

Evaluating the role of the health information system infrastructure in enhancing data quality in Central Equatoria State, South Sudan

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ABSTRACT

Introduction: A health information system (HIS) infrastructure is a critical foundation to produce high-quality routine health data for planning, monitoring, and decision-making, particularly in low-resource and fragile settings such as South Sudan. The aim of this study was to assess the influence of HIS infrastructure on the quality of the Health Management Information System (HMIS) data in public health facilities in Central Equatoria State, South Sudan.

Method: A cross-sectional study was conducted using a self-administered, structured questionnaire completed by health workers at the public health facilities. Descriptive statistics and Multivariate Analysis of Variance were produced using Stata software version 15.

Results: 139 health workers participated in the study. About half (50.4%) of respondents reported routine use of the District Health Information System version 2 (DHIS2); 30.2% of facilities had functional computers or tablets; and 53.2% lacked reliable internet connectivity. The HIS infrastructure factors collectively affect HMIS data quality, as shown by Wilks' Lambda = 0.507 ($p < 0.001$).

Conclusion: Inadequate digital infrastructure, inconsistent training coverage, and limited system utilization undermine HMIS data quality in Central Equatoria State. Strengthening HIS infrastructure, alongside standardized capacity-building and improved reporting processes, is essential to improving routine health data quality in South Sudan.

Keywords: health information system, infrastructure, data quality, health facilities, South Sudan

Introduction

Healthcare systems depend on reliable information from a well-established Health Management Information System (HMIS). As one of the health system building blocks, HMIS plays a significant role in collecting, storing and analysing data to support better decision-making.^[1,2] For enhanced quality data, HIS infrastructures, such as availability of computers, Internet connectivity, and software, need to be adequate. This is because data quality impacts all aspects of a business, including operational efficiency, compliance, and customer engagement. In healthcare, poor-quality data leads to misallocation of resources, wrong decision-making,

and risks to patients' lives and safety.^[3]

The HIS infrastructure refers to all components, including, but not limited to, hardware, software, networking, services, and policies that enable the collection, storage, and sharing of data.^[4] The HIS infrastructure has two components: the Information Technology (IT), which deals with hardware and software, and the human resource infrastructure, which encompasses skills, training, and motivation.^[5]

The rollout of the District Health Information System version 2 in 2019 was critical, establishing a robust HIS infrastructure that drives digital innovation.^[6] Empirical evidence shows that robust HIS infrastructure has modernized the health service delivery in Ethiopia by enhancing health workers' response to patients and improving data quality.^[7] This study examined how the HIS infrastructure, including the availability of computers/tablets, training on the HIS, and software, influences data quality at the public health facilities in Central Equatoria, South Sudan.

Method

Study population

This was a cross-sectional quantitative study. The target population included data clerks/monitoring and evaluation (M&E) officers, data managers, and other health cadres who were working at public health facilities in Central Equatoria State. We sampled 148 respondents. A self-administered questionnaire was completed by the health care workers between June and December 2025.

Data collection

Quantitative data were collected using a structured self-administered questionnaire covering demographic characteristics, training exposure, infrastructure availability, system utilisation, and perceived challenges in data entry and reporting.

Data analysis

Data were entered and analysed using STATA version 15. Descriptive statistics (frequencies and percentages) were generated. Additionally, a Multivariate Analysis of Variance (MANOVA) was performed to determine whether there were significant differences among infrastructural variables, such as facility electricity access and Internet connectivity, in the HMIS data quality dimensions (completeness, consistency, and timeliness).

Ethical considerations

Ethical approval was obtained from the Mount Kenya University Institutional Scientific and Ethics Review Committee (Reference: MKU/ISERC/4883) and the Ministry of Health Research Ethics and Review Board, South Sudan (Reference: MOH/RERB/P/A/15/8/2024-MOH/REBR/A/19-N/2024). Written, informed consent was obtained from all participants, and confidentiality was maintained throughout.

