Original Research

DIGITAL HEALTH

Digital Health
Volume 8: 1–12

DOI: 10.1177/20552076221131151
journals.sagepub.com/home/dhj
SAGE

Level of implementation of district health information system 2 at public health facilities in Eastern Ethiopia

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Abstract

Objective: The major aim of this study was to assess the level of District health information system 2 (DHIS 2) implementation in the public health facilities (HFs) in Dire Dawa City Administration.

Methods: This study was employed both quantitative (cross-sectional) and qualitative (phenomenological) study designs. All public HFs found in Dire Dawa City Administration and health workers were participated in the study. Quantitative data were collected using a pre-tested, structured, self-administered questionnaire. The collected data were entered into Epi-Data and analyzed using STATA version 14 software. A descriptive summary was computed using proportion and frequencies. Qualitative data were collected from in-depth interview with key informants (KIs), and the results were then analyzed thematically.

Results: The overall implementation level of DHIS 2 was 80%, which shows good implementation. The main difficulties encountered in implementing DHIS 2 were a lack of power backup (64.3%), unreliable internet connectivity (43%), and a lack of training (34.6%). According to an in-depth interview with a 32-year-old professional, "...there is offline and online DHIS 2 software for data collection and reporting that is an opportunity for the health center, but there is a challenge of interruption of electricity lost unsaved data and hinder data to enter and view for making a decision...."

Conclusion: The level of DHIS 2 implementation in this study was good compared to other studies in Ethiopia. However, more than half of the HFs require infrastructure maintenance and support.

Keywords

District health information system 2, implementation, health information, Ethiopia

Submission date: 15 January 2022; Acceptance date: 20 September 2022

Introduction

The World Health Organization (WHO) defines a health information system (HIS) as a system that integrates data collection, processing, analysis, reporting, and use of information to improve health service effectiveness and efficiency through better management at all levels of health service practices.[1] The worldwide COVID-19 pandemic served as a wake-up call for the international health community about the critical role that HIS play in comprehending the effects of the pandemic on health services in

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Low and middle income countries. This provided a turning point for a significant advancement toward strengthening systems.[2]

District health information system 2 (DHIS2) is an open-source, flexible offline, and online software that collects, validates, analyzes, and presents data tailored to manage and aggregate patient-based statistical data and integrated health information.[3] The primary goal of DHIS 2 is to generate high-quality health data that can be used and communicated to the right people at the right time in the right format.[3,4] In the era of the Sustainable Development Goals (SDG), proper information use is seen as the cornerstone for efficient performance of the health system and as a method of achieving goals pertaining to health.[5] Despite its growing importance, the health information system has weaknesses and a high performing system need to be strengthened.[6]

DHIS2 is currently an inefficiently taught and implemented system in developing countries. Inadequate analytical abilities, a lack of internet access, electricity, supervision and regular feedback, organizational infrastructure, HIS training, knowledge, workload, computer skills, computer access, the availability of health management information system (HMIS) guidelines, and the availability of human resources are all issues that must be addressed.[7] Moreover, data stored in data banks, reports, or shelves are not sufficiently utilized in program development, quality improvement, strategic planning, and advocacy.[7–11]

Ethiopia has been putting various initiatives into action to strengthen the national HIS, such as the 2017 revision of the national HMIS, which was made possible by the creation of the roadmap for the information revolution, which helped to direct the information revolution's implementation. For instance, the Ministry of Health (MOF), in partnership with higher education institutions, launched a novel model called the Capacity Building and Mentorship Partnership (CBMP) Program.[4,12] Through the appropriate application of information and communication technologies, this initiative aims to maximize the availability, accessibility, quality, and use of health information for decision-making processes. However, the results of HIS implementations have fallen short of expectations. As a result, the quality of care and patient satisfaction at the health care facility remain low. This can be improved by implementing appropriate interventions and increasing the proportion of staff who are capable of producing higher-quality data and using continuous information for local action-oriented performance monitoring.[9] Poor HIS infrastructure includes things like lack of Internet access, insufficient power, a lack of medical record rooms, low staff commitment, inadequate support, poor data analytics abilities, high attrition rates among health information technicians (HITs), and limited use of e-Health applications or digitalization have all contributed to poor data quality and low information use.[13,14]

The Ethiopian government has considered about improving the HIS to effectively monitor and evaluate health policies, programs, projects, and strategies. For instance, Ethiopia developed a new HIS strategic plan for the period of 2020/21 to 2024/25 (2013 EFY to 2017 EFY) to enhance the use of digital health information technologies for HIS and improve HIS governance and leadership at all levels of the health system. It is noted that in these new strategies, only 1% of private HFs have DHIS2 in place and only 5% of healthcare facilities have enough HIS health workers.[15]

Even though Ethiopia has made impressive progress in the utilization of HIS in recent years, a growing body of evidence indicates that the level of data quality and the use of information for decision-making is still not adequate, which in turn affects the level of HMIS implementation.[12,16,17] In addition, to the best of the author's knowledge, no research has been conducted on the level of DHIS2 implementation in the public HFs in the study setting. As a result, this study aimed to assess the level of DHSI2 implementation among public HFs in Dire Dawa City Administration.

