



Assessing Breast Cancer awareness and knowledge in Multan, Pakistan: Development of a Bilingual mobile application for early detection

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Breast cancer remains a significant health concern, and early detection is crucial for improving survival rates. However, awareness and proper practices related to breast cancer screening are often inadequate, especially in resource-limited settings. A cross-sectional survey was conducted with 417 women aged 15-60 in Multan, Pakistan. The survey aimed to evaluate the participants' awareness and knowledge of BSE, CBE, and mammography. Data were collected using a validated questionnaire covering demographic information, breast cancer awareness, and screening practices. The questionnaire was administered following COVID-19 SOPs, and data analysis was performed using Graph Pad Prism, with significance set at $p < 0.05$. Results indicate low overall awareness of breast cancer and its screening methods among the participants, especially among older women. Only a small percentage of women across all age groups had received training on BSE techniques or knew the optimal time for conducting BSE. Awareness of CBE and mammography was also limited, with younger women showing slightly better knowledge than older women. Conclusion: In response to the identified knowledge gaps, a bilingual mobile application was developed, offering comprehensive information in English and Urdu, including written content and audio playback. It includes a self-examination video with subtitles in both languages, aiming to raise awareness, promote self-examinations, and facilitate early detection. Targeting younger women is emphasized to bridge knowledge gaps. The application leverages mobile technology to reach diverse backgrounds, addressing the need for widespread dissemination of breast health information.

Keywords: breast cancer awareness, bilingual mobile application, breast self-examination, mammography screening.

INTRODUCTION

Breast Cancer is a serious illness with high mortality rates, ranking as the second most common cause of cancer-related deaths in women (Parkin, 1994). Each year, almost 249,260 individuals are diagnosed with breast cancer in the United States alone. According to a 2018 report by the International Agency for Cancer Research, breast cancer affects 2.1 million women across 154 countries, with one in four female patients being diagnosed with the disease (Parkin, 1994). Early diagnosis is a key factor in higher survival rates for breast cancer patients in developed countries, whereas in developing countries, women are often diagnosed later, leading to inferior treatment outcomes (Parkin et al. 2005). Breast cancer presents a significant concern in both nations, developed and developing (Ferlay et al. 2015), and it is responsible for 64% of deaths from cancer in these regions.

In countries with limited resources, breast cancer remains a significant issue despite progress in healthcare and medicine, largely due to challenges associated with detecting the disease early, providing timely diagnosis, and delivering effective treatment. Self-examination of breast is particularly encouraged at the initial level, as other diagnostic methods such as ultrasound and mammography are not readily available to many individuals. Breast Health Global Initiative (BHGI) actively supports the promotion of breasts self-examination and raising awareness about the importance of early detection in economically disadvantaged countries (Anderson et al. 2006). Breast self-examination (BSE) is a simple yet effective that women can accomplish on their own. During this examination, women can manually inspect and observe each breast for any lumps, swelling, or other noticeable changes in the breast area. Unlike a physical examination conducted by medical

professionals, BSE does not require any special equipment or hospital visits. Consistent practice of breast self-examination (BSE) can be highly advantageous in the early detection of breast cancer, increasing the chances of successful treatment and improved survival rates among women (Erbil & Bolukbas, 2014).

Research has demonstrated that breast self-examination (BSE) can accurately detect symptoms of breast cancer with a high rate of effectiveness ranging from 80-90%, potentially contributing to a significant 50% reduction in mortality rates. Recognizing the initial signs and symptoms of breast cancer in its early stages is critical to promoting timely diagnosis and symptoms of breast cancer in its early stages is critical to promoting timely diagnosis and appropriate treatment, ultimately increasing the chances of positive outcomes for individuals. Therefore, it is recommended that women perform breast exams regularly. By doing so, it may be possible to prevent 95% of breast cancer cases from advancing to a later stage (Kwok et al. 2015).

To promote healthcare accessibility and convenience, Connected Health, a public healthcare transmission project, has been established. It provides patients with easy access to medical care centers and empowers them to manage their health using technology (Giunti et al. 2018). Mobile health (mHealth), the delivery of public healthcare services through mobile devices, has also seen significant growth in recent years (Riley et al. 2011). As a result, utilizing mobile software applications to promote health services can prove to be a powerful strategy in expanding outreach efforts and raising awareness about the importance of timely identification and diagnosis of breast cancer.