Results

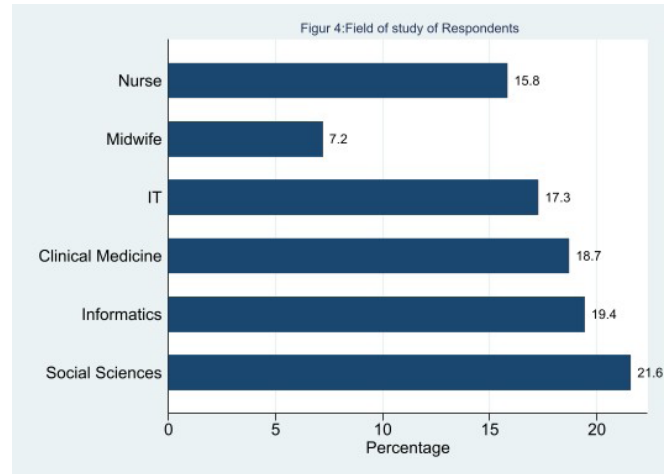
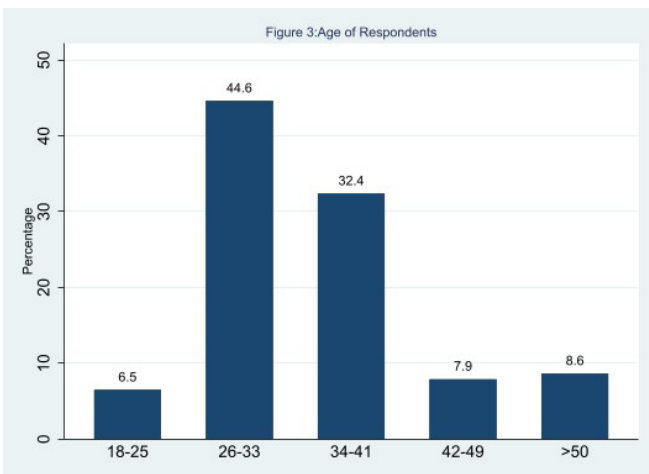
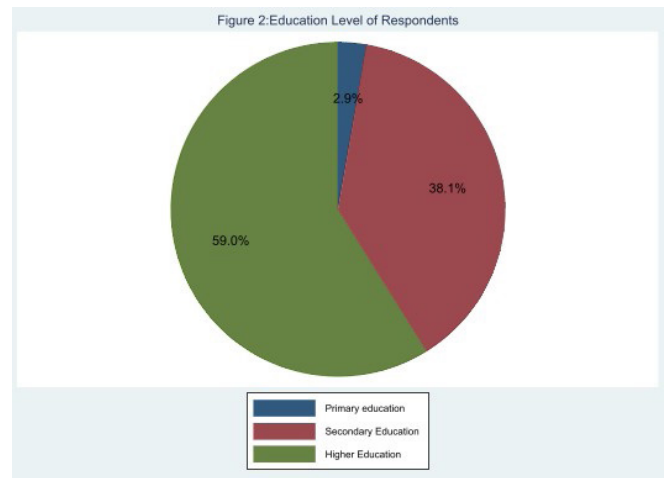
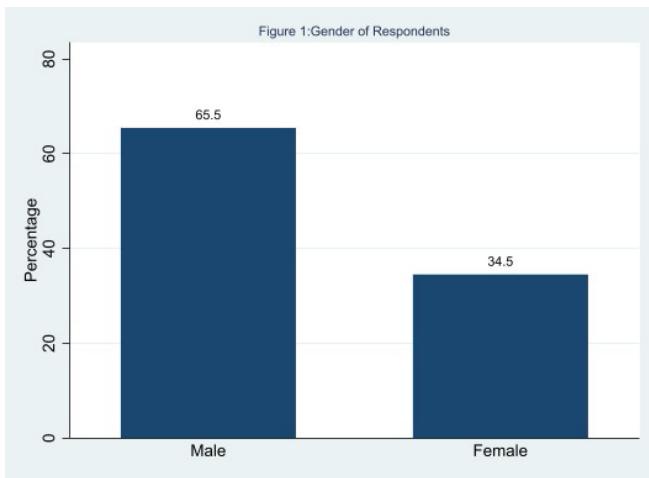
Figures 1-4 show the demographic characteristics of the 139 respondents out of 148 sampled (93.9% response rate): 65.5% were male, and 35% were female, with 45% aged 26-33 years, followed by 34-41 years (32.4%). The respondents' educational attainment varied significantly, with most holding higher education certificates (61.9%), followed by secondary education (38.1%). Most of the respondents studied social sciences (21.6%), health informatics (19.4%), clinical medicine (18.7%), and IT (17.3%).

The descriptive statistics in Table 1 show the HIS infrastructure factors that influence data quality in the District Health Information Software (DHIS) system. The findings revealed that only 50.4% were using DHIS2, indicating a suboptimal rollout across health facilities. 63.3% of those using DHIS2 received training on the system, yet only 46% of those trained rated the training as adequate. Additionally, 50% of those who received training on DHIS2/HMIS covered all aspects of the training.

The system's ease of use was rated positively by most respondents, with 82.7% finding it easy to use. However, a small proportion (16.1%) of respondents struggled with the system, possibly due to interface complexities or technical limitations. The availability of computers or tablets in health facilities was reported to be limited: only 30.2% of respondents confirmed their presence, and 81% reported functionality.

