

Contextual Factors Undermining Community Health Worker Data Systems During Health Emergencies in Zimbabwe: A Cross-Cadre Survey Analysis

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Abstract Community health workers (CHWs) are central to community surveillance and primary health care in Zimbabwe, yet the data systems supporting their work are especially vulnerable during epidemics, cyclones and other health emergencies. This study examined the contextual factors undermining the collection, transmission, verification and use of CHW data during health emergencies in Zimbabwe between 2018 and 2025 and identified priorities for strengthening system resilience. A cross-sectional, multi-cadre structured survey was administered through Kobo Toolbox to 142 respondents across eleven cadres spanning the community, facility, district and provincial levels of the health system. Respondents reported near-universal involvement in emergency-related data work (95.0%) and described data roles as clearly defined (89.3%), but only 67.1% could still transmit data when electricity or internet connectivity failed. Data collection was the most disrupted stage of the CHW data pathway (30.7%), and tools and devices (67.6%) together with power and connectivity (58.5%) were the factors most often blamed for undermining continuity. Only 33.6% rated emergency-specific training as adequate, and overall data timeliness and quality was rated good or very good by 48.6% of respondents, falling to 40% among community-level respondents. Respondents' priorities for the Ministry of Health and Child Care centred on infrastructure investment (32.9%) and workforce training (30.0%). The findings indicate that Zimbabwe's community health information system is broadly functional at its technical core but remains constrained at the point of community-level data capture, pointing to sequenced, practical investment priorities for strengthening emergency-responsive CHW data systems.

Keywords Community Health Workers, Data Systems, Health Emergencies, Health Information systems, Health System Resilience, Zimbabwe.

Introduction

Community Health Workers occupy a distinctive position at the interface between the formal health system and the community, and it is this position that makes their data uniquely valuable, especially during health emergencies [1]. In Zimbabwe, the Community Health Worker programme, which traces its lineage to the Village Health Worker programme of the 1980s, has been consolidated under a "one health worker" model within the 2026–2030 National Health Strategy, and CHWs remain a central pillar of the country's primary health care system [2, 3]. During disease outbreaks and disasters, CHWs are frequently the first to detect, record and report unusual events at household and village level, making their data systems an early-warning and situational-awareness resource of national importance [4].

However, the same emergencies that elevate the importance of CHW data also place unusual strain on the systems used to collect, transmit, verify and act on that data. Zimbabwe's experience with the 2018 and 2023 cholera outbreaks, Cyclone Idai in 2019 and the COVID-19 pandemic illustrates a recurring pattern in which community-level reporting becomes fragmented, delayed or incomplete precisely when demand for real-time information is highest [5, 6]. During the COVID-19 response, the Ministry of Health and Child Care, working with the World Health Organization and partners, sought to strengthen a weekly routine monitoring system linked to the District Health Information System in order to maintain data-driven decision-making, an initiative that itself signalled the pre-existing gaps in emergency-responsive community data flows [7].

Globally and across sub-Saharan Africa, evidence indicates that community-based health information systems are disproportionately vulnerable during crises. A four-country interrupted time series analysis found that continuity of community-based care during COVID-19 depended heavily on how

well CHWs were remunerated, supplied and supervised prior to the shock [8]. Similarly, comparative work across the Democratic Republic of Congo, Nigeria, Senegal and Uganda documented that CHWs were central to COVID-19 surveillance and response, but that their data and reporting roles were constrained by weak connectivity, inadequate protective and reporting supplies, and limited integration with national systems [9]. These findings resonate with Zimbabwe's own digital health trajectory, where investment in platforms such as Impilo has expanded electronic health record functionality, but persistent barriers to electricity, internet connectivity, and human resource capacity continue to constrain reliable data generation, particularly in rural and emergency-affected districts [10, 11].

This paper reports a mixed-methods doctoral study, combining a cross-cadre quantitative survey with a parallel qualitative strand, that examined the contextual factors, infrastructural, institutional, technological and sociocultural, that undermine the functioning of CHW data systems specifically during health emergencies in Zimbabwe. The analysis presented here draws on the quantitative survey strand, administered to 142 health workers and system managers with direct experience of CHW data work during recent emergencies. In doing so, it moves beyond the routine, non-crisis framing that dominates much of the existing monitoring and evaluation literature on CHW programmes and generates context-specific evidence to inform the design of data systems that remain functional under conditions of acute stress.

Background and Zimbabwean Context

The Community Health Worker cadre in Zimbabwe was established to extend primary health care to underserved rural and peri-urban populations and has since been mobilised repeatedly during public health emergencies, including cholera outbreaks, floods and cyclones, and the COVID-19 pandemic [3]. Historically, community-level reporting relied

on paper-based registers and monthly aggregate returns submitted through district health offices into the national health information system. While Zimbabwe has progressively introduced digital tools, including mobile data collection and the Impilo electronic health record platform, the transition remains incomplete and uneven across the country's ten provinces [10, 11].

Zimbabwe faces a recurrent and diverse hazard profile, including epidemics such as cholera and typhoid, extreme weather events, and disease pandemics, a profile that has driven the recent establishment of Public Health Emergency Operations Centres to coordinate multisectoral response [3]. Each of these emergencies has generated evidence of strain on community-level data systems. The 2023 cholera outbreak, which began in Chegutu and spread to seventeen hotspot districts across all ten provinces, required rapid case-based surveillance and community-level case detection, yet response reviews point to continuing challenges of standardisation, timeliness and resource availability in outbreak data management [12, 13]. Descriptive epidemiological analysis of the earlier 2018-2019 cholera outbreak similarly emphasised that effective epidemic control depended on a functioning multisectoral surveillance architecture, reinforcing that community reporting gaps have long been a recognised vulnerability rather than a new phenomenon [5].

During the COVID-19 pandemic, essential health services, including those delivered and reported on by CHWs, were disrupted across Zimbabwe and the wider sub-Saharan African region, with the World Health Organization estimating that the majority of countries experienced disruption in at least one essential health service [9]. In Zimbabwe specifically, the Ministry of Health and Child Care worked with WHO and partners to reinforce weekly routine monitoring tied to the District Health Information System precisely because

pre-existing community reporting mechanisms had proved insufficiently resilient to sustain service continuity monitoring under pandemic conditions [7].

Evidence from Zimbabwe and comparable settings converges on several recurring categories of contextual barriers. Infrastructural constraints, including unreliable electricity and limited internet and mobile network coverage, restrict the reach of digital and cloud-based reporting tools, with power shortages alone estimated to cost the Zimbabwean economy the equivalent of 6.1 percent of gross domestic product annually and directly affecting facility and community data connectivity [11]. Interoperability challenges, arising from parallel, poorly linked information systems, compound these infrastructural gaps; a scoping review of digital health interventions across Ethiopia, Ghana and Zimbabwe found that fragmented systems and limited technical integration reduce the extent to which community-generated data can be aggregated and used for decision-making at higher levels [10].

Workforce-related barriers are equally prominent. Evidence from Ethiopia's electronic community health information system found that health worker digital literacy, resistance to new tools, inadequate training, and limited trust among stakeholders operating parallel systems each independently constrained routine data quality, patterns that are plausible analogues for Zimbabwe's CHW cadre operating under the added pressure of emergency conditions [1, 4]. Institutional and governance-related barriers, including weak feedback loops between community and higher-level data users, insufficient supervision, and unclear coordination mechanisms during multisectoral emergency response, further limit the extent to which community data translate into timely action [4]. Finally, sociocultural and contextual factors, including community trust, language diversity, and the seasonal and geographic accessibility of remote study and reporting

sites, shape both the willingness of communities to engage with CHWs during crises and the practical feasibility of consistent reporting [3].

Problem Statement

Despite the centrality of Community Health Workers to Zimbabwe's emergency response architecture, and despite ongoing national investment in digitising health information systems, there has been limited systematic, context-specific evidence on the factors that undermine the functioning of CHW data systems specifically during health emergencies, as opposed to during routine, non-crisis programme implementation. Existing assessments have tended to focus either on general monitoring and evaluation weaknesses in the CHW programme, or on outbreak-specific epidemiological review, without an integrated examination of the infrastructural, institutional, technological and sociocultural contextual factors that interact to weaken community-level data systems precisely when their reliability is most critical. This gap constrains the ability of the Ministry of Health and Child Care and its partners to design CHW data systems that remain functional and trustworthy under conditions of acute stress, and it is this gap that the present study addresses.

