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Assessing the functionality of the routine health information system in health facilities of Yaoundé, Cameroon: a cross-sectional study

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Abstract

Background: Functional Routine Health Information Systems (RHIS) are essential for evidence-based decision-making, performance monitoring, and attaining Universal Health Coverage and Sustainable Development Goals. Despite substantial investment in health information infrastructure in Cameroon, gaps in RHIS functionality persist. This study assessed the functionality of the RHIS in health facilities (HFs) of Yaoundé, Cameroon.

Methods: A cross-sectional study was conducted from November 2024 to July 2025 in 88 HFs selected from six health districts. The MEASURE Evaluation RHIS rapid assessment tool was used to evaluate performance of RHIS domains and subdomains. RHIS functionality was quantified as a percentage score at the subdomain, domain, and global levels, and dichotomised as good (≥60%) or poor (<60%). Pearson Chi-square and Fisher's Exact tests (when necessary) were used to establish associations between categorical variables. A p-value <0.05 was considered statistically significant.

Results: RHIS domains functioned at 46% (Data Collection and Processing), 44% (Data Analysis, Dissemination and Use), 39% (Data and Decision Support Needs), and 29% (Management and Governance). Subdomain scores ranged from 20% (Human Resources) to 54% (Data Demand and Use). Of the surveyed HFs, 65.9% demonstrated good functionality and varied significantly across health District ($p < 0.001$) with Efoulan (100%), Nkolndongo (91.3%), and Biyem-Assi (84.2%) showing good functionality, while Nkolbisson (50.0%), Djoungolo (22.7%), and Cité Verte (20.0%) recording poor scores.

Conclusion: RHIS functionality in Yaoundé is constrained by weaknesses in governance, and human resources. Strengthening these organisational determinants is essential for sustainable system performance.

Keywords: Health Information System; Routine Health Information System; Health Facilities; Decision Making; Cameroon

Background

The transformation of health systems into learning organisations capable of delivering equitable, efficient, and responsive care depends fundamentally on the availability and intelligent use of timely, accurate, and disaggregated health data[1]. As countries advance toward the Sustainable Development Goals (SDGs) and Universal Health Coverage (UHC), the role of robust national health information architectures has shifted from a peripheral administrative concern to a strategic determinant of system performance [2,3]. The World Health Organization (WHO) explicitly recognises health information as one of the six building blocks of the health system, alongside service delivery, the health workforce, access to essential medicines, financing, and leadership and governance [4]. Within this architecture, routine health information system (RHIS) occupies a uniquely strategic position. Unlike periodic surveys or vertical disease-specific reporting platforms, the RHIS generates continuous, locally produced data through the day-to-day operations of health facilities (HFs), capturing information on service delivery, disease patterns, resource utilisation, and population health needs at the level where care is actually delivered [5,6]. When functioning effectively, the RHIS provides the empirical substrate for facility-level quality improvement, district-level planning, and national-level policy formulation. It also constitutes the principal mechanism through which health systems generate the granular, equity-sensitive evidence required to identify underserved populations, track progress toward national targets, and document the impact of policy interventions [7,8]. The conceptual understanding of what constitutes a "functional" RHIS has evolved substantially over the past two decades. Early frameworks emphasized on the technical adequacy of data collection tools, reporting templates, and information technology infrastructure. More recent thinking, articulated most influentially through the Performance of Routine Information System Management (PRISM)

framework developed by Aqil et al., recognises that RHIS performance is determined by the dynamic interaction of technical, organisational, and behavioural determinants [9]. Within this framework, the production of quality data and its meaningful use for decision-making are conceptualised not as natural by-products of well-designed tools, but as institutional achievements requiring sustained investment in governance, human resources, supervision, and a culture of evidence-informed practice.

Despite the conceptual and operational maturation of the field, the practical performance of RHIS across low- and middle-income countries (LMIC) remains uneven and, in many settings, deeply concerning. A growing body of evidence from sub-Saharan Africa documents persistent challenges with data completeness, timeliness, and accuracy that undermine the credibility of routinely generated indicators and discourage their use in decision-making [10,11]. A systematic review by Hoxha et al., examining RHIS performance across LMICs, identified the gap between data production and data use as the most prevalent and intractable challenge facing African health information systems[12]. This gap is compounded by structural fragmentation, as parallel disease-specific information systems funded by external partners proliferate alongside the routine system, intensifying the reporting burden on frontline health workers and diluting institutional accountability for system performance [13,14]. The introduction of the District Health Information Software version 2 (DHIS2), now implemented in more than 70 countries, has significantly improved the technical infrastructure for routine data collection and aggregation across the Africa region[15]. However, evidence accumulating over the past decade demonstrates that technological upgrades, while necessary, are insufficient on their own to produce sustained improvements in RHIS performance.

Studies from Uganda, and Mozambique have consistently shown that gains in reporting completeness achieved through DHIS2 implementation have not been matched by corresponding improvements in data quality, governance, or use [16,17. This pattern reflects

what experienced practitioners have increasingly characterised as a misalignment between technical investment and the organisational reforms required to translate digital infrastructure into health system intelligence [18]. The COVID-19 pandemic has further sharpened global attention to the strategic importance of functional health information systems. The crisis exposed, with unprecedented clarity, the consequences of weak RHIS performance for outbreak detection, resource allocation, and equity-sensitive response planning [19]. It has also catalysed renewed international commitment to RHIS strengthening as a foundational element of pandemic preparedness and health system resilience [20]. Within this evolving global context, comprehensive assessments of RHIS functionality at the facility and district levels have acquired new urgency, particularly in countries where the evidence base for

system strengthening remains limited. In Cameroon, the Health Sector Strategy (HSS) 2016–2027 identifies the development of a high-quality, integrated health information system as a national priority, with the explicit objective of enabling evidence-based decision-making at all levels of the health pyramid by 2027 [21]. Yet empirical assessments of RHIS performance in the country remain scarce, geographically limited, and methodologically heterogeneous.

