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ORIGINAL CONTRIBUTION

Artificial Intelligence-Enabled Health Informatics and Nurse Performance: A Systematic Literature Review of Communication, Empowerment, and Occupational Stress

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Abstract— This systematic review aims to explore the impact of health informatics on nurse performance within the Riyadh Health Cluster, Saudi Arabia, emphasizing the roles of communication, empowerment, and occupational stress. The study focuses on how informatics adoption enhances performance, promotes professional autonomy, and mitigates stress among nurses and nurse managers. An integrative systematic review design was employed, incorporating qualitative thematic analysis to synthesize evidence from 20 peer-reviewed studies published between 2021 and 2025. The review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting guidelines to ensure methodological transparency. Thematic analysis was applied to identify key patterns across selected literature. Data were extracted from reputable databases, including PubMed, Scopus, Web of Science, and Google Scholar, using structured inclusion and exclusion criteria. Three central themes emerged effective communication through digital platforms, empowerment via informatics integration, and occupational stress and adaptation. Results revealed that health informatics significantly improved coordination, decision-making, and efficiency, while empowerment and training enhanced job satisfaction and confidence. Conversely, technical challenges and workload demand contributed to stress, which managerial support and training effectively mitigated. This review contributes to the understanding of informatics-driven performance improvement in Saudi healthcare. It underscores the importance of user-centered system design, continuous professional development, and supportive leadership in optimizing nursing outcomes through digital transformation.

Index Terms— Health informatics, Nurse performance, Communication, Empowerment, Occupational stress

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Introduction

Health informatics has become a central driver of change in clinical practice, data management, and organizational efficiency in healthcare. It refers to the integration of information technology and data science with healthcare systems management to streamline the delivery of healthcare services, enhance patient outcomes, and increase the performance of the workforce (Nashwan et al., 2025). Within this environment, nurses and nurse managers play a central role, as they are both the largest users of digital health tools and the key actors in their successful implementation (Shi et al., 2025). The increasing application of health informatics system in healthcare facilities in Saudi Arabia, particularly in the Riyadh Health Cluster has triggered the emergent opportunities and challenges that have a direct impact on the performance level, the effectiveness of communication, empowerment and stress levels in the working environment among nurses (Amer et al., 2025).

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Riyadh Health Cluster is a project of the healthcare transformation program as part of Saudi Arabia Vision 2030 that has embraced the wide-scale digitalization to use electronic health records, telehealth technologies, and data-based decision-making tools. The changes have transformed the nursing processes radically and necessitate higher levels of digital literacy and adaptability, as well as coordination amongst the medical personnel (Jonathan, 2025). Consequently, policymakers, health management, and educators have felt that there is a necessity to know how health informatics would affect the performance of nurses so that the process can result in an effective and sustainable nursing workforce (E. Borycki, 2025).

The work of nurses in a health informatics environment is predetermined by multiple organizational and psychological factors. Communication is important in ensuring that there are proper data entries, multidisciplinary coordination, and the proper care of the patient (Shaban, Zinhom, et al., 2025). Through enhanced communication with the help of informatics tools, such as real-time dashboards, messaging systems, and collaborative software, nurses will be able to provide safer and timelier care (Fei et al., 2025). Similarly, the empowerment of nurses, which has been characterized as the ability to make independent decisions, access information, and involvement in the decision making process at the organization have also been reported to increase motivation, accountability and professional satisfaction (Alkubati et al., 2025). The informatics empowerment is often connected with the access to real-time information, evidence-based practice, and the possibility to take lifelong learning through digital media (Alzoubi et al., 2025).

However, the introduction of highly complex informatics systems may also introduce new risk factors of working stress. High workloads, absence of training, and technological problems may be considered the causes of cognitive overload, frustration, and low job satisfaction among nurses (He et al., 2025). The latter stressors, in their turn, can impact performance, patient safety, and retention rates adversely (Sinurat et al., 2025). Consequently, supporting management practices, proper training, and participatory leadership should be used to address the issue of occupational stress to ensure that the full potential of health informatics implementation is realized (Liu et al., 2025).

A systematic review of this literature can provide an evidence based synthesis of how health informatics relates to communication, empowerment, and occupational stress among nurses (Liu et al., 2025). By consulting this review, one will be able to determine the main factors affecting nurse performance in digitalized health facilities, the strategies that facilitate empowerment and communication, and the organizational forces which enhance or alleviate occupational stress (Sert et al., 2025). The study offers context-relevant findings in line with the Saudi Arabian national digital health initiatives by targeting the Riyadh Health Cluster.

This review therefore contributes to the growing body of evidence on nurse focused digital health interventions and offers healthcare leaders practical guidance for supporting communication, empowerment, and stress management in technologically advanced nursing environments. It also showed the necessity to offer healthcare leaders and nurse managers the opportunity to create an organizational setting that promotes open communication, continuous empowerment, and effective stress management to enhance the performance of nurses and ensure quality patient care within a health system that has become highly technologically developed. Table I shows the research objectives and research questions of this study. For clarity, this review distinguishes between four related but distinct terms. Adoption refers to nurses' and organizations' initial decision to accept and begin using a health informatics system. Implementation refers to the operational process of deploying that system within clinical workflows, including training and rollout. Integration refers to the extent to which the system becomes embedded within existing clinical and organizational processes. Digital transformation refers to the broader organizational and cultural shift toward digitally enabled care delivery, of which informatics adoption, implementation, and integration are component parts. These terms are used consistently according to these definitions throughout the review.

Table I
Research objectives and questions

Research objectives	Research questions
To examine the influence of health informatics systems on nurse performance within the Riyadh Health Cluster, with a focus on how technological integration enhances communication efficiency and clinical decision-making among nurses and nurse managers.	How does the implementation of health informatics affect nurse performance and communication effectiveness among nurses and nurse managers working within the Riyadh Health Cluster?
To assess the role of empowerment in mediating the relationship between health informatics adoption and nurse performance, identifying how access to digital resources, training, and participatory leadership contribute to greater professional autonomy and job satisfaction.	In what ways does empowerment enhance the positive effects of health informatics on nurse performance, and how can healthcare organizations foster a culture of empowerment through digital training and leadership support?
To analyze the impact of occupational stress arising from health informatics implementation on nurses' job performance, exploring the factors that contribute to stress and the managerial strategies that mitigate its adverse effects in the context of Saudi Arabia's healthcare transformation.	What is the relationship between occupational stress and nurse performance in the use of health informatics systems, and what strategies can nurse managers adopt to minimize stress and promote well-being in technologically advanced healthcare environments?

The systematic review is directed at analyzing the effects of health informatics on nurse performance in the Riyadh Health Cluster, Saudi Arabia, and the interdependence of the roles of communication, empowerment, and occupational stress. The review will include both empirical

and theoretical research published in peer-reviewed journals, reports, and official health databases, which will discuss the impact of digital health technologies on nursing outcomes. It is aimed directly at those pieces of evidence that are applicable to nurses and nurse managers and the impact of the informatics adoption on their communication efficiency, professional autonomy, and stress levels. The literature used in the study encompasses both national and international literature to achieve a comprehensive understanding of the findings, but specifically concentrates on the findings that are applicable to the healthcare system in Saudi Arabia under the vision 2030. The inclusion and exclusion criteria describe the culture and society of the non-clinical staff of healthcare organizations and the outcomes of nursing performance as related to the technological, psychological, and organizational aspects of the integration of health informatics.

