

Multidimensional Digital Competence and the Quality of Routine Health Information among Health Workers in Bayelsa State

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ABSTRACT	ARTICLE DETAILS
As health information systems become increasingly digital, the need for health workers to possess strong digital skills has grown. However, there is limited understanding of how different aspects of digital competence relate to the quality of routine health data particularly in resource-constrained settings like Nigeria. This study examined the link between multidimensional digital competence and the quality of routine health information among health workers in Bayelsa State, Nigeria. A cross-sectional survey was conducted across four public health facilities in the state, targeting staff involved in routine health data tasks. Based on the Taro Yamane formula, 242 participants were initially required from a population of 612, but after multistage stratified and simple random sampling, 200 usable responses were analyzed. Data were collected using a structured questionnaire and processed with SPSS version 26. Statistical methods included descriptive analysis, correlation tests, linear and multiple regression, one-way ANOVA, and independent-sample t-tests, with significance set at $p < 0.05$. Respondents reported high levels of digital competence ($M = 3.45$, $SD = 0.42$), perceived reporting accuracy ($M = 3.95$, $SD = 0.54$), and timeliness ($M = 3.97$, $SD = 0.51$). Positive correlations emerged between digital competence and both accuracy ($r = 0.411$, $p < 0.001$) and timeliness ($r = 0.430$). The model showed that digital competence accounted for 16.9% of the variation in accuracy and 18.5% in timeliness. In regression analysis, cognitive/informatics competence had the strongest influence on reporting performance, followed by technical/operational and privacy/security competencies. Differences in digital competence were significant across facilities, $F(3,196) = 3.290$, but not by gender, $t(198) = 0.159$. Digital competence is significantly associated with the quality of routine health information, though it explains less than a quarter of the variability in reporting outcomes. Cognitive and informatics skills appear to be the most influential component. The findings underscore the importance of strengthening health workers' abilities in data processing, management, and advanced use of health software, as well as addressing disparities between facilities. However, due to the cross-sectional design, causal conclusions cannot be drawn about the relationship between digital skills and data quality. KEYWORDS: Digital competence, Health information systems, Routine health information, Data quality, Health workers, Bayelsa State, Nigeria	Published On: 07 September 2026 Available on: https://ijrsr.org/

1. INTRODUCTION

The shift toward digital health systems has transformed how health data are generated, processed, analyzed, shared, and used in decision-making. Routine health information systems (RHIS) are vital for monitoring service delivery, planning interventions, and evaluating health programs at facility levels. Yet simply having electronic systems in place does not guarantee reliable or timely data. Effective use depends on health workers' ability to operate digital tools, manage data securely, and produce accurate reports efficiently. The World Health Organization (WHO) identifies digital competence as essential for modern health workforce

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development, encompassing technical proficiency, data handling, communication, and professional engagement with digital technologies (WHO, 2026). Similarly, the WHO Data Management Competency Framework stresses the need for skills across the entire data lifecycle to support informed decisions at all levels of the health system.

Despite this, evidence linking specific dimensions of digital competence to routine health data quality remains sparse especially in low-resource contexts such as Nigeria. While systematic reviews point to weaknesses in current assessment tools, particularly self-reported measures, validated instruments tailored to low- and middle-income countries remain scarce (Longhini et al., 2022; Mainz et al., 2024). In sub-Saharan Africa and Nigeria specifically, RHIS often suffer from inconsistent, incomplete, or inaccurate reporting, undermining data-driven decision-making (Nutley et al., 2020; Sylla et al., 2024).

Digital health literacy the confidence and capability to access and apply digital health information is crucial for improving health outcomes (Leemi et al., 2025). However, populations with limited digital literacy may be excluded from care, especially in preventive services or chronic disease management. Ensuring equitable access to digital health tools requires targeted efforts to bridge skill gaps and reduce disparities. Artificial intelligence holds promise for supporting clinical and administrative decisions in hospitals (Mohammed et al., 2022), yet benefits are unevenly distributed. Achieving fair adoption and use of digital innovations remains a challenge (Ferreira et al., 2025; Novelli et al., 2021).

Health information systems have been shown to improve care quality when implemented effectively across healthcare settings (Mutiar, 2021). Consequently, health workers must be equipped with information technology skills. Digital health technology involves using digital tools such as computers, smartphones, medical devices, and wearables to collect, share, and analyze health data for better patient outcomes and service delivery (Turakhia et al., 2016).

Although digital competence is clearly important for high-quality routine reporting, the nature of its relationship with data accuracy and timeliness is complex and not fully understood. Research suggests it includes multiple domains: technical skills, data management, analytical and informatics capabilities, communication, and privacy protection (Konttila et al., 2019; Longhini et al., 2022). However, little is known about how each dimension contributes uniquely to reporting performance. Some studies indicate that training, support, and feedback can improve data practices (Nutley et al., 2020), while others highlight structural barriers like poor infrastructure and weak institutional capacity that hinder even skilled workers (WHO Regional Office for Africa, 2026).

Thus, both individual capabilities and systemic factors likely shape the impact of digital competence on data quality. Most prior research treats digital competence as a single overall measure, overlooking potential differences among its components. This study addresses that gap by analyzing how distinct dimensions of digital competence affect two key aspects of routine data quality: accuracy and timeliness. Conducted in four public health facilities in Bayelsa State, Nigeria, the research adds to emerging knowledge on digital skills in health information management and identifies areas for targeted improvement.

