

## **THE ROLE OF ARTIFICIAL INTELIGENCE IN ELECTRONIC MEDICAL RECORDS FOR PATIENT-CENTERED CARE: A LITERATURE REVIEW**

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### **ABSTRACT**

The incorporation of artificial intelligence (AI) within electronic medical records (EMRs) has the potential to transform these systems from passive data repositories into intelligent, patient-oriented platforms (Min et al., 2024; Ali, 2023). This literature review consolidates research published between 2015 and 2025 concerning AI-EMR integration, emphasizing four primary domains: (1) natural language processing and data enrichment (Biswas & Talukdar, 2024); (2) predictive analytics and clinical decision-making support (Anakal & Soumya, 2024; Prentzas et al., 2023); (3) automation of documentation and workflow optimization (Min et al., 2024); and (4) governance, ethical considerations, and challenges to adoption (Chen et al., 2023; Solaiman & Cohen, 2024). Findings indicate that AI can enhance patient-centered care by expanding data quality, reducing the documentation load on clinicians, facilitating proactive insights, and enabling collaborative decision-making. These advantages, however, depend on effectively managing issues such as bias, transparency, reliability, workflow compatibility, and legal responsibility (Prentzas et al., 2023; Chen et al., 2023). The paper presents a conceptual overview of AI functionalities in EMRs and outlines recommendations for design, assessment, and governance strategies to ensure alignment with patient-centered care values.

**Key words:** artificial intelligence; electronic medical records; patient-centered care; natural language processing; clinical decision support; interpretability; governance

### **INTRODUCTION**

Electronic Medical Records (EMRs), also known as Electronic Health Records (EHRs), have become fundamental infrastructures in modern healthcare systems, facilitating the storage, retrieval, and sharing of patient data across clinical settings (Min et al., 2024). In recent years, the integration of Artificial Intelligence (AI) into EMR platforms has been increasingly recognized as a way to move beyond static data storage—enabling predictive insights, automated alerts, and more personalized care pathways (Ali, 2023; Biswas & Talukdar, 2024). The central question explored in this review is: how can AI-embedded EMRs enhance patient-centered care? Patient-centered care underscores respect for patients' values, collaborative decision-making, care continuity, and personalized health management. Therefore, the incorporation of AI into EMRs should not only emphasize predictive accuracy but must also ensure transparency, usability, ethical responsibility, and seamless integration into clinical workflows (Prentzas et al., 2023; Solaiman & Cohen, 2024). Although EMRs function as vital digital repositories that consolidate patient histories, laboratory data, prescriptions, and progress notes, they often remain static systems that rely heavily on manual documentation and reconstruction of clinical narratives. Such limitations hinder real-time decision-making and reduce efficiency in patient management. In this context, AI presents a transformative potential—turning EMRs from passive data archives into adaptive, learning systems capable of supporting clinicians, surfacing context-specific insights, and tailoring care to individual patient needs. To truly contribute to patient-centered care, AI-enabled EMRs must go beyond automation or predictive modeling. They must sustain clinician–patient trust, uphold data transparency, ensure fairness, and maintain harmony with clinical workflows (Chen et al., 2023; Solaiman & Cohen, 2024). Accordingly, this literature review examines studies published between 2015 and 2025 concerning the integration of AI within EMRs, aiming to assess their contributions to patient-centered care, identify implementation challenges, and propose strategic directions for future development.

### **METHOD**

This study adopts a thematic narrative synthesis approach to review existing literature on the use of artificial intelligence (AI) in electronic medical record (EMR) systems to promote patient-centered care. The review process involved a comprehensive search of both peer-reviewed and preprint publications available between 2015 and 2025. Relevant studies were identified through multiple academic databases, including PubMed, IEEE Xplore, and Google Scholar, as well as through preprint repositories such as arXiv and medRxiv. The search strategy employed key terms and Boolean combinations of keywords including “artificial intelligence,” “electronic health records,” “EMR,” “clinical decision support,” “natural language processing,” “generative AI,” “interpretability,” and “patient-centered care” (Prentzas et al., 2023; Chen et al., 2023; Ali, 2023). The inclusion

criteria consisted of: (1) publications issued between 2015–2025, (2) written in English, (3) focusing specifically on AI tools integrated within EMR/EHR systems (excluding standalone AI applications), and (4) demonstrating relevance to at least one of the following domains: documentation, data extraction, prediction, ethics, or usability. From an initial pool of several hundred studies, approximately 30 articles met all inclusion criteria and were selected for full-text analysis. These studies were examined to identify recurring patterns and thematic relationships among findings. Due to heterogeneity in research design, data types, and evaluation metrics, a meta-analysis was not conducted. Instead, results were synthesized qualitatively to highlight conceptual frameworks and practical implications within the AI-EMR research landscape.