The primary aim of our project is to develop a bilingual mobile application in Urdu and English that seeks to increase awareness and knowledge about breast cancer, including its practical screening methods, with a particular focus on supporting women in developing countries. In contexts like Pakistan, there is often limited access to information and resources related to breast cancer and its screening methods. Thus, our project also includes a research component, which aims to gauge the current level of breast cancer awareness among women of all ages in Multan, Pakistan and to provide education about breast self-examination methods.

MATERIALS AND METHODS

Study framework

Between May 2022 and June 2023, we conducted a cross-sectional survey targeting female residents aged 15-60 in Multan, Pakistan. Our goal was to evaluate women's familiarity with and adherence to breast self-examination (BSE), clinical breast examination (CBE), and mammography in Multan.

Data Collection and Instruments

In this study, the researchers employed a random sampling strategy to obtain data from females residing in both urban and rural areas of Multan. To ensure content reliability, a questionnaire was developed by the research team and validated by subject matter experts. The survey was then disseminated among females aged 15 years and older. The survey followed the Standard Operating Procedures (SOPs) during the COVID-19 pandemic. Uneducated females were interviewed in their native language, and their questionnaires were filled out by the researchers. The survey comprised of twelve questions, divided into three distinct sections. The first section was comprised of two questions that aimed to gather demographic information, including age and marital status. The second section included six questions that evaluated the participants' knowledge and practices related to breast cancer and self-examination. The third section consisted of three questions that assessed the understanding of females regarding clinical breast examination and mammography. Furthermore, the third section of the questionnaire included a question about the feasibility of developing a mobile application. The application would have a dual purpose, firstly to raise awareness about breast cancer, and secondly, to facilitate self-examination. The questionnaire used 'Yes' and 'No' options to determine the percentage of awareness and to identify the age group that needs more attention in Multan, Pakistan.

Application Development

For the development of the breast cancer application, Android Studio was used, and the Java language was used for coding. This mobile application can be operational on devices running on the Android operating system from KitKat version 4.4 to the latest version available.

Statistical Method

In this study, GraphPad Prism Version 9.1.2 was utilized for data analysis and tabulation purposes. The Chi-Square test was employed to ascertain the association between variables, and statistical significance was inferred when the p-value was less than 0.05.

RESULTS

In this cross-sectional survey, 417 women from various regions of Multan, Pakistan participated. To investigate the correlation between age and knowledge of breast self-examination (BSE), the collected data was segregated into three distinct age cohorts: individuals between 15-29 years (young age), those between 30-44 years (middle age), and 45-60 years (old age).

Sources of Knowledge:

The media emerged as the primary source of information for females of all age categories regarding

breast cancer and breast self-examination (BSE). Surprisingly, the young age group showed a high percentage of reliance on media as a source of knowledge, as depicted in Figure 1.

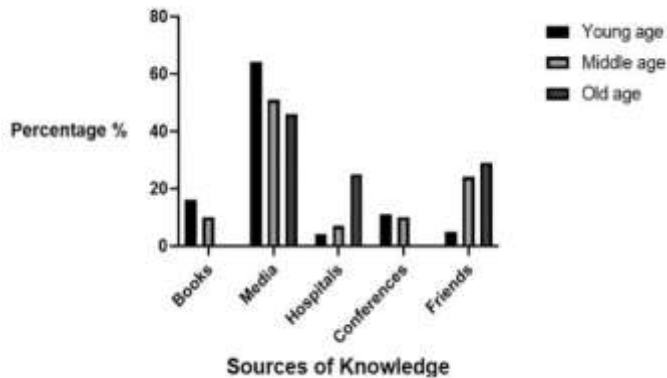


Figure 1: Factors contributing to knowledge about breast self-examination.