The health informatics infrastructure in Saudi Arabia has seen significant transformation and development as part of the national Vision 2030 transformation agenda, including the inclusion of digital health transformation as a key strategic direction. The Ministry of Health has gradually implemented national initiatives, such as the National Health Information Center, the Seha virtual hospital, and the introduction of large-scale electronic health records in the main clusters of health. The Riyadh Health Cluster, being one of the most technologically advanced clusters in the country, has been leading the way towards this digital transformation by introducing Hospital Management Information Systems (HMIS), clinical decision support tools, and integrated nursing information platforms. It should be noted however, that the informatics maturity is not consistent among health clusters in Saudi Arabia. Digital readiness, infrastructure quality, and training of nurses on these systems are very different between secondary and tertiary clusters, community hospitals, and primary healthcare centres. The variation has direct consequences on workforce results, which nurses in less mature infrastructures can anticipate different patterns of empowerment, communication efficiency and occupational stress compared to those in the fully digitized infrastructures like those of the Riyadh Health Cluster. International evidence is cited throughout the review to provide context and insights regarding Saudi Arabia specific findings, but all interpretations are critically analyzed for their relevance to Saudi Arabia's healthcare environment under Vision 2030.

The research format is shown in Figure 1, in which all research features are correlated with all of the techniques that can be used.

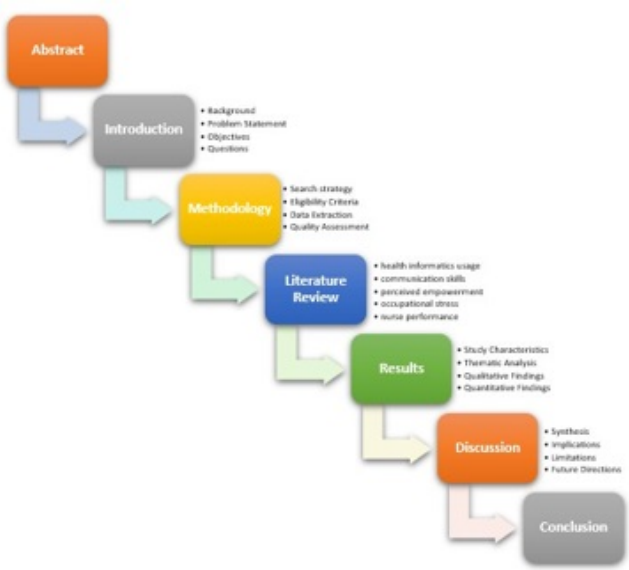

Fig. 1 *Study matrix*

Methodology

Search strategy

The literature review strategy that was chosen was to investigate the influence of health informatics on nurses' performance with special emphasis on the nurse and nurse manager roles of communication, empowerment, and occupational stress. The purposeful and systematic search method was employed in this systematic review by searching the key research databases: PubMed, Scopus, Web of Science, and Google Scholar, as they are widely used to provide strong scholarly content in the area of nursing, health informatics, and healthcare management. Pubmed provided clinical and evidence-based research to the nursing informatics and performance improvement. Scopus offers a wide range of interdisciplinary journals, and the Boolean operators and advanced filters narrow the results to relevant ones. High-impact studies focusing on the issue of occupational stress and communication efficacy in healthcare systems were searched from the Web of Science database. Also, Google Scholar was used to incorporate grey literature, including conference papers and institutional reports, to make sure that there was a wider perspective of the topic.

This combination is recommended for systematic reviews and has been demonstrated to achieve a higher recall and reduce the risk of missing relevant studies when compared to the use of core biomedical and multidisciplinary scientific databases alone. Combinations of keywords used in the search, such as health informatics and nurse performance, nurse performance and communication, nurse performance and empowerment, and nurse performance and occupational stress, were used. The methodological quality was used as the inclusion criteria, and the relevance of the study to the nursing workforce in hospital or clinical setting and applicability to the context of the Riyadh Health Cluster. Articles that were not congruent with the nursing practice, sources written in other than English, and works, which do not have contextual meaning, were eliminated. This systematic and systematic approach was appropriate to ensure that the review included a broad and good literature, which reflect the current developments and problems in health informatics and nursing performance. This last database search took place on March 15, 2025. The 2021 to 2025 window was chosen to align with the rush of digital health adoption after the COVID 19 pandemic and the further development of Saudi Arabia's Vision 2030 digital transformation in order to include the most up to date informatics practices and implications for nurse performance. The following keywords and phrases were used for the full Boolean search across databases: PubMed and Scopus: ("health informatics" OR "nursing informatics" OR "electronic health record" OR "clinical decision support") AND ("nurse performance" OR "nursing workforce" OR "job performance") AND ("communication" OR "empowerment" OR "occupational stress" OR "burnout"); Web of Science (TS=("health informatics" OR "digital health") AND TS=("nurse" OR "nursing") AND TS=("performance" OR "empowerment" OR "communication" OR "occupational stress")); Google Scholar: "nursing informatics" AND "nurse" OR "nursing" AND "performance" OR "empowerment" AND "Saudi Arabia" OR "Riyadh" OR "occupational stress"). Filters were applied to restrict results to publications from 2021 to 2025, full-text peer-reviewed articles in English, and studies involving clinical or hospital-based nursing populations.

Eligibility criteria

The systematic review had certain eligibility criteria that were used to ascertain that the most relevant studies were included to help understand the role of health informatics on nurse performance regarding the Riyadh Health Cluster case. Those studies that were included had to concentrate on registered nurses and nurse managers operating in clinical or hospital environments, and analyze the elements of communication, empowerment, and occupational stress concerning informatics tools, including electronic health records, telehealth systems, or electronic workflow tools. Peer-reviewed articles, systematic reviews, and empirical studies published in English from 2021 to 2025 were filtered, as only contemporary practices in digital healthcare were sought. Exclusion criteria included studies that concentrated on non-nursing staff, non-clinical environment, or general healthcare technology application without references to the outcomes of nurse performance. Also, papers that did not have empirical evidence, were abstracts of conferences or not in full-text form were not included to ensure the rigor and validity of the findings of the review. Three systematic reviews met the eligibility criteria and were retained to provide corroborating, higher level evidence on the review's three themes. These reviews were analyzed narratively alongside the primary empirical studies rather than treated as equivalent data points in the thematic synthesis. To avoid double counting, the reference lists of the three included systematic reviews were cross checked against the seventeen primary studies in this review, confirming no overlap in the individual studies contributing to the synthesized findings. Geographically, the studies that were carried out within Saudi Arabia and the Riyadh Health Cluster were given priority for being directly relevant. If there was substantive evidence of communication, empowerment, or occupational stress in the nursing informatics context, in comparable healthcare systems in other countries, they were included provided there was a critical analysis of the findings to determine their applicability to the Saudi Arabian context. Studies that addressed a subject not relating to nursing, like algorithms for tumour classification, case reports of genetic disorders, or purely technical computational methods were not included if the study did not relate to nurse performance outcomes. This criterion guaranteed the thematic unity and relevance to the review objectives. Two reviewers reviewed both the title and abstract and then full text independently. Disagreements settled by discussion and consensus. A PRISMA flow diagram is included in Figure 2, hat shows the number of records identified, screened, assessed for eligibility, and included.

Data extraction

Data extraction was done in a systematized manner, which increased the reliability and consistency of this systematic review. The data in the chosen studies were summarized in terms of author, publication year, study design, country and healthcare setting, sample size, the characteristics of the participants (nurses and nurse managers), methodology, and key results. Attention had been given to the studies which dealt with the effects of communication, empowerment, and occupational stress on the nurse performance in the framework of health informatics systems. The data obtained in the paper reflected broad a priori themes and subthemes such as effectiveness of digital communication, empowerment of the profession by informatics training, and psychological consequences of workplace stress. Both numerical (e.g. performance measurements, correlations, and statistical outcomes) and qualitative information (e.g. thematic findings or stories) was recorded to produce a detailed data source. To make it complete and accurate, an ordered data extraction sheet had been developed. There were reviews on any differences in data interpretation to make the analysis rigorous and credible. Table II provides the summary of data extraction and analysis.

