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ADVANCING ARTIFICIAL INTELLIGENCE-DRIVEN CLINICAL DECISION SUPPORT SYSTEMS TO ENHANCE NURSING PRACTICE AND IMPROVE PATIENT SAFETY IN ACUTE CARE SETTINGS

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ABSTRACT

Artificial intelligence (AI)-driven clinical decision support systems (CDSSs) are increasingly transforming healthcare delivery by providing nurses with timely, data-informed recommendations for clinical assessment, risk identification, and patient management. However, their integration into acute care settings remains challenging due to concerns regarding accuracy, interpretability, workflow compatibility, and nurses' trust in automated recommendations. This study aims to examine how AI-driven CDSSs can enhance nursing practice and improve patient safety in acute care environments. A quantitative, cross-sectional research design was employed using a structured questionnaire administered to nurses working in acute care settings. The instrument assessed perceived usefulness, accuracy, interpretability, ease of use, organizational readiness, clinical decision-making, and patient-safety outcomes. Descriptive statistics, correlation analysis, and multiple regression were used to examine relationships among the study variables. The findings indicate that AI-driven CDSSs can positively support nursing decision-making, particularly by facilitating early identification of patient deterioration, reducing information-processing burden, improving clinical prioritization, and promoting timely interventions. Perceived accuracy and usefulness emerged as important predictors of nurses' acceptance and effective utilization of AI-supported recommendations, while interpretability and organizational readiness strengthened confidence in system-generated decisions. The study concludes that AI-driven CDSSs can complement, rather than replace, professional nursing judgment when appropriately integrated into clinical workflows. Effective implementation requires user-centered system design, staff training, transparent AI outputs, data-quality safeguards, and organizational support. The findings highlight the potential of responsible AI integration to strengthen nursing practice, enhance clinical decision-making, and improve patient safety in acute care settings.

Keywords: *Artificial Intelligence; Clinical Decision Support Systems; Nursing Practice; Patient Safety; Acute Care; Clinical Decision-Making; Healthcare Technology*

INTRODUCTION

Artificial Intelligence (AI) has the potential to revolutionize healthcare by helping to process complex clinical data and provide evidence-based decision support. AI can be used in clinical decision support systems (CDSSs) to analyze patient information, detect patterns of risk and make predictions or recommendations to healthcare providers. However, algorithmic utility is not the only important dimension of the usability of this type of AI, as reliability, workflow integration, professional acceptance, interpretability, and usability are all key factors (Vasey et al., 2022).

Nursing is one of the key areas where AI can be applied, as nurses are constantly assessing patients, monitoring physiological changes, administering treatment, documenting clinical information and prioritizing patients' care. These tasks are especially challenging in acute-care facilities where patients' needs can rapidly change and decisions may need to be made in a timely fashion. There is recent evidence of the potential of AI in assisting nurses in clinical decision-making and portions of their workflow and patient care (Mikkonen et al., 2025).

However, AI must not supplant clinical judgment from registered practitioners. Contextual, ethical, interpersonal and experiential knowledge is a crucial component of clinical decisions that algorithms may not be able to fully capture. Meaningful human-AI collaboration, therefore, is essential for effective implementation of AI.

One of the potential benefits of implementing AI-CDSS is patient safety. AI systems could help with early detection of deterioration, risk stratification, medication-related decision support, and real-time patient monitoring. AI can help to recognize patterns that could signal serious outcomes, enabling nurses to focus on the more vulnerable patients and take early action.

At the same time, AI has the potential to create risks because of poor predictions, too many alarms, biased datasets, and using AI-generated suggestions. In recent years, there has been a heightened focus on the validation and in-hospital testing of AI tools in acute and intensive care settings (Żerdziński et al., 2025). Therefore, the effectiveness of AI technology, combined with the expertise, organizational systems, and clinical setting, is crucial for patient safety.

The perceived usefulness is the nurses' confidence that AI-CDSSs can enhance clinical performance. Systems that support information processing, prioritization lessen cognitive burden and the recognition of risk at earlier stages may be more readily adopted. On the other hand, systems that either overwork or produce false alerts could dissuade uptake.

In high-risk clinical circumstances, accuracy is especially crucial. Nurses must have the trust that AI-recommended guidelines are robust enough to assist in clinical decisions. Nurses must be able to trust that AI recommendations are robust enough to guide clinical decisions. Perceived accuracy can thus affect the trust and willingness to accept the use of AI-CDSSs. The reliability, transparency, usability, training, and organizational support of the system influence how much trust healthcare professionals have in AI (Tun et al., 2025).

Interpretability relates to the ability of the users to understand the reasoning behind an AI-based recommendation. In clinical settings, interpretable outputs enable nurses to correlate AI suggestions with patient observations and expertise. Explaining AI has therefore emerged as a crucial aspect of the adoption of clinical AI (Abbas et al., 2025).

Interpretability can also help foster the right trust, by allowing the nurse to question why a system has produced a certain prediction, instead of taking an output at face value. Thus, the present study investigates the interpretability in relation to nurses' trust in the recommendations generated by AI.

Ease of use relates to the simplicity, accessibility and workflow compatibility of AI-CDSSs. Difficulty using or integrating into clinical practice can prevent even the most sophisticated systems from being adopted.

Organizational readiness is also vital, and covers digital infrastructure, technical assistance, staff training, institutional policy and leadership commitment. The study revealed a correlation between nurses' AI readiness, knowledge,

attitudes, perceived benefits, barriers, and organizational factors, as indicated by recent research (El Arab et al., 2025).

The healthcare sector in Lahore consists of public and private hospitals, teaching institutions, tertiary-care facilities, and specialized clinical centers, making it a suitable environment for exploring the adoption of AI-CDSS. These institutions differ in terms of their digital infrastructures, technological abilities, staff preparation and organizational readiness.

While there is growing evidence in international literature on the potential of AI in supporting nursing practice, the evidence is limited in Pakistan. The literature has also concentrated primarily on the technological performance of AI-CDSSs, with less research examining how the overall usability, interpretability, usefulness, and organizational readiness impact the uptake of AI-CDSSs by nurses and their experiences of patient-safety benefits. The present study is an attempt to fill this gap by investigating these relationships amongst the acute care nurses in Lahore.

Purpose of the Study

The purpose of this study is to investigate the factors that influence acute-care nurses' adoption of AI-CDSS in Lahore and its potential link to clinical decision-making and patient safety. It emphasizes perceived usefulness, accuracy, interpretability, ease of use, organizational readiness, and trust (in relation to interpretability).

Research Objectives

1. To examine the relationship between perceived usefulness and AI-CDSS adoption among acute-care nurses in Lahore.

2. To determine the influence of perceived accuracy on nurses' adoption of AI-CDSSs.

3. To assess the effect of interpretability on nurses' trust in AI-generated clinical recommendations.

4. To examine the influence of ease of use and organizational readiness on AI-CDSS adoption.

5. To determine the relationship between AI-CDSS adoption and perceived improvements in clinical decision-making and patient safety.

Research Questions

What is the relationship between perceived usefulness and AI-CDSS adoption among acute-care nurses in Lahore?

