# Implication of AI Technologies in Improving the Diagnosis of Breast Cancer Within the Pakistani Healthcare System

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## Abstract

**Background:** Breast cancer is the one of the main causes of deaths among women worldwide.
**Objective:** The study aims to evaluate the implication of AI technologies in improving the diagnosis of breast cancer within the Pakistani healthcare system.
**Methods:** A cross-sectional survey was conducted from June to December 2023, involving 380 physicians through a convenience sampling technique. Participants were recruited via a Google Drive questionnaire. The study received ethical approval, and all participants provided informed consent. Data were analyzed using SPSS version 23 for descriptive statistical analysis.
**Results:** The questionnaire was emailed to a total of 380 physicians. Out of which 106 (27.8%) participants agreed that the implication of AI in breast cancer would benefit their field of expertise moderately whereas 121 (31%) expected this improvement to be significant. Almost 153 (40%) respondents cited 'quick diagnosis' as the most significant benefit of AI.
**Conclusion:** Artificial intelligence has revolutionized breast cancer management by enhancing early diagnosis, diagnostic accuracy, risk assessment, personalized treatments, and predictive analytics.

**Keywords:** Artificial Intelligence, Breast cancer, Early Diagnosis, Screening

## Introduction

Cancer remains one of the most challenging threats to human health, and a permanent cure has yet to be discovered (1). Among the various types of cancer, breast cancer is one of the most prevalent. Breast cancer is one of the leading causes of death among women worldwide (2). Early diagnosis can significantly improve the lives of millions. In the past decade, researchers in computer vision and Artificial Intelligence (AI) have intensified their efforts to develop automated frameworks that not only detect breast cancer but also identify its stage (3). This surge in research is primarily due to the advent of AI and the availability of hardware capable of accessing large datasets required for training (4). Early cancer detection and artificial intelligence (AI) are fast-emerging fields with significant overlap. In the United Kingdom, national registry data reveal that cancer stage is closely associated with one-year cancer mortality, with incremental reductions in outcome per stage increase for some subtypes (5). Early detection is essential for better survival rates because the stage of disease upon diagnosis directly affects the overall prognosis (6). Computer-aided detection enables radiologists to identify abnormalities more efficiently. Medical images serve as vital sources of information for detecting and diagnosing various diseases and abnormalities. Multiple imaging modalities allow radiologists to examine internal structures, and these have garnered significant interest in various research areas. In certain medical fields, each modality holds considerable importance (7).Breast cancer develops when the cells of the breast become aberrant and uncontrollably divide. These aberrant cells produce a big lump of tissues, which develops into a tumor (8). According to reports, 1.7 million cases of breast cancer were diagnosed globally in 2012. Breast cancer is the second leading cause of cancer death, with a standardized mortality rate of 12.9 per 100,000, and its incidence has increased over time (9).

Breast cancer can be effectively treated if detected early, making it crucial to have reliable screening methods for early signs. Researchers have employed a variety of imaging modalities to automate breast cancer detection, including mammograms, ultrasound, magnetic resonance imaging (MRI), and histopathological images, often using these methods in combination (10). Mammography is a key method for early diagnosis, but it is less effective for dense breast tissue, where ultrasound or diagnostic sonography is recommended. Considering that small masses might be missed by radiography, thermography can

be more effective than ultrasound in detecting smaller cancerous masses (11). However, mammography can miss cancers, particularly in women with dense breast tissue. For high-risk women, mammography alone may be insufficient for effective screening (12).This has led to the development of additional imaging techniques like dynamic contrast-enhanced breast MRI, digital breast tomosynthesis, and automated whole breast ultrasound to support mammography. The growing variety of imaging methods in breast cancer diagnosis provides radiologists with larger datasets and multiple diagnostic tools to use in different clinical situations (13). Artificial intelligence (AI) can enhance and integrate radiologists' skills, helping to identify complex patterns in images, translate tumor characteristics, and predict outcomes for treatment and prognosis. AI is transforming breast cancer management by improving early detection, diagnostic accuracy, risk assessment, personalized treatment, and outcome prediction (14). This study aims to evaluate the use of AI technologies in enhancing breast cancer diagnosis within the Pakistani healthcare system, addressing a significant research gap both nationally and internationally.

**Objective**
To evaluate the implication of AI technologies in improving the diagnosis of breast cancer within the Pakistani healthcare system

**Methodology**
A cross-sectional survey was conducted among 380 patients through a convenience sampling technique. The questionnaire for this survey study was designed by a team of four specialists in breast disease and cancer treatment from the hospital, utilizing Google Drive. Ethical approval for this survey was obtained from the ethical review committee of one of the private hospitals in Pakistan. The recipients included general surgeons (breast surgeons), radiologists, pathologists, medical oncologists, and radiation oncologists (registrars, associate professors, professors) from different regions of the country. The term 'AI' was used throughout the questionnaire, instead of individual terms such as algorithm, deep learning, or machine learning. The questionnaire comprised 14 questions that explored the demographic characteristics of the participants and covered their approaches, daily practices, and outlook for the future. Respondents who did not complete the questionnaire or who returned it after the deadline were excluded from the study. Hence, the participation in the survey was voluntary and all of them were informed regarding the aim and objective of the study.

