

# Quality of Health Data in Public Health Facilities of Oromia and Gambela Regions, Ethiopia

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## Abstract

**Background:** The quality of routine health data in Ethiopia remains poor despite the existence of proven effective improvement strategies. Implementation research frameworks assist in analyzing, operationalize, and assess the implementation process by systematically addressing the "know-do" gap. The study aimed to assess routine health data quality status in public health facilities of selected districts in Oromia and Gambella regions of Ethiopia using the Consolidated Framework for Implementation Research (CFIR).

**Methods:** This study is part of a larger implementation research project that employed an institutional-based cross-sectional study design. A pre-intervention baseline assessment was conducted using qualitative and quantitative data collection methods. All health centers and hospitals in the selected districts and selected health posts based on their performance, one high, one medium and one low performer, a total of three from each primary health care unit, were included in the study. As a result, two hospitals, seven health centers, 35 health posts, and both district health offices were included in the study. Moreover, a total of 51 key informant interviews, four participants from each health facility, who have more connection with HMIS data like facility head, HMIS focal, MCH and outpatient department heads as well as HMIS focal person from the district, District health office head, plan and MCH heads one health extension worker per selected health post were included purposely. Structured checklists were developed from the Performance of Routine information system management (PRISM) assessment tool, which is nationally approved and used for quantitative data. For the qualitative data, semi-structured interview guides were developed by reviewing different literature. Descriptive analysis was done for quantitative data, while a thematic analysis approach was used for qualitative data.

**Results:** A total of 46 HFs in 2 districts were involved in the study. Data quality in terms of accuracy, timeliness and completeness was assessed for eight selected indicators. Accordingly, three of the assessed data elements were in the acceptable range. These were delivery service (98%), Penta-3 (96%) and Measles (94%). The remaining 5 were out of the acceptable range, indicating the presence of over-reporting. In both districts, report completeness was 100% regarding timeliness 53.5% of the report in Digalu-Tijo and 79% in Godere submitted to the next level according to the national schedule for each level. Data were inconsistent both over time and between indicators. Supportive supervision and higher-level mentorship support were inadequate, although the extent varies between districts. The gaps were more pronounced in the Digalo-Tijo district than in the others. Internal supervision and mentorship were also missing in both contexts. Data quality review meetings were not conducted regularly. Many recording and reporting tools were unavailable on the assessment day or never available in health facilities. Many health workers did not receive training during the last 12 months on health management information system-related topics.

**Conclusion:** Data generated through routine health management information systems is generally low quality. Supportive supervision, mentorship, and review meetings are not accomplished as indicated in the strategy. Many health facilities lack important recording and reporting tools. Training on health management information system-related topics is inadequate. The findings highlight the need to design tailored and context-specific interventions to improve data quality. [*Ethiop. J. Health Dev.* 2022;36 (SI-2)]

**Keywords:** Data quality, health management information system, HMIS, implementation research, Gambella, Oromia, Ethiopia

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## Introduction

The World Health Organization (WHO) has identified health information systems (HIS) as one of the six key attributes that contribute to strengthening the health system (1,2). High-quality health data is critical for solving global health challenges and building robust public health systems. In developing countries, the quality of data has been improved since the 1990s by enhancing the routine HIS with the help of information technology. In these times of resource limits, establishing and maintaining such systems is critical for good governance, transparency, accountability, and evidence-based decision making (3).

Generation and utilization of quality health data are indispensable to ensure the functionality of health systems that ultimately improve health outcomes (4,5). However, the quality of routine health data in low- and middle-income countries is poor, making evidence-based decision-making at various health system levels difficult (6-8). Generating quality health and health-related data and their timely use has been recognized as essential in the Ethiopian Health Sector Transformation Plan (HSTP) (4,9). In response to this, the Ethiopian Ministry of Health (MoH) has been working on an extensive reform to redesign the national Health Management Information System (HMIS) to improve data and information quality continuously in the health sector (9). Even though the reform has taken significant steps to address the lack of routine health data, which has hampered the quality of care, planning, and management systems, as well as decision-making by managers at all levels of the health care system, poor data quality has remained a challenge (6,8,10).

The evidence from the Ethiopian public health institute (EPHI) report indicated that the antenatal care (ANC) report was matched with the source document only in about half (52%) of the studied health facilities across the country, giving a data verification factor (VF) of 0.93. Similarly, the delivery service report matched the source document 50% of the time, with a VF of 0.97 on a national scale. A data VF of  $< 1$  indicates lower numbers were recorded as being provided at lower health service levels than are reflected in the numbers sent to the next levels (over-reporting). Conversely, a  $\text{VF} > 1$  indicates that higher numbers were recorded as being provided at lower health service or administration levels than are reflected in the number sent to the next levels (implies underreporting) (11). Other studies in different parts of Ethiopia also revealed a data quality problem. The level of data quality assessed in terms of accuracy, completeness, and timeliness dimensions remained low and below the standard (11-13). The discrepancy observed between the desired and actual levels of data quality indicators in the country and the two regions requires extra effort (19).