Earlier studies by Nguefack-Tsague et al. and Tamfon et al. have documented important inadequacies in RHIS functionality in HFs in Yaounde and identified several factors associated with RHIS performance [22,23]. These have paved the way for targeted strengthening of the RHIS in the HFs in Yaounde over the years.

Given the rapid evolution of digital health initiatives and the ongoing decentralisation reforms in the Cameroon health sector since 2020, there remains a critical need to assess the performance of the RHIS. This is particularly consequential for Yaoundé, which concentrates a substantial proportion of the national health information infrastructure and serves as a reference setting for health system innovation in Cameroon.

The objective of the study was to assessing the functionality of the RHIS in HFs of Yaoundé, Cameroon. The study will contribute to attaining three interrelated objectives: (i) To inform targeted evidence-based strengthening interventions within the Cameroonian health system; (ii) To expand the regional evidence-base on RHIS performance in urban sub-Saharan African contexts; and (iii) To support national progress towards the health information benchmarks articulated in the HSS 2016–2027 and the broader SDGs agenda.

Methods

Study design and setting

We conducted a cross-sectional descriptive and analytical HF-based study for 9 months (from November 2024 to July 2025) in six health districts (HDs) in Yaoundé: Biyem-Assi, Cité Verte, Djoungolo, Efoulan, Nkolbisson, and Nkolndongo. Each HD contains a mix of public and private (confessional and non-confessional) HFs operating at primary, secondary, and tertiary levels of care, reflecting the pluralistic structure of Cameroon's national health system as defined by the HSS [21]. Yaoundé, the political capital of Cameroon is located in the Centre region. It hosts the highest concentration of HFs and health information management infrastructure in the country. This characteristic makes it an appropriate site for a

comprehensive assessment of RHIS performance. The diversity of HF types, ownership models, and HD characteristics present in Yaoundé enable analysis of RHIS performance across a broad spectrum of institutional contexts.

Study population and selection criteria for HFs, and respondents.

At the HF level, we included HFs located within the administrative boundaries of the six HDs, facilities that had been operational for at least twelve months prior to data collection, HFs with at least one staff member formally responsible for data management or health information

activities, and HFs that provided written informed consent for participation. HFs that were temporarily closed or suspended at the time of data collection, specialised HFs that did not contribute to the national RHIS reporting framework (e.g., standalone laboratory services, blood banks) were excluded.

Within each selected HF, questionnaires were addressed to either of the two categories of respondents: the facility head (medical officer in charge, nurse-in-charge, or equivalent) or the designated data manager (also referred to as the focal point for health information or the RHIS officer) with possible complementarity of responses between the two.

Sample size and sampling

The minimum sample size (n) of 85 heath facilities required for this study was calculated using Cochran's modified formula for finite populations [24, 25, 26]:

$$n = \frac{\frac{Z^2 \times P(1-P)}{d^2}}{1 + \frac{\frac{Z^2 \times P(1-P)}{d^2} - 1}{N}}$$

where $Z = 1.96$ (corresponding to a 95% confidence level); $P = 50\%$ [25] denotes the proportion of HFs with good functionality of RHIS; $d = 0.10$ the margin of error; $N = 666$ refers to the estimated number of HFs in Yaoundé. A stratified random sampling approach was employed to ensure proportional representation of HFs across HDs. Firstly, the total number of eligible HFs in each HD was enumerateded using the masterr facility list maintained by the Ministry of Public Health (MoPH). Secondly, HFs within each HD were stratified by status (private non-confessional, private confessional, and public HFs). Lastly, facilities were randomly selected from each stratum in proportion to the stratum's share of the total eligible facilities population, using a computer-generated random number sequence. This stratification approach prevents overrepresentation of larger districts or dominant HF types

and ensures that the analytical findings be interpretable across the full range of health system contexts present in Yaoundé. One questionnaire was administered to one respondent per HF.

Study variables

The primary variable of interest was the overall functionality of the RHIS at the HF level, operationalised as a continuous percentage score ranging from 0 to 100%. It was subsequently dichotomised into a binary categorical variable (good versus poor functionality) for descriptive classification purposes, as described in the scoring subsection below [27]. Other variables included: socio-professional characteristics of respondents (age, sex, professional qualification, years of professional experience, position of responsibility within the institution, and duration in the current post), HF status (public, private confessional, or private non-conf essional), and the Health Facility and Community Information System (HFCIS) standards. The HFCIS standards are defined and grouped into domains and subdomains by WHO and MEASURE Evaluation. These domains and subdomains that were used to assess the functionality of the RHIS were the following [27]:

1. *Management and Governance:* This domain examins the degree to which governance mechanisms create an enabling environment for quality health data, and the institutional foundations that enable the RHIS to function. Its subdomains will assess the Policies and Planing for health information, RHIS Management structures, and Human Resources to sustain RHIS activities.

2. *Data and Decision Support Needs:* This examines whether facilities have clearly articulated their information requirements and adopted appropriate technical standards. In otherwords, it assesses the alignment between needed information and what the system is designed to produce. Subdomains are Data Needs and Data Standards and System Design.