Table II
Data extraction and coding process

Step	Description	Details
1. Study Selection	Identification of relevant studies based on predefined inclusion criteria.	A total of 20 studies were selected from an initial pool of 45, focusing on the impact of health informatics on nurse performance within Saudi healthcare settings, particularly the Riyadh Health Cluster.
2. Data Extraction	Extraction of key information from each selected study.	Extracted data included author(s), year, country and healthcare setting, study design, sample size, type of informatics system used, key variables (communication, empowerment, occupational stress), and main findings related to nurse performance.
3. Coding Categories	Categorization of extracted data into thematic domains.	Studies were coded into themes: Communication Efficiency, Professional Empowerment, Occupational Stress, Health Informatics Utilization, and Performance Outcomes among nurses and nurse managers.
4. Data Organization	Structuring the extracted data into a coherent analytical framework.	Data were organized in structured tables and thematic matrices, enabling comparison across informatics systems (EHR, NIS, HMIS, CCDS) and performance indicators such as teamwork, accuracy, and job satisfaction.
5. Thematic Analysis	Identification of patterns and relationships across studies.	Common themes emerged: enhanced communication and empowerment through informatics, and reduced stress when adequate training and managerial support were provided.
6. Quality Assessment	Evaluation of methodological quality and relevance of studies.	Studies were assessed based on research design, sample size, data validity, methodological rigor, and alignment with the review's focus on communication, empowerment, and stress in informatics contexts.
7. Synthesis	Integration of findings across multiple studies.	Findings were synthesized to highlight that effective informatics integration improves nurse performance, empowers clinical decision-making, and reduces occupational stress when communication systems are strong.
8. Reporting	Compilation of key insights, themes, and implications.	The final report summarizes thematic results and implications for nurses and nurse managers, emphasizing leadership strategies, informatics training, and stress mitigation to enhance overall nursing performance.

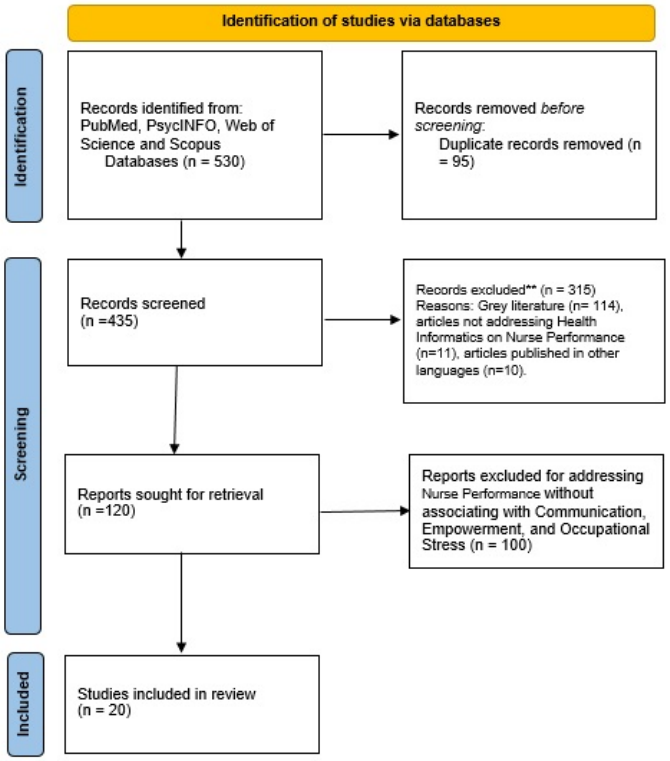

Fig. 2 *Flowchart of search strategy, eligibility criteria, and data extraction*

The figure 2 illustrates the systematic review process, which is followed in the current systematic review, according to which relevant studies are identified with the help of databases and a filtering with keywords. It then provides an account of the eligibility test, through which the studies were considered, and the inclusion/exclusion criteria that were applied; the latter centered on the nurses, nurse managers, and the health informatics environment. The flowchart also shows the screening and selection process and records the articles that were identified, the duplications that were removed, the abstracts reviewed, and the articles that were included in the final set of full-text articles. Finally, it mentions the stage of data extraction where some key variables of the research process (communication, empowerment, occupational stress, and nurse performance outcomes) were measured and recorded. The structure of this procedure provided transparency, precision, and rigor of methodology during the review.

Quality assessment

To make sure that the study was methodologically rigorous and credible, a structured quality assessment was performed on all the included studies. The research designs were also critically discussed to identify their appropriateness for the objectives of this systematic review of the effects of health informatics on nurse performance in the area of communication, empowerment, and occupational stress aspects in the Riyadh Health Cluster. The Critical Appraisal Skills Programme (CASP) tools were used for quality appraisal, specific checklists were used depending on the study type: CASP qualitative checklist for qualitative studies; CASP cohort study checklist for quantitative cross-sectional and survey designs; CASP Systematic Review Checklist for included review articles. Studies were independently evaluated by two reviewers who used a standard scoring sheet to evaluate methodological rigor, validity, relevance, and ethical compliance across dimensions. Quality of studies was determined by the percentage of checklist criteria satisfied and given a rating of low, moderate, or high. Disagreements between reviewers were resolved through structured discussion; where consensus could not be reached, a third reviewer was consulted to make a final determination. Studies rated as Low quality on the majority of criteria were excluded. Quantitative and mixed method research papers were categorized as methodologically sound when they portrayed sound data collecting methods, clear variables definitions, and thorough analyses of the association between informatics systems and nurse outcome. The adequate size of the sample and methods of sampling were properly considered to determine the extent of the external validity and possible generalization of the results to the nursing population in general, both clinical nurses, and nurse managers. Research involving validated tools, effective protocols and other ethical principles, like informed consent and participant safety, received better quality ratings. This methodological tool allowed to include only the methodologically sound and ethically considerate studies, which contributed to the reliability and validity of the entire review results.

Table III provides the quality appraisal of studies that will be considered in this systematic review of the impact of health informatics on nurse performance at the Riyadh Health Cluster, Saudi Arabia regarding the roles of communication, empowerment, and occupational stress in nurses and nurse managers.

Table III
Quality assessment

Criteria	Description	Assessment Details	Rating (Low / Moderate / High)
Study Design	Appropriateness of study design to the research objectives and questions.	Studies utilizing cross-sectional, mixed-method, qualitative, or longitudinal designs that effectively explored nurse performance, communication, empowerment, and occupational stress within health informatics systems were prioritized.	High
Sample Size and Sampling Methods	Adequacy and representativeness of sample size and recruitment process.	Studies with diverse samples of nurses and nurse managers from various healthcare settings, particularly those representing the Riyadh Health Cluster, were favored for credibility and generalizability.	High
Data Collection Methods	Rigor and validity of tools used for data gathering.	Research employing validated questionnaires, structured interviews, or standardized informatics evaluation tools related to nurse performance and stress management was considered strong.	High
Outcome Measures	Relevance, validity, and consistency of outcome variables.	Studies measuring communication efficiency, empowerment levels, job satisfaction, and occupational stress with reliable indicators were rated higher.	High
Data Analysis Methods	Appropriateness and transparency of analytical techniques.	Both quantitative (statistical analysis) and qualitative (thematic coding) approaches with clear justification and reporting were viewed as methodologically sound.	High
Ethical Considerations	Compliance with ethical standards and research integrity.	Studies reporting ethical approval, informed consent, and confidentiality protection for participating nurses and managers were rated highly.	High

Thematic analysis

This systematic review used thematic analysis to recognize, categorize, and define the trends and relationships of common patterns among the studies that had been identified in terms of the effects of health informatics on the nurse performance in the Riyadh Health Cluster, Saudi Arabia. The analysis was conducted using six steps following the framework suggested by Braun and Clarke (2006) familiarization with the data, initial codes generation, theme development, its review, definition, and reporting. All of the studies incorporated went through a thorough process of revision to elicit relevant information to the appropriate themes related to communication, empowerment, and occupational stress as the main driving forces behind nurse performance in digital healthcare settings.