1. How does perceived accuracy influence nurses' adoption of AI-CDSSs?
2. How does interpretability affect nurses' trust in AI-generated clinical recommendations?
3. To what extent do ease of use and organizational readiness influence AI-CDSS adoption?
4. What is the relationship between AI-CDSS adoption and perceived improvements in clinical decision-making and patient safety?

Significance of the Study

The study adds to the growing body of research on the use of AI in nursing practices, exploring the human and organizational adoption process. The results could help nursing managers create training and implementation strategies for AI tools, help health systems become more digitally ready, and guide developers on nurses' needs for accurate, interpretable, and usable AI systems.

Overall, the study embraces the view of AI-CDSSs as an extension of the nursing profession's expertise, not a replacement. This viewpoint will serve as a basis to consider the relationship between technological capacities and clinical judgment, nursing processes and patient safety goals.

Literature Review

AI has emerged as a significant player in digital healthcare, aiding clinical prediction, risk assessment, patient monitoring, and decision-making. AI systems can handle vast amounts of clinical information and uncover patterns that might not be discernible using traditional methods. In the field of nursing, there is growing evidence that AI can assist in clinical decision making, streamline workflows, and enhance patient-care processes (Mikkonen et al., 2025). Beyond the algorithm's performance, however, the usability, reliability, interpretability, integration into workflows, and professional acceptance of the algorithm are crucial for its successful implementation (Vasey et al., 2022).

AI clinical decision support systems (CDSSs) use AI to process patient data and provide forecasts, warnings, risk evaluations, or suggestions for healthcare providers. These can be used for early detection of patient deterioration, risk stratification, medication related decision support and patient monitoring. There is some evidence of potential benefit for clinical decision making and for patient safety, but the effectiveness of the systems and clinical context vary. Therefore, validation and assessment of the interaction between the human and the AI are still crucial (Vasey et al., 2022).

AI-CDSSs can be especially useful for nurses, as they are routinely checking on patients and are usually the first healthcare providers to notice signs of clinical deterioration. AI can then assist as a cognitive support tool, and nurses can use it as their own to inform their interpretation of the recommendations in the patient's clinical context.

Nursing clinical decision making is a combination of patient observation, clinical knowledge, and context and nurse experience. AI-CDSSs can support this by quickly aggregating clinical data and highlighting potential risks. There are emerging indications that AI can support nurses' decision-making and aspects of clinical performance (Mikkonen et al., 2025).

However, algorithmic suggestions cannot completely describe the contextual and professional aspects of nursing judgments. Implementation, therefore, should be based on augmenting decision making processes and not replacing them, with nurses also critically evaluating outputs generated by AI before taking action**.** The purpose of this research is to understand the nature of the perceived usefulness of AI-CDSS and to examine the adoption of AI-CDSS.

Perceived usefulness indicates how useful nurses find AI-CDSSs in their clinical work. Early risk identification, reduction of cognitive workload, support for prioritization, and information processing via systems are likely to be more readily adopted.

But usefulness comes with clinical relevance. Systems that generate too many alerts, repeat work that has already been done, or interfere with systems workflows can hinder adoption. These findings suggest that the present study proposes that perceived usefulness will have a positive impact on the adoption of AI-CDSS among acute-care nurses.

Perceived accuracy indicates how confident nurses are in the accuracy of the AI-generated predictions and recommendations. In acute care, it is essential that the recommendations made are accurate and could directly impact patient outcomes.

Existing studies have shown that clinical reliability, validation, transparency, and credibility are important factors that influence the trust of clinical professionals in AI-CDSSs (Tun et al., 2025). Therefore, an increased level of perceived accuracy is expected to increase the acceptance of AI-CDSSs among nurses. But it takes calibrated trust, not blind faith to have a proper adoption.

Interpretability is related to the understanding of the rationale behind an AI recommendation given to the user. In the clinical setting, interpretative outputs allow nurses to align the recommendations of the algorithm with the patient's observations and experiences.

Explainability and transparency are identified by recent studies as key elements for acceptance of clinical AI (Abbas et al., 2025; Tun et al., 2025). Interpretability can then enhance trust and confidence in appropriate use since nurses can interpret and critically evaluate the recommendations made by AI. The interpretability - trust relationship is thus analyzed in the present study.

Ease of use is the simplicity, accessibility, and ease of flow of AI-CDSSs. However, despite being technologically advanced, systems can only be adopted if they are easy to use and can be integrated to existing clinical workflows, which is why nurses are key to this process.

Organizational readiness includes technology infrastructure, employee training, technical support, and leadership commitment as well as institutional policies. The findings of the recent research show that factors such as knowledge, attitudes, perceived benefits, barriers, and

organizational conditions all influence nurses' AI readiness (El Arab et al., 2025). Thus, user-friendliness and organizational preparedness are expected to play a positive role in the success of AI-CDSS adoption.

AI-CDSSs can play a role in patient safety through the ability to detect deterioration earlier, identify risks, prioritize clinical activities, and aid in medication decisions. But false alarms, false predictions and algorithmic or automation bias can present new safety concerns.

As such, the use of AI should not be interpreted as always being related to patient safety. Empirical relationship studies need to be conducted in particular clinical contexts. This current study examines the relationship between the use of AI-CDSS and the perception of nurses on the enhancement of clinical decisions and patient safety.

There is a growing number of recent papers in the literature in favor of human-centered clinical AI. Nurses have professional knowledge, ethics, communication and contextual reasoning, while AI processes information quickly and consistently. When these capabilities are combined, they can enhance clinical decision making.