2. MATERIALS AND METHODS

Study Design and Population

This was a facility-based cross-sectional survey involving health workers engaged in routine health information tasks in four public health facilities in Bayelsa State: Federal Medical Centre, Yenagoa; General Hospital, Kolo; KOLGA Referral Hospital; and Primary Health Centre, Agudama-Epie. These institutions formed the sampling frame.

The target population included all staff involved in collecting, recording, processing, validating, managing, or reporting routine health data within these facilities. A total of 612 health workers were identified as eligible. Participants were selected based on their involvement in RHIS activities and availability during data collection.

Sampling and Sample Size

A multistage sampling approach was used. First, the population was stratified by location and profession, then random selection was applied within each stratum. Using the Taro Yamane formula, the desired sample size was calculated as 242 from the total population of 612. After data collection and quality checks, 200 fully completed questionnaires were retained for analysis.

Consistent with proportional allocation, a larger share of respondents came from the Federal Medical Centre, Yenagoa (151, or 75.5%), followed by General Hospital, Kolo (31, 15.5%), KOLGA Referral Hospital (13, 6.5%), and Primary Health Centre, Agudama-Epie (5, 2.5%).

Study Variables and Operational Definitions

The main independent variable was multidimensional digital competence; dependent variables were reporting accuracy and timeliness. Additional variables included demographic, institutional, and environmental factors.

Multidimensional digital competence: The capacity of health workers to effectively use digital tools and health information systems. It was measured through three domains:

Technical/operational competence: Ability to use computers, software, and electronic data entry devices.

Cognitive/informatics competence: Skills in processing, interpreting, analyzing, and applying health data.

- Security/privacy competence: Ability to safeguard patient information and follow confidentiality protocols.

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- Routine health information quality: The extent to which reported data meet standards for accuracy and timeliness.
- Reporting accuracy: How closely reported figures align with expected standards.
- Reporting timeliness: Whether reports are submitted on schedule.

Other variables included gender, age, occupation, years of experience, electricity availability, internet access, workload, staffing levels, ICT training, receipt of data quality feedback, and funding for digital infrastructure. These were defined based on existing literature and study objectives.

Data Collection Instrument

A structured, self-administered questionnaire was developed according to the study's aims and variables. It used a five-point Likert scale to assess agreement levels with statements related to digital competence and data quality. The scale ranged from "strongly disagree" to "strongly agree."

Responses were scored numerically, with a mean score of 3.0 serving as the threshold: scores at or above 3.0 indicated favorable perceptions, while those below reflected lower levels of agreement.

Measurement and Scoring

Items covered demographics, digital competence, data quality, and contextual factors. Each construct's score was derived by averaging responses to its respective items. Data were treated as continuous rather than dichotomous, preserving the full range of responses and allowing more nuanced analysis of agreement levels.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional authority before commencement of the study, and permission was obtained from the participating facilities. Participation was voluntary, and participants provided informed consent before completing the questionnaire. Confidentiality was maintained throughout data collection, analysis, and reporting, and individual participants were not identified in the published results. Ethical clearance was provided by the Research Ethics Committee of both Federal Medical Centre, Yenagoa (reference number: FMCY/REC/ECC/2026/APRIL/00011) and the Bayelsa State Primary Health Care Board (reference number: PHCB/AD/181/05).

3. RESULT

A total of 242 questionnaires were distributed across various health facilities, with 200 completed

Table 1. Characteristics of study participants (N = 200)

Characteristic	Category	n	%
Sex	Male	120	60.0
	Female	80	40.0
Age	<20	3	1.5
	21–30	13	6.5
	31–40	61	30.5
	41–50	85	42.5
	>50	38	19.0
Experience	1–5 years	61	30.5
	6–10 years	74	37.0
	11–15 years	45	22.5
	≥16 years	20	10.0
Education	OND	50	25.0
	HND/BSc	111	55.5
	MSc	31	15.5
	PhD	8	4.0
Facility	FMC Yenagoa	151	75.5
	General Hospital Kolo	31	15.5
	KOLGA Referral Hospital	13	6.5
	PHC Agudama-Epie	5	2.5

Table 1 presents the socio-demographic and professional characteristics of the 200 health workers included in the study. The participants were predominantly male (60.0%), while females constituted 40.0%. The largest age group was 41–50 years (42.5%), followed by 31–40 years (30.5%) and those older than 50 years (19.0%). Only 8.0% were aged 30 years or younger. Regarding

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professional experience, 37.0% had 6–10 years of experience, 30.5% had 1–5 years, 22.5% had 11–15 years, and 10.0% had at least 16 years of experience. Educationally, more than half of the participants (55.5%) possessed HND/BSc qualifications, while 25.0% had OND, 15.5% had MSc qualifications, and 4.0% had PhD qualifications.

The distribution of respondents across facilities was uneven, with FMC Yenagoa accounting for 75.5% of participants, followed by General Hospital Kolo (15.5%), KOLGA Referral Hospital (6.5%), and PHC Agudama-Epie (2.5%). This distribution indicates that the study sample was concentrated predominantly within the federal medical centre, although participants from secondary and primary healthcare settings were also represented. The relatively broad distribution across age, experience, and educational categories provides variation in professional characteristics that can be considered when interpreting differences in digital competence and routine health information quality.

