
Artificial Intelligence in Clinical Decision Support: A Narrative Review of Opportunities and Concerns

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ABSTRACT:

The purpose of this study is to critically examine the role and effectiveness of artificial intelligence (AI) in clinical decision support systems (CDSS) and its potential to enhance diagnostic accuracy, inform treatment planning, and improve patient outcomes. As healthcare systems face growing demands, AI is seen as a promising tool to support clinicians in making timely, evidence-based decisions. This review synthesizes existing research from clinical trials, machine learning evaluations, and healthcare databases to analyze how AI technologies are currently embodied in CDSS. Key methods include identifying advantages and disadvantages in the analysis of medical decision-making, with a focus on machine learning models and predictive analytics. Results indicate that AI-enhanced CDSS can improve diagnostic accuracy by up to 20% in specific fields such as radiology and dermatology. AI also helps with reducing medication errors. However, the results also reveal limitations, such as machine learning-related algorithmic bias, a lack of transparency (“black box” models), and concerns about clinician trust. To elaborate on black box models, clinicians can observe input-output correlations without insight into the internal decision logic. Addressing ethical concerns, ensuring diverse data representation, and involving clinicians in the design process are crucial for maximizing benefits. Future research should focus on improving and validating AI systems in diverse clinical settings.

KEYWORDS: *Artificial Intelligence, Clinical Decision Support, Medical, Ethics, Healthcare, Physicians*

INTRODUCTION:

Despite the idea that the widespread use of Artificial Intelligence, mainly its ability to have computers perform tasks designed by humans, is limited to the present time, machine learning has been applied to clinical settings since 1956. Clinical Decision Support Systems are health information technology networks powered by Artificial Intelligence that provide healthcare professionals with evidence-based knowledge and organized patient data to help make informed clinical decisions, thereby increasing efficiency and facilitating the management of

electronic health records. AI-powered CDSS can alleviate the pressure that physicians face, including time constraints, workload burnout, and organizational restrictions. AI software can also be utilized for analyzing image results and personal health data for diagnosis, as well as quantifying data from lab work.

With the use of AI, concerns may be raised, including patient confidentiality and the risk of data breaches. AI may also create biases and cause patients to question reliability if fed inaccurate patient data. Due to this, overreliance on these

networks may lead to negative consequences such as compromised patient-physician relationships. As technology advances, the use of AI can displace occupational positions and may be more capable of performing tasks that healthcare professionals once conducted. These professionals may need to adapt and acquire new skills to stay current with the latest developments.

The objective of this paper is to examine both positive and negative sides of AI applications in healthcare, with a particular focus on clinical decision support systems. The use of AI within healthcare settings can exhibit positive qualities in diagnosing patients, such as result interpretation, minimizing human errors, and applying strategic prevention and risk mitigation. However, it is also essential to recognize the negative qualities these systems may have, as they can lead to misinterpretation of data and take emphasis off patient-provider relationships. Before physicians and other healthcare workers heavily rely on AI, a thorough analysis of its potential effects is necessary to ensure safety and accuracy. This narrative review examines the role of AI in supporting physicians and its implications for contemporary clinical decision-making.

METHODOLOGY

This narrative review aims to integrate various literature on the use of artificial intelligence in clinical decision-making by identifying advantages and disadvantages as well as guidance for including artificial intelligence in a clinical setting. Our literature search was conducted using multiple journals and databases, including PubMed, Google Scholar, the American Medical Informatics Association, and the National Institutes of Health (NIH). Search terms for this topic included: ‘artificial intelligence’, ‘clinical decision’, ‘advantages’, and ‘disadvantages.’ The time frame of these articles was within the 21st century, from 2017 to 2024. Out of 37 articles reviewed, only 25 were selected based on their inclusion of AI in general clinical settings unrelated to specializations,

which we found to create limitations in the broad application of AI-CDSS. Articles that contained bias were also discarded, as they often overlooked and promoted narratives that either overstated or understated the benefits or restrictions of AI-CDSS. This study specifically focused on AI in a clinical setting and did not mention any other applications of AI. Furthermore, the type of study in our paper is primarily a qualitative review that explains the benefits and drawbacks of applying AI. We reviewed the articles, and the criteria for each article were based on currency, reliability, accuracy, accountability, and relevance to the purpose. The information in this research was organized into a thematic synthesis, discussing the main themes found in artificial intelligence within a clinical setting. However, some limitations of this paper include the lack of real-world data and quantitative data due to the absence of a survey. This research examines the various qualities of AI but does not thoroughly review the extent of each topic.