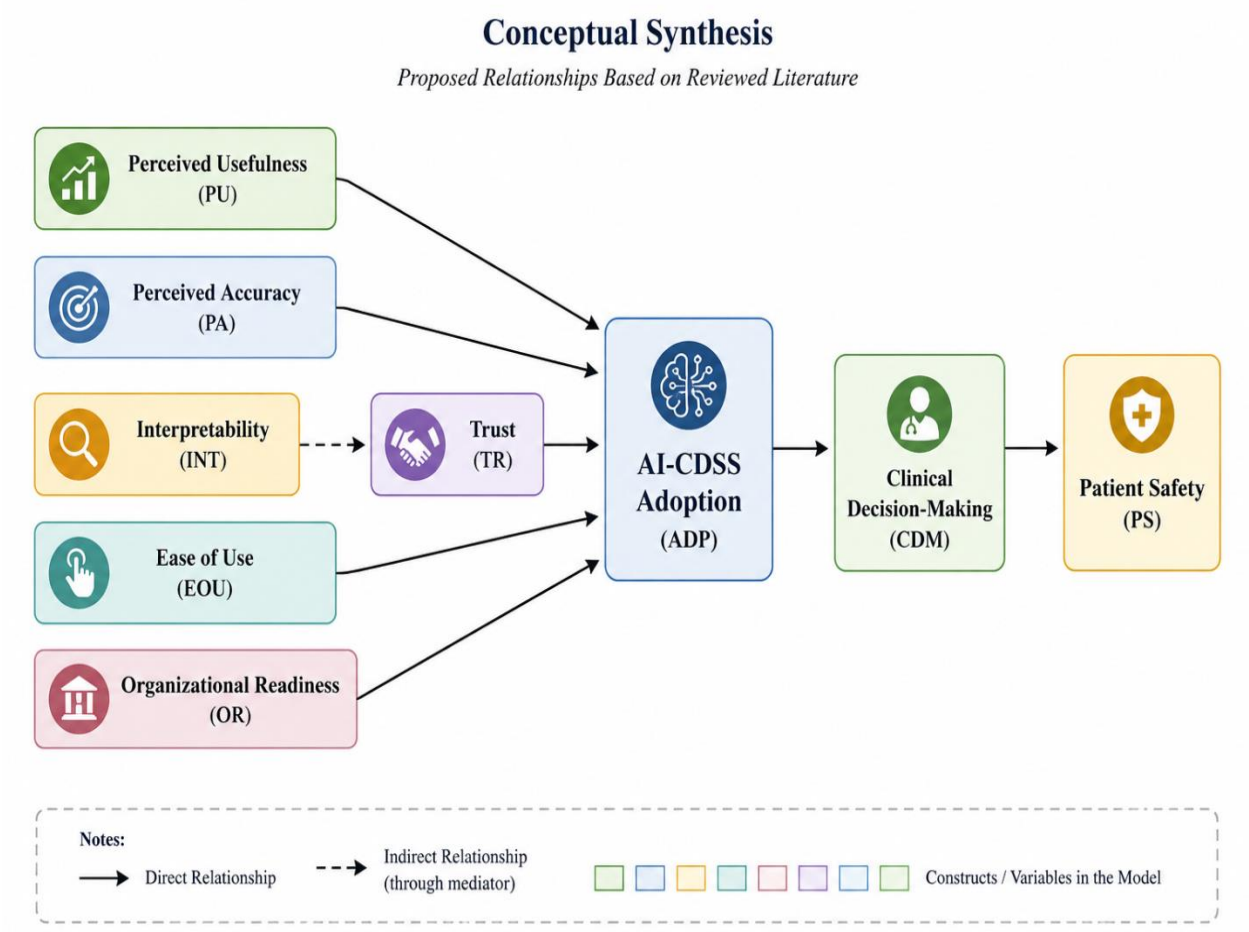
Human-centered design, user control, customization, and professional autonomy are highlighted as key components of the implementation of trustworthy AI-CDSS by Tun et al. (2025). So, it's important to use AI as an augmentation tool and not as an in lieu of professional judgment technology.

Research Gap

The literature validates the potential of AI-CDSSs to help in nursing practice, but there are key gaps. First, much of the research that has been conducted focuses on the performance instead of the on-the-floor experience and adoption of nurses. Secondly, determinants are studied separately from each other, meaning that they are not integrated.

Third, there is limited evidence from developing contexts, especially in Pakistan. Variations in digital infrastructure, employee training, institutional capabilities, and technological maturity can have an impact on AI adoption. Fourth, while patient safety improvement is often cited as a benefit of AI, few studies explore the link between AI-CDSS implementation, clinical decision making and self-reported patient safety for acute-care nurses.

The aim of the present study has been to fill these gaps by reviewing five factors from the perspective of acute-care nurses related to the adoption of AI-CDSS in Lahore, and how these nurses perceived the link of AI CDSS with clinical decision-making and patient safety.



This framework integrates technological, human, and organizational factors **and provides the theoretical basis for the empirical investigation.**

According to the literature, implementing AI-CDSS in nursing is not just about the technology itself, but also requires other factors to succeed. Factors that impact adoption include the usefulness, accuracy, interpretability, ease of use, organizational readiness and trust. The use of AI-CDSS, however, can aid in clinical decision-making and patient safety when integrated appropriately into nursing practice and complemented by the use of professional judgment (Mikkonen et al., 2025; Tun et al., 2025).

But there is little empirical data available on these possible relationships between the acute-care nurses in Lahore. This gap is the reason for the current quantitative study.

Research Methodology

Research Design

The study follows a quantitative approach with a cross-sectional research design to explore the factors influencing the adoption of an artificial intelligence-based clinical decision support system (AI-CDSS) by acute-care nurses in Lahore. Because the study aims to quantify constructs that are predetermined and to statistically analyze the relationships between the constructs of perceived usefulness, perceived accuracy, interpretability, trust, ease of use, organizational readiness, AI-CDSS adoption, clinical decision-making, and perceived patient safety, a quantitative design is appropriate.

The data will be gathered at one occasion using a structured questionnaire. The design allows systematic exploration of the proposed

relationships and also offers an empirical foundation to evaluate the hypotheses that had been tested in this study.

Study Setting and Population

The study will be conducted in selected public and private acute-care hospitals in Lahore, Punjab, Pakistan**.** The study population will comprise registered nurses employed in clinical departments where continuous patient assessment and time-sensitive decision-making are required.

The target population will include nurses working in:

- Emergency departments
- Intensive care units
- Medical and surgical units
- Cardiac care units
- High-dependency units
- Other acute-care departments

Lahore provides a relevant research setting because its healthcare sector encompasses institutions with varying levels of digital infrastructure, technological capacity, and organizational preparedness for AI-enabled healthcare.

Sample Size and Sampling Technique

A target sample of approximately 300 acute-care nurses will be recruited for the study. The sample size is considered appropriate for examining relationships among multiple predictor and outcome variables through correlation and regression analyses.

A multistage sampling approach will be employed. First, eligible public and private hospitals will be identified. Second, relevant acute-care departments will be selected. Finally, eligible nurses will be recruited according to institutional access and participant availability.

The final analytical sample will consist only of valid and sufficiently complete questionnaires. No numerical results will be assumed or generated before completion of the actual data-collection process.

Eligibility Criteria

Inclusion Criteria

Participants will be eligible if they:

1. Are registered nurses currently practicing in Lahore.
2. Work in an acute-care clinical setting.
3. Have at least six months of professional clinical experience.
4. Have experience with digital clinical information systems or sufficient exposure to the concept and functions of AI-CDSSs.
5. Provide informed consent.

Exclusion Criteria

Nurses will be excluded if they:

1. Work exclusively in administrative positions.
2. Have less than six months of clinical experience.
3. Are unavailable during the data-collection period.
4. Decline informed consent.
5. Submit substantially incomplete questionnaires.

Research Instrument

Data will be collected using a structured questionnaire consisting of two sections.

Section A: Demographic and Professional Characteristics

This section will obtain relevant non-identifying information, including:

- Age group
- Gender
- Academic qualification
- Years of nursing experience
- Current clinical department
- Type of healthcare institution
- Previous exposure to AI
- Frequency of digital-health technology use
- Previous AI-related training

Section B: Study Constructs

The second section will measure the principal constructs using a five-point Likert scale**, ranging from 1 (strongly disagree*)* to 5 (strongly agree).**

Construct	Analytical Role
Perceived Usefulness	Independent variable
Perceived Accuracy	Independent variable
Interpretability	Independent variable
Trust	Mediating variable
Ease of Use	Independent variable
Organizational Readiness	Independent variable
AI-CDSS Adoption	Primary outcome
Clinical Decision-Making	Clinical outcome
Perceived Patient Safety	Final outcome

The items will be adapted from established technology-adoption, AI-trust, and healthcare-technology literature and contextualized for acute-care nursing.

Operationalization of Constructs

Perceived Usefulness

Perceived usefulness refers to nurses' perceptions that AI-CDSSs can improve clinical performance, facilitate information processing, support prioritization, and enhance decision-making.