Table 2. Multidimensional digital competence: representative indicators

Pattern	Indicator	Mean	SD
High	Digital communication effectiveness	4.49	0.76
High	Institutional email usage	4.37	0.9
High	Core statistical data analysis	4.36	0.92
High	Search-engine operation	4.33	1.13
High	Interface navigation	4.2	0.98
Low	Hardware troubleshooting	2.31	1.13
Low	System interoperability understanding	2.17	1.05
Low	Advanced software proficiency	2.14	1.08
Low	Typing speed	2.02	1.17
Low	Touch typing	1.89	0.99
Overall	Digital competence	3.45	0.42

Table 2 presents the mean scores and standard deviations (SD) for digital competence among the study participants. The data show that overall digital competence was fairly high, with an average score of 3.45 (SD = 0.42). The highest scores were recorded in digital communication effectiveness (M = 4.49, SD = 0.76), followed by use of institutional email (M = 4.37, SD = 0.90), core statistical data analysis (M = 4.36, SD = 0.92), search engine usage (M = 4.33, SD = 1.13), and interface navigation (M = 4.20, SD = 0.89). This indicates that participants generally felt confident in performing routine digital tasks related to communication, information retrieval, navigating digital environments, and basic data analysis.

In contrast, performance was notably lower in areas such as touch typing (M = 2.91, SD = 0.87), typing speed (M = 2.85, SD = 0.89), software proficiency (M = 2.78, SD = 0.91), system interoperability (M = 2.65, SD = 0.93), and hardware troubleshooting (M = 2.54, SD = 0.76). These results suggest that while participants demonstrated solid foundational digital skills, their abilities in more advanced technical areas were comparatively weaker. Additionally, the larger standard deviations observed in some of the lower-scoring items indicate substantial variation in skill levels across individuals in these domains. While overall digital competence was relatively strong (M = 3.45, SD = 0.42), there was a noticeable gap between proficiency in basic versus advanced digital competencies.

Table 3. Routine health information quality: accuracy and timeliness

Domain	Selected indicator	Mean	SD
Accuracy	Alignment with institutional data fields	4.11	0.77
Accuracy	Adherence to system validation rules	4.08	0.8
Accuracy	Consistency across monthly aggregations	4.05	0.73
Accuracy	Source data match electronic DHIS2 records	4.02	0.81
Accuracy	Data completeness across health indices	3.96	0.86
Accuracy	Periodic internal audits of facility registers	3.98	0.92
Accuracy	Correction of automated validation warnings	3.9	0.89
Accuracy	Data verification before submission	3.85	0.95
Accuracy	Absence of over-reporting/inflated metrics	3.81	1.11
Accuracy	Absence of mathematical transcription errors	3.74	1.02
Accuracy	Overall accuracy	3.95	0.54
Timeliness	Swift navigation of DHIS2 submission portals	4.15	0.71
Timeliness	Prompt data synthesis by records personnel	4.12	0.79

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Timeliness	Immediate report compilation	4.1	0.85
Timeliness	Real-time data-entry processing	4.1	0.82
Timeliness	Consistent monthly submission timelines	4.05	0.69
Timeliness	Rapid rectification of data queries	4.01	0.74
Timeliness	Immediate transmission of digital summaries	3.96	0.88
Timeliness	Submission before national 15th-day deadline	3.92	0.99
Timeliness	Avoidance of month-end bottlenecks	3.83	1.05
Timeliness	Absence of system-downtime delays	3.75	1.13
Timeliness	Minimal delays from power interruptions	3.68	1.22
Timeliness	Overall timeliness	3.97	0.51

Table 3 outlines respondents' views on the accuracy of routine health information. The target mean score for each accuracy indicator was above 3.95 (SD = 0.54). The highest scores were given to indicators reflecting data alignment with institutional data fields (M = 4.11, SD = 0.77), compliance with the system's validation rules (M = 4.08, SD = 0.80), and consistency with monthly totals (M = 4.05, SD = 0.73). Other well-rated aspects included agreement between reported figures and source documents or electronic DHIS2 entries (M = 4.02, SD = 0.81). Notably, even the lowest-scoring items such as absence of numerical transcription errors (M = 3.74, M = 4.110) and lack of over-reporting or inflated data (M = 4.111, M = 4.112) still exceeded the minimum threshold. This indicates an overall favorable perception of data accuracy among respondents.

Similarly, respondents viewed the timeliness of routine health reports positively, reflected in a mean score of 3.97 (M = 4.113). Key strengths in timeliness included ease of access to the online DHIS2 platform (M = 4.114, M = 4.115), rapid data summarization (M = 4.116, M = 4.117), efficient report preparation (M = 4.118, M = 4.119), and fast data entry processing (SD = 0.770, SD = 0.771). However, performance was lower on indicators related to minimal reporting delays caused by power outages (SD = 0.772, SD = 0.773) and uninterrupted system availability (SD = 0.774, SD = 0.775). These results suggest that while timely reporting is generally achievable, certain operational issues still pose challenges.

