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Long Paper

Role of Artificial Intelligence (AI) in Breast Cancer Screening: An Integrative Review

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Abstract

Purpose – This paper reviews existing research on the application of artificial intelligence (AI) in breast cancer screening. It summarizes how AI contributes to early detection, diagnostic accuracy, and efficiency in imaging interpretation.

Method – An integrative review was conducted using studies retrieved from Google Scholar, PubMed, CINAHL, Scopus, and ScienceDirect. Peer-reviewed, English-language articles discussing AI in breast cancer detection were included. Twenty studies published between 2019 and 2022 met the inclusion criteria.

Results – The selected studies from various countries demonstrated that AI improved the detection of suspicious lesions, reduced false-positive and false-negative findings, and enhanced image-reading efficiency. AI tools applied to mammography, tomosynthesis, magnetic resonance imaging, and ultrasound provided greater consistency and reliability in identifying subtle and interval cancers. Combining AI with radiologist interpretation produced superior diagnostic performance compared to either used alone. Machine-learning models were also shown to predict recurrence and assist in individualized risk assessment, providing valuable insights for patient management and follow-up care.

Conclusion – Integrating AI into breast cancer screening enhances accuracy, efficiency, and timeliness in diagnosis. Rather than replacing medical practitioners, AI should be implemented as a supportive tool that strengthens human expertise and decision-making in clinical practice.

Recommendations – Healthcare institutions must consider to adopt validated AI systems with structured training, monitoring, and evaluation to ensure safe, ethical, and equitable use.

Research Implications – Future research should include large, diverse populations and multicenter trials to validate outcomes, minimize algorithmic bias, and assess cost-effectiveness for sustainable integration into screening programs.

Keywords – artificial intelligence, breast cancer, screening, oncology, diagnosis

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INTRODUCTION

Breast cancer is one of the most common causes of death in women globally. It is estimated that one in six deaths, or 9.6 million, were attributed to cancer in 2018. (Ferlay et al., 2019). The most prevalent cancer in less developed countries in males is lung cancer, whereas the most prevalent in women is breast cancer (Torre et al., 2012; De Silva & Alcorn, 2022; Lin et al., 2019). Large numbers of cancer patients all over the world lack access to prompt, high-quality diagnosis and treatment because many health systems in low and middle-income nations are least equipped to handle this load (World Health Organization, 2022). Implementing what we already know can lead to significant advances in the treatment of breast cancer worldwide (World Health Organization, 2021).

The diagnostic evaluation may involve a physical exam, digital mammography, ultrasonography, and occasionally a breast magnetic resonance imaging (MRI), which are examples of diagnostic imaging (Bevers et al., 2018; Schünemann et al., 2020). Screening for breast cancer is available to women aged 50-70 years in the United Kingdom every three years, with 2 different mammograms obtained of each breast. (Taylor-Phillips et al., 2022). Although standard mammography (film or digital) is the most popular method of detecting breast cancer in women, overdiagnosis, possibly radiation-induced cancer, and false positive results are the main negative effects of mammographic screening for breast cancer (Lauby-Secretan et al., 2015).

Only a few empirical studies on AI-based tumor detection in mammograms have been published among many Asians, who already have higher breast densities than Caucasians. (Fane et al., 2022; Suh et. al, 2020; Rajaram et al. 2016). Mammography AI algorithms in identifying tumors without adding depth to misdiagnoses have the potential to improve the efficacy of community cancer screening programs. (Marinovich et al., 2022). Artificial Intelligence (AI) has proven to be extremely beneficial in terms of early disease detection and accelerating accurate diagnosis. The application of AI in the detection of breast cancer is making it possible to evaluate mammograms 30 times faster and with 99% accuracy, which eliminates the need for pointless biopsies (Burke, 2022).

Artificial intelligence has aided in the advancement of healthcare research (Guo & Li, 2018). Scientists have created tools to assist in the identification and diagnosis of cancer because of the availability of open-source healthcare information, and when trying to deal with such complicated illnesses, learning-based and machine-learning methods provide a dependable, quick, and effective service. (Kumar et al., 2022; Patel et al.,2019; Houssami et al., 2019; Sechopoulos et al., 2021). Radiologists accurately classify screening mammograms into the appropriate (BI-RADS) breast imaging reporting and data system category, along with the assistance of AI (Dang et al., 2022), which lessens the burden of radiologists and improves cancer diagnosis (Shoshan et al., 2022; van Winkel et al., 2021); Dembrower et al., 2020.