Methods and materials

Study area and period

The study was conducted at all public HFs in Dire Dawa City Administration. Dire Dawa City Administration is one of the Ethiopia's federal city administrations. It is located in the eastern part of the country, 515 kilometers from Ethiopia's capital city (Addis Ababa). According to 2019 Dire Dawa regional health office projections, the city administration of Dire Dawa had a population of 506,639 people, of which 248,253 (49%) were males and 258,386 (51%) were females. Out of the total population, 343,490 (67.8%) live in cities, whereas 163,150 (32.2%) live in rural areas. There were 2 public hospitals, 12 health centers, 32 health posts, and 1076 health workers in Dire Dawa City Administration.[12] The study was conducted from January 1, 2020 to May 30, 2020.

Study design and population

Sequential mixed study designs (quantitative and qualitative) were applied. Quantitative cross-sectional study design and phenomenological qualitative designs were applied. All health professionals working in DHIS2 activities and DHIS2 units of public HFs in Dire Dawa City Administration were a source of population, and all health professionals who were working in DHIS2 activities handled the data, used the generated data for decision making, and those who served as a focal person within the facilities where included in the study. Health workers with less than 6 months of experience, those on annual leave, and those on training leave were excluded from the study.

Sample size determination and sampling procedure

For the quantitative study. There were 2 public hospitals and 12 primary health care units (health centers). From each HF's, study participants were approached and information was obtained. The sample size was calculated based on the number of study participants from all HFs. As a result, the number of respondents was extremely low (42). All health institutions and those health professionals who served as the focal person with their HFs were included in the study instead of applying the probability sampling technique.

For the qualitative study. The sample size was calculated based on the level of information saturation and the variety of ideas among the sub-groups. Data saturation is the process of sampling until no new information is obtained and redundancy is reached. Because the study population was diverse, a key interview guide was used to gather more detailed information on the subject matter based on the research objective. To obtain detailed and in-depth information, KIs were chosen based on their level of involvement in the organization, training, and work experience. KIs were included in the qualitative study: from hospitals (5) [(chief clinical director (1), chief executive officer (1), OPD case team head (1), matron (1), DHIS2 focal (1)]; from health centers (5) [(5 PHCU heads, 5 DHIS2 focal), DHIS2 documents and reports; a total of 15 KIs are interviewed.

Data collection method and data collection procedure

The quantitative data were collected through structured questionnaires, observation, and document review. The questionnaire was adapted from various pieces of literature as well as the performance review information system management (PRISM) framework.[18–20] The questionnaires addressed the health worker's socio-demographic information, organizational factors, behavioral factors, and technical factors, compliance of health workers with national guidelines, level of knowledge on DHIS2, motivation of staff to collect data, utilization of DHIS2 data, and data quality. The scale's internal reliability was checked by Cronbach's alpha and its value was 0.87.

Document review. For data consistency, 2-month report formats, registration books, and/or tally sheets were reviewed to see whether data consistency existed between registration and/or tally sheets and report formats. Five data elements were reviewed (antenatal care first visit [ANC1], prevention of mother-to-child transmission [PMTCT] coverage, institutional deliveries, pentavalent/DTP third dose vaccine [PENTA 3], contraceptive acceptance rate [CAR], tuberculosis [TB] cure rate, malaria). For supervision, a two-quarter supervisory logbook was reviewed to assess whether HFs received supervision with written feedback based on the standard. For the self-assessment meeting, two-quarter self-assessment meeting logbooks were reviewed to assess whether the self-assessment meeting was held based on DHIS2 data or not. For lot quality assurance sampling (LQAS), LQAS registries were reviewed for 3 months to assess whether facilities conduct LQAS based on the standard.

Qualitative data were collected through an in-depth interview. A semi-structured interview guide was used. Each KI's data were recorded using an audio recorder in a controlled setting to avoid disruption during the interview. The collected data were checked for completeness, consistency, and clarity throughout the data collection period.