## RESULTS AND DISCUSSION

The reviewed studies coalesce around four interrelated functional domains: (1) data extraction and augmentation; (2) predictive analytics and decision support; (3) documentation automation and workflow integration; and (4) governance, ethics, and barriers to adoption.

### 1. Data Extraction & Augmentation

A growing number of studies investigate how natural language processing (NLP) and generative AI technologies can convert unstructured text—such as physician notes, patient communications, and narrative histories—into structured and actionable clinical data (Biswas & Talukdar, 2024; Batista & Evsukoff, 2023). These techniques allow EMR systems to extract and contextualize information that was previously trapped in free-text form, thus enhancing the completeness and usability of medical records. Generative AI models are also being applied to automatically summarize clinical encounters or draft preliminary documentation, thereby assisting clinicians in capturing relevant details more efficiently. Such tools can generate patient summaries, treatment suggestions, or follow-up notes that improve continuity of care and reduce manual workload. However, these advantages are accompanied by risks—most notably AI “hallucinations” (fabrication of inaccurate content), misinterpretation of clinical intent, and the potential amplification of existing data bias. The enrichment of EMR data with additional contextual variables—such as social determinants of health, patient-reported sentiment, and functional capacity—has also been identified as an important advancement. Incorporating these dimensions provides a more holistic understanding of each patient’s needs and supports individualized care planning aligned with patient-centered principles.

### 2. Predictive Analytics & Decision Support

AI-driven predictive models embedded within EMR systems are increasingly used to anticipate adverse outcomes, such as hospital readmissions, patient deterioration, and disease onset (Min et al., 2024; Anakal & Soumya, 2024). By analyzing longitudinal data patterns, these models enable early identification of high-risk patients and support clinicians in initiating timely interventions. Implementations typically involve clinical dashboards or real-time alert systems integrated into EMR interfaces. When designed appropriately, these systems can enhance the responsiveness and precision of clinical decisions. Nonetheless, successful deployment depends on several factors: model transparency, calibration accuracy, external validation, and alignment with clinical workflows. Predictive models that lack interpretability or produce excessive alerts risk overwhelming clinicians and eroding trust. Therefore, achieving a balance between model performance and human usability remains a central challenge in applying AI for decision support within EMRs.

### 3. Documentation Automation & Workflow Integration

One of the most frequently cited benefits of AI-enhanced EMRs is the reduction of clinician documentation workload. AI-based systems that assist in generating summaries, completing structured templates, or identifying missing information have shown promising results in improving documentation efficiency (Liu et al., 2024). By automatically drafting or refining clinical notes, these tools help decrease after-hours charting and allow clinicians to allocate more time to direct patient care. However, full automation of documentation processes remains uncommon. Current AI models often struggle with domain-specific terminology, contextual understanding, and integration with diverse EMR interfaces. As a result, the adoption of human-in-the-loop frameworks, where clinicians retain oversight and the ability to edit AI-generated content, is emerging as a more reliable strategy. Studies show that systems incorporating clinician review mechanisms achieve higher accuracy, stronger acceptance, and better alignment with workflow requirements. Despite technical progress, challenges persist in system interoperability, data standardization, and user interface design, all of which influence the usability and sustainability of AI-driven documentation systems in clinical environments.

**4. Governance, Ethics & Adoption Barriers**

Ethical, legal, and organizational considerations are among the most persistent challenges in the implementation of AI-based EMR solutions. Many studies emphasize that algorithmic bias—particularly biases linked to demographic or socioeconomic factors—poses a significant threat to fairness in healthcare delivery (Chen et al., 2023; Solaiman & Cohen, 2024). Moreover, concerns surrounding data privacy, patient consent, and accountability for AI-driven decisions are often cited as barriers to widespread adoption. Regulatory ambiguity remains another key limitation. Existing health data governance frameworks frequently lack specific provisions addressing algorithmic explainability or liability for AI-generated recommendations. Similarly, model drift—where model performance deteriorates as underlying data patterns evolve—introduces risks that require continuous monitoring and retraining. Clinician and patient trust emerges as a central determinant of adoption. Transparency regarding how AI systems function, combined with clear delineation of human versus machine responsibility, has been shown to foster higher confidence and safer implementation. Ethical alignment, oversight mechanisms, and participatory design processes involving clinicians and patients are therefore critical to ensuring that AI in EMRs supports—not undermines—the principles of patient-centered care.