3. *Data Collection and Processing;* The domain covers the core operational functions of the RHIS and assesses how reliably and accurately health data flows from the point of care, along the reporting chain, to the decision-making level. The subdomains are Collection and Management of Individual Client Data, Collection, Management and Reporting of Aggregated Facility Data, Data Quality Assurance, and Information and Communication Technology (ICT).

4. *Data Analysis, Dissemination, and Use:* It evaluates whether collected data are transformed into actionable information. The domain collectively measures the level of end utilisation of the RHIS data along the data transmission chain. Subdomains are Data Analysis, Information Dissemination, and Data Demand and Use. Table 1 illustrates the various subdomains, the number of question items per subdomain and maximum possible score per subdomain for all the four RHIS domains.

Table 1: Structure of the MEASURE Evaluation RHIS Rapid Assessment Tool: domains, subdomains, item references, and maximum scores

Domain	**Subdomain**	**N items**	**Max score**
1 : Management and Governance	Policies and Planning	9	36
	Management	12	48
	Human Resources	7	28
2: Data and Decision Support Needs	Data Needs	21	84
	Data Standards and System Design	7	28
3: Data Collection and Processing	Collection and Management of Individual Client Data	5	20
	Collection, Management and Reporting of Aggregated Facility Data	5	20
	Data Quality Assurance	8	32
	Information and Communication Technology (ICT)	5	20
4: Data Analysis, Dissemination and Use	Data Analysis	6	24
	Information Dissemination	5	20
	Data Demand and Use	7	28
TOTAL	12 subdomains	97	388

Data collection procedure

Data were collected using the data entry module of the MEASURE Evaluation RHIS rapid assessment tool [27]. This tool was slightly modified to capture socio-professional data of participants and characteristics of sampled HFs. The tool organises information system standards into four domains and twelve subdomains that assessed the functionality of the HFs through a set of 97 questions (Table 1). Each question was scored by the respondent on a four-point ordinal scale reflecting the degree of implementation of the assessed standard as follows: **0 = No response / Not applicable:** the standard is not relevant to this facility or the respondent could not assess it; **1 = Absent, needs to be developed:** the standard is entirely absent; significant development work is required; **2 = Needs a lot of strengthening:** elements of the standard are in place but require extensive improvement; **3 = Needs some strengthening:** the standard is largely implemented but requires moderate refinement; **4 = Already present, no action required:** the standard is fully implemented and no corrective action is needed. Accordingly, the maximum possible score per item is 4 (already present/no action required) and the minimum is 0 (No response/Not applicable). The maximum aggregate score across all 97 applicable items is $97 \times 4 = 388$, representing a hypothetical facility where every standard is fully implemented. The tool was pre-tested in two separate HFs and revised to ensure feasibility in administration. It was then incorporated into Kobo Toolbox and self-administered digitally by participants. Direct examination of facility health information tools (registers, and other documentation) were also done to triangulate participants' responses with physical evidences where possible. Completed questionnaires were reviewed daily for completeness, internal consistency, and legibility. Responders of questionnaires with missing critical information or apparent inconsistencies were follow-up for completion.

Data management and statistical analysis

RHIS functionality was quantified at subdomain, domain, and global levels using a standardised percentage scoring approach adapted from Nguefack et al. [22] and Indrayan et al. [28]. Each score represents the proportion of the maximum achievable performance actually attained by a given HF. The three-step procedure is described belows:

Step 1: Subdomain score: For each subdomain, the score was obtained using the formula

$$Score\ (\%)\ =\ \Sigma\ (item\ scores\ within\ subdomain)\ /\ [Napplicable\ \times\ 4]\ \times\ 100$$

where Napplicable is the number of items within the subdomain scored 1 to 4 (i.e., relevant and assessable). Items scored 0 (not applicable) were retained within the scoring denominator, consistent with the scoring conventions of the MEASURE Evaluation RHIS rapid assessment tool, and were not excluded from subdomain or domain-level calculations.

Step 2: Domain score: The domain score was calculated using the formula

$$Score\ (\%)\ =\ \Sigma\ (all\ applicable\ item\ scores\ within\ domain)$$
$$/\ [Ndomain_applicable]\ \times\ 4\times\ 100$$

where Ndomain_applicable is the total number of items scored 1 to 4 across all subdomains of the domain. This approach weights each subdomain proportionally to its number of items, thereby reflecting the relative contribution of each component to the overall domain performance.

Step 3: Global RHIS functionality Score

The global RHIS functionality score was derived with the formula

$$Score\ (\%)\ =\ \Sigma\ (all\ applicable\ item\ scores\ across\ all\ 4\ domains)$$
$$/\ [Ntotal_applicable\ \times\ 4]\ \times\ 100$$

where Ntotal-applicable is the total number of items scored 1 to 4 across all domains. The global score thus integrates performance across all four domains, giving each domain a weight proportional to its number of items. The global RHIS functionality score was dichotomised to produce a binary outcome : Good functionality if its global RHIS functionality score was ≥ 60%; or Poor functionality if its global RHIS functionality score was < 60%, a classification threshold applied in prior RHIS assessments in Cameroon [22, 28]. This threshold reflects the consensus view in the RHIS performance literature that a score below 60% indicates fundamental deficiencies across the system's core functions; deficiencies severe enough to compromise the reliability of data produced and their utility for evidence-based decision-making. The 60% cut-off is also consistent with the minimum performance standards embedded in the Cameroon HSS 2016–2027, which stipulates that HFs should have well-organised data management systems supporting routine reporting, monitoring, and evaluation activities [21].