Although various proven effective Data Quality Assurance (DQA) strategies, such as Lots Quality Assurance (LQAS), Performance Monitoring Teams (PMT) and Integrated Supportive Supervision (ISS), have been introduced in the country, their implementation is noncompliant with the recommended practices in most cases (9,14). Evidence

shows that systematically addressing the “Know-Do” gap using implementation research frameworks helps identify, understand, operationalize, and evaluate the ‘black box’ phenomenon, i.e., the implementation of an intervention (15). However, as an emerging research approach, it is rarely used in the real world. Challenges in the implementation of proven effective interventions cannot be effectively remedied by using conventional research approaches.

The present study was conducted as part of the implementation research project to characterize the quality of routine health data, and understand the implementation challenges of DQA strategies in public health facilities in Godere and Digalu-Tijo districts of the Gambella and Oromia regions of Ethiopia, respectively.

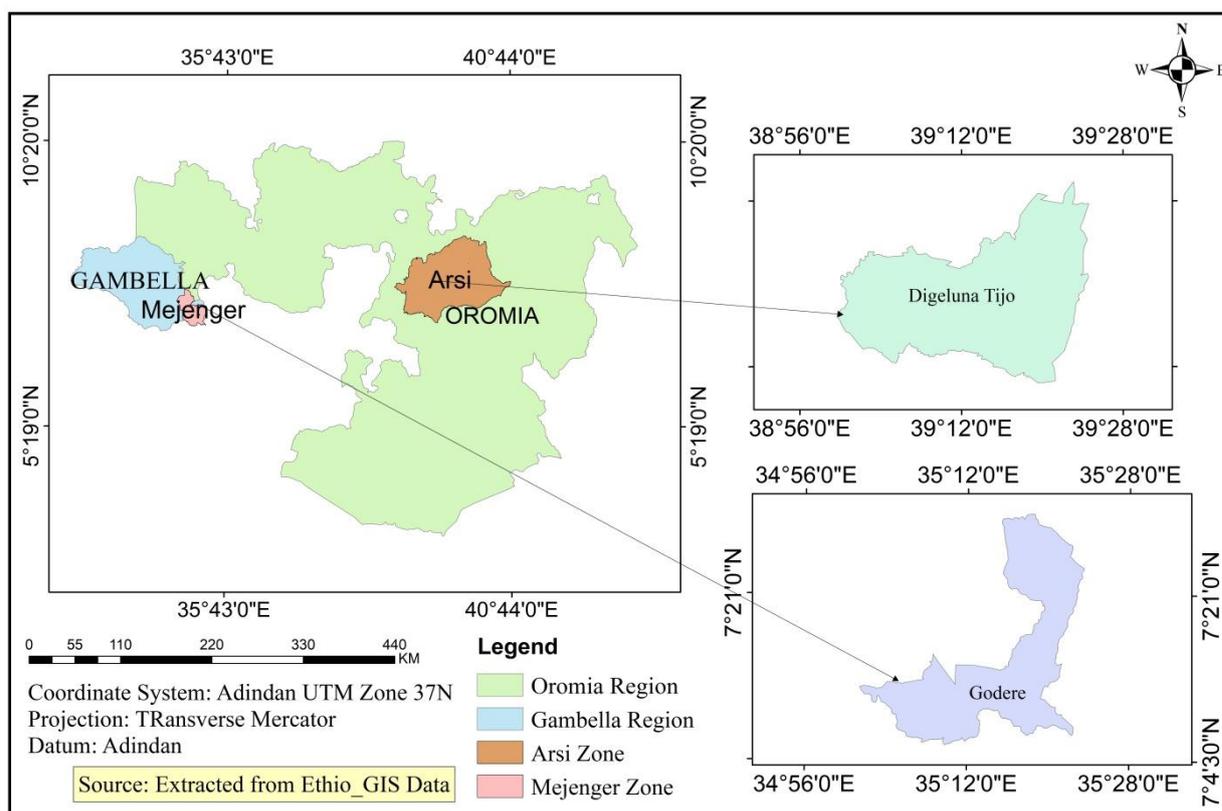
## Methods

### Study setting

The study was conducted in two districts, Digalu-Tijo in the Oromia region and Godere in the Gambella region. Purposefully these two districts were selected, with the purpose of demonstration and learning sites of Doris Duke Charitable Foundation (DDCF). They were selected in collaboration with the FMOH and their respective Regional Health Bureaus (RHBs).

Digalu-Tijo is one of the districts in the Arsi zone, Oromia region. It is located 200 KM southeast of Addis Ababa, the capital of Ethiopia (Figure 1). It hosts a population of 206,950 and is served by five health centers and 25 health posts. Asella University Hospital, which is part of the CBMP, serves as a referral facility for the district’s population.

Godere is one of the districts in the Majang zone of Gambella regional state. The district is located 205 KM South of the regional capital, Gambella, and 628 KM Southwest of Addis Ababa (Figure 1). A total population of 65, 009 reside in the district, served by two health centers and 14 health posts. Kumi primary hospital is part of the CBMP as a referral facility.



**Figure 1: Map of the study area**

### Study population

The study population for quantitative data was all health centers and hospitals and selected health posts found in Digalo-Tijo and Godere districts of Oromia and Gambela regional health bureaus.

The study population for qualitative data was selected healthcare providers who have worked in health institutions under these two districts. The selected health workers, who have more connection with HMIS data, were included in the study.