Eight health workers (two midwives, two diploma nurses, two health informatics technicians, one health officer, and one BSc nurse) with experience in DHIS2 tasks and training on DHIS2 were recruited to collect data. Data collectors were selected from public HFs that were not in the study area.

Operational definitions

Level of implementation. The level of DHIS2 implementation was assessed by availability, data quality, and utilization dimensions. The overall level of DHIS2 implementation was calculated by taking the sum of availability indicators, data quality, and utilization dimension scores. The following judgment criteria were used: Excellent (≥95%), Very Good (85%–94%), Good (70%–84%), Fair (60%–69%), and Poor (<60%).[21,22]

Health information utilization. Health information utilization was evaluated in terms of using information for decision making, presentations of indicators using charts and graphs, feedback and supervision, self-assessment, lot quality assurance system, performance monitoring team (PMT), department evaluation, service improvement, patient treatment, planning, and review meeting. Those health workers who used DHIS2 data for five or more of the 11 utilization questions were considered good health information users, while those who used less than five were considered poor health information users.[23,24]

Data consistency. Data consistency was measured by calculating the number from the source document over the number from a report submitted to the next level. Based on 10% tolerance, data accuracy is classified as: over-reporting (<90%), acceptable limit (90%–110%), and under-reporting (>110%).[9]

Content completeness. Content completeness was assessed by the proportion of filled data elements on report formats for selected months. A tolerance level of 90% was used

in grading facilities, which meant that each facility was expected to complete at least 90% of data elements on report formats.[25]

Data quality. Data quality was measured as the fitness of data use based on three dimensions: accuracy ≥80%, completeness ≥85%, and timeliness ≥85%.[26]

Availability of adequate amount of DHIS2 format. It refers to the presence of the following formats for at least the previous 3 months to the next 2 months: tally sheets, registers, and report forms.[22]

Medical record unit with adequate space. It refers to a minimum of 24 m^2 for health centers and 60 m^2 for hospitals.[8]

Data quality control

Data collectors and supervisors were trained for 2 days on data collection tools, obtaining consent, keeping the confidentiality of the information, and quality of data collection. The quality of data was guaranteed by conducting a pretest on 5% of the public HFs that were not eligible for the study before actual data collection and amendments were made accordingly. Every day after data collection, questionnaires were reviewed and checked for completeness, consistency, and clarity. Finally, double data entry was done by two data clerks, and the consistency of data was checked by comparing the two separately entered data.

To assure the quality of qualitative data, the in-depth interview was recorded using an audio recorder. Authors check for the interviews (after the transcription, by summarizing main points and confirming with the interviewee). The initial results were shown for the peers to receive input (peer debriefs). Moreover, triangulation through various KI interviews was employed.

Data processing and analysis

Data were entered into Epi-Data version 4.6 and exported to Statistical Package for the Social Sciences (SPSS) version 20 for further processing and analysis. Descriptive information was presented using frequency, percentage, mean, and standard deviation. Categorical data were used for cross-tabulation and association among variables using the chi-square test.

For the qualitative data, responses from KIs were coded, categorized, and analyzed using the thematic analysis technique using ATLAS.ti version 7.1. The recorded data were transcribed and translated. Then the translated data were coded into different codes. Each code was categorized into different categories and then categorized into themes.

Results

Characteristics of health facilities

Fourteen HFs were included in the study. The response rate increased to 100%. Twelve of them were health centers and two of them were hospitals. In those HFs, 42 study participants were included in the study. The DHIS2 national open-source data processing system was used by all healthcare facilities for data entry and analysis. DHIS2 currently takes the place of e-HMIS.

Availability of required resources

A finding from resource inventory and participant interviews for the availability of resources indicated that all public HFs have DHIS2 focal persons, and health informatics technicians were assigned as the DHIS2 focal point in approximately 12 (85%) of the HFs. The presence of required resources for DHIS2 implementation was observed in 14 HFs (2 hospitals and 12 health centers). Almost all public HFs had a well-equipped DHIS2 unit, including a DHIS2 office, computer access, and DHIS2 software, and all had policies in place to prevent unauthorized data changes (password). HITs were present in 85% of the HFs. Almost 65% of facilities have set aside funds from their total health expenditure budget for DHIS2-related activities and have begun printing full DHIS2 recording and reporting tools. In terms of training availability (data analysis and management), approximately 64% of HFs trained their staff on DHIS2 implementation. All 14 (100%) HFs established a HMIS office and a PMT.