Study Objective and Research Questions

The study aimed to examine the contextual factors that undermine the functioning of community health worker data systems during health emergencies in Zimbabwe and to inform the design of more resilient, emergency-responsive community health information systems. It was guided by five questions: how community health worker data systems operate and adapt during declared emergencies; which infrastructural and technological barriers constrain data collection, transmission and use; how institutional and governance arrangements shape system performance; which sociocultural

and community factors influence data completeness and reliability; and which strategies could strengthen resilience before, during and after future emergencies. The cross-cadre survey reported in this article speaks most directly to the second, third and fourth of these questions, providing structured, quantifiable evidence on infrastructural, institutional and sociocultural barriers across the data pathway; the first and fifth questions, concerning adaptive practice and forward-looking strategy, are being addressed jointly with the parallel qualitative interview and focus-group strand of the wider study.

Policy Relevance, Scope and Novelty

The study is directly relevant to Zimbabwe's 2026-2030 National Health Strategy and to the World Health Organization's Health Emergency Prevention, Preparedness, Response and Resilience (HEPR) framework, launched at the Seventy-sixth World Health Assembly in 2023, both of which emphasise strengthening national and community-level information systems as a pillar of emergency preparedness [6]. Findings provide evidence to inform the operationalisation of Zimbabwe's Public Health Emergency Operations Centres, which depend on timely, quality community-level data to function as effective coordination hubs [3].

Although the global literature on CHW programmes and on digital community health information systems has expanded considerably in recent years [1, 4], comparatively little of this evidence is specific to the emergency context, and even less is grounded in Zimbabwe's own experience across cholera outbreaks, cyclones and the COVID-19 pandemic. This study addresses that gap by generating context-specific, emergency-focused evidence rather than extrapolating from routine-period studies.

Recurrent cholera outbreaks, including the 2023 outbreak that resulted in nearly 5,000 confirmed and suspected cases and

approximately 100 deaths in Chegutu district alone, illustrate the direct public health cost of delayed or incomplete community-level surveillance data [12]. By identifying the contextual factors that undermine CHW data systems during such emergencies, the study is expected to generate practical, implementable recommendations capable of reducing detection and response delays in future outbreaks and disasters, thereby contributing to the protection of lives and the more efficient allocation of emergency health resources.

The study is confined to Zimbabwe's Community Health Worker programme and focuses specifically on the health-emergency context, drawing on the experience of stakeholders involved in the response to recent cholera outbreaks, Cyclone Idai and the COVID-19 pandemic. As a purposive, non-probability survey nested within a broader case-study design, the findings provide descriptive, context-specific evidence rather than nationally representative statistical estimates; transferability beyond the surveyed provinces and cadres will depend on the similarity of health-system architecture and emergency profile. Recall bias associated with retrospective accounts of past emergencies is a further limitation, which the study sought to mitigate through the breadth of cadres and emergency types sampled and, in the parallel qualitative strand, through triangulation with programme documents and situation reports. Access to some rural and emergency-affected sites was constrained by seasonal conditions; data collection was therefore scheduled to avoid the peak rainy season, and remote data-collection options were offered where physical access remained restricted.

The novelty of the study lies in analysing community health worker data systems as emergency-response infrastructure rather than only as routine monitoring mechanisms, and in doing so through a structured, multi-cadre survey that spans the full data pathway, from community-level collection through facility,

district and provincial use. By integrating health-system resilience and implementation-science perspectives, the study examines how technical, organisational, workforce and community conditions interact under acute stress.

Theoretical and Conceptual Framework

The study is anchored in the World Health Organization's health systems resilience framework, which conceptualises resilience as the capacity of a health system to absorb, adapt to and transform in response to shocks while maintaining core functions, including the generation and use of health information [14]. Applied to CHW data systems, this framework directs attention to the extent to which community-level data infrastructure, workforce and governance arrangements are able to withstand and adapt to the surges in demand and disruption in supply that accompany health emergencies, rather than assuming that systems designed for routine conditions will automatically perform under crisis conditions.

Building on the conceptualisation by Kok et al. [15] of CHW performance as embedded within a layered health system comprising "hardware" (infrastructure, supplies, technology and formal governance structures) and "software" (relationships, trust, values and informal norms), this study conceptualises CHW data system performance during emergencies as shaped by the dynamic interaction of four contextual domains: infrastructural and technological factors, institutional and governance factors, workforce-related factors, and sociocultural and community factors. Each domain is understood to interact with the others, and their combined configuration under emergency conditions is expected to determine whether CHW data systems remain functional, degrade, or fail during a given crisis. These four domains directly informed the design of the cross-cadre survey instrument, structuring both the common questions asked of every respondent

and the cadre-specific items described below.

Table 1 summarises the contextual domains that guided data collection and analysis.

Table 1. Contextual Domains Guiding Data Collection and Analysis

Contextual Domain	Illustrative Factors	Relevance to Emergency Data Systems
Infrastructure and technology	Electricity, connectivity, devices and interoperability	Determines whether reporting tools function under surge conditions
Institutions and governance	Supervision, feedback, coordination and emergency-operations linkages	Shapes whether data are verified, aggregated and acted upon
Workforce	Training, digital literacy, workload, motivation and safety	Affects data accuracy, completeness and timeliness at source
Sociocultural and community	Trust, language, stigma and geographical accessibility	Influences reporting, participation and household reach

Materials and Methods

Study Design and Setting

The study adopted a mixed-methods design nested within a broader doctoral research programme investigating the contextual factors that undermine CHW data systems during health emergencies in Zimbabwe. This article reports the quantitative strand: a cross-sectional, multi-cadre structured survey administered to health workers and system managers who had direct experience of collecting, managing, supervising or using CHW data during major health emergencies in Zimbabwe between 2018 and 2025, including the 2018-2019 and 2023 cholera outbreaks, Cyclone Idai and the COVID-19 pandemic [5, 8, 9, 12, 13]. A parallel qualitative strand, comprising semi-structured interviews and focus group discussions with a purposively selected subset of informants and analysed using reflexive thematic analysis [16] against established qualitative trustworthiness criteria [17], is being conducted to provide rich, context-embedded description of how and why

contextual factors undermine CHW data systems; it is referenced here only where it shaped the conceptual framework and instrument design, and its findings will be reported separately. The exploratory case-study framing common to both strands allowed triangulation across multiple emergency events while remaining sensitive to the distinct characteristics of each emergency type [18].

Respondents were drawn from provinces with documented emergency exposure during the study period. Most respondents reported experience based in Mashonaland East (57 respondents, 40.1% of the 140 who completed the core sections) and Midlands (42, 29.6%), with smaller numbers from Matabeleland South (12), Matabeleland North (7), Masvingo (6), Mashonaland West (6), Manicaland (4), Harare (3) and Mashonaland Central (3). The predominance of rural settings among respondents' primary emergency experience reflects the rural distribution of Zimbabwe's CHW programme and of its highest-burden emergency-affected districts.

Study Population and Sampling

The study population comprised Community Health Workers, community and facility nurses, laboratory and environmental health technicians, district and provincial monitoring, information and nursing officers, and a national-level laboratory services official, all involved in CHW programme data management and drawn from areas that experienced significant health emergencies between 2018 and 2025. A purposive, maximum-variation sampling strategy was used [18], targeting variation in cadre, health-system level and emergency exposure. A total of 142 respondents completed one of eleven cadre-specific structured questionnaires: 48 Community Health Workers (33.8%), 40 Facility Nurses in Charge (28.2%), 24 District Health Information Officers (16.9%), 11 Environmental Health Technicians (7.7%), 5 Provincial Monitoring and Evaluation Officers (3.5%), 4 Laboratory Technicians (2.8%), 4 Community Nurses (2.8%), 2 Provincial Laboratory Scientists (1.4%), 2 District Nursing Officers (1.4%), 1 Provincial Pharmacist (0.7%) and 1 Deputy Director of Laboratory Services (0.7%) (Table 2). For cross-cutting comparisons, cadres were grouped into four health-system levels: community level (Community Health Workers and Community Nurses, $n = 52$), facility level (Facility Nurses in Charge, Laboratory Technicians and Environmental Health Technicians, $n = 55$), district level (District Health Information Officers and District Nursing Officers, $n = 26$), and provincial or national level (Provincial Monitoring and Evaluation Officers, Provincial Pharmacists, Provincial Laboratory Scientists and the Deputy Director of Laboratory Services, $n = 9$). All 142 respondents gave informed consent to take part; two did not complete the substantive sections beyond the consent stage, so most pooled results are reported out of 140. Frontline and facility-level cadres accounted for 79% of the sample, while several provincial and

specialist cadres had very small counts of one or two respondents; findings for these small cadres are treated as illustrative rather than statistically representative throughout.