Data were managed and scored using the MEASURE Evaluation RHIS rapid assessment tool [27]. The tool is implemented as two functionally distinct but interoperable modules for data entry, and data analysis and dashboard. For each participating HF, responses were entered directly into the facility-level data entry module. The data entry module is architecturally organised to mirror the four-domains and multi-subdomain structure of the HFCIS assessment framework. Each item corresponds to a specific RHIS functional standard within a defined subdomain, and responses are recorded using a five-point categorical scale. The module incorporates scoring algorithms that automatically assign numerical weights to categorical responses and compute subdomain-level and domain-level functionality scores as weighted proportions. These computations are executed in real time as responses are entered, enabling immediate quality checking of score outputs against expected ranges and facilitating rapid identification of data entry anomalies or outliers, as well as enabling immediate feedback to

the HF. Upon verification and quality assurance of all facility-level data entry files, the individual workbooks were imported into the aggregate data analysis and dashboard module. This module systematically consolidated facility-level subdomain and domain scores across all workbooks and generated a unified analytical dataset representing RHIS functionality across the full study sample.

The analysis and dashboard module produces a suite of pre-programmed summary outputs, including frequency distributions of categorical responses for each item, subdomain, and domain across all facilities. It also produces graphical visualisations enabling rapid comparative analysis of RHIS performances across HFs and districts. Following automated score generation by the data analysis and dashboard module, data was then transferred to IBM SPSS version 27.0 for further statistical analysis. Continuous variables were presented as mean ± standard deviation, and categorical variables were presented as frequencies and percentages. Pearson Chi-square test and Fisher's Exact test where indicated, were used to establish associations between categorical and a p-value <0.05 was considered statistically significant.

Results

1. Socio-Professional Characteristics of Participants and Health Facilities

A total of 88 HFs participated in the study. Majority (85.2%, n=75) were private non-confessional, followed by private confessional HFs (9.1%, n=8). HFs were distributed across the six HDs of Yaoundé as follows: Nkolndongo (26.1%, n=23), Djoungolo (25.0%, n=22), Biyem-Assi (21.6%, n=19), Efoulan (12.5%, n=11), Nkolbisson (9.1%, n=8), and Cité Verte (5.7%, n=5). The 88 respondents had a mean age of 42.17 ± 9.28 years (range: 27–64), with nearly two-thirds (63.6%) of them female. Data managers constituted 58.0% and heads of facilities 42.0%, with a mean duration in the current post of 7.24 ± 4.89 years. According

to the Cameroonian health workforce classification, senior paramedical staff (Registered Nurses, Senior Nurses, Senior Registered Nurses, Midwives, Medical Health Technicians, Biologists, and Master of Public Health holders) were majority (59.1%), followed by mid-level paramedical staff (Nurses, Caregivers, and Psychosocial Assistants; 31.8%). Medical and pharmaceutical personnel accounted for 3.4%, and administrative and management personnel 5.7% (**Table 2**).

Table 2: Socio-professional characteristics of participants and health facility-related characteristics (n = 88).

Variables and modalities	**Frequency(n)**	**Percentage (%)**
Professional qualification		
Medical and pharmaceutical personnel	3	3.4
Paramedical personnel (Senior/Superior cadre)	52	60.2
Paramedical personnel (Mid-level cadre)	28	31.8
Administrative and management personnel	5	5.7
Sex		
Female	56	63.6
Male	32	36.4
Post of responsibility		
Data manager	51	58
Head of facility	37	42
Duration responsibility (years)		
1-5	36	40.9
6-10	34	38.6
>10	18	20.5
Health District		
Cite Verte	5	5.7
Djoungolo	22	25
Nkolbisson	8	9.1
Biyem-Assi	19	21.6

Nkolndongo	23	26.1
Efoulan	11	12.5
Total	88	100

2. Functionality Level of the Routine Health Information System Domains and Subdomains

This section presents the categorical breakdown of RHIS functionality across the four domains and twelve subdomains, based on item-level response distributions. At the domain level (**Figure 1**), Data collection and Processing was the most functional domain, with 46% of items already present and needed no action, followed by Data Analysis, Dissemination, and Use (44%). Management and Governance had the least functional items (29%), but registered the highest proportion (71%), of items that needed some strengthening (17%), a lot of strengthening (12%), items that were absent and needed to be developed (17%), and items with no responses/not applicable (25%). Data Collection and processing domain equally registered the lowest proportion (54%), of items that needed some strengthening (21%), a lot of strengthening (11%), items that were absent and needed to be developed (13%), and items with no responses/not applicable (9%).

