JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO 3

Nursing Informatics Skills and Knowledge among Nurses in Eastern Cluster Hospitals:A mixed Method

Nasreen Hassan Alsalem[1] *, Fatimah Ali Aburshaid[1] , Abeer Yousif Alabbad[1] Lamees Abdulwahed Al Mansour[2], Safia Ali Belal[3], , Mona Abdulmajeed Alduhaileb[4], Mohammed I. Al Bazroun[5] ,

1 Maternity and Children Hospital, Dammam 32253, Saudi Arabia
2 Jubail General Hospital, Jubail 35412, Saudi Arabia.
3 College of Applied Medical Sciences, King Faisal University, Saudi Arabia.
4 Dammam Medical Complex, Saudi Arabia
5 Qatif Health Network, Qatif 32654, Saudi Arabia.

Correspondence: nhalsalem@moh.gov.sa

Abstract:
Background: Informatics is vital in healthcare; evaluating nurses' informatics skills is essential for optimal care.
Aim: The study aims to assess nurses' level of knowledge and skills about their competencies in nursing informatics to identify any existing gaps or obstacles that may require future projects for improvement.
Methods: A mixed-methods design included a questionnaire with 347 participants and digital interviews with nurses in Eastern Health Cluster, Saudi Arabia.
Result: The combined results show most nurses have sufficient informatics skills: Beginner (2.3%), Competent (30.0%), Proficient (45.0%), and Expert (22.8%). Proficiency is driven by self-directed learning and support, but limited improvement opportunities, resources, and heavy workloads pose challenges.
Conclusions: The findings highlight the need for support to promote nurses' continuous growth in informatics.
Keywords: Competencies, Nursing Informatics, ,Knowledge and skills ,Eastern Health cluster , Nursing Competency.

1. Background

The concept of informatics first emerged in the 1950s (Masic, 2020) . Since then, it has undergone a myriad of changes and is now defined as a field of study. In the current world of healthcare, nurses are at the forefront, experiencing a wide range of complex and simple technologies. This necessitates the development of advanced knowledge and skills in informatics. Also, being proficient in informatics is crucial for delivering prompt, quality, and safe care, making it a core part of nurses' professional roles (Kaihlanen et al., 2023) . Competency in nursing informatics describes the acceptable level of skills, ability, and knowledge needed to fulfill various informatics roles and is an essential function among nurses. Nurses, as a critical part of the healthcare team, significantly contribute to the successful utilization of clinical information and decision-supporting systems through their informatics competency.

In various community facilities, nurses often perceive a need for increased informatics competency and basic computer skills (Kaihlanen et al., 2023) . According to a survey, nearly half of the nurses needed to improve their nursing informatics skills. Reports on the high prevalence of nurses with unacceptable and unsatisfactory proficiency in computer skills highlight the critical need to explore their capabilities and provide further support to promote the delivery of safe care for patients.

Today, education at the baccalaureate level and above includes nurse informatics (AACN.,2021). Nurses should possess essential competencies such as system management, patient care technologies, and quality improvement processes. In Saudi Arabia, the provision of the Saudi Health Informatics Competency Frameworks proposed by (Almalki et al., 2021) was to help fill the gap in the health information landscape, which helps meet the workforce and market demands. The framework, comprising 92 competencies across 6 domains and 22 subdomains, serves as a crucial guideline to improve the nurses' training program, equipping health professionals with the essential skills and knowledge to manage informatics demands in the healthcare system.

Literature Review

The literature underscores the increasing importance of nursing informatics competency. However, the variety of competency lists complicates information assimilation for nursing staff, educators, administrators, and researchers. Therefore, further research is needed to reach a consensus on key domains and indicators of nursing informatics competency across different roles (Kleib et al., 2021). A recent study shows a positive correlation between nursing informatics competency and clinical decision-making, emphasizing the need to enhance informatics skills through targeted training programs. Additionally, a comprehensive analysis highlights that Saudi Arabian nurses face burnout and workload challenges that health informatics can alleviate, improving care quality (Al Baalharith et al., 2022).

Nursing informatics competencies are essential for ensuring quality patient care and effective use of health information systems. This study aims to assess nurses' knowledge and skills in health informatics, identify competency gaps, and address educational needs for improving healthcare services and nursing care. To the best of our knowledge, this study has not been previously conducted in the Eastern Health Cluster ”EHC” hospitals, rendering it a unique foundation for enhancing digitalization in the healthcare system of the Eastern Health Cluster.

2. Methods

2.1. Study Design

To gain a deeper understanding of health informatics competencies, a combined mixed-methods design was adopted. This approach included quantitative data collection via a structured questionnaire and qualitative data collection through digital written structured interviews, where questions and responses were exchanged in writing instead of being spoken or conducted traditionally face-to-face. This method may be advantageous in terms of time constraints and convenience for respondents to express themselves.

