Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Technological, Organisational, and Behavioural Determinants of Routine Health Information System Data Quality in Osun State, Nigeria: A Qualitative Study

Sunday Akingbola Omokanye

asomokanye@oauife.edu.ng

Obafemi Awolowo University

Daisy Ada Oguizu

Rivers State University

Clement Kevin Edet

Rivers State University

Ajibola Olayemi Omokanye

Obafemi Awolowo University Teaching Hospitals Complex

Research Article

Keywords: Routine Health Information System, information technology, organisational factors, health worker behaviour, qualitative research, key informant interviews, Nigeria

Posted Date: November 18th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11303521/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Quantitative studies consistently identify technological, organisational, and behavioural factors as determinants of Routine Health Information System (RHIS) data quality, but the specific mechanisms through which these factors operate, and the perspectives of the health workers and supervisors who experience them daily, are less well documented. This study explored these three determinant domains qualitatively in Osun State, Nigeria.

Methods

A qualitative descriptive design was used, comprising 35 key informant interviews: 22 with facility-level health workers and 13 with district-level monitoring and evaluation officers and supervisory staff. Interviews followed a semi-structured guide developed for this study and were analysed thematically within each determinant domain, with facility- and district-level accounts triangulated to assess convergence and divergence.

Results

Within information technology, facilities reported reliance on shared or LGA-based devices (16/22) and near-universal absence of formal DHIS2 training (17/22), while district offices reported comparatively stronger, though still imperfect, infrastructure and training access. Within organisational factors, supervisory visits (15/22) and leadership engagement (13/22) were commonly reported facility-level strengths, but formal training (17/22 reporting its absence) and documented standard operating procedures (8/22 reporting their absence or inconsistency) were comparatively weak. Within behavioural factors, staff commitment was strong among supervisory cadres, but the near-total absence of formal incentive or accountability structures was the single most consistently reported finding across both facility (18/22) and district (12/13) respondents, more consistent than any other subtheme identified in either domain.

Conclusions

Technological and organisational weaknesses in Osun State's RHIS are substantially matters of infrastructure and training access that differ between facility and district level. The absence of incentive and accountability structures for data quality performance, however, is a shared, system-wide gap affecting both levels equally, and is not compensated for by district-level supervision in the way that other facility-level weaknesses are. This distinguishes it as a distinct category of intervention priority, one requiring system-level policy action rather than facility-level correction.

Trial registration

Not applicable.

Background

Routine Health Information Systems (RHIS) are the main source of the data needed to plan, deliver, and monitor primary health care and progress towards universal health coverage [1]. The Performance of Routine Information System Management (PRISM) framework identifies technical, organisational, and behavioural determinants as jointly shaping RHIS performance, operating through their combined influence on the processes by which routine data are generated, verified, and used [2, 3]. Quantitative RHIS research has increasingly adopted this tripartite framework, testing the statistical association between each determinant category and data quality outcomes [4–6]. What this quantitative literature is less able to establish is the specific, situated mechanism through which each determinant category actually operates: the particular infrastructural gap, training deficit, supervisory practice, or motivational condition that a summary regression coefficient necessarily compresses into a single number.

Qualitative inquiry into RHIS determinants can address this gap directly, but published qualitative accounts of technological, organisational, and behavioural determinants that span both the facility level, where these factors are experienced, and the district level, where they are in part supervised and resourced, remain comparatively rare. This is a meaningful omission. Technological and organisational conditions at facility level are shaped substantially by decisions and resources originating at district or state level, and behavioural conditions among facility staff are shaped by the organisational and supervisory environment districts help create. A determinant-level account confined to facility respondents alone risks describing symptoms without their upstream sources; an account confined to district respondents alone risks describing intentions without their downstream reality.

This study addresses this gap by exploring, through key informant interviews with both facility-level health workers and district-level supervisory staff in Osun State, Nigeria, the technological, organisational, and behavioural factors participants identify as shaping RHIS data quality. It examines each determinant domain in turn and triangulates facility- and district-level accounts to identify where the two levels' experience of the same determinant converges and where it diverges.

Methods

Study design

A qualitative descriptive design was used, drawing on key informant interviews (KIIs) to explore participants' first-hand accounts of the technological, organisational, and behavioural conditions shaping their RHIS work. Reporting follows the Consolidated Criteria for Reporting Qualitative Research (COREQ) [7]; the completed COREQ checklist is provided as Additional file 2.

Setting and participants

The study was conducted in Osun State, south-western Nigeria, across primary, secondary, and tertiary healthcare facilities and their supervising Local Government Areas (LGAs), spanning urban, semi-urban, and rural contexts including Ife Central, Ife North, Ife East, Ife South, Ede North, Ede South, and Egbedore. A total of 35 key informants were purposively sampled: 22 facility-level health workers (officers-in-charge, health records officers, ART coordinators, and facility M&E officers) and 13 district-level respondents (LGA M&E officers, Disease Surveillance and Notification Officers, and RHIS focal persons). Years of experience ranged from 3 to over 20 years across both groups. Participants were approached face to face, and none declined to participate or withdrew from the study.

Research team and reflexivity

The interviews were conducted by the first author (SAO; male; PhD; research fellow and health information manager), assisted by five research assistants. The wider research team comprised DAO (female; professor and lecturer with a background in public health nutrition), CKE (male; PhD; lecturer in community medicine), and AOO (female; MSc; nurse). No relationship existed between the interviewers and participants before the study, and participants were informed of the purpose of the study during the consent process. The first author's professional background in health information management may have shaped the framing of probes; this was mitigated by the use of a common interview guide for all respondents and by inductive coding involving two members of the research team.

Data collection

The key informant interview guide was developed by the authors specifically for this study and has not been published elsewhere. Its content was informed by the technical, organisational, and behavioural determinant domains of the PRISM framework [2, 3]. Before use, the guide was pilot-tested with health information management staff of Obafemi Awolowo University Teaching Hospitals Complex. The guide covered three areas. The first was the availability and use of information technology tools and electronic systems, staff IT capacity and training, and technical challenges affecting data reporting. The second was the availability and use of standard operating procedures, data monitoring and supervision practices, staff training on data quality management, and leadership support. The third was staff commitment, attitudes, incentive and accountability systems, and understanding of data's importance.

The guide contained a common core of questions for all respondents, with probes adapted for facility-level and district-level respondents. Each participant was interviewed once, face to face in their own office, with no one else present. Interviews explored participants' direct experience of, and reasoning about, each domain, and each lasted approximately 15–20 minutes. All interviews were audio-recorded with the permission of each participant, and field notes were taken during the interviews. Recordings were transcribed verbatim for analysis; transcripts were not returned to participants for comment. Data

collection continued until no new subthemes emerged in successive interviews, indicating data saturation. An English-language version of the full interview guide is provided as Additional file 1.

