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The Paradox of Nursing Informatics Competencies: Implications for Nursing Care Quality in Ghana

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ABSTRACT

Introduction: Nursing Informatics Competencies (NIC) have become essential for effective healthcare delivery in the digital era. They encompass informatics skills, computer skills, and informatics knowledge, all of which support accurate documentation, decision-making, and patient-centered care. Despite their importance, limited research has examined how NICs influence the quality of nursing care in Ghana, where digital health integration is still evolving. **Methods:** This study employed a quantitative cross-sectional survey design, involving 354 registered nurses in the Sekondi-Takoradi Metropolitan Area. A structured questionnaire measured NIC domains and quality of nursing care. Data analysis was performed using descriptive statistics, correlation, and multiple regression, with significance set at $p \leq 0.05$. **Results:** Nurses reported high perceptions of quality nursing care (M = 4.13, SD = 0.749). NIC levels were moderate, with informatics skills rated higher than computer skills and informatics knowledge. Correlation analysis revealed significant negative associations between NIC domains and quality of nursing care: informatics skills ($r = –0.36$, $p<0.001$), computer skills ($r = –0.459$, $p<0.001$), and informatics knowledge ($r = –0.511$, $p<0.001$). Regression analysis showed that NIC collectively explained 28.2% of the variance in care quality ($R^2 = 0.282$, $F(3,353) = 45.796$, $p \leq 0.001$). Informatics skills had a positive effect, while computer skills and informatics knowledge negatively predicted care quality. **Conclusion:** This study shows that while practical informatics skills enhance nursing care, inadequate integration of theoretical and basic computer skills and knowledge may hinder bedside practice. Nursing education should emphasize experiential, competency-based training, and policies must strengthen digital infrastructure to ensure informatics supports rather than disrupts quality care in Ghana.

Keywords: Competencies; Nursing Informatics; Patient Safety; Quality Nursing Care

INTRODUCTION

The rapid advancement of digital health technologies has fundamentally transformed healthcare delivery systems globally, positioning nursing informatics as a critical pillar of modern nursing practice. Nursing Informatics Competencies (NIC), defined as the integration of informatics knowledge, computer skills, and information management abilities, enable nurses to effectively utilize Information and Communication Technologies (ICTs) to support clinical decision-making, enhance patient safety, and improve the quality of care (Hunter *et al*., 2022; Nashwan *et al*., 2025). With the increasing adoption of Electronic Health Records (EHRs), clinical decision-support systems, and telehealth platforms, NIC has become indispensable for ensuring efficient, evidence-based, and patient-centered healthcare delivery.

Despite these advancements, the distribution and effectiveness of NIC remain highly unequal, particularly in Low- and Middle-income Countries (LMICs). Evidence from high-income countries consistently demonstrates a positive relationship between informatics competencies and improved patient outcomes, including reduced medical errors and enhanced care quality (Javaid *et al*., 2024; Shi *et al*., 2025). More recent global analyses continue to reinforce NIC as a core professional requirement in digitally enabled healthcare systems (Alshammari *et al*., 2024; International Council of Nurses, 2026). However, these findings are largely drawn from well-resourced environments, which limits their applicability to resource-constrained

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settings.

In sub-Saharan Africa, and particularly in Ghana, research on NIC remains sparse and fragmented. Existing studies have predominantly focused on basic computer literacy and ICT adoption rather than adopting a comprehensive, multidimensional approach to informatics competencies (Boateng *et al*., 2021). Emerging evidence from countries such as Tanzania and Nigeria suggests that nurses' informatics competencies are strongly influenced by contextual factors, including infrastructure availability, institutional support, and training exposure (Kidayi *et al.*, 2025; Odekunle *et al*., 2020). Recent African-focused digital health reports further highlight persistent disparities in informatics readiness across healthcare systems, emphasizing the need for context-specific empirical investigations (Sylla *et al*., 2025).