Data Collection Instruments

Data were collected using eleven cadre-specific structured questionnaires administered on KoboToolbox, one for each cadre involved in the CHW data pathway. Every questionnaire followed a common structure. Section A comprised four true-or-false baseline statements about respondents' involvement in emergency-related CHW data work and about the availability of the data system to them. Section B covered emergency experience and common system factors shared across cadres, including the types of emergencies experienced, the geographical setting, the pathway stage most disrupted, the frequency of infrastructure-related reporting delays, the adequacy of emergency-specific training, the clarity of reporting procedures, the effect of community trust and misinformation on data completeness, the factors most undermining continuity, and an overall rating of data quality. Section C comprised six questions tailored to the specific responsibilities of each cadre; for example, Community Health Workers were asked how they submit data, while District Health Information Officers were asked about DHIS2 capacity and interoperability. Section D asked respondents to name a single priority action for the Ministry of Health and Child Care and offered an optional open-ended comment. Because Sections A, B and D used identical wording and response options across all eleven instruments, these responses were pooled into a single cross-cadre dataset for system-wide analysis, while Section C, being cadre-specific by design, was analysed separately for each cadre. All instruments were developed from the study's conceptual domains (Table 1) and piloted prior to full data collection.

Data Management and Analysis

Survey exports from KoboToolbox were cleaned, checked for completeness and analysed descriptively. Pooled Section A, B and D responses were summarised as frequencies and percentages across the full sample and cross-tabulated by health-system level, most notably for the overall data-quality rating. Section C responses were analysed and reported separately for the three largest cadres, Community Health Workers, Facility Nurses in Charge and District Health Information Officers, since together they provided the most statistically robust cadre-specific detail; findings for smaller cadres remain in the underlying dataset but are not reported as standalone percentages given their limited size. Multiple-response items, such as the types of emergencies experienced and the factors most undermining continuity, were summarised as the percentage of respondents selecting each option rather than as a percentage of total selections.

Validity and Reliability

Content and face validity of the survey and companion qualitative instruments were established through review by a panel of experts in CHW programming, monitoring and evaluation, and health emergency management, following recognised content-validity assessment procedures [19]. Instruments were piloted with a small number of informants outside the main sample prior to full data collection and refined accordingly.

Ethical Considerations

The study received approval from the Medical Research Council of Zimbabwe and administrative permission from the Permanent Secretary of the Ministry of Health and Child Care and participating study sites prior to data collection. Written informed consent was obtained from all participants, who were

briefed on the purpose, procedures, risks and voluntary nature of participation and who retained the right to withdraw at any stage without consequence. Participant confidentiality was protected through the use of pseudonyms where applicable and secure, access-controlled storage of survey and interview data. Data collectors were trained and briefed, instruments were piloted as described above, and coding and analysis were subject to independent review to ensure alignment between the data, the reported findings and the study's objectives.

Results

This section reports findings from the cross-cadre survey of 142 respondents (140 for most pooled items) who had experience of CHW data work during health emergencies in Zimbabwe between 2018 and 2025. Findings are presented in the order in which the underlying survey sections were administered: sample profile, baseline system resilience, emergency experience and common system factors, cadre-specific highlights for the three largest cadres, and respondents' priority recommendations.

Sample Profile

Community Health Workers, Facility Nurses in Charge and District Health Information Officers together accounted for close to four in five respondents (Table 2, Figure 1), reflecting the frontline focus of the CHW data pathway and of the sampling strategy. Grouped by health-system level, community- and facility-level cadres made up the majority of the sample, with district- and provincial or national-level respondents contributing smaller but analytically important numbers (Figure 2). Most respondents drew on experience from rural settings, with urban, mixed, peri-urban and remote or hard-to-reach settings each represented in smaller numbers (Figure 3).

Table 2. Sample Size and Distribution of Survey Respondents by Cadre

Cadre	Respondents (n)	% of Sample
Community Health Worker	48	33.8%
Facility Nurse in Charge	40	28.2%
District Health Information Officer	24	16.9%
Environmental Health Technician	11	7.7%
Provincial Monitoring and Evaluation Officer	5	3.5%
Laboratory Technician	4	2.8%
Community Nurse	4	2.8%
Provincial Laboratory Scientist	2	1.4%
District Nursing Officer	2	1.4%
Provincial Pharmacist	1	0.7%
Deputy Director, Laboratory Services	1	0.7%
Total	142	100%

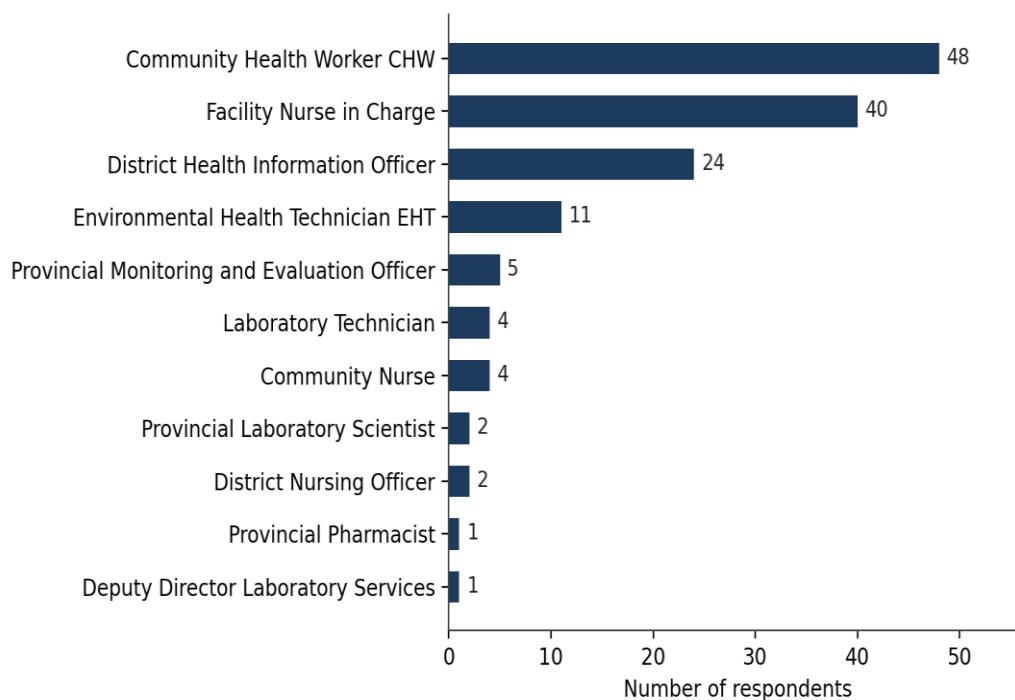


Figure 1. Survey Respondents by cadre (N = 142). Community Health Workers, Facility Nurses in Charge and District Health Information Officers Together Account for Close to Four in Five Respondents

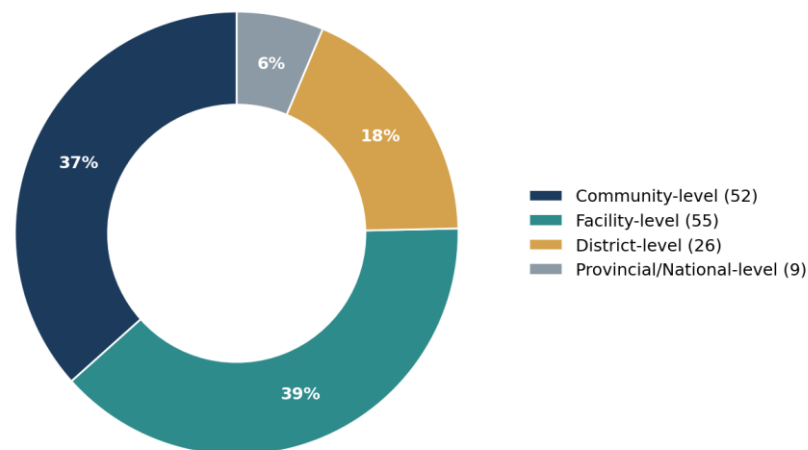


Figure 2. Respondents by Health-System Level. Community- and Facility-Level Cadres Make up the Majority of the Sample, Reflecting the Frontline Focus of the CHW Data Pathway