Data analysis

Interview data were analysed thematically within each of the three determinant domains. Transcripts were managed in ATLAS.ti and coded inductively by two members of the research team to identify recurring subthemes, which were grouped into broader themes derived from the data rather than specified in advance. Subtheme frequencies (respondents whose account reflected a given subtheme, out of the total respondents at that level) were tabulated to indicate relative prevalence within this purposive sample. Facility-level (n = 22) and district-level (n = 13) accounts were analysed separately and then triangulated for each domain, comparing where the two respondent groups' accounts converged or diverged. Illustrative verbatim quotations are presented with de-identified facility codes (e.g., F02) to preserve anonymity.

Trustworthiness

Credibility was supported through triangulation of facility- and district-level accounts of the same underlying determinant domains. Confirmability was supported by grounding all themes in tabulated frequency counts and retained verbatim quotations. Transferability is supported by the detailed description of setting and participant characteristics provided above.

Ethical considerations

Ethical approval

for the study was obtained from the Research Ethics Committee of Rivers State University (approval number: RSU/FBMS/REC/26/497) and the Health Research Ethics Committee of the Osun State Ministry of Health (approval number: OSHREC/PRS/569T/899). Permission to conduct the study was also obtained from the management of each participating facility. Written informed consent, including permission for audio-recording, was obtained from all participants before interview. Participation was voluntary, and all interview data were de-identified and stored securely. The study was conducted in line with the principles of the Declaration of Helsinki and the National Code of Health Research Ethics [8, 9].

Results

Findings are organised into four sections: respondent characteristics, information technology factors, organisational factors, and behavioural factors. Within the latter three, facility-level and district-level findings are reported and then triangulated.

Respondent characteristics

Table 1 summarises the roles, geographic distribution, and experience profile of the 35 key informants. At the facility level, respondents included officers-in-charge of primary health centres, health records/information officers, ART coordinators, and facility M&E officers, drawn from primary, secondary, and tertiary facilities. At the district level, respondents comprised LGA monitoring and evaluation officers, Disease Surveillance and Notification Officers, and RHIS focal persons. Both groups spanned urban, semi-urban, and rural Local Government Areas, and years of service ranged from 3 to over 20 years at both levels.

Table 1
Characteristics of key informants (N = 35)

Characteristic	Facility-level (n = 22)	District-level (n = 13)
Roles represented	Officers-in-charge (PHCs), health records/information officers, ART coordinators, facility M&E officers	LGA M&E officers, Disease Surveillance and Notification Officers (DSNOs), RHIS focal persons
Facility/administrative levels	Primary, secondary, and tertiary healthcare facilities	Local Government Area (LGA) health offices
Local Government Areas represented	Ife Central, Ife North, Ife East, Ife South, Ede North	Ife Central, Ife North, Ife East, Ife South, Ede North, Ede South, Egbedore
Geographic context	Urban and semi-urban facilities	Urban, semi-urban, and rural LGAs
Years of experience	3 to over 20 years	2–3 years (newly posted) to over a decade of M&E/RHIS experience

Information technology factors

Four themes described the technological environment shaping RHIS data quality at the facility level: availability and use of IT infrastructure, use of electronic systems, staff IT capacity and training, and technical challenges. Figure 1 presents subtheme frequencies.

Theme 1: Availability and use of IT tools. Most respondents reported some access to computers or laptops used in RHIS management (16/22, 72.7%), but this access was frequently indirect, shared, or located only at the LGA level rather than owned by the facility itself. Reliance on personal devices or LGA-provided systems for DHIS2 data entry was described by 9 of 22 respondents (40.9%), while 8 of 22 (36.4%) reported limited or no facility-based access to digital devices at all.

“We don’t have a system in our facility; we send the summary to the LGA where they enter it on the computer.” (F02)

Theme 2: Use of electronic systems. The DHIS2 platform was near-universally recognised as the primary electronic reporting destination (20/22, 90.9%), but direct facility-level interaction with the

platform was less common than this figure might suggest. Fifteen of 22 respondents (68.2%) described compiling data manually and only later uploading it digitally, often through LGA intermediaries, while 13 of 22 (59.1%) cited the absence of local internet connectivity as the specific barrier preventing direct electronic entry.

“We know about DHIS2, but we don’t use it here. We compile and send it to them at the LGA office.” (F14)

Theme 3: Staff capacity and IT training. A pronounced capacity gap was evident: 17 of 22 respondents (77.3%) reported having received no formal training on electronic data systems, relying instead on informal, on-the-job learning or mentorship (10/22, 45.5%). This gap concentrated responsibility for digital data management in a small number of trained individuals, with 12 of 22 respondents (54.5%) describing direct dependence on M&E focal persons or LGA officers to complete or troubleshoot electronic reporting tasks.

“Most of us were not trained. It’s the M&E officer that helps us compile and enter on the system.” (F17)

Theme 4: Technical challenges affecting data quality. System failures and software access issues were reported by 12 of 22 respondents (54.5%), internet or hardware-related upload delays by 13 of 22 (59.1%), and power supply instability by 9 of 22 (40.9%). Facilities dependent on LGA-based systems were described as particularly exposed to these disruptions, since their reporting is contingent on the availability and function of shared, externally located resources.

“Sometimes the system is down or there’s no light. That’s why we don’t upload on time.” (F05)

District-level perspective on information technology. District offices reported comparatively stronger, though still imperfect, technological infrastructure. Functional computers and internet connectivity at the district office were confirmed by 12 of 13 respondents (92.3%), and all 13 district respondents actively used DHIS2 as their primary reporting platform, frequently supplemented by Microsoft Excel for pre-upload data cleaning and validation (8/13, 61.5%). Formal DHIS2 training had been received by 9 of 13 respondents (69.2%), a substantially higher proportion than at facility level, though gaps in data-analysis-specific skills, as distinct from basic data entry, were acknowledged by 7 of 13 (53.8%). Technical disruptions persisted even at this better-resourced level: internet downtime causing DHIS2 upload delays was reported by 10 of 13 respondents (76.9%), software freezing or slowness by 6 of 13 (46.2%), and risk of data loss from power interruption by 5 of 13 (38.5%), though districts more often mitigated this through local backups or postponed uploads. Table 2 summarises the triangulated pattern across the information technology domain.

Table 2
Triangulation of facility- and district-level findings: information technology factors

Dimension	Facility-level (n = 22)	District-level (n = 13)
Infrastructure access	Indirect/shared access common (16/22, 72.7%)	Functional office-based access (12/13, 92.3%)
Direct DHIS2 use	Limited; most compile offline first (15/22, 68.2%)	Universal, direct daily use (13/13, 100%)
Formal training	Rare (17/22, 77.3% report no training)	More common (9/13, 69.2% report training received)
Technical disruption	System failures, power instability (40.9%–59.1%)	Persist even with better infrastructure (38.5%–76.9%)

The two levels converge on the centrality of DHIS2 as the ultimate reporting destination and on the persistence of technical disruption regardless of resourcing level. They diverge sharply on direct infrastructure access and training: the district level functions as a better-equipped, better-trained technological hub that facility-level staff depend upon rather than operate independently, a dependency structure with direct implications for how quickly facility-level errors can be identified and corrected.