The sample was drawn from nurses working in clinical roles and providing direct patient care at government hospitals in the eastern region of Saudi Arabia. These hospitals included Maternity and Children Hospital in Dammam, Dammam Medical Complex, Al Jubail Hospital, and Qatif Networks. We used a convenience sampling method to recruit 347 nurses from Eastern Cluster hospitals who provide direct patient care in various clinical settings and agreed to participate in the study. The sample included both male and female nurses, Saudi and non-Saudi, with diverse educational backgrounds. The study excluded nurses who do not provide direct patient care and those who declined to participate.

We calculated the sample size using Andrew Fisher's formula, ensuring a 95% confidence level and a 5% margin of error. Initially, we set the sample size at 345 nurses; however, 347 nurses participated in the study, all of whom provided complete responses to the questionnaire, surpassing the anticipated recruitment target. This enabled us to determine whether there is an educational

gap in the target population regarding nursing informatics competency and what the obstacles and enhancers are to reaching a professional level.

2.2. Data Collection Tool and Validation

The quantitative data adapted a structured standard questionnaire to collect the data. The Nursing Informatics Competency Assessment Tool (NICAT), developed by Rahman (2015), serves as the questionnaire. The NICAT concept is based on Benner's Dreyfus model (Benner's Stages of Clinical Competence, 1984) of skills training and examines proficiency in nursing informatics at the beginning and expert levels. We designed the questionnaire to take approximately five to ten minutes for each participant to complete. Data collection took place over a three-month period, from April to June 2024. The researcher used a three-section instrument to achieve the study's objective as follows: I. Socio-demographic data includes information about age, sex, nationality, level of education, years of experience, and work areas. We included the questions in a mix of open-ended and closed formats.

II The Nursing Informatics Competency Assessment (NICAT) questionnaire consists of four parts: Part (a) includes ten questions on computer skills and literacy, Part (b) has three items on information management skills, and Part (c) contains seven items on nursing informatics management skills. Responses are graded on a 5-point Likert scale: novice (1), advanced beginner (2), competent (3), proficient (4), and expert (5). Scores are classified as follows: Novice: 30, Advanced Beginner: 31–59, Competent: 60–89, Proficient: 90–119, and Expert: 120–150. The instrument evaluates informatics proficiency in registered nurses, excluding questions related to informatics experts and innovators. Additionally, the qualitative section includes two open-ended questions addressing factors influencing and hindering nursing informatics competency, based on recent literature (Rahman, 2015).The tool's internal consistency was demonstrated by Cronbach's alpha value of 0.958, indicating a very high level of reliability among the items in the questionnaire, with a strong correlation between them.

We utilized Google Forms to invite nurses to participate in the online survey and outline the study's objectives. Participants provided consent before taking the survey. The survey link was distributed to nurses through their hospital's nursing director. They had to affirm their consent prior to participation, and completing the survey also indicated consent. To enhance participation, staff nurses received a web link invitation via official email. Incomplete responses were excluded for data integrity. A pilot study with 20 nurses confirmed the test's validity using Cronbach's alpha, yielding coefficients of 0.962, 0.920, and 0.927 for the first, second, and third sections, respectively. Ethical approval for this study was granted by the DMC IRB committee (approval number NUR-37) and the MCHD IRB committee (approval number NR-2024-006). In the online questionnaire introduction, respondents were informed of their right to withdraw at any time without penalty. Participants were assured of confidentiality, with data used solely for this study and accessible only to the researchers. Data security measures included encrypted digital storage and response anonymization to protect participant privacy.

2.3. Statistical Analysis

The study utilized a variety of statistical methods, including both descriptive and inferential analyses. Statistical analysis was conducted using SPSS Version 25. Frequencies and descriptive statistics were performed to ensure the absence of missing or anomalous data. Categorical variables were presented as frequencies and percentages. Pearson's correlation analysis was applied to assess correlations between quantitative variables with a significance level (Sig.) of 2-

tailed. Results with a p-value of ≤ 0.05 were considered statistically significant. Qualitative results and thematic analysis were also employed, with qualitative data collected using thematic analysis.

3. Results

The study included 347 nurses from various Eastern Health Cluster hospitals, with the Maternity and Children Hospital in Dammam representing the largest group at 161 (46.4%). Other facilities included AL Jubail General Hospital (59, 17%), Dammam Medical Complex (56, 16.1%), and Qatif General Hospital (54, 15.6%). All respondents (100%) provided direct patient care, emphasizing their essential frontline roles. Regarding clinical experience, 171 nurses (49.3%) have over 10 years of experience, while 28.8% have 5 to 10 years, indicating a stable workforce. More than half (209, 60.2%) work in critical care settings. The majority are female (337, 97.1%), typical of the nursing profession, and 227 (65.4%) are Saudi nationals. Age distribution shows that 204 respondents (58.8%) are aged 30-39, with fewer under 30 or over 40. In terms of education, 205 nurses (59.1%) hold bachelor's degrees, followed by 126 (36.3%) with diplomas. Overall, the nursing workforce is diverse, experienced, and engaged in critical care. (see Table 1).