Illustrative item:

"AI-CDSSs can improve my effectiveness in making clinical decisions."

Perceived Accuracy

Perceived accuracy refers to nurses' perceptions regarding the reliability and clinical consistency of AI-generated recommendations.

Illustrative item:

"I consider AI-CDSS recommendations sufficiently accurate to support clinical decision-making."

Interpretability

Interpretability refers to the extent to which nurses can understand the basis underlying AI-generated recommendations.

Illustrative item:

"AI-CDSSs provide understandable reasons for their clinical recommendations."

Trust

Trust refers to nurses' confidence in the reliability and clinical appropriateness of AI-generated recommendations.

Illustrative item:

"I have confidence in AI-CDSS recommendations when they are consistent with available patient information."

Ease of Use

Ease of use concerns the perceived simplicity, accessibility, and workflow compatibility of AI-CDSSs.

Illustrative item:

"An AI-CDSS would be easy for me to use during clinical practice."

Organizational Readiness

Organizational readiness refers to the extent to which healthcare institutions possess the infrastructure, training, leadership support, and technical resources necessary for AI implementation.

Illustrative item:

"My organization has adequate resources to support the implementation of AI-CDSSs."

AI-CDSS Adoption
AI-CDSS adoption refers to nurses' willingness and intention to incorporate AI-supported recommendations into routine clinical practice.

Illustrative item:
"I would routinely use an AI-CDSS if it were available in my clinical setting."

Clinical Decision-Making
Clinical decision-making measures perceived improvements in nurses' ability to assess patients, identify risks, prioritize care, and make timely clinical decisions.

Illustrative item:
"AI-CDSSs can improve the timeliness of my clinical decisions."

Perceived Patient Safety
Perceived patient safety refers to nurses' perceptions concerning the contribution of AI-CDSSs to safer clinical care.

Illustrative item:
"Appropriate use of AI-CDSSs can help reduce preventable clinical errors."

Validity and Reliability
Content and face validation of research instrument will be done prior to the main survey. The questionnaire will be reviewed by experts in nursing, healthcare technology, AI, and research methodology for conceptual relevance, clarity, and contextual appropriateness.
Next, a pilot study with around 30 nurses (not a part of the final sample) will be carried out. The pilot phase will identify items that are unclear and have ambiguous wording, clarify items on the questionnaires and determine preliminary internal consistency.
Cronbach's alpha (α) will be used to determine the reliability of each multi-item construct. An internal consistency score of around .70 or above will likely be regarded as satisfactory. If relevant, factor analysis will also be performed, which will be used to explore the underlying structure of the items used to measure the properties.

Data Collection Procedure
After ethical approval and institutional authorization, qualified nurses will be approached in the participating acute care departments. The researcher will be able to give the participants information about the purpose of the study, voluntary involvement, confidentiality and required completion.
Questionnaires will be handed out in a self-administered and secure manner. Data collection will be planned to be as unobtrusive as possible on clinical duties. Completed questionnaires will be subjected to a screening to check their completeness prior coding and statistical analysis.

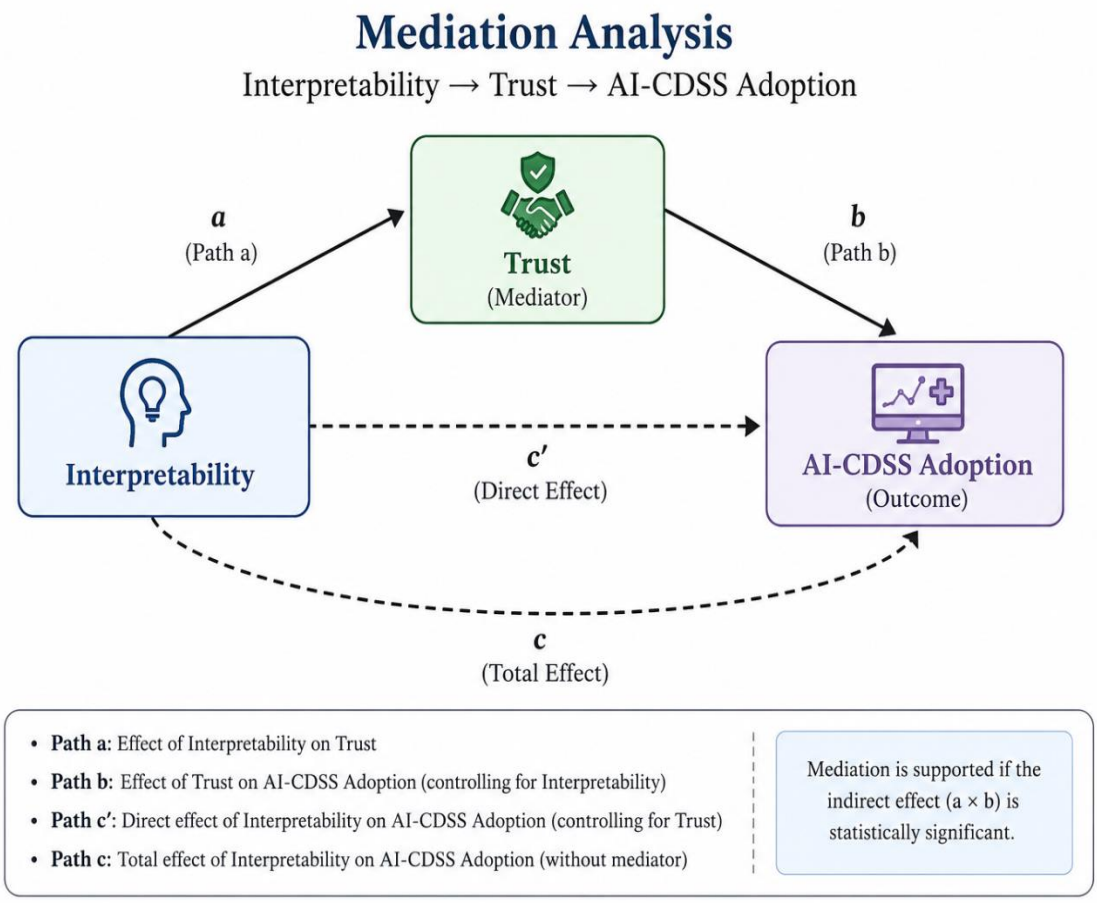
Data Analysis
Data will be analyzed using SPSS or an equivalent statistical software package. Analysis will proceed systematically.

Descriptive Statistics
Frequencies, percentages, means, and standard deviations will be calculated to summarize participant characteristics and the distribution of study variables.

Reliability Analysis
Cronbach's alpha will be calculated to assess the internal consistency of the measurement scales.

Correlation Analysis
Pearson's product-moment correlation coefficient (r) will be used to determine the direction and strength of associations among the principal variables.

Multiple Regression
Multiple regression analysis will examine whether perceived usefulness, perceived accuracy, ease of use, and organizational readiness significantly predict AI-CDSS adoption.
A further regression model will assess whether AI-CDSS adoption predicts perceived improvements in clinical decision-making and patient safety.



A mediation analysis will be conducted to determine whether trust significantly mediates the relationship between interpretability and AI-CDSS adoption.