Awareness of Breast Cancer and BSE:

This section of the survey aimed to evaluate the participants' awareness of BSE across different age groups. The graph in figure 2 presents the majority of young-age (92%), middle-aged (77%),

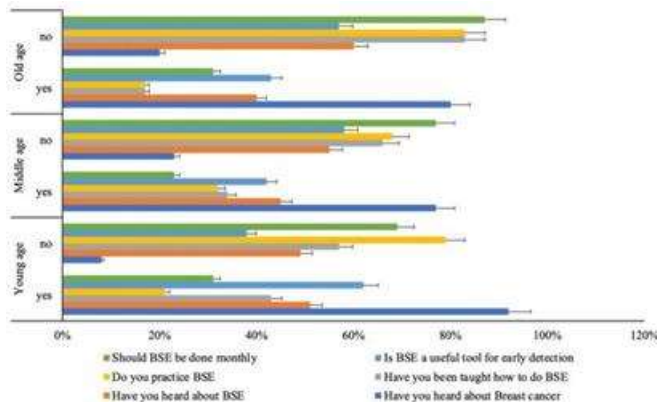


Figure 2: Awareness about Breast Cancer and Breast Self-Examination BSE

and old-age (80%) participants had heard about breast cancer, and the differences in values were significant ($p < 0.05$). Despite 55% of females in the young-age category being aware of breast self-examination (BSE), the overall comprehension of BSE across all age groups was found to be inadequate. Specifically, the study revealed that only 43% of young-age, 34% of middle-aged, and 17% of old-age participants had received training on the proper techniques for conducting BSE. Additionally, less than half of the females in all age groups knew the optimal time to conduct BSE. The results suggest a lack of awareness resources in Multan

regarding BSE.

Understanding of CBE and Mammography:

The final section aimed to assess the participants' perception of clinical breast examination (CBE) and mammography. The results showed that the old-age (80%) and middle-age (72%) groups had more awareness about CBE than the young-age group (54%). Mammography was recognized as a reliable method for breast cancer diagnosis. However, the awareness of screening methods among females was not satisfactory. The figure 2 presents the results of a survey conducted to evaluate the awareness and knowledge of breast cancer and breast self-examination (BSE) among females of different age groups. The results are grouped by age (young age: 15-29 years, middle age: 30-44 years, and old age: 45-60 years) and presented in terms of the number of participants (N) and the percentage of participants who answered yes or no to each question. The first question was about whether the participants have heard about breast cancer. The results show that the majority of participants in all age groups had heard about breast cancer.

However, the difference between the young age group and the old age group was statistically significant ($p < 0.05$), indicating that the awareness of breast cancer among younger women was higher than among older women. The second question was whether the participants have heard about BSE. The results show that the percentage of participants who had heard about BSE was higher among the young age group than among the middle and old age groups, although the difference was not statistically significant. The third question was whether the participants had been taught how to do BSE. The results show that the percentage of participants who had been taught how to do BSE was highest among the young age group, followed by the middle age group, and then the old age group. The difference between the groups was statistically significant ($p < 0.05$), indicating that the awareness and knowledge of BSE were higher among younger women. The fourth question was whether the participants practiced BSE. The results show that the percentage of participants who practiced BSE was highest among the young age group, followed by the middle age group, and then the old age group. The difference between the groups was statistically significant ($p < 0.05$), indicating that the practice of BSE was more prevalent among younger women. The questionnaire's fifth query probed whether the participants deemed breast self-examination (BSE) to be a valuable technique for the timely detection of breast cancer. The findings unveiled that the proportion of respondents who regarded BSE as a beneficial tool for early diagnosis was highest among the young age category, trailed by the middle age cohort, and lastly, the old age category. The observed inter-group variation was statistically significant ($p < 0.05$), indicating that younger women had a more profound

comprehension of the significance of BSE in detecting breast cancer early. The sixth question was whether the participants believed that BSE should be done monthly. According to the results, the highest percentage of participants who endorsed conducting breast self-examination (BSE) on a monthly basis belonged to the middle age category, trailed by the young age cohort, and lastly, the old age group. The observed inter-group variation was statistically ($p < 0.05$), denoting that younger and middle-aged females were more familiar with the recommended frequency of BSE. Based on the results in figure 2, it appears that women in Multan, Pakistan, have insufficient knowledge and awareness of breast cancer and BSE, particularly among the older population. However, the younger women have a comparatively better understanding of breast cancer and BSE, indicating that targeting educational and awareness programs towards this demographic could be an effective strategy for increasing awareness and knowledge of these topics among the population.

