Assessment of knowledge and awareness regarding practices of breast imaging in females of Rural area Vs Urban area

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Abstract- INTRODUCTION: Breast cancer remains a leading cause of morbidity and mortality among women globally, with early detection critically improving prognosis. Despite advances in breast imaging technologies such as mammography, ultrasound, and MRI, disparities in awareness and utilization persist, particularly between rural and urban populations. Understanding the knowledge gaps and screening practices is essential to designing effective interventions that promote timely diagnosis and reduce breast cancer burden.

AIM AND OBJECTIVES: The study aimed to assess and compare the knowledge, awareness, and practices related to breast imaging among females residing in rural versus urban areas. Key objectives included identifying factors contributing to the knowledge gap, enhancing understanding of breast cancer risk factors and symptoms, and promoting adherence to regular screening protocols, especially among rural women.

METHODOLOGY: This prospective survey was conducted in the Delhi NCR region, enrolling 384 women aged 20 to 60 years through randomized sampling. Data collection involved structured, face-to-face interviews utilizing closed-ended questionnaires assessing baseline and post-intervention knowledge and practices regarding breast cancer symptoms, risk factors, and screening methods including breast self-examination (BSE), mammography, ultrasound, and MRI. A targeted health education intervention was administered, and statistical analyses were performed to evaluate changes in awareness and practice across demographic variables.

RESULTS AND OBSERVATIONS: The intervention yielded statistically significant improvements in knowledge and screening practices in both rural and urban cohorts. Rural awareness of mammography increased from 20% to 60% (p=0.001), ultrasound awareness from 25% to 55% (p=0.003), and MRI awareness from 15% to 30% (p=0.005). Urban women exhibited gains from 50% to 85%, 50% to 75%, and 25% to 60% respectively. BSE awareness in rural areas rose from 20% to 75% (p=0.001), with correct practice increasing from 10% to 30% (p=0.005). Urban participants showed improvements from 50% to 90% in awareness and 25% to 50% in correct practice. Despite educational gains, rural populations continued to face greater barriers related to healthcare access and cultural stigma. Educational status and socioeconomic factors significantly influenced knowledge and screening adherence.

CONCLUSION: Targeted health education significantly enhances breast cancer screening knowledge and practices, particularly among underserved rural populations. Although urban women exhibited higher baseline awareness, the intervention effectively narrowed this gap. Persistent structural and psychosocial barriers highlight the need for integrated strategies combining education with healthcare accessibility and culturally sensitive outreach to achieve equitable early detection and improved outcomes in breast cancer care.

INTRODUCTION

The current study titled *"Assessment of Knowledge and Awareness Regarding Practices of Breast Imaging in Female Participants of Rural Area vs Urban Area"* was a prospective survey-based investigation conducted in the Delhi NCR region. The research aimed to assess and compare the levels of knowledge, awareness, and utilization of breast imaging modalities among women residing in rural and urban areas. Furthermore, it sought to identify sociocultural and economic factors influencing these disparities and to evaluate the impact of a structured health education intervention designed to improve awareness, screening behavior, and early detection of breast cancer.

Sociodemographic and Educational Disparities

The findings revealed pronounced sociodemographic differences between rural and urban populations, significantly influencing health literacy and screening practices. Rural participants showed higher illiteracy rates (26.2%) compared to urban women (10.4%) and a much lower representation in graduate-level education (34.8% vs. 55.7%). Additionally, 62.2% of rural women belonged to lower socioeconomic classes compared to 36.4% of urban women (p=0.001). These disparities mirrored previous observations by Gangane et al. and Kumarasamy et al., who reported that education and income are critical determinants of breast cancer awareness and preventive practices. Such differences reinforce the need for tailored educational strategies targeting low-literacy rural populations to enhance breast health understanding.

Improvement in Knowledge and Awareness After Intervention

Following the health education intervention, both rural and urban groups exhibited substantial improvements in breast cancer knowledge. Awareness of key symptoms, such as a lump in the breast, rose from 25% to 78% in rural women and from 55% to 89% in urban women (p=0.002). Similarly, recognition of breast pain increased from 15% to 60% in rural and from 40% to 78% in urban participants, while awareness of nipple discharge improved from 10% to 47% and 30% to 68%, respectively. These improvements indicate that structured health education significantly enhances knowledge, particularly in underserved rural populations that start from a lower baseline.