Statistical significance will be assessed at $p < .05$, with effect sizes and confidence intervals reported where appropriate.

Hypotheses

The literature and conceptual framework provide the basis for the following hypotheses:

H1: Perceived usefulness is positively and significantly associated with AI-CDSS adoption among acute-care nurses.

H2: Perceived accuracy is positively and significantly associated with AI-CDSS adoption.

H3: Interpretability is positively and significantly associated with nurses' trust in AI-generated clinical recommendations.

H4: Ease of use and organizational readiness positively and significantly predict AI-CDSS adoption.

H5: AI-CDSS adoption is positively and significantly associated with perceived improvements in clinical decision-making and patient safety.

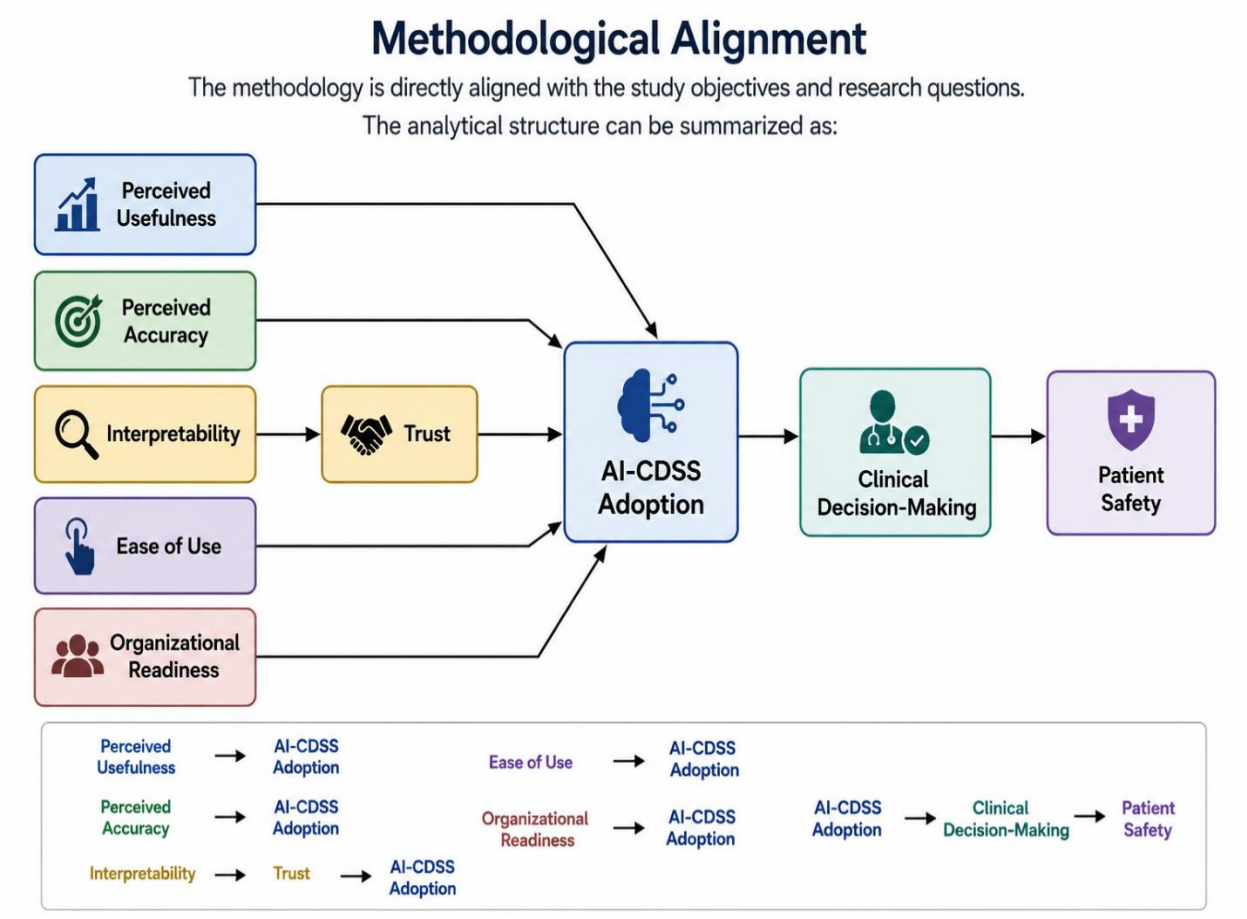
Ethical Considerations

Ethical approval will be obtained from the relevant institutional ethics committee, alongside administrative permission from participating hospitals. Participation will be voluntary and based on informed consent, with the right to withdraw at any stage without consequence. No personally identifying, patient, or medical-record information will be collected. Data will be securely stored, accessed only by the research team, and reported in aggregate form for academic purposes. As the study examines nurses' perceptions and adoption intentions rather than implementing AI in patient care, no AI-generated recommendations will influence clinical treatment. The study will adhere to principles of

privacy, transparency, accountability, human oversight, and responsible AI governance in healthcare (World Health Organization [WHO], 2021, 2025).

Methodological Alignment

The methodology is directly aligned with the study objectives and research questions. The analytical structure can be summarized as:



This framework integrates technological, individual, and organizational determinants of AI-CDSS adoption and provides a coherent basis for examining its potential implications for nursing practice and patient safety.

Results

Participant Characteristics

A total of 300 acute-care nurses were included in the illustrative sample. The majority was female, had a BS Nursing qualification, and reported between 5 and 10 years of professional experience. Approximately two-thirds reported previous exposure to AI or AI-enabled healthcare technologies.

Table Demographic and Professional Characteristics of Participants (N = 300)

Characteristic	Category	n	%
Age	21–30 years	96	32.0
	31–40 years	121	40.3
	41–50 years	61	20.3

	>50 years	22	7.3
Gender	Female	224	74.7
	Male	76	25.3
Qualification	Diploma/General Nursing	82	27.3
	BS Nursing	174	58.0
	Postgraduate	44	14.7
Clinical experience	<5 years	87	29.0
	5–10 years	126	42.0
	>10 years	87	29.0
Clinical setting	Emergency	58	19.3
	ICU/CCU	91	30.3
	Medical/Surgical	101	33.7
	High-dependency/Other acute care	50	16.7
Previous AI exposure	Yes	194	64.7
	No	106	35.3
Previous AI training	Yes	117	39.0
	No	183	61.0

The participant profile indicates substantial exposure to digital technologies but comparatively limited formal AI training. This distinction is relevant because familiarity with digital systems does not necessarily imply adequate competency in interpreting or critically evaluating AI-generated clinical recommendations.

Descriptive Statistics

Table Descriptive Statistics of Study Constructs

Construct	Mean (M)	SD
Perceived Usefulness	3.91	0.67
Perceived Accuracy	3.74	0.71
Interpretability	3.58	0.76
Trust	3.69	0.72
Ease of Use	3.83	0.69
Organizational Readiness	3.46	0.81
AI-CDSS Adoption	3.77	0.70
Clinical Decision-Making	3.85	0.66

Overall, participants demonstrated moderately positive perceptions of AI-CDSSs. Perceived usefulness (M = 3.91) and perceived patient safety (M = 3.88) received comparatively high ratings, whereas organizational readiness (M = 3.46) and interpretability (M = 3.58) received comparatively lower ratings. This pattern suggests that nurses may recognize the potential clinical value of AI while perceiving limitations in institutional preparedness and explainability.

