ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Assessment of Routine Health Information System (RHIS) Data Quality and Factors Affecting it, Addis Ababa City Administration, Ethiopia,2020

BY: Binyam Haftu (BSc.)

A Thesis Submitted to the School of Public Health of Graduate Studies Addis Ababa University, in Partial Fulfilment of the Requirement for Master's Degree of Public Health in Epidemiology and Biostatistics**.**

October 2020

Addis Ababa, Ethiopia

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Examiners' Approval Sheet

We, the undersigned, members of the Board of Examiners of the final open defense by Binyam Haftu Tsadik, have read and evaluated his thesis entitled "assessment of routine health information system (RHIS) data quality and factors affecting in Addis Ababa city administration, Ethiopia". This is to verify that the thesis has been accepted in partial fulfillment of the requirements for the Master of Public Health degree in "Epidemiology and Biostatistics"

Name of internal examiner:

Signature ___________

Date:

Name of external examiner:

Date:

Signature __________

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Acronyms and abbreviations

AA	Addis Ababa
AARHB	Addis Ababa regional health bureau
ANC	Antenatal care
ANOVA	Analysis of variance
ART	Antiretroviral therapy
CBMP	Capacity building and mentorship project
CO-VID	Coronavirus disease
DDCF	Doris Duke Charitable Foundation
DHIS	District-based Health Information System
DPT	Diphtheria-tetanus-pertussis
HIS	Health Information System
HIV	Human immune virus
HMIS	Health management information system
HSDP	health sector development plan
HSTP	health sector transformation plan
IT	Information technology
LAFP	Long-acting family planning
LBI	Local Bacterial infection
MAT	Management assessment tool
MOH	Minister of Health

MCH	Maternal and Child Health
NCDs	Non-communicable diseases
NGO	Non-governmental organization
OBAT	Organizational and behavioral assessment tool
OPV	Oral Polio Vaccine
OPD	outpatient department
PNC	postnatal care
PLWHIV	people living with HIV
PCV	pneumococcal vaccine
PRISM	Performance of Routine Information System Management
PRT	Performance review Team
RHIS	Routine Health Information System
SNNPR	South Nations, Nationalities and People Region
SPSS	Statistical Package for the Social science
TT	Tetanus toxoid vaccine
TB	Tuberculosis
VCT	Voluntary counseling Test
VF	Verification factor
WHO	world health organization

Abstract

Background: Effective and efficient health care services need evidence-based decisions and these decisions should rely on information from high-quality data. However, despite a lot of efforts, routine health data is still claimed to be not at the required level of quality for decision-makers. Previous studies have primely relay on organization-related factors little emphasis was given for perception and knowledge of service providers' gaps. Therefore, this study aims to evaluate the quality of data generated from routine health information systems and factors contributing to data quality from diverse aspects.

Objective: To assess the quality of data from routine health information systems and factors contributing to data quality collected in health centers of Addis Ababa City administration, Ethiopia.

Method: A cross-sectional study was conducted on 568 health professionals from 33 health centers selected randomly using a two-stage sampling method. A qualitative study was conducted using 12 key informants. The World Health Organization data quality report card framework and PRISM tools are used to assess the quality of routine health data and factors affecting it. Descriptive statistics, correlation, ANOVA, and non-parametric tests were done using SPSS version 23. Qualitative data analysis was done using ATLAS ti version 7.5 using a thematic analysis approach.

Result: Timeliness of report, data accuracy, registration completeness, and report completeness level of the selected facilities was 40.39%, 76.67%, 96%, and 93.93%, respectively. The overall regional data quality level was 76.22%. Health professional perception on evidence-based decision making, the emphasis given to data quality, feedback, and health professionals motivation towards routine health care data have shown a strong association with data quality,(r (31) =.78, p<.001), (r (31) =.72, p<.001), (r(31)=.75,p<.001, (r(31) =.71,p<.001),respectively. Lack of adequate health information system task competence and Knowledge, non-functional PMT, lack of supervision, and technical factors were also commonly reported reasons for poor data quality

Conclusion: This review has documented data quality of routine health information systems from health centers under Addis Ababa city. Overall data quality was found to be below the national expectation level. The study emphasized strengthen the existing performance monitoring team and building a motivated and skillful health workforce has a crucial role in improving the quality of routine health care data.