The findings of a study exploring the comprehension of clinical breast examination (CBE) and mammography in females belonging to three distinct age groups (young age, middle age, and older) are presented in figure 3.

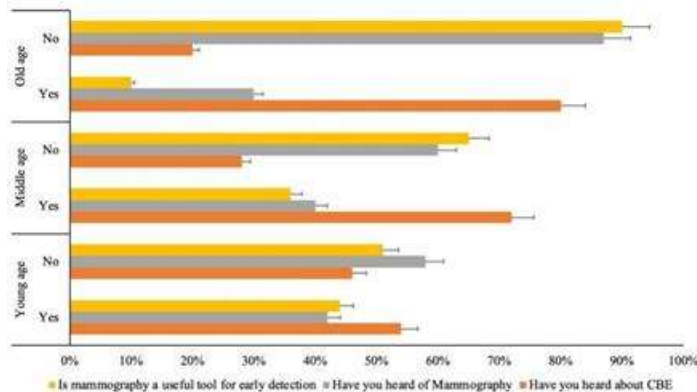


Figure 3: Understanding Clinical Breast Examination and Mammography

The table shows the number and percentage of participants who have heard about CBE and mammography, and their understanding of the usefulness of mammography for early detection. The p-value is also reported, which is used to determine the statistical significance of the differences observed between the age groups. The results indicate that a majority of participants in all age groups had heard about CBE and mammography, but the level of awareness varied significantly between the age groups. The older age group had the highest awareness of CBE and mammography, with 72% and 87% of participants having heard about them, respectively, while the young age group had the lowest awareness, with 54% and 42% of participants having heard about CBE and mammography, respectively. The observed dissimilarities in awareness

levels among the age groups were deemed statistically significant, with a p-value of less than 0.05. The graph also shows that a higher percentage of middle and old age group participants considered mammography to be a useful tool for early detection compared to the young age group, and these differences were statistically significant ($p < 0.05$). The percentage of participants who considered mammography to be useful for early detection was also higher among those who had heard of it.

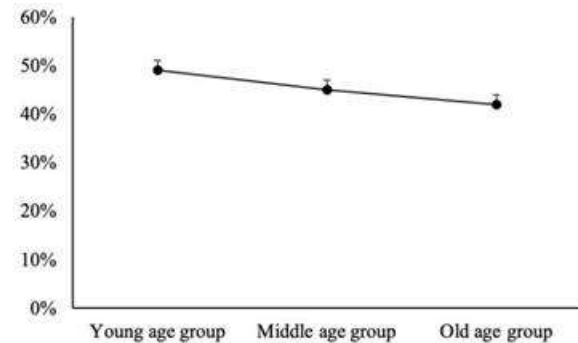


Figure 4: The categorized groups exhibit the extent of awareness expressed as a percentage.

Displayed in figure 4 are the proportions of breast cancer awareness, breast self-examination awareness, clinical breast examination awareness, and mammography awareness among three distinct age groups: young, middle-aged, and older women. The table indicates that the young age group has the highest percentage of awareness (49%), followed by the middle age group (45%), and the old age group (42%). This suggests that overall awareness of breast cancer and related screening methods is relatively low in all age groups, but the young age group seems to have a slightly higher level of awareness than the other two age groups. It is important to note that the table only provides information on the percentage of awareness and does not provide details on the specific factors that contribute to differences in awareness levels among the different age groups.

Breast Cancer Education Application:

Users of the Breast Cancer Application can access a wealth of information in both English and Urdu, with the entirety of the application’s content available in both languages. Additionally, the application offers the convenience of reading and hearing the information in both languages. Below, you can find a comprehensive overview of our application.



Figure 5: Mobile Application Screenshots (a) Cover image with a language selection button (b) Language selection option. (c) Application page with five different buttons (d) Breast Cancer with audio options.