### Study design and participants selection

This study was conducted as part of a larger implementation project that intends to employ an institutional-based cross-sectional study design with a mixed methods approach. This paper reports the pre-intervention findings from the baseline assessment. All health centers and hospitals and selected health posts based on their performance one high, one medium and one low performer from each primary health care unit were included in the study. As a result, two hospitals, seven health centers, 35 health posts, and both district health offices were included in the study. The baseline survey was conducted in health institutions of the two districts from March 19-27, 2021.

Moreover, a total of 51 key informant interviews, four participants from each health institution, who have more connection with HMIS data like facility head, HMIS focal, MCH and outpatient department heads and from woreda HMIS focal, woreda health office, plan and MCH heads were included purposely. One health extension worker per selected health post was also included.

### Data collection

Data were collected using structured checklists, which were developed based on the Performance of the Routine Information System Management (PRISM) framework(16), which is comprised of a facility office checklist and a routine health information system (RHIS) diagnostic tool for quantitative data collection. Semi-structured Interview guides were similarly developed, guided by the PRISM framework, reviewing different literature and other national HMIS guidelines for qualitative data collection. The key contents of the interview guide were data quality assurance, Staff participation in maintaining data quality, data quality experiences of health facility staff and data quality problems. A tape recorder was used to conduct the in-depth interview, and the interviewers were master's degree holders and health professionals. The interview takes twenty-nine minutes and thirty seconds on average. Data collection instruments were translated into the local language by the subject matter, and language expert and back-translated to English with the independent expert translator.

A total of 14 data collectors and three supervisors participated in the data collection. Data collectors were health information technicians and other health professionals with a qualification of diploma or above. Supervisors were master's degree-holding health professionals. The research team was recruited from outside of the study area. A three-day training was given to the team on the purpose of the study, data collection techniques (including how to use a tape recorder), and research ethics. The data collection

process was monitored daily, and supervisors provided support and feedback in the field whenever needed.

### Data processing and analysis

Duplicate records were eliminated after each data record was reviewed for completeness and consistency. The quantitative data were entered and analyzed in Microsoft Excel, whereas the qualitative data were transcribed into Amharic and translated into English. Descriptive statistics were computed to summarize quantitative results.

Data accuracy was measured by calculating the HMIS data verification factor (VF). The verification factor was calculated as the ratio of a recount from the register over the HMIS data report. A  $VF < 0.90$  or  $VF > 1.10$  indicated over- and under-reporting in HMIS, respectively. HMIS data VF was calculated for the following nine data elements: skilled birth attendance (SBA), Penta 3 immunization, Measles immunization, Tuberculosis all forms, malaria, contraceptive acceptor rate (CAR), antenatal care fourth visit (ANC 4), early postnatal care (EPNC), and pneumonia treatment. Data completeness was assessed by taking the proportion of facilities within greater than 90% of the acceptable range for report completeness. It was calculated as the total number of reports received divided by a total number of expected reports in the specified period. The consistence of the reported data over time was assessed by using sample indicators (CAR, ANC 4, SBA, EPNC, Penta-3, measles and OPD visits over 12 months (January 2020 to December 2020).

Qualitative data were analyzed manually using a thematic analysis technique. The themes were discovered using the CFIR model's domains. As a result, the investigation concentrated on two of the model's five domains: inner setting and process. Tables and figures were used to present quantitative results, while qualitative results were narrated. Data from both sources were triangulated to interpret and discuss the findings as appropriate.

### Operational Definitions

**Data accuracy** is defined as the ratio of a recount from the register divided by the HMIS data report.

**Completeness of the report** is the proportion of reports received from specified health institutions out of the expected reports within the specified period.

**Data consistency overtime:** To examine the presence of any deviation from the mean of reported data over 12 months (January 2020 to December 2020) for selected indicators.

**Timeliness:** Proportion of reports sent timely from specified health institutions, according to a pre-defined schedule within the specified period.

### Ethical consideration

Ethical clearance was obtained from the Jimma University Institute of Health Institutional Review Board. The relevant Regional Health Bureaus wrote a support letter to district health offices and health facilities. The study was conducted in accordance with the Helsinki Declaration. Each participant was informed about the study's purpose, benefits, risks, and signed an informed consent form.

### Results

A total of 44 health facilities were included in the study for data quality assessment. Twenty-eight health facilities were from Digaluna Tijo woreda (5 health center, 22 health posts and one referral hospital), and the remaining 16 health facilities were from Godere woreda (2 health centers, 13 health posts and 1 primary hospital). Both woredas had no hospitals, and as a result, the zonal hospitals located adjacent to the woredas were included. All the health facilities, including the health posts, provide outpatient care, antenatal, postnatal and family planning services. Delivery services were provided only at health centers and hospitals. Moreover, 51 key informants (38 from Digaluna Tijo woreda and 13 from Godere) have participated in the study.

### Data quality

#### Accuracy

The data quality assessment in the Digaluna Tijo woreda has revealed that four indicators (contraceptive acceptance rate (VF 0.52), antenatal care coverage 4 (VF 0.79), early postnatal care coverage (VF 0.29) and pneumonia treatment (VF 0.83)) had an inaccurate data due to over-reporting. Similarly, the assessment result in Godere Woreda has indicated three indicators had inaccurate data due to over-reporting (malaria diagnosis (VF 0.18), early postnatal care (VF 0.79) and measles coverage (VF 0.73) and underreporting for antenatal care coverage 4 (VF 1.13). The most serious inaccuracies of data were reported in the Digaluna Tijo woreda for early postnatal care (VF 0.29) and Godere woreda for malaria diagnosis (VF 0.18).

