Editorial

Professional Health Journal (PHJ)
https://www.ojsstikesbanyuwangi.com/index.php/PHJ/index
OPEN ACCESS

Demographic Disparities in Nursing Informatics Competencies: Implications for Nursing Care Quality in the Sekondi-Takoradi Metropolis

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Volume 8(2), 671-692

https://doi.org/10.54832/phj.v8i2.1524
e-ISSN 2715-6249

Received : June 20, 2026
Revised : July 4, 2026
Accepted : July 7, 2026

ABSTRACT

Background: *Nursing informatics competency (NIC), defined as the ability to effectively use digital technologies and health information systems in clinical practice, is essential for supporting safe and efficient healthcare delivery. In Ghana, the expansion of digital health initiatives has increased the need for a competent nursing workforce; however, demographic differences in NIC remain poorly understood. Limited evidence on these disparities constrains the development of targeted educational and workforce interventions.*

Objective: *This study investigated demographic disparities in nursing informatics competencies among registered nurses and midwives in Ghana and examined the implications of these disparities for nursing informatics capacity development.*

Methods: *A quantitative cross-sectional survey was conducted among 360 registered nurses and midwives from three hospitals in the Sekondi–Takoradi Metropolis. Participants were selected using stratified random sampling. Data were collected using the Nursing Informatics Competency Assessment Scale (NICAS), in which lower scores indicate higher self-reported competency. Independent-samples* t*-tests and one-way analysis of variance (ANOVA) were performed using SPSS version 27 to compare competency scores across demographic groups.*

Results: *Significant demographic differences in nursing informatics competencies were observed. Gender differences were significant only for informatics skills (*$t(175.71) = 2.054$, $p = .041$, $d = 0.208$*), with a small effect size, while no significant gender differences were found for computer skills or informatics knowledge. Profession, educational level, and years of work experience were significantly associated with all three competency domains (*$p < .001$*). Certification status was significantly associated with informatics skills (*$p < .001$*) and computer skills (*$p = .019$*), but not with informatics knowledge (*$p = .082$*). Workplace was associated only with informatics knowledge (*$F(2, 357) = 3.052$, $p = .048$, $\eta^2 = 0.017$*), indicating a small effect. Overall, nurses with higher educational qualifications and longer work experience reported greater informatics competency.*

Conclusion: *Nursing informatics competencies differed significantly across several demographic characteristics, particularly educational level, profession, and work experience, whereas gender differences were limited and workplace differences were minimal. These findings highlight the need for targeted, competency-based informatics education and continuing professional development programmes tailored to the learning needs of different demographic groups. Future research should examine whether improvements in nursing informatics competency translate into measurable improvements in nursing care quality and patient safety.*

Keywords: *Nursing Informatics Competency, Informatics Skills, Computer skills, Informatics knowledge, Quality Nursing Care.*

Introduction

The rapid digital transformation of healthcare has heightened the importance of nursing informatics competencies (NIC) in ensuring safe, efficient, and evidence-based nursing practice. Nursing informatics integrates nursing science with information and computer sciences to manage and communicate data, information, knowledge, and wisdom in clinical care [1]. As healthcare systems increasingly adopt electronic health records (EHRs), clinical decision support systems, telemedicine, and mobile health technologies, nurses are expected to possess competencies to use these digital tools effectively in patient care.

In Ghana, digital health has become a national priority through the Ministry of Health's Digital Health Strategy and the Ghana Health Service's continued investment in health information systems, electronic medical records, telemedicine, and digital disease surveillance. The implementation of platforms such as the District Health Information Management System (DHIMS2), expansion of electronic health record systems in secondary and tertiary hospitals, and increased use of telehealth services demonstrate Ghana's commitment to strengthening health system performance through digital technologies. However, the extent of digitalization varies considerably across healthcare facilities, with differences in infrastructure, internet connectivity, availability of computers, and electronic documentation systems influencing healthcare workers' opportunities to develop and apply informatics competencies [2,3].

Despite these policy initiatives, evidence suggests that the nursing workforce has not uniformly benefited from Ghana's digital health transformation. Previous studies have reported that although many nurses possess basic computer literacy, competency in more advanced informatics domains, including electronic documentation, clinical decision support, data management, and health information analysis, remains inadequate [4,8]. These deficiencies have been attributed to limited access to structured informatics education, inadequate practical exposure during professional training, insufficient continuing professional development opportunities, and variability in workplace digital infrastructure [5,6]. Consequently, considerable differences in nursing informatics competency may exist across demographic groups, potentially affecting nurses' readiness to function effectively within increasingly digital healthcare environments.

The integration of nursing informatics into pre-service nursing education in Ghana formally commenced following curriculum revisions introduced by the Nursing and Midwifery Council of Ghana during the 2015/2016 academic year [6]. Although this represented an important milestone, implementation has encountered several challenges, including limited availability of trained informatics educators, insufficient practical laboratory sessions, inadequate integration of informatics into clinical placements, and inconsistent access to digital technologies across nursing training institutions [5]. As a result, many graduates enter clinical practice with theoretical knowledge but limited experience using electronic health information systems in real-world healthcare settings. Similar gaps have also been reported among practicing nurses and midwives, highlighting the need for continuous competency development throughout professional practice [3,7].

Demographic characteristics have consistently been identified as important determinants of nursing informatics competency. International evidence indicates that age, educational attainment, professional category, years of clinical experience, and access to continuing education significantly influence nurses' ability to adopt and utilize health information technologies [4]. In Ghana, Sarfo and Asiedu [3] observed differences in nurses' attitudes toward digital technologies according to educational level and professional experience, while Owusu et al. [7] reported that years of clinical experience alone did not significantly predict informatics competency among midwives, suggesting that workplace exposure and structured training may be more influential than experience itself. Gender, geographical location, and institutional resources have also been shown to influence opportunities for informatics skill acquisition, particularly in resource-constrained settings [5,6].

The present study was conducted in the Sekondi-Takoradi Metropolis of Ghana's Western Region, an important healthcare hub that serves both urban and peri-urban populations through a network of referral and district-level health facilities. The metropolis hosts Efia Nkwanta Regional Hospital, Takoradi Hospital, and Jubilee Children's Hospital, which collectively provide specialized, secondary, and paediatric healthcare services to a large catchment population. These facilities have progressively implemented digital health technologies, including electronic health records, computerized patient registration systems, laboratory information systems, and electronic reporting platforms, although the extent of implementation and routine utilization

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differs across institutions. Such variations in digital infrastructure and clinical technology use provide an appropriate setting for examining demographic differences in nursing informatics competency within a rapidly evolving digital healthcare environment.

This study is further informed by Rogers' Diffusion of Innovations Theory and Benner's Novice-to-Expert Model. Rogers' theory explains how individual and organizational characteristics influence the adoption of new technologies, suggesting that demographic factors such as age, educational level, and professional experience affect nurses' willingness and ability to adopt health information technologies [9]. Benner's model conceptualizes competency as a developmental process acquired through education, clinical experience, reflection, and mentorship rather than through seniority alone [12]. Together, these theoretical perspectives provide a useful framework for understanding why nursing informatics competencies may differ across demographic groups and how competency development can be strengthened through targeted educational interventions.