In terms of supportive supervision and feedback, according to standards, approximately 78% of facilities (HFs) received supportive supervision from their respective higher level. In the last two quarters, the majority (85.7%) of HFs completed self-assessments based on the standard.

More than half of the HFs (57%) have an internet connection for DHIS2 software. However, the majority of HFs (64.3%) lack electricity and do not have a backup generator. For data collection, data transfer, data management, data analysis, data dissemination, and data use, the majority of HFs used DHIS2 with a proper backup system to HMIS. About 93% of HFs had HMIS indicator definition reference guidelines, 64% of HFs had a national classification of disease (NCD), and nearly two-thirds of HFs had standard shelves with free space for the new individual folder (Table 1). Generally, the availability of DHIS2 HFs structure was 79.98%, which was good according to HIS judgment criteria (Table 2).

Data quality

Reviewing documents revealed data accuracy, report completeness, content completeness, and report timeliness on

Table 1. Availability of resources for DHIS2 implementation in the public HFs of Dire Dawa City Administration, Eastern Ethiopia, 2020 ($n = 14$).

Variables	Frequency (#)	Percentage (%)
Health information system unit/center of HMIS office		
Yes	14	100
No	0	0
Health information technicians		
Yes	12	85.7
No	2	14.3
Access to computer and printer in the DHIS2 unit		
Yes	14	100
No	0	0
Access to internet connection for DHIS2 unit		
Yes	8	57
No	7	43
Allocation of budget for DHIS2 report form procurement		
Yes	9	64.4
No	5	35.6
Access to electricity power with backup functional generator		
Yes	5	35.7
No	9	64.3
Access to DHIS2 software used for data capturing and reporting		
Yes	14	100
No	0	0
DHIS2 manuals and guideline, NCD, indicator definition reference		
Yes	12	85.7
No	2	14.3
Standardized common data collection and reporting tools		
Yes	12	85.7
No	2	14.3
Functional PMT minute logbook		
Yes	11	78.5
No	3	21.5
HFs with medical record unit with adequate space which serves for 24 h		
Yes	13	92.8
No	1	7.2
HFs with free shelve for the new folders in medical record room		
Yes	9	64.4
No	5	35.6

Note. DHIS2 = district health information system 2; HFs = health facilities; HMIS = health management information system; NCD = national classification of disease; PMT = performance monitoring team.

the data quality sub-dimension. For data accuracy, report completeness, report timeliness, and the overall sub-dimensions assessed in the HFs were 93%, 88%, and 91.6%, respectively. The overall data quality of the HFs was 87.5% based on the three dimensions of data quality (Table 3).

Data accuracy was evaluated using seven data items or indicators. From the top priority indicators at the national level, the seven indicators verified were: ANC1, CAR, institutional delivery, PENTA 3, PMTCT, TB cure rate, and confirmed malaria cases. Service delivery reports and registration books were checked for January and February at random. Ten (71.4%) of the 14 public HFs observed were within acceptable levels of accuracy (90% tolerance level).

In terms of consistency based on the seven selected indicators, the tendency of over-reporting was observed in two indicators (PMTCT and PENTA 3), which were reported by eight (75%) HFs, 1.3% and 2% (more than 10% tolerance level), respectively. The HFs did not show any signs of under-reporting. According to the findings, 10 (71.4%) of HFs accepted five indicators (ANC1, institutional delivery, CAR, malaria, and TB cure rate) (Figure 1). The overall accuracy of the data findings was 93%.

In terms of data completeness and report timeliness, the overall content completeness was scored 88% after checking 2 months of service delivery reports to see if the required data elements in a report form are filled out or data are complete. The findings of the observation and document review indicated that 91.6% of HFs report their

Table 2. Judgment matrix for availability dimension for implementation of DHIS2 in the HFs of Dire Dawa City Administration, 2020.

Indicators	Weight given (X)	Expected value (Y)	Observed value (Z)	Finding (X × Z/Y)
Proportion of HFs with DHIS 2 unit in the organization	4	14	14	4
Proportion of HFs with at least one health information technician (HIT)	3	14	12	2.57
Proportion of HFs have computer and printer in DHIS 2 unit	3	14	14	3
Proportion of HFs with any type of internet connectivity	3	14	8	1.71
Proportion of HFs that allocate budget for DHIS 2 from total health budget	3	14	9	2
Proportion of HFs that have electricity power with backup functional generator	1.5	14	5	0.54
Proportion of HFs that have DHIS 2 software used for data capturing reporting, compiling, analysis	4	14	14	4
Proportion of HFs that have updated implementation guidelines (NCD), DHIS 2 guideline, HMIS indicator definition	3	14	12	2.57
Proportion of HFs that have standardized common data collection and reporting tools	4	14	12	3.43
Proportion of HFs that have functional performance monitoring team	1.5	14	11	1.18
Proportion of DHIS 2 units with stationary materials during data collection	3	14	11	2.35
Proportion of HFs with free shelves for new folders in medical record room	2	14	9	1.3
Proportion of HFs with medical record unit which have adequate space and service for 24 h	3.5	14	13	3.25
Proportion of HFs that have landline telephone service	1.5	14	5	0.21
$32.43/39 \times 100 = 83.2\%$	39			32.43