Table 1. Demographic data of the study sample (N=347)

Demographic characteristics of nurses		**Number**	**Percent %**
Years of experience in clinical nursing care (Provide direct patient care)?	Less than 6 months	5	**1.4%**
	More than 6 months to 2 years	18	**5.2%**
	From 2 to 5 years	53	**15.3%**
	More than 5 to 10 years	100	**28.8%**
	More than 10 years	171	**49.3%**
Are you currently working in critical care?	No	138	**39.8%**
	Yes	209	**60.2%**
Gender	Female	337	**97.1%**
	Male	10	**2.9%**
Nationality	Non- Saudi	120	**34.6%**
	Saudi	227	**65.4%**
Age	20-29	53	**15.3%**
	30-39	204	**58.8%**
	40-49	77	**22.2%**
	50 and above	13	**3.7%**
Qualification	Bachelors in nursing	205	**59.1%**
	Diploma in Nursing	126	**36.3%**
	High degree in Nursing	16	**4.6%**

The assessment of nurses' proficiency is conducted through the Nursing Informatics Competency Assessment (NICAT). It is noteworthy that in all parts of the assessment tool, the highest percentage was rated as competent, while a lower percentage was rated as not competent.

Table 2 displays the highest and lowest responses in the tool among the samples.

Nursing Informatics Competency Assessment (NICAT)		**Number**	**Percent %**
1. Computer skills and computer literacy			
1-Use of telecommunication tools such as electronic mail.	Not competent	4	**1.2%**
	Competent	143	**41.2%**
2-Recognize the basic components of the computer system such as mouse, screen, and workstation.	Not competent	3	**0.9%**
	Competent	121	**34.9%**

3-Use of remote communication tools such as adobe connect, Skype, and Lync.	Not competent	37	**10.7%**
	Competent	139	**40.1%**
4-Create, rename, move, and delete files using computer operating systems such as Microsoft Windows.	Not competent	8	**2.3%**
	Competent	135	**38.9%**
5-Use word processing function such as save, categorize documents, copy, paste, and delete.	Not competent	5	**1.4%**
	Competent	127	**36.6%**
6-Navigate computer operating systems to access installed application and choose active printer.	Not competent	12	**3.5%**
	Competent	128	**36.9%**
7-Use software to create presentations such as Microsoft PowerPoint.	Not competent	17	**4.9%**
	Competent	122	**35.2%**
8-Use external devices such as USB flash drive, digital camera, CD-ROM.	Not competent	34	**9.8%**
	Competent	128	**36.9%**
9-Perform basic computer systems troubleshooting such as checking power source, rebooting computer, and printing.	Not competent	26	**7.5%**
	Competent	146	**42.1%**
10-Manage computer systems security to protect data, devices, and passwords.	Not competent	27	**7.8%**
	Competent	147	**42.4%**
2. Informatics management skills			
11-Use the Internet to locate and download items of interest.	Not competent	14	**4.0%**
	Competent	135	**38.9%**
12-Access to the electronic health record.	Not competent	10	**2.9%**
	Competent	140	**40.3%**
13-Review and acknowledge patient orders in the electronic health record	Not competent	5	**1.4%**
	Competent	129	**37.2%**
14-Develop and document care plan in electronic health record.	Not competent	7	**2.0%**
	Competent	145	**41.8%**
15-Review point of care data such as urine dipstick, glucose check, and hemoglobin meter to make timely decisions.	Not competent	8	**2.3%**
	Competent	148	**42.7%**
16-Respond appropriately to alerts from health information system (HIS) such as abnormal laboratory result and critical result alert	Not competent	8	**2.3%**
	Competent	138	**39.8%**
17- Conduct literature searches in the accessible proprietary database systems such as CINAHL, EBSCO, etc.	Not competent	63	**18.2%**
	Competent	118	**34.0%**
18-Use medication administration chart to verified patient identification and apply medication rights	Not competent	13	**3.7%**
	Competent	125	**36.0%**
19-Use of medication dispensing system and requesting.	Not competent	18	**5.2%**
	Competent	128	**36.9%**
20-Collect and document patient data relevant to care such as vital signs, height, and weight.	Not competent	5	**1.4%**
	Competent	128	**36.9%**
	Not competent	9	**2.6%**

21-View trended electronic documentation to understand the effectiveness of nursing interventions.	Competent	138	**39.8%**
22. Use systems to assist with admission and discharge process	Not competent	14	**4.0%**
	Competent	135	**38.9%**
23. Continue patient care documentation and patient identification when computer system is down.	Not competent	7	**2.0%**
	Competent	143	**41.2%**
3. Nursing informatics managerial skills			
24-protect confidential patient data by logging out, suspending sessions and password protection.	Not competent	14	**4.0%**
	Competent	141	**40.6%**
25-Use information technology as a primary means of patient safety such as bedside laboratory verification, barcode scanning, etc.	Not competent	13	**3.7%**
	Competent	136	**39.2%**
26-Use electronic health record and other clinical information system as per organizational policy for documentation.	Not competent	12	**3.5%**
	Competent	140	**40.3%**
27. Use electronic communication with colleagues, patients or other Departments'	Not competent	13	**3.7%**
	Competent	156	**45.0%**
28. Find information stored in the clinical information system to guide patient care such as standard care plans and guidelines.	Not competent	18	**5.2%**
	Competent	157	**45.2%**
29. Use nursing data for improving practice and for clinical decision-making.	Not competent	12	**3.5%**
	Competent	162	**46.7%**
30-Use data and statistical reports for unit-based quality improvement initiatives and practice evaluation.	Not competent	12	**3.5%**
	Competent	156	**45.0%**