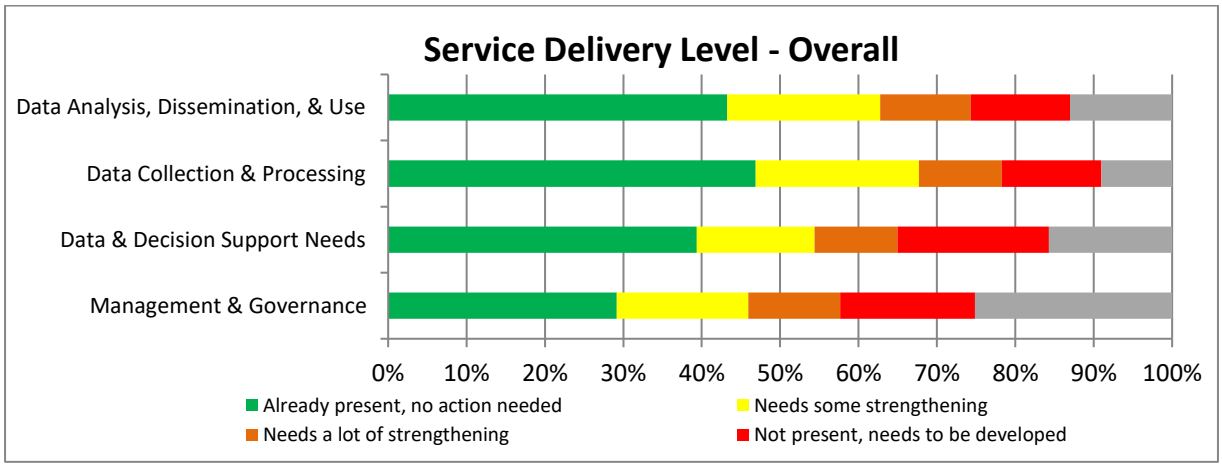


Figure 1: Functionality level of RHIS domains in health facilities of Yaoundé

Functionality levels varied within the various domains. In domain 1 (Management and Governance), Management (42%) was most functional, and it registered only 7% of non-applicable/no answer items (**Figure 2**). Human Resources was least functional (11%), and most (54%) of its items were non-applicable or not responded to, leaving only about 35% of the items that needed some strengthening (10%), a lot of strengthening (9%) and needed to be developed (18%). Data Collection and Processing subdomains performed fairly better, with three of the four subdomains scoring above 45% of items that are already present and need no action (**Figure 2**). These are Collection and management of individual client data (46%), Collection, management and reporting of aggregated facility data (53%), and Data Quality Assurance (50%) (**Figure 2**). The most poorly functional subdomain in this domain (Information and Communication Technology (35%) still scored higher than Human Resources (11%), Policy and Planning (25%), and Data Analysis (30%). The subdomain Data Demand and Use, of the Data Analysis, Dissemination and Use domain scored the highest proportion (54%) of items that functioned well in subdomain (**Figure 2**). Thus, ranked in ascending order of categorical functionality, the subdomains were: Human Resources (11%), Policies and Planning (26%), Data Analysis (30%), ICT (35%), Standards and System Design (36%), Data Needs (40%), Management (42%), Information Dissemination (43%), Collection and Management of Individual Client Data (46%), Data Quality Assurance (51%), Collection,

Management and Reporting of Aggregated Facility Data (53%), and Data Demand and Use (54%) (**Figure 2**).