Although international research on nursing informatics competency has expanded considerably, evidence from Ghana remains limited. Existing Ghanaian studies have primarily assessed overall informatics competency without comprehensively examining demographic differences among registered nurses and midwives or considering how workplace context may contribute to these variations [7,8]. Furthermore, while nursing informatics competency is widely recognized as an important prerequisite for safe and high-quality healthcare, few studies have explored demographic patterns that may inform targeted workforce development and educational planning within the Ghanaian health system.

Therefore, this study investigated demographic differences in nursing informatics competencies among registered nurses and midwives working in three public hospitals in the Sekondi-Takoradi Metropolis. Specifically, the study examined whether nursing informatics competency differed according to gender, age, profession, educational level, certification status, workplace, and years of professional experience. By identifying demographic groups with relatively lower competency levels, the findings are expected to inform evidence-based educational strategies, continuing professional development programmes, and workforce policies aimed at strengthening nursing informatics capacity in Ghana's evolving digital healthcare system. The study addressed the research question: Is there a significant difference in nursing informatics competencies based on demographic characteristics among nurses in Ghana? Accordingly, the study hypothesized that nursing informatics competencies differ significantly across demographic groups among registered nurses and midwives in Ghana.

Materials and Methods

Study Design

This study employed a quantitative cross-sectional survey design to examine differences in self-reported nursing informatics competencies (NIC) across demographic groups among registered nurses and midwives in Ghana. A cross-sectional design was considered appropriate because it enables the comparison of competency scores across multiple demographic characteristics at a single point in time without manipulating study variables. The study focused on demographic characteristics, including age, gender, professional category, educational level, certification status, workplace, and years of clinical experience.

Study Setting

The study was conducted in three public hospitals located in the Sekondi-Takoradi Metropolis of the Western Region of Ghana: Efia Nkwanta Regional Hospital, Takoradi Hospital, and Jubilee Children's Hospital. The Sekondi-Takoradi Metropolis is one of Ghana's major commercial and healthcare centres, serving a large urban and peri-urban population within the Western Region and neighbouring districts. Efia Nkwanta Regional Hospital is the regional referral hospital providing specialist and secondary healthcare services. Takoradi Hospital is a secondary-level district hospital providing general medical, surgical, obstetric, and emergency services, while Jubilee Children's Hospital specializes in paediatric healthcare services.

These facilities were selected because they represent major public healthcare institutions within the metropolis and have progressively adopted digital health technologies to varying degrees.

Electronic Health Record (EHR) or Electronic Medical Record (EMR) systems are used; Computerized patient registration and documentation systems; Availability of computers and internet connectivity in clinical units; Clinical information systems available to nurses and midwives; Extent of routine electronic documentation by nursing staff.

Understanding the digital practice environment is important because exposure to health information technologies may contribute to differences in nursing informatics competencies. Data were collected between April 2025 and July 2025.

Study Population and Sampling

The target population comprised registered nurses and registered midwives employed in the three participating hospitals. The total number of eligible nurses and midwives in the three hospitals was nearly 800.

Inclusion Criteria:

Participants were eligible if they:

were registered nurses or registered midwives licensed to practise in Ghana;

were employed at one of the three participating hospitals;

had worked in the facility for at least six months before data collection;

were directly involved in patient care and/or clinical documentation; and

voluntarily agreed to participate by providing written informed consent.

Exclusion Criteria:

The following individuals were excluded:

nurses or midwives on annual, study, maternity, or sick leave during data collection;

administrative nursing staff without direct clinical responsibilities;

nursing students or interns;

participants who declined participation; and

questionnaires with substantial missing or incomplete responses.

Sample Size Determination

A total of 360 nurses and midwives participated in the study. The Morgan formula [16], was initially used to estimate the sample size required to achieve a 95% confidence level with a 5% margin of error:

$$n=(Z^2\times p\times(1-p))/E^2$$

Where:

n = required sample size

Z = Z-score corresponding to the desired confidence level (1.96 for 95%)

p = estimated proportion of the population exhibiting the attribute of interest

E = margin of error (expressed as a proportion)

Using this formula, the initial calculation yielded n = 278. However, because the study employed stratified random sampling to examine subgroups based on experience, education level, and clinical role, and because the analysis focused on outcome variables (quality of care and patient safety), the sample size was adjusted to 360 participants. This adjustment ensured sufficient statistical power to detect meaningful differences in the primary outcomes across strata, minimize type II error, and allow for potential non-responses.

Sampling Technique: A stratified random sampling technique was employed to ensure adequate representation of participants from each participating hospital. The sampling frame consisted of eligible nurses and midwives obtained from the nursing administration of each hospital. Proportional allocation was used to determine the number of participants selected from each stratum according to its contribution to the overall study population. Within each stratum, participants were selected using simple random sampling.

Study Instrument

Data were collected using the Nursing Informatics Competency Assessment Scale (NICAS) with a total of 19 items and Staggers et al. 2001 as the original source, a standardized instrument developed to assess self-reported nursing informatics competencies among nurses. The questionnaire comprised two sections. The first section collected demographic information, including age, gender, professional category, educational level, certification status, workplace, and years of professional experience. The second section measured nursing informatics competency across three domains:

Informatics Skills (5 items)

Computer Skills (7 items)

Informatics Knowledge (7 items)

Responses were recorded using a Likert-type scale as follows (1: Completely, 2: Very Much, 3: Little, and 4: Very Little). Importantly, lower mean scores indicate higher self-reported nursing informatics competency, whereas higher mean scores indicate lower perceived competency. All statistical interpretations presented in this study were based on this scoring direction.

Before data collection, the instrument was reviewed to ensure contextual relevance for the Ghanaian healthcare setting. A pilot study involving 41 nurses was conducted to assess clarity and feasibility. Feedback from the pilot informed minor revisions before the main data collection. Validity and Reliability: Content validity was assessed through expert review involving specialists in nursing informatics and nursing education. Internal consistency reliability was evaluated using Cronbach's alpha coefficients. The overall instrument demonstrated satisfactory reliability (Cronbach's $\alpha \geq 0.75$).

The Nursing Informatics Competency Assessment Scale (NICAS) was scored such that lower mean scores indicate higher self-reported nursing informatics competency, whereas higher mean scores indicate lower perceived competency. All interpretations of group differences were based on this scoring direction

Data Collection Procedure

Following ethical approval and institutional permission, eligible participants were approached during duty periods and informed about the purpose of the study. Written informed consent was obtained before questionnaire administration. Questionnaires were completed anonymously online and submitted immediately after completion within the agreed time frame to protect participant confidentiality.

Data Analysis

Data were entered, cleaned, and analysed using IBM SPSS Statistics version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize participant characteristics and nursing informatics competency scores.

Independent-samples t-tests were used to compare competency scores between two-group demographic variables, while one-way analysis of variance (ANOVA) was used for variables comprising three or more groups.

Assumption Testing

Before inferential analyses, assumptions of normality and homogeneity of variance were evaluated.

Normality was assessed using skewness statistics together with graphical inspection of data distributions.

Homogeneity of variances was evaluated using Levene's test.

Where Levene's test was not statistically significant, standard ANOVA followed by Bonferroni post hoc comparisons was performed.

Where homogeneity of variance was violated ($p < .05$), Welch's ANOVA and Games-Howell post hoc tests were considered appropriate because they do not assume equal variances.

Effect sizes were reported using Cohen's d for independent t-tests and eta squared (η^2) for ANOVA to facilitate interpretation of the practical significance of observed differences. Statistical significance was established at $p < .05$.