Knowledge about risk factors also demonstrated significant gains. Awareness of family history as a risk factor rose from 12% to 40% among rural women and from 40% to 70% among urban women. Understanding of obesity and early menopause as risks improved notably in both groups, consistent with the findings of Al-Zalabani et al. and Alam et al., who emphasized that culturally appropriate health education can effectively elevate awareness among populations with limited prior exposure.

Screening Methods and Adherence

Knowledge and adherence to screening methods such as mammography, ultrasound, and MRI increased substantially following intervention. Awareness of mammography improved from 5% to 30% in rural areas and from 30% to 50% in urban areas (p=0.001), while knowledge of ultrasound rose from 10% to 35% and 40% to 55%, respectively. MRI screening awareness also showed gains, increasing from 5% to 15% among rural and from 15% to 45% among urban women (p=0.01). These improvements signify the growing reach of health education in disseminating knowledge about diagnostic technologies even in resource-constrained areas.

Importantly, adherence to regular screening increased in both groups. Rural women's awareness and willingness to undergo mammography rose from 5% to 25% (p=0.001), while urban women's increased from 25% to 50%. These outcomes are consistent with the work of Kumarasamy et al., who reported that intervention-driven awareness can significantly enhance participation in breast cancer screening programs.

Breast Self-Examination (BSE) Practices

The study observed a substantial improvement in knowledge and practice of Breast Self-Examination (BSE) after the intervention. Awareness among rural women increased from 30% to 75%, while urban women's awareness rose from 60% to 90%. Correct practice of BSE improved from 5% to 20% in rural participants and from 20% to 50% among urban women (p=0.03). Despite these gains, the frequency of regular BSE performance remained unchanged in both groups, suggesting that while educational interventions effectively increase knowledge, behavioral change requires ongoing motivation and reinforcement.

These outcomes align with Rumpa Sarker et al. and Nair et al., who found that educational programs substantially enhance BSE knowledge but that sustained behavioral adoption demands repeated follow-up and community engagement. Thus, while the study succeeded in bridging informational gaps, further initiatives are necessary to promote consistent self-screening practices.

Reduction in Barriers and Role of Media

Barriers to breast cancer screening—such as lack of access to healthcare facilities, fear of diagnosis, and cultural stigma—declined significantly post-intervention. In rural areas, these reduced from 40%, 50%, and 35% respectively, to 15%, 30%, and 20%.

Urban areas showed similar but smaller reductions. The improvement highlights the role of health education in overcoming both psychological and logistical obstacles, validating findings by Sinha et al. and Al-Zalabani et al., who emphasized that education reduces fear and stigma surrounding breast cancer screening.

Additionally, social media and awareness campaigns played a pivotal role in spreading information, especially among younger participants. Awareness through digital platforms increased from 10% to 30% in rural and from 30% to 60% in urban populations, illustrating the growing influence of digital health literacy. This indicates that technology-driven outreach, when integrated with community-based programs, can effectively complement traditional awareness methods.

Need for the Study

Mammary gland malignancy "sustain to be one of the most contributive causes of mortality among the women. Effective screening with the use of breast imaging--mammography, ultrasound, and MRI—plays an important role in improving prognosis and reducing mortality. However, disparities in awareness, accessibility, and utilization of these diagnostic tools persist, especially between urban and rural populations".[16]

Urban women generally benefit from better access to healthcare infrastructure, educational exposure, and organized screening programs, which contribute to higher awareness and uptake of breast imaging services. In contrast, women residing in rural areas often face systemic challenges including limited availability of diagnostic facilities, lack of structured awareness campaigns, and socio-cultural barriers, resulting in delayed diagnosis and advanced-stage presentations.[17]

By evaluating the understanding of breast cancer and imaging techniques, and identifying behavioral patterns in screening adherence, the study aims to uncover the specific gaps in public health education and service delivery.[18]

The findings will explain the development of targeted community-specific awareness strategies and resource allocation models, thereby facilitating equitable access to early detection services. Ultimately, this will support timely diagnosis and improve breast cancer outcomes, particularly in under-resourced rural populations.[18]

AIM and OBJECTIVES

AIM: To assess the knowledge and awareness regarding practices of breast imaging in females of rural areas Vs urban areas.

