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REVIEW

Diagnostic Challenges and Patient Safety: The Critical Role of Accuracy – A Systematic Review

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Background: Accurate diagnosis is critical for patient safety, guiding treatment and preventing harm. Diagnostic errors remain prevalent, contributing to avoidable harm, increased healthcare costs, and morbidity. Understanding diagnostic accuracy is essential to improving clinical outcomes.

Objective: This review aims to systematically explore the impact of accurate diagnosis on patient safety, identifying challenges in current diagnostic practices and strategies for improvement.

Methods: A comprehensive search of PubMed, CINAHL, the Cochrane Library, and Google Scholar was conducted from 2010–2024. Initial screening yielded 579 records, using keywords like "accurate diagnosis", "diagnostic errors", and "patient safety." A full-text review of 125 studies was conducted after duplicates were eliminated and titles and abstracts were screened for relevancy. Exclusion criteria excluded studies with inadequate data, non-English publications, and opinion pieces, while inclusion criteria mandated that studies concentrate on patient safety and diagnostic accuracy in acute care settings. Ultimately, 26 studies were found to meet the final eligibility requirements and were added to the review. Retrospective cohort studies and randomized controlled trials were among the study designs.

Results: Accurate diagnosis was found to improve treatment efficacy, enhances patient safety, and reduces unnecessary procedures. Challenges include cognitive biases, insufficient diagnostic tools, and fragmented care. Technological advancements, including artificial intelligence (AI) and machine learning, were found to significantly enhance diagnostic precision. Despite these benefits, variability in clinical skills and systemic barriers remain substantial obstacles.

Conclusion: Accurate diagnosis is essential to enhancing patient safety. The results of this review indicate that using AI tools, improving clinician training, and creating standardized diagnostic procedures may help reduce diagnostic errors; however, because of the small dataset and lack of meta-analysis, the findings should be interpreted cautiously. To further evaluate the effect of diagnostic accuracy on patient safety, future research should concentrate on carrying out larger-scale studies and statistical validations.

Keywords: accurate diagnosis, patient safety, diagnostic errors, artificial intelligence, healthcare outcomes

Introduction

Accurate diagnosis is fundamental to ensuring patient safety, as it informs the course of treatment and prevents harm.[1,2] Diagnostic errors occur when a clinician fails to diagnose at the right time correctly or overlooks a diagnosis. Diagnostic errors are a prevalent problem globally. Diagnostic error rates have been approximated at 10–15% in most clinical medicine areas, and the estimated percentage of medico-legal claims against primary care providers due to diagnostic error varies from 63–72%.[3] Diagnostic errors are a leading cause of preventable harm in healthcare systems worldwide, with the Institute of Medicine reporting that diagnostic errors affect approximately 12 million Americans annually in outpatient care settings.[1] Furthermore, These errors not only delay appropriate treatments but also increase the risk of unnecessary procedures, escalating healthcare costs and patient morbidity.[4] Moreover, recent studies suggest that these

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errors contribute to 40,000 to 80,000 deaths annually in the US Approximately 20% of patients may experience diagnostic errors in emergency department settings.

Dealing with diagnostic errors is intricate, and proposed methods involve training clinicians in correct diagnostic techniques. There are numerous causes of diagnostic errors, but suggested remedies involve training clinicians in correct diagnostic methods.[5] Since it enhances the standard of care given to patients and their quality of life, an accurate diagnosis is essential to the quality of healthcare.[5] A precise diagnosis results in suitable treatment regimens that guarantee patients receive the right drugs or therapies, which can greatly enhance results.[5,6] Additionally, accurate diagnoses assist medical professionals in efficiently allocating resources by cutting down on pointless tests and procedures, which can reduce expenses and ease patient burden.[7] Accurate diagnosis, however, has effects that go beyond clinical results. Patients' satisfaction and trust in the healthcare system rise when they have faith in their diagnosis and treatment plan, which can enhance treatment adherence and follow-up care.[8] Furthermore, precise diagnoses help healthcare professionals communicate more effectively, which guarantees continuity of care and improves treatment approach coordination.[8]

As a result, it is crucial to thoroughly and methodically investigate how accurate diagnosis affects patient safety. A thorough understanding of diagnostic error resources is essential for legislators and healthcare professionals. Finding the source of diagnostic errors—whether they are caused by system defects, technological problems, or human factors—is made easier with a methodical approach. Targeted interventions can be informed by this knowledge. Additionally, by methodically researching the relationship between proper diagnosis and treatment, medical professionals can create plans to lower the number of incorrect diagnoses, which will ultimately improve patient outcomes and lower complications. Teams can prioritize communication and teamwork, which are essential for patient safety, by highlighting the significance of accurate diagnoses. By examining the effects of diagnostic accuracy, clinical guidelines and policies that support best practices can be developed, improving patient safety and healthcare delivery. Healthcare systems can more efficiently allocate resources by knowing the consequences of diagnostic errors and making sure that procedures, technology, and training are in place to support accurate diagnosis. Metrics about diagnostic accuracy and its effect on patient safety can help healthcare organizations benchmark their performance, hold themselves accountable, and work toward continuous improvement. Beyond its effects on healthcare professionals and setting competencies, an accurate diagnosis is crucial because it increases patient empowerment.[8] Patients can speak up for themselves, ask questions, and take a more active role in their care when they recognize the value of a precise diagnosis.