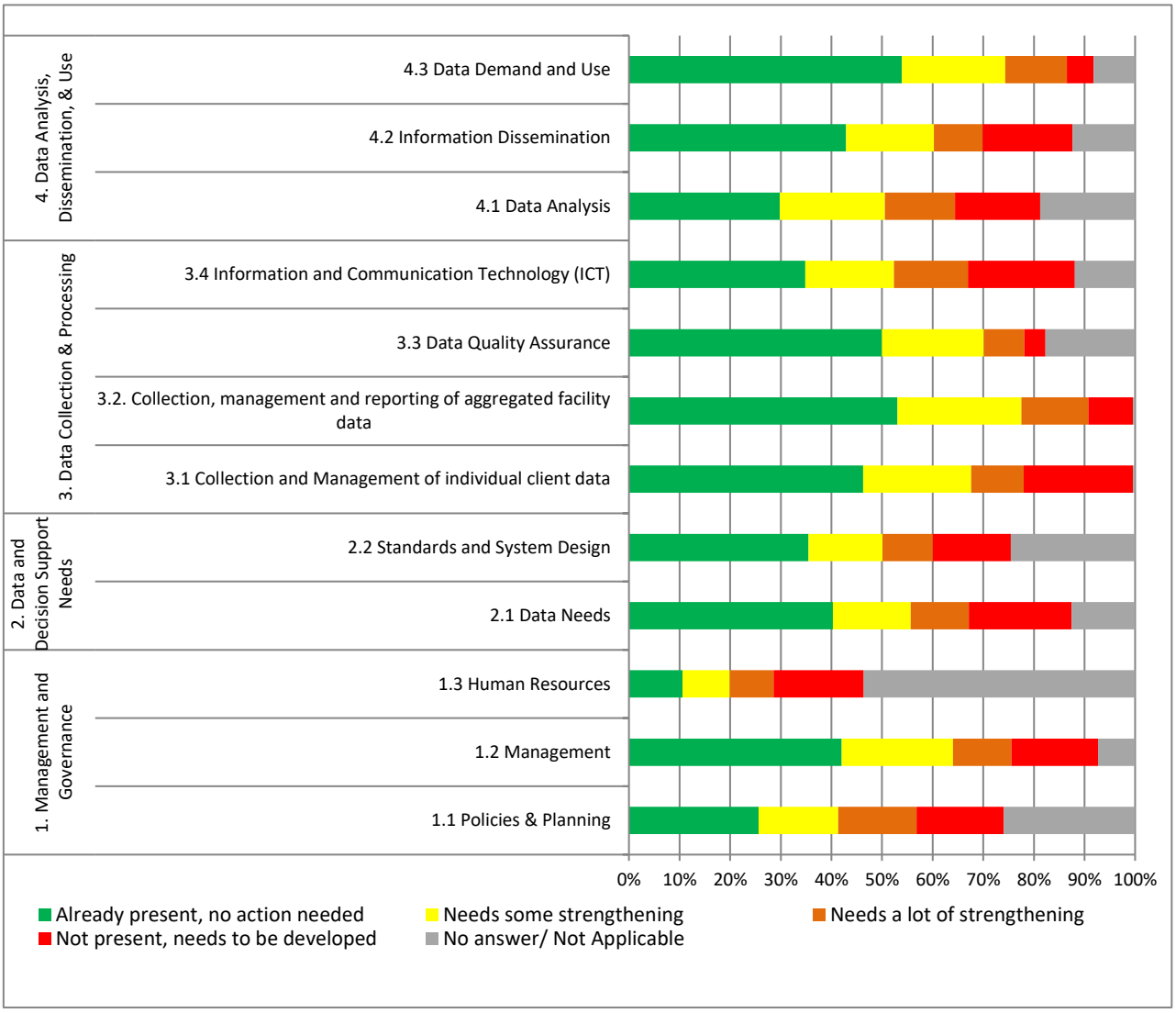


Figure 2 Functionality level of overall domains and subdomains of the RHIS in HFs of Yaoundé

3. Functionality of health facility Routine Health Information System by Health District and Health Facility Status

Of the 88 HFs assessed, 58 (65.9%) demonstrated good RHIS functionality (global score ≥60%), while 30 facilities (34.1%) were poorly functional. Across the six HDs, RHIS

functionality scores varied substantially from Efoulan (11/11; 100.0%), Nkolndongo (21/23; 91.3%), and Biyem-Assi (16/19; 84.2%) that demonstrated good functionality, to Nkolbisson (4/8; 50.0%), Djoungolo (5/22; 22.7%), and Cité Verte (1/5; 20.0%) that recorded unacceptable functionality scores (χ^2 = 38.972, p < 0.001). By HF status, public HFs demonstrated the highest proportion of functional facilities (4/5; 80.0%), followed by private confessional HFs (6/8; 75.0%) and private non-confessional HFs (48/75; 64.0%), though the finding is not statistically significant (χ^2 = .858, p = 0.711). No statistically significant associations were found between RHIS functionality and age group (χ^2 = 0.594, p = 0.898), sex (χ^2 = 0.002, p = 0.966), professional qualification (χ^2 = 1.874, p = 0.392), position of responsibility (χ^2 = 1.418, p = 0.234), duration of professional experience (χ^2 = 2.500, p = 0.475), or duration in the current post (χ^2 = 0.836, p = 0.841). (**Table 3).**

Table 3: Functionality of the Routine Health Information System by Health District and Health Facility Status (n = 88)

Variable	**Total**	**Functionality (%)**		**Statistical test**	**p-value**
		Good	**Poor**		
Health District				χ^2 = 38.972; df = 5	< 0.001[1]
Cité Verte	5	1 (20.0)	4 (80.0)		
Djoungolo	22	5 (22.7)	17 (77.3)		
Nkolbisson	8	4 (50.0)	4 (50.0)		
Biyem-Assi	19	16 (84.2)	3 (15.8)		
Nkolndongo	23	21 (91.3)	2 (8.7)		
Efoulan	11	11 (100.0)	0 (0.0)		
Health Facility Status				χ^2 = .858; df = 2	0.711[2]
Private non-confessional	75	48 (64.0)	27 (36.0)		
Private confessional	8	6 (75.0)	2 (25.0)		

Public hospital	5	4 (80.0)	1 (20.0)		
Age Group (years)				$\chi^2 = 0.594$; df = 3	0.898[1]
≤ 33	13	9 (69.2)	4 (30.8)		
34–42	37	25 (67.6)	12 (32.4)		
43–52	24	16 (66.7)	8 (33.3)		
≥ 53	14	8 (57.1)	6 (42.9)		
Sex				$\chi^2 = 0.002$; df = 1	0.966[1]
Male	32	21 (65.6)	11 (34.4)		
Female	56	37 (66.1)	19 (33.9)		
Professional Qualification				$\chi^2 = 1.874$; df = 2	0.392[1]
Senior paramedical personnel	52	37 (71.2)	15 (28.8)		
Mid-level paramedical personnel	28	17 (60.7)	11 (39.3)		
Administrative, medical and pharmaceutical	8	4 (50.0)	4 (50.0)		
Position of Responsibility				$\chi^2 = 1.418$; df = 1	0.234[1]
Data manager	51	31 (60.8)	20 (39.2)		
Head of facility	37	27 (73.0)	10 (27.0)		
Duration of Professional Experience (years)				$\chi^2 = 2.500$; df = 3	0.475[1]
≤ 5	20	14 (70.0)	6 (30.0)		
6–13	32	19 (59.4)	13 (40.6)		
14–21	22	17 (77.3)	5 (22.7)		
≥ 22	14	8 (57.1)	6 (42.9)		
Duration in Current Post (years)				$\chi^2 = 0.836$; df = 3	0.841[1]

≤ 2	15	11 (73.3)	4 (26.7)		
3–7	38	24 (63.2)	14 (36.8)		
8–12	21	13 (61.9)	8 (38.1)		
≥ 13	14	10 (71.4)	4 (28.6)		
Total	88	58 (65.9)	30 (34.1)		

[1] Pearson Chi-square test; [2] Fisher's Exact Test (applied due to expected cell counts < 5); df= degree of freedom

Discussion

This study assessed the functionality of the RHIS across 88 HFs in the six HDs of Yaoundé, Cameroon. Using the MEASURE Evaluation RHIS rapid assessment tool, the study provided a comprehensive, contemporary, and disaggregated characterisation of the RHIS performance across all six HDs, encompassing HFs of varying status. The use of this standardised tool ensured full methodological fidelity to the PRISM assessment protocol, guaranteed internal consistency of all scoring computations, and enhanced the comparability of findings with those generated by PRISM-based assessments in other sub-Saharan African (SSA) settings [27]. Each of our findings warrants careful interpretation in light of the existing body of evidence on RHIS performance in SSA, the structural mechanisms that plausibly explain the observed patterns, and the practical implications for health information system policy and practice in Cameroon and comparable settings.