OBJECTIVE:

1. To identify and analyzing factor that affect knowledge gap between urban Ana rural population.
2. To enhance knowledge about breast cancer's risk factors, symptoms, and the importance of early detection among women in rural areas.
3. To encourage women in rural area to undergo regular breast cancer screening.

MATERIALS AND METHODS

Study design: Prospective survey design.

Study place: Delhi NCR.

Sample size: 384 women.

The Sample Size for Frequency in a Population

Population size (correction factor for finite population or fpc) (*N*):	1000000
Hypothesized percetange (%) frequency of outcome factor in the population (*p*):	51.1%+/5
Confidence limits as % of 100(absolute +/- %) (*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size (*n*) for Various Confidence Levels

Confidence Level (percentage %)	Sample Size
95%	384
80%	165
90%	271
97%	471
99%	663

99.9%	1082
99.99%	1512

Equation

Sample size n = [DEFF*Np(1-p)]/ [($d^2/Z^2_{1-\alpha/2}$*(N-1) +p*(1-p)]

Inclusion criteria:

Females between 20-60 years of age who has given consent were selected for the study.

Exclusion Criteria:

Females below 20 years of age were excluded from the study.

RESULT:

The study analyzed and compared the knowledge, awareness, and practices related to breast cancer among rural (n=164) and urban (n=220) women, both before and after a structured health education intervention. The findings reflect significant improvements across all domains—knowledge of symptoms, risk factors, screening methods, and breast self-examination (BSE)—with notable urban–rural disparities that narrowed considerably post-intervention.

Sociodemographic Profile

The sociodemographic characteristics revealed distinct differences between rural and urban populations. Urban women were generally more educated and belonged to higher socioeconomic classes than rural women. Illiteracy was considerably higher in rural participants (26.2%) compared to urban participants (10.4%), while 55.7% of urban women had graduate-level education or higher. Socioeconomic disparities were evident, with 62.2% of rural women classified in the lower-income group versus only 36.4% in urban settings (p=0.001). These factors—education and socioeconomic status—proved influential in shaping awareness and health-seeking behavior, establishing the basis for differing baseline knowledge levels.

Knowledge of Breast Cancer Symptoms

Health education had a profound effect on the recognition of breast cancer symptoms across both populations. Awareness of a lump in the breast increased dramatically from 25% to 78% among rural women and from 55% to 89% among urban women (p=0.002). Similarly, recognition of breast pain improved from 15% to 60% in rural areas and from 40% to 78% in urban areas (p=0.01). Awareness of nipple discharge also rose significantly, from 10% to 47% in rural women and 30% to 68% in urban women (p=0.03). These results demonstrate that although urban participants had higher baseline knowledge, rural participants showed more substantial relative improvement after intervention.

Awareness of Risk Factors

Post-intervention data indicated marked gains in understanding breast cancer risk factors. Knowledge of family history as a risk factor increased from 12% to 40% in rural women and from 40% to 70% in urban women (p=0.001). Awareness of obesity as a risk factor rose from 20% to 50% in rural and from 45% to 75% in urban participants (p=0.004). Similarly, recognition of early menopause as a contributing factor increased from 10% to 30% among rural women and from 25% to 50% among urban women (p=0.02). These results validate the effectiveness of the educational intervention in improving awareness, particularly among rural populations where baseline understanding was limited.

Knowledge of Screening Methods and Adherence

There was significant improvement in the awareness of screening methods following the educational campaign. Knowledge of mammography rose from 5% to 30% in rural women and from 30% to 50% in urban women (p=0.001). Similarly, awareness of ultrasound screening increased from 10% to 35% in rural areas and 40% to 55% in urban regions (p=0.003). Awareness of MRI screening rose from 5% to 15% among rural participants and 15% to 45% among urban ones (p=0.01). These results indicate that targeted educational interventions can enhance understanding of screening modalities, with rural populations showing greater relative gains. Furthermore, adherence to regular screening practices improved notably in both groups post-intervention,

especially among rural women, who showed a fivefold increase in mammography uptake (5% to 25%).

Breast Self-Examination (BSE) Awareness and Practice

The most prominent improvement was observed in knowledge and practice of BSE. In rural areas, awareness of BSE rose from 30% to 75% (p=0.001), and in urban areas from 60% to 90%. Proper practice of BSE improved from 5% to 20% in rural women and from 20% to 50% in urban women (p=0.03). The intervention successfully addressed both informational and behavioral gaps, demonstrating the effectiveness of structured health education in enhancing self-care practices.