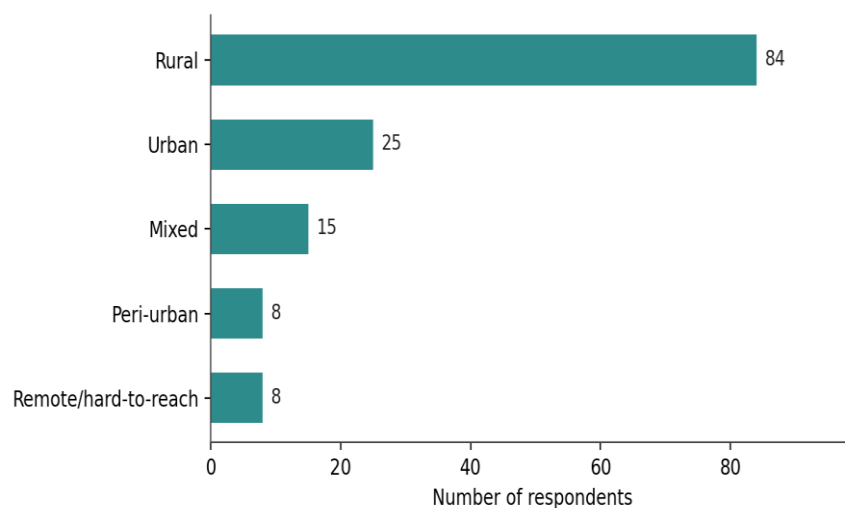


Figure 3. Geographical Setting of Respondents' Primary Emergency Experience (n = 140). Rural Settings Dominate, with Urban, Mixed, Peri-Urban and Remote or Hard-to-Reach Settings Each Represented in Smaller Numbers

Baseline System Resilience

Four true-or-false statements captured respondents' baseline experience of the CHW data system during emergencies (Figure 4). Involvement in emergency-related CHW data work was almost universal, with 95.0% answering true, confirming that the sample was well placed to speak to the topic. A large majority, 89.3%, said their roles were clearly defined, and 75.7% said standard reporting tools remained available. The weakest of the

four statements concerned continuity of transmission during a power or connectivity failure: only 67.1% said CHW data could still be transmitted when electricity or internet access failed, meaning close to a third of respondents, 32.9%, hit a hard stop in the flow of data whenever infrastructure failed. This early finding foreshadows a pattern that recurs throughout Section B: connectivity and power resilience emerge as the single largest structural weakness in the CHW data pathway during emergencies.

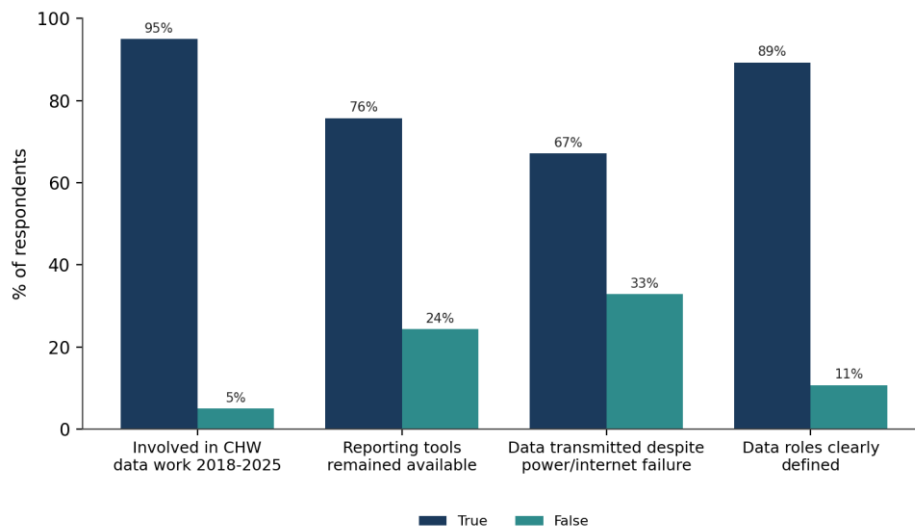


Figure 4. Percentage of Respondents Answering True Versus False to Each Baseline Statement (n approximately 140)

Emergency Experience and Common System Factors

Types of Emergencies Experienced

Respondents could select more than one type of emergency experienced between 2018 and 2025 (Figure 5). COVID-19 dominated respondents' emergency experience, cited by

83.8%, consistent with its scale and duration, and general epidemic or outbreak events were also common at 64.8%. Climate-related emergencies came up less often, with drought or heat events reported by 15.5% and cyclone or flood events by 10.6%, though these still matter a great deal in the provinces most exposed to them.

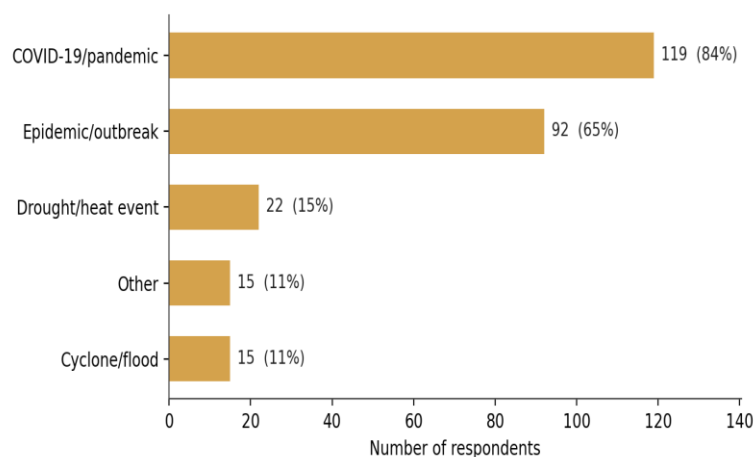


Figure 5. Types of Health Emergencies Experienced (Multiple Responses Allowed, N = 142)

Disruption Along the CHW Data Pathway

Collection was the stage respondents most often cited as a point of disruption, at 30.7%, ahead of feedback and use (23.6%) and transmission (22.1%) (Figure 6). This matters because collection sits at the very start of the

pathway, so a failure there works its way through every stage that follows. Verification (16.4%) and aggregation or analysis (7.1%) were flagged far less often, suggesting that once data enter the formal system, the later processing stages hold up reasonably well compared with the initial community-level capture of information.

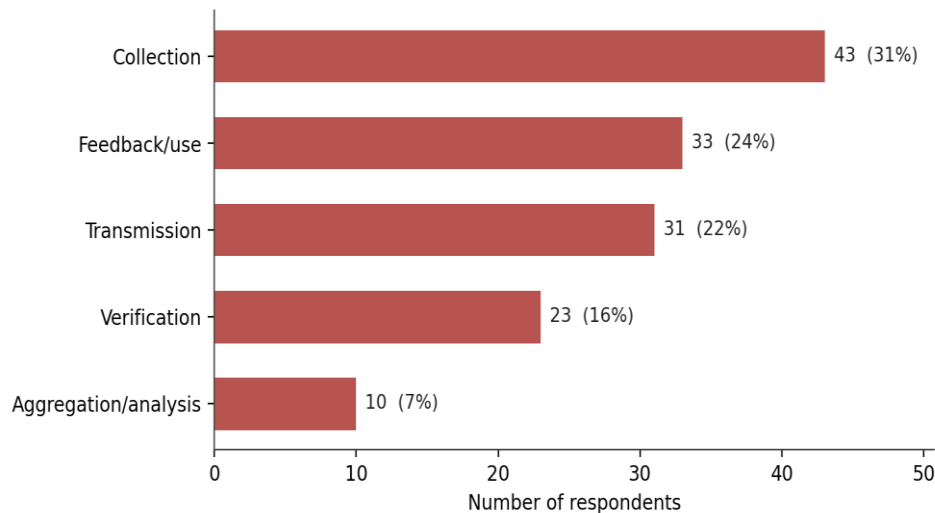


Figure 6. CHW Data Pathway Stage Identified as Most Disrupted (n = 140)

Infrastructure Failures and Reporting Delays

Two-thirds of respondents, 67.9%, said infrastructure failures delayed CHW reporting at least sometimes, and 9.3% said this happened often or always; only 15.0% said such failures

never delayed their reporting (Figure 7). This corroborates the baseline finding on transmission continuity and points to infrastructure and connectivity as a recurring problem across the whole system rather than something confined to a few locations.