The major challenge reported by 53.2% of the respondents was poor internet connectivity and a lack of data bundles.

The MANOVA shown in Table 2 examines the HIS infrastructural determinants of HMIS data quality, assessing factors such as the DHIS2 system, training, tablets, reasons for delayed on-time data entry, and challenges facing the data entry process. The overall model was statistically significant (Wilks' $\lambda = 0.5072$, p



Figures 1-4. Demographic information of the respondents

= 0.0005), indicating that the HIS infrastructural factors jointly significantly affect the quality of HMIS data.

However, at the individual factor's level such as availability of DHIS 2 (Wilks' $\lambda = 0.9562$, $p = 0.2707$), training on the DHIS2/HMIS (Wilks' $\lambda = 0.9394$, $p = 0.1405$), the availability of computers/tablets (Wilks' $\lambda = 0.9607$, $p = 0.3196$) were not statistically significant, indicating that the above factors cannot individually impact on the quality of HMIS data.

Nevertheless, other factors, such as reasons for the delay in data entry, perhaps related to motivation, data entry protocols, or reporting procedures (Wilks' $\lambda = 0.8082$, $p = 0.0266$), challenges, such as internet connectivity (Wilks' $\lambda = 0.7231$, $p = 0.0042$), were statistically significant, confirming their potential for impacting the quality of HMIS data.

Discussion

In this study, there were more males than females. This sex disparity reflects employment ratios within the public health sector.^[8] Conversely, a similar study in Benin found that 81.7% of respondents were female.^[9] Our findings revealed that respondents' fields of study varied widely, with most having studied social sciences, health informatics, clinical medicine, and IT. This diversity emphasizes the multidisciplinary nature of, and the need required in, the public health workforce. A study conducted in Ethiopia in 2015 found that those tasked with data collection and reporting were nurses, accounting for 44% of the total respondents,^[10] unlike in South Sudan, where the responsibilities for data recording and reporting rested with data clerks and M&E officers.

The use of DHIS2 in South Sudan, like other countries such as Uganda^[6] is mandatory for all health facilities owned by the government, and is one of the HIS infrastructures upon which this study focused. The infrastructural determinants

Table 1. Descriptive statistics for HIS infrastructural determinants of quality of DHIS (N = 139)

Variable	Responses	n (%)
Datasets using DHIS 2 system for reporting?	Yes	70 (50.4)
	No	69 (49.6)
DHIS/HMIS training received	Yes	88 (63.3)
	No	51 (36.7)
Topics covered during the training	Data entry	20 (22.7)
	Data Analysis	8 (9.1)
	Data Quality Check	1 (1.1)
	All HMIS tools and DHIS2	18 (20.5)
	All of them	38 (43.2)
	Others	3 (3.4)
	Adequacy of the HMIS/DHIS2 training	Inadequate
	Somehow adequate	22 (25.3)
	Adequate	40 (46.0)
System use after HMIS/DHIS2 training	Very adequate	15 (17.2)
	Very difficult	5 (5.8)
	Difficult	9 (10.3)
	Easy	59 (67.8)
	Very easy	13 (14.9)
Computers/tablets available at the facility	Missing value	1 (1.2)
	Yes	42 (30.2)
Functionality of Computers/tablets	No	97 (69.8)
	Yes	34 (81.0)
Other Means of reporting in case no computer/tablet	No	8 (19.1%)
	Reporting through CHD	74 (76.3)
	Using mobile phone	18 (18.6)
Challenges facing data entry process	Borrow computer from friends	5 (5.2)
	Poor system design	16 (11.5)
	Incomplete data system	20 (14.4)
	Inaccurate data	18 (13.0)
	Poor internet/ lack of bundles	74 (53.2)
	Others	11 (7.9)

assessed included the availability of HMIS reporting tools, such as HMIS registers, reporting forms, computers/tablets, and the overall database. The investigation encompassed the training on DHIS2 or HMIS tools, the topic covered, and whether the training was adequate. The influence of infrastructural factors on the quality of HMIS data was assessed using logistic regression and MANOVA, with a significance level of 5%. The results showed that about 50% of respondents used the DHIS2 system and were familiar with HMIS tools, of whom about 60% had received training on the HMIS/DHIS2 system.