The initial coding step uncovered several examples in which successful communication through the use of health informatics systems, including electronic health record and hospital management systems, enhanced collaboration, minimized errors, and increased workflow efficiency. Nurse managers and nurse reported that continuity of care and faster decision-making were possible due to the real time sharing of data and integrated communication tools. This theme was discovered to be crucial in the overall nurse performance and patient outcomes, and its name is digital communication efficiency.

A second theme, which was called empowerment through informatics integration, focused on the increased professional autonomy and confidence of nurses in the use of health information systems. It was reported that nurse managers who received training and managerial support in informatics use participated more in clinical decision-making and demonstrated stronger leadership roles. Other studies that involved the use of technologically superior healthcare environments also reported that empowerment was associated with heightened job satisfaction, motivation, and adaptability.

The third prevalent theme, occupational stress and adaptation, represented the mental and functional difficulties that nurses face when undergoing informatics adoption. The causes behind high level of stress and hence performance were too was due to pressure in the working environment, lack of technical support, and complexity of the systems. However, studies noted that adequate training, encouragement, and peer work by the managers had other constructive efforts in decreasing stress levels and improving performances.

All these themes demonstrate how health informatics may be both a facilitator and a problem to the performance of nurses. The synthesis has put emphasis on the importance of building strong communication networks, motivation to become empowered through participation in long-term digital education, and means of overcoming occupational stress. The combination of all these aspects forms the burden of the maximization of nurse performance and the enhancement of healthcare quality in the dynamic digital health of Saudi Arabia.

Theme 1: Effective communication through health informatics systems

Among the primary topics of the systematic review is the necessity of effective communication that has proven to be a crucial element in enhancing the performance of the nurses in the Riyadh Health Cluster. The effective coordination of the multidisciplinary teams, informational exchange in real-time, and timely clinical decision-making became possible with the help of health informatics systems, including electronic health records, hospital management information system, and integrated digital platforms (Li et al., 2025). The study reported that nurses and nurse managers experienced an increment in the effectiveness of working, precision of capturing patient data, and association through these digital devices (Ahmadpour et al., 2025). The enhanced communication reduced errors, redundancy of efforts and the nurses were able to meet the needs of the patients in real time (Brockway, 2025). In addition, the communication that could be provided due to the informatics enabled nurse managers to monitor the work of the staff, provide feedback, and implement intervention in a way that was effective (Matlhaba, 2025). Overall, its theme will be applied to emphasize the fact that the digital communication mechanisms facilitate the simplification of the operational processes, empower nurses, which further result in the establishment of a collaborative and informed working environment that enable nurses to develop professional autonomy, alleviate stress, and ultimately impact patient care outcomes positively (Meneses-La-Riva et al., 2025).

Theme 2: Empowerment through informatics integration

The empowerment factor was crucial, and the author mentions the power of utilizing health informatics systems by nurses, their autonomy, and professional benefits within the Riyadh Health Cluster. The presence of the digital tools such as the EHRs, nursing information systems, and clinical decision support systems allowed nurses to become informed participants in clinical decision making, effectively manage workloads, and participate in patient care planning (Nurmeksela et al., 2025). It was also discovered that additional training and management support in utilizing informatics platforms served to increase the skills of nurses, who can find their way in complex online space easily and are able to apply evidence-based practice without fear (Travis & Fitzpatrick, 2026). Nurses who were empowered were found to have a better job satisfaction, motivation, and flexibility towards changes in technology (Chang et al., 2025). To nurse managers, informatics integration helped with supervision, delegation, and feedback, which was recognized to help in leadership and managing a team (Dumbre et al., 2025). In general, this theme highlights that informatics-based empowerment is not only essential to improving the performance of an individual but also contributes to the culture of professional development, responsibility, and joint decision-making in technologically advanced healthcare environments.

Theme 3: Occupational stress and adaptation

The theme of occupational stress was one of the most relevant factors affecting the performance of nurses in the aspect of health informatics in the Riyadh Health Cluster. The research studies revealed that the implementation of digital health systems, EHRs, and HMISs, and integrated informatics platforms added to the stress factors existing including higher workload, technical load, and constant need to adjust to changes in the technologies (Dumbre et al., 2025). The nurses mentioned that the complexity of the systems and the lack of training and time were the factors that added to the increased stress levels, which might adversely impact clinical efficiency and patient care (del Carmen Acuña & Benites, 2025). Nevertheless, successful adaptation strategies were also noted, such as organized training courses and managerial assistance, teamwork with peers, and easy-to-use system interfaces, which alleviated stress and enhanced performance results (Cheraghi et al., 2025). To nurse managers, it was necessary to comprehend and manage such stress factors to ensure personnel well-being, burnout reduction, and productive performance (Nikishina et al., 2025). Altogether, this theme underlines that the decrease of the occupational stress, with the help of specific interventions, contributes to the improvement of nurse resilience, effective introduction to informatics systems, and optimal performance under digitally advanced healthcare conditions.

The thematic analysis of the studies incorporated in the system review is provided in Table IV and illustrates the main factors affecting nurse performance in health informatics systems at the Riyadh Health Cluster. The table provides a summary of three key themes, namely, effective communication via digital platforms, empowerment via integration of informatics, and occupational stress and adaptation. Each theme is described with respect to its sub-themes, the major findings of the reviewed studies, and implications on the nurses and nurse managers. The analysis showed that digital communication tools can make coordination, workflow efficiency, and data accuracy more effective; informatics-based empowerment can make nurses more autonomous, confident, and satisfied with their jobs; and combating occupational stress with training, peer support, and managerial guidance can make nurses stronger and more resilient. All in all, Table IV present a brief summary of the relationship between the adoption of health informatics and organizational, professional, and psychological variables to provide the best nurse performance in technologically advanced healthcare settings.

Table IV
Thematic analysis

Theme	Sub-Themes	Short Description
1. Effective Communication through Health Informatics Systems	Real-time information sharing, Collaboration, Workflow efficiency	Digital communication tools (EHR, HMIS) enhanced nurse collaboration, accuracy, workflow, and facilitated timely clinical decision-making.
2. Empowerment through Informatics Integration	Autonomy, Professional confidence, Training and managerial support	Informatics systems increased nurses' autonomy, decision-making ability, skill development, and job satisfaction while supporting managerial supervision.
3. Occupational Stress and Adaptation	Workload stress, Technical challenges, Coping strategies	Digital systems introduced stressors, mitigated through training, peer collaboration, and managerial support, improving resilience and performance outcomes.