Table 1: Data accuracy for selected indicators in Digaluna Tijo and Godere woreda, Ethiopia, 2021

Indicators	Digaluna Tijo			Godere			Total		
	Recounted	Reported	VF	Recounted	Reported	VF	Recounted	Reported	VF
CAR	5123	9846	0.52	1007	1007	1.00	6130	10853	0.56
ANC 4	577	726	0.79	135	120	1.13	712	846	0.84
SBA	3003	3068	0.98	218	219	1.00	3221	3287	0.98
Early PNC	876	2992	0.29	196	248	0.79	1072	3240	0.33
Penta-3	1987	2054	0.97	240	266	0.90	2227	2320	0.96
Measles	1889	1947	0.97	193	264	0.73	2082	2211	0.94
Malaria	390	428	0.91	13	71	0.18	403	499	0.81
Pneumonia	768	923	0.83	103	108	0.95	871	1031	0.84

### Completeness

The completeness of data was assessed based on report completeness and primary source document completeness. A total of 132 reports (84 from Digaluna Tijo and 48 from Godere woreda) were expected in the quarter preceding the study. All the facilities in the study woredas have submitted monthly reports, making a report completeness rate of 100%.

Family planning, antenatal care, delivery, early postnatal care and outpatient department registers were reviewed to check the completeness of data values for relevant variables. The family planning client records had all the required information except that the medical record number (MRN) was missed in 3.2% of the cases in Digaluna Tijo woreda and 32% of the cases in Godere Woreda. Moreover, the provider's signature was absent in 74% of the cases in Digaluna Tijo woreda and more than three-fourths of the cases in Godere woreda.

The antenatal care register was incomplete for the following information in Digaluna Tijo woreda: syphilis test result (14.4% of the cases), hepatitis B test result (14.4% of the cases), Tetanus toxoid provision (9.6% of the cases) and iron provision (40% of the cases). While, syphilis test and Hepatitis B test results were absent in 24.5% and 7.5% of cases in Godere

woreda, respectively. On the other hand, the review of delivery and postnatal care registers revealed that the newborn column was missing in 74.5% and 40% of the cases in the Godere and Digalu-Tijo districts, respectively.

The outpatient department (OPD) register was incomplete for the National Classification of Diseases (NCOD) in 11% of the cases in Digaluna Tijo woreda and the new/repeat category in 10.7% of the cases in Godere district.

### Timeliness

Greater than half of the expected reports (45 out of 84 expected reports or 53.5%) were submitted timely in the recent quarter preceding the study in the Digaluna Tijo woreda. While 38 out of 48 expected reports (79%) were submitted on time in the Godere district.

### Consistency over time

Except for the Penta-3 indicator, which had a moderate outlier (2 standard deviations from the mean) for April 2021, all of the reported data of the Digaluna Tijo woreda were consistent over time. On the other hand, a moderate outlier was observed for contraceptive acceptance rate, early postnatal coverage, and measles in Godere woreda (Figure 2a, Figure 2b, Figure 2c and Figure 2d).

