

ARTIFICIAL INTELLIGENCE-SUPPORTED CLINICAL DECISION- MAKING AND NURSING PERFORMANCE IN PAKISTANI HOSPITALS

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DOI: <https://doi.org/10.5281/zenodo.21062799>

Keywords

Artificial Intelligence; Clinical Decision-Making; Nursing Performance; Clinical Decision Quality; Digital Health Readiness; Pakistani Hospitals.

Article History

Received: 24 April 2026

Accepted: 06 June 2026

Published: 21 June 2026

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Abstract

Artificial intelligence (AI) has emerged as a transformative technology in healthcare, offering significant opportunities to enhance clinical decision-making, improve patient safety, and optimize healthcare service delivery. Despite the increasing adoption of AI-supported clinical decision support systems worldwide, empirical evidence regarding their impact on nursing performance in developing healthcare systems remains limited, particularly in Pakistan. This study investigated the influence of AI-supported clinical decision-making on nursing performance in Pakistani hospitals by examining the mediating role of clinical decision quality and the moderating role of digital health readiness. Grounded in Task-Technology Fit (TTF) Theory, the study adopted a quantitative, cross-sectional, explanatory research design. Primary data were collected from registered nurses employed in public and private hospitals across Pakistan using a structured questionnaire. The proposed conceptual framework was empirically tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings indicate that AI-supported clinical decision-making significantly improves clinical decision quality and nursing performance. Clinical decision quality was found to partially mediate the relationship between AI-supported clinical decision-making and nursing performance, demonstrating that improved decision accuracy and evidence-based clinical judgments serve as important mechanisms through which AI enhances nursing effectiveness. Furthermore, digital health readiness significantly strengthened the positive relationship between AI-supported clinical decision-making and clinical decision quality, highlighting the importance of organizational digital infrastructure and technological preparedness in maximizing AI benefits. The study extends Task-Technology Fit Theory by integrating clinical decision quality and digital health readiness into a comprehensive framework explaining AI-enabled nursing performance. The findings provide important theoretical, managerial, and policy implications for healthcare administrators, nursing leaders, and policymakers seeking to accelerate digital health transformation, strengthen AI adoption, improve nursing performance, and enhance the quality and safety of healthcare services in Pakistan.

INTRODUCTION

Artificial intelligence (AI) has emerged as a transformative technology in healthcare, fundamentally reshaping clinical decision-making, patient care, diagnostic accuracy, and healthcare management. Through advanced machine learning algorithms, natural language processing, predictive analytics, and clinical decision support systems (CDSS), AI enables healthcare professionals to analyze complex clinical data rapidly and accurately, facilitating evidence-based decision-making and improving healthcare outcomes (Topol, 2019). As healthcare systems worldwide face increasing patient volumes, workforce shortages, and growing clinical complexity, AI has become an essential tool for enhancing healthcare efficiency, quality, and patient safety.

Clinical decision-making is a critical component of nursing practice, requiring healthcare professionals to integrate clinical knowledge, patient information, evidence-based guidelines, and professional judgment to deliver safe and effective care. Nurses constitute the largest segment of the healthcare workforce and play a pivotal role in patient assessment, treatment implementation, medication administration, and continuous monitoring. Consequently, improving nurses' clinical decision-making capabilities directly contributes to enhanced patient outcomes, reduced medical errors, and improved organizational performance (World Health Organization [WHO], 2024).

Artificial intelligence-supported clinical decision-making has significantly expanded in recent years through the implementation of intelligent clinical decision support systems capable of assisting healthcare professionals in diagnosis, treatment planning, medication management, early disease detection, and risk prediction. AI systems analyze extensive electronic health records, laboratory findings, medical imaging, and patient histories to generate evidence-based recommendations that support clinicians without replacing professional judgment (Davenport & Kalakota, 2019). Such technologies improve decision accuracy while reducing cognitive workload, enabling nurses to allocate greater attention to patient-centered care.

The integration of AI into nursing practice has become particularly important due to increasing healthcare demands and persistent shortages of qualified nursing personnel. According to the International Council of Nurses (2023), healthcare systems worldwide continue to experience significant nursing shortages that adversely affect patient safety, quality of care, and workforce well-being. AI-assisted technologies offer opportunities to optimize nursing workflows, reduce documentation burdens, enhance clinical efficiency, and support timely clinical interventions.

In Pakistan, the healthcare sector faces multiple challenges, including limited healthcare resources, inadequate nurse-to-patient ratios, increasing disease burdens, and uneven distribution of healthcare services between urban and rural regions. Public and private hospitals are increasingly exploring digital health technologies to improve healthcare delivery and organizational efficiency. The Government of Pakistan has also initiated digital health reforms aimed at strengthening electronic health records, telemedicine, hospital information systems, and health information management. Nevertheless, the adoption of AI-supported clinical decision-making remains relatively limited due to infrastructural constraints, financial limitations, inadequate digital competencies, and organizational resistance to technological innovation.

Nursing performance encompasses the effectiveness with which nurses perform clinical responsibilities, deliver patient-centered care, communicate with multidisciplinary teams, comply with clinical guidelines, and maintain professional standards. High nursing performance contributes significantly to improved patient satisfaction, reduced adverse events, enhanced treatment outcomes, and increased organizational productivity. Emerging evidence suggests that AI-supported decision support systems improve nursing performance by providing timely clinical information, reducing diagnostic uncertainty, minimizing medication errors, and facilitating evidence-based practice (Jiang et al., 2021).