Organisational factors

Four themes described the organisational environment shaping RHIS data quality: availability and use of standard operating procedures, data monitoring and supervision, staff training on data quality management, and leadership and institutional support. Figure 2 presents subtheme frequencies.

Theme 1: Availability and use of SOPs and routine procedures. Fourteen of 22 respondents (63.6%) confirmed the existence of standard operating procedures or routine data management procedures at their facility. However, 8 of 22 (36.4%) described these as either undocumented or inconsistently applied, and 9 of 22 (40.9%) reported that guidance was instead passed on verbally or based on individual staff experience, a practice that reduces consistency particularly when new or untrained personnel are involved.

“We have a way we do it, but it’s mostly what we were taught. There’s no written SOP here.” (F03)

Theme 2: Data monitoring and supervision. Fifteen of 22 respondents (68.2%) described monthly or routine supervisory visits from LGA or state officers, and 11 of 22 (50.0%) reported internal review or peer verification of data before submission. Nonetheless, 7 of 22 respondents (31.8%), predominantly from remote or lower-resource locations, described monitoring as inconsistent or infrequent, reflecting geographic inequities in supervisory coverage.

“The M&E team comes at least once a month to check our records and correct any issues.” (F07)

Theme 3: Staff training on data quality management. The majority of respondents, 17 of 22 (77.3%), had not received formal or regular refresher training on RHIS data quality management, though 9 of 22

(40.9%) described occasional workshops organised by development partners or LGA health teams. Knowledge gaps linked to staff turnover or redeployment were reported by 10 of 22 (45.5%), since incoming staff frequently lack structured orientation on data management protocols.

“Only a few of us have been trained; when new people come, they just learn from others.” (F16)

Theme 4: Leadership and institutional support. Thirteen of 22 respondents (59.1%) described positive, engaged support from their Officer-in-Charge or senior officers, contributing to more consistent adherence to reporting standards and deadlines. Conversely, 7 of 22 (31.8%) described passive leadership, where data management was deprioritised relative to clinical service delivery. Involvement of the LGA health authority in actively promoting reporting compliance was noted by 12 of 22 respondents (54.5%).

“Our OIC always asks about the data before the 5th. He makes sure we don’t miss the deadline.” (F10)

District-level perspective on organisational factors. SOP use was more formally institutionalised at district level: 10 of 13 respondents (76.9%) reported access to national RHIS tools, indicator manuals, and data flow charts, though 6 of 13 (46.2%) acknowledged inconsistent application across LGAs, particularly among newly posted officers. Supervision was correspondingly more structured, with 11 of 13 respondents (84.6%) confirming routine supervisory visits to facilities, often combined with monthly LGA review meetings (9/13, 69.2%). Eight of 13 (61.5%) described systematic documentation and tracking of data quality issues for follow-up, a formalised practice with no clear facility-level counterpart. On training, 9 of 13 district respondents (69.2%) had received formal instruction, typically on DHIS2 usage and indicator definitions, though 7 of 13 (53.8%) noted that refresher training remained infrequent due to funding constraints, with peer mentoring (5/13, 38.5%) filling the gap. On leadership, 10 of 13 respondents (76.9%) described active involvement by LGA M&E focal persons and Directors of Health in RHIS oversight, though 4 of 13 (30.8%) reported less consistent leadership focus, echoing the facility-level pattern of variable institutional commitment. Table 3 summarises the triangulated pattern across the organisational domain.

Table 3
Triangulation of facility- and district-level findings: organisational factors

Dimension	Facility-level (n = 22)	District-level (n = 13)
SOP formality	Present but inconsistently documented (14/22, 63.6%)	More formally institutionalised (10/13, 76.9%), still uneven application
Supervision structure	Monthly visits common (15/22, 68.2%); gaps in remote areas	Structured, near-universal (11/13, 84.6%) with documented follow-up
Training access	Rare, informal (17/22, 77.3% report no formal training)	More common (9/13, 69.2%) but constrained by funding
Leadership engagement	Positive where present (13/22, 59.1%); passive elsewhere (7/22, 31.8%)	Active involvement common (10/13, 76.9%); some inconsistency (4/13, 30.8%)

Both levels converge on training as the weakest organisational subtheme, and on leadership commitment as an important but unevenly distributed driver of compliance. The clearest divergence is in supervisory formality: district-level supervision is documented and systematically followed up, while facility-level internal review remains comparatively informal and geographically uneven. This mirrors the prevention-versus-correction asymmetry identified for data quality practices in the companion analysis of this dataset.

Behavioural factors

Four themes described the behavioural environment shaping RHIS data quality: staff commitment to accurate data recording, staff attitude and perception toward data tasks, incentives and accountability mechanisms, and staff understanding of data's importance. Figure 3 presents subtheme frequencies.

Theme 1: Staff commitment to accurate data recording. Fourteen of 22 respondents (63.6%) described high commitment among Officers-in-Charge and designated M&E officers specifically, while 10 of 22 (45.5%) noted more variable commitment among lower-cadre or overworked staff. Nine of 22 respondents (40.9%) explicitly linked commitment levels to the presence or absence of supervision, suggesting commitment in this setting is substantially contingent on external accountability rather than uniformly intrinsic.

"The OIC is very committed, but the others may forget or rush the entries when it's busy." (F01)

Theme 2: Staff attitude and perception toward data tasks. Thirteen of 22 respondents (59.1%) described data documentation as perceived as secondary to clinical care, and 11 of 22 (50.0%) described data tasks specifically as burdensome and time-consuming. Where training or sensitisation had been provided, however, 9 of 22 respondents (40.9%) reported a correspondingly more positive perception, suggesting attitude is at least partly malleable through targeted intervention rather than a fixed individual trait.

"Some staff see it as extra work. They focus on the patients first and do the data later, if at all." (F04)

Theme 3: Incentives and performance systems. This theme produced the single most consistent finding across the entire study: 18 of 22 respondents (81.8%) confirmed the complete absence of any formal reward or recognition system tied to data quality performance, and 15 of 22 (68.2%) explicitly linked this absence to reduced motivation for accuracy and timely reporting. Where recognition occurred at all, it was informal and inconsistent, typically verbal praise from an Officer-in-Charge (6/22, 27.3%).

"We are not rewarded or punished based on the data we produce, so many people just do the minimum." (F13)

Theme 4: Staff understanding of the importance of data quality. Twelve of 22 respondents (54.5%) described moderate to good understanding of data's operational importance among senior or trained staff, while 10 of 22 (45.5%) described poor understanding among junior or untrained personnel, who

often did not appreciate data's implications for funding or commodity supply. Facilities that engaged staff in data review or supply-forecasting discussions were more likely to report stronger awareness (8/22, 36.4%).