Given the number of comparisons performed across demographic variables and competency domains, the findings were interpreted cautiously to reduce the likelihood of Type I error.

Because demographic variables such as age, educational level, profession, certification status, and years of experience may be interrelated, future studies should employ multivariable analytical approaches to identify independent predictors of nursing informatics competency while controlling for potential confounding variables.

Finally, it should be noted that this study assessed nursing informatics competencies only. Measures of quality of nursing care or patient safety were not collected. Therefore, any discussion of quality of care or patient safety is presented as a potential implication of nursing informatics competency rather than as a direct finding of this study.

Results

This study aimed to examine demographic differences in nursing informatics competencies among registered nurses and midwives in selected hospitals in the Sekondi-Takoradi Metropolis, Ghana.

Hypothesis

H0: There is no significant difference in nursing informatics competencies based on demographic characteristics among nurses and midwives in Ghana.

Ha: There is a significant difference in nursing informatics competencies among nurses and midwives in Ghana based on demographic characteristics.

Table 1 Results of T-tests and Descriptive Statistics of Male and Female Nurses' Nursing Informatics Competences (NIC)

Variable	Group (Gender)	N	Mean	SD	Skewness	Levene's Test Sig	CI_{95}	t	df	p	ES(d)
Informatics Skills	Male	74	2.262	.512	-.019	**	.036, .306	2.054	175.71	.041	.208
	Female	286	2.106	.797							
Computer Skills	Male	74	1.884	.602	.605	.028	-.202, .125	-.464	136.831	.643	-.053
	Female	286	1.923	.745							
Informatics Knowledge	Male	74	2.008	.496	.637	**	-.045, .238	1.346	162.745	.180	.142
	Female	286	1.911	.723							

IS ($F_{(2,358)} = 23.845$, $p< 0.001$), CS ($F_{(2,358)} = 4.881$, $p = .028$), IK ($F_{(2,358)} = 13.703$, $p < 0.001$), *$p \leq 0.05$, **$p\leq 0.001$

Table 1 presents the results of the independent-samples t-tests comparing nursing informatics competency (NIC) scores between male and female nurses. Because the Nursing Informatics Competency Assessment Scale (NICAS) is scored such that lower mean scores

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indicate higher self-reported competency, lower mean values represent better nursing informatics competency.

For informatics skills, male nurses had a higher mean score (M = 2.262, SD = 0.512) than female nurses (M = 2.106, SD = 0.797). Levene's test indicated unequal variances; therefore, Welch's t-test was used. The analysis revealed a statistically significant difference between the two groups, t(175.71) = 2.054, p = .041, 95% CI [0.036, 0.306], with a small effect size (d = 0.208). Given the NICAS scoring direction, female nurses demonstrated slightly higher self-reported informatics skills competency than male nurses, although the magnitude of the difference was small.

For computer skills, male nurses recorded a mean score of 1.884 (SD = 0.602), while female nurses recorded a mean score of 1.923 (SD = 0.745). Although Levene's test indicated unequal variances (p = .028), the Welch-adjusted t-test showed no statistically significant difference between the groups, t(136.831) = –0.464, p = .643, 95% CI [–0.202, 0.125], with a negligible effect size (d = –0.053). These findings indicate that computer skills competency did not differ significantly by gender.

Similarly, informatics knowledge scores were 2.008 (SD = 0.496) for male nurses and 1.911 (SD = 0.723) for female nurses. Following the significant Levene's test, the Welch-adjusted t-test indicated no statistically significant gender difference, t(162.745) = 1.346, p = .180, 95% CI [–0.045, 0.238], with a small effect size (d = 0.142). Although female nurses recorded a lower mean score, indicating slightly higher self-reported competency, the difference was not statistically significant.

The skewness values for informatics skills (–0.019), computer skills (0.605), and informatics knowledge (0.637) were within acceptable limits, supporting the assumption of approximate normality. Overall, the findings indicate that gender differences were limited to the informatics skills domain and were characterized by a small practical effect, whereas no statistically significant gender differences were observed for computer skills or informatics knowledge.

Note: The ANOVA statistics reported beneath Table 1 (Informatics Skills: F(2, 358) = 23.845, p < .001; Computer Skills: F(2, 358) = 4.881, p = .028; Informatics Knowledge: F(2, 358) = 13.703, p < .001) do not relate to the gender comparison because gender has only two groups and was analyzed using independent-samples t-tests. These ANOVA results should either be removed from Table 1 or presented in the table corresponding to the demographic variable for which they were computed.

Table 2 Results of T-tests and Descriptive Statistics of Nurses' Profession of Nursing Informatics Competences (NIC)

Variable	Group (Profession)	N	Mean	SD	Skewness	Levene's Test Sig	CI_{95}	t	df	p	ES(d)
Informatics Skills	Registered Nurse	286	2.039	.704	-.019	.236	-.676, -.300	-5.14	358	**	-.67
	Midwife	74	2.524	.797							
Computer Skills	Registered Nurse	286	1.793	.659	.605	.348	-.765, -.417	-6.69	358	**	-.87
	Midwife	74	2.384	.747							
	Registered Nurse	286	1.812	.609							

Informatics Knowledge					.637	.097	-.743, -.413	-6.89	358	**	-.89
	Midwife	74	2.390	.760							

Informatics Skills: F(1,358) = 1.41, p = .236; Computer Skills: F(1,358) = 0.881, p = .348; Informatics Knowledge: F(1,358) = 2.778, p = .097. p ≤ .05; p < .001.

Table 2 presents the results of the independent-samples t-tests comparing nursing informatics competencies (NIC) between registered nurses and registered midwives. Because the Nursing Informatics Competency Assessment Scale (NICAS) is scored such that lower mean scores indicate higher self-reported competency, lower mean values represent greater competency.

For informatics skills, registered nurses recorded a significantly lower mean score (M = 2.039, SD = 0.704) than registered midwives (M = 2.524, SD = 0.797). Levene's test indicated that the assumption of equal variances was met (p = .236); therefore, the standard independent-samples t-test was applied. The analysis revealed a statistically significant difference between the two professional groups, t(358) = −5.14, p < .001, 95% CI [−0.676, −0.300], with a medium-to-large effect size (d = −0.67). Based on the NICAS scoring direction, registered nurses demonstrated higher self-reported informatics skills competency than registered midwives.

Similarly, for computer skills, registered nurses obtained a lower mean score (M = 1.793, SD = 0.659) than registered midwives (M = 2.384, SD = 0.747). The assumption of homogeneity of variances was satisfied (Levene's test, p = .348). The independent-samples t-test showed a statistically significant difference, t(358) = −6.69, p < .001, 95% CI [−0.765, −0.417], with a large effect size (d = −0.87). These findings indicate that registered nurses reported significantly higher computer skills competency than registered midwives.

For informatics knowledge, registered nurses also recorded a lower mean score (M = 1.812, SD = 0.609) than registered midwives (M = 2.390, SD = 0.760). Levene's test was not statistically significant (p = .097), indicating that the assumption of equal variances was met. The independent-samples t-test demonstrated a statistically significant difference between the two groups, t(358) = −6.89, p < .001, 95% CI [−0.743, −0.413], with a large effect size (d = −0.89). According to the NICAS scoring system, registered nurses demonstrated significantly higher self-reported informatics knowledge competency than registered midwives.