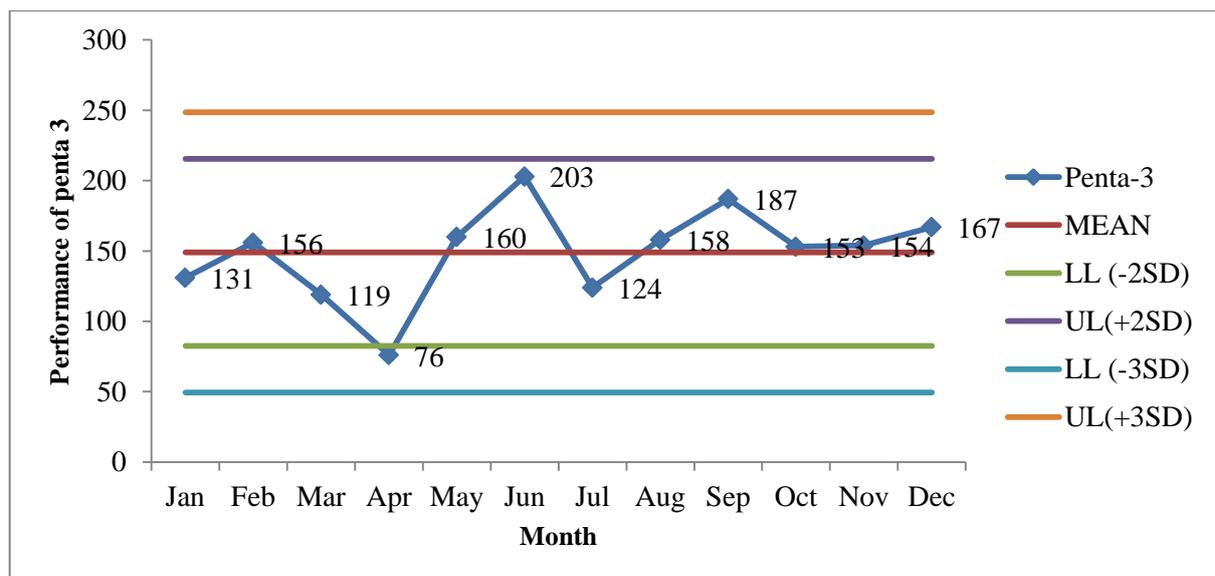


Figure 2a: Penta-3 data consistency over time at the Digalu-Tijo district, 2021

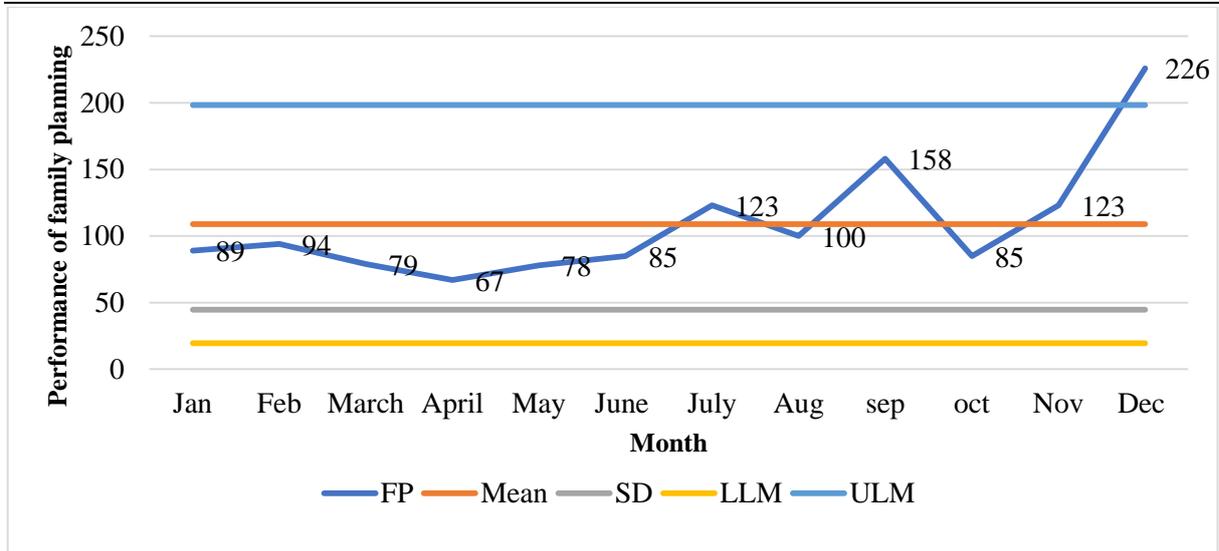


Figure 2b: Family Planning data consistency overtime at the Godere district, 2021

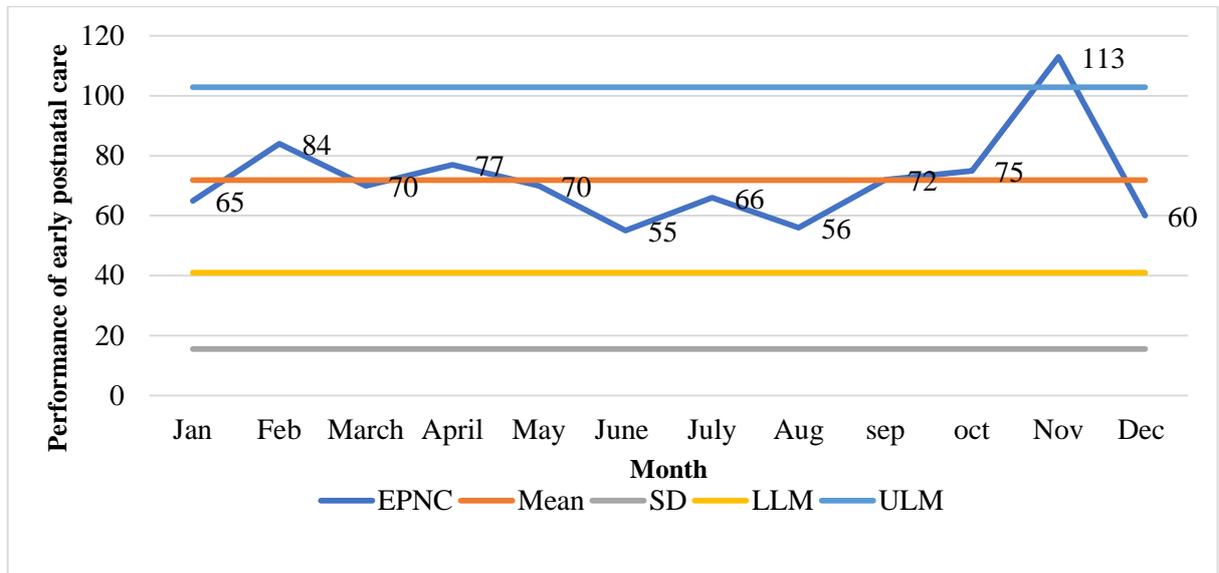


Figure 2c: Early Post Natal Care data consistency overtime at Godere district, 2021