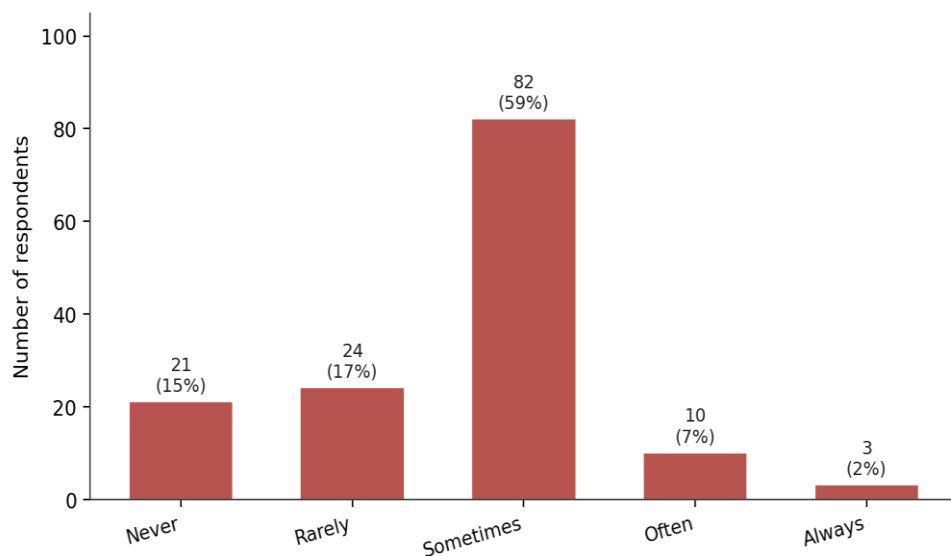


Figure 7. Frequency with Which Infrastructure Failures Delayed CHW Reporting (n = 140)

Adequacy of Emergency-Specific Training

Training stands out as an area needing real strengthening (Figure 8). Just 33.6% of respondents rated emergency-specific training on data tasks as adequate or very adequate,

nearly half, 47.1%, rated it only fair, and 19.3% rated it inadequate or very inadequate. Because data collection was separately identified as the most disrupted pathway stage, it is plausible that under-investment in training for frontline data tasks contributes to that disruption.

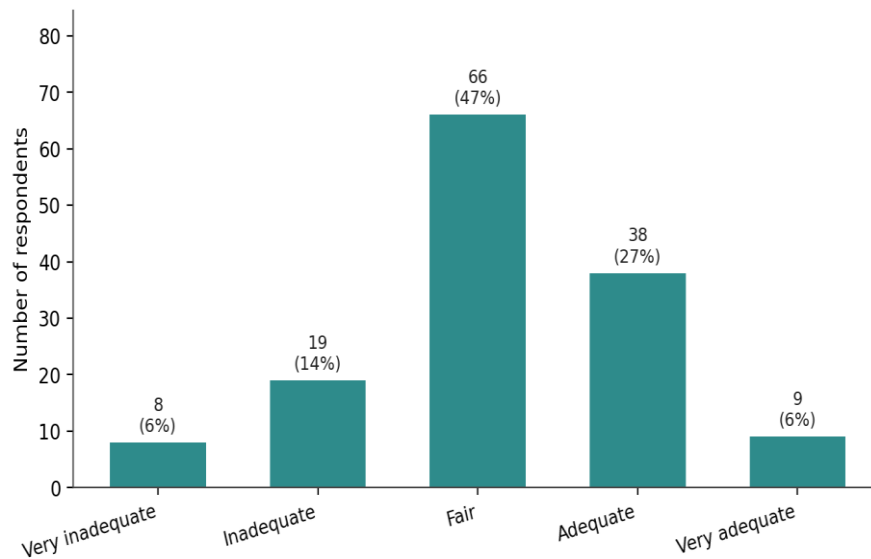


Figure 8. Adequacy of Emergency-Specific Training on Data Tasks (n = 140)

Clarity of Reporting Procedures and Accountability

Procedural clarity fared somewhat better than training (Figure 9). Just over half of respondents, 53.6%, found emergency reporting procedures and accountability lines

clear or very clear, compared with 9.3% who found them unclear or very unclear. Just over a third, 37.1%, rated clarity as only fair, suggesting there is still room to sharpen and standardise emergency standard operating procedures even though a basic structure is already in place.

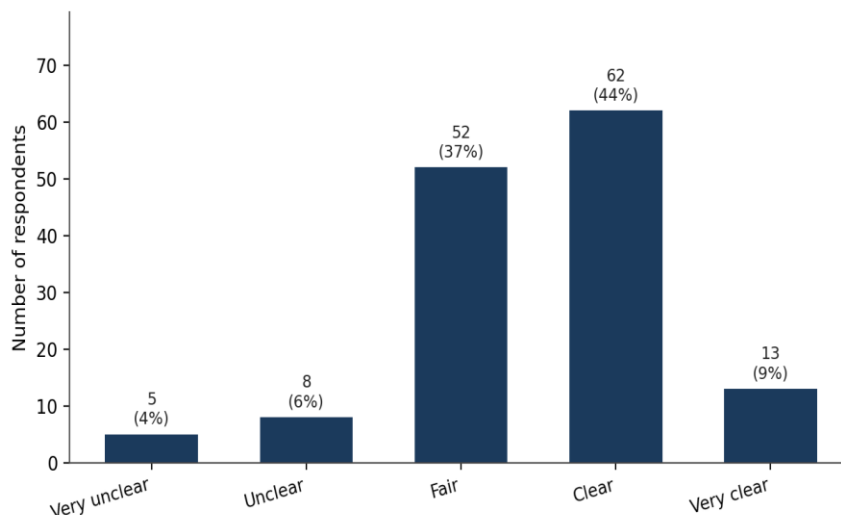


Figure 9. Clarity of Emergency Reporting Procedures and Accountability Lines (n = 140)

Community Trust, Stigma and Misinformation

Nearly half of respondents, 47.9%, said community trust, stigma, language or misinformation affected data completeness moderately, substantially or extremely, while

17.1% said it had no effect at all (Figure 10). This underlines that technical and infrastructural fixes alone will not resolve data-completeness gaps, and that community engagement and risk-communication strategies also matter a great deal to data quality during emergencies.

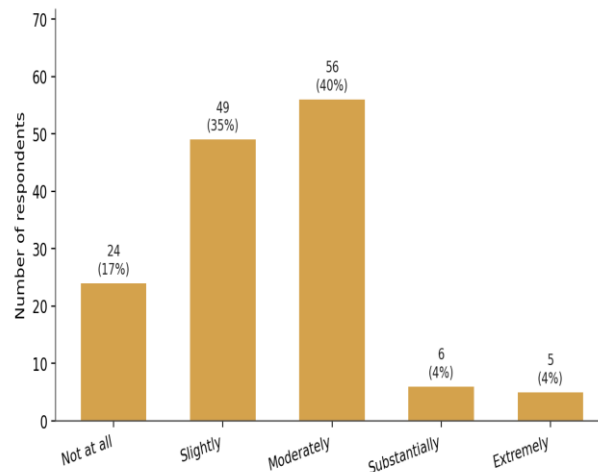


Figure 10. Effect of Community Trust, Stigma, Language or Misinformation on Data Completeness (n = 140)

Factors Most Undermining Continuity

Respondents selected up to three factors that most undermined the continuity of CHW data systems during emergencies (Figure 11). Tools and devices (67.6%) and power and connectivity (58.5%) were by far the most frequently selected factors, echoing the infrastructure findings already described.

Workload and staffing (45.1%) and skills (40.1%) followed, while sociocultural barriers (33.8%) and governance or coordination (12.7%) were selected less often. Taken together, these results point to hardware and workforce capacity as the main constraint, with governance and coordination a smaller, though still relevant, bottleneck.

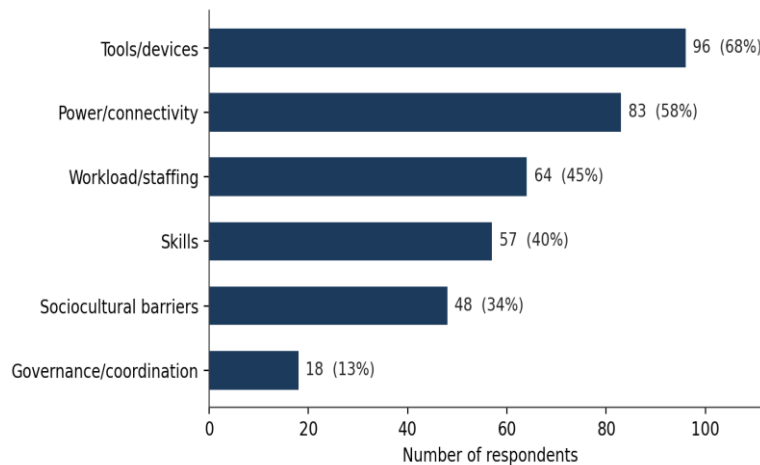


Figure 11. Factors Most Frequently Selected, Among up to Three, as Undermining Continuity of CHW Data Systems (N = 142)

Overall Rating of Data Timeliness and Quality

Just under half of respondents, 48.6%, rated overall CHW data timeliness and quality during emergencies as good or very good, 41.4% rated

it fair, and 10.0% rated it poor or very poor (Figure 12). This is a cautiously positive picture: most respondents see the system as functional, but the large fair rating alongside a meaningful poor or very poor minority indicates substantial room for improvement.