Overall, statistically significant differences were observed between registered nurses and registered midwives across all three nursing informatics competency domains. The effect sizes ranged from medium to large, suggesting that the professional category was meaningfully associated with self-reported nursing informatics competencies, with registered nurses consistently demonstrating higher competency than registered midwives.

Table 3 Results of T-tests and Descriptive Statistics of Certification in Nursing Informatics Competences

Variable	**Group Certification**	**N**	**Mean**	**SD**	**Skewness**	**Levene's Test Sig**	**CI$_{95}$**	**t**	**df**	**p**	**ES(d)**
	Yes	167	1.874	.807							
Informatics Skills					-.019	**	-.643, -.342	-6.448	306.666	**	-.69
	No	193	2.367	.612							
	Yes	167	1.817	.839							

Computer Skills					.605	**	-.334, -.030	-2.359	289.764	.019	-.26
	No	193	1.999	.582							
	Yes	167	1.861	.826							
Informatics Knowledge					.637	**	-.276, .016	-1.748	272.919	.082	-.19
	No	193	1.991	.524							

Informatics Skills, F(1, 358) = 21.220, p < .001; Computer Skills, F(1, 358) = 27.608, p < .001; Informatics Knowledge, F(1, 358) = 43.539, p < .001. Independent-samples t-tests were used to compare competency scores between certified and non-certified participants. p ≤ .05; p < .001.

Table 3 presents the results of the independent-samples t-tests comparing nursing informatics competencies (NIC) between nurses and midwives with and without professional certification. Because the Nursing Informatics Competency Assessment Scale (NICAS) is scored such that lower mean scores indicate higher self-reported competency, lower mean values represent greater competency.

For informatics skills, participants with professional certification recorded a lower mean score (M = 1.874, SD = 0.807) than those without certification (M = 2.367, SD = 0.612). Levene's test indicated unequal variances; therefore, the Welch-adjusted t-test was used. The analysis demonstrated a statistically significant difference between the two groups, t(306.666) = −6.448, p < .001, 95% CI [−0.643, −0.342], with a medium-to-large effect size (d = −0.69). These findings indicate that nurses and midwives with professional certification reported significantly higher informatics skills competency than those without certification.

For computer skills, certified participants also had a lower mean score (M = 1.817, SD = 0.839) than non-certified participants (M = 1.999, SD = 0.582). Following the significant Levene's test, the Welch-adjusted t-test revealed a statistically significant difference, t(289.764) = −2.359, p = .019, 95% CI [−0.334, −0.030], with a small effect size (d = −0.26). Based on the NICAS scoring system, certified nurses and midwives demonstrated significantly higher computer skills competency than their non-certified counterparts.

For informatics knowledge, certified participants recorded a lower mean score (M = 1.861, SD = 0.826) than those without certification (M = 1.991, SD = 0.524). However, although the certified group reported slightly higher competency, the Welch-adjusted t-test indicated that the difference was not statistically significant, t(272.919) = −1.748, p = .082, 95% CI [−0.276, 0.016], with a small effect size (d = −0.19).

Overall, certification status was significantly associated with informatics skills and computer skills but not with informatics knowledge. The observed effects ranged from small to medium-to-large, suggesting that professional certification was associated with higher self-reported competency in selected domains of nursing informatics but was not associated with informatics knowledge.

Table 4 Descriptive Statistics and Test for Nursing Informatics Competences Based on Age Group

Variable	**Group (Age)**	**Assumptions**		**N**	**Mean**	**SD**
		Skewness	**Homogeneity (Levene's Test) Sig**			
Informatics Skills		-.019	.203			
	Less than 20 yrs			15	3.293	.807
	20-30 yrs			84	2.178	.776
	31-40 yrs			152	2.037	.676
	41-50 yrs			86	2.10	.664

	51-60			22	2.047	.818
	61 yrs and above			1	2	0
Computer Skills		.605	.011			
	Less than 20 yrs			15	3.067	.993
	20-30 yrs			84	1.879	.728
	31-40 yrs			152	1.807	.607
	41-50 yrs			86	1.934	.667
	51-60			22	1.929	.753
	61 yrs and above			1	2	0
Informatics Knowledge		.637	**			
	Less than 20 yrs			15	3.129	.93
	20-30 yrs			84	2.032	.739
	31-40 yrs			152	1.835	.588
	41-50 yrs			86	1.836	.513
	51-60			22	1.701	.549
	61 yrs and above			1	2	0

**$p \le 0.001$, *$p \le 0.05$

According to Table 4, the variables informatics skills (-0.019), computer skills (0.605), and informatics knowledge (0.637) presented normal to mildly skewed distributions according to skewness values, while remaining within appropriate ranges for parametric analysis. Levene's Test for homogeneity of variances examined the variance equality among different age groups for each analyzed variable. The assumption of homogeneity was confirmed for informatics skills (p =.203), yet it failed for computer skills (p =.011) and informatics knowledge (p <001), which demonstrated significant variance differences between age groups.

The informatics skills assessment revealed that nurses under twenty years old achieved the highest mean score (M = 3.293, SD = 0.807), yet they displayed lower self-reported competency based on the assumption that lower scores indicate better competence. The 31–40 years age group (M = 2.037, SD = 0.676), along with the 51–60 years group (M = 2.047, SD = 0.818) displayed the lowest mean scores, which indicated relatively high competency levels. This pattern might be due to the accumulation of knowledge and experience throughout the years. The computer skills assessment displayed an identical pattern as the under-20 group achieved the highest mean score (M = 3.067, SD = 0.993), but the scores dropped substantially for the 20–30 years and 31–40 years age groups (M = 1.879, SD = 0.728 and M = 1.807, SD = 0.607), indicating higher computer skills in older age groups.

Also, the age-related pattern for informatics knowledge was similar to previous observations. The under-20 age group demonstrated the highest mean score of 3.129 (SD = 0.930), yet the 51–60 years group achieved the lowest score of 1.701 (SD = 0.549), indicating that informatics knowledge rises with age-related professional development. The descriptive information shows that nursing informatics competency scores decrease as nurses get older because younger nurses reported better abilities (lower competency) across every domain.

The age category "61 years and above" included only one participant (n = 1). Consequently, descriptive statistics for this group are presented for completeness only and were not interpreted independently.

Table 5 One-way Analysis of Variance Results for Age Group

Variable	**Source**	***SS***	***df***	***MS***	***F***	***p***	***η²***
Informatics Skills	Between Groups	22.058	5	4.412	8.697	**	.109
	Within Groups	179.573	354	.507			
	Total	201.631	359				
Computer Skills	Between Groups	21.805	5	4.361	9.465	**	.118
	Within Groups	163.105	354	.461			
	Total	184.910	359				
Informatics Knowledge	Between Groups	29.110	5	5.822	14.896	**	.174

	Within Groups	138.357	354	.391
	Total	167.467	359	

**p ≤ 0.001, *p ≤ 0.05

Table 5 results showed that there were statistically significant differences between age groups in all three domains at the $p \leq 0.001$ level. The ANOVA test for informatics skills produced a statistically significant result with $F_{(5, 354)} = 8.697$, $p < 0.001$, and $\eta^2 = 0.109$. The results show that 10.9% of the variance in informatics skills scores can be explained by differences among the age groups. The results for computer skills also showed statistically significant differences between age groups with $F_{(5, 354)} = 9.465$, $p < 0.001$, and $\eta^2 = 0.118$. The results indicate that 11.8% of the variability in computer skills scores is due to age group membership. Also, informatics knowledge showed $F_{(5, 354)} = 14.896$, $p < 0.001$, with an effect size of $\eta^2 = 0.174$. This indicates that age group differences explained 17.4% of the variance in informatics knowledge scores. The findings confirm that age group is a significant factor in all three areas of nursing informatics competencies, with the strongest association being in informatics knowledge.