Approximately two-thirds (65.9%) of the assessed facilities demonstrated good RHIS functionality, situating a system within a transitional zone between dysfunction and effective performance. An earlier assessment by Tamfon et al. [23] reported a substantially weaker performance in Yaoundé compared to the present study, suggesting either real improvement in RHIS functionality over the intervening period, or methodological differences in scoring conventions. The practical implication of this finding for Cameroon is significant. The fact

that 65.9% of HFs registered good functionality should not be interpreted as a position of safety or sufficiency, but rather as evidence of a system whose performance currently rests on a fragile institutional base. Without targeted investment in the foundational dimensions of the system, the operational gains accumulated to date are unlikely to be sustained over time.

Our analysis revealed a profoundly uneven internal architecture, in which the operational processes of data collection, processing, and reporting are comparatively well-institutionalised, whereas the foundational dimensions of management, governance, and most critically human resources for health information management remain severely underdeveloped. The score for Data Collection and Processing exceed the score for Management and Governance by nearly 20 percentage. This gap widened further at the subdomain level, where Collection, Management and Reporting of Aggregated Facility Data out-performed Human Resources by more than 43 percentage points. This pattern reflects a coherent institutional logic in which the visible, auditable outputs of the system have been systematically prioritised over the invisible foundational structures that produce them. This pattern is among the most consistently reported findings in the global RHIS literature [6, 11, 12, 16]. Though some studies have reported a reverse pattern [30], our findings diverge sharply from this configuration, reflecting instead the dominant African experience of operational investment without corresponding institutional strengthening. Reporting completeness and timeliness of data has long served as a primary metric of RHIS performance in donor accountability frameworks. This has generated strong incentives for HFs and health ministries to prioritise the mechanics of data collection and transmission over the institutional quality of data governance [6, 12]. The Human Resources subdomain recorded the lowest score across the entire assessment, a finding suggestive of a structural system-wide phenomenon. This finding is not merely a relative ranking but signals the near-absence of an organised institutional structure for managing health information personnel at the HF level.

The evidence base across SSA strongly corroborates this finding [18, 31, 32]. A partial counterpoint emerges from studies of digital health interventions in which technological solutions have been proposed as substitutes for human resource investment. Some implementations of mobile data collection platforms have demonstrated short-term improvements in reporting completeness without parallel investment in human resources [33]. However, such gains may erode over time in the absence of dedicated personnel to manage data quality assurance, supervision, and data use processes, ultimately reinforcing the centrality of human resource investment. Human resource development and governance reforms are politically complex, resource-intensive, and slow to yield visible results, characteristics that have systematically disadvantaged the domain in the competition for finite system-strengthening investment. The dominant model of RHIS strengthening over the past two decades has been characterised by investment in tools, software platforms, and reporting formats which have produced visible improvements in operational outputs but has not generated the foundational institutional capacity required to translate those outputs into sustained system performance. The practical implication is that incremental investment in additional reporting tools, dashboards, or data platforms is unlikely to produce proportional gains in RHIS performance. The next generation of RHIS strengthening interventions in Yaoundé must shift decisively toward addressing the organisational determinants of system performance, in line with the theoretical framework articulated by the performance of the routine information system management model [9]. Without such structural reform, marginal investments in tools, training, or supervisions will continue to yield diminishing returns.

We equally noticed functionality variations across HDs, with the proportion of functional subdomains ranging from 20.0% to 100.0%, a five-fold disparity within a single urban health system. A clear east–west performance gradient emerged, with eastern districts (Nkolndongo, Efoulan, Biyem-Assi) consistently outperforming western and central districts (Cité Verte,

Djoungolo, Nkolbisson). The existence of substantial intra-urban variations in health system performance has been documented in several African settings [8, 34]. Conversely, Manzi et al. reported a relatively uniform RHIS performance across facilities participating in a coordinated district-level supervision intervention in rural Rwanda [35]. This suggests that variations in the operational intensity and consistency of district health management team functions constitute the principal drivers of the observed disparities, rather than HF-level factors. These variations are driven by supervision and capacity-building initiatives, combined with contextual differences in HF leadership and organisational culture. The pronounced east–west gradient cannot then be attributed to differences in formal RHIS architecture, since all districts operate under the same national framework. The fact that such substantial disparities exist within a single capital city where HFs are geographically proximate and nominally subjected to identical regulatory and supervisory structures raises important questions about the actual operational reach of district-level management functions. For the Cameroon Ministry of Public Health, the findings also raise specific governance questions about the current model of district health management team support functions, which may not be operating with uniform effectiveness.

The findings disaggregated by HF status, though based on small subsamples, are similarly suggestive. The descriptive pattern suggests that confessional and public HFs exhibit more structured RHIS practices than private non-confessional HFs. The relative strength of public HFs in operational domains, coupled with their weakness in governance, suggests that public HFs may be functioning as efficient data producers within a weak institutional governance frame; a configuration that if confirmed in larger studies, would have substantial implications for the design of RHIS strengthening interventions.