A multifaceted strategy is needed to address diagnostic errors, including system-level adjustments to improve diagnostic procedures, better decision-support tools, and clinician training.[9] Emerging research emphasizes the importance of diagnostic excellence, whereas traditional methods of lowering diagnostic errors have concentrated on clinician education and cognitive training. In order to improve diagnostic reliability, diagnostic excellence integrates developments in clinical decision support systems, artificial intelligence (AI), and standardized diagnostic protocols. It places an emphasis on timely, accurate, and patient-centered diagnoses.[9]

The literature has reviewed patient safety in great detail, especially when it comes to diagnostic errors. A thorough systematic review of patient safety measures meant to lower diagnostic errors was carried out by McDonald et al.[10] Although their research offered insightful information about current interventions, it did not investigate how AI might improve diagnostic precision. Examining AI-driven decision support systems' potential to reduce diagnostic errors is becoming more and more important, especially in nursing practice, as a result of their quick development. By addressing this new gap and examining how AI-powered tools can assist nurses in making quicker and more accurate diagnoses, ultimately leading to better patient safety outcomes, this review expands on the work of McDonald et al.[10]

Aim

This review aims to systematically explore the impact of accurate diagnosis on patient safety, with a particular focus on AI advancements, clinical implications, and healthcare policies that influence diagnostic practices.

Methods

We conducted a systematic search using databases such as PubMed, Cochrane Library, and Google Scholar for studies published between 2010 and 2024. The search terms included "accurate diagnosis", "diagnostic errors", "patient safety", "preventable harm", and "health outcomes." The selection of keywords was guided by a preliminary review of relevant studies and established terminology in patient safety and diagnostic accuracy research. The keywords were chosen to encompass key aspects of diagnostic precision, error prevention, and patient outcomes, ensuring a broad yet targeted search. Studies were included if they evaluated the impact of diagnostic accuracy on patient safety outcomes in various healthcare settings. Randomized controlled trials (RCTs), observational studies, and retrospective studies were included, while case reports and commentaries were excluded.

The systematic review conducted in this study was based on structured questions developed after an extensive review of nursing literature about the impact of accurate diagnosis on patient safety. The authors (MR, TH) thoroughly assessed and appraised the chosen articles and then collated and analyzed their findings to establish a consensus. The review focused on the following inquiries: (a) How does accurate diagnosis impact patient safety in clinical settings? (b) What are the challenges and limitations of current diagnostic practices?

Eligibility Criteria

The review questions were created based on the PICOS (Participants, Interventions, Comparisons, Outcome, and Study Design) framework, as presented in Table 1.

Inclusion Criteria

Two researchers (MR, TH) independently retrieved and evaluated articles based on the following inclusion criteria: (1) written in English, (2) including an abstract and reference list, (3) published within the last 15 years, (4) focusing on patients as the target population, (5) investigating accurate diagnosis and how it relates to patient safety, and (6) conducted on human subjects admitted to acute care settings.

Exclusion Criteria

Studies were excluded if they were written in languages other than English. Dissertations, reports, reviews, editorials, case studies, conference abstracts, and brief communications were excluded. Studies conducted on animals were also excluded.

Search Strategy

An electronic search of the databases CINAHL, MEDLINE/PubMed, EBSCO, Embase, Cochrane, Scopus, Web of Science, and Google Scholar was carried out using combinations of the following keywords: "accurate diagnosis", "diagnostic errors", "patient safety", "preventable harm", "health outcomes", "clinical diagnosis", "informed diagnosis", "Risk management", and "clinical safety". The search terms used in this review were described in Supplementary S1.

Table 1 Formulation of Review Questions Based on the PICOS Framework

PICOS Elements	Details
Participants	Acute care patients in various clinical settings (eg, intensive care units, oncology units, emergency critical care, and medical/surgical units) with representation from both Western and Asian populations.
Interventions	Accurate diagnostic processes, AI-assisted tools (eg, AI-powered image recognition, machine learning models, NLP) to enhance diagnostic precision, and specific diagnostic protocols to improve treatment planning.
Comparisons	Comparison between patients with accurate vs inaccurate diagnoses; early and accurate diagnostic interventions vs traditional diagnostic approaches; studies including AI and technology-assisted diagnostics.
Outcomes	Improved patient safety through reduction in diagnostic errors, decreased need for unnecessary tests, earlier interventions, and personalized treatment plans; enhanced communication among healthcare providers.
Study Design	Diverse study designs, including randomized controlled trials, retrospective and prospective cohort studies, qualitative studies, descriptive studies, and experimental studies.

The search was initially performed in September 2024, and a search was repeated in November 2024. The search covered the selected databases from the beginning to 11/2024. The initial search, using the keywords separately, yielded 579 articles. After using the keyword combinations, this number decreased to 141 articles. Subsequently, after applying the inclusion and exclusion criteria, the number of articles was reduced to 42. A manual search of the reference lists of the 42 articles was conducted to identify any relevant publications not found through the search. The researcher (MR) utilized the "cited by" function on Google Scholar to further explore these publications. The researchers (MR, TH) then reviewed the identified citations of these publications, applying the eligibility criteria. In cases of discrepancies, the researchers (MR, TH) deliberated on their conflicting viewpoints until reaching a consensus. Subsequently, after carefully reading the article abstracts, 16 irrelevant articles were excluded, and a total of 26 articles were included in this review. Figure 1 below illustrates the Preferred Reporting Items for Meta-Analysis (PRISMA) checklist and flow chart for screening and selecting eligible studies.