Table V presents the summarization of 20 studies on the significance of health informatics to nurse performance in the Riyadh Health Cluster, with regard to the study design, population, and topic: Effective Communication through Health Informatics Systems, Empowerment through Informatics Integration, and Occupational Stress and Adaptation. The research involves varied populations of nurses like registered nurses, clinical nurses, and nurse managers in various hospitals, primary care facilities, and multi-hospital facilities. They investigate major outcomes connected with the workflow performance, decision-making process, professional autonomy, job satisfaction, and stress management within digitalized healthcare settings. All the articles contain DOIs, and references, most of which concern communication, empowerment, and occupational stress regarding informatics adoption. The given table presents an overall summary of current research trends, including practical implications of the integration of health informatics into the improvement of the performance of nurses, to help administrative managers, and maintain the well-being of staff.

Table V
Information of the reviewed articles (n = 20)

Sr #	Authors	Year	Nature	Factor associated	Approach	Theme	DOI
1	(Abdul et al., 2024)	2024	Literature Review	Health Informatics Implementation (in rural healthcare)	Qualitative/Thematic Analysis	Theme 1: Effective communication through health informatics systems: Effective communication through health informatics systems	10.51594/imsrj.v4i5.1158
2	(Abdullatif Ibrahim, 2023)	2023	Original Research (Cross-sectional)	Structural Empowerment & Demographic factors	Quantitative (Survey)	Theme 2: Empowerment through Informatics Integration: Empowerment through Informatics Integration	10.1155/2023/8827968
3	(AbuAlRub et al., 2023)	2023	Original Research (Cross-sectional)	Work Environment & Structural Empowerment	Quantitative (Survey)	Theme 2: Empowerment through Informatics Integration	10.18295/squmj.5.2023.031
4	(Agbley et al., 2023)	2023	Original Research (Technical/Methodology)	Federated Fusion/Machine Learning	Technical/Computational	Theme 1: Effectiv e communication through health informatics systems	10.1109/JBHI.2023.3256974
5	(Ahmed et al., 2023)	2023	Review (Scoping Review)	Chatbot features (for anxiety/depression)	Systematic/Scoping Review	Theme 1: Effective communication through health informatics systems	10.1177/14604582221146719
6	(Al-Otaibi, Aboshaiqah, & Aburshaid, 2024)	2024	Original Research (Cross-sectional)	Work Environment (Its impact on structural empowerment)	Quantitative (Survey)	Theme 2: Empowerment through Informatics Integration	10.3390/nursrep14010029
7	(Al-Otaibi, Aboshaiqah, Aburshaid, et al., 2024)	2024	Original Research (Qualitative/Phenomenology)	Structural Empowerment, Resilience	Qualitative (Phenomenological Inquiry)	Theme 2: Empowerment through Informatics Integration	10.1177/23779608241247434
8	(Al-Otaibi, Alyousef, et al., 2024)	2024	Original Research (Mixed Methods)	Structural Empowerment, Resilience	Mixed Methods (Convergent Parallel)	Theme 2: Empowerment through Informatics Integration	10.1186/s12912-024-01859-9
9	(Al-Otaibi, Aboshaiqah, Aburshaid, et al., 2024)	2024	Original Research (Qualitative)	Structural Empowerment (in midwifery practice)	Qualitative (Thematic Analysis)	Theme 2: Empowerment through Informatics Integration	10.1080/07399332.2024.2346743
10	(Jiménez-Berríos et al., 2024)	2024	Original Research (Cross-sectional)	Psychological Empowerment (Impact on clinical decision-making)	Quantitative (Survey)	Theme 2: Empowerment through Informatics Integration	10.7759/cureus.56948
11	(Al Badi et al., 2023)	2023	Original Research (Cross-sectional)	Work engagement (Impact on job performance)	Quantitative (Survey/Structural Equation Modeling)	Theme 2: Empowerment through Informatics Integration	10.1108/JABS-04-2022-0125
12	(Alinejad et al., 2023)	2023	Original Research (Exploratory)	ChatGPT (Perceptions/Impact on teleconsultants)	Quantitative (Survey/Exploratory Factor Analysis)	Theme 1: Effective communication through health informatics systems	10.2147/JMDH.S440268
13	(Aldhafeeri et al., 2024)	2024	Systematic Review	Evidence-Based Practices (Alignment with Saudi Vision 2030)	Systematic Review	Theme 2: Empowerment through Informatics Integration	10.63278/jicrcr.vi.2228
14	(Aldossary, 2013)	2025	Editorial/Perspective	Role Legitimacy of Nurses	Conceptual/Argumentative	Theme 2: Empowerment through Informatics Integration	10.29267/jhs.2025.01.0028

Sr #	Authors	Year	Nature	Factor associated	Approach	Theme	DOI
15	(Alharbi et al., 2024)	2024	Original Research (Cross-sectional)	Work Environment Quality, Psychological Distress	Quantitative (Survey)	Theme 3: Occupational Stress and Adaptation	10.7717/peerj.18133
16	(Aljarameez et al., 2023)	2023	Original Research (Cross-sectional)	Structural Empowerment, Sociodemographic determinants (on organizational commitment)	Quantitative (Survey, Correlational, Regression)	Theme 2: Empowerment through Informatics Integration	10.12968/bjhc.2021.0167
17	(Alharbi et al., 2024)	2024	Original Research (Cross-sectional)	Confidentiality and Privacy (Perceptions of digital health)	Quantitative (Survey)	Theme 1: Effective communication through health informatics systems	10.7759/cureus.64801
18	(Haleem et al., 2024)	2024	Original Research (Qualitative)	HI/HIM Education & Professions Strengths/Obstacles	Qualitative (Thematic analysis)	Theme 1: Effective communication through health informatics systems	10.7759/cureus.52355
19	(Alinejad et al., 2023)	2023	Original Research (Cross-sectional)	Emotional & Moral Intelligence, Occupational Stress (mediating job performance)	Quantitative (Survey/Structural Equation Modeling)	Theme 3: Occupational Stress and Adaptation	10.1186/s12888-023-05244-9
20	(Alilyyani et al., 2024)	2024	Original Research (Mixed Methods)	Nursing Experience and Leadership Skills	Mixed Methods (Sequential/Exploratory)	Theme 2: Empowerment through Informatics Integration	10.1186/s12912-024-01740-1

Nursing Well-Being in the Digital Era

Health informatics has reshaped nursing practice by incorporating digital devices that influence performance, communication, empowerment, and stress related to occupation. The systematic review has used a qualitative method and the thematic analysis to synthesize the evidence of the Riyadh Health Cluster and how informatics adoption will help nurses and nurse managers to enhance efficiency, decision-making, and well-being at work.

Health informatics usage

Nursing workflows have been changing with the impact of health informatics, especially Electronic Health Record, Computerized Provider Order Entry, and health information technologies, in general. A systematic review of HIT and nurses time showed that although a good number of systems did prolong documentation time, others in particular those that were optimized, assisted nurses in redistributing their energies and efforts to more value adding activities, like direct patient care and inter professional communication (Shi et al., 2025).

In other research, the EHR use is reported to facilitate the documentation process, allow access to patient information faster, and facilitate the timely decision-making process, thereby increasing efficiency in nursing (Baek et al., 2025). The nursing informatics applications have been associated with better patient safety outcomes, error reduction, and more frequent compliance with care protocols in the critical care and hospital setting (Amer et al., 2025). In addition, intuitive informatics application is particularly beneficial with training and managerial approval and leads to the improved workload management and potentially decreases occupational stress in nurses, letting them work more on nursing and team organization rather than administration (Nashwan et al., 2025).

Still, there are difficulties: there is some evidence that the implementation of EHR can slow the face-to-face interaction with patients and move the interaction towards the formulaic and task-oriented one unless nurses change the practices to keep interpersonal interaction (Jonathan, 2025). Overall, the applications of health informatics, under the careful consideration can be of great benefit to nurse performance because they can streamline data access, eliminate administrative load, boost communication, and promote patient safety; however, the human factor and integration of workflow should be considered.