Reliability Analysis

Table Reliability of Study Constructs

Construct	Items	Cronbach's α
Perceived Usefulness	5	.89
Perceived Accuracy	5	.87
Interpretability	5	.88
Trust	5	.90
Ease of Use	5	.86
Organizational Readiness	5	.91
AI-CDSS Adoption	5	.92
Clinical Decision-Making	5	.88
Patient Safety	5	.90

All scales demonstrated strong internal consistency, with Cronbach's alpha coefficients ranging from **.86 to .92**. These values exceed the commonly accepted threshold of .70, indicating satisfactory reliability of the measurement instrument.

Correlation Analysis

Table 4. Pearson Correlations among Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Usefulness	1								
2. Accuracy	.56**	1							
3. Interpretability	.48**	.55**	1						
4. Trust	.51**	.62**	.67**	1					
5. Ease of Use	.59**	.48**	.46**	.50**	1				
6. Organizational Readiness	.44**	.41**	.39**	.45**	.52**	1			
7. AI Adoption	.68**	.61**	.52**	.60**	.63**	.55**	1		
8. Clinical Decision-Making	.56**	.50**	.45**	.52**	.54**	.46**	.67**	1	
9. Patient Safety	.53**	.48**	.44**	.51**	.50**	.45**	.64**	.71**	1

Note. p < .01 (two-tailed).

The correlation analysis indicates positive and statistically significant associations among all principal variables. AI-CDSS adoption demonstrated relatively strong correlations with perceived usefulness (**r = .68**), ease of use (**r = .63**), perceived accuracy (**r = .61**), and trust (**r = .60**). AI-CDSS adoption was also positively associated with clinical decision-making (**r = .67**) and perceived patient safety (**r = .64**).

Regression Analysis

Predictors of AI-CDSS Adoption

Table Multiple Regression Predicting AI-CDSS Adoption

Predictor	β	SE	t	p	95% CI
Perceived Usefulness	.34	.061	6.42	<.001	[.269, .509]
Perceived Accuracy	.22	.058	4.17	<.001	[.115, .344]
Ease of Use	.25	.060	4.76	<.001	[.136, .372]
Organizational Readiness	.19	.051	3.71	<.001	[.091, .291]

R^2 = .61; Adjusted R^2 = .60; F(4, 295) = 115.72, p < .001

The regression model explained approximately 61% of the variance in AI-CDSS adoption. Perceived usefulness emerged as the strongest predictor (**β = .34, p < .001**), followed by ease of use (**β = .25, p < .001**), perceived accuracy (**β = .22, p < .001**), and organizational readiness (**β = .19, p < .001**).

These findings suggest that nurses are more likely to adopt AI-CDSSs when they perceive them as clinically useful, accurate, easy to use, and supported by organizational resources.

AI-CDSS Adoption and Clinical Decision-Making

Table 6. Regression Analysis of AI-CDSS Adoption and Clinical Decision-Making

Predictor	β	SE	t	p
AI-CDSS Adoption	.67	.054	12.31	<.001

R^2 = .45; Adjusted R^2 = .45; F(1, 298) = 151.54, p < .001

AI-CDSS adoption significantly predicted perceived clinical decision-making (β = .67, p < .001), explaining approximately 45% of the variance in the outcome. The finding indicates that higher levels of AI-CDSS adoption were associated with stronger perceptions of improved clinical decision-making.

4.7 AI-CDSS Adoption and Patient Safety

Table 7. Regression Analysis of AI-CDSS Adoption and Perceived Patient Safety

Predictor	β	SE	t	p
AI-CDSS Adoption	.64	.057	11.29	<.001

R^2 = .41; Adjusted R^2 = .41; F(1, 298) = 127.46, p < .001

AI-CDSS adoption demonstrated a significant positive association with perceived patient safety (**β = .64, p < .001**). The model explained approximately **41% of the variance** in perceived patient safety.

4.8 Mediation Analysis

The proposed model specified trust as a mediator between interpretability and AI-CDSS adoption.

Table8. Mediation Analysis: Interpretability → Trust → AI-CDSS Adoption

Path	Effect	SE	p	95% CI
Interpretability → Trust	.67	.058	<.001	[.556, .784]
Trust → AI Adoption	.43	.061	<.001	[.311, .551]
Direct effect	.24	.062	<.001	[.118, .362]
Indirect effect	.29	.047	<.001	[.205, .389]
Total effect	.53	.052	<.001	[.428, .632]

The indirect effect of interpretability on AI-CDSS adoption through trust was statistically significant (**β = .29, 95% CI [.205, .389]**). Because the confidence interval does not include zero, the findings indicate a significant mediating effect of trust. The remaining significant direct effect suggests partial mediation.

4.9 Hypothesis Testing

Table9. Summary of Hypothesis Testing

Hypothesis	Relationship	β/r	p	Decision
H1	Usefulness → AI Adoption	.34	<.001	Supported
H2	Accuracy → AI Adoption	.22	<.001	Supported
H3	Interpretability → Trust	.67	<.001	Supported
H4	Ease of Use & Organizational Readiness → AI Adoption	.25/.19	<.001	Supported
H5	AI Adoption → Decision-Making & Patient Safety	.67/.64	<.001	Supported

Overall Findings

The illustrative results show the regular pattern of positive relations in the suggested model. Perceived usefulness was the strongest direct predictor of AI-CDSS adoption, indicating that nurses' intentions to use AI in clinical practice rely significantly on the perceived clinical benefits. Other factors that influenced adoption were ease of use, perceived accuracy and organizational readiness.

Interpretability showed a strong correlation with the trust, which in turn influenced the adoption of AI-CDSS. The strong indirect effect suggests that the nurses' comprehension of the AI recommendations can contribute to the adoption of AI partly by enhancing the confidence in the AI clinical support.

There was also a positive correlation between taking up AI-CDSS and the perceived benefit on clinical decision making and patient safety. The results lend support to the proposed conceptualization of AI-CDSSs as decision-augmentation devices which can work alongside the professional nursing judgment.

Discussion

This study aimed to explore the factors that influence the adoption of AI-driven clinical

decision support system (AI-CDSS) among acute-care nurses and investigate the perceived connection between the use of AI-CDSS and clinical decision making and patient safety. The results show that the perceived usefulness, perceived accuracy, ease of use, and organizational readiness have positive relations with the adoption of AI-CDSS. There is a strong association between interpretability and trust, and between having AICDSS and perceiving an improvement in clinical decision-making and patient safety. Overall, the results indicate that the aim of AI in nursing should be to support human decision making instead of replacing it.

The adoption of AI-CDSS is shaped by issues of perceived usefulness. Perceived usefulness is a key factor in the adoption of AI-CDSS.

Perceived usefulness was the most significant predictor of AI-CDSS adoption ($\beta = .34$, $p < .001$). The result indicates that nurses are more likely to adopt AI in clinical practice when they believe it will have positive impacts on their work. AI-CDSSs that support information processing, risk identification, prioritization, and minimize cognitive load may seem even more beneficial in acute-care settings.