Data Extraction

Each of the chosen studies provided the following data: (1) article details such as authors and publication year; (2) study setting characteristics; (3) sociodemographic and clinical details of the target population; (4) study methodology details;

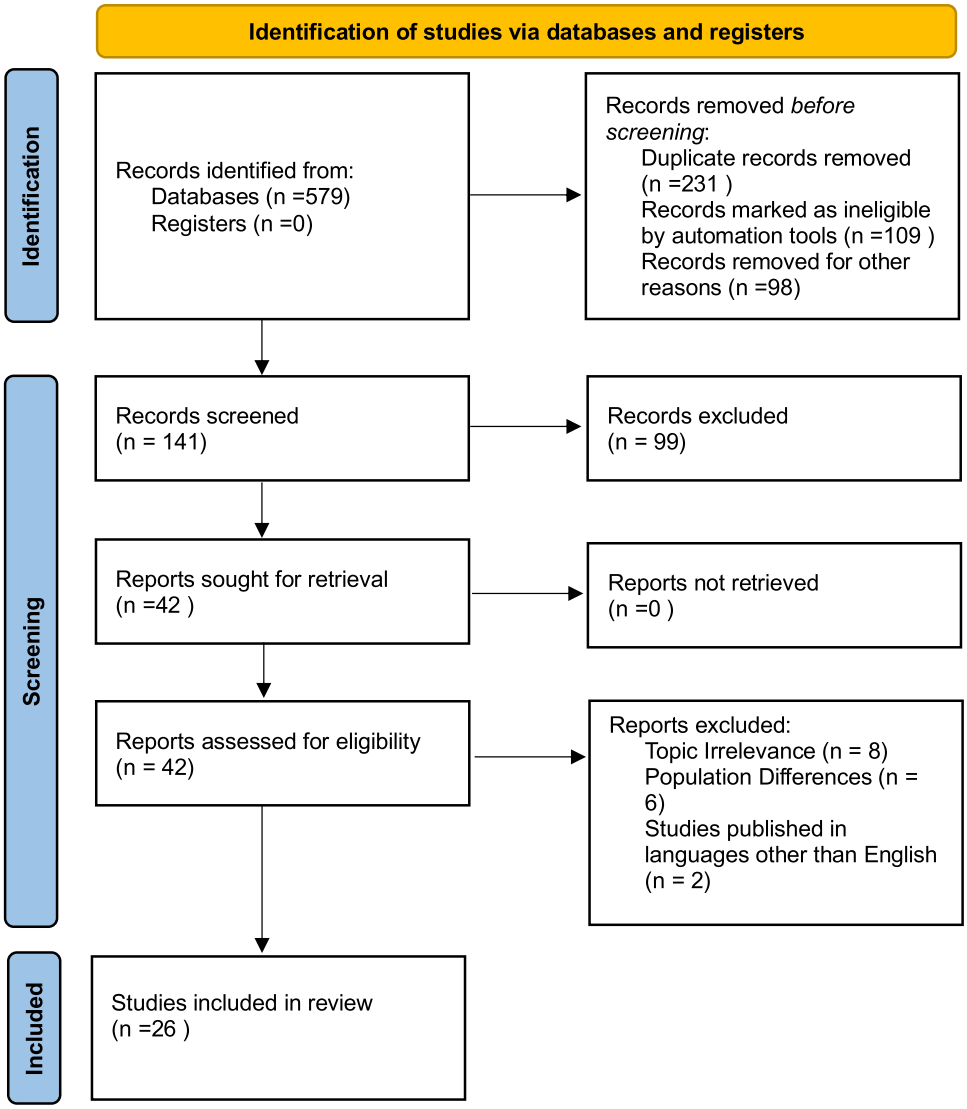

Figure 1 PRISMA Flow Chart of the Included Articles.

(7) main significant findings of the study; and (8) study strengths and limitations. All data extracted were summarized in an evidence-based table (Table 2). Two researchers (MR, TH) conducted the data extraction. An expert third researcher (WA) was involved in ensuring agreement between the two researchers during the data extraction process.