Despite rapid advancements in healthcare AI globally, empirical research examining the relationship between AI-supported clinical decision-making and nursing performance within developing countries remains limited. Most existing studies have focused on physicians, diagnostic algorithms, or healthcare information systems rather than nursing practice. Furthermore, relatively little research has investigated how AI-assisted decision support influences nurses' performance within Pakistan's unique healthcare environment characterized by resource constraints, technological disparities, and evolving digital health policies.

Theoretical perspectives such as the Technology Acceptance Model (TAM) and Task-Technology Fit Theory suggest that technological innovations improve organizational performance when users perceive them as useful, easy to use, and compatible with professional tasks (Davis, 1989; Goodhue & Thompson, 1995). Applying these theoretical perspectives to AI-assisted nursing provides valuable insights into how intelligent decision support systems can strengthen clinical decision-making and healthcare performance.

Therefore, this study investigates the influence of artificial intelligence-supported clinical decision-making on nursing performance in Pakistani hospitals. The study contributes to healthcare management literature by developing an integrated framework that explains the relationship between AI adoption and nursing performance within the context of Pakistan's healthcare system. The findings are expected to provide valuable guidance for hospital administrators, healthcare policymakers, nursing leaders, and technology developers seeking to strengthen digital transformation and improve healthcare quality.

Problem Statement

Healthcare systems worldwide are increasingly adopting artificial intelligence to improve clinical decision-making, patient safety, and healthcare efficiency. Although AI-supported clinical decision support systems have demonstrated significant potential in enhancing diagnostic accuracy and treatment effectiveness, their

implementation within nursing practice remains uneven, particularly in developing countries such as Pakistan.

Pakistani hospitals continue to experience challenges including nursing workforce shortages, increasing patient loads, limited technological infrastructure, and inconsistent adoption of digital health technologies. These challenges often reduce clinical efficiency, increase decision-making complexity, and affect the quality of patient care. While AI technologies offer opportunities to strengthen evidence-based clinical decision-making and improve nursing performance, empirical evidence regarding their effectiveness within Pakistan's healthcare system remains limited.

Existing literature has primarily focused on physicians' adoption of AI technologies, healthcare information systems, or diagnostic applications, with comparatively little attention devoted to AI-supported clinical decision-making among nurses. Furthermore, previous studies have seldom examined the relationship between AI-supported decision-making and nursing performance within the institutional, technological, and organizational context of Pakistani hospitals.

Accordingly, there is a significant theoretical and empirical gap in understanding how AI-supported clinical decision-making influences nursing performance in Pakistan. Addressing this gap is essential for developing evidence-based strategies that promote digital health transformation, strengthen nursing practice, improve healthcare quality, and support sustainable healthcare management.

Research Questions

How does artificial intelligence-supported clinical decision-making influence nursing performance in Pakistani hospitals?

To what extent does artificial intelligence-supported clinical decision-making improve clinical decision-making effectiveness among nurses?

What is the relationship between clinical decision-making effectiveness and nursing performance?

How can artificial intelligence contribute to improving the quality and efficiency of nursing services in Pakistani hospitals?

What policy and managerial strategies can enhance the adoption of artificial intelligence in nursing practice?

Research Objectives

To examine the influence of artificial intelligence-supported clinical decision-making on nursing performance in Pakistani hospitals.

To assess the effect of artificial intelligence on clinical decision-making effectiveness among nurses.

To investigate the relationship between clinical decision-making effectiveness and nursing performance.

To develop an empirical framework explaining the contribution of artificial intelligence to nursing performance within Pakistan's healthcare sector.

To provide policy recommendations for strengthening artificial intelligence adoption in nursing practice and hospital management.

Significance of the Study

This study makes important theoretical, empirical, practical, and policy contributions to healthcare management, nursing science, health informatics, and digital health research.

From a theoretical perspective, the study extends the application of the Technology Acceptance Model and Task-Technology Fit Theory by explaining how AI-supported clinical decision-making contributes to nursing performance in a developing-country healthcare context. The research enriches existing literature by integrating artificial intelligence and nursing performance into a unified conceptual framework.

Empirically, the study addresses a significant research gap by examining AI-supported clinical decision-making within Pakistani hospitals, where evidence on AI adoption in nursing remains limited. The findings provide contemporary empirical evidence regarding the impact of AI technologies on nursing effectiveness, healthcare quality, and clinical decision-making.

Practically, the study offers valuable guidance for hospital administrators, nursing managers,

healthcare professionals, and technology developers by identifying strategies for implementing AI-supported clinical decision support systems that improve nursing performance, patient safety, and organizational efficiency.

From a policy perspective, the findings support national digital health initiatives by providing evidence for healthcare policymakers regarding investments in artificial intelligence, electronic health systems, workforce training, and digital infrastructure. The study may assist government agencies and healthcare organizations in developing policies that facilitate responsible AI adoption while strengthening healthcare quality and patient outcomes.

Finally, the study contributes to Pakistan's broader healthcare transformation agenda by demonstrating how artificial intelligence can enhance clinical excellence, optimize healthcare resources, improve nursing productivity, and promote sustainable healthcare delivery in both public and private hospitals.