"Some of us understand that if our data is wrong, we won't get enough drugs or support from the LGA." (F19)

District-level perspective on behavioural factors. District-level accounts closely mirrored facility-level patterns on commitment, with 10 of 13 respondents (76.9%) describing themselves and M&E colleagues as highly committed, while consistently observing that frontline facility staff deprioritise documentation under workload pressure (7/13, 53.8%). On incentives, the district-level finding was, if anything, starker than at facility level: 12 of 13 respondents (92.3%) confirmed that no official reward or accountability structure existed at their level either, with only occasional, non-incentivised commendation in meetings (4/13, 30.8%) and no performance-based monitoring system (9/13, 69.2%). On understanding, district officers demonstrated a stronger self-reported grasp of data's role in resource allocation and programme evaluation (11/13, 84.6%) while acknowledging variable facility-level awareness (8/13, 61.5%), and 6 of 13 (46.2%) described instances where demonstrating data-informed decisions to facility staff improved subsequent reporting compliance. Table 4 summarises the triangulated pattern across the behavioural domain, and Fig. 4 presents the convergence of facility- and district-level evidence across all three determinant domains.

Table 4
Triangulation of facility- and district-level findings: behavioural factors

Dimension	Facility-level (n = 22)	District-level (n = 13)
Commitment	Strong among OIC/M&E cadre (14/22, 63.6%); variable elsewhere	Strong among district M&E staff themselves (10/13, 76.9%)
Attitude toward data tasks	Often perceived as secondary/burdensome (13/22, 59.1%)	Frontline deprioritisation acknowledged (7/13, 53.8%)
Incentives/accountability	Almost entirely absent (18/22, 81.8%)	Almost entirely absent (12/13, 92.3%); the strongest convergence in the study
Understanding of importance	Uneven; stronger among senior/trained staff (12/22, 54.5%)	Strong at district level (11/13, 84.6%); facility variability acknowledged

Of the theme-level comparisons made across all three determinant domains in this study, the absence of incentive and accountability structures is the only one where facility-level (81.8%) and district-level (92.3%) respondents report almost identical prevalence on a directly comparable, same-polarity basis, and the only one where district-level resourcing or formality offers no apparent advantage over the facility level. Figure 4 presents this pattern across all comparable dimensions from Tables 2–4, expressed on a consistent basis (the percentage reporting the corresponding favourable or, where noted,

unfavourable condition) so that the size of the facility–district gap can be compared across dimensions. Two facility-level values in Fig. 4 (direct DHIS2 use and formal training) are derived as the arithmetic complement of the corresponding table figures, since those table rows report facility and district results on opposite polarities (for example, '% without training' versus '% with training received').

Every dimension in Fig. 4 except incentives/accountability shows the district level more formalised, better resourced, or otherwise structurally advantaged relative to facilities, several substantially so (direct DHIS2 use, Δ = 68.2 points; formal training, Δ = 46.5 points). The incentive/accountability gap (Δ = 10.5 points) is the smallest among dimensions measured on a directly comparable basis and, unlike every other dimension, reflects both levels converging on the absence of a favourable condition rather than the district level possessing more of one. This distinguishes incentive and accountability gaps as a system-wide, rather than facility-specific or resource-specific, weakness.

Discussion

This qualitative study explored the technological, organisational, and behavioural determinants of RHIS data quality in Osun State, Nigeria, from the perspective of both facility-level staff and district-level supervisors. Three findings merit particular discussion: the facility-district dependency structure evident in the technological domain; the training gap that recurs, in different forms, across all three determinant domains; and the singular, system-wide character of the incentive and accountability gap identified in the behavioural domain.

A dependency, not a deficit, structure in technological determinants

The technological findings are better characterised as a dependency structure than as a uniform facility-level deficit. Facilities are not simply under-resourced in isolation; they are structurally reliant on district-level infrastructure and personnel to complete the digital portion of their own reporting workflow. This has an important implication that a facility-only study would not surface: technological data quality risk in this system is concentrated wherever the facility-district handoff occurs, since this is the point at which locally compiled data becomes dependent on externally controlled infrastructure, connectivity, and trained personnel. This is consistent with evidence from Rwanda and Ghana showing that the effect of electronic health record functionality on data quality depends on integration and consistent access, not merely nominal availability [10, 11].

A recurring training gap across all three domains

Formal training was identified as the weakest, or among the weakest, facility-level subtheme in all three determinant domains examined. Of the facility respondents, 77.3% reported no formal IT/DHIS2 training and 77.3% reported no formal data quality management training, while poor understanding of data's importance was concentrated among untrained junior staff in the behavioural domain. This recurrence across three conceptually distinct domains suggests that training deficits are not domain-specific gaps

requiring three separate interventions. They appear instead to be a single, cross-cutting capacity constraint whose consequences are expressed differently depending on the domain examined: technical competence in the technological domain, procedural consistency in the organisational domain, and awareness of data's stakes in the behavioural domain. Nigerian health workers have similarly attributed improvements in routine data completeness to training and retraining, and declines to its withdrawal [12]. A single, well-designed onboarding and refresher training programme addressing all three domains together may therefore be a more efficient intervention than three domain-specific training initiatives.

The incentive and accountability gap as a distinct, system-wide priority

Unlike every other subtheme examined in this study, where the district level showed some structural advantage over the facility level, the absence of formal incentive and accountability mechanisms was reported at near-identical, very high prevalence at both levels (81.8% facility; 92.3% district). This is a materially different finding from the other gaps identified. It cannot be addressed by facility-level capacity building or by strengthening district-level supervision, because district-level respondents report experiencing the identical absence of formal recognition or accountability for their own work. The finding points toward a system-wide policy gap, most plausibly located at state or national level, where performance-based recognition frameworks for RHIS personnel have not been developed or implemented at any tier of the system examined.

This interpretation is consistent with earlier Nigerian evidence, in which health workers in Anambra State identified the lack of health worker incentives as a barrier to complete routine data and staff motivation as an enabler of data management [12]. Evidence from elsewhere in the region, however, cautions that incentive design matters. In Sierra Leone, a performance-based financing scheme that included data quality targets improved the timeliness and completeness of HMIS reporting but was associated with reduced reporting accuracy [13]. Any incentive framework developed for RHIS personnel in Osun State should therefore reward verified accuracy, not reporting volume or timeliness alone, and should be paired with routine data verification.