It is worth noting that conducting literature searches in accessible proprietary database systems such as CINAHL, EBSCO, etc. reveals the highest percentage rated as not competent among the whole. Specifically, the rating of 63 (18.2%) nurses as not competent is higher than that of 77 (22.2%) nurses with somewhat competent skills and 118 (34.0%) nurses with competent skills.
The chart in Figure 1 illustrates the distribution of competency among the staff nurses in three areas: computer literacy, informatics literacy, and informatics management skills.

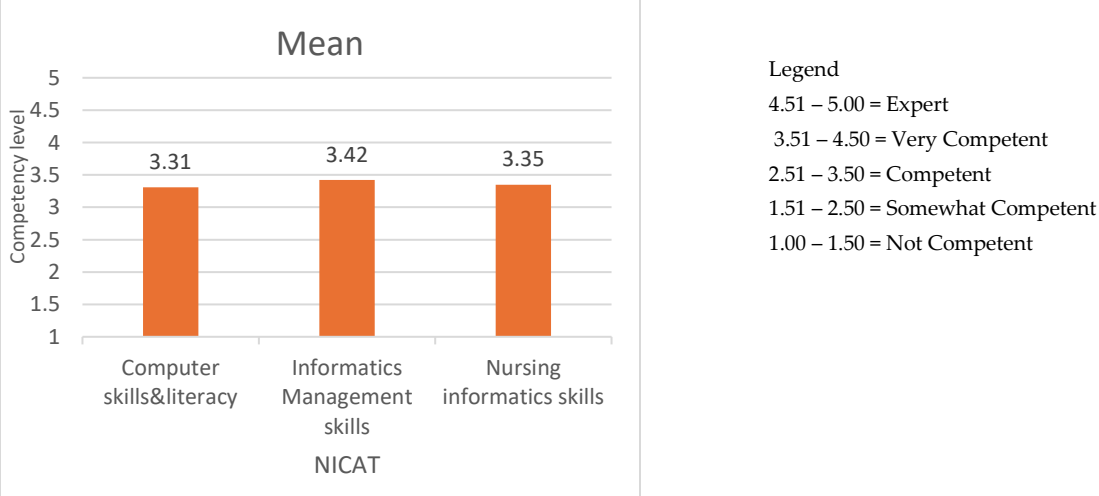

Figure.1shows the level of nursing informatics competencies of the staff nurses

Table 3 displays the informatics scores of nurses. 8 nurses (2.3%) comprised the beginner group. Competent participants comprise 104 (30.3%), proficient participants comprise 156 (45%), and expert participants comprise 79 (22.8%).

Table 3. Total nursing informatics scores among studied subjects (n = 347)

	Number	**Percent %**
Beginner (31-59)	8	2.3
Competent (60-89)	104	30.0
Proficient "very competent" (90- 119)	156	45.0
Expert (120 -150)	79	22.8
Total	**347**	**100.0**

According to Table 4, by SPSS version 25, data analyzed using a sig (2-tailed) test shows there is a positive correlation between informatics competency and gender (r = .226, p = .000), but a negative correlation between informatics competency and nurses' age (r = -.190, p = 0.000). Additionally, the study found no significant relationship between years of experience, qualifications, nationality, and informatics competency.

Table .4 Correlation between nursing informatics competency and related factors

Variables	**Sig. (2-tailed)**	**Nursing informatics competency**
Years of experience	.372	.048
Are you currently working in critical care?	.712	.020
Gender	.000*	.226**
Nationality	.545	-.033
Age	.000*	-.190**
Qualification	.100	-.088
****. Correlation is significant at the 0.01 level (2-tailed).**		

Qualitative Results

After analyzing the quantitative results, the researchers conducted a qualitative investigation to explore factors influencing nursing informatics skill growth and barriers. Thematic analysis was employed to identify and evaluate key themes, including:

Factors that enhance nurse competency in informatics:

Most nurses mentioned that they enhance their skills through ***self-learning***. One nurse stated, *'Trying to search for the information myself and not only waiting for others to deliver it to me to ensure I deliver the best patient care and protect my image*.' Two other nurses mentioned, *'I took computer courses on my own*,' while others emphasized learning from home or family members. Some nurses also mentioned learning from colleagues and their unit manager, stating, *'Ask for help from other staff who know and do it by yourself to become familiarized,' as well as 'We work like one team and help each other'*. Many nurses highlighted the ***significance of practice***. One nurse stated, *'I believe practice makes everything perfect.*' Another nurse mentioned, *'Continuing to deal with it and practicing*,' as well as *'More practice and staying up to date*,' and 'Updating information with current trends.' This was identified as another factor that helped enhance their competency. Many nurses also underscored the hospitals' ***supportive environments*** and the role of nursing educators. One mentioned, *'My preceptor*,' as a source of learning. Another nurse mentioned, *'Clinical instructors help us to improve up-to-date information*.' They also mentioned attending courses relevant to their needs, and some nurses stated, *'Conducting departmental training frequently*.' One nurse emphasized her first training, stating, *'During the first three months of joining the hospital, receiving orientation with preceptors and clinical instructors helps to improve*

knowledge.' They also mentioned that attending ***continuing education courses*** helps to improve their knowledge. However, it is worth noting that several nurses emphasized in this part the need for further training and higher levels of competency when it comes to using electronic health records.

Factors that hiders nurse competency in informatics:

In this section, several nurses reported encountering various challenges when using computers. Many nurses expressed concern about ***resource availability and system malfunctions.***

Some nurses expressed the need for more computers, stating, "*It would be helpful if we had more computers and better systems."* Others pointed out the lack of other resources, such as printers, with one nurse stating, "*My unit does not have enough computers and printers, and when the printer is working, there is no ink*." Another nurse mentioned "*the unavailability of needed things."*

Many nurses stressed the need for system improvements, specifically mentioning, "*PC devices need improvements as hardware*." They also emphasized the malfunctions of electronic devices, stating, "*We need good working systems for practicing. We need more systems."* The challenges of system failure, lack of computer access, technical support problems, and the shortage of devices like tablets and laptops were also highlighted. Slow internet connectivity was mentioned as a challenge as well; one nurse specifically mentioned this challenge as "*slow internet and lack of computers in nursing stations*." Another nurse highlighted the impact of a slow system, stating, "*A slow-down system with poor internet, overloaded work, and patient assignments make it difficult to spend time on the system. Patients are the priority over the system."* . **Nursing shortages and work overload** *are raised here as significant challenges to being competent in nursing informatics. Several nurses mentioned that the high ratio of patient assignments does not give them the opportunity to improve their competency in nursing informatics. They specifically mentioned "work pressure, administration pressure, job burnout, multitasking." They also highlighted that informatics in nursing can be a potential source of stress and can prevent them from practicing hands-on patient nursing skills. "Informatics in nursing is to be a potential source of stress....and not even practicing hands-on to patients nursing skills". The busy days and inappropriate staffing are mentioned as additional challenges. "Busy schedule and inappropriate staffing pattern" "Not enough time because our department always busy"*

They also mentioned the lack of opportunities available to attend courses unless it is their day off due to work pressure. They also expressed concern regarding time for learning. *"Fatigue from work, unwillingness to learn" "There are no opportunities available to attend courses unless on an off-day Work pressure" "Have no time to check or study because of heavy work" "If l handles more patients no time for learning*". The ***culture of work*** is mentioned as another challenge, specifically referring to as "*Blaming culture" "Working with blame-culture."*

Furthermore, the reliance on video tutorials sent via cell phone was mentioned as a limitation. Nurses expressed the need for actual hands-on training to grasp the necessary skills. Mentioned, "*Lack of actual training and only sending videos via cell phone*."

4. Discussion

Quantitative Discussion

Demographic Characteristics and Representativeness

The study sample of 347 nurses from the Eastern Health Cluster provides sufficient insight into nursing informatics competencies in various hospital settings. With 49.3% having over ten years of experience, the sample represents a workforce with considerable clinical expertise, which is important in integrating informatics skills with existing practice (Chang et al., 2011) . Of the respondents, 97.1% were female nurses, and 65.4% were Saudi nationals, which is consistent with the Saudi nursing workforce population but may reduce generalizability to male nurses. The age distribution, with 58.8% in the 30-39 age group, can be considered a relatively young to middle-aged population that might affect technology utilization. The educational background, with 59.1% holding bachelor's degrees, reflects the rising focus on education in nursing, which can be beneficial for adaptation to the new healthcare technologies (Almalki et al., 2021)

Overall Nursing Informatics Competency Levels

The study's findings show encouraging nursing informatics competencies, with 97.7% of nurses meeting the criterion level, 45% at proficiency and 22.8% at expertise. This suggests a solid foundation in nursing informatics, essential for implementing health information technologies in patient care, consistent with (Ball et al., 2011). Notably, 2.3% of nurses at the beginner level indicate a need for enhanced support and training to effectively use health information systems and contribute to quality patient care, as highlighted by (Boykins., 2014).