Furthermore, since an AI program is unaffected by fatigue or subjective diagnosis, fewer malignancies may be overlooked (Freeman et al., 2021). It is also important to consider the potential limitations and challenges in implementing AI-based screening. These challenges include the potential for algorithmic bias, data privacy concerns, and the need for extensive validation across a diverse population (Carter et al., 2020; Mema &McGinty, 2020)

Based on the literature, to the researchers' knowledge, this is the first review to synthesize the role of artificial intelligence in breast cancer screening. Furthermore, the goal of this research is to 1) recognize different AI platforms used in breast cancer screening, 2) identify the benefits of using AI in breast cancer screening, and lastly 3) to describe the role of healthcare professionals when it comes to diagnostic imaging reading with the aid of AI.

METHODOLOGY

Design

This study is an integrative review based on available literature related to the role of artificial intelligence (AI) in breast cancer screening using Whittemore and Knafl's (2005) approach to accommodate diverse data sources and unrestricted study designs through the following phases: Literature review, problem identification, data analysis, data evaluation, and result or conclusion presentation will offer a formulation of understanding as well as the applicability of significant study results to practice (Souza et al., 2010) and provide important insight to recommend future research directions (Cronin & George, 2020).

Search Strategy

The review was conducted in November 2022. The researchers proceed with the search for literature from inception using online resources such as Google Scholar, PubMed, CINAHL, Scopus, and ScienceDirect. The keywords used in the search were as follows: artificial intelligence AND breast cancer OR oncology AND screening. The initial search yielded 389 studies, of which 150 were excluded because they were not related to AI or breast cancer screening. Left with 239 studies, headlines, and summaries were also filtered for exclusion and inclusion criteria, leaving 150 potential eligible articles that seemed relevant for further analysis and evaluation. Of this total, 130 studies were further excluded as there was no discussion about AI in breast cancer screening, leaving 20 articles selected to be included in this study. The researchers used the Preferred Reporting Items for Systematic and Meta-Analysis (PRISMA) as shown in Figure 1 to describe the search and selection of studies. To find relevant references, the researchers also consulted an expert librarian.

Eligibility Criteria

The following inclusion criteria were included: (a) papers that discussed the role of artificial intelligence in breast cancer screening, and (b) only peer-reviewed academic journals written in English and that can be accessed. Whereas the following exclusion criteria were used: (a) articles that were not related to artificial intelligence or breast cancer screening; (b) irrelevant, duplicate, and non-English articles; and (c) full-text articles that were unavailable. Taking the exclusion and inclusion criteria into account, the researchers have been left with 20 articles to use in this study.

Data Evaluation and Quality Appraisal

Appendix A depicts the 20 included studies to evaluate the quality of the data. A table matrix extracting data using the tool by Sparbel and Anderson (2000) with the following information: First Author, Year, Country, Focus, Design, Sample Size, AI Platform/Method, Study Findings, Limitations, and Level of Evidence (LOE). Two of the researchers conducted the initial result search, while the other two researchers conducted the screening. Potential studies were reviewed, individually assessed, and decided through consensus for critical analysis.

The researchers critically appraised the study design to determine the levels of evidence using the Hierarchy of Evidence for Intervention Studies (Melnyk & Fineout-Overholt, 2019) to check the strength of the scholarly studies and quality as a tool to better practice decisions resulting in improved outcomes for evidence-based practice. To further evaluate the included studies, the researchers followed the guidelines of the Critical Appraisal Skills Programme (2018) Systematic Review Checklist. The tool includes ten questions, each of which concentrates on a different methodological aspect of the study. The tool's questions prompt researchers to consider whether their research methods were appropriate and whether their results were clearly stated and important. CASP tools successfully and succinctly cover the areas required for a critical analysis of the evidence (Nadelson & Nadelson, 2014), ensuring that all significant elements or considerations are considered, allowing researchers to be systematic.

Ethical Considerations

Ethical considerations were also paramount in conducting this integrative review. The researchers ensured that all included studies were peer-reviewed and published in reputable journals to maintain a high standard of ethical integrity. Issues such as data privacy, informed consent, and the potential for algorithmic bias were carefully considered. Additionally, the ethical implications of implementing AI were addressed and are crucial for the responsible and effective deployment of AI on academic integrity in ensuring transparency, accountability, and the protection of patient rights and data privacy, maintaining patient confidentiality, and the necessity of conducting further research to ensure AI systems do not perpetuate existing health disparities (European Commission, 2024)

RESULTS

Included Studies' Characteristics

Publications were created in China (n=2), the United States of America (n=6), Australia (n=1), Egypt (n=1), France (n=1), Japan (n=1), Germany (n=1), Spain (n=1), South Korea (n=3), Sweden (n=1), Taiwan (n=1) and Turkey (n=1). The publication period is from 2019 to 2022. Study designs varied from one another with the following breakdown: retrospective studies (n=11), multi-reader/multi-case studies (n=3), prospective cohort studies (n=1), retrospective cohort studies (n=1), randomized controlled trial (n=1), cohort studies (n=2), and prospective study (n=1). The tally for the levels of evidence (LOE) is the following: LOE II (n=2) and LOE IV (n=18).