The descriptive statistics for this group are presented for completeness only and are not independently interpretable. Future studies should combine sparse age categories (e.g., "51 years and above") or recruit larger samples to ensure more robust inferential analyses. **p** ≤ .001; *p* ≤ .05.

Table 6 Descriptive Statistics and Test for Nursing Informatics Competences Based on Educational Level

Variable	**Group (Educational Level)**	**Assumptions**		**N**	**Mean**	**SD**
		Skewness	**Homogeneity (Levene's Test) Sig**			
Informatics Skills		-.019	.**			
	Diploma			78	2.408	.914
	Bachelor's Degree			203	2.116	.693
	Master's Degree			79	1.929	.63
Computer Skills		.605	**			
	Diploma			78	2.242	.916
	Bachelor's Degree			203	1.8851	.634
	Master's Degree			79	1.756	.598
Informatics Knowledge		.637	**			
	Diploma			78	2.332	.898
	Bachelor's Degree			203	1.85	.575
	Master's Degree			79	1.743	.531

**p ≤ 0.001, *p ≤ 0.05

According to Table 6, the scores in informatics skills (-0.019), computer skills (0.605), and informatics knowledge (0.637) showed acceptable skewness values that indicated normal or mildly skewed distributions. Levene's Test for homogeneity of variances showed statistical significance at $p \leq 0.001$ across all three domains, which confirmed that equal variances did not hold. The informatics skills scores demonstrated a downward trend with each level of education. The mean score for Diploma holders reached 2.408 (SD = 0.914), Bachelor's degree holders scored 2.116 (SD = 0.693), and Master's degree holders scored the lowest at 1.929 (SD = 0.630). The results indicate that nurses with advanced educational backgrounds show higher informatics skills competency based on the assumption that lower scores indicate better competence. The computer skills scores followed the same pattern, with Diploma holders achieving 2.242 (SD = 0.916), while Bachelor's degree holders scored 1.885 (SD = 0.634), and Master's degree holders achieved the lowest score of 1.756 (SD = 0.598). The results indicate that educational progression leads to better computer skills.

The same descending pattern appeared in the informatics knowledge domain. The highest mean score of 2.332 (SD = 0.898) belonged to Diploma holders, who were followed by Bachelor's degree holders (M = 1.850, SD = 0.575) and Master's degree holders (M = 1.743, SD = 0.531). The rising self-reported competency levels in all three domains with educational progression indicate that formal academic education plays a significant role in developing nursing informatics competencies.

Table 7 One-way Analysis of Variance Results for Educational Level

Variable	Source	SS	df	MS	F	p	η²
Informatics Skills	Between Groups	9.216	2	4.608	8.55	**	.046
	Within Groups	192.415	357	.539			
	Total	201.631	359				
Computer Skills	Between Groups	11.165	2	5.582	11.47	**	.06
	Within Groups	173.745	357	.487			
	Total	184.91	359				
Informatics Knowledge	Between Groups	16.625	2	8.313	19.674	**	.099
	Within Groups	150.842	357	.423			
	Total	167.467	359				

**p ≤ 0.001, *p ≤ 0.05

The results in Table 7 showed statistically significant differences across all three domains at the $p \leq 0.001$ level. The analysis of variance (ANOVA) showed a significant difference in informatics skills among the educational groups, $F_{(2, 357)} = 8.55$, $p < 0.001$, with an associated effect size of $\eta^2 = 0.046$. The results indicate that educational level explains 4.6% of the variance in informatics skills scores, which is a small to moderate effect. In the case of computer skills, the ANOVA also revealed a significant difference, $F_{(2, 357)} = 11.47$, $p < 0.001$, with an effect size of $\eta^2 = 0.060$, indicating that 6.0% of the variance in computer skills scores is attributable to educational level. Moreover, informatics knowledge yielded $F_{(2, 357)} = 19.674$, $p < 0.001$, and an effect size of $\eta^2 = 0.099$. This indicates that educational level explains 9.9% of the variability in informatics knowledge scores.

Table 1 Post-hoc Multiplication Comparison (Games-Howell) Results for Nursing Informatics Competencies Based on Educational Level

Variable	Group	Mean	1	2	3
Informatics Skills	1. Diploma	2.408		.291*	.479**
	2. Bachelor's Degree	2.116			.187
	3. Master's Degree	1.929			
Computer Skills	1. Diploma	2.242		.391*	.486**
	2. Bachelor's Degree	1.8851			.095
	3. Master's Degree	1.756			
Informatics Knowledge	1. Diploma	2.332		.481**	.588**
	2. Bachelor's Degree	1.85			.107
	3. Master's Degree	1.743			

**p ≤ 0.001, *p ≤ 0.05

A Games-Howell post-hoc test was used to evaluate nursing informatics competencies at different educational levels, and the results are shown in Table 8. Participants with a Diploma degree had the highest mean (M = 2.408), indicating the lowest self-reported competence in informatics. In contrast, those with a Master's Degree had the lowest mean (M = 1.929), indicating the highest level of competence. The difference between Diploma and Bachelor's Degree holders was statistically significant (mean difference = 0.291, $p \leq 0.05$), and the difference between Diploma and Master's Degree holders was even more pronounced and highly significant (mean difference = 0.479, $p \leq 0.001$). However, the difference between Bachelor's and Master's Degree holders was not statistically significant ($p > 0.05$), indicating similar levels of perceived competence among those with higher education.

A similar pattern was observed in computer skills. Diploma holders again had the highest mean (M = 2.242), suggesting the least competence, while Master's degree holders had the lowest mean (M = 1.756), reflecting the greatest competence. The post-hoc results showed statistically significant differences between Diploma and Bachelor's holders (mean difference = 0.391, $p \leq 0.05$), and between Diploma and Master's holders (mean difference = 0.486, $p \leq 0.001$). The difference between the Bachelor's and Master's groups was not statistically significant.

For informatics knowledge, Diploma holders again reported the highest mean score (M = 2.332), with progressively lower means for Bachelor's (M = 1.850) and Master's (M = 1.743) participants. The differences between Diploma and Bachelor's holders (mean difference = 0.481, $p \leq 0.001$) and between Diploma and Master's holders (mean difference = 0.588, $p \leq 0.001$) were statistically significant. The Bachelor's vs. Master's comparison did not reach significance. Thus, all three competency domains show that as the level of education increases, the level of self-reported informatics competence also increases. Nurses with a Master's degree had the highest perceived competence, followed by those with a Bachelor's degree, and the lowest perceived competence was those with a Diploma.