Specific Competency Areas

Computer Skills and Computer Literacy

The high competency levels in basic computer skills, with 99.1% recognizing computer components and 98.8% using telecommunication tools, indicate that most nurses have mastered fundamental digital literacy. This proficiency is vital for navigating electronic health records and healthcare technologies, as noted in the context of Saudi Arabian nursing informatics competencies (Alshammari et al., 2017). However, lower competency in advanced skills, such as using presentation software like Microsoft PowerPoint (35.2% competent), highlights areas for improvement. These skills are essential for nurses in patient education, staff training, and professional presentations, reflecting their evolving role in healthcare technology (Lloyd et al., 2023).

Informatics Management Skills

The results indicate strong competencies in core nursing informatics, with 97.1% competent in accessing electronic health records, 98% in developing electronic care plans, and 97.7% in responding to health information system alerts. These skills are vital for patient safety and quality care in future digital healthcare, as highlighted by (HAVENS et al., 2010). in their study on technology integration in nursing practice. However, a concern arises with 81.2% of nurses reporting low competency in searching proprietary databases, which is essential for evidence-based practice and lifelong learning. This underscores the need for focused faculty training in research methods and databases in nursing informatics, as suggested (Kaihlanen et al., 2023).

Nursing Informatics Managerial Skills

When applying nursing data to enhance practice and clinical decision-making, 96.5% of nurses demonstrated high competency levels. This indicates that nurses effectively work with health information systems to improve patient care, as outlined in the Saudi Health Informatics Competency Framework (Kleib et al., 2021). Additionally, 96.3% were competent or above in using technology to ensure patient safety, and 96% were competent or above in protecting patient privacy. This reflects an awareness of ethical issues in digital health, crucial for maintaining patient confidence and preventing errors in healthcare, as emphasized in a study on advancing nursing dialogue for patient safety (Kinnunen et al., 2023).

Correlations with Demographic Factors

The study revealed that informatics competency increased with the gender of the nurse, indicating that male nurses exhibited higher competency levels. However, this finding should be interpreted cautiously, as only 2.9% of participants were male. Further studies with larger, gender-balanced samples are needed to confirm this association and explore its causes. A negative correlation between age and informatics competency ($r = -.190$, $p = 0.000$) suggests that younger nurses may be more skilled in using health information technologies, likely due to greater exposure to technology and recent education. It is important to note that this correlation is weak, with many older nurses displaying high competency levels. Notably, there was no significant relationship between years of experience, qualifications, nationality, and informatics competency, suggesting that factors beyond demographics—such as personal technology use, workplace training availability, or perceived technology utilization in nursing practice—may influence competency, as identified in a study on nursing informatics competence (Kaihlanen et al., 2023).

Relevance to Nursing Practice and Education

The high scores recorded in the study show that the nursing informatics competency levels of the studied population are high, revealing that the nurses in the Eastern Health Cluster have the potential to adopt health information technologies. This proficiency may help in patient care, communication, and the overall efficiency of the healthcare process (Masic., 2020).However, self-reported deficits in computer proficiency and reference database knowledge reveal further areas for educational focus. Nursing education programs and continuing professional development activities should address the competencies outlined above, providing a comprehensive approach (Almalki et al., 2021). Formal education levels do not necessarily correlate with informatics competency levels, highlighting the importance of practice-oriented training and learning. The study recommends that healthcare organizations ensure their personnel participate in training sessions as a way of familiarizing nurses with new technologies in practice, given the dynamism in healthcare information technology (AACN.,2021)

Qualitative Discussion

This qualitative analysis provides valuable information that addresses inquiries regarding the development of nursing competency in informatics.

Factors Enhancing Nurse Competency in Informatics

A prominent theme was self-directed learning, with many nurses actively seeking to enhance their knowledge and skills, reflecting the dynamic nature of healthcare technology and the trend of lifelong learning in nursing (Lloyd et al., 2023). Nurses engaged in self-learning by independently

researching information, enrolling in computer courses, and learning from peers. One nurse stated, "*I'm still attempting to look for the information on my own and not just rely on others to provide it to me so that I can provide optimal patient care and not compromise my image*." Such comments highlight the action orientation and professional commitment driving this self-improvement process (Kleib et al., 2021). Many participants stressed the importance of practical experience as a key component necessary for skill retention. The nurses also discovered that the only way they could establish and sustain their informatics competency was through daily interactions with the systems. For instance, in response to the question, the participants expressed their belief that "practice makes things perfect" and emphasized the importance of continuing to practice and improve. The findings validate the concept of competency, which encompasses not only the mastery of knowledge but also the practical application of that knowledge (Alshammari et al.,2017; Chang et al., 2011).Institutional support helped to build the informatics competencies. Nurses' comments confirmed the potential of preceptors, clinical instructors, and departmental training. One nurse mentioned, "During the first three months of joining the hospital, receiving orientation with preceptors and clinical instructors helps to improve knowledge," emphasizing the importance of structured onboarding processes. Another noted, "Clinical instructors help us to improve up-to-date information," highlighting the ongoing role of educational support (Almalki et al., 2021) This indicates that education assistance is a continuous process. (Ball et al., 2011).