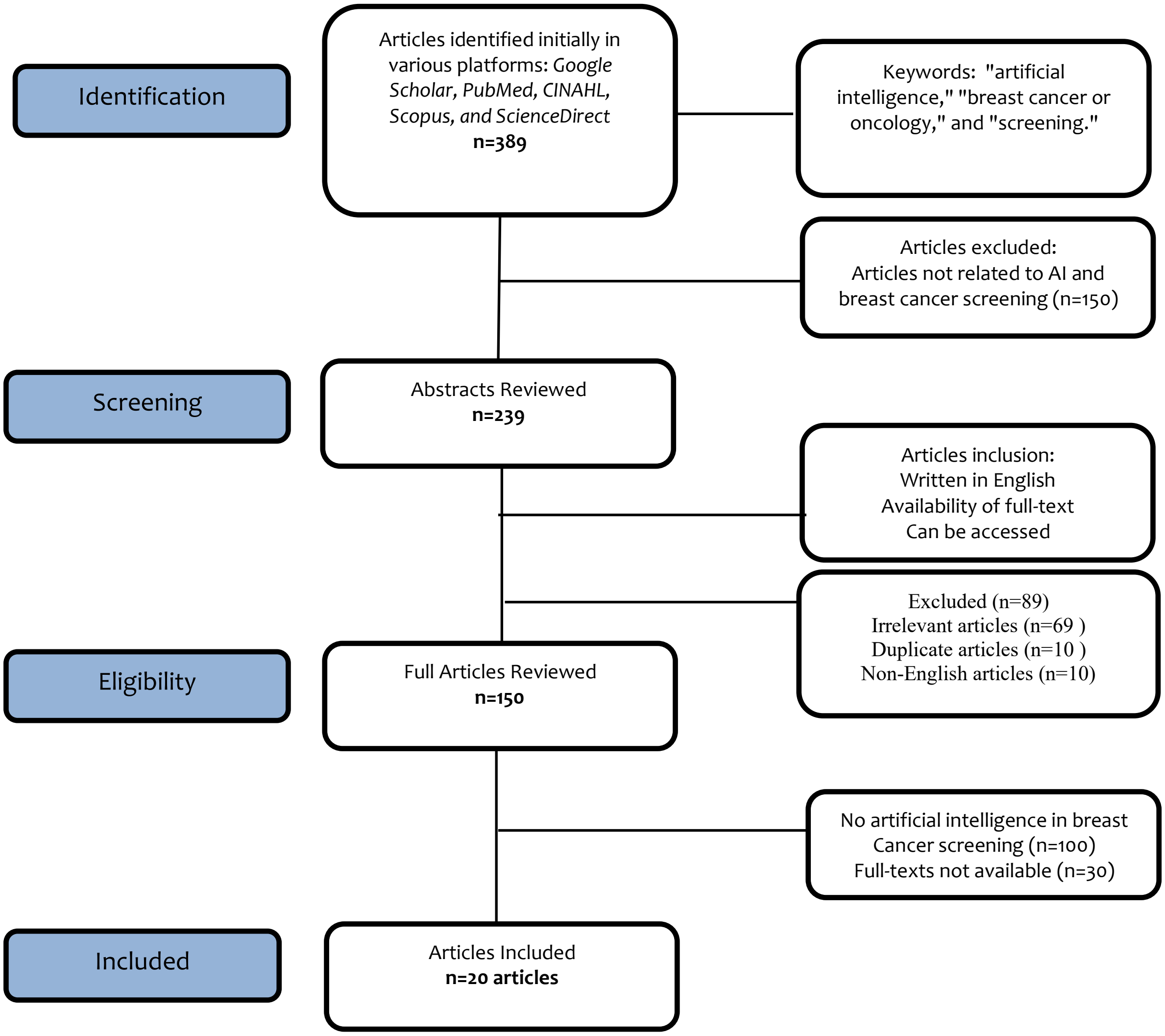

Figure 1. PRISMA Search Strategy on AI in Breast Cancer

Different Platforms of AI

As shown in Table 1, data gathered from the studies use different AI platforms. Ten studies (Dang et al., 2022; Kim et al., 2022; Liebig et al., 2022; Marinovich et al., 2022; Raafat et al., 2022; Romero-Martín et al., 2022; Shoshan et al., 2022; van Winkel et al., 2021; Yirgin et al., 2022; and Dembrower et al., 2020) discussed the usage of AI software in digital mammograms and/or digital breast tomosynthesis designed to detect suspected areas containing breast cancer and to assess their degree of suspicion. Four studies (Park et al., 2022; Uematsu et al., 2022; Watanabe et al., 2019; & Yoon et al., 2022) discussed the use of AI computer-aided detection in DM and/or DBT to detect breast cancer through screening, diagnostic, or surveillance imaging. Two studies (Lou et al., 2020 & Xiao et al., 2022) used AI forecasting models based on machine learning algorithms to predict prognosis and recurrence of breast cancer. Two studies (Jiang et al., 2021 & Witowski et al., 2022) evaluated the use of AI software in magnetic resonance imaging in detecting breast cancer. One study (Gastounioti et al., 2022) used an AI risk design to forecast the short-term risk of breast cancer and identify women at high risk of breast cancer who would benefit from additional screening. One study (Zhang et al., 2021) investigated the use of AI in ultrasound imaging for diagnosing breast cancer axillary lymph node metastasis.

Role of Radiologist and AI in Breast Cancer Screening

Technological advancement evolves rapidly, and AI has proven to be helpful in terms of early disease detection and aiding in getting an accurate diagnosis; however, the functions of a radiologist are still important. Three studies (Jiang et al., 2021; van Winkel et al., 2021; & Watanabe et al., 2019) found that the use of AI reading support systems improves radiologists' performance in differentiating malignant from benign images. Four studies (Dembrower et al., 2020; Leibig et al., 2022; Romero-Martin et al., 2022; & Shoshan et al., 2022) found out in their studies that the use of AI could potentially reduce the workload of radiologists without sacrificing the caliber of their reading and instead enhancing it.

Table 1. Platforms and Roles of AI in Breast Cancer Screening

AI platform	**Included articles**
AI computer-aided detection in DM and DBT	Park et al. (2022); Uematsu et al., (2022); Watanabe et al., (2019); Yoon et al. (2022)
AI forecasting models	Lou et al., (2020); Xiao et al. (2022)
AI risk model	Gastounioti et al. (2022)
AI software in digital mammogram and/or digital breast tomosynthesis	Dang et al. (2022); Dembrower et al., (2020); Kim et al., (2022); Liebig et al. (2022); Marinovich et al. (2022); Raafat et al. (2022); Romero-Martín et al., (2022); Shoshan et al. (2022); van Winkel et al. (2022); Yirgin et al. (2022)