Figure 5(a) depicts the application's cover image, showcasing the language selection button. By clicking on this button, users can opt for either English or Urdu language, shown in figure 5(b). Once the language change button is pressed, a prompt appears offering the English and Urdu language options. The chosen language can then be selected by clicking on the "Start" button located at the bottom right corner. The ensuing screen displays the English language selections, and the user can read all information in English. If the user selects another option, a new page will appear, providing another opportunity for audio playback in both English and Urdu.

The audio is clear and delivered at an average pace that is easy for the listener to comprehend. With a bottom-right button selection, five additional buttons in Urdu become visible, each of which will allow users to continue reading the information in Urdu. All information is presented in Urdu, along with audio in both languages (figure 6).



Figure 6: Mobile Application screenshots in the Urdu language (a) Screen with the Urdu language (b) Options in the Urdu language (c) Information in Urdu.

The application's best feature is that users can listen to the lead in both languages without having to revert to the primary language selection page. The Breast Cancer

Application has a user-friendly interface that can be easily navigated without requiring any specialized expertise or prior experience. Its ease of use can serve as a valuable tool for promoting greater breast cancer awareness among women.

In addition, we have included a video demonstrating Breast Self-Examination (BSE) in the application (shown in figure 7).



Figure 7: Mobile application screenshot of Breast Cancer awareness video option.

The self-examination video included in the Breast Cancer Application outlines all the essential steps, complete with subtitles in both English and Urdu. This dual-language feature enables users to comprehend the video content with ease in either language. The self-examination video demonstrates the necessary steps for women to detect any changes in their breasts for early detection. Moreover, the video is accompanied by refreshing music to avoid discomfort. The application is designed in a user-friendly manner to facilitate women's awareness of breast cancer.

DISCUSSION

Breast cancer is becoming increasingly prevalent and leading to high mortality rates among women worldwide, regardless of their culture or traditions. Developed countries are particularly affected, with women often being diagnosed at an advanced, metastatic stage, making it more challenging to control. Meanwhile, the breast cancer spreading rate in Asian countries is the highest. Breast cancer diagnosis in less economically developed countries frequently occurs in later stages, despite a tendency for women to develop the disease at earlier ages. Achieving positive treatment outcomes and enhancing the likelihood of survival are heavily contingent on early detection of breast cancer. Therefore, it is essential for women to be aware of the early signs and proper health treatment. The main aim of this study was to evaluate the level of knowledge and familiarity with performing breast self-examination (BSE) among females of different age groups. This trend is consistent with similar studies conducted in different regions, including

the Hail region of Saudi Arabia, which assessed demographic characteristics and attitudes towards cancer prevention (Alshammari et al. 2021). The recent increase in cancer epidemiology in Saudi Arabia has been attributed to the lack of health education and cancer awareness towards prevention measures. In our study, media emerged as the primary source of information for breast cancer and BSE among women in Multan, Pakistan. This finding parallels the Saudi study where social media was the most cited source of information about cancer, followed by personal experiences and awareness campaigns. This similarity underscores the crucial role of media in disseminating health information and the need for targeted educational interventions (Alshammari et al. 2021).

This trend is consistent with the broader research landscape in Pakistan, as captured by a recent bibliometric study on breast cancer research in the country. The bibliometric study aimed to capture a clear picture of breast cancer research in Pakistan by analyzing data from the Web of Science database. It was found that between 2015 and 2020, there were 1,605 research publications on breast cancer authored by 7,774 individuals, reflecting a significant but uneven research output in relation to the growing incidence of breast cancer in the country (Ahmad et al. 2021).

The findings of our study showed that BSE awareness is insufficient among all age groups, with less than 50% of young, middle-aged, and old groups being knowledgeable about BSE. These results are consistent with previous research conducted in Southern Punjab, Pakistan (Noreen et al. 2015). Our study, however, analyzed a wider range of age groups and provided more comprehensive results on the BSE knowledge of females. We found that the main source of awareness among the participants was the media. Although more women knew about breast cancer, their awareness of its detection methods, such as BSE, was inadequate. Comparing our results with an Italian study on Italian and Chinese women, notable disparities in breast cancer control practices emerge. Italian women exhibited higher adherence to clinical check-ups (53% vs. 3%) and free screenings (70% vs. 4%). Chinese women reported a lower frequency of mammography (96% vs. 33%) and ultrasound (69% vs. 16%), and a higher percentage never performed BSE compared to Italian women (47% vs. 12%) (Conte et al. 2024).