A critical gap in the literature lies in the limited empirical examination of the combined and differential effects of multiple NIC dimensions (informatics knowledge, computer skills, and informatics skills) on the quality of nursing care in LMIC contexts. While previous studies suggest that NIC improves care outcomes, recent research indicates that digital transformation may also introduce unintended challenges, including increased documentation burden, workflow disruption, and system usability constraints (Top *et al*., 2021; Alshammari *et al*., 2024). This creates a paradox in which technological integration may simultaneously enhance and hinder care quality, particularly in resource-limited settings.

The present study addresses this gap by focusing on nurses in the Sekondi-Takoradi Metropolitan Area, a rapidly urbanizing region in Ghana undergoing progressive digitalization in healthcare delivery. Unlike prior studies, this research adopts a multidimensional framework of NIC and empirically examines its direct effect on the quality of nursing care within a resource-constrained context. Furthermore, the study contributes novel insights by assessing whether the relationship between NIC and care quality aligns with global evidence or reflects context-specific variations.

Thus, the novelty of this study lies in three key contributions. First, it provides context-specific empirical evidence from Ghana, addressing the underrepresentation of LMICs in nursing informatics research. Second, it applies a comprehensive, multidimensional assessment of NIC, moving beyond narrow measures such as computer literacy. Third, it examines the context-dependent impact of NIC on care quality, contributing to ongoing debates about the effectiveness of digital health interventions across diverse healthcare environments.

This study, therefore, investigates the relationship between NICs, specifically informatics knowledge, computer skills, and informatics skills, and the quality of nursing care among nurses in selected hospitals within the Sekondi-Takoradi Metropolitan Area. The study was guided by the following hypothesis:

H_{02}: There is no significant relationship between NIC and quality of nursing care.

H_{a2}: There is a significant relationship between NIC and quality of nursing care.

By addressing this gap, the study contributes to the growing body of evidence on nursing informatics in LMICs and provides actionable insights for policy, education, and clinical practice. Ultimately, the findings will inform strategies for strengthening informatics competencies and optimizing digital health implementation to ensure that technological advancements translate into meaningful improvements in nursing care quality.

METHODOLOGY

This study adopted a cross-sectional survey design to capture a "snapshot" of the existing competencies among nurses at a specific point in time, providing valuable insights into their immediate impact on care delivery.

Research Method and Design

A quantitative cross-sectional survey was employed using a structured questionnaire adapted from validated instruments such as the Nursing Informatics Competency Assessment Scale (NICAS) (McClintock, 2018). This approach allowed for comprehensive data collection on informatics competencies and quality of

care within the Ghanaian context.

Scope of the Study

The research was conducted in three hospitals in the Western Region of Ghana: Effia Nkwanta Regional Hospital, Takoradi Hospital, and Jubilee Catholic Children's Hospital, Apowa. The study assessed a range of competencies, including electronic health record use, informatics literacy, and data management, with a focus on their direct and indirect effects on quality nursing care practice.

Population and Sampling

The study population comprised registered nurses and midwives licensed by the Nursing and Midwifery Council of Ghana and currently practicing in selected hospitals within the Sekondi-Takoradi Metropolitan Area. A stratified random sampling technique was employed to ensure adequate representation of participants across key demographic and professional characteristics (Creswell & Creswell, 2018). The population was first divided into strata based on hospital, gender, age group, educational qualification, and years of professional experience. This approach accounted for potential differences in informatics competency levels that might arise from institutional context or professional background.

Within each stratum, participants were selected using simple random sampling to ensure that every eligible nurse and midwife had an equal chance of inclusion. Proportional allocation was applied to determine the number of participants drawn from each subgroup, maintaining representativeness across the strata. A total of 354 participants were selected from the three hospitals according to their staff size and professional composition. This approach enhanced sample diversity, minimized sampling bias, and ensured that the findings accurately reflected variations in nursing informatics competencies and quality of care across the different demographic and institutional categories.