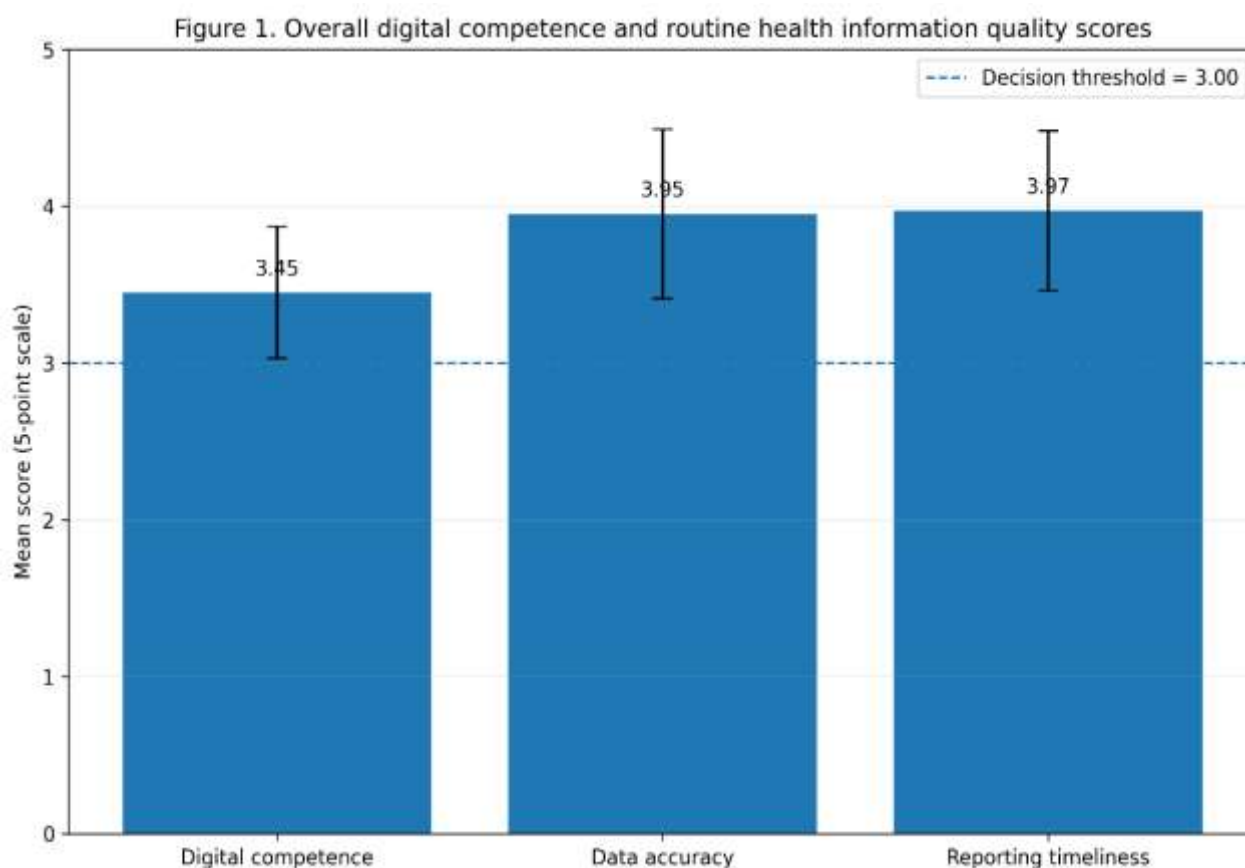


Figure 1. Average scores for overall digital competence and routine health information quality.

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The figure presents a comparison of mean scores across three areas: digital competence, data accuracy, and reporting timeliness. The lowest average score was observed in digital competence ($M = 3.45$), with slightly higher scores for data accuracy ($M = 3.95$) and reporting timeliness ($M = 3.97$). Despite these differences, all three indicators exceeded the study's predefined threshold, indicating generally favorable performance levels. The pattern suggests that respondents expressed greater confidence in the quality of routine health information particularly its accuracy and timeliness than in their own digital skills. This implies that even with relatively lower digital competence, individuals were still able to submit reasonably accurate and timely reports. However, it should be emphasized that digital competence remains significant; subsequent analysis reveals it is positively linked to both the timeliness and accuracy of RHIS reporting.

Table 4. Associations and regression estimates for digital competence and RHIS quality

Outcome	Statistic	Estimate	p-value
Reporting accuracy	Pearson r	0.411	<0.001
Reporting accuracy	R ²	0.169	—
Reporting accuracy	Adjusted R ²	0.165	—
Reporting accuracy	SE of estimate	0.493	—
Reporting timeliness	Pearson r	0.43	<0.001
Reporting timeliness	R ²	0.185	—
Reporting timeliness	Adjusted R ²	0.181	—
Reporting timeliness	SE of estimate	0.461	—

Table 4 reveals a statistically significant positive association between digital competence and all aspects of information quality. Specifically, digital competence showed a positive correlation with reporting accuracy ($r = 0.411$, $p < 0.001$) and reporting timeliness ($r = 0.430$, $p < 0.001$). While both relationships are notable, the influence on accuracy appears slightly stronger, as suggested by the higher correlation coefficient. This implies that individuals with greater digital skills tended to report higher levels of both accuracy and timeliness in information sharing.

The findings further show that digital competence accounts for 16.9% of the variance in reporting accuracy ($R^2 = 0.169$) and 18.5% in reporting timeliness ($R^2 = 0.185$). The adjusted R^2 values 0.165 for accuracy and 0.181 for timeliness are very close to the original R^2 figures, indicating only a minor reduction in explained variance after model adjustment. Despite the measurable impact of digital competence on these dimensions of information quality, its overall explanatory power remains modest. This suggests that additional factors ranging from individual and organizational characteristics to technological and systemic influences likely play important roles and warrant further investigation to better understand variations in routine health information quality.