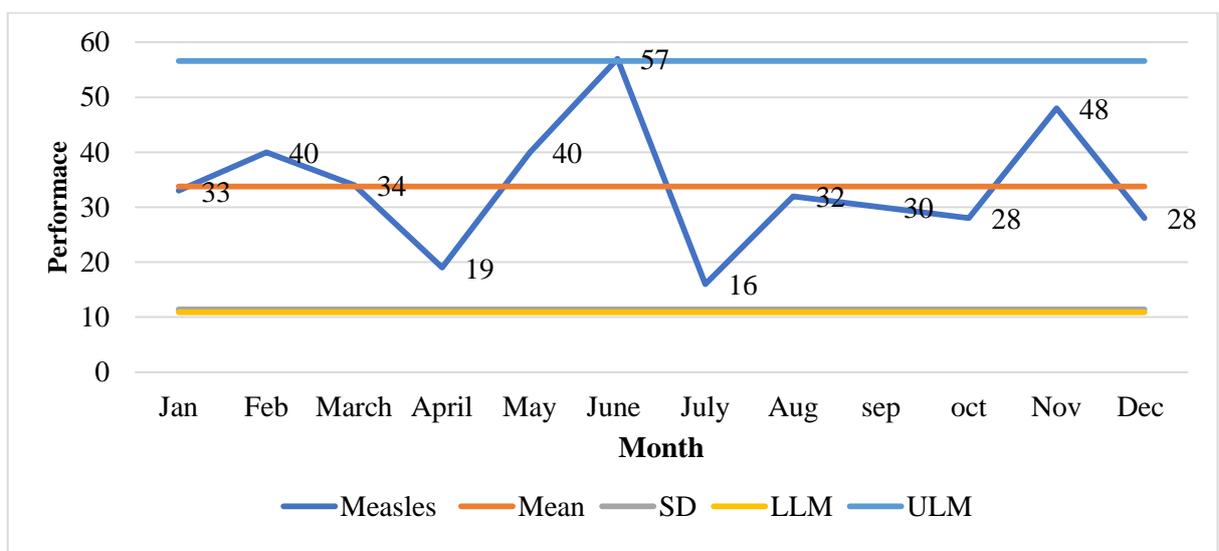


Figure 2d: Measles data consistency overtime at Godere district, 2021

Furthermore, the between-indicator consistency assessment has revealed a high level of inconsistency between the syphilis test and antenatal care one in Digaluna Tijo woreda. The syphilis test scored

approximately a quarter of a point higher than the antenatal care one. On the other hand, in three health facilities of Godere woreda (two health centers and one

hospital), antenatal care one has scored greater than a quarter than the syphilis test.

**Table 2: Between indicators consistency for selected indicators at Digalu and Godere districts, Ethiopia, 2021**

Woredas	Indicator	Values	Difference	% difference
Digaluna Tijo	Antenatal care visit 1	776	192	24.8
	Syphilis test	968		
Godere	Antenatal care visit 1	612	164	26.8
	Syphilis test	448		

### Implementation barriers

#### Inner setting

#### Supportive supervision, mentorship and review meeting

All health centers and hospitals in the Godere woreda had received regular supportive supervision and mentorship on data quality assurance with written feedback in the last quarter prior to the survey. An action plan was developed for all health facilities following supportive supervision. One-third (30.8%) of the health posts didn't receive supportive supervision and mentorship focused on data quality.

In support of this finding, a 26 years old, female health worker has mentioned that;

*'Supportive supervision has no fixed schedule or time, higher level supervisors did not use standard checklist...but, those who come from partner and region use the check list during supervision. They give a feedback to me orally however; sometimes they give by written form. We have a resource gap and transportation problem even we haven't motorcycle to conduct supportive supervision*

Contrasting to Godere district, none of the health centers or hospitals in Digaluna Tijo woreda has received monthly supportive supervision in the most recent quarter. The absence of internal supportive supervision was a lack of awareness and difficulty understanding supervision checklists. Most health posts (85%) had received supportive supervision once during the reference period and nearly half were provided a written feedback on the supervision findings.

This finding was affirmed by a 32 years old female health worker who she mentioned that;

*"...There is no supervision aimed at data quality and HMIS related from higher officials."*

All the health facilities in Digaluna Tijo woreda didn't receive external mentorship and haven't provided internal mentorships focused on data quality. The most frequent reasons for this were the lack of awareness, transportation to support lower-level facilities and the shortage of staff that provides mentorships. On the other hand, all health centers and most health posts (95%) in the woreda have conducted review meetings on data quality in the quarter before the survey period. A review meeting was not implemented in the hospital. The spread of the COVID-19 pandemic was mentioned a reason for not conducting the meeting.

A 40 year-old male health worker has mentioned that; *"There is no such strong mentorship program implementation whether from us or external body...but,*

*currently the mentorship program is implemented by partner only. The main mentorship implementation challenge is lack of transportation, additionally there is no enough budgets to conduct a mentorship"*.

Another 26 years old male health worker added that; *"...The mentorship is implemented quarterly ..... The mentors do not use checklist rather they discuss simply and give feedback. The schedule of mentorship is one challenge. It [mentorship schedule] is every quarter, not enough to improve our performance. Additionally, lack of resource {budget} is another challenge"*.