**Results**
The questionnaire was emailed to a total of 380 physicians. Out of which 106 (27.8%) participants agreed that the implication of AI in breast cancer would benefit their field of expertise moderately whereas 121 (31.8%) expected this improvement to be significant. Almost 153 (40.2%) respondents cited 'quick diagnosis' as the most significant benefit of AI.

**Table I- Analysis of Questionnaire regarding implication of AI technologies in improving the diagnosis of breast cancer.**

| List of Questions | n | % |
|---|---|---|
| **1-Age group** | | |
| • 32–42 | 63 | (16%) |
| • 42–52 | 105 | (27%) |
| • 52–62 | 78 | (20%) |
| • 62–72 | 23 | (6%) |
| **2-What is your specialization in the field of medicine?** | | |
| • Surgery | | |
| • Radiology | | |
| • Pathology | 132 | (34%) |
| • Oncology related to medicine | 65 | (17%) |
| • Oncology related to medicine | 74 | (19%) |
| | 47 | (12%) |
| | 62 | (16.3%) |
| **3-Which specialization focuses on the treatment of breast cancer? Which will be the most impacted by AI soon?** | | |
| • Surgery | | |
| • Radiology | | |
| • Pathology | 38 | (10%) |
| • Oncology Related to Medicine | 212 | (55%) |
| • Oncology related to radiology | 35 | (9.2%) |
| | 46 | (12%) |
| | 62 | (16.3%) |

| Question | Count | Percentage |
|---|---|---|
| **4- What is your primary fear about AI's potential application in breast cancer? (There could be multiple options.)** | | |
| • Fear of Losing job | | |
| • Increased medical mistakes and dependability concerns. | 66 | (17.3%) |
| • AI dependency | 123 | (45.7%) |
| • Big data sharing concerns | | |
| • Ethical violations | | |
| • No concern | 149 | (39.2%) |
| • Artificial intelligence misdirection | 136 | (35.7%) |
| • Medicolegal responsibilities. | | |
| • Legal approaches to legal culpability | 149 | (39.2%) |
| | 47 | (17.5%) |
| | 1 | (2.6%) |
| | 1 | (2.6%) |
| | 1 | (2.6%) |
| **5- What is the key advantage of using AI in breast cancer treatment? (There could be multiple options.)** | | |
| • Rapid diagnosis | | |
| • Cost-effective response. | | |
| • Improved patient evaluation | | |
| • Increased examination volume | 269 | (70.7%) |
| • Enhanced accessibility. | 96 | (25.2%) |
| | 204 | (53.6%) |
| | 190 | (50%) |
| | 118 | (31%) |
| **6- What do you know about the use of artificial intelligence in breast cancer?** | | |
| • Lack of information | | |
| • Limited knowledge | | |
| • Moderate knowledge | 104 | (27%) |
| • Expertise | 189 | (49%) |
| | 78 | (20.5%) |
| | 8 | (2%) |
| **7- Have you ever used artificial intelligence (AI) to seek information regarding breast cancer practice?** | | |
| • Never used | | |
| • Occasional usage | | |
| • Moderate use | 305 | (80.2%) |
| • Frequent use | 47 | (12.3%) |
| | 18 | (4.7%) |
| | 9 | (2.3%) |
| **8-Do you believe AI in breast cancer will assist your area of expertise?** | | |
| • No improvement | | |
| • Small improvement. | 3 | (7.8%) |
| • Moderate improvement. | 37 | (9%) |
| • Great improvement | | |
| • No idea | 155 | (40%) |
| | 148 | (38%) |
| | 18 | (4.7%) |