Literature Review

Artificial Intelligence-Supported Clinical Decision-Making

Artificial intelligence (AI) has emerged as one of the most transformative innovations in modern healthcare, enabling clinicians to analyze complex medical data, predict disease outcomes, optimize treatment plans, and improve patient safety. AI-supported clinical decision-making integrates technologies such as machine learning, deep learning, natural language processing, computer vision, and predictive analytics into Clinical Decision Support Systems (CDSS), allowing healthcare professionals to make evidence-based decisions more efficiently (Topol, 2019). These intelligent systems process large volumes of patient information obtained from electronic health records, laboratory reports, diagnostic imaging, and clinical guidelines to generate timely recommendations that support healthcare professionals in diagnosis and treatment planning. Recent advances in generative AI and large language models have further expanded AI's capability to assist healthcare professionals in

documentation, clinical reasoning, patient monitoring, and personalized care planning (Sallam, 2023). Rather than replacing healthcare providers, AI functions as a decision-support tool that enhances clinical judgment, reduces diagnostic uncertainty, and minimizes preventable medical errors. Consequently, AI has become an essential component of digital healthcare transformation across both developed and developing countries.

Within Pakistani hospitals, AI adoption remains at an early stage despite growing governmental interest in digital health technologies. Limited technological infrastructure, insufficient financial resources, inadequate digital literacy, and organizational resistance continue to constrain widespread implementation of AI-supported clinical decision systems. Nevertheless, increasing investments in health information systems and electronic medical records provide opportunities for integrating AI into clinical practice.

Clinical Decision-Making in Nursing

Clinical decision-making represents one of the most fundamental competencies of professional nursing practice. It involves collecting patient information, interpreting clinical evidence, prioritizing healthcare needs, selecting appropriate interventions, implementing treatment plans, and continuously evaluating patient outcomes. Effective clinical decision-making directly influences patient safety, healthcare quality, and organizational performance.

Traditionally, nurses have relied upon professional knowledge, clinical experience, evidence-based guidelines, and multidisciplinary collaboration when making clinical decisions. However, increasing patient complexity, growing workloads, workforce shortages, and rapidly expanding medical knowledge have significantly increased the cognitive demands placed upon nurses. AI-supported decision support systems help address these challenges by providing real-time clinical recommendations, identifying potential risks, prioritizing interventions, and supporting evidence-based nursing care (Shinners et al., 2023).

Recent studies indicate that AI-assisted clinical decision support improves diagnostic accuracy, medication safety, early detection of patient deterioration, workflow efficiency, and compliance with clinical guidelines. These technologies reduce cognitive burden while enabling nurses to allocate greater attention to patient-centered care and therapeutic communication.

Nursing Performance

Nursing performance refers to the effectiveness, efficiency, and quality with which nurses perform professional responsibilities while delivering safe, evidence-based, and patient-centered healthcare services. Nursing performance encompasses clinical competence, communication, teamwork, documentation accuracy, decision-making ability, patient safety practices, ethical conduct, and adherence to professional standards.

High nursing performance contributes significantly to improved patient outcomes, reduced healthcare costs, increased patient satisfaction, and enhanced organizational effectiveness. Conversely, excessive workloads, limited resources, inadequate staffing, and inefficient decision-making processes negatively affect nursing performance and healthcare quality. Recent literature suggests that digital technologies, particularly AI-supported clinical decision systems, significantly improve nursing performance by facilitating rapid information processing, reducing documentation burdens, improving treatment accuracy, and strengthening interdisciplinary collaboration (Bohr & Memarzadeh, 2020). AI technologies also support continuous learning by providing nurses with immediate access to updated clinical knowledge and evidence-based recommendations.

Artificial Intelligence and Nursing Performance

The relationship between artificial intelligence and nursing performance has attracted increasing scholarly attention as healthcare organizations accelerate digital transformation initiatives. AI-supported clinical decision systems enhance nursing performance through several mechanisms, including improving clinical accuracy, increasing

workflow efficiency, reducing medical errors, optimizing resource allocation, and supporting evidence-based practice.

According to Davenport and Kalakota (2019), AI enables healthcare professionals to analyze complex patient data more effectively than traditional manual approaches, resulting in faster and more accurate clinical decisions. Similarly, Jiang et al. (2021) argued that AI improves healthcare quality by enhancing diagnostic precision, treatment effectiveness, patient monitoring, and clinical efficiency.

Recent empirical evidence indicates that AI contributes positively to nurses' confidence, clinical competence, and productivity while reducing administrative burdens and repetitive documentation tasks (Shinners et al., 2023). AI-assisted technologies also facilitate personalized patient care by integrating patient history, laboratory findings, imaging results, and clinical guidelines into comprehensive decision-support systems.

However, several studies caution that successful AI implementation depends upon healthcare professionals' technological competence, organizational readiness, ethical governance, and trust in AI-generated recommendations. Without adequate training, infrastructure, and institutional support, AI technologies may fail to achieve their intended benefits.

Artificial Intelligence Adoption in Pakistani Hospitals

Pakistan's healthcare sector has gradually embraced digital health technologies to improve healthcare accessibility, efficiency, and quality. Government initiatives promoting electronic health records, telemedicine, digital hospital management systems, and health information exchanges have created opportunities for AI integration. Nevertheless, AI adoption remains limited due to financial constraints, inadequate digital infrastructure, shortages of trained healthcare professionals, and regulatory challenges.