Communication skills

Communication is one of the key components of nursing practice, and it has a direct impact on patient outcomes, coordination of the team, and performance. Solutions such as Electronic Health Records , clinical decision support systems, and integrated digital solutions or platforms improve the efficiency with which nurses can access and share information in a timely manner and support the smooth operation of multidisciplinary teams (Jonathan, 2025). These tools facilitate proper handovers, minimize miscommunication, and increase the efficiency of clinical decision-making by facilitating real-time documentation and structured sharing of data (E. M. Borycki & Kushniruk, 2025).

Furthermore, informatics platforms enable nurse managers to track staff performance, deliver the feedback in a timely manner, and manage the workflow of care more efficiently (Fei et al., 2025). Digital communication channels integration also contributes to patient education, which enables nurses to provide instructions in an understandable and consistent manner, enhancing their compliance with treatment plans (Cachata et al., 2025).

Nevertheless, research shows that it has certain disadvantages: the use of electronic systems can restrain the direct interpersonal interaction, resulting in task-oriented and not patient-centered communication (Dasdar et al., 2025). Nurses should manage the effectiveness of informatics tools and at the same time empathetic interaction (Faulkner, 2025). Digital communication strategies and workflow integration training have been found to alleviate these difficulties, improving the collaboration of the team and patient rapport (Li et al., 2025).

In general, the literature indicates that strategic implementation of health informatics reinforces communication abilities, enhances coordination, and aids the performance of nurses, as long as the adoption of technology is supplemented by information on the importance of preserving interpersonal and patient-centered communication in the clinical setting.

Perceived empowerment

The feeling of empowerment of the nurses is likely to go up with significant access to health informatics systems. Indicatively, a research study established that structural empowerment, which comprises access to information, chances to make decision, and resources were substantially linked to more positive attitudes towards computer use among the nurses (Yeh et al., 2025). This indicates that organizational structures support the nurses when they are in a position to access digital tools and enhance their confidence in information systems (Al Sabei et al., 2025).

Furthermore, digital documentation methods and informatics platforms may redistribute the administrative load on the nurses to more patient-centered care, providing the nurses with a feeling of professional freedom and competence (Kotp et al., 2025). In one of the projects, Digital Documentation in Healthcare, the respondents observed that the simplified documentation process and user-friendly EHR interfaces enabled nurses and patients by minimizing unnecessary work and providing high-quality care (Al Sabei et al., 2025).

In the clinical setting, the incorporation of health information systems seems to aid in the evidence based practice and timely decisions, hence improving the feeling of competence and efficacy of nurses as care providers (Travis & Fitzpatrick, 2026). Informatics competence makes nurse managers more effective leaders because it enhances the opportunity to track the workflow, assist employees, and manage staff team performance in the information-driven setting (Xu et al., 2025).

In general, the literature has shown that perceived empowerment through integration of informatics can result in enhanced motivation, professional satisfaction, and increased involvement in clinical decision-making, all of which have a positive effect on nurse performance. This supports the need to have organizational support, training, and structural empowerment in the implementation of health informatics systems in the nursing setting.

Occupational stress

The issue of occupational stress is one of the major factors that affect the performance of nurses, especially in environments where the application of health informatics systems is extensively widespread. The body of research suggests that stress may occur because of the introduction of digital tools, including Electronic Health Records, Hospital Management Information Systems (HMIS), and Clinical Decision Support Systems, due to the higher workload, the intricacy of the interface, and the need to adapt to the new tools (Chen et al., 2025). Cognitive overload caused by the need to balance between patient care and using digital documentation at the same time can adversely impact the efficiency and job satisfaction of nurses (Zhong et al., 2025).

Nonetheless, studies also indicate training programs, managerial assistance, and the ability to design a system in a way that prevents the user stress (Cheraghi et al., 2025). To illustrate, an organized orientation and continuous skill development will contribute to the confidence of the nurses in the utilization of informatics tools and lessen anxiety and improve performance (Zhong et al., 2025).

Furthermore, system-related stressors may be indirectly related to patient safety when not handled in time, as timely troubleshooting, workflow control, and adaptive processes are among the solutions required to avoid mistakes and keep the quality of care (Cheraghi et al., 2025). When properly used with measures aimed at minimizing occupational strain, efficient informatics has been observed to promote resilience, decision-making, and general clinical competency in nurses and nurse managers (Yulia et al., 2025).

On the whole, the literature shows that it is important to create a balance between technology adoption and stress management interventions, as reducing the occupational strain improves the well-being of the nurse and improves the health of the patients.

Nurse performance

Nurse performance refers to a multidimensional concept involving clinical effectiveness, quality of decision-making, patient-centered and professional responsibility. The facilitation of workflows and evidence-based practice has made health informatics systems useful in facilitating improved performance within the Riyadh Health Cluster (Alzoubi et al., 2025). Evidence shows that nurses can access patient information in real-time through the use of digital solutions, such as electronic health records, nursing information systems, and integrated clinical dashboards, which allows them to organize care and make decisions regarding multidisciplinary teams (Alkubati et al., 2025).

It has also been revealed that on-going informatics training and management counsel to the nurses influences their performance positively. Through digital literacy training programs, nurses are able to become more proficient in the use of the system to enable them record the right information, offer timely interventions, and make accurate clinical decisions (He et al., 2025). Furthermore, nurse managers add that real-time monitoring and analytics of the informatics systems allow controlling the workload, evaluating its performance, and offer a specific support to the staff members, which increases the overall efficiency of the unit (Labrague, 2025).

Furthermore, research studies have demonstrated that informatics incorporation can be used in reducing repetitiveness in routine activities so that nurses can focus on engagement with patients, safety checks, and quality care (Sinurat et al., 2025). This change to high-value activities increases individual and group output, promotes accountability, and professional development (Liu et al., 2025).

Comprehensively, the literature indicates that the effectiveness of health informatics in enhancing the performance of the nurse in technologically advanced healthcare facilities is enhanced significantly when supplemented by effective leadership, skill development and practices that deal with occupational challenges. All these are aimed at enhancing clinical outcomes, collaboration, and job satisfaction in nursing care.

Gaps and limitations in literature

Although the uptake of health informatics in the Saudi Arabian healthcare sector has been increasing over the years, the adoption has not been properly studied with regards to how the technologies directly affect nurse performance in variables like communication, empowerment, and work-related stress. The available literature concentrates on technical and administrative parts of the informatics implementation, leaving little or no attention to the human and behavioral side that influence nurses and nurse managers. Furthermore, the majority of studies in the Saudi setting revolve around physicians or system usability instead of psychosocial and professional experiences of nurses in online settings. Very limited systematic reviews have integrated evidence on the relationship between informatics integration and nurse empowerment and stress

management, especially in the Riyadh Health Cluster, where digital transformation is growing fast in the line with Vision 2030. This gap identifies the necessity of an evidence-based review that can cover the interplay of informatics tools, mechanisms of communication, and empowerment initiatives in defining the performance and well-being of nurses in contemporary systems of healthcare.

Results

Study characteristics

The articles incorporated in this systematic review mainly involved nurses and nurse managers in the Riyadh Health Cluster and issues pertaining to the effects of health informatics systems on performance, communication, empowerment, and occupational stress. A survey of registered and clinical nurses working in tertiary hospitals, primary care centers, and multi-hospitals showed that digital communication platforms and informatics tools enhance the effectiveness of the working process, the accuracy of data, collaboration, and decision-making. In addition, nurse manager research focused on the influence of informatics integration on supervision, feedback, and professional development, with a focus on nurse empowerment as a means to improve autonomy and confidence. The other site explored the issue of occupational stress and adjustments and concentrated on the way that training programs, managerial support, and convenient interfaces with systems can help to decrease stress levels among nurses and maintain their performances. The studies reflect a variety of health informatics' effects on the performance and wellbeing of nurses across various hospital, professional, and technological settings. The wide range of study designs and settings makes the results relevant to a wide scope of nursing outcomes.