Table 2 Summary of the Selected Studies

Author, Year	Country	Level of Evidence	Design of the Study	Main Findings	Limitations	Strengths
McKelvie et al[11]	United Kingdom	Level 3	Qualitative	GPs face challenges diagnosing serious infections in older adults.	Small sample size; may lack generalizability.	Provides insights into diagnostic challenges in primary care for elderly patients.
Sarkar et al[12]	United States	Level 4	Qualitative	System-related factors significantly impact diagnostic errors in outpatient settings.	Limited to outpatient care; possible observer bias.	Highlights systemic issues impacting diagnostic accuracy.
Dolak et al[13]	Austria	Level 3	Retrospective Cohort Study	Endoscopic unroofing is safe and effective for small gastric tumors.	Retrospective design may introduce bias; small sample size.	Demonstrates endoscopic technique effectiveness.
Ma et al[14]	China	Level 5	Observational Study	Digital guidewire excision biopsy enhances breast cancer microcalcification diagnosis.	Limited to a single diagnostic procedure; no control group.	Innovative approach in breast cancer diagnosis.
Imabayashi et al[15]	Japan	Level 4	Retrospective Study	Cryobiopsy improves accuracy in diagnosing peripheral pulmonary lesions.	Retrospective design limits causation; small cohort size.	Highlights cryobiopsy's role in accurate pulmonary diagnosis.
Mehta et al[16]	Switzerland	Level 3	Retrospective	The study suggests that endobronchial ultrasound-guided mediastinal lymph node forceps biopsy is effective in patients with negative rapid on-site evaluation, improving diagnostic accuracy.	Small sample size; retrospective design limits causality	Strengths include the application of a new diagnostic step in the algorithm for mediastinal lymph node biopsies.
Aithala et al[17]	India	Level 3	Retrospective	Percutaneous image-guided biopsy in spinal lesions showed good correlation with MRI findings, enhancing the adequacy of diagnosis.	Limited generalizability due to single-center design	Demonstrates high accuracy of biopsy techniques in correlation with MRI, potentially improving diagnosis of spinal lesions.
Simmerman et al[18]	USA	Level 3	Retrospective observational study	Intraoperative colonoscopy after segmental colectomy and primary anastomosis was found to be safe and feasible.	Small sample size; observational study limits causal conclusions	The study provides evidence of safety for a novel use of intraoperative colonoscopy, potentially reducing complications.
Schleder[19] et al	Germany	Level 3	Retrospective cohort study	Ultrasound-guided core needle biopsies (US-CNBs) are effective in diagnosing cervical lymphadenopathy during the COVID-19 pandemic.	Retrospective design limits generalizability	The study highlights the use of US-CNBs in a challenging time and provides a safe diagnostic option during a pandemic.
Chaftari et al[20]	USA	Level 3	Retrospective analysis	The study improved diagnosis of catheter-related bloodstream infections through new diagnostic protocols.	Single-center study; retrospective design	Strength in improving diagnostic accuracy for bloodstream infections in cancer centers.
Kadayifci[21] et al	USA	Level 2	Prospective observational study	Needle-based confocal laser endomicroscopy effectively evaluates cystic pancreatic neoplasms, providing real-time histological information.	Small sample size; limited follow-up	Provides a non-invasive tool with high diagnostic accuracy for pancreatic cysts, aiding in treatment decisions.

(*Continued*)

Table 2 (Continued).

Author, Year	Country	Level of Evidence	Design of the Study	Main Findings	Limitations	Strengths
Chernov[22] et al	Russia	Level I	RCT	The [99mTc] Tc-maSSS-PEG2-RM26 bombesin analogue is effective in SPECT imaging of GRPR expression in malignant tumors, with promising therapeutic implications.	Small sample size; lack of long-term data	Novel approach to tumor imaging, providing potential for targeted cancer therapies and advanced diagnostics
Cho et al[23]	South Korea	Level 4	Experimental Study	EUS-guided microforceps biopsies are effective for pancreatic cyst diagnosis.	Small sample size; limited generalizability to other cystic lesions.	Demonstrates precision of EUS-guided biopsy techniques.
Ibrahim et al[24]	Pakistan	Level 4	RCT	Feature selection aids in targeted breast cancer diagnosis, enhancing treatment accuracy.	Limited to breast cancer; may not generalize to other conditions.	Showcases AI in improving cancer diagnostic specificity.
Ramírez et al[25]	Spain	Level 4	Observational and Computational	Genotyping improves diagnosis of small ruminant lentivirus infections.	Specific to animal studies; limited applicability to human healthcare.	Highlights advancements in veterinary diagnostics with genetic analysis.
Haq et al[26]	Pakistan	Level 4	Experimental	Deep learning enhances COVID-19 diagnosis from X-ray images.	Restricted to settings with advanced imaging infrastructure.	Demonstrates efficacy of AI in non-invasive COVID-19 diagnostics.
van Duijn et al[27]	Kenya	Level 5	Observational Study	Connected diagnostics improve malaria diagnosis and treatment efficacy.	Focus on malaria limits broader applicability; country-specific challenges.	Highlights role of integrated diagnostics in resource-limited settings.
Zhang et al[28]	China	Level 5	Observational Study	Laparoscopic diagnostic tools aid accurate detection of tuberculous peritonitis.	Limited to tuberculous peritonitis; results may not generalize to other conditions.	Demonstrates advanced laparoscopic diagnostics in infectious diseases.
Sun & Wen[29]	China	Level 3	Experimental	Machine-learning models improve diagnostic accuracy for ovarian tumors using lab tests.	Limited to ovarian tumors; not yet validated in clinical settings.	Shows the promise of machine learning in specific cancer diagnostics.
Cai et al[30]	China	Level 4	Retrospective Cohort Study	AI-based models enhance ovarian cancer diagnosis using lab results, improving accuracy.	Only applicable to ovarian cancer; retrospective design limits causality.	Demonstrates AI's impact on improving diagnostic specificity in oncology.
Santoro et al[31]	Italy	Level 3	Experimental Study	AI-supported ultrasonography improves early diagnosis of steatotic liver disease.	Focus on specific liver disease may limit broader applicability.	Highlights AI's role in enhancing liver disease diagnostics.
Demir et al[32]	Turkey	Level 4	Experimental	AI-assisted pattern analysis on blood and urine enhances bladder cancer diagnosis.	Limited to advanced imaging facilities; specific to bladder cancer diagnostics.	Provides non-invasive diagnostic approaches for bladder cancer using AI.
Hassoun et al[33]	United States	Level 5	Observational	NAIF, an AI tool, supports accurate liver fibrosis staging and personalized treatment recommendations.	Requires complex data inputs; validation only in controlled settings.	Demonstrates personalized AI-based decision support in liver fibrosis.