AI software in magnetic resonance imaging	Jiang et al. (2021); Witowski et al. (2022)
AI in ultrasound imaging	Zhang et al. (2021)

DISCUSSION

Cancer has become prevalent, and it is a very devastating disease that leaves many patients uncertain about their prognosis. While there is currently no absolute cure for cancer, the next best option would be early detection. Innovations in screening have been discovered and implemented over the years with the use of AI. This integrative review presented a considerable amount of literature focused on the role of artificial intelligence in breast cancer screening. Different AI platforms and the role of radiologists in breast cancer screening were discussed among the included studies.

According to Marinovich et al. (2022) and Yirgin et al. (2022), AI algorithms for reading mammograms have the potential to increase the efficacy of population breast cancer screening. This will be very beneficial because it allows for the identification of high-risk mammograms versus low-risk mammograms that would need further evaluation from radiologists. In addition, studies done by Dembrower et al. (2020) and Park et al. (2022) found that the use of AI technology in mammography screenings can be helpful to promote early cancer detection. This would be very advantageous because it would identify otherwise missed or interval cancers that would have been discovered later. However, not all breast cancer screenings are simple, and AI technology has the potential to overcome screening mammography restrictions in the diagnosis of breast cancer as well as the detection of mammographically occult breast cancers, as described in Raafat et al. (2022) and Kim et al. (2022).

Breast cancer screening is not just for first-time detection of the malignancy, but also for those who were already diagnosed and underwent surgery. Breast cancer surveillance imaging can be challenging for patients who have undergone breast-conserving therapy because of the aftereffects of surgery, but the study by Yoon et al. (2022) has proven that the addition of AI in cancer detection as a supplement to digital mammography (DM) reduced recall rates and improved accuracy. Moreover, another study of surveillance imaging by Zhang et al. (2021) puts emphasis on the diagnosis of breast cancer axillary lymph node metastasis using an AI algorithm in ultrasound imaging that promotes early detection. This is crucial for breast cancer patients who have already undergone treatment and are in remission because surveillance imaging puts them under a great deal of stress yet again, and so, they would appreciate it if surveillance imaging were efficient.