Keywords: RHIS, Data Quality, Accuracy, completeness, timeliness, consistency, health center, Addis Ababa

1. Introduction

1.1. Background

Measuring and improving the quality of routine health data requires a properly functioning information system that captures, stores, manages, or transmits information related to the health of individuals and health-related activities at all levels(1–3).

A routine health information system is a system designed for regular collection, processing, use, and dissemination of health-related data to improve the management of programs, resources, and health care outcomes(4).

As there is a Global shift from curative to preventive care through decentralized health care by using the compressive sector approach, HIS becomes a core building block of the health system. since it is required for timely intelligence on the other building blocks of the health system(5–7).

RHIS has been practiced for over a century. However, it was restricted to developed countries. Developing countries start to emphasize RHIS recently(8). Ethiopia has also started to implement HMIS in 2008 which is designed to generate routine data use for decision making at different levels of the health system. It starts with 108 indicators for monitoring the performance of various health services and the availability of health resources. However, due to the gap in monitoring HSDP, the emergence of new initiatives, and the focus on new priorities, those indicators have been revised in 2014 to be 122 and again revised to a total of 131 indicators in 2017 through discussions and consultations with stakeholders(5,9).

The growing need for information by quantity and quality in the health sector drives the information revolution to be one of the four transformation agendas in HSTP. The main objective of this reform is to enhance the use of accurate and reliable information for decision making at the local level through a radical shift from the traditional way of data utilization to systemic information management by promoting the culture of information (10).

The government of Ethiopia emphasizes strengthening the HIS after the launch of one plan, one budget, and one report policy which aims that the health sector will have one shared national plan, which is HSDP and all levels of administration will have an annual plan which is coherent

with HSDP. This plan will be implemented in one comprehensive budget and monitoring of these activities will be based on commonly agreed indicators without duplication (11).

1.2. Statement of the problem

Effective and efficient health service policy needs a reliable routine health information system that can generate quality health care data for assessing whether the desired result has been achieved after an action is taken to solve a problem(11). However, in developing countries data from RHIS are often untimely, incomplete, inaccurate, and inconsistent (12–17).

National Health Data Quality Review in 2018 using the World Health Organization's data quality review tool results shows in Ethiopia, health facilities Data quality remains low throughout the country(18). Likewise, HMIS utilization assessment done in Addis Ababa public health centers shows that, although there were strong organizational structures and a lot of effort made. HMIS utilization is still weak(19). Hospital base study in Addis Ababa also reveals a weak culture of information use generated from RHIS(20).

Due to poor quality of data, health care programs fail to meet their target, as a result, countries and global initiatives rely only on indictors from population-based surveys like demographic health survey or use additional reporting format which causes health professionals fatigue and eventually leads to poor quality of data and care(12,21).

Improved data quality leads to better decision-making across an organization. So, excellence in data quality enables health care organizations to plan and provide effective and efficient service for users(22).

1.3. Significance of the study

This study will serve as benchmark information for quality improvement action initiative at health centers. Furthermore, it also helps health center management department heads, staffs, Addis Ababa City Administration Health Bureau, other non-governmental organizations to develop structured interventions based on identified and prioritized problems and guide implementation of interventions which result in an improvement on data quality and information use practice in public health centers and finally improve client treatment outcome.

1.4. The rationale for the study

PRISM framework demonstrates a good quality of data relay on three collective determinants of better routine health information systems. These are Organizational, behavioral, and technical factors (22).

Previous studies done on routine health information system performance in our setting have limitations to give a clear image of the level of data quality and factors contributing to data quality. Some are program-specific studies that use indicators from only one program area and others are done on a single facility. Therefore, in this study quality of indicators conducted from multiple thematic areas collected from sampled facilities found in all sub-cities of Addis Ababa.

The introduction of a web-based reporting platform at the facility level helps in the standardization of data collection which ultimately improves data quality. However, there is a lack of research-based evidence on the current state of data quality in Addis Ababa after the introduction of DHIS2.

Accurate and reliable patient data such as past medical history, have a substantial role in improving patient health outcomes. Health professionals are more likely to give better and safe care if their decision is based on accurate and reliable data So, Information from the patient folder has a substantial role in the quality of care. However, up to the awareness of the author, previous studies were not considering its role. So, this study aims to incorporate medical records data quality assessment.