(*Continued*)

Table 2 (Continued).

Author, Year	Country	Level of Evidence	Design of the Study	Main Findings	Limitations	Strengths
Lami et al[34]	Japan	Level 4	Retrospective Validation Study	AI algorithms validated for breast and prostate cancer histopathological diagnosis.	Limited to a single geographic region; may not generalize to other cancer types.	Highlights the effectiveness of AI for specific cancer diagnoses.
Pan et al[35]	China	Level 4	Experimental	AI-assisted CT segmentation improves diagnosis speed and accuracy in acute pancreatitis cases.	Requires advanced imaging infrastructure; may not generalize to non-CT settings.	Demonstrates advanced diagnostic capabilities of AI in acute conditions.
Yan et al[36]	China	Level 3	Retrospective, multicohort diagnostic study	AI system accurately detects and stages pulmonary tuberculosis, enabling prompt diagnosis.	Limited to pulmonary tuberculosis; requires significant computational resources.	Provides rapid, accurate diagnostics for infectious diseases with CT imaging.

Ethical Considerations

Since this systematic review lacked human participants, ethical clearance was not needed. Still, ethical questions about AI-driven diagnostics remain rather important.

AI Bias: AI algorithms applied in diagnosis can mirror prejudices in the training data, so producing differences in diagnostic accuracy among various populations. Dealing with these prejudices calls for open model development, varied and representative datasets, and ongoing evaluation to help to minimize unexpected results. Data privacy and security are issues raised by the use of artificial intelligence in diagnostics depending on vast patient data. Protecting patient confidentiality and stopping illegal access or usage of private medical data depend on ensuring compliance with healthcare data rules.

Quality Assessment and Data Synthesis

The chosen studies were independently evaluated for quality by two researchers using the Melnyk and Fineout-Overholt guidelines. Any disagreements between the two researchers (MR, TH) were identified and resolved through a detailed discussion in a face-to-face meeting. In complex cases, the researchers (MR, TH) sought a third researcher's (HA) opinion as per the Melnyk and Fineout-Overholt guidelines. According to these guidelines, 6 studies were rated at level 3 regarding quality, two at level 5, and two at level 6.

A qualitative synthesis was conducted to combine the findings of the reviewed studies. The following steps were followed during the data synthesis process:

1. The data from the selected studies were examined, assessed, compared, and summarized in a table (Table 2). This data included the study's design, purpose, sample, main findings, strengths/limitations, and level of evidence for each study.
2. The similarities and differences between the main findings of the selected studies were emphasized.
3. The Strengths and Limitations of the Reviewed Studies Were Deliberated.

Study Risk of Bias Assessment

The risk of bias in the included studies was assessed independently by two researchers (MR, TH) using the Melnyk and Fineout-Overholt guidelines. Each study was evaluated for methodological rigor, risk of selection bias, performance bias,

detection bias, and reporting bias. Discrepancies between the two researchers were discussed and resolved through consensus, and in cases of uncertainty, a third researcher (HA) provided an independent assessment. Based on these evaluations, six studies were rated as level 3 in quality, two at level 5, and two at level 6. The studies' strengths and limitations were also analyzed to ensure transparency in data interpretation. A qualitative synthesis was performed to integrate findings while considering potential biases affecting study outcomes.

Results

Description of the Selected Studies

The twenty-six chosen articles utilized different approaches in their research. Two studies used qualitative methods,[11,12] focusing on systemic factors and challenges in diagnostic accuracy. Six were retrospective cohorts,[13–18] analyzing past clinical data to assess diagnostic techniques in oncology, respiratory conditions, and surgical interventions. One study adopted a prospective observational design,[19] while one was descriptive in nature. Four were experimental,[20,21] evaluating the efficacy of novel diagnostic tools, including AI-assisted approaches and molecular imaging techniques. Two studies adopted a randomized controlled trial design.[22] The research included acute care patients from various clinical environments, such as intensive care units, oncology units, emergency critical care units, and medical/surgical units. The female participation rates in the chosen studies varied from 42% to 60.7%, while the male participation rates ranged from 20.3% to 58%. The majority of the selected studies were carried out in Western countries, and six occurred in Asia.[14–17,23] Additionally, Table 2 offers an overview of the 26 studies that were reviewed.