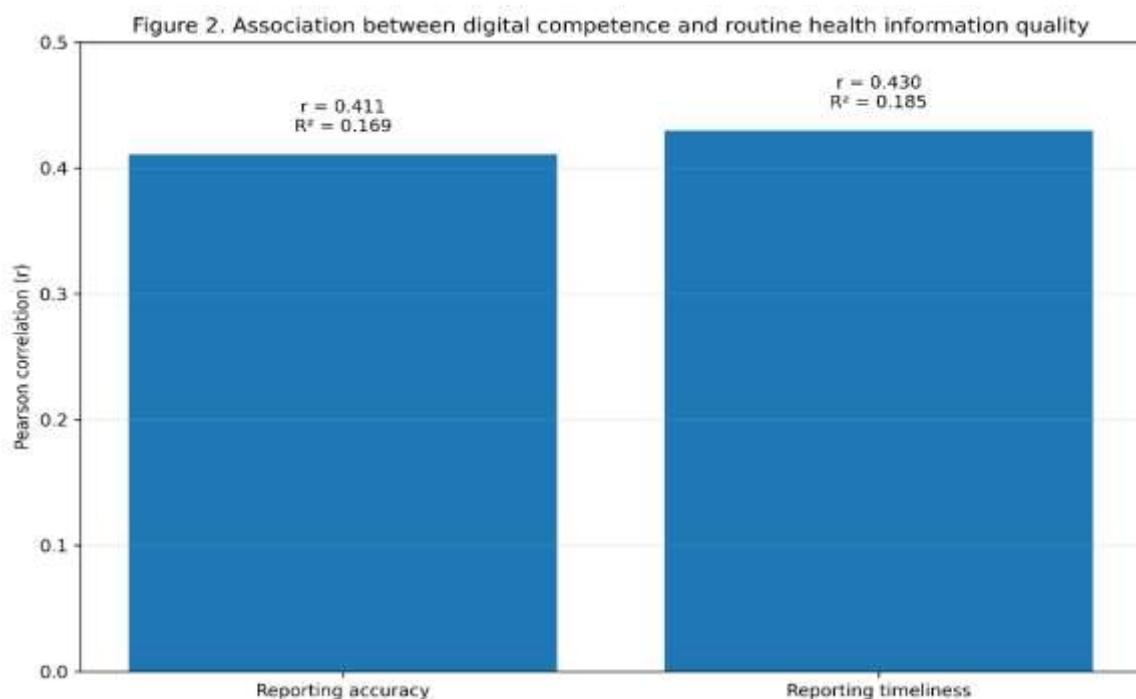


Figure 2. Association between digital competence and routine health information

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Figure 2 shows the relationship between digital competence and two aspects of routine health information quality: timeliness and accuracy. Both relationships are positive and moderately strong, with a slightly higher correlation for timeliness ($r = 0.430$) compared to accuracy ($r = 0.411$). The figure also indicates that digital competence explains 18.5% of the variation in timeliness and 16.9% in accuracy.

This confirms the strong, positive associations previously presented in Table 4. The somewhat stronger link with timeliness implies that digital competence serves as a moderate predictor for both quality indicators. However, since the correlation coefficients are not especially high, improving digital competence by itself is unlikely to fully resolve issues related to the overall quality of routine health information.

Table 5. Relative contribution of digital competence domains to reporting performance

Predictor	B	SE	β	t	p
Technical/operational skills	0.285	0.062	0.291	4.596	<0.001
Cognitive/informatics skills	0.312	0.058	0.34	5.379	<0.001
Security/privacy skills	0.164	0.049	0.158	3.346	0.001
Constant	1.824	0.231	—	7.896	<0.001

Table 5 displays the results of the multiple regression analysis, showing that all three predictor variables significantly and positively influenced reporting performance. Among them, cognitive/informatics skills had the strongest effect ($\beta = 0.340$, $p < 0.001$), followed by technical/operational skills ($\beta = 0.291$, $p < 0.001$), with security/privacy skills showing the smallest but still significant effect ($\beta = 0.158$, $p = 0.001$). This indicates that while each predictor contributes to explaining variations in reporting performance, cognitive/informatics competence accounts for the greatest share of variance.

The unstandardized coefficients are all positive, reinforcing that each skill set is associated with improved reporting outcomes. Specifically, technical/operational competence ($B = 0.285$), cognitive/informatics competence ($B = 0.312$), and security/privacy competence ($B = 0.164$) each have a positive relationship with the dependent variable. These statistically significant results confirm that the predictors collectively influence reporting performance, though to differing degrees. The lower unstandardized coefficient for security/privacy skills suggests a comparatively modest impact relative to the other two. In contrast, both the higher unstandardized and standardized coefficients for cognitive/informatics skills indicate that this factor exerts the strongest influence among the three.