Similarly, in Multan, the younger age group showed relatively higher awareness of BSE and CBE, yet overall comprehension and training on proper techniques were inadequate across all age groups. Less than half of the participants knew the optimal time for BSE, and only a minority received proper training, mirroring the low participation rates seen among Chinese women in Italy. Only 31% of females had been taught the correct way to perform BSE, and 23% incorporated it into their routine. Our study revealed that 49% of participants knew that

self-examination was the best tool for detecting breast cancer at an early stage, but only 28% knew the right time to perform it. Furthermore, only 37% of participants knew about mammography, indicating an insufficient level of knowledge about this diagnostic tool.

Our study on breast cancer awareness in Multan, Pakistan, reveals significant gaps in knowledge and training on breast self-examination (BSE), clinical breast examination (CBE), and mammography among females, particularly older women. Similarly, the study on immigrant Arab women (IAW) in the United States identifies knowledge deficits and social barriers that hinder mammography screening (MS) uptake.

In Multan, younger women were relatively more aware of BSE and CBE, yet overall comprehension and proper training on these techniques were inadequate across all age groups. Less than half of the participants knew the optimal time for BSE, and only a minority received proper training. This reflects the knowledge gaps identified among IAW, where familiarity with MS and awareness of screening recommendations were significantly associated with increased mammography uptake (Alatrash & Alkrisat, 2024).

Our study aimed to address this knowledge gap by introducing an offline breast cancer mobile application available in both English and Urdu. This application provides women with a comprehensive guide on breast self-examination, clinical examination, and mammography, and is updated monthly to reflect the latest self-evaluation steps and symptoms. By making this application available, we hope to increase awareness about breast cancer and encourage more women to perform regular self-examinations and seek professional health care.

CONCLUSIONS

A study conducted in Multan, Pakistan, revealed a concerning lack of awareness about breast cancer, breast self-examination (BSE), clinical breast examination (CBE), and mammography among females, particularly older women. To address this issue, a bilingual mobile app has been developed, providing comprehensive information on breast cancer in both English and Urdu, including written content and audio playback. The app also features a self-examination video with subtitles in both languages to guide women in performing regular checks. This initiative is crucial in the digital age, where mobile phones are widely accessible, even among less-educated women. The app's user-friendly interface makes it a valuable tool for spreading awareness, promoting early detection, and encouraging regular self-examinations among women in Multan. By addressing the knowledge gap through this mobile app, the aim is to improve understanding, promote early detection, and ultimately reduce breast cancer-related morbidity and mortality rates in Multan, Pakistan.

Author contributions

Data curation and authored the entire manuscript, A.M.; designed project, data analysis, and review and editing manuscript, F.R.; designed a mobile application and prepared it for mobile use, R.R.; project administration, S.R.

Funding statement

No specific funding was received for conducting current study.

Institutional Review Board Statement

The study was approved by the Bioethical Committee of the University of Central Punjab, Pakistan.

Informed Consent Statement

Not applicable.

Data Availability Statement

All of the data is included in the article.

Acknowledgments

We extend our heartfelt gratitude to all the participants whose invaluable contributions enriched our survey with vital data. Their willingness to engage and share insights has been instrumental in advancing our research endeavors.

Conflict of interest

All authors declare that they have no competing financial or personal interests.

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and thanks the anonymous reviewer(s) for their contribution to the peer review of this article.