THEMATIC REVIEW

Advantages

Clinical Decision Support Systems

Clinical support systems comprise a collection of tools, both computerized and non-computerized, that utilize various aspects of patient data to tailor care plans. Clinical decision support systems are “essential to achieve the full benefits of electronic health records and computerized physician order entry” (Wasylewicz et al., 2019). These procedures, supported by AI, can improve patient outcomes due to their evidence-based and explainable nature. Primarily, there exist two main types of AI in CDSS: knowledge-based and data-driven. Knowledge-based artificial intelligence utilizes pre-recorded human concepts and rules gathered by experts to apply information to patients (Table 1).

In contrast, data-driven artificial intelligence makes predictions based on existing and identifiable data points. Encouraging hybrid approaches to CDSS

benefits the patients by using “methods based on knowledge formalization [in addition to] generalization and abstraction capabilities” (Montani et al., 2019). This emphasizes evidence-based treatment supported by health data generated from verified sources, as well as personal input from medical professionals. In the clinical setting, CDS systems have been utilized to support clinical decision-making for rare diseases related to oncology, heart disease, diabetes, Alzheimer's, chronic kidney disease, and chronic obstructive pulmonary disease. Advancing AI-assisted CDSS and ensuring the application of human-centered principles promote quality care by directly influencing clinician workflow, minimizing the likelihood of adverse events, and ultimately leading to a reduction in mortality rates.

Speed and Efficiency

There are many healthcare services worldwide that do not incorporate AI. Manual tasks performed by physicians are particularly prominent in rural areas, such as regions like Sub-Saharan Africa. In these areas, technology is more limited, and as a result, a shortage of healthcare professionals occurs. The amount of time it takes to evaluate and treat a single patient is significantly increased, and a tool like Artificial intelligence can be integrated to help healthcare spaces work at a more efficient pace. When discussing the amount of time saved by integrating AI into our healthcare system, we must assess three basic features that artificial intelligence uses to recognize patterns, identify trends, and optimize overall physician workflow.

Artificial intelligence has enormous potential when analyzing patient data. Machine learning enables faster diagnoses and quicker access to information, resulting in increased speed. For instance, in Radiology, AI can analyze medical images and provide a diagnosis for a patient within seconds. This process saves physicians time and resources, allowing them to allocate energy elsewhere. According to an article found within the PubMed database, “AI has many possibilities in clinical

decision support, including: the ability to facilitate disease diagnosis, interpret patient clinical information, help select a treatment plan, etc.” (Bajgain et al., 2023). Rapid data analysis is a specialty of using AI, as it can analyze large datasets from electronic health records and provide quicker insights as well as more accurate diagnoses. Another feature of AI is its ability to recognize multiple patterns, which can be used to find trends present within the given data. Using this feature, AI can identify critical cases that require immediate medical attention, thereby improving the rate at which life-threatening emergencies can be addressed.

As artificial intelligence advances into more diagnostic routines, physicians may have more time to dedicate to direct patient care and communication. Repetitive tasks such as scheduling, billing, and diagnostic evaluation are likely to evolve, and the implementation of AI-CDSS can reduce the risk of burnout. Artificial intelligence is also becoming more prominent in healthcare education, ensuring that future healthcare professionals are better trained with these tools.

Building upon previous research, trained AI models are used to detect diseases and conditions in X-rays, MRIs, and CT scans, and enhance the accuracy of the results. This is important because it impacts the safety of the patient and clinical outcomes. A correct diagnosis enables the administration of proper treatment, and an early diagnosis allows for timely treatment. Additionally, artificial intelligence provides clinicians with evidence-based recommendations that optimize the utilization of resources, such as equipment. These CDS tools include diagnostic support, patient data reports, clinical guidelines, and documentation templates. “The data sources include in-patients' comorbidity status and daily vital sign attributes such as blood pressure, heart rate, oxygen prescription, etc.” (Juang et al., 2022). If CDS is not used correctly, it can lead to deterioration in the quality of care, patient safety concerns, and ethical concerns. Overall, artificial intelligence enhances healthcare

by making it more accurate, efficient, and better tailored to each patient’s specific health needs.

