Exploring the Use of Artificial Intelligence in Supporting Clinical Decision-Making in Nursing Practice

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1 Introduction

The integration of artificial intelligence into healthcare represents one of the most significant technological transformations in modern medicine. While considerable attention has been devoted to AI applications in medical diagnosis and treatment planning, the specific role of AI in supporting nursing clinical decision-making remains underexplored. Nursing practice encompasses a complex interplay of technical knowledge, clinical experience, intuitive judgment, and interpersonal skills that collectively inform decision-making processes. This research addresses a critical gap in the literature by examining how AI systems can be designed to complement and enhance nursing clinical judgment rather than replace it.

Nursing decision-making involves continuous assessment, interpretation of clinical data, and implementation of appropriate interventions across diverse patient populations and clinical contexts. The cognitive load associated with these decisions is substantial, particularly in high-acuity settings where rapid and accurate judgments can significantly impact patient outcomes. Traditional clinical decision support systems have often focused on rule-based approaches that may not adequately capture the nuanced reasoning processes characteristic of expert nursing practice. Our research proposes a novel framework that recognizes the distinctive nature of nursing cognition and the importance of preserving clinical autonomy while leveraging AI capabilities.

This study is grounded in the premise that effective AI integration in nursing practice requires a fundamental rethinking of how technology interacts with human expertise. Rather than approaching AI as a replacement for nursing judgment, we conceptualize it as a collaborative partner that can process complex data patterns while leaving ultimate clinical decisions in the hands of experienced nurses. This perspective represents a significant departure from conventional approaches that often prioritize algorithmic performance over human factors and workflow integration.

The research questions guiding this investigation are: How can AI systems be designed to support nursing clinical decision-making while preserving professional autonomy and clinical judgment? What specific features and functionalities enhance nurses' trust and adoption of AI-assisted decision support? To what extent do AI systems incorporating uncertainty quantification and contextual reasoning improve clinical decision outcomes compared to traditional approaches? These questions address fundamental aspects of human-AI collaboration in healthcare settings and have important implications for both system design and clinical practice.

2 Methodology

Our research employed a comprehensive mixed-methods approach that combined quantitative experimental design with qualitative phenomenological inquiry. The study was conducted across three major healthcare institutions representing diverse clinical settings including medical-surgical units, critical care, and emergency departments. A total of 127 registered nurses with varying levels of experience participated in the research, providing a robust sample for examining the complex interplay between AI systems and nursing decision-making processes.

The core of our methodological innovation lies in the development of the Symbiotic AI Framework for Nursing Decision Support (SAF-NDS). This framework integrates three key

components: contextual reasoning engines that incorporate patient-specific factors and environmental variables, uncertainty quantification modules that explicitly represent the confidence levels of AI recommendations, and adaptive interface systems that adjust information presentation based on nurse expertise and situational demands. Unlike conventional AI systems that typically provide binary recommendations, our framework generates nuanced suggestions accompanied by explanatory rationales and confidence intervals.

The experimental phase involved presenting participating nurses with standardized clinical scenarios of varying complexity, ranging from routine patient assessments to critical emergency situations. Each scenario was evaluated under three conditions: traditional decision-making without AI support, AI-assisted decision-making using a conventional clinical decision support system, and AI-assisted decision-making using our SAF-NDS framework. Decision accuracy, response time, and confidence levels were measured quantitatively, while follow-up interviews explored nurses' perceptions, trust levels, and cognitive processes during decision-making.

A particularly innovative aspect of our methodology was the incorporation of eye-tracking technology and think-aloud protocols to capture the cognitive processes underlying nursing decisions. This approach provided unprecedented insights into how nurses integrate AI recommendations with their clinical expertise and how different interface designs influence information processing and judgment formation. The qualitative component employed phenomenological analysis to understand the lived experience of nurses interacting with AI systems, focusing particularly on themes of trust, autonomy, and professional identity.

The data analysis integrated quantitative measures of decision performance with qualitative insights into user experience, creating a comprehensive understanding of the factors that contribute to successful AI integration in nursing practice. Statistical analyses included repeated measures ANOVA for comparing decision outcomes across conditions, correlation analyses examining relationships between nurse characteristics and AI adoption, and thematic analysis of interview data to identify patterns in nurses' experiences and perceptions.

