

Progress in Health Management Information System (HMIS) Data Quality: Findings of a Mixed Method Assessment in Liberia



Liberia, a West African country with an estimated population of five million people, has endured a 14-year civil war during which many health facilities were destroyed and a 2014–2015 Ebola epidemic that resulted in more than 10,000 cases and close to 5,000 deaths. Malaria is the leading cause of illness and death in the country.

Health Management Information Systems (HMIS) are data collection systems designed to collect, manage, analyze, and disseminate health data so that it can be used for making sound decisions, including planning and implementing a national health strategy. The availability and use of high-quality data play a critical role in a robust HMIS.

Data Quality Reviews (DQRs) can serve as a critical quality improvement tool, highlighting the strengths and weaknesses of an HMIS and encouraging collaboration across the levels of the system.¹ DQRs focused on facility-level data have consistently shown that the limited use of local data hinders evidence-based decision-making.²

- 1 O'Hagan, R., Marx, M. A., Finnegan, K. E., et al. 2017. National assessment of data quality and associated systems-level factors in Malawi. *Global Health: Science and Practice*, 5(3), 367-381.
- 2 Tilahun, B., Teklu, A., Mancuso, A., et al. 2021. Using health data for decision-making at each level of the health system to achieve universal health coverage in Ethiopia: the case of an immunization programme in a low-resource setting. *Health Research Policy and Systems*, 19(2), 1-8.



AT A GLANCE



From October 2020 to January 2021, the Ministry of Health (MOH) of Liberia conducted a data quality review (known as the 2020 DQR) of the health management information system (HMIS) at the health facility, district, and county levels.



In comparison to a previous DQR conducted in 2017 (known as the 2017 DQR), the 2020 DQR revealed marked improvement for several data quality indicators, especially with regard to data completeness.



The 2020 DQR also identified challenges related to data accuracy and timeliness, the use of data for programmatic decision-making, the availability of recording and reporting forms, and health worker competency.



The MOH and its partners should consider the development, implementation, and resourcing of a Data Improvement Plan to address the limitations identified in the 2020 DQR and strengthen Liberia's HMIS.



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CONTEXT

Data availability and quality and the use of data for health programs (e.g., immunization and other disease control programs, maternal and reproductive health) are essential to improving health program coverage, management, and overall health outcomes.

Recognizing the challenges associated with data availability, quality, and use across the health sector, the Ministry of Health (MOH) of Liberia decided to develop a data improvement plan (DIP) to chart a more integrated approach to data improvement across the MOH's units and departments and with its implementing partners.

To create a foundation for the DIP, the MOH, with support from JSI Research & Training Institute, Inc. (JSI) and other core partners, conducted a comprehensive assessment of data quality and data management systems beginning in health facilities, the primary source of health data. The purpose of the DQR was to identify changes since the DQR conducted in 2017 and to develop insights to inform a comprehensive DIP and strengthen the HMIS.

METHODOLOGY

Data Collection

In collaboration with the MOH's Health Monitoring, Evaluation and Research Unit, JSI provided technical leadership for the DQR, with support from Gavi, the Strategic Technical Assistance for Improved Health System Performance and Health Outcomes activity (STAIP/USAID), and the Global Fund.

The 2020 DQR relied on the following data sources:

- A **desk review** of data for a core set of indicators that are reported to the national level and to intermediate data aggregation levels, including the completeness and timeliness of reporting, the internal consistency of data, analyses of trends, denominator and numerator issues/concerns, and triangulation of Liberia's HMIS data
- A **health facility assessment** that examined the completeness of reporting, verification of indicator values for specific reporting periods for data sent from facilities to the next higher level, and an evaluation of the capacity of the HMIS to produce quality data

Health facility data were collected by five regional coordinators on tablets, then synchronized, consolidated, and cleaned prior to analysis. A local information and communications technology specialist/programmer reviewed the data and provided feedback for improving data quality.

Sampling Method

Six hundred fifty-two of the country's 800 public and private health facilities reported HMIS data during the second quarter of 2020, making them eligible for the DQR target sample. A

stratified random sampling method was used to ensure that the study included health facilities with diversity along the following dimensions: setting (urban and rural), ownership (public and private), facility type (hospitals, health centers, and clinics), health services provided, and facility caseload.

All hospitals (excluding specialized mental health facilities), health centers, and clinics offering antiretroviral therapy (ART) were selected for inclusion. A sample of public and privately owned clinics not offering ART was randomly selected proportionate to the number of clinics per county. The final sample size consisted of 243 health facilities, which included 37 hospitals, 55 health centers, and 151 clinics.

All of Liberia's 15 counties were included in the sample. For each county, one urban and one rural district were selected. Because five of the 15 counties did not have a district health team (DHT), verification of health facility data was completed by interviewing county health team (CHT) members in these counties.