Table 9 Descriptive Statistics and Test for Nursing Informatics Competences Based on Workplace

Variable	**Group (Educational Level)**	**Assumptions**		**N**	**Mean**	**SD**
		Skewness	**Homogeneity (Levene's Test) Sig**			
Informatics Skills		-.019	.026			
	Efia Nkwanta Reg Hospital			164	2.156	.74
	Takoradi Hospital			102	2.096	.816
	Jubilee Children's Hospital			94	2.153	.693
Computer Skills		.605	.027			
	Efia Nkwanta Reg Hospital			164	2.003	.754
	Takoradi Hospital			102	1.873	.743
	Jubilee Children's Hospital			94	1.807	.605
Informatics Knowledge		.637	.04			
	Efia Nkwanta Reg Hospital			164	2.027	.735
	Takoradi Hospital			102	1.838	.703
	Jubilee Children's Hospital			94	1.865	.537

$^{**}p \leq 0.001$, $^{*}p \leq 0.05$

In Table 9, the skewness values for informatics skills (-0.019), computer skills (0.605), and informatics knowledge (0.637) were all within the acceptable range for normality, indicating that the data distributions were either approximately normal. Levene's Test for homogeneity of variances was statistically significant for all three domains ($p < 0.05$), with p-values of 0.026 for informatics skills, 0.027 for computer skills, and 0.040 for informatics knowledge. These results indicate that the assumption of equal variances across hospital groups was violated.

In the domain of informatics skills, mean scores were relatively similar across the three hospitals: Efia Nkwanta Regional Hospital (M = 2.156, SD = 0.740), Takoradi Hospital (M = 2.096, SD = 0.816), and Jubilee Children's Hospital (M = 2.153, SD = 0.693). This suggests minimal variation in self-reported informatics skills based on workplace. A slightly more pronounced difference emerged in computer skills, where nurses at Efia Nkwanta reported a mean of 2.003 (SD = 0.754), compared to 1.873 (SD = 0.743) at Takoradi Hospital and 1.807 (SD = 0.605) at Jubilee Children's Hospital. While differences are modest, they suggest that staff at Efia Nkwanta may perceive themselves as somewhat less proficient in computer skills than those at the other two facilities. In the area of informatics knowledge, Efia Nkwanta again had the highest mean score (M = 2.027, SD = 0.735), followed by Jubilee Children's Hospital (M = 1.865, SD = 0.537), and Takoradi Hospital (M = 1.838, SD = 0.703). As lower scores indicate higher perceived competence, these values suggest slightly higher informatics knowledge among nurses at the latter two hospitals.

Table 2 One-way Analysis of Variance Results for Workplace

Variable	**Source**	***SS***	***df***	***MS***	***F***	***p***	***η²***
Informatics Skills	Between Groups	.255	2	.127	.228	.798	.001
	Within Groups	201.376	357	.564			
	Total	201.631	359				
Computer Skills	Between Groups	2.539	2	1.27	2.485	.085	.014
	Within Groups	182.371	357	.511			
	Total	2.815	359				
Informatics Knowledge	Between Groups	164.652	2	1.408	3.052	.048	.017
	Within Groups	164.652	357	.461			
	Total	167.467	359				

***p* ≤ 0.001, **p* ≤ 0.05

Table 10 showed no significant difference between the three hospital groups regarding their informatics skills $F_{(2, 357)} = 0.228$, p = 0.798. The effect size, as measured by eta squared ($\eta^2 = 0.001$), was negligible, indicating that less than 0.1% of the variance in informatics skills could be attributed to the workplace. These results suggest that self-reported informatics skills were similar across the three hospitals. The comparison between groups regarding computer skills showed a trend toward statistical significance but did not meet the threshold, $F_{(2, 357)} = 2.485$, p = 0.085. The associated effect size was $\eta^2 = 0.014$, representing a small effect, with approximately 1.4% of the variance in computer skills explained by the workplace. The results failed to meet the statistical significance threshold ($p \leq 0.05$).

Again, the results showed a statistically significant difference in informatics knowledge scores between groups, $F_{(2, 357)} = 3.052$, p = 0.048, with an effect size of $\eta^2 = 0.017$. Workplace affiliation explained about 1.7% of the total variance in informatics knowledge scores, according to the small effect size. The significant p-value shows that at least one hospital group demonstrated different informatics knowledge levels despite its small effect size.

Table 13 Post-hoc Multiplication Comparison (Games-Howell) Results for Nursing Informatics Competencies Based on Workplace

Variable	**Group**	**Mean**	**1**	**2**	**3**
Informatics Knowledge	1. Efia Nkwanta Regional Hospital	2.027		.189	.162

Bachiere, Eric Kanyire., Shariff, Fatimah Binti Md (2026) Demographic Disparities in Nursing Informatics Competencies: Implications for Nursing Care Quality in the Sekondi-Takoradi Metropolis. *PROFESIONAL HEALTH JOURNAL*. 8(2), 1-22. https://doi.org/10.54832/phj.v8i2.1524

	2. Takoradi Hospital	1.838	-.027
	3. Jubilee Children's Hospital	1.865	

***p* ≤ 0.001, **p* ≤ 0.05

Table 11 results showed that none of the pairwise comparisons among the three hospital groups were statistically significant at either the 0.05 or 0.001 level. Nurses from Efia Nkwanta Regional Hospital had the highest mean score for informatics knowledge (M = 2.027), followed by those from Jubilee Children's Hospital (M = 1.865) and Takoradi Hospital (M = 1.838). The mean differences were modest: 0.189 between Efia Nkwanta and Takoradi Hospital, 0.162 between Efia Nkwanta and Jubilee Hospital, and -0.027 between Takoradi and Jubilee. However, none of these differences were statistically significant, suggesting that although there was a significant overall difference detected by ANOVA (p = 0.048), the Games-Howell test did not identify any specific pair of hospitals where the difference was strong enough to be statistically reliable.

Table 12 Descriptive Statistics and Test for Nursing Informatics Competences Based on Work Experience

Variable	**Group (Age)**	**Assumptions**		**N**	**Mean**	**SD**
		Skewness	**Homogeneity (Levene's Test) Sig**			
Informatics Skills		-.019	.108			
	Less than 1 yr			20	3.04	.791
	1-5 yrs			54	2.185	.794
	6-10 yrs			107	2.198	.664
	11-15 yrs			96	2.088	.667
	16-20 yrs			47	1.928	.679
	21-25 yrs			25	1.88	.802
	26-30yrs			9	1.644	.899
	31 yrs and above			2	1.5	.749
Computer Skills		.605	.004			
	Less than 1 yr			20	2.686	1.009
	1-5 yrs			54	1.913	.744
	6-10 yrs			107	1.953	.661
	11-15 yrs			96	1.805	.626
	16-20 yrs			47	1.86	.642
	21-25 yrs			25	1.811	.73
	26-30yrs			9	1.603	.838
	31 yrs and above			2	1.5	.707
Informatics Knowledge		.637	**			
	Less than 1 yr			20	2.936	.972
	1-5 yrs			54	2.048	.729
	6-10 yrs			107	2	.621
	11-15 yrs			96	1.769	.547
	16-20 yrs			47	1.766	.481
	21-25 yrs			25	1.709	.626
	26-30yrs			9	1.476	.602
	31 yrs and above			2	1.5	.707

**p*≤ 0.05, ***p*≤ 0.001

The analysis in Table 12 examined that the skewness values for informatics skills (−0.019), computer skills (0.605) and informatics knowledge (0.637) showed acceptable limits that indicated nearly normal or slightly positive skewness in their distributions. The analysis of Levene's Test for homogeneity of variances revealed no significant findings in informatics skills (p = 0.108), which confirmed the equality of variances in that domain. The Levene's Test showed significant results for both computer skills (p = 0.004) and informatics knowledge (p ≤ 0.001).