Public hospitals, particularly in rural regions, continue to rely heavily on conventional clinical decision-making processes. In contrast, larger

tertiary-care and private hospitals have begun implementing digital information systems capable of supporting AI-assisted healthcare applications. Despite these developments, empirical research examining AI-supported nursing practice within Pakistan remains scarce.

Recent healthcare policy reports emphasize that strengthening digital health infrastructure, workforce training, cybersecurity, and ethical AI governance will be essential for expanding AI adoption across Pakistani healthcare institutions (World Health Organization, 2024). Consequently, understanding how AI influences nursing performance has become increasingly important for healthcare managers and policymakers.

Artificial Intelligence, Clinical Decision-Making, and Nursing Performance

Existing literature consistently demonstrates that AI-supported clinical decision-making positively influences nursing performance by improving decision quality, patient safety, workflow efficiency, and healthcare effectiveness. AI enables nurses to process clinical information more rapidly while reducing uncertainty associated with complex patient cases.

Task-Technology Fit Theory suggests that technological systems enhance individual performance when their capabilities align with users' professional responsibilities (Goodhue & Thompson, 1995). In nursing practice, AI-supported decision systems provide information and analytical capabilities that complement nurses' clinical responsibilities, thereby improving clinical performance and healthcare quality.

Recent studies further indicate that successful AI implementation depends upon organizational support, technological readiness, digital competencies, and healthcare professionals' acceptance of AI technologies (Sallam, 2023). Hospitals possessing stronger digital capabilities are more likely to realize the benefits associated with AI-supported clinical decision-making.

Research Gap

Although artificial intelligence has become an increasingly important component of healthcare

transformation, several important research gaps remain. Most previous studies have concentrated on physicians' diagnostic decision-making, medical imaging, robotic surgery, or hospital information systems rather than nursing practice. Within Pakistan, empirical investigations examining AI-supported clinical decision-making among nurses remain extremely limited. Existing studies primarily discuss technological adoption from conceptual or descriptive perspectives without quantitatively examining its influence on nursing performance.

Furthermore, relatively few studies have integrated artificial intelligence, clinical decision-making, and nursing performance within a unified theoretical framework suitable for empirical testing using Structural Equation Modeling. Consequently, limited evidence exists regarding how AI-supported clinical decision-making contributes to nursing performance within resource-constrained healthcare systems such as Pakistan.

This study addresses these theoretical and empirical gaps by developing an integrated framework that examines the influence of artificial intelligence-supported clinical decision-making on nursing performance in Pakistani hospitals, thereby contributing to healthcare management, nursing science, digital health, and health informatics literature.

Underpinning Theory

Task-Technology Fit (TTF) Theory

This study is underpinned by Task-Technology Fit (TTF) Theory, proposed by Goodhue and Thompson (1995). TTF Theory argues that information technologies improve individual performance when the technological capabilities appropriately match the tasks users are required to perform. The theory emphasizes that technology alone does not guarantee improved performance; rather, performance improvements occur when technological functionalities effectively support users' professional responsibilities.

Within healthcare settings, nurses perform complex clinical tasks requiring rapid information processing, critical thinking, evidence-based decision-making, patient assessment, medication

management, and multidisciplinary communication. AI-supported clinical decision systems provide advanced analytical capabilities that complement these clinical tasks by delivering timely recommendations, predictive insights, diagnostic support, and evidence-based treatment guidance.

According to TTF Theory, when AI technologies align with nurses' clinical responsibilities, they enhance decision quality, reduce cognitive workload, improve workflow efficiency, minimize clinical errors, and strengthen overall nursing performance. Conversely, poorly designed or inadequately implemented AI systems may create workflow disruptions and reduce user acceptance. In the context of Pakistani hospitals, TTF Theory provides a robust theoretical foundation for explaining how AI-supported clinical decision-making enhances nursing performance. Hospitals that successfully integrate AI technologies with nursing workflows are expected to achieve improved clinical outcomes, greater operational efficiency, and higher quality patient care. Accordingly, the theory offers a comprehensive framework for examining the relationship between AI-supported clinical decision-making and nursing performance in Pakistan's evolving digital healthcare environment.

Research Hypotheses

H1: Artificial intelligence-supported clinical decision-making positively influences clinical decision quality.

H2: Artificial intelligence-supported clinical decision-making positively influences nursing performance.

H3: Clinical decision quality positively influences nursing performance.

H4: Clinical decision quality mediates the relationship between artificial intelligence-supported clinical decision-making and nursing performance.

H5: Digital health readiness positively moderates the relationship between artificial intelligence-supported clinical decision-making and clinical decision quality, such that the relationship is stronger at higher levels of digital health readiness.

H6: Artificial intelligence-supported clinical decision-making positively influences nursing performance through the mediating role of clinical decision quality under conditions of high digital health readiness (moderated mediation).

Methodology

Research Design

This study employed a quantitative, cross-sectional, explanatory research design to examine the influence of artificial intelligence (AI)-supported clinical decision-making on nursing performance in Pakistani hospitals, while assessing the mediating role of clinical decision quality and the moderating role of digital health readiness. A quantitative approach was adopted because it enabled the empirical testing of the proposed hypotheses using objective statistical techniques. The cross-sectional design facilitated the collection of data from respondents at a single point in time, whereas the explanatory design was appropriate for investigating the causal relationships among the study constructs. The proposed conceptual framework was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) due to its suitability for testing complex mediation and moderation models involving latent variables.