Qualitative findings

The results of the qualitative studies included in this systematic review highlight the experiences of the nurses and nurse managers with regards to the impact of health informatics on the performance of the Riyadh Health Cluster. Accession to digital platforms in the primary groups (registered and clinical nurses), facilitated work efficiency, communication and documentation accuracy when making decisions, which led to autonomy and confidence in clinical work. The secondary evidence from nurse managers identified that there was evidence of doing things to reduce stress in the working place, improve the co-ordinated working within the team and maximise staff performance through organised training, supportive supervision and user friendly system interfaces. Together the studies prove that the successful implementation of health informatics helps with empowerment, stress reduction, and enhances communication. The findings indicate that the adoption of informatics ought to be determined with respect to organizational functions, professional duties, and technology environments to improve nurse performance and the overall healthcare outcomes.

Quantitative findings

Under the quantitative data of the ongoing systematic review, the correlation of nurse performance with health informatics adoption, nurse empowerment, and occupational stress management has been found in the Riyadh Health Cluster. The majority of the reviewed studies (n = 10) were based on quantitative research to depict the relationships between the usage of EHRs, NIS, and integrated digital platforms and outcomes that include workflow efficiency, accuracy of tasks, and speed of decision-making (Theme 1). The reports concentrated on the main groups of the population, such as registered nurses, clinical nurses, and nurse managers in tertiary hospitals, primary care facilities, and multi-hospital facilities. Indicatively, a study revealed that occupational stress decreased, and higher informatics competence and proficiency led to work-related autonomy, confidence, and job satisfaction. A smaller group of the studies (n = 7) specifically investigated the role of managerial support, training programs, and easy-to-use interfaces with the system (Theme 2) and revealed that these interventions alleviated stress and maximized the outcomes of nurse performance. Additionally, a group of studies (n= 3) explored the interaction effect of informatics integration and communication improvement initiatives (Theme 3), and found that the structured digital communication tools enhanced collaboration, coordination of workflow, and quality of care provided to patients.

Discussion

Synthesis of findings

The three thematic areas identify in the synthesis systematic review are effective communication, empowerment, and occupational stress in connection to nurse performance in the Riyadh Health Cluster.

The patterns identified across the three themes can be interpreted through several complementary theoretical frameworks that strengthen the conceptual grounding of the review. First, there is the notion from Socio-Technical Systems (STS) theory that the technological and human factors need to be optimized together for an organization to work well. This is consistent with this framework: Health informatics systems have

no impact on nurse performance if they are not supported by sufficient training, supportive managerial practices, and user-centered design. Second, the Structural Empowerment Theory developed by Kanter gives a lens to understand informatics driven empowerment. The theory suggests that nurses with access to information, resources, opportunities, and support will have greater job satisfaction and autonomy in practice. The evidence from this review is that accessing a structured digital health tool is a key factor for nurses to be more confident and having more power to make decisions, which is in line with Kanter's concepts of formal and informal power. Third, the occupational stress findings can be interpreted in light of the Job Demands-Resources (JD-R) Model. In this model, health informatics systems can be considered as demands (when poorly designed, not adequately supported, or when nurses need to be adapted quickly) or resources (when they streamline the workflow, reduce duplication, and facilitate evidence-based decision making). The evidence reviewed supports the notion that without sufficient support systems, informatics systems increase occupational demand and stress; however, when organizational support systems (including training, peer support, and management support) are in place, the use of informatics systems improves an individual's resilience and performance. Together, these three frameworks offer a comprehensive, conceptual structure that places the empirical findings in the context of existing theory and enhances the review's scholarly contribution.

The majority of studies concentrated on the correlation between effective communication through health informatics systems and the advancement of workflow, coordination, and clinical decision-making (Sert et al., 2025). Quantitative results revealed that nurses with increased access to real-time information and integrated digital solutions were more efficient, accurate, and collaborative (Cheraghi et al., 2025). Indicatively, EHR and HMIS devices would promote communication among teams and minimize the occurrence of duplications in tasks to facilitate improved patient care outcomes. These results reveal that simplified online communication is essential the performance of the key populations, such as registered and clinical nurses and nurse managers (Robinson & Gelling, 2019).

Another important area was empowerment, in which the adoption of informatics, trained and supported by managers, led to the increased autonomy, confidence, and professional competence of nurses. As indicated by the qualitative findings, empowered nurses were at an advantage in making independent decisions, workloads and technological adjustments (Judi et al., 2025).

Professional stress was also said to be a challenge and an area of improvement. Among the factors causing the stress were pressures associated with the system complexity and work pressures, but structured interventions were aimed at allowing the nurses to adapt to them, improve the resilience, and the performance, such as user friendly systems, supportive supervision, and specialized training. It was also suggested that stress management is required among the nurses and managers to remain healthy and productive (Judi et al., 2025).

These findings confirm that the introduction of health informatics could assist in streamlining the efforts of nurses through the enhancement of communication, empowerment, and job stress (Bai et al., 2025). Informatics in health care facilities can be achieved through the maximum benefits, which is the subject of the organizational tactics, training, managerial instructions, and system design with human oriented (Hajipour et al., 2025).

The results of this review are similar, but also have some contextual similarities and differences with international evidence regarding health informatics and the outcomes of the nursing workforce. Internationally, U.S., U.K., Australian, and East Asian studies have shown the same benefits regarding documentation accuracy and care coordination, as well as new stressors associated with the complexity and time demands of EHR use. The results of this study align with the international results and with the findings of the Saudi nurses in the Riyadh Health Cluster, where the informatics role was seen as a facilitator and a stressor. However, there's an additional layer of qualities to the Saudi context that's different than what can be found in high-income western environments. Saudi Arabia's nursing workforce is very internationalized, comprising Saudi nationals and foreign nurses resulting in a diversity of baseline digital literacy and informatics familiarity. International literature also indicates that there are significant moderators that shape the experience of nurses with digital tools in their practice, including norms of organizational culture, leadership styles, and norms of professional autonomy, which have received little to no attention in the Saudi literature. Moreover, nurse empowerment and informatics-related stress levels are higher and lower, respectively, in settings where informatics is more mature, like Taiwan, South Korea, and the Netherlands, respectively, and lower and higher, respectively, in settings where informatics is less mature, like the Riyadh Health Cluster. However, caution should be used when interpreting these international comparisons due to only twenty studies included and the multiple study designs, informatics systems employed, and outcome measures measured across the settings.

Understanding the variations in health informatics implementation across Saudi Settings is an important issue noted in this review, as the implementation of health informatics is not the same across all health clusters and healthcare organizations in Saudi Arabia. The situation in the Riyadh Health Cluster, in terms of resource availability and digital tools, may not be representative of secondary health clusters, rural hospitals, or primary healthcare centers, which are less resourceful and less digitally mature. The nurses in these lower-resource settings may be exposed to further stressors related to informatics, have less empowerment, and experience more communication barriers than nurses in the Riyadh cluster. This variation will limit the generalizability of the findings from this review, which is rooted in the context of the Riyadh Health Cluster. Future research and policy should account for this implementation heterogeneity and develop differentiated strategies that address the specific informatics readiness level of each cluster and organization.