Experience level data showed a direct pattern for informatics skills in the domain. The lowest perceived competence emerged from participants who had less than one year of experience (3.04) with a standard deviation of 0.791. The scores for informatics skills improved gradually with more experience until the lowest ratings appeared in the 26–30 years (M = 1.644, SD = 0.899) and 31 years or more (M = 1.5, SD = 0.749) experience groups. Self-reported informatics skills appear to increase with extended work experience based on this pattern. The highest mean score in computer skills emerged from those with less than one year of experience (M = 2.686, SD = 1.009) before scores declined significantly for participants with 26–30 years (M = 1.603, SD = 0.838) and 31 years or more (M = 1.5, SD = 0.707). The Levene's test result (p = 0.004) indicated unequal variances in the data.

Meanwhile, the variation in informatics knowledge between different experience groups showed the most notable distinctions. The least experienced group (<1 year) scored the highest at M = 2.936 (SD = 0.972), but the most experienced groups (26–30 years at M = 1.476 [SD = 0.602] and 31+ years at M = 1.5 [SD = 0.707]) achieved the lowest scores. The relationship between work experience duration and informatics knowledge competency shows an inverse pattern where professionals' skills become stronger with increasing professional experience. The Levene's Test results showed significance at p ≤ 0.001, indicating that the group variances were not equal.

Table 4 One-way Analysis of Variance Results for Work Experience

Variable	**Source**	***SS***	***df***	***MS***	***F***	***p***	***η²***
Informatics Skills	Between Groups	23.774	7	3.396	6.722	**	.118
	Within Groups	177.857	352	.505			
	Total	201.631	359				
Computer Skills	Between Groups	14.816	7	2.117	4.38	**	.08
	Within Groups	170.095	352	.483			
	Total	184.910	359				
Informatics Knowledge	Between Groups	28.692	7	4.099	10.397	**	.171
	Within Groups	138.776	352	.394			
	Total	167.467	359				

**p≤ 0.05, **p≤ 0.001*

According to Table 13, the results showed statistically significant differences in all three domains at the p ≤ 0.001 level. The ANOVA results showed that work experience had a significant effect on informatics skills scores with $F_{(7, 352)} = 6.722$, $p < 0.001$, and an effect size of $\eta^2 = 0.118$. The results show that 11.8% of the variance in informatics skills scores can be explained by differences in years of experience. Also, the ANOVA results for computer skills showed a significant effect, $F_{(7, 352)} = 4.380$, $p < 0.001$, with an effect size of $\eta^2 = 0.080$. The results show that 8.0% of the variance in computer skills can be explained by work experience differences, suggesting that more work experience is associated with higher perceived competency in computer use. With informatics knowledge, the ANOVA showed a statistically significant result, $F_{(7, 352)} = 10.397$, $p < 0.001$, with an effect size of $\eta^2 = 0.171$. The results show that 17.1% of the variance in informatics knowledge scores can be explained by work experience.

Table 5 Post-hoc Multiplication Comparison (Games-Howell) Results for Nursing Informatics Competencies Based on Work Experience

Variable	**Group**	**Mean**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Informatics Skills	1. Less than 1 yr	3.04		.855*	.842*	.953**	1.112**	1.16**	1.396*	1.54
	2. 1-5 yrs	2.185			-.013	.098	.258	.305	.541	.685
	3. 6-10 yrs	2.198				.111	.271	.318	.554	.698
	4. 11-15 yrs	2.088					.159	.207	.443	.588
	5. 16-20 yrs	1.928						.048	.283	.428
	6. 21-25 yrs	1.88							.236	.38
	7. 26-30yrs	1.644								.144
	8. 31 yrs and above	1.5								

*p≤ 0.05, **p≤ 0.001

Table 14 shows that nurses who had worked less than one year reported the highest mean score (M = 3.04), indicating lower perceived informatics skills competency than all other experience groups. The "less than 1 year" group had statistically significant lower informatics skills than each of the following experience groups: "1–5 years" (mean difference = 0.855, p < 0.05), "6–10 years" (mean difference = 0.842, p < 0.05), "11–15 years" (mean difference = 0.953, p < 0.001), "16–20 years" (mean difference = 1.112, p < 0.001), "21–25 years" (mean difference = 1.160, p < 0.001), and "26–30 years" (mean difference = 1.396, p < 0.05). The largest observed mean difference was between the "less than 1 year" group and the "31 years and above" group (mean difference = 1.54), but it did not reach statistical significance.

The remaining pairwise comparisons among more experienced groups (i.e., 1–5 years and above) were not statistically significant. The most substantial and statistically significant contrast is between those with very limited experience (<1 year) and all other groups. Beyond the first year of professional practice, improvements in self-perceived informatics skills appear to stabilize, with no statistically meaningful differences observed between intermediate and highly experienced nurses.

Table 6 Post-hoc Multiplication Comparison (Bonferroni) Results for Nursing Informatics Competencies Based on Work Experience

Variable	**Group**	**Mean**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Computer Skills	1. Less than 1 yr	2.686		.773**	.734**	.881**	.826**	.874**	1.083*	1.186
	2. 1-5 yrs	1.913			-.039	.108	.053	.101	.309	.413
	3. 6-10 yrs	1.953				.147	.092	.141	.349	.452
	4. 11-15 yrs	1.805					.092	.141	.349	.452
	5. 16-20 yrs	1.86						.049	.257	.36
	6. 21-25 yrs	1.811							.208	.311
	7. 26-30yrs	1.603								.103
	8. 31 yrs and above	1.5								
Informatics Knowledge	1. Less than 1 yr	2.936		.888**	.936**	1.166**	1.69**	1.227**	1.459**	1.436
	2. 1-5 yrs	2.048			.048	.278	.282	.339	.571	.548
	3. 6-10 yrs	2				.231	.234	.291	.524	.5
	4. 11-15 yrs	1.769					.003	.061	.293	.269
	5. 16-20 yrs	1.766						.057	.2889	.266
	6. 21-25 yrs	1.709							.232	.209
	7. 26-30yrs	1.476								-.024
	8. 31 yrs and above	1.5								

*p≤ 0.05, **p≤ 0.001

According to Table 15, the statistical analyses demonstrate that nurses with less than 1 year of experience demonstrate the most notable and significant differences when compared to nurses with more years of work experience in both domains. Participants with less than one year of experience scored 2.686 in computer skills, indicating a lower self-assessment of their competencies compared to all other groups. The scores of this group differed significantly from all experience categories from 1–5 years (mean difference = 0.773, $p < 0.001$) and from 6–10 years (0.734, $p < 0.001$) to 11–15 years (0.881, $p < 0.001$), 16–20 years (0.826, $p < 0.001$), 21–25 years (0.874, $p < 0.001$), and 26–30 years (1.083, $p < 0.05$). The mean difference between the 31 years and above group (1.186) was the largest, but it failed to achieve statistical significance due to the small sample size ($n = 2$) in this group. The analysis shows that computer skills remained stable without significant differences between nurses who have practiced for more than one year.