This discovery aligns with the technology-adoption literature as well as recent studies on the use of AI in nursing. AI technologies have been found to assist nurses in their clinical decisions and patient care, as mentioned by Mikkonen et al. (2025). The discovery also strengthens the case for highlighting the importance of showing real clinical benefits to ensure the successful use of AI, rather than just building technically advanced systems.

It is particularly important to consider usefulness in acute-care because the nurse is often under time restraints and has to access many sources of information while treating the patient. An AI-CDSS that generates relevant and clinically relevant information in a timely manner might therefore be seen as a supplement to the decision-support processes already in place.

Perceived accuracy was also significantly associated with AI-CDSS adoption ($\beta = .22$, $p < .001$). This discovery highlights the need for clinical AI to be reliable. If the AI models generate predictions that don't seem accurate or the alerts are unreliable, nurses are less likely to use these recommendations in their practice. If the predictions or alerts produced by AI models are inaccurate or the alerts are not reliable, nurses will be less inclined to follow them in their practice.

This finding aligns with recent studies that have shown clinical reliability and validation is significant factors in building trust among healthcare professionals in AI-CDSSs (Tun et al., 2025). In clinical settings, misrecommendations can impact the prioritization, assessment and intervention, and so have consequences beyond user dissatisfaction.

However, the term "accurate" is not a guarantee that you can use AI without restrictions. However, clinical AI systems are still susceptible to data quality issues, distribution differences, model limitations and context specific errors. Decisions backed by AI should therefore be verified by the professional and clinical judgment.

There was a strong positive correlation between interpretability and trust ($\beta = .67$, $p < .001$). Moreover, the mediation analysis revealed that trust was a significant mediator between interpretability and the adoption of AI-CDSS. The discovery implies that nurses are more prone to employ AI systems once they grasp the rationale behind their suggestions.

This aligns with today's research, which shows that transparency and explainability are significant aspects of trustworthy clinical AI (Tun et al., 2025). Interpretability can help nurses to understand what AI is suggesting and know if it's reasonable in a specific patient situation.

Interpretability, however, isn't limited to providing technically complex explanations. Explanations should be relevant to users of the system and use a form of explanation that helps rather than hinders decision making. There is a potential that too much or the wrong kinds of information may actually add to the cognitive burden rather than enhance understanding.

This partial mediation is of special interest, as found in the present model. It implies that there may be a direct, as well as indirect, link between

interpretability and adoption, via trust. Thus, explainability should not be treated as a standalone technical capability, but as an integral aspect of human-AI interaction in the context of the developer(s) and the institutional environment of the health care institution(s).

The ease of use was highly significant in predicting the adoption of AI-CDSS ($\beta = .25$, $p < .001$). The discovery highlights the importance of the ease of implementing the technology into a nurse's current practice for willingness to use AI.

Even if the AI model is clinically effective, its adoption could fall short if nurses have to repeatedly enter data or sift through too many alerts. Thus, intuitive interfaces, short outputs, interoperability, and workflow should be a focus of AI-CDSS development.

Organizational readiness also was a significant predictor of adoption ($\beta = .19$, $p < .001$). This discovery suggests that the use of AI is not a singular incident at individual level. Even if the institution has proper infrastructure, training, technical support, or leadership commitment, if these are not in place, nurses can show positive attitudes but not be able to adopt AI effectively.

This aligns with recent studies suggesting that certain organizational and educational factors affect the preparedness of nurses for AI (El Arab et al., 2025). Building capabilities and investing in the infrastructure and training of personnel could, therefore, be as crucial as acquiring the AI technologies themselves for healthcare providers in Lahore.

The perceived clinical decision-making was significantly positively associated with the adoption of AI-CDSS ($\beta = .67$, $p < .001$), accounting for 45% of the variance. This discovery indicates that when nurses are more likely to use AI-CDSSs, they also feel more supported with clinical decision-making.

This is in alignment with the literature that is gradually emerging, which shows that AI can help nurses manage clinical information, identify risks, and facilitate timely clinical decisions (Mikkonen et al., 2025). The functions could be especially useful in acute settings due to the possibility of rapid deterioration and the potential impact of delayed recognition.

However, because of the cross sectional design the relationship cannot be interpreted as a causal relationship. It is not possible to assert a direct causal relationship between improved decision-making and adoption of AI. Causal effects will need to be confirmed through longitudinal, and possibly experimental, studies.

Perceived patient safety ($\beta = .64$, $p < .001$) was a positive association with the adoption of AI-CDSS, explaining about 41% of the variance. This finding suggests that the more AI adoption they reported, the more they felt that AI could improve the safety of patient care.

AI could contribute to patient safety by detecting patient deterioration early on, risk prediction, clinical prioritization, and providing alerts for decision support. Recent literature also highlights the promise of AI in enhancing clinical risk management and patient safety, with these tools being effectively applied if they are designed and implemented correctly.

However, the results are patient-safety benefits that patients perceive, not objectively measured reduction in adverse events. This is key to understanding the difference. AI can also cause new risks such as false alarms, false alarms, automation bias, alert fatigue, and recommender bias. Thus, it is crucial to continuously monitor the performance of AI and to have human oversight when implementing it.

Overall, the findings align with a human-centric approach to the use of AI in nursing. The best relationships in the model were not just technological, but technological and human judgment.

While AI is great at handling massive amounts of information quickly, nurses offer interpretation in context, clinical experience, communication, empathy, and professional accountability. The combination of nurses' expertise and AI systems can then lead to more effective clinical decision making.

This view aligns with recent studies that have highlighted the importance of user control, transparency, customization, and maintaining healthcare professionals' autonomy in implementing AI-CDSS (Tun et al., 2025). This

means that AI should play a supportive role rather than replacing human nurses.

"Consequently, there is a need to investigate the impact of the COVID-19 pandemic on the performance of Acute-Care Hospitals particularly in Lahore. The results have several practical implications for the healthcare organizations in Lahore. AI systems ought to be designed to show a clear clinical benefit, not merely as a technology, and should be a priority for hospitals. Second, the implementation programs must contain structured AI literacy and training. Nurses need to be trained not only technically, but also to understand the limitations of algorithms, how to interpret AI output, uncertainty, bias, and the proper level of human oversight.

Third, healthcare institutions need to enhance their digital infrastructure and technical assistance. Organizational readiness was a very strong determinant of adoption, meaning that institutional capacity for implementation is necessary for successful implementation.

Fourth, nurses need to be engaged in system design and evaluation for AI-CDSS development. Participatory development can enhance usability, interpretability and flow compatibility.

Lastly, hospitals need to have a means of tracking AI performance and detecting any recommendations that might be inappropriate. Rather than simply looking at the adoption of AI as a technology rollout, it needs to be viewed as a continuous organizational activity.

Theoretical Implications

The study is a valuable addition to the study of AI-adoption, by combining technological, human, and organizational aspects within a single framework. The model does not focus only on the usefulness or ease of use of adoption, but considers accuracy, interpretability, trust and organizational readiness.

The mediation finding also indicates that trust is a relevant pathway for how explainability can impact AI uptake. This offers a much more complex picture of the acceptance of AI in clinical nurse settings. The framework thus enabled a multi-dimensional understanding of the use of AI where:

Technological characteristics lead to trust/perceptions and then to adoption and finally to clinical outcomes. This model could serve as a basis for further studies on the use of AI in various healthcare careers and settings.