Core Indicators

As recommended in the World Health Organization's (WHO) DQR toolkit³ and in consultation with key program experts, seven core indicators from five priority programs were selected for data collection during the field assessment (see Figure 1). The MOH routinely monitors these core indicators through joint integrated supportive supervision (JISS) activities.

Figure 1. 2020 DQR Priority Programs and Indicators



1. Maternal Health

- Proportion of pregnant women who had three or more antenatal care (ANC) visits seeking intermittent preventive treatment during pregnancy (IPTp3).
- Institutional delivery assisted by a skilled birth attendant (SBA)



2. Immunization

- Proportion of children under one who took the third dose of a pentavalent vaccine (Penta3)
- Infants fully immunized (Fully Immunized Coverage—FIC)



3. HIV/AIDS Prevention and Control

- Patients/persons currently on ART (ART)



4. Tuberculosis Prevention and Control

- Notified cases of all forms of tuberculosis (TB)



5. Malaria Control

- Confirmed malaria cases among children under age 5 (Malaria)

3 World Health Organization. 2020. *Data Quality Review (DQR) Toolkit: Overview of the Data Quality Review (DQR) Framework and Methodology*. Geneva: World Health Organization.

Verification Factor

Data accuracy is assessed by reviewing the number of events recorded in a source document against the number recorded in the corresponding monthly report. Accuracy is calculated using a verification factor, which is the ratio between the number of events verified or recounted from the source document at one level (the numerator) compared to the number of events reported by that level to a higher level (the denominator). This ratio gives the proportion of reported events that could be verified. A VF higher than one (1) implies an underreporting of events in the HMIS during the verification period. A VF less than one (1) implies an overreporting of events during the period.

At the facility level, data accuracy was assessed among facilities providing services associated with the indicators reviewed and where the relevant source documents were physically available (i.e., monthly report and source documents like daily tally sheets).

FINDINGS

The 2020 DQR assessed three indicators that were not present in the 2017 DQR (i.e., TB, Penta3, IPTp3). This section provides a comparison of indicators employed in both DQRs and presents findings specific to the 2020 DQR. In comparison to the 2017 review, the overall 2020 DQR findings revealed progress in the areas of service availability and data quality. The study also identified areas for improvement, including shortcomings related to data accuracy and timeliness, the use of data for programmatic decision-making, the availability of recording and reporting forms, and health worker competency.

Reporting Completeness

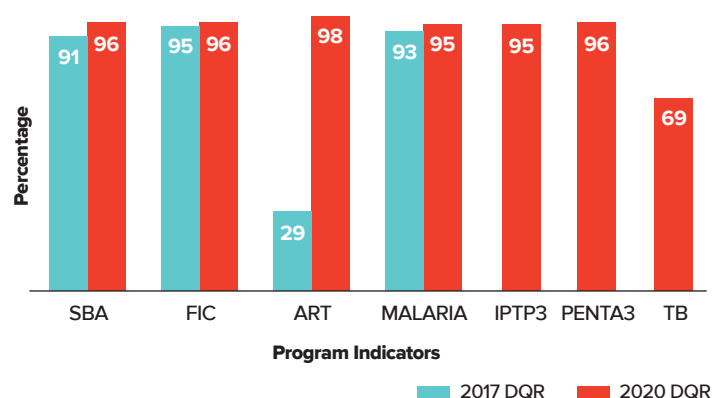
In this study, reporting completeness is the percentage of reports submitted by health facilities to county health offices in a given period. The MOH set a target of 90 percent reporting completeness. From 2017 to 2020, reporting completeness improved across all indicators, with significant improvement in ART—from 29 percent in 2017 to 98 percent in 2020. In fact, all of the indicators except the TB case report met the 90 percent threshold (see Figure 2).

The results of the 2020 DQR also revealed that urban health facilities had a lower reporting completeness rate than rural health facilities, except for reporting on the TB case indicator, where reporting completeness was higher among urban health facilities. In general, public health facilities had higher reporting completeness rates than private facilities. The 2017 and 2020 DQRs also examined data element completeness (i.e., information in the monthly report was the same as that in the source document). All facilities in both studies met the 90 percent threshold of data element completeness.

Reporting Timeliness

The MOH set a national standard that districts and counties must submit monthly reports by the seventh day of the following month. Three-quarters of county staff knew the deadline for report submission, whereas only 30 percent of district staff did.

Figure 2. Reporting Completeness by Program Indicators in the 2017 and 2020 DQRs



Note: IPTp3, Penta3, and TB indicators were not present in the 2017 DQR

Data Accuracy

Data Verification Factor

Data accuracy remained an issue for all of the indicators. Accuracy issues shifted from underreporting in 2017 to overreporting in 2020 (see Table 2).