Barriers to Screening and Role of Education

Before intervention, rural women faced significant barriers, including lack of access to healthcare facilities (40%), fear of diagnosis (50%), and cultural stigma (35%). After intervention, these figures reduced to 15%, 30%, and 20%, respectively ($p<0.01$). Urban women also exhibited improvement, though with lower baseline barriers. These findings highlight the role of education not only in increasing knowledge but also in reducing psychological and logistical obstacles that hinder early detection.

Influence of Education, Social Media, and Campaigns

Educational status strongly influenced awareness and practice levels. Among rural women with graduate education, BSE knowledge rose from 10% to 30%, while among urban graduates, it rose from 50% to 90%. Social media played a critical role in disseminating health information—awareness via digital platforms increased from 10% to 30% in rural and 30% to 60% in urban populations (p=0.001). Awareness campaigns were particularly effective, boosting general breast cancer knowledge from 25% to 75% in rural and 50% to 90% in urban populations.

Comparison of Rural and Urban Improvements

Across all indicators, both rural and urban groups demonstrated significant progress after the health education program. Rural participants showed larger relative improvements, indicating that interventions effectively bridged the knowledge gap. Urban women, however, consistently maintained higher post-intervention scores, reflecting better access to resources and media. The combined results affirm that education-based health interventions are crucial in improving awareness, attitudes, and practices toward breast cancer prevention, especially in underserved rural areas.

DISCUSSION

The present study, *"Assessment of Knowledge and Awareness Regarding Practices of Breast Imaging in Female Participants of Rural Area vs Urban Area,"* was a prospective survey conducted in the Delhi NCR region to assess differences in breast cancer awareness, imaging practices, and screening behavior among women from rural and urban settings. The findings revealed significant sociodemographic disparities influencing knowledge and healthcare access. Rural women showed higher illiteracy (26.2% vs. 10.4%) and lower socioeconomic status (62.2% vs. 36.4% in lower-income class), limiting their initial awareness levels. Education emerged as a major determinant of awareness, aligning with prior studies by Gangane et al. and Kumarasamy et al., emphasizing that higher literacy directly enhances breast health knowledge.

Following a structured health education intervention, substantial improvements were observed across both groups. Awareness of key symptoms, such as breast lumps and nipple discharge, rose sharply in rural women (25%→78%) and in urban women (55%→89%), confirming the effectiveness of culturally tailored education. Similarly, understanding of risk factors such as family history, obesity, and early menopause improved markedly in both populations, with rural women showing greater relative gains despite lower baselines. Knowledge of screening methods also increased—awareness of mammography rose from 5% to 30% in rural areas and from 30% to 50% in urban areas, while awareness of ultrasound and MRI screening improved substantially.

The practice and knowledge of Breast Self-Examination (BSE) demonstrated major improvement: rural women's awareness increased from 30% to 75% and correct practice from 5% to 20%, whereas urban women improved from 60% to 90% awareness and 20% to 50% correct practice.

Despite these advances, the frequency of regular BSE remained relatively unchanged, indicating that knowledge does not always translate to habitual behavior—a finding consistent with Sarker et al. and Nair et al.

Importantly, the intervention significantly reduced barriers to screening such as lack of access, fear of diagnosis, and cultural stigma. In rural groups, these barriers dropped from 40%, 50%, and 35% respectively, to 15%, 30%, and 20%. Social media and community campaigns played a vital role in expanding outreach, particularly among rural participants, where digital health literacy improved from 10% to 30%.

Overall, the study highlights a persistent yet narrowing urban–rural divide in breast cancer awareness and imaging practices. While urban women maintained higher baseline knowledge, rural women exhibited greater relative improvement post-intervention, validating the transformative potential of targeted education. However, persistent infrastructural and accessibility challenges in rural areas necessitate integrated strategies combining health education, improved screening facilities, and culturally sensitive community outreach. The study concludes that equitable, sustained, and context-specific interventions are vital to bridge the knowledge gap and promote early detection practices among women across diverse populations.