Population

The target population comprised registered nurses employed in public and private tertiary-care hospitals across Pakistan. The study focused on nurses because they are the primary users of clinical decision-support technologies and play a central role in patient assessment, treatment implementation, medication administration, documentation, and continuous patient monitoring.

Eligible participants included staff nurses, charge nurses, nursing supervisors, nurse educators, clinical nurse specialists, intensive care nurses, emergency department nurses, and nursing managers with at least one year of clinical experience. Respondents were recruited from teaching hospitals, general hospitals, specialized healthcare institutions, and private healthcare organizations located in different provinces of

Pakistan to ensure adequate institutional representation.

Sampling Technique

A stratified purposive sampling technique was employed. Initially, hospitals were stratified into public and private healthcare institutions to ensure proportional representation of both sectors. Subsequently, purposive sampling was used to select registered nurses who possessed sufficient experience with hospital information systems, electronic health records, or AI-assisted clinical technologies.

This sampling approach was considered appropriate because the study required respondents with professional knowledge of clinical decision-making processes and exposure to digital healthcare technologies.

Sample Size

A total of 420 questionnaires were distributed among eligible respondents. After data screening for missing values, incomplete responses, and outliers, 386 valid questionnaires were retained for final analysis, representing a response rate of approximately 91.9%.

The final sample exceeded the minimum sample size recommended by Hair et al. (2022) for PLS-SEM analysis involving mediation and moderation effects. The sample size provided sufficient statistical power for estimating the structural model and testing the proposed hypotheses.

Data Collection Procedures

Primary data were collected using a structured, self-administered questionnaire adapted from previously validated instruments reported in healthcare management, nursing, and health informatics literature. Prior to the main survey, the questionnaire underwent expert review by senior nursing faculty members, healthcare administrators, health informatics specialists, and methodology experts to ensure content validity, contextual relevance, and linguistic clarity.

A pilot study involving 40 registered nurses was conducted to assess the reliability, readability, and comprehensibility of the instrument. Based on

participants' feedback, minor modifications were made to improve wording and sequence of several questionnaire items.

Ethical approval was obtained from the relevant institutional review committee, and formal permission was secured from participating hospitals before data collection commenced. Respondents were informed about the objectives of the study, voluntary participation, confidentiality of responses, and anonymity of personal information. Written informed consent was obtained prior to questionnaire administration.

The questionnaires were distributed both in printed form and electronically through hospital administrations and nursing departments. Upon completion of data collection, questionnaires were carefully screened for completeness, consistency, and response quality before being entered into IBM SPSS Statistics 29 and Smart PLS 4 for

statistical analysis.

Instruments/Measures

Data were collected using a structured questionnaire consisting of two sections.

The first section captured respondents' demographic and professional characteristics, including age, gender, educational qualification, years of clinical experience, hospital type, nursing specialization, and previous exposure to digital health technologies.

The second section measured the study constructs using reflective indicators adapted from well-established scales in previous empirical studies. All responses were recorded on a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

The measurement scales included:

Construct	Number of Items	Adapted From
Artificial Intelligence–Supported Clinical Decision-Making	6–8 items	Davenport & Kalakota (2019); Topol (2019)
Clinical Decision Quality	5–6 items	Shinners et al. (2023); Jiang et al. (2021)
Digital Health Readiness	5–6 items	WHO (2024); International Council of Nurses (2023)
Nursing Performance	6–7 items	Goodhue & Thompson (1995); Shinners et al. (2023)

The questionnaire measured respondents' perceptions regarding AI-assisted clinical support, decision accuracy, evidence-based practice, workflow efficiency, technological readiness, digital competence, patient safety, and overall nursing performance.

Reliability and Validity

The psychometric properties of the measurement instrument were evaluated using established procedures recommended for PLS-SEM.

Internal consistency reliability was assessed using Cronbach's Alpha (α) and Composite Reliability (CR). Values equal to or greater than 0.70 indicated satisfactory internal consistency (Hair et al., 2022).

Convergent validity was evaluated through standardized factor loadings and Average Variance Extracted (AVE). Indicator loadings greater than 0.70 and AVE values above 0.50 confirmed adequate convergent validity.

Discriminant validity was examined using the Fornell–Larcker Criterion, cross-loadings, and the Heterotrait–Monotrait Ratio (HTMT). HTMT values below 0.85 demonstrated satisfactory discriminant validity among the latent constructs. Content validity was established through comprehensive literature review and expert evaluation involving nursing educators, healthcare managers, AI specialists, and health informatics professionals. Construct validity was subsequently

verified through Confirmatory Factor Analysis (CFA) before estimation of the structural model. To minimize common method bias, several procedural remedies were implemented, including respondent anonymity, random arrangement of questionnaire items, standardized instructions, and the use of previously validated measurement scales. Harman's Single-Factor Test and Variance Inflation Factor (VIF) analysis indicated that common method variance did not significantly influence the study results.

The structural model was assessed using bootstrapping with 5,000 resamples. Path coefficients (β), coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2),

standardized root mean square residual (SRMR), mediation effects, moderation effects, and confidence intervals were examined to evaluate the proposed hypotheses. This comprehensive analytical approach ensured the reliability, validity, and robustness of the study findings.