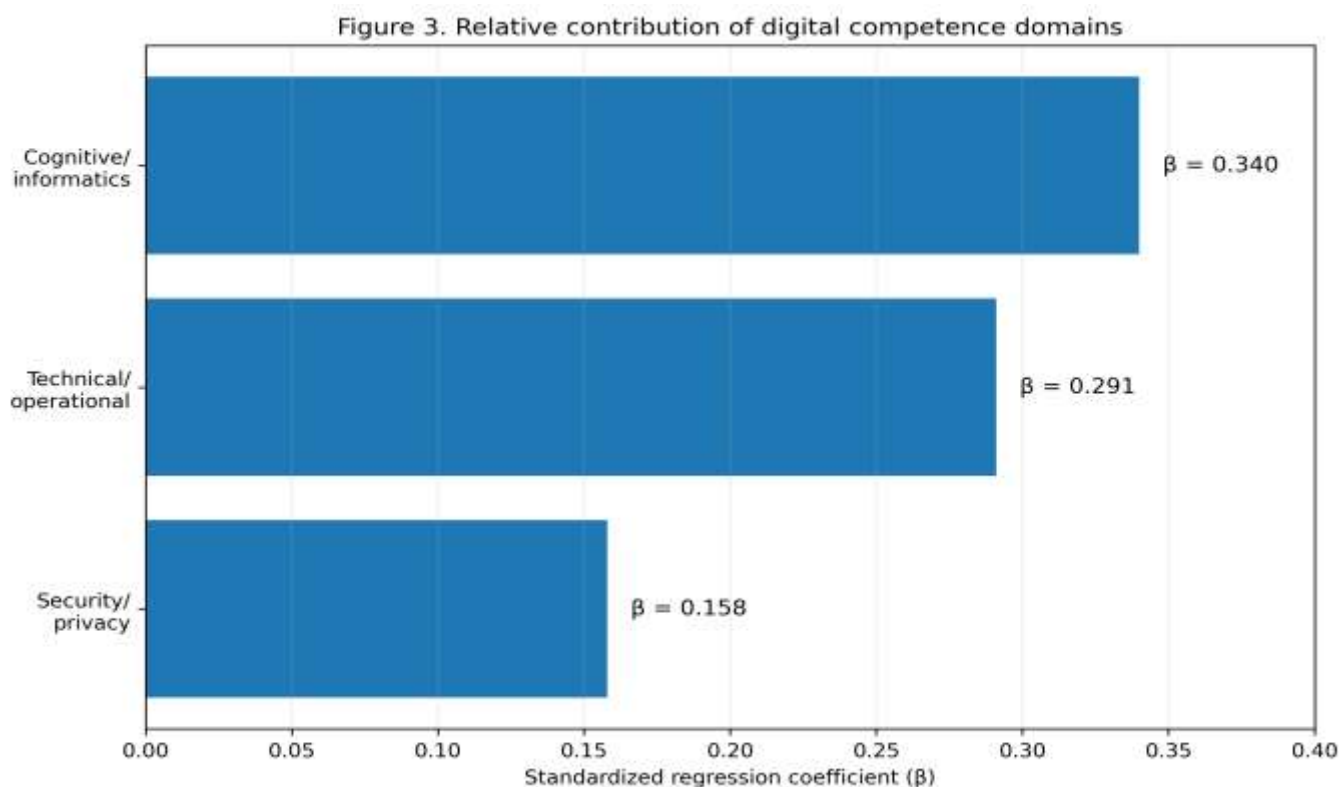


Figure 3. Relative contribution of digital competence domains.

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The chart above illustrates the standardized regression coefficients for the three domains of digital competence. Cognitive/informatics competence has the strongest influence, with a coefficient of $\beta = 0.340$, followed by the other two domains at $\beta = 0.291$ and $\beta = 0.158$. This visual representation allows for an immediate comparison of the relative strength of each predictor and complements the regression findings shown in Table 5.

The results indicate that digital competence is a multifaceted construct rather than a uniform one, suggesting that workforce development initiatives should account for differences across skill areas. Cognitive/informatics skills appear to play a more prominent role than technical/operational or security/privacy competencies. This implies that abilities related to analysis, information management, and informatics may have a greater effect on RHIS performance. However, since both technical and security-related competencies still show meaningful contributions, they remain important and should not be overlooked.

Table 6. Institutional/environmental factors and subgroup differences

Type	Factor/analysis	Mean/Test	SD/p	Interpretation
Institutional	Regular technical ICT training	1.84	0.92	Low
Institutional	Electricity/power instability	4.49	0.61	High
Institutional	DHIS2/internet access disruptions	4.35	0.78	High
Institutional	Workload/staff shortages	4.26	0.83	High
Institutional	Institutional feedback on data quality	2.15	1.04	Low
Institutional	Dedicated digital-infrastructure budget	1.96	0.88	Low
Institutional	Overall	3.17	0.34	High
Subgroup	Facility-level difference	$F(3,196)=3.290$	$p=0.022$	Significant
Subgroup	Sex difference	$t(198)=0.159$	$p=0.874$	Not significant

Table 6 presents the institutional and environmental factors that may impede routine health information reporting. The most frequently cited challenges, based on the highest mean scores, were power outages ($M = 4.49$, $SD = 0.61$), disruptions to DHIS2 or internet connectivity ($M = 4.35$, $SD = 0.78$), and excessive workload or insufficient staffing ($M = 4.26$, $SD = 0.83$). In contrast, factors with the lowest mean scores included regular technical ICT training ($M = 1.84$, $SD = 0.92$), budget allocation for digital infrastructure development ($M = 1.96$, $SD = 0.88$), and institutional feedback on data quality ($M = 0.610$, $SD = 0.611$). The overall mean for institutional and environmental factors was 3.17 ($SD = 0.612$), indicating a relatively high level of impact. This suggests these factors play a notable role in shaping the reporting environment.

Subgroup analysis showed a statistically significant variation in digital competence across health facilities ($F(3,196) = 3.290$, $SD = 0.613$), while no significant difference was found between male and female staff ($t(198) = 0.159$, $SD = 0.614$). These findings indicate that the facility's location is associated with the level of digital competence among workers, whereas gender does not appear to influence it. The observed differences between facilities further suggest that institutional characteristics significantly affect digital competence. As a result, future initiatives should prioritize addressing institutional factors to improve digital capabilities in the region.