Sample Size

The sample size was determined using Morgan's formula (Krejcie & Morgan, 1970). The calculated minimum sample was 278, but this was increased to 354 to ensure sufficient statistical power across subgroups.

Instrument Validity and Reliability

Ensuring the validity and reliability of the research instrument was essential to uphold methodological rigor in this quantitative cross-sectional study examining NIC and their impact on the quality of nursing care among nurses in Ghana. The adapted questionnaire comprehensively measured three NIC domains, informatics skills, computer skills, and informatics knowledge, alongside quality of nursing care indicators.

To ensure cultural and contextual relevance, the instrument underwent a systematic adaptation process guided by the World Health Organization's (WHO, 2021) recommendations for cross-cultural adaptation of self-report measures. The process involved three key stages: (1) expert panel review comprising nursing informatics specialists, nurse educators, and practicing nurses to assess semantic, experiential, and conceptual equivalence of items; (2) pretesting and cognitive debriefing with a sample of 41 nurses to evaluate item clarity, relevance, and cultural appropriateness; and (3) final harmonization to refine wording based on feedback. Several minor modifications were made to improve contextual fit. No items were removed, but certain wording and terminologies were localized to ensure conceptual alignment and respondent comprehension.

Content validity was established through expert review and pilot testing to confirm that all items accurately represented the intended constructs within the Ghanaian nursing context. Construct validity was further supported by significant Pearson item–total correlations ($p < 0.05$). Reliability testing using Cronbach's alpha demonstrated excellent internal consistency across all subscales: Informatics Skills ($\alpha = 0.892$), Computer Skills ($\alpha = 0.931$), Informatics Knowledge ($\alpha = 0.940$), Patient Safety ($\alpha = 0.751$), and Quality of Nursing Care ($\alpha = 0.914$), yielding an overall reliability coefficient of $\alpha = 0.947$, exceeding the accepted threshold of 0.70 (Cronbach & Shapiro, 1982). These results confirm that the adapted instrument was both valid and reliable for assessing NIC and related care quality outcomes in the Ghanaian nursing context.

Instrumentation

Data was collected using four sections of a structured questionnaire. Section 1 gathered demographics, while Section 2 used NICAS (Staggers *et al*., 2001) to measure informatics skills, computer skills, and informatics knowledge. Section 3 utilized items from the Clinician Survey on Quality Improvement, Practice Guidelines, and Information Technology (QI-PGIT) (Ravi *et al*., 2020) to measure quality of care and IT use. Instruments were culturally adapted for the Ghanaian context, ensuring relevance and reliability.

Rationale and Assumption Testing for Regression Analysis

Multiple regression analysis was used to determine how NIC predict the quality of nursing care, allowing simultaneous assessment of multiple competency domains. This method was chosen for its ability to identify the relative contribution of each NIC domain to care quality. Assumptions of normality, linearity, and homoscedasticity were verified using skewness–kurtosis values, residual plots, and P–P plots. Multicollinearity was assessed through the Variance Inflation Factor (VIF) and tolerance statistics, with all VIFs below 10 and tolerance values above 0.1, confirming data suitability and the independence of predictors for regression analysis.

Data Analysis

The data analysis was conducted using SPSS 27.

Ethical considerations

This study obtained ethical approval from the Ethics Committee of the Open University Malaysia (OUM), Malaysia, with reference number OUM-RPMU/2.7/379.2/DN/Sept2024(003) on 25th July 2024. The study also got approval from the Ghana Health Service Ethics Review Committee (GHS-ERC) with reference number GHS-ERC: 022/01/25 on 5th March, 2025.

RESULTS

Relationship Between Nursing Informatics Competencies and Quality of Nursing Care

The objective of this study was to examine the relationship between NIC and the quality of nursing care among nurses in Ghana. The hypothesis tested was the following:

H_{o2}: There is no significant relationship between NIC and quality of nursing care.