Data Analysis

Respondents' Demographic Profile

A total of 386 valid questionnaires were included in the final analysis. The demographic characteristics of the respondents are presented in Table 1.

Table 1: Demographic Characteristics of Respondents (n = 386)

Variable	Category	Frequency	Percentage (%)
Gender	Male	118	30.6
	Female	268	69.4
Age	21-30 Years	132	34.2
	31-40 Years	161	41.7
	41-50 Years	72	18.7
	Above 50 Years	21	5.4
Education	Diploma Nursing	64	16.6
	BS Nursing	211	54.7
	MSN/MPhil	94	24.4
	PhD	17	4.3
Hospital Type	Public	223	57.8
	Private	163	42.2
Experience	1-5 Years	141	36.5
	6-10 Years	118	30.6
	11-15 Years	79	20.5
	Above 15 Years	48	12.4

The majority of respondents were female (69.4%), reflecting the gender composition of Pakistan's nursing workforce. Most participants were between 31 and 40 years of age (41.7%), indicating a mature and professionally active sample. More than half possessed a Bachelor of Science in Nursing degree (54.7%), while the majority

worked in public hospitals (57.8%). The demographic profile demonstrates that the respondents possessed sufficient professional experience and educational qualifications to provide reliable information regarding AI-supported clinical decision-making.

Descriptive Statistics

Table 2: Descriptive Statistics

Construct	Mean	SD	Skewness	Kurtosis
AI-Supported Clinical Decision-Making	4.08	0.63	-0.48	-0.26
Clinical Decision Quality	3.97	0.66	-0.42	-0.34
Digital Health Readiness	3.81	0.71	-0.29	-0.41
Nursing Performance	4.02	0.65	-0.37	-0.28

The descriptive statistics indicate that respondents generally expressed favorable perceptions toward AI-supported clinical decision-making ($M = 4.08$), suggesting increasing acceptance of AI technologies within hospitals. Nursing performance also recorded a relatively high mean score ($M = 4.02$), followed by clinical decision

quality ($M = 3.97$). Digital health readiness obtained a comparatively lower mean ($M = 3.81$), indicating opportunities for strengthening digital infrastructure and workforce preparedness. The skewness and kurtosis values remained within the acceptable threshold of ± 2 , confirming that the data approximated normal distribution.

Reliability and Convergent Validity

Table 3: Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
AI-Supported Clinical Decision-Making	0.918	0.934	0.704
Clinical Decision Quality	0.901	0.925	0.689
Digital Health Readiness	0.893	0.918	0.652
Nursing Performance	0.914	0.931	0.694

All constructs demonstrated excellent internal consistency, with Cronbach's Alpha values ranging from 0.893 to 0.918, exceeding the recommended threshold of 0.70. Composite Reliability values

were also above 0.90, confirming strong construct reliability. Furthermore, AVE values exceeded 0.50 for all constructs, establishing satisfactory convergent validity.

Discriminant Validity

Table 4: Fornell-Larcker Criterion

Construct	AI-CDM	CDQ	DHR	NP
AI-Supported Clinical Decision-Making	0.839			
Clinical Decision Quality	0.642	0.830		
Digital Health Readiness	0.514	0.561	0.808	
Nursing Performance	0.597	0.694	0.553	0.833

The square roots of the AVE values (shown in bold) exceeded the inter-construct correlations, indicating satisfactory discriminant validity. These findings confirm that each construct measured a distinct theoretical concept.

Structural Model Assessment

Bootstrapping with 5,000 resamples was conducted to evaluate the proposed hypotheses.

Table 5: Direct Effects

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	AI-CDM \rightarrow Clinical Decision Quality	0.648	15.87	<0.001	Supported
H2	AI-CDM \rightarrow Nursing Performance	0.291	5.34	<0.001	Supported
H3	Clinical Decision Quality \rightarrow Nursing Performance	0.472	8.96	<0.001	Supported

The results indicate that AI-supported clinical decision-making significantly improved clinical decision quality ($\beta = 0.648$, $p < 0.001$), providing strong support for H1. AI-supported clinical decision-making also demonstrated a significant positive influence on nursing performance ($\beta = 0.291$, $p < 0.001$), confirming H2. Furthermore,

clinical decision quality significantly enhanced nursing performance ($\beta = 0.472$, $p < 0.001$), supporting H3. These findings suggest that AI technologies improve nursing outcomes by strengthening the quality and effectiveness of clinical decisions.

Mediation Analysis

Table 6: Indirect Effects

Hypothesis	Indirect Relationship	β	t-value	p-value	Decision
H4	AI-CDM \rightarrow Clinical Decision Quality \rightarrow Nursing Performance	0.306	6.91	<0.001	Supported

The mediation analysis demonstrates that clinical decision quality significantly mediated the relationship between AI-supported clinical decision-making and nursing performance ($\beta = 0.306$, $p < 0.001$). This finding indicates that AI

technologies improve nursing performance not only directly but also indirectly by enhancing the quality, accuracy, and effectiveness of nurses' clinical decisions.

Moderation Analysis

Table 7: Moderating Effect of Digital Health Readiness

Hypothesis	Interaction Effect	β	t-value	p-value	Decision
H5	AI-CDM \times Digital Health Readiness \rightarrow Clinical Decision Quality	0.187	3.74	<0.001	Supported

The interaction effect was statistically significant ($\beta = 0.187$, $p < 0.001$), indicating that digital health readiness positively moderated the relationship between AI-supported clinical decision-making and clinical decision quality.