The functionality score for Data Analysis, Dissemination, and use Domain was 44%, a finding that is similar to that observed in Ethiopia where 45.8% of health workers had good RHIS

utilisation [29]. At the subdomain level, Data Demand and Use, was relatively higher (54%). However, item-level analysis exposed a critical weakness in the feedback loop between district health management teams and HFs, constituting a structural impediment to the consolidation of informed decision-making at the operational level. The relatively strong utilisation profile observed in Yaoundé contrasts with much of the prior SSA surveys as were evidenced by Nutley and Reynolds, [7], and Belay and Lippeveld [36]. The comparatively strong utilisation observed in Yaoundé may reflect urban-specific factors, including higher educational attainment among HFs staff, greater proximity to supervisory structures, and more concentrated exposure to data use training initiatives. District-to-HF feedback on submitted data was weak (only 27.1% of HFs received regular feedback from the district level) as was revealed by item-level analysis, a finding similar to that obtained in Mozambique [37]. The most plausible explanation for this pattern is that data utilisation in Yaoundé is currently sustained primarily by HF-internal initiative driven by motivated staff rather than by systemic institutional reinforcement. In the absence of regular district-level feedback, HF-level data use is unlikely to evolve from an individual practice into an institutionalised system function, and may not be sustainable over time as personnel rotate and managerial leadership changes. Thus, strengthening the feedback loop between district health management teams and HFs should be treated as a high-priority intervention. Establishing standardised, regular feedback mechanisms including district-level data review meetings, and structured feedback reports would create the institutional reinforcement necessary to strengthen and sustain utilisation patterns currently observed.

Strengths and limitations of the study

The principal strength of this study lies in its methodological rigour and the comprehensiveness of its scope. The use of the validated HFCIS assessment tool ensures methodological fidelity to internationally recognised standards and enables direct comparison

with assessments conducted in sub-Saharan Africa. The disaggregation of findings by HD and HF status provides analytical granularity, and allows for the identification of context-specific patterns that would otherwise remain hidden within aggregate scores.

Several limitations, however, must be acknowledged. Firstly, the cross-sectional design cannot illuminate the trajectory of system change or the temporal dynamics of functionality. Secondly, data were collected using a self-reported questionnaire, thereby introducing the possibility of social desirability bias, particularly in items that could be perceived as accountability-sensitive. Although triangulation with direct observation of registers and reporting tools mitigated this risk, it could not fully eliminate it. Thirdly, the sample is heavily weighted toward private non-confessional health HFs (n=75; 85.2%), which reflects the actual composition of the HF landscape in Yaoundé, but limits the precision of comparative inferences across HF status, particularly for the small subsamples of confessional (n=8; 9.1%) and public (n=5; 3.4%) health facilities. Fourthly, the study was conducted exclusively in an urban setting, restricting the generalisability of findings to the broader Cameroonian health system, where rural and semi-urban HFs operate under markedly different infrastructural, supervisory, and human resource conditions.

Conclusion

This study demonstrates that the overall functionality of the RHIS in Yaoundé is improving, as approximately two-thirds of health facilities scored above the set threshold. Taken together, our findings carry several layers of meaning for health information system policy and practice in Cameroon and comparable settings. At the most immediate level, we identified a clear and actionable hierarchy of priorities, with human resource capacity for health information management, governance and accountability structures at HF and HD levels, and

district-to-facility feedback mechanisms emerging as the three most critical leverage points for RHIS strengthening in Yaoundé. Targeted investment in these three areas would likely produce disproportionate gains in overall system performance, given their foundational role in sustaining the operational dimensions that currently appear to function reasonably well, and in supporting health planning, monitoring, accountability, and informed decision-making. Without such organisational reforms, continued investment in digital tools and reporting platforms is unlikely to translate into sustainable improvements in system performance. Marked inter-district disparities further indicate that RHIS performance is shaped not only by HF-level capacity but also by the consistency and intensity of district-level support interventions. Further surveys are needed to better understand the drivers of inter-district variations and to assess whether improvements in RHIS performance translate into measurable gains in service delivery and population health outcomes.

Declarations

List of abbreviations

DHIS2 **:** District Health Information Software version 2

HDs **:** Health Districts

HF **:** Health Facility

HFs : Health Facilities

HFCIS **:** Health Facility and Community Information System

HSS : Health Sector Strategy

ICT **:** Information and Communication Technology

LMICs **:** Low-and-Middle Income Countries

MoPH : Ministry of Public Health

RHIS **:** Routine Health Information System

PRISM : Performance of Routine Information System Management

SDGs **:** Sustainable Development Goals

SSA : Sub-Sarahan African

UHC : Universal Health Coverage

WHO : World Health Organization

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Ethics approval

The study was conducted in accordance with the Declaration of Helsinki and an ethical approval (001244/CRERSHC/2025) was obtained from the Regional Ethics Committee for Human Health Research for the Center Region. Authorisations were also obtained from the six health districts and health area heads. Prior to data collection, participants were thoroughly informed about the purpose, the procedure of the study, and the role they were expected to play. Assurance was equally provided concerning the anonymous nature and confidentiality of their responses. This was done using an information notice. Verbal or written consent was obtained before administering the questionnaires.

Availability of data and materials

The data generated from this study are available on reasonable request

Competing interest

The authors declare no conflict of interest in this study.

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Authors' contributions

LD, FFO, BBT, and MN designed the study, collected data, performed statistical analysis. FFO, BBT, LD, MNN and GNT drafted the manuscript. GNT, GK, MN, and MN scientifically supervised the study and provided critical oversight of the research design. All the authors reviewed and approved the final version of the manuscript.

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