Note. DHIS2 = district health information system 2; HFs = health facilities; NCD = national classification of disease.

records to the next level of stakeholders before the deadline. According to the report receipt records, 8.4% of the DHIS2 reports sent did not meet the reporting deadline. Based on the proportion of HFs, approximately 91.6% of the 14 HFs were found to be within 90% of the tolerance level.

Utilization dimension

In the two quarters preceding data collection, approximately 64% of HFs held monthly performance monitoring review meetings using HIS data. Using DHIS2 data, more than a third of HFs (78%) held self-assessment meetings in the last quarter. In the last two quarters, more than half (57%) of HFs made decisions based on DHIS2 data.

In this study, 12 (%) of administrative units held review meetings with all departments in the last two quarters, and also 85.7% of HFs performed LQAS monthly in the previous quarter. According to the current study's findings, the utilization of DHIS2 was 70.3% (Table 4).

The overall level of DHIS2 implementation

The implementation value is the sum of three dimensions, namely, infrastructure structure/availability, data quality, and information utilization. According to the current study's findings, the overall level of DHIS2 implementation was 80%. The three dimensions with their weights are summarized in Table 5.

Table 3. Data quality dimension in the public HFs of Dire Dawa City Administration, Eastern Ethiopia, 2020.

Dimensions	Indicators	Weight given (X)	Expected value (Y)	Observed value (Z)	Finding (X × Z/Y
Data quality (26%)	Proportion of HFs that conduct LQAS as per standard	2	14	12	1.7
	Number of administrative health units with report completeness within national standard	12	14	12	10.3
	Number of administrative health units with report timeliness within national standard	2	14	13	1.85
	Proportion of HFs with data accuracy within national standard	4	14	13	3.7
	Number of administrative units which conduct review meeting as per standard	4	14	12	3.5
	Proportion of HFs with content completeness of reports within national standard	2	14	12	1.7
26 = 100%	22.75/26 × 100 = 87.5%	26			22.75

Note. HFs = health facilities; LQAS = lot quality assurance sampling.