Different AI platforms like an AI risk model used by Gastounioti et al. (2022), a machine learning-based prognostic prediction model tested by Xiao et al. (2022), a machine learning algorithm through artificial neural networks (ANN) model compared by Lou et al. (2020), and a deep neural network-based AI system in (DCE-MRI) magnetic resonance imaging with dynamic contrast described by Witowski et al. (2022) all had common goal of predicting the probability of having breast cancer and/or its recurrence in the context of patient survivability. AI can process extensive amounts of patient data, such as genetic information, medical history, and treatment results, in order to customize cancer screening and treatment strategies for each patient. Individualized strategies can result in more successful treatments and improved results.

Breast cancer needs a multidisciplinary approach from screening to management, but among the studies in this review, only the role of radiologists was mentioned, as the emphasis was on screening. When it comes to radiologist performance, Leibig et al. (2022) discovered that combining the strengths of radiologists and AI for breast cancer screening improves the screening accuracy of radiologists. Moreover, studies carried out by Dang et al. (2022), Jiang et al. (2021), and van Winkel et al. (2021) all supported the findings that AI technology improves radiologists' performance in terms of reading and assigning the correct BIRADS category. In contrast, a study by Romero-Martin et al. (2022) found that AI could replace radiologists' readings in breast screening as a stand-alone. The sole use of AI technology has the potential to reduce radiologists' workload and fatigue, as expressed in the study by Shoshan et al. (2022). The challenge here is that although AI technology can predict and decide based on the input, it lacks the objective factor and judgment that only radiologists can provide during reading. Therefore, integrating AI as a supportive tool rather than a replacement seems to be the most effective approach.

Artificial intelligence (AI) is crucial in cancer screening due to its benefits over conventional methods. It aids in early detection, precise analysis of medical images, personalized medicine for informed decisions, improved patient outcomes, risk assessment for recommending suitable screening strategies, interventions for early cancer detection, and decision support by integrating clinical guidelines, research, and patient data for better decision-making and patient care. AI has the capacity to transform cancer screening by enhancing early diagnosis precision, efficiency, and individualized treatment, resulting in improved patient outcomes. It is crucial to properly examine, validate, and ethically adopt AI technologies to realize their potential.

Key findings from the studies demonstrated that AI algorithms significantly improve the early detection of breast cancer, especially in identifying interval cancers that traditional methods might miss. AI systems have been shown to enhance the diagnostic accuracy of radiologists, reducing their workload while increasing the detection rate of cancers. Specifically, AI-supported mammography and digital breast tomosynthesis (DBT) have been effective in distinguishing between high-risk and low-risk mammograms, which aids in focusing radiologists' attention on cases needing further evaluation. The findings highlighted the transformative potential of AI in enhancing the precision, efficiency, and individualization of breast cancer screening, diagnostic, and surveillance processes.

CONCLUSIONS AND RECOMMENDATIONS

The integration of artificial intelligence (AI) technology in breast cancer screening has shown remarkable potential to enhance various aspects of patient care. These advantages can be summarized into three distinct points for clarity: Early Detection: AI significantly aids in identifying cancers at earlier stages, thereby reducing the incidence of missed and interval cancers. Research indicates that AI can detect a higher percentage of interval cancers compared to traditional methods, enabling earlier and potentially more effective treatment interventions. Enhanced Diagnostic Performance: AI assists radiologists by increasing the accuracy and efficiency of interpreting mammograms and other imaging modalities. AI technology can substantially decrease the workload of radiologists while identifying more cancers per screened population. This improvement not only enhances diagnostic precision but also allows radiologists to dedicate more time to complex cases. Broad Impact: AI provides substantial benefits across all phases of breast cancer management, including screening, diagnosis, and surveillance. Its capabilities improve the precision and reliability of medical decision-making. AI-assisted screening has demonstrated reduced recall rates and improved accuracy in detecting cancers in patients who have undergone treatments like breast-conserving therapy. AI technology has proven its potential to revolutionize breast cancer screening, leading to earlier detection, better diagnostic accuracy, and improved patient outcomes.