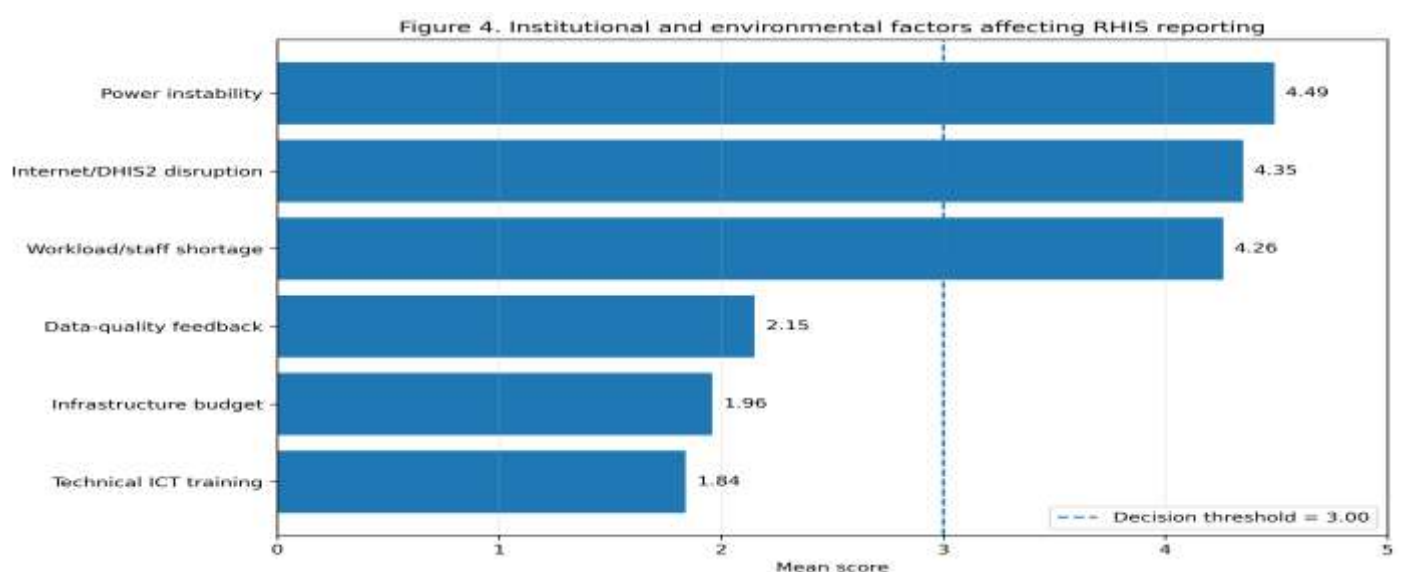


Figure 4. Institutional and environmental factors affecting routine health information reporting

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Figure 4 illustrates the institutional and environmental factors affecting routine health information reporting. The most prominent contextual challenges were political instability, followed by issues related to DHIS2 or internet access, and concerns about workload or staffing levels. These factors had notably higher average scores compared to technical elements such as ICT training, data-quality feedback mechanisms, and dedicated budget allocations for digital systems. This indicates that the primary obstacles to reporting in this study stemmed more from institutional and infrastructural weaknesses than from technical shortcomings. Although Table 6 shows that individual digital skills are generally present, Figure 4 reveals that these competencies often exist alongside significant systemic constraints. For example, unreliable electricity and poor connectivity can undermine digital proficiency, especially when organizational support structures are insufficient. Likewise, excessive workloads may hinder reporting effectiveness, even among staff who possess strong digital abilities. Thus, while individual capabilities are evident, the findings emphasize the need to strengthen the broader enabling environment to ensure efficient and consistent reporting.

4. DISCUSSION

The study found that health workers in Bayelsa State generally possess a high level of multidimensional digital competence ($M = 3.45$, $SD = 0.42$), with particularly strong perceptions of routine health information accuracy ($M = 3.95$, $SD = 0.54$) and reporting timeliness ($M = 3.97$, $SD = 0.51$). Despite these positive overall assessments, notable deficiencies were identified in advanced technical skills such as using complex software, ensuring system interoperability, and troubleshooting hardware issues. These findings align with earlier research emphasizing that digital competence extends beyond basic computer literacy, requiring a broader set of abilities in informatics, communication, problem-solving, and ethical practices for effective use of digital tools in healthcare (Konttila et al., 2019; Longhini et al., 2022). The results also echo Alunyu et al.'s (2020) review of digital health training across Africa, which highlighted a mismatch between current educational programs and the competencies needed to implement national digital health policies and adopt new technologies. That review called for African nations to develop comprehensive competency frameworks and modernize health professional education. This is reflected in Nigeria's experience with the nationwide rollout of the DHIS2 immunization module, which included training over 60,000 health workers in data collection, entry, and interpretation (Fawole et al., 2020). Thus, the relatively strong digital proficiency observed in Bayelsa may stem from foundational digital literacy enabling basic use of reporting systems. However, the lack of advanced skills suggests that such foundational knowledge alone is inadequate for managing the complexities of modern health information systems. There is a clear need to expand training beyond basic operations to include informatics, data analysis, system integration, technical troubleshooting, and digital information management.