Study	Setting	AI Application	Outcomes Reported	Key Limitations
Liu et al. (2024) – DAX Copilot trial	Outpatient clinics, USA	Documentation assistant reducing charting time	Lower after-hours documentation; modest clinician satisfaction improvements	Short follow-up; self-reported satisfaction; bias in recruitment
Katonai et al. (2025) – Primary Care Scoping Review	Primary care settings	Mixed tools: diagnostic, workflow, documentation	Technical accuracy good; implementation constraints in usability and trust	Mostly pilot studies; varied outcome measures
Li et al. (2024) – TrajVis CKD trajectory visualisation	Specialist research hospital setting	Longitudinal trajectory inference + visualization	Improved clinician insight into disease progression; better care planning	Limited generalisation; synthetic or restricted data cohorts

*Source: compiled from recent peer-reviewed and preprint studies.*

Figure 1. Core Functional Domains of AI in EMRs and Their Relationship

Legend / relationships:

- *Data Extraction & Augmentation* feeds into *Predictive Analytics*, supplying clean, enriched data.
- *Documentation Automation & Workflow Integration* interacts with both *Data Extraction* (helps structure input) and with *Governance & Ethics* (ensures documentation meets legal & ethical standards).
- *Predictive Analytics & Decision Support* must be constrained by *Governance & Ethics* to avoid undue harm. (et al., 2024).

**Synthesis & Trade-Offs**

Across the reviewed studies, a consistent theme emerges: balancing technical performance with human usability is essential for successful AI integration into EMR systems. High-performing algorithms that lack interpretability often fail to gain clinician trust, while simpler but more explainable models are more readily accepted in real-world settings. The concept of human-in-the-loop design is a recurring enabler, highlighting the importance of maintaining clinician oversight in AI-assisted processes. This hybrid approach not only mitigates potential errors but also reinforces accountability and ethical safety. Furthermore, while efficiency metrics—such as time saved in documentation—are frequently reported, the actual influence of AI on patient-centered outcomes (e.g., satisfaction, shared decision-making, emotional well-being) remains underexplored (Solaiman & Cohen, 2024; Chander et al., 2024). Equity considerations represent another underdeveloped dimension in current research. Many studies do not adequately examine how AI systems perform across demographic subgroups, potentially concealing disparities in model accuracy and healthcare delivery. Addressing these equity gaps will be vital for ensuring that AI-EMR systems benefit all patient populations fairly.

**CONCLUSION**

AI-enabled EMR systems have demonstrated considerable promise in transitioning healthcare toward a more proactive, personalized, and patient-centered model. Nevertheless, realizing this vision requires more than

algorithmic capability—it necessitates careful attention to design integrity, interpretability, workflow integration, ethical regulation, and the perspectives of both patients and clinicians.

Recommendations:

To ensure alignment with patient-centered care, future research and development efforts should emphasize:

1. Transparency and interpretability ensuring that AI-generated outputs are explainable and include uncertainty indicators.
2. Workflow integration embedding AI functionalities directly within EMR interfaces to enhance accessibility and reduce disruption.
3. Human-in-the-loop approaches maintaining clinician oversight to balance automation and safety.
4. Continuous monitoring, implementing systems for performance auditing, model drift detection, and periodic retraining.
5. Evaluation of patient-centered outcomes, measuring satisfaction, shared decision-making quality, and health equity.
6. Governance frameworks establishing clear protocols for consent, data privacy, liability, and fairness auditing.
7. Participatory co-design involving clinicians and patients in AI tool development to ensure clinical relevance and trustworthiness.

If these elements are effectively addressed, AI-powered EMRs can evolve from administrative tools into collaborative systems that not only support clinical decision-making but also empower patients and strengthen the ethical foundation of digital healthcare.

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