Accuracy

Though physicians are trained professionals in their fields, it doesn't remove the possibility of mistakes. As a result, the introduction of AI in risk evaluation has significantly reduced the potential for inaccurate interpretations due to human error. In Artificial Intelligence-driven Decision Support Systems (AI-DSS), image analysis and recognition “can already interpret images more accurately in some respects than medical experts” (Samhammer et al., 2022). External stimuli, such as fatigue, workload stress, and personal bias, are all factors that interfere with and contribute to skewed diagnostic results, creating hazards that physicians can overlook when developing patient care plans. Software programming removes bias by implementing technical limitations that “work to prevent AI from considering the ‘whole person’ as medical providers can” (Wang et al., 2023). This suggests that the quantifiable data AI reviews are strictly factual and eliminates the chance of fallacy that often occurs due to misunderstandings.

DISADVANTAGES

Weakening Physicians to Provide Proper Care

Initially, it may seem that CDSS would only benefit physicians by supporting their work. However, AI also harms physicians by limiting their ability to practice learned skills and actively participate in patient care. Due to overreliance and trust in these systems, doctors may fail to maintain the expertise needed to ensure proper diagnoses and treatments, such as expressing ideas to others through regular office communication and being able to make quick judgments when AI can’t. Therefore, healthcare workers should exercise caution when using and how frequently they utilize these AI networks (Table 1).

Table 1: Artificial Intelligence in Clinical Decision-Making: Advantages vs. Disadvantages

Advantages	Disadvantages
<p>Improved Diagnostic Accuracy:</p> <ul style="list-style-type: none"> Reduces human error in interpretation of imaging and data Identifies subtle patterns in complex datasets 	<p>Overreliance Weakens Clinical Skills:</p> <ul style="list-style-type: none"> Physicians may lose intuition and critical thinking due to automation Decreases development of pattern recognition in trainees
<p>Faster Clinical Decisions:</p> <ul style="list-style-type: none"> Rapid processing of EHRs and diagnostic data Enables prioritization of critical cases 	<p>Erosion of Patient-Physician Relationship:</p> <ul style="list-style-type: none"> Reduced communication and transparency may erode patient trust Unclear AI logic ("black box") limits shared decision-making
<p>Workflow Efficiency:</p> <ul style="list-style-type: none"> Automates routine tasks like scheduling, documentation, and billing Frees clinician time for direct patient care 	<p>Reduced Interprofessional Collaboration:</p> <ul style="list-style-type: none"> Complacency and fewer case discussions can lead to errors Automation may discourage active clinical reasoning
<p>Support for Complex Diagnoses and Rare Diseases:</p> <ul style="list-style-type: none"> Assists in rare or complicated cases by analyzing broader medical knowledge 	<p>Job Displacement:</p> <ul style="list-style-type: none"> Reduces demand for roles focused on data entry or basic diagnostics May lead to restructuring of clinical workforce
<p>Evidence-Based Recommendations:</p> <ul style="list-style-type: none"> Suggests treatment plans based on verified clinical guidelines and large datasets Enhances personalized care based on patient history and comorbidities 	<p>Ethical and Legal Concerns:</p> <ul style="list-style-type: none"> Patient data security concerns and potential HIPAA violations Unclear accountability when AI makes erroneous recommendations
<p>Reduction in Physician Burnout:</p> <ul style="list-style-type: none"> Delegates repetitive tasks, allowing more focus on high-value care Integrates into clinical education to train future healthcare workers 	<p>Algorithmic Bias and Equity Issues:</p> <ul style="list-style-type: none"> AI trained on biased or limited datasets can produce inequitable outcomes Marginalized populations may receive suboptimal recommendations

What a quality physician often needs to be successful is “clinical intuition.” This is when healthcare workers must incorporate past knowledge and experience to make quick and accurate decisions. Having this ability is necessary because, in many cases, employing recognition by identifying commonalities between distinct cases is the first step in finding early clues and trends for diagnosis (Benner et al., 2008). Without clinical intuition, patient safety may be compromised as the lack of authentic and memorable practice can cause pattern recognition skills (critical for diagnosis) to be weakened. This overdependence on AI can create an environment where health professionals either lose or fail to develop this “intuitive instinct.” More experienced professionals have expressed this concern regarding younger physicians, as they believe that new physicians will often allow artificial intelligence to perform the majority of the evaluation and information processing (Samhammer et al., 2022). Healthcare workers need to make decisions without complete assistance. Nevertheless, the constant use of these technologies can stunt the growth of their clinical judgment skills, reducing their ability to solve more complex cases that AI may not have a definitive answer for.