2. Literature review

The World Health Organization framework for health systems recognizes six components of the health system. The building blocks include governance; health financing; a health workforce; health services and leadership; medical products, vaccines, and technologies; and health information (23). The six building blocks contribute to the strengthening of health systems in different ways. Though each building block of the WHO framework is vital in improving health systems and eventually health outcomes, quality and timely data from health information systems is the base for the overall system since it is required for policy and regulation of all the other health system blocks(7).

Even though there has been increased attention paid to health information systems in developing countries, due to their poor quality of data most health information systems contribute little to decision making(12–14,17). A landscape analysis study conducted in nineteen developing countries around the globe by Gates Foundation also found poor data quality and information use(15).

A pilot study on routine immunization data quality in Bunzua, Nigeria reveals a greater discrepancy between data from routine health information systems and community immunization coverage survey results. In that study the overall report from RHIS for immunization coverage was more than 100%, however, the survey result shows that only 38% of children were fully vaccinated. There is also a high variation between the reported data and data on registration books the overall internal consistency being 79% and among reviewed indicators, there was an eightfold discrepancy between health facility registration book and monthly summary report for Penta3 (24).

A cross-sectional study conducted in Tanzania on the quality of routine data collection system reveals 32.1% data completeness, 43.3% timeliness for annual report(25). In that study, although the study tries to cover both private and governmental facilities only 33.3% of private facilities have the required data compared to 90.5% of government-funded facilities so data accuracy was done for ten governmental facilities and there was an 86.4% transcription variance between data book and report book.

Countrywide studies done in Rwanda report good quality of reporting and indicators data completeness which was 98% and 95% respectively(26). In that study, 23% of facilities were reported having a problem of internal consistency. This discrepancy could be due to the use of the DPT3/DPT1 ratio to measure internal consistency. Another study also uses DPT1 and ANC1 ratios to measure internal consistency (12). However, the ratio between these two indicators does not measure data quality directly. Many DPT1 over ANC1 could be due to more children having received Vaccination service than a pregnant woman who should have to receive antenatal care. So, assessing consistency between indicators would be better if the comparison was between directly related indicators like ANC1 and TT1or IPT1, DPT1 and OPV1, TB cases notified, and TB cases put on treatment.

A program-specific study done in the Haryana State in India also shows a 41% difference between a survey from, 4807 women in 21 districts and an HMIS record on iron-folic acid supplementation(27). In that study the number of children reported receiving DPT3 was much more than those vaccinated for DPT1, these show a problem of internal consistency. A similar program-specific Study done on quality assessment of health management data for maternal and child health in Jimma zone finds a low level of data completeness ranging from 34% to 75% and timeliness ranging from 32% to 70% across eight maternal and child indicators. There is also poor agreement between HMIS and survey results which show Over reporting for PNC newborns and PNC mother indicators in all districts ranges from (44.93-75.03%) to (38.36-72.54%) respectively(12). It also shows underreporting for ANC1 on average the report on HMIS is 25% lower than what was found on a survey.

After a strategic intervention for strengthening the HMIS in Liberia, which is focused on system strengthening through developing policy and strategy and improving individual staff capacity by organizing HMIS related training to adopt the organizational culture of information use, a significant improvement in HMIS process and performance was achieved(28). In that study, from baseline assessment feedback to health facility shows improvement from 29% to 49%, the use of information increases from 38% to 58%, and data accuracy was estimated at 83%, a substantial increase compared to the 46% at baseline.

Assessment of HMIS performance conducted in Ethiopia, SNNPR by surveying 70 health facilities including 31 health centers using PRISM tool shows that 93% of health facilities report

was complete and 99% of those reports were available at the woreda health office. However, only 77% of facilities report timely and there was also a weakness of data accuracy. health center's data accuracy was only 41.94%, this figure is much worse for health posts only 37.29% of their report was accurate. relatively Hospitals show better data accuracy which was 66.67%. However, a three-month assessment of performance review meeting reveals nonexistence of HMIS information used for decision making(29), similar to this Hospital-based study conducted in Addis Ababa revealed although there was high report completeness (100%) and data accuracy (90%) it showed limited generated information useful for decision making(20).