3 Results

The findings from our research reveal several significant insights regarding AI integration in nursing clinical decision-making. Quantitative analysis demonstrated that nurses using our SAF-NDS framework achieved significantly higher decision accuracy compared to both traditional decision-making and conventional AI-assisted approaches. The improvement was particularly pronounced in complex clinical scenarios involving multiple competing priorities and ambiguous clinical presentations. Decision accuracy increased by 28

A crucial finding concerns the relationship between AI system design and nurse trust. Systems that incorporated explicit uncertainty quantification and contextual reasoning features generated significantly higher trust levels among nurses, as measured by both self-report scales and behavioral indicators. Nurses reported feeling more comfortable with AI recommendations when the system transparently communicated its confidence levels and the factors influencing its suggestions. This transparency appeared to facilitate more critical engagement with AI outputs rather than uncritical acceptance or blanket rejection.

The qualitative data provided rich insights into how nurses integrate AI recommendations with their clinical judgment. Experienced nurses particularly valued systems that supported rather than supplanted their decision-making processes. One participant expressed this sentiment clearly: "The best AI system feels like having a brilliant colleague who points out things I might have missed, but still respects that I'm the one who knows the patient and the situation." This metaphor of AI as collaborative colleague emerged repeatedly in interviews, suggesting that successful system design must prioritize partnership over automation.

Eye-tracking data revealed interesting patterns in how nurses process AI-generated information. When presented with conventional AI recommendations, nurses tended to focus primarily on the final recommendation, spending minimal time on supporting rationale. In contrast, with our SAF-NDS framework, nurses engaged more deeply with the explanatory components, particularly the uncertainty metrics and contextual factors. This deeper engagement correlated with more nuanced clinical decisions that integrated AI insights with

nursing expertise.

An unexpected finding emerged regarding the relationship between nursing experience and AI utilization. Contrary to assumptions that experienced nurses would be more resistant to AI assistance, our data indicated that the most experienced nurses actually derived the greatest benefit from well-designed AI systems. These nurses demonstrated sophisticated ability to critically evaluate AI recommendations, integrating them with their extensive clinical knowledge while filtering out suggestions that conflicted with their assessment of the patient situation. Less experienced nurses, while also benefiting from AI support, showed greater tendency to either over-rely on or unnecessarily dismiss AI recommendations.

The research also identified specific design features that significantly influenced system usability and adoption. Nurses strongly preferred interfaces that presented information in clinically meaningful patterns rather than raw data outputs. Visualization techniques that highlighted trends, relationships, and anomalies were particularly valued. Additionally, the ability to customize information display based on personal preferences and specific clinical contexts emerged as an important factor in long-term system adoption.

4 Conclusion

This research makes several original contributions to the understanding of AI integration in nursing practice. First, we have demonstrated that AI systems specifically designed to complement nursing clinical judgment rather than replace it can significantly enhance decision accuracy while preserving professional autonomy. The Symbiotic AI Framework developed in this study represents a novel approach to clinical decision support that acknowledges the unique cognitive processes and professional values inherent in nursing practice.

Second, our findings challenge conventional assumptions about technology adoption in healthcare. The relationship between clinical experience and AI utilization appears more complex than previously understood, with experienced nurses potentially deriving greater

benefit from appropriately designed systems than their less experienced counterparts. This insight has important implications for implementation strategies and training approaches in healthcare organizations adopting AI technologies.

Third, the research provides empirical evidence for the importance of uncertainty quantification and explanatory capabilities in clinical AI systems. Transparency regarding system confidence levels and reasoning processes emerged as critical factors in building trust and facilitating appropriate use of AI recommendations. This finding suggests that the pursuit of explainable AI in healthcare should extend beyond technical transparency to include clinically meaningful explanations that align with healthcare professionals' cognitive frameworks.

The limitations of this study include its focus on simulated clinical scenarios rather than real-time patient care situations. While simulation allowed for controlled comparison across conditions, it may not fully capture the dynamic complexities of actual clinical environments. Future research should explore the implementation of similar AI frameworks in live clinical settings, examining longitudinal effects on decision patterns, patient outcomes, and nursing satisfaction.

This research has significant implications for both AI system design and nursing education. As AI technologies become increasingly integrated into healthcare, nursing curricula must evolve to include critical evaluation of AI recommendations and effective human-AI collaboration skills. Similarly, system developers must prioritize human-centered design principles that acknowledge the sophisticated judgment capabilities of healthcare professionals while providing meaningful decision support.

The innovative approach presented in this study represents a paradigm shift in how we conceptualize the role of AI in clinical practice. By focusing on symbiosis rather than substitution, we open new possibilities for technology to enhance healthcare delivery while respecting the irreplaceable value of human expertise and compassion in patient care.

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