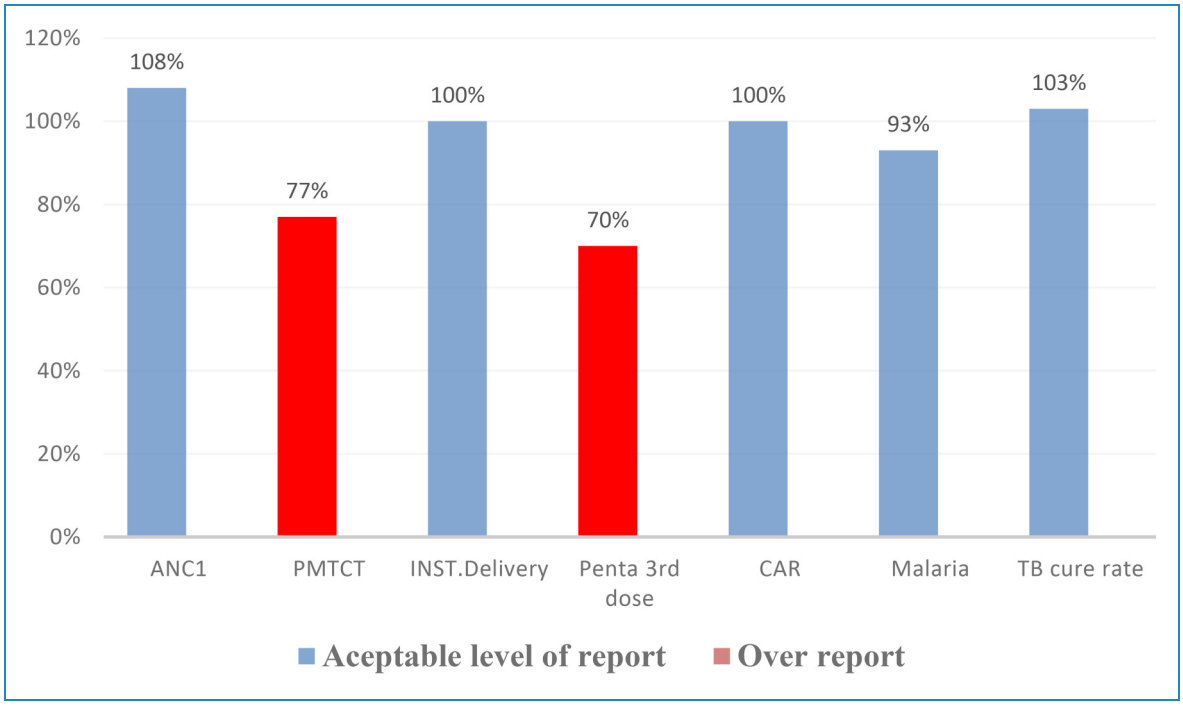

Figure 1. Schematic representation of data accuracy by indicators for the level of implementation of DHIS2 in the public HFs of Dire Dawa City Administration, 2020. *Note.* DHIS2 = district health information system 2; HFs = health facilities.

Qualitative results

Theme 1: Data reporting. In-depth interviews with KIs were conducted to hear their perspectives on how the DHIS2 is being used in their HFs for data collection and reporting. The majority of respondents stated that the DHIS2 system is very convenient for both staff and patients to use when action and decision-making are required. In-depth interview with KIs about the common tools used in their HFs for data

Table 4. Judgment matrix for utilization dimension for implementation of DHFS2 in the public HFs of Dire Dawa City Administration, Eastern Ethiopia.

Dimensions	Indicators	Weight given (X)	Expected value (Y)	Observed value (Z)	Finding (X × Z/Y)
Utilizations (30%)	Proportion of HFs received supportive supervision from higher level quarterly with written feedback	4	14	11	3.15
	Proportion of HFs that conduct LQAS as per standard and utilized for gap improvements	1	14	12	0.85
	Proportion of HFs that conduct self-assessment	4	14	12	3.43
	Proportion of HFs that analyze data quarterly to meaningful information by table/percentage/graph	4	14	9	2.57
	Proportion of HFs make decision based on DHIS 2 data	12	14	8	6.85
	Proportion of HFs that conduct PMT as per standard	1	14	12	0.85
	Proportion of HFs those conduct participatory review meeting as per standard	4	14	12	3.43
	Proportion of HFs used DHIS 2 for program improvement	1	14	8	0.57
	Proportion of HFs have DHIS 2 access right for any required purpose	4	14	10	2.9
	24.6/35 × 100 = 70.3%	35			24.6

Note. DHIS2 = district health information system 2; HFs = health facilities; LQAS = lot quality assurance sampling; PMT = performance monitoring team.

Table 5. The overall level of implementation of DHIS2 in the public HFs of Dire Dawa City Administration, Eastern Ethiopia, 2020.

Evaluation dimensions	Indicators numbers	Value given (x)	Value achieved (y)	Percentage achieved (y/x × 100)	Judgment
Availability	15	39	32.43	83.2	Good
Data quality	6	26	22.75	87.5	Very good
Utilization	9	35	24.6	70.3	Good
Total	30	100	80	80	Good
Judgment parameter: ≥95–excellent, [85–94]–very good, [70–84]–good [60–79]–fair, [<60]–poor[4,6]					

Note. DHIS2 = district health information system 2; HFs = health facilities.

collection and reporting. According to one of the interviewees, "service reports were reported using standardized tools (tally sheet, registration log-book, and report formats) provided by the regional health bureau…" (Report from a 32-year-old female HIS officer). In-depth interview with KIs to hear their thoughts on the new DHIS2 and how it is being used in their HFs for data collection and reporting. Respondents see "DHIS2" as a chance to digitalize Ethiopia's health sector information revolution. It also helps health managers and providers in visualizing data coverage trends with catchments and avoiding multiple parallel reports. It is also possible to use any technology to view the report in the form of table figures and charts from any location at any time using a smartphone, tablet, or laptop. It is simple, comfortable, and best for staff as well as the patient.