Factors Hindering Nurse Competency in Informatics

Computer use challenges included limited resources, computer breakdowns, the need for an upgrade in hardware, a slow connection to the internet, and a lack of assistance. Nurses complained about these problems. Finally, one of the nurses remarked, "*We need more computers and improved systems."* Another said, "*My unit lacks appropriate computers and printers, and even if the printer is working, there is no ink*." These challenges highlight the importance of providing healthcare facilities with adequate technological support, an aspect often overlooked in informatics competency (Kaihlanen et al., 2023; Kinnunen et al., 2023).The extent to which these technological constraints affected patient care was also observed. One nurse expressed, "*This slow-down system with poor internet, work overload, and patient assignments decreases the time spent with the system. Patients come before the system."* The comment highlighted the conflict between direct care to the patient and supervision of technology, which remains a key balance that healthcare organizations need to strike to incorporate informatics into nursing practice (Dingley et al., 2008)**.** Administrative and educational barriers were among the system-related factors that impacted the informatics competency. The survey revealed several challenges, such as a scarcity of nurses, a heavy workload, a high patient-to-nurse ratio, and limited time for training due to work obligations. Statements such as "*work pressure, administration pressure, job burnout, multitasking*," "*busy schedule and inappropriate staffing pattern*" reveal the existence of systematic problems (Boykins., 2014). References to a "*blaming culture*" in the workplace suggest that organizational culture may also play a role in hindering skill development. This culture of fear can prevent nurses from trying new technologies or cause problems, which can slow the growth of informatics systems and processes. These findings corroborate previous studies on organizational factors and their impact on the adoption of nursing informatics(Masic, 2020 ; HAVENS et al., 2010) **.** Notably, the notion of informatics as a source of stress and hindering clinical nursing skills also emerged. In its overview, one of the nurses said, "*Informatics in nursing is to be a potential source of stress... and not even practicing hands-on with patients' nursing skills*." Such a comment poses the question of how informatics can be implemented into the practice of nursing so that it improves patient care without hampering it, aligning with the literature (Chang et al., 2011)**.** The participants highlighted several drawbacks. Participants cited the use of video tutorials on mobile phones as a limitation. Nurses also mentioned the importance of

acquiring the skills through practical sessions rather than filling out the forms. Several of the nurses interviewed commented that *'This place lacks actual training; they only send videos through cell phones.'* The comment emphasizes the need for face-to-face, hands-on mentoring to build informatics competencies (Kleib et al., 2021; Lloyd et al., 2023)

Limitations and Future Research

Limitations include potential bias in self-rated competency levels and the predominance of female participants, limiting generalizability to male nurses. The quantitative approach may not fully capture health IT interactions, and the cross-sectional method fails to reveal competency dynamics over time. Future studies should address these limitations. Reducing gender bias can enhance the objectivity of competency metrics. Longitudinal studies indicate that nurse competencies improve over time, suggesting further research on linking informatics skills to patient outcomes, comparing teaching methods, and exploring organizational factors in competency development, particularly in Saudi Arabia. This research could inform nursing education and policy.

Implications of the study

Healthcare organizations should foster lifelong and self-directed learning by implementing a learning management system for convenient access to training materials. Virtual simulations and risk-free labs will enable nurses to practice EHRs and health IT effectively. Mentorship programs must be available for shift workers to ensure equitable access to training, allowing for "training respite" from patient care. Additionally, organizations should evaluate and invest in technological infrastructure to minimize disruptions. Addressing staff ratios and workloads is essential for professional development. A supportive culture that promotes learning from mistakes and involves nurses in informatics system design can enhance clinical workflow integration.

5. Conclusions and recommendations

This study emphasizes the necessity of preparing nurses to effectively integrate health informatics into their practice, identifying both strengths and challenges in achieving this goal. While nurses are motivated to self-learn and gain practical experience in informatics, systemic issues such as limited resources, staff shortages, and inadequate training methods hinder competency development. Organizational support, including improved access to technology and experiential learning opportunities, is crucial for overcoming these barriers. Addressing these challenges can enhance informatics skills and ultimately improve patient care. The findings suggest that fostering informatics proficiency requires a balanced effort between education, organizational practices, and healthcare policy changes, along with a commitment to enhancing nurse informatics skills through targeted training and support initiatives.

Funding Source: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the institutional review boards of all sites.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: : Data used and analyzed in this study will be promptly available for the publisher upon request.

Acknowledgments: The research team and the authors would like to acknowledge the nurse managers in all sites for their logistic support during data collection. We would like to extend our sincere thanks, and appreciation to all our respondents for their patience in cooperation.

Conflicts of Interest: The authors declare no conflict of interest.