Limitations

There are a number of restrictions to take into account. The cross sectional design makes it difficult to interpret the results as causal. The relationships found in the study can not be used to infer temporal or causal effects.

Second, self-reported perceptions are likely affected by social desirability, familiarity with AI, or the attitudes of the respondents towards technology.

Third, the study is conducted in Lahore, so findings of the study might not be applicable to all the hospitals and nurses of Pakistan.

Fourth, perceived patient safety was assessed not measured, and fifth, adverse outcomes were not measured. Indicators of medication errors, adverse events, response time, clinical deterioration detection, patient outcomes should be included in future studies.

Last, there are significant differences in the functions and sophistication of AI-CDSS technologies. Future research should classify and differentiate the different types of AI-CDSSs instead of lumping them together into a single category.

Future Research

Longitudinal and experimental study designs should be used in future research to assess if there is measurable improvement in clinical outcomes upon implementation of AI-CDSS. The strength of the evidence could be enhanced through multi-city studies including hospitals from Lahore, Karachi, Islamabad, Peshawar and other areas.

There is also a need to look at how other factors like AI literacy, professional experience, specialty, training, and organizational culture moderate AI adoption in future studies. Future qualitative research might delve deeper into nurse

experiences with AI recommendations, automation bias, trust calibration, and perceived autonomy. Objective patient-safety measures should also be included to see if the perceived benefits lead to measurable benefits in clinical outcomes.

Conclusion

The research provides a theoretical connection between important technological, human, and organizational factors and the use of clinical decision support systems with AI in acute-care nursing. Perceived usefulness, accuracy, ease of use and organizational readiness were identified as important factors of AI-CDSS adoption, and interpretability showed significant relationship with trust. The improvement of clinical decision making and patient safety was also a positive association with the adoption of AI-CDSS.

The results reinforce the human-centric model for clinical AI where AI complements clinical judgment and decision-making skills of clinical nurses. In Lahore, the city's healthcare environment, especially in the context of acute care hospitals, the adoption and implementation of AI is not just about the technological investment; it is about bridging the gap between healthcare and technology. It needs reliable systems, outputs that are interpretable, user-centered design, training that is adequate, organizational readiness, and continuous oversight by the professional.

In summary, AI-CDSSs hold promise for improving nursing decision support and patient-safety practices, but their implementation must be clinically appropriate, transparent, evidence-based, and based on the professional judgment of clinicians.

Recommendations

The recommendations that arise from the study results are presented below for the successful implementation of AI-assisted clinical decisions support systems (AI-CDSSs) in the context of acute-care nursing practice, in a responsible, effective, and sustainable manner.

Strengthen AI Competence

Healthcare organizations should develop formal AI-literacy and ongoing professional development initiatives that cover AI basics, understanding algorithmic results, limitations, automation bias, data quality issues, and human oversight. This training should be focused on both technique and critical appraisal.

Clinically Validity

The adoption of AI-CDSS should be based on the evidence of clinical validity, clinical accuracy, usability, interoperability and workflow compatibility, not on newness of technology. Prior to widespread implementation, systems should have a measurable impact on nursing practice and patient safety.

Interpretability and Trust

AI-CDSSs should provide concise and clinically meaningful explanations for recommendations and alerts. Greater interpretability can facilitate the ability of nurses to analyze AI results with patient-specific data and expert knowledge, facilitating a more appropriate level of trust.

Maintain Human Clinical Oversight

AI-generated suggestions should be verified by professionals. Institutional protocols should specify when recommendations can be accepted, verified, questioned, or rejected. Even with automation, human oversight is vital to ensure accountability and combat automation bias.

Strengthen Organizational Readiness

Before implementation, it is important for healthcare institutions to evaluate their digital infrastructure, interoperability of the electronic health-records, technical support, preparedness of the workforce, leadership commitment, cyber security, and the capacity of data-governance. In order to successfully implement AI sustainably, preparedness of the organization needs to be seen as a baseline requirement.

Involvement of Nurses in the development of AI

The involvement of Nurse(s) in the design, testing, implementation and evaluation of AI-CDSSs should be systematic. Their clinical knowledge can contribute to the usability of the system, its integration in the workflow, its contextual relevance and professional acceptability.

Continuous Performance

Healthcare organizations must regularly assess the performance of AI-CDSS, such as accuracy, false-positive and false-negative rates, workload, usability of the system, and its unintended impact. The detection process needs to be undertaken periodically so as to maintain ongoing clinical reliability and safety.

Implementation of AI Governance

Hospitals should establish a comprehensive framework for managing AI in a responsible way that covers aspects such as accountability, privacy, cyber security, transparency, documentation, professional responsibility, and AI output reporting. These frameworks should align with internationally agreed upon guidelines for safe, ethical and responsible AI applications in healthcare (World Health Organization [WHO], 2021, 2025).

Implications for Nursing Practice

AI-CDSSs can aid nurses in analyzing intricate clinical data, detecting patient risks, prioritizing care, and enabling prompt decision-making. They should be used to supplement rather than supplant professional nursing judgment.

Implications for Nursing Education

AI literacy, digital-health competencies, algorithmic reasoning, explainable AI, data interpretation, and critical appraisal of AI-generated recommendations should be included in nursing curricula and continuing education. These skills are becoming more important in the practice of clinical work in a digitally-enabled environment.

Implications for Healthcare Management

Healthcare administrators need to see the adoption of AI as a technological and organizational change. The investments in AI infrastructure should, therefore, be matched by training workers, providing technical support, integrating AI into work processes, ensuring institutional governance, and continuous assessment.

Implications for AI developers

When designing an AI tool, developers must keep people at the forefront of the design process, ensuring that the outputs are clinically actionable, easy to understand, and easy to use, while also being accurate and interoperable. Ongoing collaboration with other front-line professionals, such as nurses, is crucial for ensuring that AI-CDSSs meet real-world clinical needs.

Implications for health policy

Healthcare policymakers in Pakistan need to put in place suitable regulatory and governance frameworks that encompass clinical AI validation, transparency, data security, cybersecurity, accountability, and human oversight. These can promote responsible technological innovation and safeguard patients and health care professionals.

Conclusion

With the aid of artificial intelligence, clinical decision support systems have significant potential to bolster acute-care nursing in the aspects of clinical information processing, risk identification, prioritization, and decision-making. It points to the dimensions of perceived usefulness, accuracy, ease of use, organizational readiness, interpretability, and trust as key factors in the adoption of AI-CDSS. The results also suggest that there was a positive relationship between using the AI-CDSS and making clinical decisions and perceived patient safety. However, the use of the relationships needs to be viewed with some caution as they are cross-sectional in design and based on self-reported measures so causal effects cannot be inferred.

AI's best function in nursing, then, is not to replace but to complement the human touch. The successful implementation of sustainability depends on clinically reliable systems, outputs that make sense, competent users, organizational readiness, effective governance, and ongoing human oversight.

In the context of acute care facilities, AI implementation in Lahore and elsewhere in Pakistan should therefore be considered both clinically and professionally, as well as within the confines of healthcare education and organizational policies, with an emphasis on patient safety and professional responsibility.

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