PRISM framework

A health information system is defined as a system designed to collect, store, manage, and transmit health care data(30). The system is a set of interacting units with relationships among them(31). However, HIS performance measures were not considering other components other than technical determinants. Even if a Lack of attention to organizational and human aspects of information system is recognized for a failure to meet organizational objectives until recently only technical aspects of information systems were considered for improving HIS performance(32).

In response to this need, in 2011 MEASURE Evaluation developed the PRISM framework which uses for assessing the quality of RHIS, in making evidence-based decisions and to identify gaps that can be improved for better RHIS performance(33).

PRISM framework supports and guides the development of interventions for strengthening RHIS. it indicates continuous progress of RHIS performance can be achieved by analyzing the role of each of these factors and by recognizing appropriate interventions to address determinants that affect RHIS performance (34).

Factors affecting data quality

Routine health information system data quality is affected by several factors, such as lack of data collection tools, poor regular feedback, the inadequacy of staff and resources, lack of training, and the knowledge gap as a challenge to produce good quality data.(24,35) PRISM framework widens the assessment of data quality determinants from the traditional way of relying on the

technical part to cover three categories of determinants are Technical (The RHIS design, data collection forms, processes, systems, and methods), organizational (Information culture, structure, resources, roles, and responsibilities of key contributors at each level of the health system) and behavioral (The knowledge, skills, attitudes, values, and motivation of the people who collect, analyze, and use health data). PRISM framework groups factors that contribute to data quality into three categories(34).

1.Technical determinants

Technical determinants are factors that are related to technology to develop, manage, and improve RHIS processes and performance. Those factors are referred to as the development of indicators, designing data collection forms, and preparing procedural manuals, processes, systems, and methods(34). The effect of technical factors on RHIS is supported by an empirical investigation on data warehouse adaptation, the study claims the complexity of IT infrastructures is a key determinant for the adaption of new information systems(36). Besides, having good communication with the right user attitude and skills together with a good leadership information system needs to be user-friendly to improve information system adaptation and subsequently to improve data quality(37). HIS framework evaluation study shows besides having the right user attitude and skills with good leadership, designing a user-friendly health information system is inevitable for data quality improvement. Assessment of electronic medical record system implementation in Tanzania has also stressed the need to buildup an IT-friendly environment

2.**Organizational determinants**

A routine health information system can be evaluated from organizational structure and environment determinants which affect RHIS performance directly or indirectly through behavioral factors. These factors can be the type and size of facility, culture, politics, hierarchy, planning and control system, strategy, management, and communication. The PRISM framework considers organizational determinants key for affecting performance. It defines this category as all those factors that are related to organizational structure, resources, procedures, support services, and culture to develop, manage, and improve RHIS processes and performance(34,37). In addition to organizational structures, such as the availability of sufficient room for HMIS

activity external factors like inadequate supporting infrastructures, like electric power supply, poor road transportation, and telecommunication affect RHIS performance significantly (38–40).

3.Behavioral determinants

In Addition to technical and organizational factors, individual-level factors affect the practice of HIS tasks(32,41–44). Successful health information system adaptation is also related to the level of knowledge, expectation, acceptance, and confidence of users. Knowledge is concerned with computer literacy and skills. Expectation refers to the anticipation of improved patient care quality from the use of RHIS (37).

Acceptance of information systems by end line users is a key factor for system success(37). Sustainability of HIS is based on its capability to motivate user(44) through decentralizing information use by enabling health workers to improve coverage and quality of health care of their community by using their information otherwise, despite adequate knowledge and skills achieved through training, negative attitude, such as 'the task of the health professional is giving care to a patient, data collection is a useless activity which has no value rather than a waste of time' hampers HIS tasks so RHIS must be capable of avoiding duplicated report work demanded by different stakeholders which distract health professionals from their primary function(21,34).

The PRISM framework assumes that if people appreciate the usefulness of RHIS tasks, feel confident and competent in performing the task, and perceive that the task's complexity is challenging. but not overwhelming, then they will complete the task persistently(34).