Some of the study participants in the Godere district have commented that supervision and mentorship feedbacks were constructive rather than destructive or discouraging. It was also revealed that HMIS review meetings were held once every quarter at the woreda level but not at all health facilities.

#### Availability of recording tools and reporting formats

Respondents from the woredas have reported that all required recording and reporting tools were available at the woreda health office level, including the ambulance service register, report timeliness and completeness monitoring form, performance monitoring team and data quality log-book, and reporting forms. However, a shortage of the revised HMIS tools was reported by a few participants in the Godere woreda, which has forced them to record on the older version.

A 28-year-old male participant described that; *"We do have adequate HMIS tools for the health center. However, in rare case if we came across scarcity, we communicate with regional health bureau and overcome easily"*.

Another 26-year-old female participant has said;

*"I did not remember the exact date, but we faced the scarcity of card many times. For example, if you see the antenatal care follow up paper, it has no card at all. We had been using blank paper to overcome that challenge. Even though it is not enough, currently we have a limited number of cards"*.

Cervical cancer screening and treatment (CCST), Post-exposure prophylaxis (PEP), and Trachomatous trichiasis (TT) surgical registers had never been sent to more than half of the health facilities in the Digaluna Tijo woreda. Two health centers had no PMTCT tally sheet, while 16.7% had never got an appointment card and/or master patient index (MPI). Moreover, all the district health facilities had no emergency or intensive care unit (ICU) register. More than half of the facilities

in the Godere district had no individual tracer cards, abortion care tally sheets, patient cards, and different registers, such as for HPV immunization, drug resistance tuberculosis (DR-TB) treatment and follow-up, ICU and visceral leishmaniasis. They also lacked health institution report timeliness and completeness monitoring forms and integrated management of newborn and child illnesses (2-5 years) registers.

At the health post level, we assessed the availability of all the necessary recording tools and reporting formats. Cards for integrated infectious and tropical diseases, nutrition, hygiene and sanitation, TB treatment follow-up, and integrated maternity and childcare were never available in all health posts in Godere woreda, despite being among the instruments anticipated to be provided at the health post-level. Tally sheets for common diseases, service delivery and drug availability, were also never available in these facilities. Furthermore, in 69% of health posts in the same woreda, a family folder (pouch) and a family health card were never available. Similarly, many items were never available in health posts of Digaluna Tijo woreda including quarterly diseases reporting format (81.8%), drug availability tally sheet (68%), disease tally sheet and dispensed family planning method tally sheet (54.5%), quarterly service delivery reporting format (36.4%), service delivery tally sheet (22.7%), Community Based Newborn Care register (0-2 months) (27.3%), and field book (13.6%).

Regarding the availability of recording and reporting tools, a 28-year-old female participant mentioned that; *“It is difficult to list for you but as a general we have no enough materials to do our daily activities*

A 29-year-old female participant elaborated on this idea:

*“...We have no tickler in our health post. Currently we have no family planning register book and appointment cards by which we give an appointment. So, in place of it we use traditional prepared one (i.e., which is prepared manually here in our health post)”*

### **The process**

A document review result of health institutions in the woredas revealed that nearly half of the health professionals did not receive any training on either of the following topics in the 12 months before the study period: data quality, information use, or the revised health management information system (HMIS). The professionals were not also trained on the national classification of diseases (NCoD), connected woreda (CW), DHIS2 and electronic medical record systems.

Of note, none of the HEWs in the Godere district was trained on electronic community health information (e-CHIS) and NCoD topics. Similarly, about a third (32%) of HEW in the Digalo-Tijo district were not trained on data quality, and the great majority (15%) of them were not trained on NCoD.

Most key informants in the Godere district similarly indicated inadequate coverage and quality of HMIS training. They mentioned that even the training

opportunity available for a limited number of staff members focused more on the theoretical aspects than the practical ones and was not need-based.

With this regard, a 40-year-old male participant said that;

*“HMIS training is given for limited number of staffs this may be reason for data quality problem. It is also not given based on our need; it is given based on the need of a body who prepares that training. The capacity of trainer is good”*.

### **Discussion**

Quality health data is a very important factor that enables health managers to monitor progress and make informed decisions for the improvement of the health status of society(11). Except for the completeness of reports, this study has found gaps in the quality of data generated through HMIS and identified barriers to implementing national DQA strategies in the two districts from the Gambella and Oromia regions. In terms of accuracy, the data gap between what is on the register and on report formats which show the tendency of over-reporting in all the assessed indicators in both districts and under-reporting in one of the indicators in the Godere was observed. All of these findings corroborate the findings on major data quality evidence published in several prior similar studies across the country (11,13,17-19). The problem of over-reporting might be related to incompleteness of data, not understanding the definition of cases or data elements or data that may not fall within the reporting period(20). The other issue may be the unintended effects of various incentive mechanisms to reward the best-performing health management structures and health facilities. Unless rectified through external assessments, the possibility that people may be motivated to over-report their performances with the aim of competing for rewards cannot be ruled out of the explanation(21). Computational errors due to a lack of data analysis skills might also be a reason for the observed gap(22). In the face of proven, effective improvement strategies in place, inaccurate, inconsistent, and incomplete data generated and submitted late indicate breakdowns along the implementation pathways. This may ultimately lead to indecision or wrong decisions.