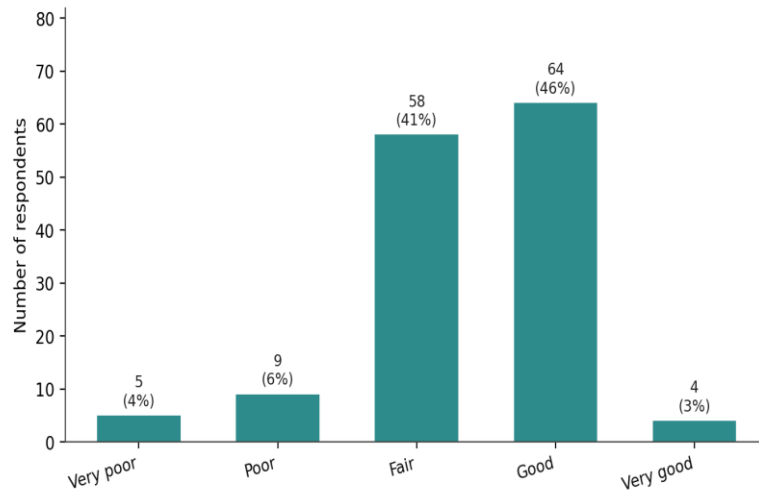


Figure 12. Overall Rating of CHW Data Timeliness and Quality During Emergencies (n = 140)

Rating by Health-System Level

Perceptions of data quality improved further up the health system (Figure 13). Sixty-seven percent of provincial and national-level respondents rated data quality as good, compared with 50% at district level, 45% at facility level and 40% at community level. Community-level respondents, who sit closest to the point of data capture and are most exposed to the connectivity, device and workload pressures already described, reported

the least favourable picture, including the highest share of very poor ratings of the four groups, at 6%, compared with 4% at district level, 2% at facility level and none at provincial or national level. This gradient suggests that problems visible to frontline workers may not be fully appreciated further up the system, supporting the case for weighing frontline perceptions alongside those from higher levels rather than treating any single level's assessment as the whole picture.

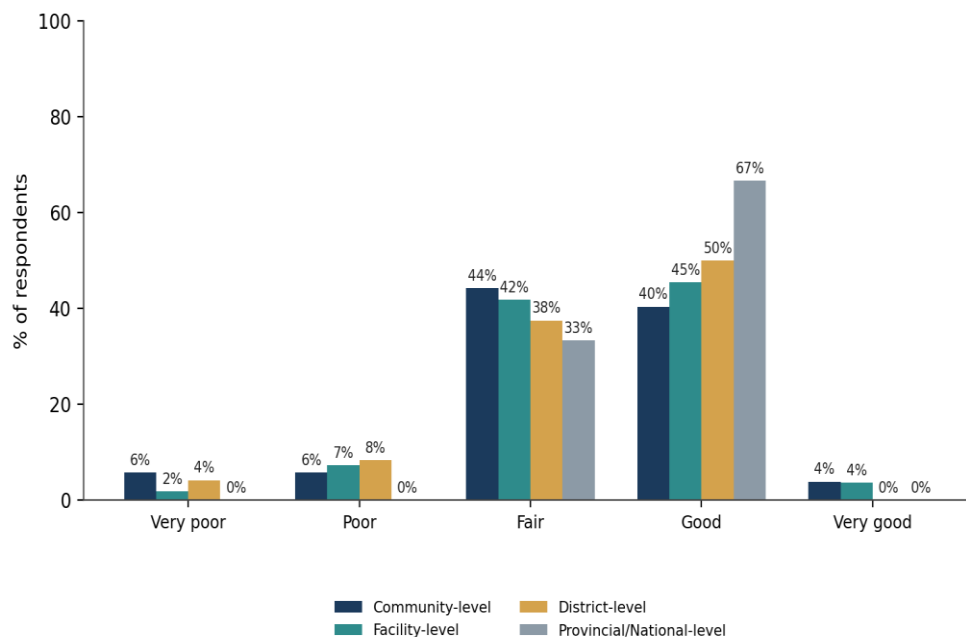


Figure 13. Overall Data-Quality Rating by Health-System Level (Percentage Within Level)

Role-Specific Findings for the Three Largest Cadres

Section C questions were tailored to each cadre's specific responsibilities within the CHW data pathway and were therefore not pooled across cadres. This section summarises the leading responses for the three largest cadres in the sample: Community Health Workers (48 respondents), Facility Nurses in Charge (40 respondents) and District Health Information Officers (24 respondents).

Community Health Workers

Community Health Workers sit at the point of first data capture, and their responses highlight practical, resourcing-level barriers rather than conceptual or technical ones (Table 3). A lack of tools or forms (44%) and movement restrictions (38%) were the leading

reasons recording was incomplete, and paper submission to facilities (50%) remained the dominant reporting channel, alongside informal channels such as phone calls, SMS (29%) and WhatsApp (17%). Stigma or fear (25%) and misinformation (25%) were the community factors most often identified as affecting reporting. On a more encouraging note, most CHWs reported at least moderate confidence that their data were used for local action, and facility feedback on errors or missing data was reasonably frequent, suggesting the supervision loop was partly functioning even where tools remained scarce. The reliance on paper and informal channels, at 46% combined for phone, SMS and WhatsApp, reflects the connectivity gaps identified system-wide, and the lack of tools and forms confirms, from the frontline perspective, why collection emerged as the most disrupted pathway stage overall.

Table 3. Role-Specific Survey Findings, Community Health Workers (n = 48)

Question	Leading Response(s)
What most often prevents complete recording of household or client data?	No tools or forms (44%); movement restrictions (38%)
How do you usually submit community data?	Paper to facility (50%); phone call or SMS (29%); WhatsApp (17%)
How often does the facility give feedback on errors or missing data?	Sometimes (50%); always (25%); rarely (10%)
Which community factor most affects reporting?	Stigma or fear (25%); misinformation (25%); low trust (17%)
What support would most improve emergency reporting?	Phone or device (29%); refresher training (29%); airtime or data bundles (27%)
Confidence that reported data are used for local action	Very confident (33%); moderately confident (33%); completely confident (31%)

Facility Nurses in Charge

Facility Nurses in Charge sit at the interface between community-level collection and the formal health information system (Table 4). Thirty-two percent identified CHW collection as the largest bottleneck in community data flow, ahead of verification (22%) and receipt at facility (20%), corroborating the CHW-level

finding that collection is the weakest link. Workload (35%) and staff shortages (20%), not only connectivity (25%), limited timely verification. Reconciliation of CHW reports with facility data was reported as consistently strong, at 82% always or often, indicating that once data reach the facility, quality-control processes function reasonably well. Informal

channels, WhatsApp or SMS (52%) and phone (32%), dominated urgent-signal escalation over formal paper forms (10%), at 84% combined,

again pointing to adaptive, informal workarounds rather than fully resourced formal channels.

Table 4. Role-Specific Survey Findings, Facility Nurses in Charge (n = 40)

Question	Leading Response(s)
Where is the largest bottleneck in community data flow?	CHW collection (32%); verification (22%); receipt at facility (20%)
How often are CHW reports reconciled with facility data?	Always (70%); often (12%)
What most limits timely verification?	Workload (35%); connectivity (25%); staff shortages (20%)
How are urgent community signals most commonly escalated?	WhatsApp or SMS (52%); phone (32%); paper form (10%)
Which preparedness measure should be prioritised?	Data bundles (32%); staff cross-training (22%); emergency tools (20%)
How often do community data change facility decisions?	Sometimes (50%); always (20%); often (12%)

District Health Information Officers

District Health Information Officers manage the technical backbone of the data system, aggregation, validation and interoperability (Table 5). Connectivity (42%) was again identified as the leading technical failure affecting reporting, ahead of server or platform downtime (29%), and validation (50%) was the data-processing step requiring the most correction, consistent with data-quality issues originating upstream at the point of collection. A quarter of officers received emergency reports outside the official system often or

sometimes, pointing to informal parallel reporting that formal systems do not fully capture. Most, 62%, rated DHIS2 and system capacity as adequate for emergency community data, suggesting the core information system itself is broadly fit for purpose, with the bottleneck lying more in what reaches it, through connectivity, offline capture and manual transfer, than in the platform itself. Offline capture (42%) and backup power or server capacity (33%) were identified as the most important safeguards, reinforcing the infrastructure priority identified across the whole system.