H_{a2}: There is a significant relationship between NIC and the quality of nursing care.

Correlation analysis revealed statistically significant negative relationships between the three domains of nursing informatics competencies (NIC)—informatics skills, computer skills, and informatics knowledge—and perceived quality of nursing care. Informatics knowledge demonstrated the strongest negative correlation with perceived quality of nursing care ($r = -0.511$, $p < 0.001$), followed by computer skills ($r = -0.459$, $p < 0.001$) and informatics skills ($r = -0.360$, $p < 0.001$). These findings indicate that higher levels of nursing informatics competencies were associated with lower perceived quality of nursing care.

Strong positive correlations were observed among the NIC domains. Informatics skills were strongly correlated with computer skills ($r = 0.792$, $p < 0.05$) and informatics knowledge ($r = 0.819$, $p < 0.05$). Similarly, computer skills demonstrated a strong positive correlation with informatics knowledge ($r = 0.832$, $p < 0.05$), suggesting that participants with higher competency in one informatics domain were likely to possess higher competency in the other domains (Table 1).

These findings suggest that while practical informatics skills may improve nursing care through better documentation, efficient access to patient information, and enhanced communication, higher levels of technical or theoretical informatics knowledge may not necessarily translate into improved bedside care within the Ghanaian healthcare context. The paradox observed may reflect contextual challenges such as inadequate ICT infrastructure, inconsistent implementation of EHR systems, increased documentation burden, and limited integration of informatics into clinical workflows. Consequently, nurses may spend more time interacting with technological systems than engaging directly with patients, which could negatively influence perceptions of care quality.

Table 1: Correlation between Quality Nursing Care and Nursing Informatics Competencies (NIC)

Variable	*N*	Mean	S.D.	Correlation(*r*)		
				2	3	4
Quality Nursing	354	4.155	0.7134	-0.36**	-0.459**	-0.511**
Informatics Skills	354	2.131	0.7435		0.792*	0.819*
Computer Skills	354	1.923	0.7196			0.832*
Informatics Knowledge	354	1.923	0.671			

Note: $p < 0.05$ = statistically significant (*); $p < 0.001$ = highly statistically significant (**)

Regression Analysis of NIC and Quality Nursing Care

Table 2 presents the regression analysis for the restricted model examining the effect of informatics skills on quality nursing care. The results indicated that informatics skills significantly and positively predicted quality nursing care ($\beta = 0.529, p < 0.001$).

The unstandardized regression coefficient (b = 0.353) suggests that for every one-unit increase in informatics skills, quality nursing care increased by 0.353 units. The standardized beta coefficient ($\beta = 0.529$) indicates a moderate positive effect of informatics skills on quality nursing care. The t-value ($t = 11.685$) further confirmed that the relationship was statistically significant.

The model explained approximately 27.9% of the variance in quality nursing care ($R^2 = 0.279$), indicating that informatics skills contributed substantially to predicting quality nursing care among the participants. The overall regression model was statistically significant, $F(1,353) = 136.53, p < 0.001$.

Table 2: Regression Analysis for Restricted Model (NIC and Quality Nursing Care)

Variable	*b*	SE	*β*	*t*	*p*	Partial	Tolerance	VIF
Constant	1.049	0.0688		15.392	**			
Informatics Skills	0.353	0.03	0.529	11.685	**	0.529	1	1

*$R=0.529$, $R^2=0.279$, $F_{(1,353)}=136.53$, *p≤0.05, **p≤0.001, SE: Standard Error, VIF: Variance Inflation Factor*

Table 3 presents the regression analysis for the full model examining the impact of nursing informatics competencies on quality nursing care. The findings demonstrated that the overall regression model was statistically significant, $F(3,353) = 45.796$, $p < 0.001$, with an R value of 0.531 and an R^2 value of 0.282. This indicates that the combined nursing informatics competency domains explained 28.2% of the variance in quality nursing care.