Comparison with the wider literature

These qualitative findings are consistent with, and mechanistically extend, the companion quantitative analysis of this dataset. That analysis found technological and behavioural factors to be significant direct predictors of RHIS data quality, while organisational factors showed a significant effect only when tested as an indirect pathway operating through behaviour and technology use. The present qualitative findings offer a plausible explanation for this pattern. Organisational factors such as supervision and leadership were found to shape the technological and behavioural conditions facility staff operate within (for example, leadership engagement driving deadline adherence, and supervision driving commitment), rather than being reported by participants as acting on data quality through any separate, independent channel. This account of organisational factors working through, rather than alongside, technological and behavioural conditions corresponds closely to the mediation pathway identified in the quantitative

strand of this research programme, and to the PRISM framework's proposition that organisational determinants influence RHIS performance partly through behavioural determinants [2].

Methodological reflections on cross-domain analysis

Examining three determinant domains within a single qualitative analysis, rather than as three separate studies, is what allowed the recurring training gap and the singular convergence on incentive and accountability absence to be identified. Had information technology, organisational, and behavioural factors each been studied in isolation, each study would most plausibly have reported its own training deficit as a domain-specific finding, without the cross-domain comparison needed to recognise these as expressions of a single, shared capacity constraint. Similarly, the system-wide character of the incentive and accountability gap was only visible by comparing its facility-district convergence pattern (Fig. 4) against the divergence pattern observed for every other subtheme. A single-domain study of behavioural factors could have reported the incentive gap but would not have been positioned to establish that it differed in kind from the technological and organisational gaps identified elsewhere. Qualitative RHIS determinant research designed around PRISM's tripartite structure therefore benefits from analysing all three domains together within a single study, even at the cost of greater analytic complexity, since cross-domain patterns of this kind are, by construction, invisible to single-domain designs.

Strengths and limitations

This study's principal strength is its paired facility- and district-level design, analysed across all three PRISM determinant domains within a single study, which allowed cross-domain and cross-level patterns to be identified that single-domain or single-level designs would not reveal. Several limitations should be noted. Subtheme frequencies describe prevalence within a purposive sample of 35 key informants (22 facility-level and 13 district-level) and should not be interpreted as population-representative estimates. Interviews were relatively brief (approximately 15–20 minutes), which may have limited the depth of exploration on some topics, although the common guide and probes ensured consistent coverage of all three domains. Transcripts and findings were not returned to participants for comment, so member checking did not contribute to credibility. The interviews capture participants' accounts at a single point in time, and participants' accounts of their own commitment and verification practices may be subject to social desirability bias, a risk partially mitigated by triangulating facility-level self-report against independent district-level accounts of the same domains. Finally, this study examined three determinant domains in parallel but did not, within its qualitative design, formally test the mediated relationship between them identified quantitatively elsewhere in this research programme. The account offered here of organisational factors operating through technological and behavioural conditions is consistent with, but does not independently establish, that pathway.

Conclusions

This qualitative study found that technological and organisational determinants of RHIS data quality in Osun State are structured substantially around a facility-district dependency. Facility-level infrastructure,

training, and internal verification are consistently less formalised than their district-level counterparts, and district-level supervision performs a compensatory, though imperfect, corrective function in both domains. A training gap recurs across all three determinant domains, suggesting a shared underlying capacity constraint rather than three unrelated deficits. Most distinctively, the near-total absence of formal incentive and accountability mechanisms was reported at almost identical, very high prevalence by both facility- and district-level respondents, the only finding in this study where district-level resourcing offered no apparent advantage. This identifies incentive and accountability structures as a system-wide gap requiring policy intervention at a level above both facility and district, rather than a facility-level weakness that stronger district supervision can be expected to resolve.

Recommendations

Based on the findings, five recommendations are proposed, each specifying the responsible party and the action required.

1. The Osun State Ministry of Health and State Health Service Commission should design and implement a formal, performance-based recognition or incentive framework for RHIS personnel at both facility and district level, rewarding verified data accuracy as well as timeliness and completeness. The absence of any such structure was the most consistently reported gap in this study (81.8% facility; 92.3% district) and cannot be resolved through facility-level or district-level action alone.

2. The ICT and Planning departments of the Osun State Ministry of Health should extend facility-level access to functional, dedicated IT infrastructure and reliable internet connectivity, prioritising facilities currently dependent on LGA-based or personal devices for DHIS2 entry (40.9% of facility respondents), since this dependency was identified as a specific point of vulnerability in the data quality chain.

3. Health Information Management training institutions, in partnership with the Osun State Ministry of Health, should design a single, integrated onboarding and refresher curriculum addressing IT/DHIS2 competence, data quality management procedures, and the operational rationale for accurate reporting together, given that training deficits recurred as the weakest facility-level subtheme across all three determinant domains.

4. LGA Health Departments should formalise and document currently informal facility-level SOPs and internal review practices, particularly in remote or lower-resourced facilities where supervisory coverage was reported as inconsistent (31.8% of facility respondents), extending the documentation and follow-up already present in district-level practice to the facility level.

5. District M&E teams and RHIS focal persons should include explicit, concrete demonstrations of how facility-level data are used in resource allocation and programme decisions during supervisory visits. Facilities exposed to such engagement reported stronger staff understanding of data's importance (36.4%), making this a low-cost intervention within the existing supervisory relationship.

Implications of the study

The findings carry implications for RHIS workforce policy, training design, and supervisory practice. For policy, identifying the incentive and accountability gap as a system-wide weakness implies that its resolution requires state- or national-level policy action, a distinct category of intervention from the facility-level and district-level recommendations otherwise emerging from this study. For training design, the recurrence of training deficits across all three determinant domains implies that integrated, cross-domain training curricula are likely to be more resource-efficient than domain-siloed programmes. For supervisory practice, the facility-district dependency identified in the technological domain implies that technological data quality risk should be monitored specifically at the facility-district data handoff point, rather than assumed to reside uniformly within facilities.

Contributions to knowledge

This study contributes to the RHIS literature in three ways. First, it provides a paired facility- and district-level qualitative account of technological, organisational, and behavioural RHIS determinants within a single analysis, revealing a facility-district dependency structure in the technological domain that facility-only research would not surface. Second, it identifies training as a cross-cutting capacity constraint recurring across three conceptually distinct determinant domains, reframing what is often treated as three separate training needs as a single, shared capacity gap. Third, and most significantly, it identifies the absence of incentive and accountability mechanisms as a qualitatively distinct finding: the only determinant examined where facility- and district-level experience converged almost completely. This provides empirical qualitative grounding for treating incentives and accountability as a system-wide policy priority, and offers a mechanistic explanation consistent with the mediated organisational-factors pathway identified in this research programme's companion quantitative analysis.