Similarly, report timeliness was also assessed by reports by the predetermined deadlines. A serious gap in both districts, though it was much worse in Digalu-Tijo. All the health facilities had records to measure timeliness. The records of report receipt showed that 100% of the health facilities compiled and sent HMIS reports on time or met the reporting deadline from July/2015G.C to December/2015E.C. This result showed higher achievement than a study conducted in Southern Ethiopia, 77 %.

Unlike other studies, report representative completeness in this study is much better where close to 100% of the reports were submitted to the next level(17,23) and similar to the findings of a study done in the Tigray region and Rwanda, where 100% facilities met 90% requirements(24,25). Whereas content completeness was a major challenge in which

registers for various services at all levels (i.e., from HP to hospitals) were incomplete in both districts, and data were inconsistent both over time and between indicators. Similar to this finding, content incompleteness of the HMIS register and report was reported in other research (24,26,27).

Another dimension of data quality was timeliness, measured by facilities receiving and submitting reports by the predetermined deadlines. Accordingly, 53.5% of the report in Digelu and 79% in Godere were submitted to the next level. This finding is lower than the result from a study done in other parts of the country (17,24,27). Possible reasons may be due to the lack of attention of respondents about the implications of data not being submitted timely, and it may also be less emphasis was given to data quality during supervision.

Using the adapted CFIR framework, this study has also revealed barriers to implementing the strategies above. Barriers related to the inner setting of the implementation environment and the implementation processes were identified. The implementation climate is among the essential elements of the inner setting domain of the CFIR construct (15). This subdomain includes interventions such as access to knowledge and information, which can be achieved through supportive supervision and mentorship support from higher levels with proper feedback mechanisms.

Evidence shows that capacity-building activities such as supportive supervision and mentorship with responsive feedback systems have positive effects on data quality (3,12,28). The results showed that these interventions had not been carried out in both districts as per the national recommendation, although the extent of the gaps varied between the districts. In particular, the gaps were more pronounced in the Digalo-Tijo district than in the others. Internal supervision and mentorship were also missing in both contexts. Where supervision and mentorship were conducted, the constructiveness of the feedback was a concern for some participants. The regularity of review meetings was a concern as well. Some of these results are congruent with similar studies within the country and outside (17,29,30). The findings highlight limited opportunities for organizational learning in the study institutions towards data quality improvement. This might have contributed to the observed low level of data quality, although this needs further investigation with a more rigorous study design.

Assessment of readiness for implementation is another constituent of the inner setting, according to the CFIR framework, that might determine the successful implementation of an intervention (15). Under this subdomain, we assessed the availability of the required resources, mainly recording and reporting forms, to enable the implementation. In both districts, many recording and reporting items were either unavailable on the assessment day or unavailable in the studied health facilities. A shortage of staff was also mentioned in a few cases. This is another organizational bottleneck for implementing data quality improvement

interventions in the study settings. Other studies also reported similar results, lack of input and human resources as challenges for proper implementation of data quality interventions (18,24,31)

The process domain of the CFIR constructs assessed refresher training on HMIS-related topics. Many health workers from both districts did not receive such training in the 12 months preceding the study. For example, among the important topics on which training was not given are DQA techniques and related electronic platforms like DHIS2 and electronic medical record systems. Notably, no HEW was trained on electronic community health information (e-CHIS) and NCoD topics in the Godere district. Inadequate coverage and quality of training were also critical issues. More emphasis on theoretical aspects than practical and not based on felt needs were the specific concerns reported. This is another reflection of the weak capacity to carry out the required tasks and the limited organizational learning opportunities prevailing in the study settings. In fact, these findings could constitute part of the explanation for the low level of data quality previously mentioned. Intensification of training based on needs with proper planning and quality checks should be a priority for successful implementation.

### Conclusion and recommendation

In conclusion, data generated through routine HMIS is generally of low quality in the two districts. There are barriers to properly implementing the national DQA strategies in these settings. The identified barriers relate to the inner workings of the implementation environment and the process itself. Supportive supervision, mentorship, and review meetings are not accomplished as indicated in the strategy. Many health facilities lack important recording and reporting tools. Training on HMIS-related topics are inadequate both in coverage and quality. Therefore, it has been recommended that the identified breakdowns along the implementation pathways of DQA strategies should be fixed to ensure data quality. To improve data accuracy, health facilities should conduct a self-assessment of DQA using the LQAS tool, and administrative clusters (e.g., district, zone and region) should do the same using the RDQA tool. At the health facility level, self-assessment should be enhanced by enabling the PMT to conduct LQAS monthly and give feedback. HMIS focal persons at each administrative unit should ensure that reports are submitted on time, as this is their primary responsibility.

To minimize barriers related to the inner setting of the implementation environment, access to knowledge and information should be improved through supportive supervision and mentorship support from higher levels with a responsive and constructive feedback system. This should involve enhancing both internal and external support. Data quality review meetings should also be conducted regularly. These interventions will create opportunities for organizational learning and data quality improvement.

Organizational bottlenecks for the implementation of the DQA interventions should be avoided. Recording and reporting tools should be made available in all health facilities. Properly planned and need-based capacity-building training should be provided for the successful implementation of the information revolution roadmap.

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### Competing interest

The authors declare that they have no conflicts of interest in this work.

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