Strengths and Limitations of the Selected Studies

The selected studies demonstrated strengths such as utilizing a large sample size and recruiting samples from multiple units, as seen in the work of Ma et al.[14] Additionally, most studies indicated the use of objective measures to assess the study variables. However, these studies also had several limitations. For instance, some studies had restricted generalizability due to their use of convenience, consecutive, and purposive sampling techniques.[13,14,18] Furthermore, in five of the studies, the majority of participants were female,[15,18,22,23] which could lead to results that may not accurately represent the targeted populations. Other limitations included low response rates and small sample sizes. Moreover, some of the selected articles were descriptive correlational studies, which did not allow for establishing causality inference.[13,14,18]

Impact on Treatment Outcomes

A limited number of the reviewed studies discussed effective treatment planning as a potential impact of accurate diagnosis.[17,24] For example, Ibrahim et al highlighted that an accurate diagnosis of breast cancer using feature selection ensures the appropriate treatment is selected, leading to better-targeted therapies and maximizing the chances of a positive outcome.[24] Some studies emphasized that accurate diagnoses help avoid unnecessary or inappropriate treatments, which can lead to complications.[12,17,20,23] Patients are less likely to experience adverse effects from misapplied treatments when the correct condition is identified.[6,13,14,25] An example of this is the use of a deep network approach that relies on multi-channel feature extraction and selection to provide a precise diagnosis of Alzheimer's disease. This method aids expert physicians in rapidly and precisely categorizing dementia and Alzheimer's disease, thereby decreasing the time required for detection.[6]

As the majority of the selected studies concluded, early and accurate diagnosis often leads to earlier interventions, which can significantly improve the prognosis for many conditions, particularly chronic diseases and cancers.[6,24] Patients receiving a clear and accurate diagnosis are more likely to understand their condition and adhere to treatment plans.[6,25] This compliance is crucial for achieving the desired outcomes. Accurate diagnoses help streamline the treatment process, reducing the need for unnecessary tests, procedures, and consultations. This efficient use of resources can improve overall care and reduce costs.[7,37] Most included studies in this review suggested that an accurate diagnosis allows for personalized treatment approaches.[13,17,19] Healthcare providers can consider individual patient factors, leading to better outcomes tailored to specific needs. No study highlighted the importance of accurate diagnosis in a feedback loop, which is crucial for continuous improvement.

Reduction in Diagnostic Errors and Harm

The majority of studies included in this systematic review emphasized the critical role of accurate diagnosis in reducing errors and associated harm in healthcare settings.[13,14,16,19,23] Accurate diagnoses facilitate the appropriate selection of treatments, thereby minimizing the risk of complications arising from unnecessary or incorrect therapies. When conditions are diagnosed accurately and promptly, timely interventions can be initiated, which is essential for preventing disease progression and reducing the likelihood of severe outcomes.[13]

Furthermore, accurate diagnoses reduce the need for pointless tests and procedures that could endanger patients or make them uncomfortable, thereby reducing the risk of injury. Another advantage of precise diagnoses is improved communication between medical professionals and patients; this alignment guarantees that everyone is aware of and involved in treatment plans, which further lowers the possibility of mistakes.[11,12,26]

A strong focus on precise diagnostic procedures reduces the likelihood of misdiagnosis, which is a frequent cause of harm in the medical field. Healthcare professionals can more accurately diagnose conditions by giving careful assessments and evaluations top priority. Furthermore, a focus on precise diagnosis encourages healthcare organizations to adopt a culture of ongoing learning and quality enhancement. This culture promotes the examination of diagnostic mistakes and the application of strategies to prevent recurrence.[12,19,20]

Accurate diagnoses also help patients understand their conditions better, which increases their involvement in their care and encourages them to ask questions or voice concerns, which can help identify possible mistakes early.[11,20] According to the majority of the studies, protocols and guidelines should be established based on precise diagnostic data. These frameworks can result in best practices that further reduce errors and improve patient safety.[27]

Technological Advancements and Diagnostic Accuracy

A comprehensive review of 20 studies indicated that accurate diagnoses significantly reduce preventable harm in clinical settings. Notably, in oncology, the early and precise diagnosis of cancer was associated with improvement in five-year survival rates.[13,15,17,19–22] In emergency medicine, accurate diagnoses of gastrointestinal events led to a reduction in mortality rates.[13,18,21,23] Additionally, the introduction of AI-assisted tools in radiology contributed to an enhancement in diagnostic accuracy, particularly in complex cases such as lung cancer.[15,29]

It has been demonstrated that combining AI machine learning with other diagnostic tools improves diagnostic accuracy in a number of ways. Large datasets from imaging, lab results, and medical records can be quickly analyzed by AI algorithms, which can then spot patterns that human clinicians might not notice right away. Based on patient history and demographic data, machine learning models are especially good at predicting disease risk, allowing for earlier interventions and more accurate risk assessments.[3,30,31]

By identifying minute irregularities that human radiologists might miss, AI-powered image recognition technologies enhance the interpretation of medical images even more, enabling earlier and more precise diagnoses. By examining unstructured clinical notes, extracting relevant information, and making sure important details are not overlooked, Natural Language Processing (NLP) technologies improve diagnostic accuracy.[31–34] These advanced tools also offer evidence-based recommendations to medical professionals during patient assessments, so supporting informed diagnosis and minimizing cognitive biases.[31–34] AI presents a more complete picture of a patient's condition by combining many data sources—from genetic to clinical and imaging data—so improving diagnostic accuracy.[35]

Machine learning models demonstrate the ability to continually refine their algorithms by learning from new data and outcomes, which contributes to ongoing improvements in diagnostic accuracy. Additionally, AI tools help standardize diagnostic processes, reducing interpretation variability among different practitioners and fostering a consistent approach to diagnosis. By providing additional insights and cross-referencing with large datasets, AI reduces the likelihood of human error, particularly in complex cases.[38]