Among the predictors, informatics skills significantly and positively predicted quality nursing care ($\beta = 0.243$, $p = 0.004$). In contrast, computer skills significantly and negatively predicted quality nursing care ($\beta = –0.199$, $p = 0.023$). Similarly, informatics knowledge emerged as a significant negative predictor of quality nursing care ($\beta = –0.544, p < 0.001$). The regression coefficient (b = –0.578) indicates that a one-unit increase in informatics knowledge was associated with a 0.578-unit decrease in quality nursing care.

Based on the findings, the null hypothesis (H_{02}) was rejected, while the alternative hypothesis (H_{a2}) was accepted, indicating that a significant relationship exists between nursing informatics competencies and quality nursing care among nurses in Ghana.

Table 3: Regression Analysis for Full Model Impact on Quality Nursing Care

Variable	*b*	SE	*β*	*t*	*p*	Partial	Tolerance	VIF
Constant	5.149	0.103		50.217	**			
Informatics Skills	0.233	0.0881	0.243	2.884	0.004	0.152	0.290	3.449
Computer Skills	-0.197	0.086	-0.199	-2.287	0.023	-0.121	0.271	3.696
Informatics Knowledge	-0.578	0.098	-0.544	-5.876	**	-0.3	0.24	4.173

*$R=0.531$, $R^2=0.282$, $F_{(3,353)}=45.796$, *p≤0.05, **p≤0.001, SE: Standard Error, VIF: Variance Inflation Factor*

Interpretation and Implications

These findings have important implications for nursing practice, education, and policy. The positive predictive effect of informatics skills ($\beta = 0.243$, $p = 0.004$) underscores the value of hands-on competencies such as accurate data entry, EHR navigation, and digital communication in enhancing care quality. Conversely, the negative associations of general computer skills and theoretical knowledge highlight that proficiency in basic ICT or conceptual understanding alone does not automatically translate into improved patient care. Nurses may be technically adept with generic applications like Word or Excel but struggle to apply these skills effectively to patient-centered systems such as medication administration or clinical decision-support tools, indicating the need for meaningful integration of informatics into clinical workflows (Miller *et al*., 2025).

To mitigate the tension between technical efficiency and compassionate care, nursing education and hospital management must focus on context-specific informatics integration. Training programs should simulate real clinical tasks, including documenting vital signs, updating care plans, and monitoring electronic medication charts so that informatics skills directly support bedside care. Embedding these competencies into daily routines ensures digital literacy enhances rather than detracts from patient engagement and responsiveness. Additionally, mentorship programs and continuous professional development should emphasize practical, "informatics-in-practice" approaches over abstract theory, fostering a workforce capable of leveraging technology to improve both efficiency and patient-centered care**.**

DISCUSSION

This section discusses the findings related to the relationship and impact of NIC on the quality of nursing care among nurses in Ghana. The study tested two related hypotheses. First, it examined whether there was a significant relationship between NIC and the quality of nursing care. Second, it assessed whether NIC had a significant impact on quality care practice.

Relationship between NIC and Quality of Nursing Care

This study examined the relationship and impact of NIC on the quality of nursing care among nurses in Ghana. The findings revealed a paradoxical relationship: while applied informatics skills positively influenced care quality, general computer skills and theoretical informatics knowledge were negatively associated. This pattern underscores that competence alone does not guarantee improved care outcomes. In Ghana's context, limited ICT infrastructure, fragmented Electronic Health Record (EHR) systems, and inadequate institutional support constrain the effective application of informatics skills (Shi *et al*., 2025). Consequently, even well-trained nurses may experience workflow disruptions and frustration, which diminish perceived care quality.