Table 5. Role-Specific Survey Findings, District Health Information Officers (n = 24)

Question	Leading Response(s)
Which technical failure most affects CHW reporting?	Connectivity (42%); server or platform downtime (29%); user access (12%)
Which data-processing step requires most correction?	Validation (50%); completeness checks (21%); aggregation (8%)
How often are emergency reports received outside the official system?	Never (25%); rarely (25%); sometimes (25%)
What is the main interoperability problem?	Manual transfer (25%); non-standard indicators (25%); duplicate platforms (21%)

Which safeguard is most important?	Offline capture (42%); backup server or power (33%); routine backup (12%)
How adequate is DHIS2 or system capacity for emergency community data?	Adequate (62%); fair (17%); inadequate (12%)

Priority Recommendations from Respondents

All respondents were asked to identify the single action the Ministry of Health and Child Care should prioritise to make CHW data systems more resilient during future emergencies (Figure 14). Investment in infrastructure and technology was the most frequently chosen priority, at 32.9%, closely followed by workforce and training strengthening at 30.0%; together these two options accounted for almost two-thirds of all responses. Community engagement, at 20.0%, was the third most common priority, consistent

with the sizeable share of respondents who reported that community trust, stigma and misinformation affect data completeness. Supervision and feedback (13.6%) and, less often, governance and standard operating procedures (2.1%) and interoperability (1.4%) made up the remaining responses. This ordering aligns closely with the factors respondents identified as undermining continuity, where tools and devices and power and connectivity ranked highest, together suggesting that infrastructure and workforce capacity, rather than governance or system design, are what respondents themselves want addressed first.

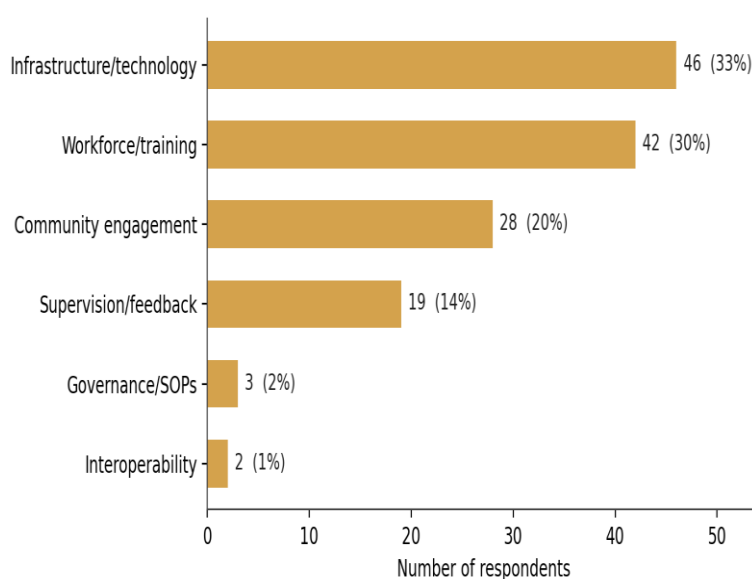


Figure 14. Priority Action Recommended for the Ministry of Health and Child Care to Strengthen CHW Data System Resilience (n = 140).

Discussion

A growing body of international literature documents the vulnerability of community-based health information systems during crises, and the present survey findings sit squarely within that pattern while adding Zimbabwe-specific, cross-cadre quantification. Interrupted

time series analysis of routine data from twenty-seven districts across four sub-Saharan African countries found that the continuity of community-based care during COVID-19 depended substantially on whether CHWs had been adequately remunerated, supplied and supervised before the pandemic began, with better-supported cadres able to sustain

reporting where less-supported ones could not [8]. This is consistent with the present finding that only 67.1% of respondents could still transmit CHW data when electricity or internet access failed, and that tools and devices (67.6%) and power and connectivity (58.5%) were the two factors most frequently blamed for undermining continuity. Complementary work across the Democratic Republic of Congo, Nigeria, Senegal and Uganda found that CHWs played a central role in COVID-19 case detection, contact tracing and risk communication, but that connectivity limitations, inadequate data collection tools and insufficient integration into national reporting systems constrained the reliability of the data they generated [9], a pattern mirrored almost exactly by Zimbabwean CHWs' own account of paper-based submission (50%) and informal phone, SMS and WhatsApp channels (46% combined) substituting for more robust digital tools. Across the region more broadly, the World Health Organization has reported that a large majority of countries experienced disruption to essential health services during the pandemic, with community-level reporting systems among the functions most affected [20].

Digitisation has been positioned as a central strategy for improving the timeliness and quality of community health data, but the evidence on implementation is mixed, and the present survey helps explain why. In Ethiopia, a phenomenological study of the electronic community health information system found that health-worker education level, resistance to new tools, unreliable electricity and network infrastructure, interoperability problems between parallel systems, weak coordination among stakeholders, and limited trust in shared platforms each independently undermined effective use of the system [1]. A subsequent implementation-science study using the CFIR-ERIC framework in Ethiopia's East Shewa zone similarly identified limited network connectivity, low digital literacy, frequent

power outages and device-maintenance difficulties as recurring barriers, while identifying leadership engagement, clear guidelines, interoperability design and technical support as facilitators [4]. The Zimbabwean survey data extend this picture with a pathway-stage diagnosis: rather than digitisation failing uniformly, it is community-level collection specifically, chosen by 30.7% of respondents as the most disrupted stage, that bears the brunt of infrastructural and workforce constraints, while District Health Information Officers rated the core DHIS2 platform itself as largely adequate (62%). A broader review of digital health interventions for health-system strengthening across Ethiopia, Ghana and Zimbabwe found that fragmentation across parallel platforms, including Zimbabwe's own Impilo electronic health record system, continues to constrain the extent to which community-generated data can be integrated into a single, interoperable national architecture, despite the platform's expanding functionality [10], a finding echoed in the present survey by District Health Information Officers' identification of manual transfer, non-standard indicators and duplicate platforms as leading interoperability problems.

Regional analyses of the broader African digital health landscape reinforce these findings, noting that infrastructure gaps, particularly unreliable electricity and internet connectivity in rural areas, remain the central technical constraint on cloud-based and mobile reporting systems, even as continental initiatives promote common data-exchange standards to improve interoperability across countries [21]. For Zimbabwe specifically, the Global Fund's 2025 digital health case study highlights that inconsistent power and internet access at facility and community level directly undermines the country's capacity for digitised surveillance, patient-centred care and supply-chain data management, with national power shortages estimated to cost the economy the equivalent of 6.1 percent of gross domestic

product annually [11]. The present survey provides direct workforce-level evidence for this claim: two-thirds of respondents, 67.9%, reported that infrastructure failures delayed CHW reporting at least sometimes, and infrastructure investment was respondents' own top priority for the Ministry of Health and Child Care, at 32.9%.

Zimbabwe's own emergency history provides the most directly relevant evidence base for this study, and the survey sample's emergency experience, dominated by COVID-19 (83.8%) and general epidemic or outbreak events (64.8%), reflects that history closely. Descriptive epidemiological analysis of the 2018-2019 cholera outbreak found that effective control depended on a functioning, multisectoral surveillance system capable of rapid case detection and response coordination, implicitly underscoring the consequences of gaps in community-level reporting [5]. The 2023 Chegutu cholera outbreak, which spread to seventeen hotspot districts across all ten provinces and resulted in almost 5,000 confirmed and suspected cases, prompted policy recommendations emphasising the need for improved risk communication, stakeholder engagement, data standardisation and capacity-building to strengthen future outbreak surveillance and response [12]. Response reporting from the International Federation of Red Cross and Red Crescent Societies similarly documented that the rapid, multi-province spread of the 2023 outbreak strained existing surveillance and coordination systems, reinforcing the case for stronger community-level data architecture ahead of future outbreaks [13].