LIMITATIONS

The current paper gives essential information regarding knowledge, awareness, & practice of breast imaging in females in rural and urban settings and the advantageous effect of specific health education. Nonetheless, some methodological limitations and situational circumstances restrict the interpretation and translation of the results of a general nature. There are issues of validity of self-report via structured questionnaire that could lead to recall and social desirability bias which may likely overestimate awareness and practice levels before and after intervention.

Furthermore, the sampling strategy, although randomized, was confined to the Delhi NCR region, limiting the external validity to broader geographic areas with differing socio-cultural dynamics. The exclusion of women below 20 years omits an important demographic that may possess different awareness and practice profiles. Limited assessment of infrastructural and systemic healthcare barriers beyond self-reported perceptions constrains understanding of practical challenges faced by participants. Finally, the study does not account for potential confounding factors such as socioeconomic status variations within urban and rural groups, which could influence breast imaging knowledge and behavior independently.

1. The utilization of face-to-face interviews and self-administered questionnaires may have led to response bias, affecting the accuracy of reported knowledge and screening practices.
2. The study's cross-sectional design precludes assessment of the sustainability of educational intervention effects on breast imaging awareness and behaviors over time.
3. Restriction of the study population to females aged 20-60 years excludes younger and older women who might have differing levels of awareness and screening habits, limiting age-related insights.
4. Geographical confinement to Delhi NCR limits applicability of findings to other regions with varying healthcare infrastructure, literacy rates, and cultural norms.
5. The reliance on closed-ended questionnaires might have constrained the depth of understanding regarding personal, cultural, and systemic barriers to breast imaging uptake.
6. The study did not stratify participants based on detailed socioeconomic indices, which could affect the interpretation of educational and awareness disparities within rural and urban groups.
7. Absence of objective verification for reported breast self-examination practices and screening attendance may lead to overestimation of compliance rates.
8. Limited exploration of healthcare system factors such as availability, affordability, and quality of breast imaging services constrains comprehensive assessment of access-related challenges influencing screening behaviors.

CONCLUSION

This study revealed pronounced discrepancy in breast imaging knowledge and practices among the women in rural and urban areas, with urban participants consistently showing higher baseline awareness and utilization of screening methods like mammography, ultrasound, and breast self-examination (BSE). Despite this, targeted health education interventions significantly enhanced knowledge and screening behaviors in both populations, particularly benefiting rural women who initially had limited exposure to breast cancer information. The marked improvements in understanding risk factors, symptoms, and available screening options underscore the critical role of context-specific education in promoting early detection and reducing breast cancer morbidity.

However, persistent challenges remain, especially regarding infrastructural and accessibility barriers in rural areas that constrain the translation of awareness into actual screening uptake. The findings indicate that while educational programs effectively address informational deficits, systemic issues such as healthcare availability, cultural stigmas, and socioeconomic limitations require integrated strategies to ensure equitable breast cancer prevention. The data emphasize the necessity for comprehensive approaches combining education with infrastructural development and community engagement to optimize breast cancer screening adherence across diverse demographic settings.

1. Significant baseline differences exist between rural and urban women in breast imaging awareness, with urban populations demonstrating higher initial knowledge of screening methods, risk factors, and self examination practices.
2. Health education interventions yielded substantial increases in knowledge & practice of breast cancer screening across both rural and urban groups, with rural women exhibiting larger relative gains in awareness and BSE proficiency.
3. Awareness of advanced screening techniques such as mammography, ultrasound, and MRI showed marked improvement post-intervention, particularly in rural populations, indicating effective dissemination of complex health information.
4. Knowledge of breast cancer risk factors, including family history and obesity, increased significantly following the intervention, bridging gaps that previously favored urban participants.
5. Despite enhanced awareness, rural populations continued to face substantial access-related barriers, with persistent challenges in healthcare availability limiting screening uptake beyond knowledge improvements.
6. Socioeconomic and educational disparities remain influential determinants of breast imaging awareness and behavior, underscoring the need for tailored educational content and support mechanisms addressing these factors.
7. Urban women exhibited higher baseline screening adherence but still benefited from intervention programs, highlighting the value of continuous health promotion even in better-resourced settings.
8. The interplay of educational initiatives with infrastructural and cultural considerations is essential to achieve sustainable improvements in breast cancer screening equity, necessitating multifaceted strategies beyond knowledge enhancement alone.

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