To advance the field of AI in breast cancer screening, several actionable recommendations are proposed. Future research should adopt diverse methodologies, including large-scale prospective studies and randomized controlled trials, to validate AI's effectiveness across varied clinical settings. Integrating AI with genomic data, electronic health records, and clinical notes can further improve screening accuracy and reliability. Ensuring diverse population representation in studies is essential to address potential biases and enhance the generalizability of AI algorithms across different ethnic, socioeconomic, and demographic groups. Advanced data integration techniques that combine imaging with clinical information, such as family history, genetic markers, and demographics, can strengthen predictive accuracy and clinical utility. Ethical considerations are paramount, requiring transparent disclosures, adherence to privacy and data governance principles, and alignment with academic integrity guidelines to mitigate risks. Regulatory frameworks must also be established, focusing on data protection, patient consent, bias reduction, and algorithm transparency to ensure

IMPLICATIONS

In detecting breast cancer, mammograms are still an effective screening/diagnostic tool; however, they have a limitation. With the help of advanced technology, the use of Artificial Intelligence (AI) in screening, diagnostic, or surveillance imaging was developed to help doctors, pathologists, oncologists, and radiologists to accurately detect breast cancer more easily and earlier. It reduces false negative/false positive results; thus, AI provides a promising result to all patients around the globe. AI must be widely available so that everyone can easily access it.

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DECLARATIONS

Conflict of Interest

The researcher declares no conflict of interest in this study.

Informed Consent

Informed consent is not applicable in a review paper. All references have been fully acknowledged by the researchers.

Ethics Approval

No ethical approval concerns on a review article.

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Appendix A. Summary of the included studies on AI in breast cancer screening

Authors (Year) Country	Main Focus	Design Study	Sample Size	AI Platform/Method	Study Findings	Study Limitation(s)	Level of Evidence (LOE)
Dang et al. (2022) France	The effect of AI technology on mammography-based breast cancer detection.	A multi-case research with multiple readers, as well as a crossover layout.	314 mammograms	AI software used in 2D digital mammography	The use of AI in mammography reading assisted radiographers in allocating the appropriate BI-RADS categorization while not slowing down interpretation time.	The AI program used did not integrate previous mammograms or tomosynthesis, as well as other clinical data, which can result in false positives and false negatives.	IV
Dembrower et al. (2020) Sweden	Analyze how AI could improve cancer detection while reducing the workload of the radiologists.	Retrospective Simulation Study	7,364 women: 547 with breast cancer and 6,817 with healthy controls.	AI cancer-detection software	In addition to cutting the workload of radiologists in half, using an AI cancer detector could discover a significant fraction of tumors that would otherwise go undetected.	The study had the following limitations: the women had to be from Sweden and had previously undergone a mammogram; the location of the radiological findings was not disclosed, so it was impossible to determine whether the AI algorithm's finding coincided with the location where cancer was later discovered; and the performance of the radiologist might be impacted by this knowledge.	IV
Gastounioti et al. (2022) USA	An artificial intelligence (AI) risk model built from mammography that was initially created in a European study setting was externally validated in a screening	Cohort Study	176 breast cancers and 4,963 randomly selected controls	AI risk model software	According to objective evaluation results, the AI risk model outperformed the well-established Gail risk model in recognizing women at significantly higher risk in a U.S. screening sample.	Further validation of the AI risk model is required, as well as testing in multiple screening web pages with culturally diverse screening communities.	IV

	group in the United States.						
Jiang et al. (2021) USA	To compare radiologists' ability to distinguish cancer from non-cancer lesions using an advanced AI system in MRI.	Retrospective Study	111 women	AI software in MRI	When using an AI system to distinguish between malignant and benign MRI breast tumors, radiologists perform better.	There is variation in the radiologists' interpretation.	IV
Kim et al. (2022) South Korea	To show the effectiveness of artificial intelligence (AI) programs in detecting breast tumors that are not visible on a mammogram.	Retrospective Study	5,480 breast cancer patients	AI software in mammograms	AI-based diagnosis-supporting software could accurately identify occult breast cancer in mammograms at the right site, which would greatly aid in breast cancer screening.	Additional prospective research using a screening cohort could confirm the clinical viability of AI-based diagnosis assistance tools.	IV
Leibig et al. (2022) Germany	Use AI and radiologists together to improve breast cancer screening.	Retrospective Analysis Study	4,463 cancers detected by screening and 100,055 normal follow-up studies	An AI system in digital mammography	The decision-referral approach shows that by combining the abilities of the radiologist and the AI algorithm, specificity and sensitivity can be enhanced.	If the study had been conducted prospectively instead of retrospectively, it would have given clear insight into the impact of the decision-referral technique.	IV
Lou et al. (2020) Taiwan	To examine the predictive power of several forecasting models for the recurrence of breast cancer within 10 years of surgery and to find important recurrence predictors.	Prospective Cohort Study	1140 patients	Cox regression (COX) models, K nearest neighbor (KNN), naive Bayes classifier (NBC), support vector machine (SVM), and Artificial neural network (ANN) were used for AI forecasting.	Since it is attribute-based recurrence within ten years of lumpectomy, healthcare managers and other institutions' medical personnel can employ the proposed ANN model to show the significance of timely and proper postsurgical care.	This study's limitation was the exclusion of problems related to recurrence following surgery.	IV