A statistically significant relationship was found between digital competence and both perceived accuracy ($r = 0.411$, $p < 0.001$) and timeliness ($r = 0.430$, $p < 0.001$) of routine reporting. Digital competence accounted for 16.9% of the variation in perceived accuracy and 18.5% in perceived timeliness. This indicates that workers' ability to use digital tools meaningfully influences their confidence in the quality and promptness of reporting. Evidence from low- and middle-income countries consistently shows that workforce capacity, supported by technology, data quality checks, and feedback mechanisms, plays a central role in strengthening health information systems (Nutley et al., 2020). The current findings are consistent with Fawole et al. (2020), who reported that after introducing DHIS2 with comprehensive training and support in Nigeria, the completeness of immunization reports improved from 53% in early 2014 to 81% by mid-2017. Similarly, Bhattacharya et al. (2020) found in Gombe State that a bundled intervention targeting data quality and feedback significantly enhanced maternal and newborn health data reliability. However, since digital competence explained less than 20% of the variance in reporting quality, other factors clearly play important roles. For instance, Bhattacharya et al. (2019) noted in the same region that despite DHIS2 availability, facility-level reports often remained incomplete and inconsistent with source records, varying across time and locations. This underscores that while digital skills are essential, they are not sufficient on their own. Organizational elements such as staffing levels, supervision, feedback systems, reporting procedures, and infrastructure—must also be strengthened to improve reporting outcomes.

An analysis of the three domains of digital competence offers further insight. Cognitive/informatics skills had the strongest association with reporting performance (std. beta = 0.420), followed closely by technical/operational competence (std. beta = 0.421) and security/privacy competence (std. beta = 0.422). These results suggest that while operational knowledge is necessary, the ability to collect, interpret, analyze, and apply health data is crucial for high-quality reporting. This aligns with Sylla et al.'s (2024) review on data quality in sub-Saharan African health systems, which identified workforce capacity and underutilization of data as key barriers. Likewise, Tadele et al. (2023) found in Ethiopia that training, data management skills, supportive supervision, guidelines, and feedback were all linked to better use of routine health information. Therefore, building individual competencies must go hand-in-hand with strengthening system-level enablers to support data-informed decision-making. The current findings reinforce the importance of moving beyond teaching health workers how to input data toward equipping them to analyze and act on it—a shift evident in Nigeria's DHIS2 training, which emphasizes data interpretation, dashboard use, and feedback (Fawole et al., 2020). While cognitive skills appear most influential, the modest contribution of security/privacy competence should not be overlooked, as it likely affects unmeasured outcomes like data confidentiality and ethical compliance. Future studies should explore how digital

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competence impacts information security and the responsible use of health data. Overall, the study supports viewing digital competence as a multifaceted construct involving technical, cognitive, and ethical dimensions that must be addressed together. The study also revealed statistically significant differences in digital competence across facilities ($F(3,196) = 3.290, p = 0.023$), indicating uneven skill levels within and between health facilities. This variability could hinder standardized data practices and lead to inconsistencies in reporting quality. These findings mirror Bhattacharya et al. (2019), who documented widespread incompleteness and misalignment in DHIS2 data in Gombe State, calling for coordinated improvements. Bhattacharya et al. (2020) further demonstrated that a multi-component intervention—including job aids, peer review, workshops, and ongoing support—can effectively enhance data quality. At the national level, Fawole et al. (2020) identified structural challenges in Nigeria's DHIS2 implementation, such as weak infrastructure, limited human resources, and poor subnational governance, which persisted despite large-scale training. These systemic issues constrained health workers' ability to fully benefit from digital tools and contributed to reporting inconsistencies. Together, these insights emphasize that efforts to improve reporting must consider the broader organizational and system context. Even with improved individual competencies, success depends on supportive environments. Therefore, alongside workforce training, local authorities should prioritize infrastructure, technical support, supervision, staffing, feedback mechanisms, and standardized reporting routines. It is also important to note the study's cross-sectional design, which limits causal inference due to potential confounding variables. The results reflect associations rather than definitive cause-and-effect relationships.

5. CONCLUSION AND RECOMMENDATION

The study confirms that most health workers in Bayelsa State have a solid foundation in multidimensional digital competence. However, gaps remain in advanced technical areas such as complex software use, system interoperability, and hardware maintenance. Moreover, digital competence was positively linked to perceived accuracy and timeliness of reporting. These findings highlight the need for health workers to develop not only technical abilities but also higher-order skills in data interpretation and critical thinking to meet evolving demands in health information management.

In summary, while health workers in Bayelsa demonstrate generally strong digital capabilities and report favorable outcomes in routine data reporting, specific shortcomings particularly in advanced computing skills may limit their effectiveness in more complex digital health environments. The significant association between digital competence and reporting quality suggests that workers' proficiency in using digital systems directly affects the reliability and timeliness of health data. Therefore, enhancing multidimensional digital competence especially in advanced and cognitive domains is essential for achieving consistent, high-quality reporting.

Based on the findings, the following recommendations are proposed:

1. Invest in targeted digital skills development, with emphasis on advanced technical abilities and analytical thinking.
2. Promote cognitive competencies that enable health workers to interpret and apply routine health data in decision-making processes.
3. Strengthen technical and operational skills to support efficient digital data management and reporting.
4. Integrate data security and privacy training into digital competence programs for health workers.
5. Tailor digital training initiatives to individual facilities, considering the observed variations in skill levels across sites.
6. Avoid treating digital competence as a standalone solution, recognizing that organizational and systemic factors also significantly influence reporting quality.

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CONFLICTS OF INTEREST

The authors declare no competing interests.

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