge and practices [40]. Furthermore, access to technology played a crucial role, as patients with portable electronic devices or mass media access demonstrated significantly better knowledge and practice. This finding echoes the results of Mansour et al., whose study on the role of social media in raising breast cancer awareness in the Gulf Cooperation Council (GCC) area highlighted how social media campaigns can enhance breast cancer awareness and promote screening programs [41].

Patients who reported symptoms had significantly higher odds of demonstrating good knowledge and practice regarding breast cancer. The type of first healthcare facility visited also played a crucial role; those who initially visited a general government hospital or a private clinic/hospital were more likely to demonstrate good knowledge and practice. Diagnosis delays were linked to poorer knowledge and practice, as patients experiencing delays had more than half the odds of achieving good outcomes. This finding aligns with previous studies showing that increased awareness and knowledge about breast cancer and breast self-examination can trigger the recognition of early symptoms and encourage timely healthcare seeking [22,42]. Patients who used alternative remedies were less likely to exhibit good knowledge and practice, with their odds being nearly 50% lower. The use of traditional medicine may negatively impact survival, particularly when it leads to the disease progressing to advanced stages or is used as a substitute for standard cancer treatment. Cooperation with traditional healers and educating them about breast cancer symptoms could help improve early diagnoses [43]. Furthermore,

patients who experienced discomfort had more than twice the odds of demonstrating good knowledge and practice on breast cancer.

Family and social support played a significant role in shaping patients' knowledge and practices. Those who were encouraged to consult a doctor by themselves, their spouses, or close family members had better knowledge and practice outcomes. Research indicates that breast cancer patients value emotional and informational support from both family and healthcare providers. However, further research is needed to better understand the specific types and amounts of social support provided by both family members and healthcare professionals in these settings [44,45]. Interestingly, patients who felt uncomfortable discussing their health with their spouse had higher odds of demonstrating good knowledge and practice, suggesting that discomfort in sharing health issues may motivate greater awareness or action. Companion involvement in decision-making during medical visits is generally seen as beneficial, and while informational support from companions is helpful, emotional support is even more highly valued by cancer patients [44–46].

As breast cancer can be diagnosed early through screening programs, understanding the barriers to screening is crucial. The results from this study highlight that embarrassment was a primary barrier to participating in breast screening programs. Many participants expressed worry, a lack of knowledge, and a lack of confidence in discussing their health with healthcare providers or others, consistent with previous research [47,48]. Receiving spousal support after diagnosis was linked to better knowledge and practice, with those who received this support showing a 21% increase in the odds of positive outcomes. Emotional and informational support, particularly from providers, family, and friends, has been associated with better mental health, self-efficacy, and improved health-related quality of life for breast cancer patients [49,50]. However, support from the social circle was less likely to lead to good knowledge and practice, suggesting a disconnect between social support and actual health behaviors. This may be because many patients were less inclined to share personal experiences with other women, as discussing such topics is not widely accepted in Bangladeshi society [51].

Our findings highlight a significant gap in awareness and understanding of breast cancer among affected women in society. With proper counseling, educational programs, and increased awareness, the issue of late diagnosis could be addressed, ultimately improving the management of breast cancer patients. The study reveals that inadequate knowledge of breast cancer, combined with social and family-related barriers, contributes to the low level of awareness and poor practices in Bangladesh. Expanding awareness programs and improving the delivery of accurate information could help shift this situation, despite the rising prevalence of breast cancer. Both healthcare professionals and the government must collaborate to create effective policies that promote early diagnosis and raise awareness, not only among women but within society as a whole.

Study strengths and limitation

This study contributes valuable insights into the knowledge and practices related to breast cancer health-seeking behaviors and the perceived social support from family and friends among breast cancer patients in Bangladesh. It fills an important gap in understanding these aspects within the Bangladeshi context.

However, there are several limitations to consider. First, as a cross-sectional study, it is unable to establish cause-and-effect relationships. Second, relying on self-reported data for measurements of self-care practices poses a limitation, as these may not accurately reflect

actual behaviors. Additionally, the use of a convenience sample from a breast cancer clinic introduces selection bias, as the study did not include individuals who did not seek medical care. This may result in higher knowledge levels compared to other studies that include women from the general population.

Furthermore, the study is not fully representative of the entire Bangladeshi population. The participants were drawn from a single region, specifically a cancer hospital in the capital, Dhaka, which may not reflect the experiences or knowledge levels of individuals from other areas of the country. Due to socio-cultural constraints, it was difficult to access a broad demographic range, and the research was conducted without external funding, limiting the ability to gather data from other regions of Bangladesh.

Additionally, while the study focused on the role of family and social support, the absence of open-ended questions in the survey means that the qualitative aspects of social support were not fully explored. Including questions about who patients first spoke to about their health issues, or how they felt receiving support from their spouse or social circle, could have provided deeper insights into the role of family and friends in the management process. Future research could benefit from a more diverse sample across different regions and demographic groups to provide a broader understanding of the factors influencing breast cancer awareness and management in Bangladesh.

Conclusions

This study highlights several key factors affecting breast cancer awareness, knowledge, and practices in Bangladesh. The findings point to a significant gap in awareness of breast cancer symptoms, the importance of early detection, and the role of breast self-examination (BSE) in early diagnosis. Despite factors like education level, household income, and access to technology being recognized as influential, many patients still lack the confidence to seek medical attention or engage in preventive practices such as BSE. Additionally, regional differences and socio-cultural barriers, such as discomfort in discussing health issues with spouses and the stigma surrounding breast cancer, contribute to delayed diagnoses and poorer health outcomes.

The study also emphasizes the critical role of family and social support in shaping patients' health-seeking behaviors and knowledge. Patients who received emotional and informational support, particularly from their spouses, demonstrated better knowledge and practices regarding breast cancer. However, the findings suggest that social support does not always lead to improved health behaviors, possibly due to societal norms and misconceptions surrounding breast cancer.

With breast cancer rates on the rise in Bangladesh, there is an urgent need for comprehensive awareness campaigns targeting at-risk populations. These programs should focus on educating women and society about breast cancer, addressing common misconceptions, and promoting early detection through regular screenings and BSE. Healthcare professionals and policymakers must work together to design accessible, culturally sensitive interventions that bridge the knowledge gap, reduce stigma, and ultimately improve early detection and patient outcomes.

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