REFERENCES

- Ahmad, S., Ur Rehman, S., Iqbal, A., Farooq, R. K., Shahid, A., & Ullah, M. I. 2021. "Breast Cancer Research in Pakistan: A Bibliometric Analysis." *Sage Open*11(3).
<https://doi.org/10.1177/21582440211046934>
- Alatrash M, Alkrisat S. 2024. "Knowledge, Age, and Perceived Social Barriers Regarding Mammography Screening Among Immigrant Arab Women in the United States: A Predictive and Associative Analysis." *J Womens Health (Larchmt)*. doi: 10.1089/jwh.2023.1167.
- Alshammari, R. F., Alshammari, N. S., & Ahemd, H. G. 2021. "Role of demographic characteristics in attitude towards cancer prevention some measures in Hail region, Saudi Arabia." *Bioscience Research* 18(2): 1067-1075.
- Anderson, Benjamin O., Roman Shyyan, Alexandru Eniu, Robert A. Smith, Cheng-Har Yip, Nuran Senel Bese, Louis W. C. Chow, Shahla Masood, Scott D. Ramsey, and Robert W. Carlson. 2006. "Breast Cancer in Limited-Resource Countries: An Overview of the Breast Health Global Initiative 2005 Guidelines." *The Breast Journal* 12 (s1): S3–15.
<https://doi.org/10.1111/j.1075-122X.2006.00199.x>
- Conte L, Lupo R, Lezzi A, Sciolti S, Rubbi I, Carvello M, Calabrò A, Botti S, Fanizzi A, Massafra R, Vitale E, De Nunzio G. 2024. "Breast Cancer Prevention Practices and Knowledge in Italian and Chinese Women in Italy: Clinical Checkups, Free NHS Screening Adherence, and Breast Self-Examination (BSE)." *J Cancer Educ*. doi: 10.1007/s13187-024-02463-4.
- Erbil, Nulufer, and Nurgul Bolukbas. 2014. "Health Beliefs and Breast Self-Examination among Female University Nursing Students in Turkey." *Asian Pacific Journal of Cancer Prevention* 15 (16): 6525–29.
<https://doi.org/10.7314/APJCP.2014.15.16.6525>
- Ferlay, Jacques, Isabelle Soerjomataram, Rajesh Dikshit, Sultan Eser, Colin Mathers, Marise Rebelo, Donald Maxwell Parkin, David Forman, and Freddie Bray. 2015. "Cancer Incidence and Mortality Worldwide: Sources, Methods and Major Patterns in GLOBOCAN 2012." *International Journal of Cancer* 136(5): E359-386. <https://doi.org/10.1002/ijc.29210>.
- Giunti, G., D. H. Giunta, E. Guisado-Fernandez, J. L. Bender, and L. Fernandez-Luque. 2018. "A Biopsy of Breast Cancer Mobile Applications: State of the Practice Review." *International Journal of Medical Informatics*110(February):1–9.
<https://doi.org/10.1016/j.ijmedinf.2017.10.022>

- Kwok, C., R. Tranberg, and F. C. Lee. 2015. "Breast Cancer Knowledge, Attitudes and Screening Behaviors among Indian-Australian Women." *European Journal of Oncology Nursing: The Official Journal of European Oncology Nursing Society* 19 (6):701-6. <https://doi.org/10.1016/j.ejon.2015.05.004>
- Noreen, Mamoona, Sheeba Murad, Muhammad Furqan, Aneesa Sultan, and Peter Bloodsworth. 2015. "Knowledge and Awareness about Breast Cancer and Its Early Symptoms among Medical and Non-Medical Students of Southern Punjab, Pakistan." *Asian Pacific Journal of Cancer Prevention* 16(3):979–84. <https://doi.org/10.7314/apjcp.2015.16.3.979>.
- Parkin, D. M. 1994. "Cancer in Developing Countries." *Cancer Surveys* 19–20:519–61.
- Parkin, D. Max, Freddie Bray, J. Ferlay, and Paola Pisani. 2005. "Global Cancer Statistics, 2002." *CA: A Cancer Journal for Clinicians* 55 (2): 74–108. <https://doi.org/10.3322/canjclin.55.2.74>.
- Riley, William T., Daniel E. Rivera, Audie A. Atienza, Wendy Nilsen, Susannah M. Allison, and Robin Mermelstein. 2011. "Health Behavior Models in the Age of Mobile Interventions: Are Our Theories up to the Task?" *Translational Behavioral Medicine* 1 (1): 53–71. <https://doi.org/10.1007/s13142-011-0021-7>.