| | | |
|---|---|---|
| **9-How would you evaluate the effectiveness of AI in the clinical diagnosis of breast cancer?** <br> • Not effective at all. <br> • Somewhat effective. <br> • Moderately effective. <br> • Very effective. <br> • Have no idea. | 21 <br> 82 <br> 138 <br> 74 <br> 68 | (5%) <br> (21.5%) <br> (36.3%) <br> (19%) <br> (17.8%) |
| **10-Does AI provide advantages in the early diagnosis and risk analysis of breast cancer with the use of big data?** <br><br> • No advantages <br> • Some advantages. <br> • Moderate advantages. <br> • Many advantages. <br> • No idea. | 1 <br> 54 <br> 127 <br> 168 <br> 18 | (2.6%) <br> (14.2%) <br> (33%) <br> (44.2%) <br> (4.7%) |
| **11- How do you envision AI being utilized to treat breast cancer?** <br> • The potential use of AI was disturbing. <br> • Should be used partially. <br> • Should be approx. collaboration between the physician and AI. <br> • Treatment should be handled by AI. <br> • I have no idea. | 4 <br><br> 84 <br><br><br> 285 <br><br> 1 <br><br> 1 | (1%) <br><br> (22.1%) <br><br><br> (75%) <br><br> (2.6%) <br><br> (2.6%) |
| **12-Evaluate the effectiveness of AI in breast cancer screening?** <br> • Not effective at all. <br> • Somewhat effective. <br> • Moderately effective. <br> • Very effective. <br> • No idea. | 3 <br> 48 <br> 91 <br> 121 <br> 58 | (7.8%) <br> (12.6%) <br> (23.9%) <br> (31.8%) <br> (15.2%) |
| **13-How reliable do you find AI in guiding the treatment of breast cancer?** <br> • Not reliable at all. <br> • Somewhat reliable. <br> • Moderately reliable. <br> • Very reliable. | 13 <br> 129 <br> 210 <br> 17 | (3.4%) <br> (33.9%) <br> (55%) <br> (4.4%) |
| **14- Are you concerned about the potential use of artificial intelligence in breast cancer treatment?** <br> • Not at all alarmed. <br> • Little alarmed. <br> • Moderately alarmed. <br> • Extremely alarmed. <br> • No idea. | 211 <br> 92 <br> 30 <br> 1 <br> 16 | (55.5%) <br> (24%) <br> (7%) <br> (2%) <br> (4.2%) |

**Discussion**

All these technological advances in AI have significantly transformed the diagnosis, treatment, and management of breast disease. This study aimed to evaluate the implication of AI technologies in improving the diagnosis of breast cancer within the Pakistani healthcare system. The study's findings revealed that artificial intelligence can benefit both physicians and patients. When considering the prospective application of AI, physicians highlighted concerns regarding ethics, errors in medicine, and legal responsibilities (15). While previous advancements in medical technology, such as the introduction of computers, initially sparked similar concerns, AI presents a unique challenge as it has the potential to directly impact physicians' roles. Although there have been rapid developments in AI, particularly in healthcare, the fear of job displacement remains prevalent among healthcare workers (16).

Despite these objections, a significant number of our participants indicated that they would be open to collaborating with AI in the future, acknowledging that AI has the potential to improve the processing and application of tremendous amounts of data in the management of breast cancer, which will benefit both patients and medical professionals (17). According to Singh (2023), these technologies can improve risk assessment, pathological diagnosis, early identification, and tailored therapy recommendations (18). According to the results, medical specialization sectors might be greatly improved by integrating AI into breast cancer management. Almost 38 % showed a strong potential for improvement and 40 % had a moderate level of enhancement. These findings suggest that with the use of AI technologies, doctors would be able to manage a higher patient volume by providing more effective patient care, to meet the increasing needs of breast cancer patients in society which is similar to a study conducted by Ahmad et al., in 2021 (19).

Further, the results show that although artificial intelligence (AI) is not yet widely used in the treatment of breast cancer with time its acceptance among the masses will increase. Studies showing a dearth of useful AI applications in healthcare contexts support this, and doctors emphasize the need for thorough research in this area. The vast majority of individuals in the current research (80.2%) said there was no AI. technology in their daily interactions with breast cancer similar to a study conducted by Welten et al., in 2022 (20).

In addition, respondents to the survey indicated little concern over the future use of AI technologies in the treatment of cancer and breast disorders, and they believed that collaborating with AI would be appropriate. They were willing, although they did have some reservations. Physician worry is natural, as new technical innovations often result in a shift in societal attitudes, particularly when the technology has the potential to replace an individual's employment. When computers were first employed in medicine, similar worries existed (21). Health professionals expressed anxiety in the latest study that AI technology might replace them in their line of work (22). In a different survey, the majority of medical professionals denied the notion that artificial intelligence would eventually replace them (23). This study has several limitations as subgroup analysis was not feasible due to the lack of participants in each group. Secondly, the survey did not include doctors from other specialty roles involved in the management of breast cancer.

**Conclusion**

Artificial intelligence has revolutionized breast cancer management by enhancing early diagnosis, accuracy, risk assessment, personalized treatments, and predictive analytics. These advancements have improved patient care, reduced adverse effects of therapy, and supported patient-centered decision-making. Addressing ethical considerations and ensuring clinical adoption is essential to fully realize AI's potential in breast cancer management, aligning with broader public health and healthcare goals.

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