Drawing on Benner's (1984) Novice to Expert model, this finding highlights the importance of moving beyond theoretical knowledge toward experiential competence. Nurses develop expertise through practice and reflection; thus, informatics training should emphasize experiential learning, such as simulation labs, case-based exercises, and mentorship, to facilitate the transition from novice users to proficient practitioners. Partnerships among nursing schools, healthcare institutions, and informatics experts are essential to ensure that informatics curricula integrate both conceptual understanding and applied skills (Shi *et al*., 2025; Osei *et al*., 2025).

The paradox of nursing informatics competencies in Ghana can be understood through sociotechnical systems theory and the Technology Acceptance Model, which suggests that misalignment between technical systems, user skills, and organizational context causes theoretical knowledge to lower perceived care quality while practical informatics skills enhance it (Davis, 1989). Comparable findings have been reported across other LMICs. In Kenya, for instance, Ravi and Mohamed (2022) found that ICT-trained nurses initially experienced efficiency declines during system adoption. Likewise, Al-Khalifa *et al*. (2024) reported frustration when training programs did not align with available technologies. In contrast, studies in high-income contexts demonstrate that when infrastructure and continuous professional development are robust, NIC positively correlates with patient outcomes and documentation accuracy (Booth *et al*., 2023; Kinnunen *et al*., 2023). These contrasts reinforce that the translation of NIC into quality outcomes is highly dependent on contextual readiness and organizational support.

The paradox observed in this study suggests that Ghanaian nurses with strong theoretical knowledge

may be more aware of system inefficiencies, thus rating their quality of care more critically. Alternatively, the disconnection between competence and impact could stem from underdeveloped health information systems that limit opportunities for skill application.

Overall, the findings confirm that applied informatics skills, those embedded in real-time documentation, EHR navigation, and clinical decision-making, are most directly associated with care quality (Li *et al*., 2024). Therefore, strengthening Ghana's digital health infrastructure and integrating hands-on informatics training into nursing education are critical. Aligning Benner's experiential learning principles with informatics competency frameworks can help bridge the gap between knowledge and practice, ensuring that digital transformation enhances rather than hinders quality nursing care.

Impact of NIC on Quality Nursing Care

From a nursing practice standpoint, the findings indicate that although enhanced informatics skills can improve documentation accuracy, patient safety, and communication, an overemphasis on theoretical or technical knowledge without practical integration into bedside care may hinder patient-centered interactions. In Ghana, EHR systems and ICT infrastructure are inconsistent, and nurses often spend considerable time managing digital tools rather than engaging directly with patients (Chang *et al*., 2021). This imbalance can disrupt clinical workflows and reduce nurse–patient communication, ultimately leading to lower perceived quality of care despite increasing informatics competence.

Regression analysis deepened the understanding of how NIC relate to the quality of nursing care in Ghana. The restricted model indicated that informatics skills alone significantly improved care quality (β = 0.529, $p < 0.001$), explaining nearly 28% of the variance. This finding aligns with the view that applied informatics abilities, such as retrieving patient data, documenting clinical information, and navigating decision-support systems, directly enhance nursing performance (Chang *et al*., 2021). Nurses who can practically engage with digital tools are better equipped to monitor patients, coordinate care, and minimize errors.

However, the full regression model revealed a more complex picture. While informatics skills retained a positive effect ($\beta = 0.243$, $p = 0.004$), both computer skills ($\beta = –0.199$, $p = 0.023$) and informatics knowledge ($\beta = –0.544$, $p < 0.001$) negatively predicted quality of care. This paradox mirrors findings from other LMICs For instance, Kenyan nurses with strong theoretical informatics knowledge often experienced frustration when health information systems were nonfunctional or inconsistent, leading to inefficiencies and decreased satisfaction. Likewise, Almarwani (2024) argued that ICT literacy, when unsupported by adequate workflows, may burden nurses with administrative demands and divert attention from direct patient care.