Despite many respondents having received training on DHIS2 and HMIS tools, the training was inadequate or not well integrated, as trainees didn't cover all essential topics as per the HMIS training manual, which could lead to differing levels of proficiency among users. A study on DHIS2 utilization in Uganda and Ethiopia reported utilization rates above 90% and 80%, respectively,^[7,8] far higher than in South Sudan. Only 46% of those who received training found it adequate, casting doubt on its efficiency and effectiveness. The robust HMIS system is anchored in the skilled human resources trained on the system and its tools, a comprehensive system design, and reliable internet connectivity.^[9,10]

As computers or tablets play a critical role in reporting and the utilization of the DHIS2 in general, their availability and functionality remain a major concern, as many health facilities do not have computers/tablets. This highlights a critical infrastructural gap that hinders data reporting and compromises the quality of datasets collected through the DHIS2 system.

Conclusion

HIS infrastructure was a key determinant of the quality of data generated at health facilities. Despite the adoption of DHIS2 as the national HIS, its utilization at the subnational level remains suboptimal, with 50% of the sampled facilities reporting through the county health department. It was also noted that most health workers who have received training on HMIS/DHIS2 have not been trained on all aspects of the curriculum, suggesting gaps in their knowledge. The limited availability of computers/tablets or HMIS tools for reporting and poor Internet connectivity further constrained the timely reporting of data into DHIS2. We recommend completing the rollout of the DHIS2 system, standardizing training, and increasing investment in HIS infrastructure.

References

Table 2. Multivariate analysis of HIS Infrastructural determinants of quality of DHIS datasets

Source	Wilks' λ	df	F (df1, df2)	F	p-value
Model	W 0.5072	10	(30;256)	2.22	0.0005
Residual		89			
DHIS2	W 0.9562	1	(3;87)	1.33	0.2707
Training	W 0.9394	1	(3;87)	1.87	0.1405
Tablets	W 0.9607	1	(3;87)	1.19	0.3196
Reasons for delay	W 0.8082	3	(9;211.9)	2.15	0.0266
Challenges	W 0.7231	4	(12;230.5)	2.5	0.0042

- Dagne E, Woreta SA, Shiferaw AM. Routine health information utilization and associated factors among health care professionals working at public health institution in North Gondar, Northwest Ethiopia. *BMC Health Serv Res.* 2018;18:685. <https://doi.org/10.1186/s12913-018-3498-7>
- Kebede M, Adeba E, Chego M. Evaluation of quality and use of health management information system in primary health care units of east Wollega zone, Oromia regional state, Ethiopia: *BMC Med Inform Decis Mak.* 2020;20:107. <https://doi.org/10.1186/s12911-020-01148-4>
- Omer MK. The Contribution of Health Management Information Systems to Enhancing Healthcare Operations. *Int J Adv Comput Sci Appl [Internet].* 2023 [cited 2025 June 3];14. <https://doi.org/10.14569/IJACSA.2023.0141263>
- Ministry of Health, South Sudan. Towards health system resilience Key Health Management Information System (HMIS) interventions and progress in South Sudan [Internet]. 2025 [cited 2025 Dec 6]. <https://moh.gov.ss/>. Accessed 6 Dec 2025
- Zerfu TA, Asressie M, Begna Z, Habtamu T, Werkneh N, Nigatu T, et al. Unveiling the role of DHIS2 in enhancing data quality and accessibility in primary healthcare facilities: Evidence from Ethiopia. *Demsash AW*, editor. *PLOS ONE.* 2024;19:e0314505. <https://doi.org/10.1371/journal.pone.0314505>
- Kiwanuka SN, Kabwama SN, Namuhani N, Gupta S, Layer E, Mechael P, et al. Barriers and facilitators of the effective use of DHIS2 data to improve program planning and monitoring in Uganda: a sequential mixed methods study. *Oxf Open Digit Health.* 2026;4:oqag002. <https://doi.org/10.1093/oodh/oqag002>
- Basajja M, Paul-Chima UO. Comparative Effectiveness of DHIS2 and FAIR Data Approaches for Privacy-Preserving Health Data Analytics in Uganda: A Systematic Review. *Clin Outcomes Res CEOR.* 2025;17:849–64. <https://doi.org/10.2147/CEOR.S560265>
- Teklegiorgis K, Tadesse K, Terefe W, Mirutse G. Level of data quality from Health Management Information Systems in a resources limited setting and its associated factors, eastern Ethiopia : original research. *South Afr J Inf Manag. AOSIS;* 2016;18:1–8. <https://doi.org/10.4102/sajim.v17i1.612>
- Global Strategy on Digital Health 2020-2025. 1st ed. Geneva: World Health Organization; 2021.
- WHO Toolkit for Routine Health Information Systems Data <https://www.who.int/data/data-collection-tools/health-service-data/toolkit-for-routine-health-information-system-data/modules>. Accessed 14 Feb 2026