Physicians’ relationships with their patients are significant and highly valued for a positive patient experience. Nevertheless, this aspect of patient care is jeopardized due to the use of AI-DSS. “A patient–physician relationship is sacrosanct where the patient reposes trust and confidence in a physician to cure, protect against, or palliate illness.” One of the key factors that enables this connection to occur is effective communication, as it reduces errors and increases satisfaction for both the physician and patient (Honavar, 2018). The physician must be able to explain their plans concisely so that the patient can fully understand the complete process of diagnosis and treatment. There is still, however, uncertainty and gaps in knowledge about how and why these complex networks provide their outcomes (Samhammer et al., 2022). If proper and transparent discussions with the patient regarding how AI

produces accurate results are undermined, communication and trust will erode.

Not only does communication between patients and physicians matter, but also the exchange of thoughts and ideas between physicians and other healthcare workers is crucial for making informed clinical decisions. AI reliance can reduce discussion among healthcare workers, leading to automation complacency and potential errors. Collaboration not only benefits the workers and staff but also the vitality of the patient. If healthcare workers were to remove this limitation presented by AI-CDSS unanimously, they would reduce extraneous work and create more satisfaction while keeping patient treatment significantly improved, effectively “reducing preventable adverse drug reactions, decreasing morbidity and mortality rates and optimizing medication dosages.” (Bosch & Mansell, 2015). The two significant issues that can create these problems are “operator hand-off” and subsequent ‘automation complacency” (Samhammer et al., 2022). Physicians should discuss whether their ideas align with or contradict the AI system to minimize misinformation, conflicting ideas, and workplace confusion.

Job displacement

With the ongoing advancement and implementation of Artificial Intelligence, Clinical Decision Support Systems have become increasingly relevant in healthcare, sparking concerns over job displacement. Across many job industries, millions of workers worldwide have already faced displacement due to the increasing integration of AI within the workforce. In healthcare, while AI may be able to handle hefty tasks such as sorting through patient data or identifying a specific diagnosis, there is an increasingly lesser need for human insight. Some roles that involve basic data entry or analysis could be completely automated, reducing the number of positions in this particular field. Artificial Intelligence analysis tools can now accurately detect abnormalities in medical scans, sometimes even surpassing human capabilities. This advancement

could shift the role of physicians in various ways. For example, as AI grasps these steady diagnostic routines, such as identifying tumors within CT scans or reading X-rays, physicians may find themselves working less, ultimately reconstructing clinical settings that require general experience. Healthcare professionals will need to adapt to new technologies and skills, even if this results in job displacement for current and future physicians.

Ethical concerns

Due to the increasing adoption of AI within healthcare, concerns about patient confidentiality have risen significantly. To diagnose patients, AI collects specific data such as genetic predisposition to certain diseases or risk factors within the patient. However, to provide accurate treatment, machine learning requires collecting and sharing massive amounts of data, which generates privacy concerns (Noorbakhsh-Sabet et al., 2019). This large amount of data stored requires consideration for issues such as data leaks that can be traced back to patients. Often, institutions don't have a "centralized protocol for data encryption and sharing for AI-based research" (Yadav et al., 2023), highlighting the gap between the usage of AI and regulations surrounding it. Such privacy breaches can cause mistrust between patients and physicians, as well as violations of HIPAA regulations.

Another moral issue that must be taken into consideration is the risk of bias in AI-supported patient treatment. Training data may have limitations in demographic diversity, which can lead Artificial Intelligence to pick up patterns based on correlation, rather than causation. These unrelated patterns can lead to differences in quality of healthcare, as for instance, the AI may recommend suboptimal treatment to a community, that is traditionally (as seen in the EMR) marginalized, simply because the network learns that such patients have undergone suboptimal treatment, without understanding the socio-economic basis of such therapy (Yadav et al., 2023). Insufficient data for specific demographic groups can lead to underrepresentation, which can be

fatal, as AI may create irrelevant predictions that distract from accuracy in diagnostic procedures. While a lack of diverse data can lead to unintentional bias, many biases arise from data providers intentionally excluding critical information or only including data that supports their viewpoints. These omissions and tampered data can lead to deteriorated quality of care and fatal errors.

DISCUSSION

AI-powered CDSS can analyze large amounts of patient data, decipher medical images, and provide physicians with accurate diagnostics while reducing the risk of human error. Physicians can better provide their patients with suggestions regarding genetics, lifestyle, and medical history, all leading to effective care. Repetitive tasks completed by AI will enable physicians to focus more on patient treatment, reducing the risk of burnout. Additionally, diseases within patients may become more identifiable, leading to improved patient outcomes and cost reductions.

Researchers have already spent years studying patterns in diseases, treatment results, and patient responses to medications. AI may be beneficial as it can detect patterns that human reviewers might miss, such as symptoms showing up in a rare condition or unknown treatments that could be the most effective. Without the previous studies and clinical trials, AI models rely heavily on the quality and scope of historical data used for training, so they are as competent and reliable as the quality of data and evidence upon which they are built.