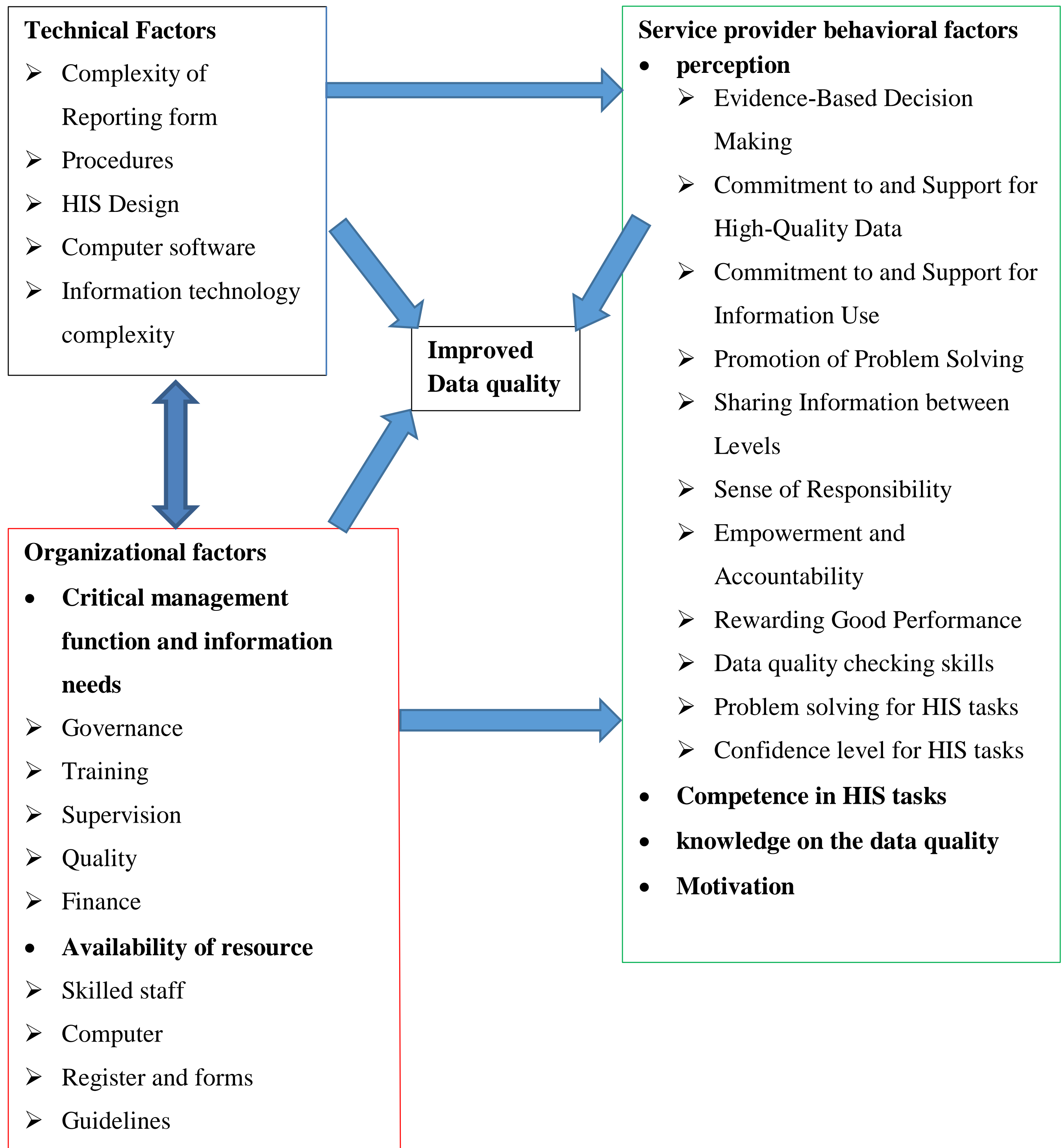

Figure 1: Adapted PRISM Conceptual framework for potential determinants of data quality(45)

3. Objective

3.1. **General objective**: to assess the quality of routine health service data and factors contributing to data quality collected in health centers of Addis Ababa City Administration in 2020.

3.2. Specific objectives

To Assess the timeliness of routine health data in Addis Ababa City Health Centers in 2020.

To Assess the completeness of routine health data in Addis Ababa City Health Centers in 2020.

To Assess the consistency of routine health data in Addis Ababa City Health Centers in 2020.

To Assess the accuracy of routine health data in Addis Ababa City Health Centers in 2020.

To identify factors contributing to the data quality of routine health information system in Addis Ababa City Health Centers in 2020.