Abbreviations

ART
Antiretroviral therapy
COREQ
Consolidated Criteria for Reporting Qualitative Research
DHIS2
District Health Information Software, version 2
DSNO
Disease Surveillance and Notification Officer
KII
Key informant interview
LGA
Local Government Area
M&E
Monitoring and evaluation
OIC

Officer-in-Charge
PHC
Primary health centre
PRISM
Performance of Routine Information System Management
RHIS
Routine Health Information System
SOP
Standard operating procedure.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was obtained from the Research Ethics Committee of Rivers State University (approval number: RSU/FBMS/REC/26/497) and the Health Research Ethics Committee of the Osun State Ministry of Health (approval number: OSHREC/PRS/569T/899). Permission to conduct the study was also obtained from the management of each participating facility. Written informed consent, including permission for audio-recording, was obtained from all participants before interview. The study was conducted in line with the principles of the Declaration of Helsinki and the National Code of Health Research Ethics [8, 9].

Consent for publication

Not applicable. This manuscript reports de-identified, aggregated qualitative findings and does not contain any individually identifying participant information, images, or videos.

Competing interests

The authors declare that they have no competing interests.

Funding

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

Author Contribution

SAO: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing – original draft, Writing – review and editing, Visualization, Project administration. DAO: Supervision, Methodology,

Writing – review and editing. CKE: Supervision, Validation, Writing – review and editing. AOO: Writing – review and editing. All authors read and approved the final manuscript.

Acknowledgement

The authors thank the 35 key informants, facility-level health workers and district-level supervisory staff across Osun State, who generously shared their time and experience for this study, and the Osun State Ministry of Health for facilitating access to participants.

Data Availability

Given the sensitive and potentially identifying nature of qualitative interview transcripts, the full dataset is not publicly available. De-identified excerpts supporting the themes reported in this manuscript are available from the corresponding author on reasonable request, subject to participant consent restrictions. The interview guide used for data collection is provided as Additional file 1.

References

1. World Health Organization. Strategy for optimizing national routine health information systems: strengthening routine health information systems to deliver primary health care and universal health coverage. Geneva: World Health Organization; 2024.
2. Aqil A, Lippeveld T, Hozumi D. PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. Health Policy Plan. 2009;24(3):217–28. https://doi.org/10.1093/heapol/czp010.
3. Hotchkiss DR, Aqil A, Lippeveld T, Mukooyo E. Evaluation of the Performance of Routine Information System Management (PRISM) framework: evidence from Uganda. BMC Health Serv Res. 2010;10:188. https://doi.org/10.1186/1472-6963-10-188.
4. Chekol A, Ketemaw A, Endale A, Aschale A, Endalew B, Asemahagn MA. Data quality and associated factors of routine health information system among health centers of West Gojjam Zone, northwest Ethiopia, 2021. Front Health Serv. 2023;3:1059611. https://doi.org/10.3389/frhs.2023.1059611.
5. Getachew N, Erkalo B, Garedew MG. Data quality and associated factors in the health management information system at health centers in Shashogo district, Southern Ethiopia. BMC Med Inf Decis Mak. 2022;22(1):154.
6. Oladoyin V, Adedini S, Ijadunola K, Ogunwemimo H, Folorunso O, Chukwu E, et al. The assessment of routine health information system performance towards improvement of quality of reproductive, maternal, newborn, child and adolescent health services in Ondo and Ekiti States, Nigeria. PLoS ONE. 2025;20(1):e0318010. https://doi.org/10.1371/journal.pone.0318010.
7. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–57.

https://doi.org/10.1093/intqhc/mzm042.
8. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191–4. https://doi.org/10.1001/jama.2013.281053.
9. National Health Research Ethics Committee of Nigeria. National code of health research ethics. Abuja: Federal Ministry of Health; 2007.
10. Fraser HSF, Mugisha M, Bacher I, Ngenzi JL, Seebregts C, Umubyeyi A, et al. Factors influencing data quality in electronic health record systems in 50 health facilities in Rwanda and the role of clinical alerts: cross-sectional observational study. JMIR Public Health Surveill. 2024;10:e49127.
11. Mensah NK, Adzakpah G, Kissi J, Abdulai K, Taylor-Abdulai H, Johnson SB, et al. Health professionals' perceptions of electronic health records system: a mixed method study in Ghana. BMC Med Inf Decis Mak. 2024;24:254.
12. Uzochukwu B, Mirzoev T, Okeke C, Hicks J, Etiaba E, Obi U, et al. Did an intervention programme aimed at strengthening the maternal and child health services in Nigeria improve the completeness of routine health data within the health management information system? Int J Health Policy Manag. 2022;11(7):937–46. https://doi.org/10.34172/ijhpm.2020.226.
13. Moseray HS, Justo GN. Impact of performance-based financing implementation on healthcare data quality of health management information system in Sierra Leone. J ICT Syst. 2023;1(2). https://doi.org/10.56279/jicts.v1i2.9010.