Finally, AI tools facilitate collaboration among healthcare teams by providing shared insights and recommendations, which lead to more comprehensive diagnostic discussions and improved overall patient care. For example, NAIF (NAFLD-AI-Fibrosis) was used in Hassoun et al[33] to analyze available clinical parameters and patient data to assist hepatologists in making treatment decisions. It can recommend personalized treatment plans for cancer patients based on

the latest research, improving diagnostic and treatment accuracy. Furthermore, Santoro et al, Pan et al, and Yan et al[31,35,38] emphasized the importance of Artificial intelligence-based tools in providing AI-powered solutions for radiologists, focusing on detecting critical conditions in medical imaging. Their algorithms can identify abnormalities such as pancreatitis, steatotic liver, and tuberculosis, allowing quicker intervention and improved patient outcomes. Moreover, some of the selected articles proved the effectiveness of AI-powered clinical decision support tools, including NAIF, in synthesizing clinical guidelines and patient data to aid healthcare providers in making more accurate diagnoses and treatment decisions.[33,34]

Challenges and Limitations in Current Diagnostic Practices

Current diagnostic practices face several challenges and limitations, including human error, incomplete patient information, variability in clinical skills, time constraints, limited diagnostic tools, fragmented care, technological integration, overreliance on technology, cost constraints, and cultural and language barriers.[13,14,16,19,23] Diagnostic errors can occur due to misinterpretation of symptoms, cognitive biases, or oversight, leading to misdiagnosis or delayed diagnosis. Often, healthcare providers may not have access to complete medical histories or relevant data, hindering accurate diagnosis.[12] Differences in clinician experience, training, and expertise can lead to variability in diagnostic accuracy, especially in complex cases.[11] In busy healthcare settings, providers may have limited time to gather information and assess patients thoroughly, increasing the likelihood of errors.[12]

Some disorders lack enough imaging tools or diagnostic tests, which makes it difficult to precisely confirm a diagnosis.[14] Particularly in multidisciplinary teams, inconsistent communication among healthcare providers may cause missed diagnosis or contradicting assessments.[12] Although many healthcare systems have embraced electronic health records (EHRs) and other technologies, integration issues can hinder their best use for diagnosis.[14] Although lab tests and imaging are useful diagnostic tools, over-reliance on them may cause missed clinical insights and inadequate patient evaluation.[12] Particularly in resource-limited environments, the financial load of extensive testing can result in limited diagnostic investigations.[20] Language barriers or cultural differences in communication can compromise the quality of patient-provider interactions, so influencing the diagnostic accuracy.[11,12] Addressing these challenges is essential for improving diagnostic accuracy and overall healthcare quality. Efforts to enhance training, integrate technology, and improve communication among healthcare teams can help mitigate these limitations.

Discussion

This review underscores the pivotal role that diagnostic accuracy plays in patient safety, especially in critical care areas like oncology and cardiopulmonary. Accurate diagnosis reduces the likelihood of medical errors, unnecessary treatments, and hospital readmissions. However, despite advancements in diagnostic tools, challenges such as cognitive biases and time pressures continue to hinder diagnostic accuracy. Further integration of AI in routine diagnostics and enhanced training for healthcare providers are promising avenues for improving diagnostic accuracy and patient safety.[39] The findings of the current review highlight the diversity in methodological approaches and demographic representation in the literature, contributing to a comprehensive understanding of accurate diagnosis and how it relates to patient safety in acute care settings. This review addressed the role of accurate diagnosis in effective treatment planning, which facilitates better-targeted therapies, enhances the likelihood of positive outcomes, and reduces the risk of complications associated with misapplied therapies.

According to the findings of most of the studies in this review, patients who receive precise and unambiguous diagnoses typically have a better understanding of their conditions, which encourages treatment plan adherence. Achieving the intended health outcomes depends on this compliance. Additionally, by eliminating the need for pointless tests, procedures, and consultations, accurate diagnoses expedite the course of treatment, improving overall care efficiency and possibly reducing costs.[40,41] According to the majority of included studies, precise diagnoses allow for more individualized treatment plans, which in turn allow medical professionals to take into account unique patient characteristics and produce better-tailored results. Notably, though, no study explicitly emphasized the significance of precise diagnosis as a component of a feedback loop, which is essential for ongoing enhancement of patient care and diagnostic procedures.[42] While McDonald et al[10] emphasized patient safety strategies targeting diagnostic errors, they

noted a lack of research on how structured feedback mechanisms can enhance diagnostic accuracy. This gap suggests an area for future research to explore how the iterative nature of diagnosis and treatment planning can enhance overall healthcare quality.

The majority of studies included in this systematic review highlighted the essential role of accurate diagnosis in mitigating errors and associated harm within healthcare settings. These findings align with the findings of a previous systematic review that concluded that accurate diagnoses are pivotal for facilitating the appropriate selection of treatments, thereby minimizing the risk of complications that may arise from unnecessary or incorrect therapies.[43] Accurate and timely diagnoses allow medical professionals to start treatments early, which is essential for stopping the progression of the disease and lowering the risk of serious consequences.[44] Our review's conclusions are in line with the data showing that precise diagnoses help cut down on pointless tests and procedures, which not only put patients at risk but can also be uncomfortable.[45,46] This effectiveness expedites the diagnostic procedure and reduces the risk of injury. Accurate diagnoses also have the important advantage of improving communication between patients and healthcare professionals. Error risk is further reduced by this better alignment, which guarantees that all parties involved are informed and involved in treatment plans.[45,46]