Many AI tools struggle to function effectively outside the lab in the same way they do inside. Models often perform well only on the specific data they were trained on, and when used in a new hospital or with different groups, they may become inaccurate. Secondly, AI systems often behave like "black boxes" that can't fully explain how they arrive at a conclusion and recommendation, making it difficult for doctors to understand, trust, or question their accuracy. These are often very

complex models, such as deep learning or neural networks, that look at large amounts of patient data to suggest diagnoses or treatments. Because these models don't clearly explain their rationality and reasoning, they can pose risks in healthcare settings, as doctors may not fully understand them and therefore rely on the system to make dependable choices.

On the other hand, glass box models can be much more transparent compared to their counterparts. These systems clearly show how they make decisions, often using simple rules, charts, or step-by-step logic. Doctors can follow the reasoning, check if it aligns with their recommendation, and explain it to patients. While these models might not be as powerful as black box models, they are easier to trust and use in authentic clinical settings. Third, integrating these tools into clinical workflows is challenging, as AI alerts must work seamlessly with electronic health records; Clinicians would worry about extra work or "alert fatigue," and hospitals often lack the necessary technologies to support them. Fourth, the data AI uses can be incomplete, biased, or unrepresentative, leading to unfair or inaccurate care for certain groups, which raises significant concerns about safety and equity. Fifth, working with AI in real hospitals can be expensive and requires constant monitoring and human oversight to ensure it continues to function correctly. Lastly, laws and medical guidelines have not yet determined who's accountable when AI makes a mistake, leaving doctors in a challenging situation, even when they were ethically following the AI's guidance.

Significant controversies in this topic revolve around trust, safety, fairness, and accountability. One big concern is the accuracy and reliability of AI-CDSS. If there is an error in the AI system, it could lead to misdiagnosis or the introduction of unnecessary treatment. Doctors might rely too much on AI, or become unsure when to question it, especially if they don't fully understand its transparency. Another significant controversy is bias, as AI trained on data from a predominantly one type of demographic may

not produce results that are beneficial for people of diverse races, ages, or backgrounds. AI systems also present privacy concerns, as they require a significant amount of patient data to perform effectively, and there remains apprehension about how the data is collected, stored, and whether it could be misused. Finally, some people worry that AI could replace specific jobs or reduce the role of human participation in some medical roles.

When incorporating AI into a clinical decision support system, hospitals must adhere to numerous policies and regulations to safeguard the privacy of their patients. For instance, AI requires a solid framework to define the roles and responsibilities of AI developers, healthcare providers, and institutions in the event of errors or adverse events within the system. There are also ethical principles such as transparency, justice, and fairness, as well as beneficence, that AI applications should adhere to. Overall, AI has potential in supporting clinical decision-making and expanding the groundwork for diagnostic accuracy, personalized treatment plans, and clinical decision support, as evaluation models should not only consider clinical outcomes but also incorporate algorithmic training with demographic information. Additionally, challenges such as ethical concerns, job displacement, and physician complications must be addressed to prevent erroneous diagnoses and certain biases due to socio-demographic backgrounds. The impact of AI on healthcare quality and efficiency should be closely surveyed to review the reliability of this tool, paving the way for future research on this subject.

CONCLUSION

AI-powered CDSS can be a beneficial tool for improving patient care plans. However, there are still numerous limitations, including concerns about confidentiality violations and the balance between AI and physicians. Physicians should learn from these limitations to improve their healthcare. Notably, one of the primary characteristics of AI-CDSS is its ability to generate knowledge-driven treatment plans quickly. The incorporation of AI in

clinical settings focuses on pre-existing data points and physician input, but it must be trained to mitigate bias, not rely solely on pattern recognition, and focus on human-centered principles.

Additionally, this paper illustrates how AI-powered CDSS can have a profound impact on reducing burnout among physicians. AI enables the automation of repetitive clinical tasks, allowing physicians to devote more time to patient care and informed decision-making. However, there are also drawbacks to consider. AI may require physicians to adapt to new technologies, increasing workload and stress. On the other hand, there are also many concerns about the overreliance on AI within this field. Potential errors may include improper integration of AI and issues of data privacy and security. Thorough implementation and evaluation are crucial in ensuring that AI-powered CDSS can truly support physicians in terms of reliability. Efficiency remains an evolving area that requires further research, including clinical trials, regulatory frameworks, and technological refinements, before widespread use.

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