Marinovich et al. (2022), Australia	Comparing radiologists' precision and the power of AI in a community of women, all of whom took part in an actual population screening for breast cancer program.	Cohort Study with Retrospective Data	235 interval cancers; 761 screen-detected cancers.	Artificial intelligence-based automated system for digital mammography interpretation	If AI mammogram reading algorithms can identify tumors, particularly interval cancers, without significantly increasing diagnostic errors, they may improve the efficacy of community cancer detection programs.	This study did not cover societal, ethical, or economic ramifications of AI.	IV
Park et al. (2022) South Korea	To determine whether missed cancer on digital mammography can be more easily detected using artificial intelligence and computer-aided diagnosis.	Retrospective Study	There were 204 cases in total, with 137 categorized as real negative, 33 as marginal signs, and 34 as overlooked carcinoma.	AI-CAD software	While the AI-CAD is capable of early cancer detection, it struggles to pick up on the asymmetry. The role of radiologists in making conclusions by comparing recent images to older ones cannot be replaced. The difficulty of the radiologists' reading procedure will be made easier with the use of AI-CAD.	This study included a limited number of participants and another AI-CAD software.	IV
Raafat et al. (2022) Egypt	To assess how sensitive artificial intelligence (AI) is compared to digital mammography in detecting various types of breast cancer.	Prospective Study	123 female patients; 134 cancerous carcinomas	An AI technology automated system scans a digital mammogram (DM) assessment.	Beyond mammographic limitations, AI demonstrated promise in identifying numerous histological types of breast cancer, including ductal carcinoma in situ, micropapillary carcinoma, invasive lobular carcinoma, and tubular carcinoma.	The following are some of the study's limitations: limited sample size; lack of research on the interaction between findings of the AI algorithm and results from a human interpretation; and lack of family history and other clinical characteristics in the AI algorithm.	IV

Romero-Martín et al. (2022) Spain	To evaluate an AI system's stand-alone performance as a self-sufficient reader of DBT and DM examinations, in retrospect.	Retrospective Study	16,067 women from the Tomosynthesis Cordoba Screening Trial	Deep learning methods are utilized by the AI system to examine DM and DBT images and identify lesions that may be breast cancer.	In breast screening, artificial intelligence could take the role of radiologists' readings, as digital breast tomosynthesis has a higher recall rate, but digital mammography has a lower recall rate and noninferior sensitivity.	The study's limitations are the following: Just one AI system was tested, and it was carried out by a single organization using a retrospective design; all machines were purchased from the same vendor, and all mammograms were obtained from the same location.	IV
Shoshan et al. (2022) USA	To evaluate the application of AI technology to reduce workload by removing standard digital mammography screens.	Retrospective Study	13,043 people: 9,938 from Healthcare Insurance Network 1 and 3,105 from Healthcare Insurance Network 2.	An artificial intelligence-based mechanism that evaluated image processing as well as medical evidence and categorized mammographic screening evaluations as cancer-free.	The artificial intelligence program was successful in screening out typical DBT screening exams, which would lessen the workload and exhaustion of radiologists, improve workflow, facilitate further DBT introduction, and decrease unnecessary recalls, stress, and radiation exposure for women.	Used a single vendor machine	IV