Figures

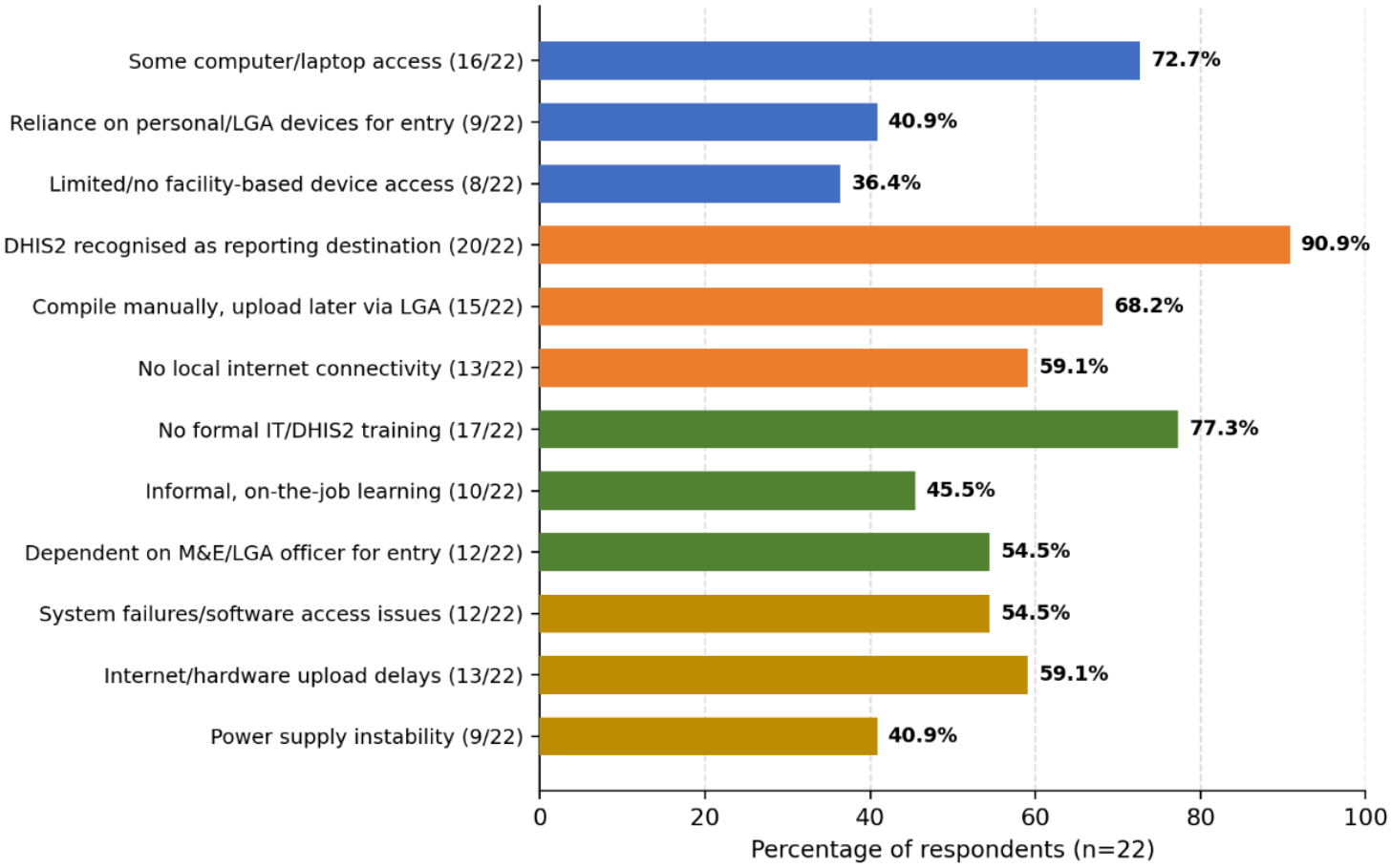


Figure 1

Frequency of information technology subthemes, facility-level KIIs (n = 22)

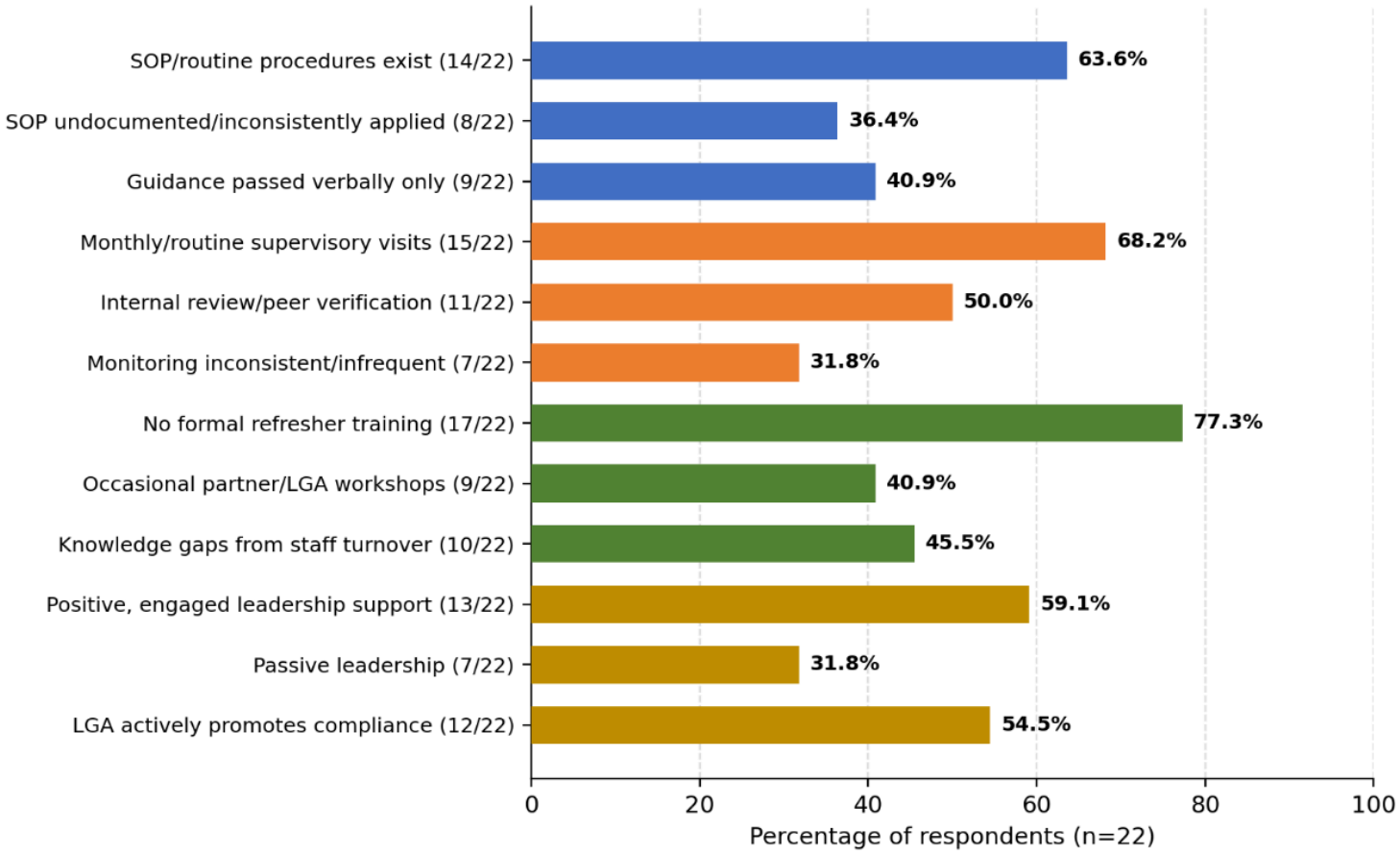


Figure 2

Frequency of organisational factor subthemes, facility-level KIIs (n = 22)