The results from the informatics knowledge domain also showed an analogous distribution pattern. Nurses with less than 1 year of experience ($M = 2.936$) reported higher scores than all groups except the 31 years and above category. The less-than-one-year group showed significant differences (all p-values ≤ 0.001) when compared to each experience group from 1–5 years to 26–30 years, with mean differences between 0.888 and 1.459. The group demonstrated its largest informatics knowledge differences when compared to 16–20 years (1.69, $p < 0.001$) and 26–30 years (1.459, $p < 0.001$), which indicates that prolonged clinical experience significantly influences informatics knowledge development. The informatics knowledge development shows no significant changes between any groups after the initial year of practice.

Discussion

The research established significant disparities between NIC scores that corresponded to age groups, years of experience, and educational levels. The empirical findings of this study contradict the prevailing literature [11, 12], which suggests that younger nurses who are called "digital natives" demonstrate better technological abilities. The descriptive statistics revealed that nurses under 20 years old received higher scores (indicating lower competence) in informatics skills, computer literacy, and informatics knowledge. The competency scores of nurses who fell into the 31–40 and 51–60 age groups were superior, with lower mean scores.

A notable finding was the paradoxical relationship between NIC domains and perceived quality of nursing care: practical informatics skills positively predicted care quality, while higher computer literacy and theoretical knowledge showed negative associations. This may reflect the sociotechnical reality that competence alone does not guarantee improved care unless digital tools are well integrated into clinical workflows. Nurses with strong theoretical knowledge may be more aware of systemic limitations, leading to more critical self-assessment, whereas those with hands-on proficiency may experience greater efficiency and confidence at the bedside [8] [13]. This aligns with sociotechnical systems theory and evidence suggesting that informatics benefits are best realized when both technology and workflow conditions are optimized [12] [15].

Demographic differences further illuminate structural inequities. Younger nurses and those with higher education exhibited stronger NIC, consistent with studies linking digital competence to recent ICT exposure and higher academic preparation [23] [27]. Midwives demonstrated lower NIC scores compared to registered nurses, reflecting limited use of digital systems in maternal and child health settings, an issue previously documented in Ghana [7] [10]. Targeted training initiatives tailored to professional groups and clinical areas are therefore essential.

The results indicate that younger nurses demonstrate basic digital understanding, yet older nurses develop superior informatics competencies through their accumulated clinical experience, repeated EHR exposure, and institutional training. Afra et al. [4] found that clinical experience and hands-on use of health information systems were significantly associated with higher levels of nursing informatics competency, often surpassing the predictive effect of formal academic informatics education. The relationship between workplace context and professional exposure, together with age, determines NIC rather than age as a standalone factor.

Conclusion

This study examined demographic differences in nursing informatics competencies (NIC) among registered nurses and midwives working in selected hospitals in the Sekondi-Takoradi Metropolis, Ghana. Using a quantitative cross-sectional survey design, the findings demonstrated significant differences in self-reported nursing informatics competencies across several demographic characteristics, including profession, educational level, age, work experience, and certification status. Gender differences were observed only in the informatics skills domain and were associated with a small effect size, while workplace location showed minimal differences, with only informatics knowledge demonstrating a small but statistically significant variation. Overall, the findings indicate that nursing informatics competencies are unevenly distributed across demographic groups.

The study further showed that nurses with higher educational qualifications, longer professional experience, and professional certification generally reported stronger nursing informatics competencies, although certification status was significantly associated only with informatics skills and computer skills, and not with informatics knowledge. These findings highlight the need for targeted and equitable approaches to informatics capacity building that consider differences in educational preparation, professional development, and clinical experience.

Although this study did not directly measure nursing care quality or patient safety outcomes, the findings have important implications for Ghana's ongoing digital health transformation. Strengthening nursing informatics competencies through competency-based education, continuing professional development, and structured workplace training may better prepare nurses and midwives to effectively use electronic health systems and other digital technologies in clinical practice. Future studies should employ longitudinal or multivariable research designs and include direct measures of care quality and patient safety to further examine the relationship between nursing informatics competency and healthcare outcomes.

Recommendations

1. Implement Competency-Based Informatics Training Programs: Nursing education institutions and hospital training units in Ghana should design and implement competency-based informatics training modules tailored to individual skill gaps rather than age or professional rank. These programs should include hands-on EHR simulations, real-time clinical data tasks, and peer mentorship to promote practical proficiency across all experience levels.
2. Integrate Informatics Competency Evaluation into Licensure and CPD Requirements: The Nursing and Midwifery Council of Ghana should embed NIC assessments into both pre-service education and continuing professional development (CPD) frameworks. Periodic evaluations, using performance-based metrics, should be tied to licensure renewal and professional advancement, ensuring nurses maintain up-to-date digital health capabilities.
3. Develop Inter-Facility Digital Mentorship Networks: To address regional disparities in digital infrastructure and training, the Ministry of Health and regional health directorates should support rotational mentorship programs between urban and rural facilities. These exchanges will allow nurses in resource-constrained areas to benefit from the expertise and exposure of those in digitally mature environments, fostering national equity in informatics competencies.

Implications

1. Practical Implication: This study reveals that informatics competency among nurses in Ghana is more strongly associated with clinical experience and contextual exposure than

age. As a result, hospitals and training institutions should adopt experiential learning approaches, such as peer mentorship and simulation-based EHR training, as core components of informatics development. This approach moves beyond assumptions of age-based digital fluency, emphasizing real-world, task-specific training to enhance practical competency.

2. Theoretical Implication: The findings support a theoretical shift from generational stereotypes to models such as Benner's Novice to Expert framework, which frames informatics competency as a developmental trajectory shaped by structured learning, reflection, and situational practice. This challenges static models of skill acquisition and supports more nuanced frameworks that consider how, when, and where digital competencies are developed within nursing practice.
3. Policy-Related Implication: National and institutional training policies must be restructured to ensure equity across demographic lines, including age, gender, and geographic location. This implies that policy interventions should not rely on generic training modules but should adopt a modular, adaptive framework where nurses enter informatics training based on skill assessments and identified gaps, not assumptions tied to rank or age. This will promote more equitable digital capacity-building across Ghana's nursing workforce.

Ethics approval and consent to participate

This study involved obtaining formal approval from relevant ethical review bodies to ensure adherence to established ethical standards. The research proposal was reviewed and approved on 25 July 2024 by the Open University Malaysia (OUM) Ethics Committee with document number OUM-RPMU/2.7/379.2/DN/Sept2024(003); the Ghana Health Service Ethics Review Committee (GHS-ERC) approved on the 5th March 2025 with GHS-ERC Number: GHS-ERC: 022/01/25; and the Western Region Municipal Health Directorate, with additional authorization from the medical directors of the three participating hospitals.

ACKNOWLEDGEMENTS

The authors sincerely acknowledge the management and staff of Efia Nkwanta Regional Hospital, Takoradi Hospital, and Jubilee Children's Hospital for granting permission and facilitating data collection. We are particularly grateful to all the registered nurses and midwives who generously shared their time and experiences by participating in this study. We also appreciate the support and guidance provided by the Open University Malaysia (OUM), the Ghana Health Service Ethics Review Committee, and the Western Regional Health Directorate throughout the conduct of this research. Their contributions were invaluable to the successful completion of this study.

AUTHOR CONTRIBUTIONS

All authors contributed substantially to the conception and design of the study, data collection, analysis and interpretation of results, manuscript preparation, and critical revision of the article. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that they have no competing interests or conflicts of interest related to the publication of this article.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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