Theme 2: Challenges of implementation of DHIS2 and a way forward. The majority of HFs reported that they brought their generator to the maintenance center but did not return to the HFs quickly, preventing them from viewing data and entering it into the DHIS2 software. This inference was supported by a 30-year-old male with 4 years of experience as DHIS2 focal personnel from a health center who stated, "There is offline and online software in the health center. However, because there was no backup generator, the power outage resulted in the loss of unsaved data…." Similarly, a 32-year-old male with 6 years of experience as DHIS2 focal personnel from a health center stated, "… there is offline and online DHIS2 software for data collection and reporting that is an opportunity for the health center, but there is a challenge of interruption of electricity lost unsaved data and hinder data to enter and view for making a decision…." The other challenges were in DHIS2 format. OPD case team head of one hospital stated that "DHIS2 Formats are complex for all staff, because of lengthy statements is too difficult to read and as well as to write in the case of standardization some information is missed, and also there is no enough space in tally sheet to write data from patients records that is the challenge for working staffs."

In a similar vein, the medical director of the hospital believed that most implementation-related issues stemmed from a lack of follow-up, training, coordination, cooperation, and communication, and he concluded his remark as follows: "…Who owns the DHIS2 project? Please train our staff to keep continuity on track; otherwise, please hand over the key to the appropriate and responsible organization so that we can enjoy the benefits and fruits of DHIS2 while being held accountable for the failure by implication."

Regarding a way forward to a challenge: In-depth interview with 33 DHIS2 focal people in the health center who stated that "health care providers and record officers should be motivated to consider DHIS2 as a routine of their professional duty, the regional health bureau and other stakeholders should take their share on implementation rather than complaining and waiting for reports…."

Theme 3: Organizational culture. To support and strengthen this change in health worker behavior, the organizational culture must change its attitudes.

According to KIs from the health center, "only data collection and reporting for the regional health bureau and FMOH should not be the final goal of DHIS2 activities." There should be a culture of using information for decision-making and planning, program improvement, and service improvement at both the HF and office levels. According to a key informant with the chief executive officer, "…information utilization in our hospital is essential for managers, community, and staffing health workforce and decision making, resource allocation, and health service quality improvements…."

According to KIs who worked 4 years in the DHIS2 unit in the health center, "…before implementation of DHIS2 is poor, the reason is LQAS tool is not standardized, but currently, in our health center there is LQAS minute logbook to monitor data quality every month and there is a great improvement data quality." A KI, a 37-year-old health officer, stated that there is a "…culture of information for decision making and resource allocation. I mean that health information is much more than just numbers. Data have no inherent value; value and relevance emerge as a result of data management and analysis, the process by which data are transformed into information and knowledge for action…."

Discussion

This study focused on the level of implementation of DHIS2 among public HFs by using three dimensions: structure/availability of resources (inputs) required to implement the DHIS2 program (79.98%), data quality dimensions (91.6%), and health information utilization for decision-making in organizational management bodies (70.3%).

The findings of the current study showed that the level of implementation of DHIS2 in the public HFs in Dire Dawa City Administration was good (80%). This study's findings were higher than the findings of the study conducted in Tigray (75.2%).[22] The current finding is also higher than the national report of HIS implementation which was 74.2%.[12] It is, however, lower than studies conducted in the Oromia region (88.6%)[10] and in Malawi (88%).[27] This disparity could be attributed to the government's recent emphasis on information revolution agendas in health sector transformation plan (HSTP) as well as differences in the study population.

According to the findings of this study, the general structure of implementation resources for DHIS2 in the HFs was 75.75%. The following resources were available for DHIS2: DHIS2 office (100%), computer (100%), internet (57%), electricity supply (35.7%), and report formats (85.7%), respectively. This finding is more significant than any other study previously conducted in Iran.[28] The lack of training on health information management systems among HFs hampered HIS implementation and HIS practice. According to a qualitative study conducted in Kenya, a lack of adequate training hurts the performance of health care facilities.[20,29]

According to the findings of this study, the availability of DHIS2 training in the HFs was 64.4%. This study's findings were superior to those of other studies conducted in the Amhara region of North Gondar (12.8%),[30] Oromia (31.3%),[10] in Hadiya zone 35.2%,[31] and Tanzania (19%).[32] This could be due to increased awareness among data collectors in the HFs, as well as the current government in HSTP giving strong attention to HIS at public HFs, a focus on information digitalization transformation in the

strategic plan, and stakeholder support. This finding was supported by a KI interview with a health information focal from a primary health care unit, who stated, "…As I believe the DHIS2 is in an immature stage to transform from paper to digitalization to health information system, and receiving training on DHIS2 is good for frontline managers and patients for successful continuity of implementation…." PMTCT and PENTA 3 were over-reported by eight (75%) HFs, 1.3 and 2% (more than 10% tolerance level), respectively. The results showed that the accuracy was 93%. This study's findings were higher than those of previous studies in Mekele (63.3%), Kenya (80.5%), and Southern Ethiopia (74.9%). This study's findings are even lower than those of Aqil et al.[33] (95%). The difference could be standardized data quality checks performed regularly in the facility, as well as increased accuracy awareness.