References

Al Baalharith, I., Al Sherim, M., Almutairi, S. H., & Albaqami, A. S. (2022). Telehealth and transformation of nursing care in Saudi Arabia: A systematic review. International Journal of Telemedicine and Applications, 2022, 1–12. https://doi.org/10.1155/2022/8426095

Almalki, M., Jamal, A., Househ, M., & Alhefzi, M. (2021). A multi-perspective approach to developing the Saudi Health Informatics Competency Framework. International Journal of Medical Informatics, 146, 104362. https://doi.org/10.1016/j.ijmedinf.2020.104362

Alshammari, F., Pasay-An, E., & Indonto, M. C. L. S. (2017). Competencies in nursing informatics in the Saudi Arabian Context: A sequential explanatory study. ResearchGate. https://www.researchgate.net/publication/328268457_

American Association of Colleges of Nursing. (2021). THE ESSENTIALS: CORE COMPETENCIES FOR PROFESSIONAL NURSING EDUCATION. https://www.aacnnursing.org/Portals/0/PDFs/Publications/Essentials-2021.pdf

Ball, M. J., Hannah, K. J., DuLong, D., Newbold, S. K., Sensmeier, J. E., Skiba, D. J., Troseth, M. R., Gugerty, B., Walker, P. H., & Douglas, J. V. (2011). Nursing Informatics. In Computers in health care. https://doi.org/10.1007/978-1-84996-278-0

Batran, Ahmad PhD, RN; Al-Humran, Saed Mohammad MSHI; Malak, Malakeh Z. PhD, RN; Ayed, Ahmad PhD, RN. The Relationship Between Nursing Informatics Competency and Clinical Decision-Making Among Nurses in West Bank, Palestine. CIN: Computers, Informatics, Nursing 40(8):p 547-553, August 2022. https://doi.org/10.1097/CIN.0000000000000890

Binkheder, S., Aldekhyyel, R., & Almulhem, J. (2021). Health Informatics Publication Trends in Saudi Arabia: A bibliometric analysis over the last twenty-four years. *Journal of the Medical Library Association*, *109*(2). https://doi.org/10.5195/jmla.2021.1072

Boykins. (2014). Core communication competencies in patient-centered care. The ABNF journal : official journal of the Association of Black Nursing Faculty in Higher Education, Inc. https://pubmed.ncbi.nlm.nih.gov/24855804/

Chang, J., Poynton, M. R., Gassert, C. A., & Staggers, N. (2011). Nursing informatics competencies required of nurses in Taiwan. International Journal of Medical Informatics, 80(5), 332–340. https://doi.org/10.1016/j.ijmedinf.2011.01.011

Dingley, C., Daugherty, K., Derieg, M. K., & Persing, R. (2008, August 1). Improving patient safety through provider communication strategy enhancements. Advances in Patient Safety: New Directions and Alternative Approaches (Vol. 3: Performance and Tools) - NCBI Bookshelf. https://www.ncbi.nlm.nih.gov/books/NBK43663/

Havens, D. S., Vasey, J., Gittell, J. H., & Lin, W. (2010). Relational coordination among nurses and other providers: impact on the quality of patient care. Journal of Nursing Management, 18(8), 926–937. https://doi.org/10.1111/j.1365-2834.2010.01138.x

Kaihlanen, A., Elovainio, M., Virtanen, L., Kinnunen, U., Vehko, T., Saranto, K., & Heponiemi, T. (2023). Nursing informatics competence profiles and perceptions of health information system usefulness among registered nurses: A latent profile analysis. Journal of Advanced Nursing, 79(10), 4022–4033. https://doi.org/10.1111/jan.15718

Kinnunen, U., Kuusisto, A., Koponen, S., Ahonen, O., Kaihlanen, A., Hassinen, T., & Vehko, T. (2023). Nurses' Informatics Competency Assessment of health information system usage. CIN Computers Informatics Nursing, 41(11), 869–876. https://doi.org/10.1097/cin.0000000000001026

Kleib, Manal1; Chauvette, Amelia1; Furlong, Karen2,3; Nagle, Lynn4; Slater, Linda1; McCloskey, Rose2,3. Approaches for defining and assessing nursing informatics competencies: a scoping review. JBI Evidence Synthesis 19(4):p 794-841, April 2021. |https://doi.org/10.11124/jbies-20-00100 - (Kleib et al., 2021)

Lloyd, S., Long, K., Probst, Y., Di Donato, J., Alvandi, A. O., Roach, J., & Bain, C. (2023). Medical and nursing clinician perspectives on the usability of the hospital electronic medical record: A qualitative analysis. Health Information Management Journal, 183335832311546. https://doi.org/10.1177/18333583231154624

Masic, I. (2020). The History of Medical Informatics Development - An Overview. International Journal on Biomedicine and Healthcare, 8(1), 37. https://doi.org/10.5455/ijbh.2020.8.37-52

Navab, E., Hoseini Azizi, T., & Darvish, A. (2024). Comparative study of master's degree curricula in Nursing Informatics at Tehran University of Medical Sciences and the University of Maryland. Journal of Medical Education Development, 17(53), 91–100. https://doi.org/10.61186/edcj.17.53.91

Rahman, A. A. (2015). Development of a Nursing Informatics Competency Assessment Tool (NICAT). ScholarWorks. https://scholarworks.waldenu.edu/dissertations/1745/