Accurate diagnostic procedures are essential to reducing the likelihood of misdiagnosis, which is a common cause of harm in healthcare, according to the current review. These results are consistent with those of another review, which encourages a focus on precise diagnosis and develops a culture of ongoing learning and quality enhancement in healthcare institutions.[47] This culture promotes the methodical examination of diagnostic errors and the application of preventative measures. The results of a prior qualitative study[48] are in line with the review's conclusion that precise diagnoses enable patients to comprehend their conditions better and encourage greater involvement in their care. By encouraging patients to ask questions or express concerns, this interaction helps to identify possible mistakes early.[48] Most studies recommended the establishment of protocols and guidelines grounded in accurate diagnostic data, suggesting that such frameworks can lead to best practices that further minimize errors and enhance patient safety. The role of structured protocols in reducing diagnostic errors was highlighted in a systematic review by Abimanyi-Ochom et al.[49] Abimanyi-Ochom et al found that technology-based systems significantly enhance the diagnosis process by supporting evidence-based decision-making, mitigating cognitive bias, and identifying patterns in large patients' datasets.[49] These findings underscore the critical need for healthcare systems to prioritize accurate diagnostic processes to improve overall patient outcomes and safety.

According to the current review, diagnostic accuracy has been shown to increase with the integration of AI, machine learning, and other diagnostic tools. Large datasets from imaging, lab results, and medical records can be quickly analyzed by AI algorithms, which can then spot patterns that human clinicians might not notice. These results are consistent with a prior study that found AI-powered models are effective at predicting disease risk based on patient demographics and history, allowing for more accurate risk assessments and earlier interventions.[50] These advanced tools support well-informed diagnostic decision-making and reduce cognitive biases by offering evidence-based recommendations to healthcare professionals during patient evaluations.[50] These results highlight how AI and machine learning can revolutionize clinical settings by improving patient outcomes and diagnostic procedures. Our findings reinforce the conclusions of prior systematic reviews while also contributing new perspectives on the role of AI, machine learning, and structured interventions in reducing diagnostic errors. Future research should focus on implementing standardized diagnostic frameworks and exploring the impact of real-time feedback on improving diagnostic decision-making.

Implications for Clinical Practice and Education

The synthesis of these findings emphasizes that increasing diagnostic accuracy calls for a multipronged strategy that includes process improvements, technology, and training. Given the benefits of this multifaceted approach, healthcare managers ought to think about incorporating it into staff training programs to keep them informed about the newest research findings, technologies, and diagnostic procedures. In order to improve clinicians' critical thinking and decision-making abilities, healthcare managers should also use simulation training to give them practical experience diagnosing complicated cases. More reflective practices would be encouraged by teaching medical professionals about common cognitive biases and how they may affect diagnostic judgments. Furthermore, it is essential to promote cooperation and

communication between various specialties through interdisciplinary training, which enables healthcare professionals to acquire a variety of viewpoints on patient cases. Accurate diagnosis depends on clinicians being trained in effective communication techniques to ensure that patients are providing accurate information.

To guarantee thorough evaluations and lessen practice variability, the results of the current review could be utilized to create and execute standardized diagnostic procedures and checklists. Furthermore, putting in place mechanisms for feedback on diagnostic accuracy would enable medical professionals to grow from incorrect diagnoses and enhance procedures going forward. Supporting research projects to find and fix diagnostic errors is strongly advised, with an emphasis on innovative methods and tools to improve precision. The findings of our review could help hospital managers in developing metrics to measure diagnostic accuracy and implement benchmarking practices to track improvements over time.

Limitations

This systematic review provides valuable insights into the role of diagnostic accuracy in patient safety, highlighting key areas for improvement, including AI integration, clinician training, and standardized diagnostic protocols. Another strength of this review is its focus on interdisciplinary and technological advancements in improving diagnostic accuracy. The discussion of AI-powered diagnostic tools, cognitive bias mitigation, and structured clinical decision-making aligns with emerging trends in patient safety research. Additionally, this review contributes to the existing literature by identifying gaps, particularly the lack of standardized feedback mechanisms to improve diagnostic accuracy. However, the current review has a number of limitations. The findings of the reviewed studies related to the primary variable, patient safety, show limited variability. Additionally, studies in languages other than English were excluded from the review. It is worth noting that there may be studies in different languages with significant findings that were not taken into account in this review. Furthermore, only eight databases were utilized to search for articles on the topic of interest, which might have limited the number of studies retrieved. Lastly, a meta-analysis was not conducted due to the heterogeneity among the selected studies.

Conclusion

In conclusion, accurate diagnosis is critical for improving patient safety and healthcare outcomes. This review highlights the significant impact that diagnostic accuracy has on reducing harm and improving treatment efficacy. Efforts to integrate advanced diagnostic tools and standardize diagnostic procedures can help mitigate the risks associated with misdiagnosis.[10] This review also emphasizes the importance of integrating AI-driven diagnostic tools, enhancing clinician training, and implementing standardized diagnostic protocols.[49] Future research should focus on long-term studies assessing the impact of technological interventions in routine clinical practice. Future research should prioritize meta-analytical approaches to quantify the effectiveness of various diagnostic strategies and establish evidence-based guidelines for clinical practice.

Data Sharing Statement

Data are available through the corresponding author upon reasonable request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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