Uematsu et al. (2022) Japan	Artificial intelligence computer-aided detection synthesized mammograph (AI CAD SM) diagnostic performance was compared to original DM, either alone or in conjunction with digital breast tomosynthesis (DBT), and multicase multireader reading performance for soft tissue density lesions, calcification lesions, and breast density was compared.	Multi-Reader, Retrospective, Completely Crossed, Completely Randomized, Multicase Research	388 mammography pictures: 84 breast tumors, 83 benign tumors confirmed by biopsy, and After a one-year follow-up, 221 normal or completely harmless cases had negative results.	AI CAD SM, digital breast tomosynthesis, as well as digital mammography, are all terms for artificial intelligence computer-aided detection synthesized mammography.	Because of its superiority over DM, AI CAD SM can be chosen entirely over DM. AI CAD SM + DBT, for example, was statistically insignificantly superior to DM + DBT. Furthermore, DBT+DM outperformed AI, CAD, and SM alone in terms of diagnostic performance. Therefore, it may imply that the new SM must take precedence over DM in clinical trials.	The study's limitations included the use of only one experienced radiologist; the utilization of a prototype design with an advanced AI computer-aided design algorithm, which needs additional validation of the algorithm. This study was conducted retrospectively at a single organization with a specific vendor and used cases and radiologists from a particular nation.	IV
van Winkel et al. (2021) USA	To determine if the application of an artificial intelligence (AI) assistance system improves breast radiologists' ability to read wide-angle DBT.	Multi-reader multi-case Study	360 cases: 110 cancer cases, 104 non-cancerous cases, and 146 negative cases	AI support system in 2D and DBT mammograms	Using an AI system as help, radiologists reduced reading time while increasing the accuracy of their cancer identification in digital breast tomosynthesis (DBT).	The utilization of a cancer-enriched dataset rather than a sequentially gathered sample of screening mammography from a healthcare setting is indeed a limitation of this research.	II
Watanabe et al. (2019) USA	To ascertain whether an AI-CAD algorithm may be utilized to increase the sensitivity of radiologists in detecting and diagnosing breast cancer.	Retrospective Study	317 cancer patients with prior mammograms	The AI-CAD algorithm used in mammography	This study demonstrates how radiologists can gain clinically from AI-based software when interpreting screening mammograms. Utilizing AI in clinical settings has the potential to improve early cancer diagnosis, speed up workflow, and decrease false-	The small number of participants and the absence of earlier mammography comparisons, which could have boosted reader sensitivity, are the study's limitations.	IV

					negative mammography.		
Witowski et al. (2022) USA	Individualize the treatment of individuals experiencing DCE-MRI and utilize an AI-based system to ultimately improve breast cancer diagnostic performance.	Retrospective Study	21,537 bilateral DCE-MRI research	Deep neural network-based artificial intelligence system in DCE-MRI research that predicts the risk of breast cancer	An artificial intelligence for forecasting breast cancer in MRI that is comparable to board-certified radiologists' performance was tested and developed, and it has the potential to eliminate unneeded tissue samples.	Limitations of the study are the following: the reader study design may not accurately reflect how the system will influence radiologists' judgment; a multireader, multicase study would be of value; a more thorough, cost-effective analysis should be conducted in the years ahead; and finally, the system does not provide clear explanations of its decision-making.	IV
Xiao et al. (2022) China	To assess the effectiveness of Cox regression and a machine learning-based breast cancer diagnostic prediction system.	Retrospective Cohort Study	22,176 cases: 15,523 training cases and 6653 test cases.	Four prognostic models (SVM, Cox-EN, RSF, and Cox) were developed to predict survival rates in women with breast cancer.	The RSF model showed potential to be utilized as a useful tool to generate forecasts in the frame of reference of survival data, modeling, and prediction by slightly outperforming the other models in terms of discriminative capacity.	The primary limitation is that this research was carried out in a solitary Chinese center without any peer approval.	IV

Yirgin et al. (2022) Turkey	To assess an artificial intelligence (AI) algorithm's ability to detect missed and interval tumors in a simulated screening environment.	Retrospective Study	211 mammograms	An AI algorithm in mammograms	AI can enhance the capacity of breast cancer screening programs by increasing cancer detection rates and decreasing false-negative assessments.	The AI system does not take into consideration any other data, for instance, clinical history, family background, or manifestations; it merely examines the images that are given.	IV
Yoon et al. (2022) South Korea	to see how supplemental AI-CAD or DBT affected recognition rates and manage and analyze in women receiving screening mammography after breast conserving treatment.	Retrospective Study	314 women received BCT followed by DBT.	Digital Mammography (DM); Digital Mammography with Digital Breast Tomosynthesis (DM plus DBT); and Digital Mammography with Artificial Intelligence-Computer-Aided Detection (DM plus AI-CAD)	In comparison to DM, adjunct DBT or AI-CAD after BCT decreased recall rates and increased accuracy in the ipsilateral and contralateral breasts. In comparison to the addition of DBT, the inclusion of AI-CAD produced a reduced recall rate and greater accuracy in the ipsilateral breast.	The limitations of the study were the following: it was a single-center retrospective investigation; there were a few reoccurrences; diagnostic accuracy may have been better in patients with a shorter time span; postsurgical transformation has an impact; and just one AI-CAD algorithm was available.	IV
Zhang et al. (2021), China	To investigate the use of ultrasonic image analysis technology utilizing artificial intelligence algorithms in the treatment of axillary lymph node metastasis	Randomized Controlled Trial	90 breast cancer patients	Ultrasonic image segmentation innovation that employs artificial intelligence	The artificial intelligence algorithm back propagation neural network had high accuracy, sensitivity, and specificity for ultrasonic image analysis, with better segmentation outcomes as well as a better diagnostic impact for breast cancer axillary lymph node metastasis.	This study's case samples are limited, which may have an effect on the test findings.	II