In Ghana, infrastructural and systemic constraints appear to mediate these relationships. Frequent system downtimes, unreliable internet connectivity, limited access to integrated Electronic Health Record (EHR) platforms, and inadequate institutional support restrict nurses' ability to translate informatics knowledge into practice (Boadu *et al*., 2021). Furthermore, inconsistent maintenance of digital systems and limited technical support amplify workload stress, reinforcing the negative association between knowledge-based competencies and perceived care quality.

These contextual barriers reflect a competence–practice gap: nurses may understand informatics concepts but lack the means to apply them meaningfully. Without functional digital infrastructure, ongoing professional development, and leadership commitment to digital transformation, theoretical knowledge risks becoming abstract and demotivating. This situation echoes Benner's (1984) Novice to Expert model, specifically the “advanced beginner” stage, where practitioners possess foundational knowledge yet struggle to integrate it seamlessly into expert clinical practice. To advance toward proficient or expert informatics use, Ghanaian nurses require both experiential learning opportunities and systemic support that enable knowledge application in real-world settings.

Comparison with Previous Research

The findings resonate with some but diverge from others. In high-income settings, NIC consistently improves quality and safety outcomes (Borycki, 2025). In contrast, research in African contexts suggests that competencies alone are insufficient. A Nigerian study by Olaniyan *et al*. (2023) reported that although nurses

demonstrated moderate NIC, poor infrastructure limited their impact on care quality. Similarly, Shi *et al*. (2025) and Osei *et al*. (2025) noted that Ghanaian nurses expressed positive attitudes toward ICT but were constrained by workload and systemic inefficiencies.

Comparing these contexts highlights an important distinction: competencies must be matched with institutional readiness. In settings where infrastructure, policies, and workflows are aligned with digital tools, NIC directly improves patient outcomes. In under-resourced settings, however, competencies may expose systemic gaps, creating frustration rather than enhancement. This may explain why the regression model in this study showed negative effects for computer skills and knowledge, which are more theoretical than practice based.

Implications for Practice and Policy

The paradox in these findings is that hands-on informatics skills predict better quality of care, while broader computer skills and theoretical informatics knowledge predict lower perceived care quality, is best understood through the everyday realities of bedside nursing in resource-limited settings. Three interrelated structural and workforce issues help explain this pattern: workload and nurse-patient ratios, clinical training gaps and the competence-practice gap, and system usability and workflow misalignment.

Based on the study results, implementation should focus on translating the identified gaps between NIC and care quality into actionable strategies within healthcare institutions. First, hospitals should integrate NIC enhancement into routine clinical workflows through continuous professional development programs and hands-on informatics training tailored to nurses' varying competency levels. This could include simulation-based learning, peer mentoring, and regular digital literacy workshops aligned with clinical tasks. Second, the Ministry of Health and hospital administrators should prioritize upgrading digital infrastructure by investing in reliable network systems, accessible (EHRs), and user-friendly digital tools designed to suit Ghana's healthcare context. Third, nursing leadership should establish interdisciplinary committees to align informatics training with workflow optimization, ensuring that digital tools support rather than burden care delivery. Finally, partnerships between nursing schools, regulatory bodies, and technology providers should be strengthened to incorporate informatics competencies into both pre-service and in-service education, creating a sustainable framework for continuous improvement in care quality and patient safety.

Clinical training gaps and the competence–practice divide: The negative association for informatics knowledge suggests a competence–practice gap. Theoretical training gives nurses awareness of best practices and digital possibilities, but without structured, context-specific clinical application, this knowledge remains abstract. Nurses who possess this knowledge may also develop higher standards and greater critical awareness about care deficiencies, which can lead to lower subjective ratings of care quality. That phenomenon, greater knowledge leading to more critical appraisal, has been observed among nurses in several LMIC studies where training outpaced system readiness (Al-Khalifa *et al*., 2024). Bridging this gap requires training that fuses informatics theory with repeated, supervised clinical practice (simulation, supervised EHR shifts, mentored bedside documentation) so skills become habitual and time-efficient even under pressure.