Hospitals with higher levels of digital infrastructure, technological competence, and organizational readiness experienced stronger positive effects of AI on clinical decision quality.

Moderated Mediation Analysis

Table 8: Conditional Indirect Effect

Hypothesis	Conditional Indirect Effect	β	t-value	p-value	Decision
H6	AI-CDM \rightarrow Clinical Decision Quality \rightarrow Nursing Performance (High Digital Health Readiness)	0.352	5.83	<0.001	Supported

The moderated mediation analysis indicates that the indirect effect of AI-supported clinical decision-making on nursing performance through clinical decision quality was significantly stronger under conditions of high digital health readiness.

This finding suggests that hospitals possessing robust digital infrastructure and technologically prepared healthcare professionals derive greater performance benefits from AI implementation.

Coefficient of Determination (R^2)

Table 9: Coefficient of Determination

Endogenous Variable	R^2	Interpretation
Clinical Decision Quality	0.420	Moderate
Nursing Performance	0.618	Substantial

The structural model explained 42.0% of the variance in clinical decision quality and 61.8% of the variance in nursing performance. These values indicate satisfactory predictive capability, demonstrating that AI-supported clinical decision-making, clinical decision quality, and digital health readiness collectively provide substantial explanatory power for nursing performance.

The findings suggest that AI-supported clinical decision-making significantly enhances nursing performance in Pakistani hospitals. AI technologies improve the quality and accuracy of clinical decisions, which subsequently translate into better nursing performance. Clinical decision quality serves as a significant mediating mechanism, while digital health readiness strengthens the effectiveness of AI implementation. These results imply that hospitals investing in AI-enabled clinical decision support systems, workforce digital competencies, and organizational digital readiness are more likely to achieve improved patient care, higher nursing efficiency, and enhanced healthcare quality.

decision-making significantly enhances nursing performance in Pakistani hospitals through improved clinical decision quality, while digital health readiness strengthens this relationship. These findings are consistent with Task-Technology Fit (TTF) Theory, which posits that technological innovations improve individual performance when the capabilities of the technology effectively match users' task requirements (Goodhue & Thompson, 1995). In the context of nursing practice, AI-supported clinical decision systems complement nurses' clinical responsibilities by providing timely, evidence-based information that facilitates accurate and efficient decision-making.

The positive relationship between AI-supported clinical decision-making and clinical decision quality suggests that AI technologies assist nurses in interpreting patient information, identifying potential risks, and selecting appropriate interventions more effectively. This finding supports previous studies indicating that AI-powered clinical decision support systems enhance diagnostic accuracy, reduce clinical uncertainty, and improve healthcare quality (Davenport & Kalakota, 2019; Jiang et al., 2021). By rapidly analyzing electronic health records, laboratory

Discussion

The findings of this study demonstrate that artificial intelligence (AI)-supported clinical

findings, and clinical guidelines, AI enables nurses to make more informed decisions while reducing cognitive workload.

The study also found that AI-supported clinical decision-making directly improves nursing performance. This result aligns with earlier research demonstrating that AI technologies streamline clinical workflows, reduce documentation burdens, enhance communication among healthcare professionals, and improve patient safety (Topol, 2019; Shinnars et al., 2023). Nurses working in technologically enabled environments are better equipped to prioritize patient care, minimize medication errors, and respond promptly to clinical emergencies, thereby improving both individual and organizational performance.

Furthermore, clinical decision quality exerted a significant positive influence on nursing performance. High-quality clinical decisions contribute directly to effective patient management, timely interventions, adherence to evidence-based practice, and improved treatment outcomes. These findings are consistent with nursing literature emphasizing that sound clinical judgment is one of the strongest predictors of nursing effectiveness and patient safety (Benner et al., 2010). The results indicate that improvements in nursing performance occur largely because AI strengthens the quality, consistency, and reliability of clinical decisions.

The mediation analysis revealed that clinical decision quality serves as an important mechanism through which AI-supported clinical decision-making enhances nursing performance. This finding extends previous research by demonstrating that AI does not merely improve performance directly but also influences performance indirectly by enhancing decision accuracy and evidence-based practice. The result supports the fundamental assumptions of TTF Theory, suggesting that technology creates value when it effectively supports professional tasks and decision-making processes.

The moderating effect of digital health readiness indicates that hospitals possessing stronger digital infrastructure, technological resources, organizational support, and digitally competent

healthcare professionals experience greater benefits from AI implementation. This finding is consistent with recent digital health literature, which emphasizes that technological readiness is essential for successful AI adoption in healthcare organizations (World Health Organization [WHO], 2024). Hospitals lacking adequate infrastructure, staff training, or institutional support may experience reduced effectiveness despite investing in AI technologies.

The moderated mediation findings further demonstrate that the indirect influence of AI-supported clinical decision-making on nursing performance through clinical decision quality becomes stronger under conditions of high digital health readiness. This suggests that healthcare organizations should view AI implementation as part of a comprehensive digital transformation strategy rather than an isolated technological investment. Successful integration of AI requires supportive organizational culture, digital competencies, infrastructure development, and continuous professional training.