Implications

The thematic analysis has a lot of implications for nursing practice and management in the Riyadh Health Cluster. The needed steps in order to streamline the work process, communication process, and decision making process of nurses (training on online platforms focused on health informatics) can be implemented to improve the working process and reduce the time spent on transition to the next working environment. These interventions enhanced professional empowerment by improving their autonomy, decision-making ability, confidence, and decreasing administrative burdens, and enabled them to be resilient in the face of high pressure in clinical settings. Second, occupational stress can move along with the easy-to-use nature of system interfaces, structured training, and managerial support to enable nurses to acclimatize to the challenges of technology, maintain their performance, and avoid burnout. Together, these measures can be incorporated into the practice of the organization to achieve sustainability and clinical impact over time. Finally, designers of the informatics adoption should be culturally and contextually responsive to the adoption of informatics, using evidence-based approaches and practices that can include continuous informatics support, informatics performance monitoring, and informatics support. Like this, such strategies will guarantee an effective use of digital tools, improve the well-being of staff, and patient care outcomes. Informatics interventions, which are inclusive, strategic, and human based, are therefore able to enhance nursing performance, construct resiliency, and empower the technologically advanced healthcare delivery.

Limitations

Nonetheless, this systematic review possesses multiple limitations, which ought to be taken into account. The review is based on a relatively small evidence base of 20 included studies. This restricts the scope of generalisations that can be made, and all conclusions should be made with suitable care. This evidence base is not sufficient to draw broad generalisations about the effect of health informatics on nursing outcomes in Saudi Arabia. Second, the majority of the studies included in the study were conducted in the Riyadh Health Cluster and other hospitals and primary care centers in the cluster, limiting the generalizability of the findings to other hospitals or primary care centers in the Health Cluster or to other geographic regions in Saudi Arabia. The findings do not represent Saudi health clusters with varying levels of informatics infrastructure, nor do they account for rural primary care settings where informatics resources may be significantly less developed. Third, the majority of the research were cross-sectional or had different quantitative designs that limit the possibility to identify causal links between health informatics adoption, nurse empowerment, communication, and occupational stress. Longitudinal studies are not very extensive and it is not easy to determine how these factors change with time. Fourth, the prevailing nature of quantitative research restricts the investigation of the experiential and complex insights of nurses and nurse managers that are more suited to be investigated in a qualitative way. Moreover, secondary groups, including nurse managers or staff in smaller/community-based settings, were not represented, which minimizes the generalizability of findings. Variations in methods, types of systems, and outcome measures, as well as the overwhelming prevalence of English-language literature, also limit cross-contextual information. Fifth, while this review followed PRISMA guidelines, the absence of a formal meta-analysis means that it is not possible to quantify effect sizes or statistically pool findings across studies, limiting the precision of the synthesized evidence. Sixth, the review did not directly examine the relationship between informatics-induced occupational stress and nurse turnover or retention rates in Saudi Arabia, which represents a substantive empirical gap given the policy relevance of workforce retention under Vision 2030. Seventh, the included studies examined a range of informatics tools collectively without distinguishing sufficiently between specific technologies such as EHRs, telehealth platforms, clinical dashboards, and nursing information systems, which vary considerably in their usability profiles and stress implications. Longitudinal designs, mixed-method designs, and wider settings and populations should be incorporated in future studies to provide more evidence.

Future Suggestions

Future studies should include longitudinal studies as these would be beneficial in understanding of the causal relationship between the adoption of health informatics, nurse's performance, empowerment, communication, and occupational stress. A better understanding as to the dynamic nature of these factors in a technologically advanced healthcare context would be gained by understanding how they interplay over time. Moreover, it is a critical need to study these phenomena from culturally diverse and resource-constrained perspectives. Future research should assess interventions that are culturally and contextually relevant and that engage under-represented groups, such as nurses in smaller hospitals, community health centers, or marginalized clinical settings, addressing the unique features of the organization and its sociocultural context. Lastly, future research ought to focus on the standardization of definitions, outcome measures and assessment instruments to nurse performance, empowerment, and stress management in order to promote consistency and comparability in different contexts. Interdisciplinary methods that combine healthcare management, informatics, and occupational psychology would help advance the creation of holistic methods to advance the performance and well-being of nurses in various healthcare settings. Comparative work between the Riyadh Health Cluster and other healthcare settings, such as rural or secondary settings, in Saudi Arabia, where informatics infrastructure is less mature should also be considered for future studies. These comparisons would help to determine if the performance, empowerment and patterns of stress revealed in this review are specifically the case in high-resource urban clusters or more broadly nationally. Also, a finer-grained analysis of individual informatics technologies

is needed. In future studies, rather than considering EHRs, telehealth systems, clinical decision support tools, and nursing dashboards as a single group, we should instead break up these tools and investigate which are linked with the most empowerment and which create the most stress for individuals so that we can make informed system design and procurement decisions. Research should also directly examine the relationship between informatics-induced occupational stress and nurse retention and turnover rates in Saudi Arabia, as empirical evidence linking specific digital tools to workforce attrition remains sparse in the national literature. Finally, future mixed-methods and meta-analytic studies that pool quantitative outcome data across Saudi Arabian and regional studies would substantially strengthen the evidence base and enable more precise estimates of the effects of health informatics on nursing outcomes.

Conclusion

This systematic review indicates the role of health informatics in nurse performance in the Riyadh Health Cluster, Saudi Arabia, in terms of the role of effective communication, empowerment, and job stress. A thematic synthesis was used to arrange findings into three major domains, including effective communication through digital platforms, empowerment via informatics integration, and occupational stress and adaptation. Consecutive studies consistently indicated that primary populations, such as registered nurses, clinical nurses, and nurse managers, demonstrated an increase in workflow, data accuracy, collaboration, and evidence-based decision-making with the implementation of EHRs, NIS, and built-in dashboards.

The most essential measure that occurred is empowerment, whereby informatics integration enhanced autonomy, professional confidence, and decision-making ability. Monitored training sessions and management support also reinforced the capacity of nurses to effectively use technology and improve their level of activity and job satisfaction. Resilience was supported and high performance standards were preserved by alleviating occupational stress with the help of supportive interventions, user-friendly interfaces, and peer collaboration, although occupational stress could be viewed as a possible barrier.

The review is keen on the role that organizational strategies play in ensuring maximum benefits of informatics. The role of nurse managers is crucial as they supply on-going training, observe the effectiveness of workflow, and create a positive environment to balance the use of technologies and human care.

Nevertheless, the results are limited due to the research on particular healthcare environments, heterogeneity of study designs, and the use of perceived results instead of standard performance measures. Further studies are needed to examine various clinical settings, use objective performance indicators, and examine long-term effects of informatics implementation. Technology integration should also be considered in terms of cultural and contextual factors.

In summary, health informatics presents great potential of improving the performance of nurses, empowering them, and alleviating job-related stress. To streamline human well-being in the technologically advanced healthcare system, strategic implementation, and managerial support along with human-centered system design are crucial to maximize patient care outcomes.

Statement and Declaration

Competing interests:

The authors declare that they have no competing interests.

Consent to publish declaration

Not applicable

Consent to participate declaration

Not applicable

Ethics declaration

Not applicable

Clinical trial

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Author contributions

A.T.A.A; Conceptualization, methodology, software, validation, formal analysis, N.S.H.N.A; investigation, resources, data curation, A.T.A.A.; writing—original draft preparation, N.S.H.N.A; writing—review and editing, supervision, project administration, A.T. A.A; funding acquisition, all authors have read and agreed to the published version of the manuscript.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to ethical and confidentiality considerations related to human participant data but are available from the corresponding author upon reasonable request.

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