According to the findings of this study, data completeness was 88%. This study's finding is in line with the study conducted by Manya and Nelson[34] (86.9%). However, this study is lower than the studies conducted in Rwanda (96.6%)[35] and Ghana (99.1%).[36] These findings were also higher than the study reported by Cheburet and Odhiambo-Otieno (44%)[6] and a study conducted in Tanzania (64.2%).[37] Even though the results were comparable across studies, they fell short of the national standard. This could be due to implementation maturity and study population differences.

The overall utilization rate of information was found to be 70.3% in this study. This study was strikingly similar to a study conducted in Hadiya Zone (69%),[38] but it was higher than a study conducted in North Gondar (22.5%),[39] Jimma (32.9%),[40] Oromia Special Zone (52.8%),[41] East Gojam (45.8%),[13] Addis Ababa (41.7%),[42] southwest of Ethiopia (57.3%),[43] and West Amhara (38%).[4] This variation could be attributed to differences in study periods and populations, as well as the availability of DHIS2 infrastructure.

All of the HFs had established a PMT, and almost all (85.6%) of the HFs held monthly PMT meetings using a minute logbook, but the majority of the facilities did not implement a solution based on the problem identified. The outcome was nearly comparable to the national standard, which stated that all HF should hold monthly PRT meetings based on the DHIS2 monthly report. The outcome was superior to the national assessment and study in the Southern Nations, Nationalities, and People Region (SNNPR).[44] The variation could be attributed to the positive impact of the information revolution and the period in between, as well as a positive habit of data culture and the current emphasis on the information revolution. According to the findings of the document review, 57.14% of facilities made decisions in the previous two quarters based on DHIS2 data. The finding was marginally better than the result of the SNNPR's national systematic review and assessment.[44,45] The emphasis placed on evidence-based decision-making by various stakeholders following the information revolution agenda may have contributed to the improvement. This was supported by an in-depth interview with the CEO. "…I believe our hospital promotes an information culture for decision-making and resource allocation. I mean that health information is much more than just numbers. Data have no inherent value; value and relevance emerge as a result of data management and analysis, the process by which data are transformed into information and knowledge for action." The facility did not have a map of the catchment area. In the facility, 64.4% of the HFs reports were displayed using charts, figures, and tables based on quarterly or monthly data. Concerning challenges related to the information infrastructure, internet connection, electricity power and backup, and the absence of free shelves for new individual folders were the most notable.

Strength and limitations of the study

This study included all urban and rural health care facilities found in the selected administrations. In addition, the study also used mixed methods to triangulate quantitative and qualitative data and to gain a better understanding of the subject matter. It might have pointed out where more work needs to be done to enhance the implementation of district HISs. However, the limitation of this study was that the spread of global pandemic COVID-19 coronaviruses impedes movement and contact. Besides, using secondary data may result in an underestimation of the findings. Another drawback of this study may be the small sample size.

Conclusion

The level of implementation of DHIS2 at the public HF in Dire Dawa City Administration is good compared to other studies conducted in Ethiopia. Even if its continuity is jeopardized by insufficient infrastructures, such as internet, power supply, a shortage of new individual patient folders, and a lack of training.

Acknowledgments: We would like to extend our sincere thanks to Haramaya University, College of Health and Medical Sciences, and Dire Dawa City Administration Health Bureau for allowing and supporting us to perform this research. We would also like to thank the data collectors for their substantial role in this research.

Availability of data and materials: All the necessary data are included in the manuscript. If additional data is required, it can be requested from the corresponding author.

Contributorship: The first author conceived of the idea and played key roles in data review, analysis, writing, and manuscript preparation. The co-authors, TG, BH, DT, AD, EY, and AE contributed to the re-analysis and writing of the final draft of the

results. Furthermore, the manuscript was written by the co-authors. The final manuscript was read and approved by all authors.

Consent to publication: Non-applicable.

Declaration of Conflicting Interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval: The study was approved by the Haramaya University, College of Health and Medical Sciences, Institutional Health Research Ethics Review Committee (IHRERC). A formal letter was written from Haramaya University, College of Health and Medical Sciences to all the concerned authorities throughout the process. Informed, voluntary, written, and signed consent was obtained from the head of the hospital. Permission was secured at all levels before the start of the study. Searching and obtaining the selected samples' medical records were processed with an assigned person.

Funding: The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was funded by Haramaya University.

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