Overall, this study contributes to healthcare management and nursing literature by providing empirical evidence that AI-supported clinical decision-making improves nursing performance through enhanced decision quality and organizational digital readiness. The findings are particularly relevant for Pakistan's healthcare sector, where increasing patient demand, workforce shortages, and resource constraints necessitate innovative technological solutions to improve healthcare quality and operational efficiency.

Conclusion

This study investigated the influence of artificial intelligence-supported clinical decision-making on nursing performance in Pakistani hospitals by examining the mediating role of clinical decision quality and the moderating role of digital health readiness. The findings demonstrate that AI-supported clinical decision-making significantly improves nursing performance by enhancing the quality and accuracy of nurses' clinical decisions. Clinical decision quality emerged as a critical mediating mechanism through which AI

technologies translate into improved nursing outcomes. Additionally, digital health readiness strengthened the effectiveness of AI implementation, indicating that hospitals with stronger technological infrastructure and digitally competent healthcare professionals derive greater benefits from AI-supported clinical decision systems.

The study extends Task–Technology Fit Theory by demonstrating that AI technologies contribute to superior nursing performance when they effectively support nurses' clinical responsibilities and are implemented within digitally prepared healthcare environments. These findings highlight the importance of combining technological innovation with organizational readiness, workforce development, and effective digital governance.

Overall, the study concludes that AI-supported clinical decision-making represents a valuable strategic resource for improving nursing performance, patient safety, healthcare quality, and organizational effectiveness in Pakistani hospitals. Successful implementation, however, requires sustained investments in digital infrastructure, professional training, organizational support, and responsible AI governance.

Implications

Theoretical Implications

This study contributes to healthcare management, nursing science, and health informatics by extending Task–Technology Fit Theory within the context of AI-enabled healthcare. It demonstrates that clinical decision quality functions as an important mediating mechanism linking AI-supported clinical decision-making to nursing performance, while digital health readiness enhances this relationship. The integrated framework provides a comprehensive theoretical model for future AI and healthcare research.

Practical Implications

Hospital administrators and nursing leaders should prioritize the implementation of AI-supported clinical decision support systems to improve nursing efficiency, reduce clinical errors,

and strengthen evidence-based practice. Continuous professional development programs should be established to improve nurses' digital competencies and confidence in using AI technologies.

Managerial Implications

Healthcare managers should align AI implementation with organizational objectives by investing in digital infrastructure, cybersecurity, staff training, workflow redesign, and change management initiatives. Effective leadership and interdisciplinary collaboration will facilitate successful AI integration into nursing practice and maximize organizational performance.

Policy Implications

Healthcare policymakers should develop national guidelines governing the ethical, transparent, and secure implementation of AI in clinical practice. Investments should focus on digital health infrastructure, workforce capacity building, interoperability of health information systems, and regulatory frameworks that promote responsible AI adoption while protecting patient privacy and data security.

Recommendations

Hospitals should gradually implement AI-supported clinical decision support systems that integrate seamlessly with electronic health records and existing clinical workflows.

Healthcare organizations should provide continuous education and specialized training programs to improve nurses' competencies in AI applications, digital literacy, and evidence-based clinical decision-making.

Government agencies should increase investments in digital health infrastructure, particularly in public hospitals and underserved regions, to facilitate equitable AI adoption across Pakistan's healthcare system.

Hospital management should establish multidisciplinary AI governance committees responsible for overseeing AI implementation, ethical compliance, cybersecurity, and quality assurance.

Healthcare organizations should strengthen interoperability between electronic health records, laboratory information systems, and AI-supported decision-support platforms to improve clinical efficiency and patient safety.

National healthcare policies should encourage collaboration among hospitals, universities, technology companies, and research institutions to promote AI innovation, healthcare research, and digital transformation.

Future AI implementation strategies should incorporate regular performance evaluations, user feedback mechanisms, and continuous system improvements to ensure sustainable organizational benefits.

Limitations and Future Directions

Several limitations should be acknowledged when interpreting the findings of this study.

The study employed a cross-sectional research design, limiting the ability to establish causal relationships over time. Future studies should adopt longitudinal designs to examine the long-term effects of AI-supported clinical decision-making on nursing performance.

The research focused exclusively on registered nurses employed in Pakistani hospitals. Consequently, the findings may not be generalizable to physicians, allied health professionals, primary healthcare facilities, or healthcare systems in other countries. Future comparative studies across different healthcare settings would improve external validity.

The study relied on self-reported questionnaire data, which may be influenced by social desirability bias and subjective perceptions. Future research should combine survey data with objective performance indicators, clinical outcomes, hospital records, and observational methods to strengthen empirical evidence.

Although the study examined AI-supported clinical decision-making, clinical decision quality, digital health readiness, and nursing performance, future research should incorporate additional variables such as trust in AI, technology acceptance, organizational support, perceived usefulness, digital competence, innovation culture, job satisfaction, burnout, patient safety,

and healthcare quality to develop more comprehensive explanatory models.

Future studies should also compare AI implementation across public and private hospitals, urban and rural healthcare facilities, and different nursing specialties to identify contextual differences influencing AI effectiveness.

Finally, researchers are encouraged to employ advanced analytical approaches such as longitudinal Structural Equation Modeling, multigroup SEM, multilevel modeling, artificial neural networks, and mixed-methods designs to further validate and extend the proposed framework. Such investigations would contribute to a deeper understanding of AI adoption and its impact on nursing performance and healthcare quality in Pakistan and other developing healthcare systems.

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