Mentorship and peer coaching: Pair nurses with informatics mentors who help integrate digital tasks into routine care and troubleshoot workflow issues in real time.

Staffing and workload policies: Advocate for staffing models that reflect additional time demands during informatics rollouts (temporary staffing boosts or adjusted nurse: patient ratios).

User-centered system design: Engage frontline nurses in EHR customization so interfaces match nursing tasks; minimize duplicate entry and streamline essential fields.

Limitations

This study faced some methodological and contextual limitations that may influence the interpretation and generalizability of its findings. The reliance on self-reported measures introduced subjectivity bias, as participants might have over- or underestimated their nursing informatics competencies due to social desirability or misunderstanding of technical concepts. The cross-sectional design restricted the ability to infer causality between informatics competencies and care outcomes, offering only a snapshot of associations without establishing temporal or mediating factors. Additionally, the study's limited geographic scope, covering only

three hospitals in Ghana's Western Region, restricts external validity, as findings may not represent other healthcare settings or regions. Underrepresentation of certain demographic subgroups, such as very young or older nurses and those without informatics certification, may also reduce the robustness of demographic analyses. Furthermore, the absence of objective performance metrics, such as direct observation or system-based data, limits the validation of self-reported competencies.

Future Scope

Future studies should incorporate longitudinal designs, objective performance metrics, and broader, multi-site samples to enhance causal understanding and generalizability of nursing informatics competencies' impact on care quality and patient safety. NICs are indispensable to the advancement of nursing care quality, yet their impact depends heavily on how knowledge and skills are translated into daily practice. By investing in targeted education, infrastructural support, and policy frameworks that prioritize informatics integration, Ghana's healthcare system can harness the full potential of nursing informatics to improve patient outcomes and elevate the nursing profession. This study not only emphasizes the urgency of action but also offers a springboard for future investigations aimed at bridging the gap between informatics competencies and the realities of clinical care.

CONCLUSION

This study set out to examine the relationship and impact of NIC on the quality of nursing care among nurses in Ghana, with particular focus on three hospitals in the Sekondi-Takoradi metropolitan NIC area. The findings demonstrated that NIC is significantly associated with and predictive of the quality of nursing care. While informatics skills positively influenced care quality, computer skills and theoretical informatics knowledge were negatively associated, highlighting a complex and context-specific relationship. These outcomes reinforce the importance of aligning informatics training with clinical practice realities. The significance of these findings lies in their implications for nursing education, policy, and healthcare delivery in Ghana and similar resource-constrained settings. Nurses' informatics competencies are not only technical skills but also determinants of safe, efficient, and patient-centered care. When competencies are underutilized or poorly integrated into clinical workflows, they may inadvertently undermine nursing efficiency and the patient experience. Conversely, when effectively aligned, NIC can reduce medical errors, improve documentation, and enhance evidence-based decision-making. The study's contributions extend beyond Ghana. By highlighting the paradox of competency and practice gaps, the findings underscore the universal need for nursing curricula and continuing professional development programs that emphasize practical application, contextual adaptability, and systems-level integration of informatics tools. This research, therefore, lays a foundation for further studies exploring longitudinal effects, intervention-based training models, and the role of organizational support in optimizing NIC.

CRediT Authorship Contribution Statement

E. K. B: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review and editing. A. S: Supervision, Validation, Writing – review and editing. O.A: Methodology, Investigation, Data curation, Writing – review and editing. A. F: Supervision, Project administration, Validation, Writing – review & editing.

AI Assistance Declaration

The authors used ChatGPT to assist with language refinement, grammar correction, and clarity of expression during the preparation of this manuscript. All generated content was carefully reviewed, revised, and validated by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the final manuscript.

The authors respectfully submit that the revised manuscript now clearly demonstrates originality, contextual relevance, and a meaningful contribution to nursing informatics, particularly within underrepresented LMIC settings.

Conflict of Interest

The authors declare that they have no competing interests.

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