During the COVID-19 pandemic, Zimbabwe's Ministry of Health and Child Care, in collaboration with the World Health Organization's Universal Health Coverage Partnership and other global health initiative partners, worked to establish a real-time, weekly routine monitoring system anchored in the District Health Information System,

explicitly in order to sustain data-driven decisions on the continuity of essential services [7]. The very necessity of this intervention indicates that pre-existing community and facility reporting mechanisms had not been resilient enough, on their own, to withstand the disruption caused by the pandemic, a conclusion the present survey supports directly: just 33.6% of respondents rated their emergency-specific training as adequate or better. Zimbabwe's establishment, from 2024 onward, of a network of Public Health Emergency Operations Centres, equipped to serve as multisectoral command and coordination hubs following recurrent cholera outbreaks, Cyclone Idai and the COVID-19 pandemic, reflects a policy-level acknowledgement of the need for stronger, better-coordinated emergency data and coordination infrastructure [3].

Beyond infrastructure and technology, the literature points consistently to workforce and governance factors as key determinants of community health data system performance. Weak supervision, limited feedback loops between community-level reporting and higher-level decision-making, and insufficient coordination among the multiple actors involved in emergency response have each been identified as constraints on the effective use of community-generated data, even where the underlying data are collected [1, 4]. The survey data qualify this picture usefully: governance and coordination were selected by only 12.7% of respondents as a factor undermining continuity, well behind tools and devices and power and connectivity, suggesting that in the Zimbabwean case the more visible, tangible resourcing gaps currently outweigh governance and coordination as the binding constraint, even though procedural clarity itself was rated only moderately favourably (53.6% clear or very clear). Sociocultural factors, including community trust in CHWs, language diversity, and stigma associated with certain conditions, further shape both the willingness of

community members to report and engage during emergencies and the completeness of the resulting data [3], a pattern the survey confirms directly: 47.9% of respondents said community trust, stigma or misinformation affected data completeness to at least a moderate degree, and Community Health Workers themselves identified stigma, fear and misinformation as the community factors most affecting their reporting. Taken together, this evidence suggests that Zimbabwe's recurrent difficulty in sustaining reliable CHW data systems during emergencies is not attributable to any single factor, but rather to the interaction of infrastructural, institutional, workforce and sociocultural conditions, a premise that underpins both the conceptual framework guiding this study and the pattern of findings it has produced.

A further contribution of the survey is its demonstration that vulnerability is not evenly distributed across the health system. Data-quality ratings improved steadily from community level (40% good or very good) through facility (45%) and district (50%) to provincial or national level (67%), and community-level respondents also reported the highest share of very poor ratings. This gradient is consistent with, and adds quantitative precision to, the broader observation in the literature that frontline perspectives are often under-represented in system assessments conducted from higher administrative levels. It suggests that national-level assessments of CHW data system performance, if based only on facility, district or provincial informants, risk understating the severity of problems as they are actually experienced at the point of data capture.

While the reviewed literature establishes, with reasonable consistency, that community health information systems across sub-Saharan Africa are vulnerable during health emergencies, and while Zimbabwe-specific evidence documents the consequences of this vulnerability across successive cholera

outbreaks and the COVID-19 pandemic, comparatively little of the existing scholarship integrates these strands into a single, contextually grounded, quantified account of why CHW data systems specifically falter during emergencies in Zimbabwe. This study helps to close that gap by generating primary, cross-cadre survey evidence directly from the CHWs, nurses, technicians, information officers and managers who have operated these systems through recent emergencies, complementing the parallel qualitative strand of the wider doctoral project.

Taken together, the findings suggest that technical investment alone is unlikely to produce a resilient community health data system. Electricity, connectivity and interoperability are necessary, but their value depends on workforce capability, clear governance, supervision, feedback and community trust, all of which the survey shows to be present but incomplete: reporting tools are broadly available (75.7%), the core DHIS2 platform is broadly rated adequate (62%), and facility-level reconciliation of CHW reports is strong (82% always or often), yet training remains under-resourced and community-level experience of the system remains the least favourable of any group. The pattern that emerges is one of a system whose technical backbone is comparatively sound but whose frontline, community-level layer is where investment is most urgently needed.

Implications for Policy and Practice

The survey findings indicate that emergency preparedness should embed community data continuity within routine system strengthening, rather than treating it as a separate, crisis-only concern. Priority actions, informed directly by respondents' own stated priorities and by the factors they identified as undermining continuity, include expanding offline-capable and interoperable reporting tools for CHWs, providing devices and airtime or data allowances to frontline workers, developing a

structured and recurring emergency-specific training curriculum with particular emphasis on data-collection tasks, pairing infrastructure and training investment with targeted community engagement and risk-communication strategies, and formally recognising and integrating the WhatsApp, SMS and phone-based channels that facility nurses and CHWs already rely on for urgent escalation. District-level safeguards such as offline capture and backup power or server capacity, prioritised by District Health Information Officers, should be extended alongside efforts to standardise indicators and reduce manual transfer and duplicate-platform problems. Public Health Emergency Operations Centres should receive defined community-level data streams and should communicate actionable feedback back to districts and frontline cadres, and system reviews should treat community- and facility-level perceptions as a leading indicator, given that these levels report the least favourable data-quality ratings and sit closest to the point where problems originate.

Study Limitations

Several limitations should be considered when interpreting these findings. The survey sample, while substantial at 142 respondents across eleven cadres, was not evenly distributed: Community Health Workers, Facility Nurses in Charge and District Health Information Officers accounted for 79% of respondents, while several provincial and specialist cadres had only one or two respondents, so findings for these small cadres are indicative only and are not reported as standalone percentages. The sample was also geographically concentrated, with Mashonaland East and Midlands provinces together accounting for 70% of respondents, so findings may not generalise evenly to all provinces. Responses were self-reported and retrospective, covering emergencies from 2018 to 2025, and are therefore subject to recall and social-desirability bias, particularly for

respondents describing more than one past emergency and for questions touching on organisational performance. Because Section C questions differed by cadre by design, direct statistical comparison across cadres on role-specific items was limited, and only the three largest cadres are reported individually here. Two respondents did not complete the substantive sections beyond the consent stage, so pooled percentages for these sections are calculated out of 140 rather than the full 142. As a purposive, non-probability sample, the survey supports descriptive, context-specific conclusions rather than nationally representative statistical inference; the parallel qualitative strand of the wider study, and future work extending the survey to additional provinces and cadres, will help to test the transferability of these findings.

Conclusion

Reliable community-level information is indispensable during health emergencies, yet the conditions that increase demand for rapid data can simultaneously weaken the systems that produce it. This cross-cadre survey of 142 respondents across eleven cadres of Zimbabwe's health workforce shows that the country's community health data infrastructure is engaged, broadly structured and, at its technical core, judged largely adequate, yet it remains constrained precisely at the point of community-level collection, where tools, connectivity, power and training are least secure. What respondents identify as undermining continuity of their data systems lines up closely with what they themselves recommend the Ministry of Health and Child Care prioritise: infrastructure and connectivity investment, followed by workforce training, community engagement and stronger supervision and feedback. Addressing these priorities in a sequenced, community-facing way, rather than through technical investment alone, offers a practical route toward more resilient, emergency-responsive community

health information systems, and the findings reported here, together with the parallel qualitative evidence being generated by the wider study, are intended to support that agenda within Zimbabwe's 2026-2030 National Health Strategy and its emerging Public Health Emergency Operations Centre architecture.

Conflict of Interest

The author declares no financial or commercial conflict of interest. The author's professional role within the Ministry of Health and Child Care creates a potential positionality consideration, which was managed through reflexive documentation, transparent sampling and independent review of the analysis.

Ethical Approval

Ethical approval was obtained from the Medical Research Council of Zimbabwe, together with administrative permission from the Ministry of Health and Child Care and participating study sites, before data collection. No participant recruitment or data collection began before all required approvals had been obtained.

Author Contributions

Tafadzwa Dzamara conceived the study, developed the protocol and survey instruments, led data collection through KoboToolbox,

conducted the analysis, undertook the literature synthesis, and prepared the manuscript.

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Data Availability

The datasets generated and analysed during the current study are not publicly available due to the terms of the ethical approval granted by the Medical Research Council of Zimbabwe and the conditions of administrative permission from the Ministry of Health and Child Care, which restrict onward sharing of respondent-level data. De-identified data are available from the corresponding author on reasonable request, subject to permission from the Medical Research Council of Zimbabwe and the Ministry of Health and Child Care.

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