Table 2: Verification Factor (VF) for Selected Indicators (2017 and 2020 DQRs)

	SAB	Penta3	FIC	ART	TB	Malaria
DQR 2017	1.09	1.00	1.05	1.29	1.39	1.08
DQR 2020	1.03	0.97	0.86	0.98	0.97	0.92

Legend: VF=1 (dark blue), VF>1 (yellow), VF<1 (red)

When the VFs for the 2020 DQR are viewed by facility type, ownership, and setting (i.e., by strata), hospitals and public health facilities were found to have accurate data for SAB, health centers had accurate data accuracy for Penta3, and urban facilities had accurate data for ART. However, over- and underreporting remain an issue of concern across indicators within each stratum (see Table 3).

Reasons for Data Discrepancy

Data discrepancy was overwhelmingly the result of calculation (i.e., arithmetical) errors and transcription errors between the source document and monthly reports. The immunization indicators (i.e., Penta3 and FIC) had the highest incidence of calculation errors and transcription errors.

Table 3. Verification Factor for Selected Indicators by Strata (2020)

Strata	SAB	Penta3	FIC	ART	TB	Malaria
Hospital	1.00	0.99	0.85	1.03	0.93	0.88
Health Center	1.06	1.00	0.88	0.99	1.02	0.93
Clinic	1.03	0.96	0.85	0.97	0.94	0.93
Public	1.00	0.98	0.87	0.98	0.97	0.93
Private	1.17	0.94	0.80	0.99	0.94	0.88
Urban	1.04	0.99	0.88	1.00	0.95	0.83
Rural	1.03	0.96	0.85	0.98	0.98	0.97

VF=1 VF>1 VF<1

Availability of Human Resources and Training

Overall, 81 percent of health facilities in the 2020 DQR reported having a designated human resource to record, compile, and review data quality. Sixty percent of the staff designated to prepare reports and 63 percent of staff who review data quality had received training in the previous two years. More hospital staff (81 percent) had received training than health center staff (57 percent), and more staff in public health facilities (65 percent) had received training than staff in private facilities (59 percent). Many health staff reported being overworked or having insufficient time for data recording/compilation and/or review.

Other Factors Influencing Data Quality

Only 56 percent of health facilities had data reporting reference materials available to health workers. The availability of recording and reporting forms improved by 12 percent from the 2017 to 2020 DQR, but the 2020 findings indicate that 45 percent of health facilities had experienced a stockout of recording and reporting forms, which can negatively affect the availability and quality of HMIS data. In some of the settings where monthly data was not charted and displayed, staff in health facilities and district and county offices attributed the issue to the absence of poster sheets and other supplies.

⁴ Except for the TB indicator, which was not included in the 2017 DQR.

⁵ Ouedraogo, M., Kurji, J., Abebe, L., et al. 2019. A quality assessment of Health Management Information System (HMIS) data for maternal and child health in Jimma Zone, Ethiopia. PLoS one, 14(3), e0213600. Ntsama, B., Bwaka, A., Katsande, R., et al. 2021. Polio Data Quality Improvement in the African Region. Journal of Immunological Sciences, (2).






DISCUSSION

Findings of the 2020 DQR reveal that data quality for some HMIS indicators in Liberia has improved and that some health facilities have achieved the MOH standard. For example, reporting completeness improved for all indicators and met the national standard of 90 percent.⁴ But data accuracy remains an obstacle, with underreporting the primary accuracy challenge in 2017 and overreporting the challenge three years later. Health workers engaged in the HMIS are not adequately trained and would benefit from capacity development on eliminating calculation and transcription errors, understanding the national guidelines and standards, and using data for programmatic decision-making. In addition, preventing the stockout of forms needs to be addressed.

These findings are consistent with DQR results in other low- and middle-income countries, where data accuracy, reporting completeness, and health worker competency have been identified as major obstacles to HMIS data quality.⁵ It is critical to address data quality gaps and barriers, beginning with health facilities, to ensure informed use of data at each level of the health system. Strengthening this aspect of the Liberian HMIS is possible through careful planning for and implementation of a Data Improvement Plan (DIP). Given that data quality is fundamental in all public health programming, the development of a DIP by the MOH and its partners is the clear next step in strengthening Liberia's HMIS and boosting all sectors that influence health outcomes.



Recommendations

- 1** |  To improve data quality, the MOH should explore strengthening human resources for HMIS in health facilities (e.g., employ a designated person, build staff capacity).
- 2** |  County and district health offices should review data quality at every reporting level (e.g., health facility, district, county) and provide feedback focused on improving data accuracy.
- 3** |  The MOH and its partners should ensure the availability of HMIS data recording and reporting forms in public and private hospitals, health centers, and clinics.
- 4** |  District and county officials should conduct on-the-job training for health facility staff to eliminate calculation and transcription errors during the preparation of monthly reports.
- 5** |  District and county officials should ensure that data are used for program improvement at the point of generation in health facilities, rather than data simply being forwarded to the next level.

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