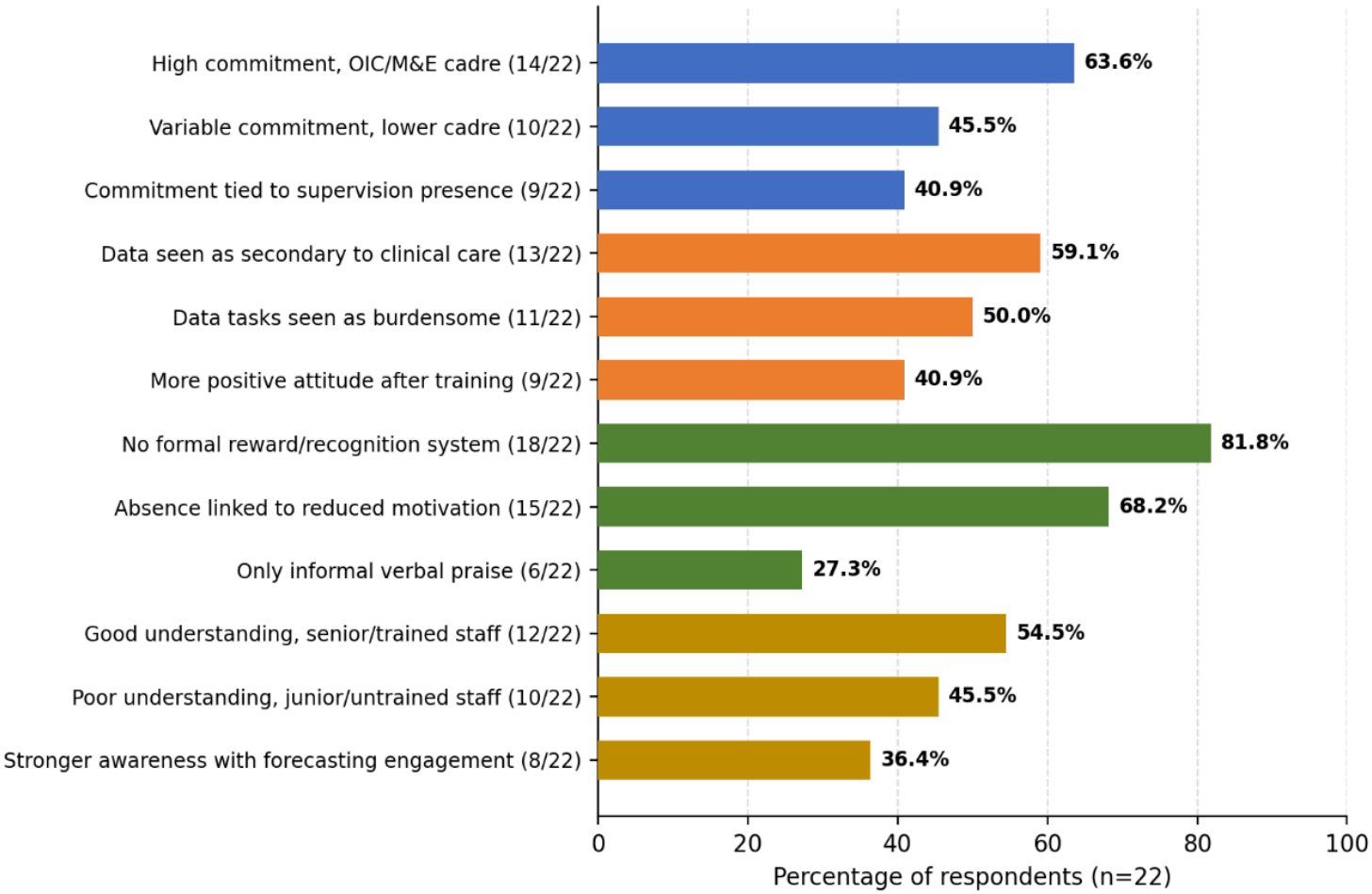


Figure 3

Frequency of behavioural factor subthemes, facility-level KIIs (n = 22)

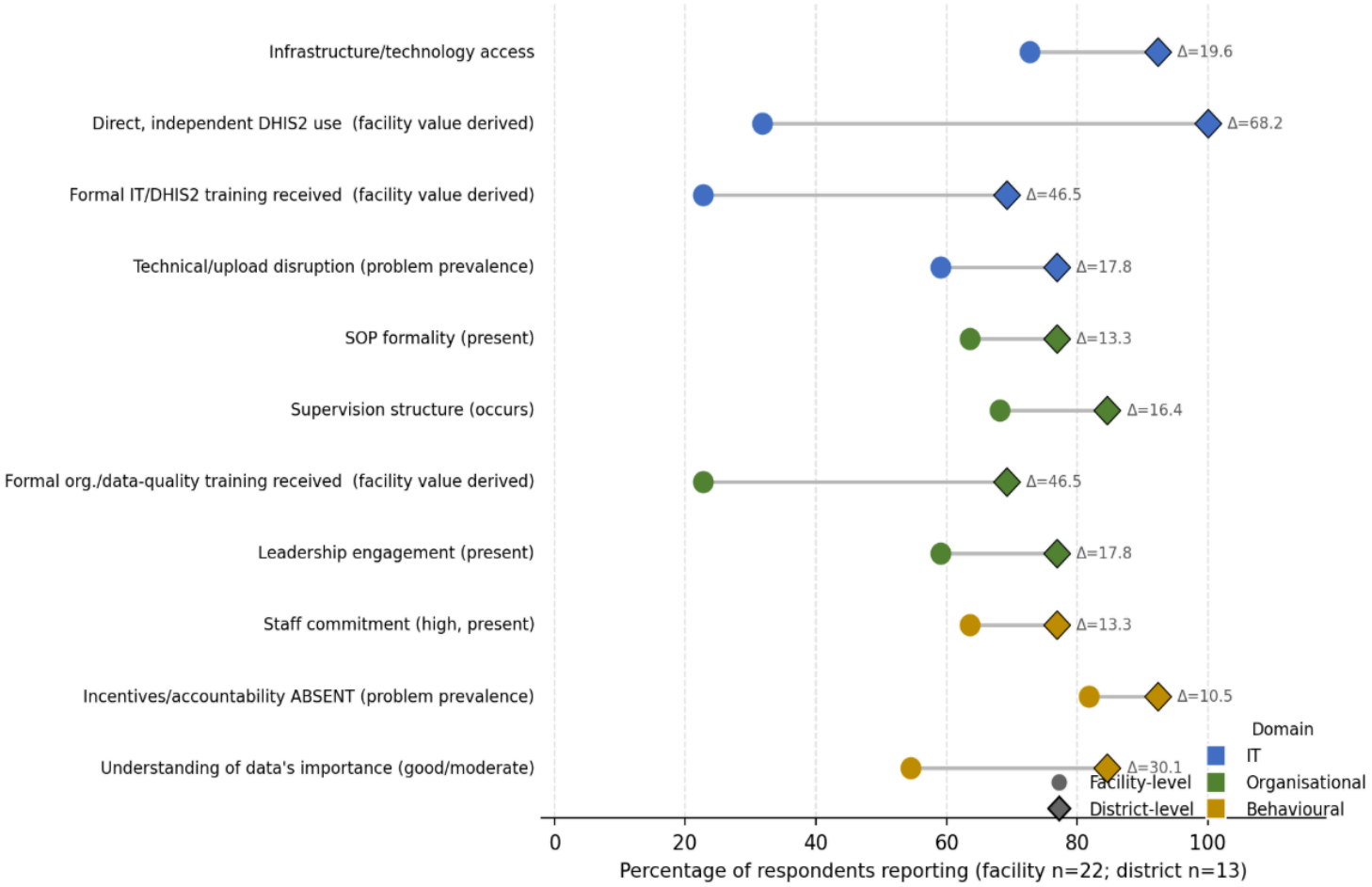


Figure 4

Convergence of facility- and district-level evidence across information technology, organisational, and behavioural domains, expressed on a consistent basis (Δ = absolute percentage-point gap)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1InterviewGuide.docx
- Additionalfile2COREQChecklist.docx