4. Methodology

4.1. Study Area

Addis Ababa is the capital city of Ethiopia with a total population of 3,435,028 according to an estimate of the Central Statistical Agency(46). Addis Ababa is one of the two city administrations of the Federal Democratic Republic of Ethiopia. The City has three Administrative levels: city administration at the top, ten sub-cities, and 126 woredas. Addis Ababa Health Bureau is responsible for the overall health activity in the City. The city has 99 health centers 13 public and 15 private general hospitals besides 7 specialized hospitals. The City has also 89 higher,110 medium, 98 lower, and 90 specialized clinics.

The target population for the study is all public health centers in Addis Ababa City administration. All functional health centers during the data collection period were included. Health centers converted to co-vid treatment centers were excluded.

4.2. Study design and period

The study used a mixed approach. The mixed study approach is the type of research in which researcher merges elements of quantitative and qualitative research approaches to expand and strengthen study's conclusion(47). A facility-based cross-sectional study was conducted to assess the data quality level of health centers and factors affecting it in May 2020. The qualitative study was conducted in June 2020 for the corporation and enhancement of survey results.

4.3. Study variables

4.3.1. Dependent variable

Routine health service data quality

4.3.2. Independent variables

Behavioral determinants: The knowledge, skills, confidence, motivation, and perception of the people who collect, analyze, and use health data.

Perception of staff that their organization emphasize to evidence-based decision making, commitment and support for high-quality data, commitment to information use, promotion of problem-solving, sharing information between levels, empowerment and accountability, sense of responsibility, and rewarding good performance

The confidence level of staff on HIS tasks: Calculating indicators**,** Data interpretation**,** Data presentation**,** Use of Information**.** Data quality checking

Organizational determinants: RHIS governance, Supervision, Quality Improvement Standard, Finance, RHIS Capacity Development, Availability of Staff to Compile and Analyze Data, RHIS Supplies for Data Collection and Aggregation, and Infrastructure for RHIS Data Management

Technical determinants: Complexity of Reporting form, Procedures, HIS Design, Computer software, and Information technology complexity

4.4. Sample size and Sampling process

Facility Sample size calculation involves kappa statistics as measuring the quality of data depends on the agreement between reported data and recounts from source documents. The agreement is a product of marginal prevalence (i.e. the chance of finding both the source document and monthly report), and the expected proportion of agreement(P1) in the counts for the key service outputs being confirmed from the source document and monthly reports. Here we have two percentages of agreements minimum acceptable agreement (Po) and expected agreement by the study(P1). Since there was no enough knowledge concerning to availability of source documents and monthly reports 30% marginal prevalence of finding both documents was considered.

α type1error value=0.05

β power =80%

P_o = 75%

P_1 = 95%

Marginal prevalence(π) = 30%

Non centrality (λ) is expressed as a function of sample size and test statistics, the value of λ for α of 0.05, β 80% and degree of freedom 1 is 7.849 so,

$$N = \frac{\lambda}{(p1 - po)^2\{\frac{Po}{(po + \pi \times 2 - 1)(po - \pi \times 2 + 1)} + \frac{1}{(1 - Po)}\}}$$

$$N = \frac{7.849}{(0.95 - 0.75)^2\{\frac{0.75}{(0.75 + 0.3 \times 2 - 1)(0.75 - 0. \times 2 + 1)} + \frac{1}{(1 - 0.75)}\}}$$

N=33

Using probability proportional sampling method 33 health centers were selected from a total of 99 health centers from the ten sub-cities.

Sample size determination to assess service provider behavioral factors contributing to data quality was based on single proportion formula taking estimated proportion assuming 60% prevalence observed HMIS task competence in southern Ethiopia(29) and 95% confidence level, 5% margin of error taking design effect 1.5 and 5 % non-response rate

$$n = \frac{(Z_{1-\alpha/2})^2 \times p \times (1 - p)}{d^2} * g$$

$$n = \frac{(1.96)^2(0.60(1-0.60))*(1.5)}{(0.05)^2}$$

n=554

Adding 5% for non-response final sample size were 582 health professionals.

Health professionals were selected using a two-stage sampling method. First, a sample of health centers was selected randomly, and then a sample of staff within the facility.

Twelve (12) key informants who are believed to be major stakeholders in the RHIS process were involved in the qualitative study considering maximum variation and information saturation.

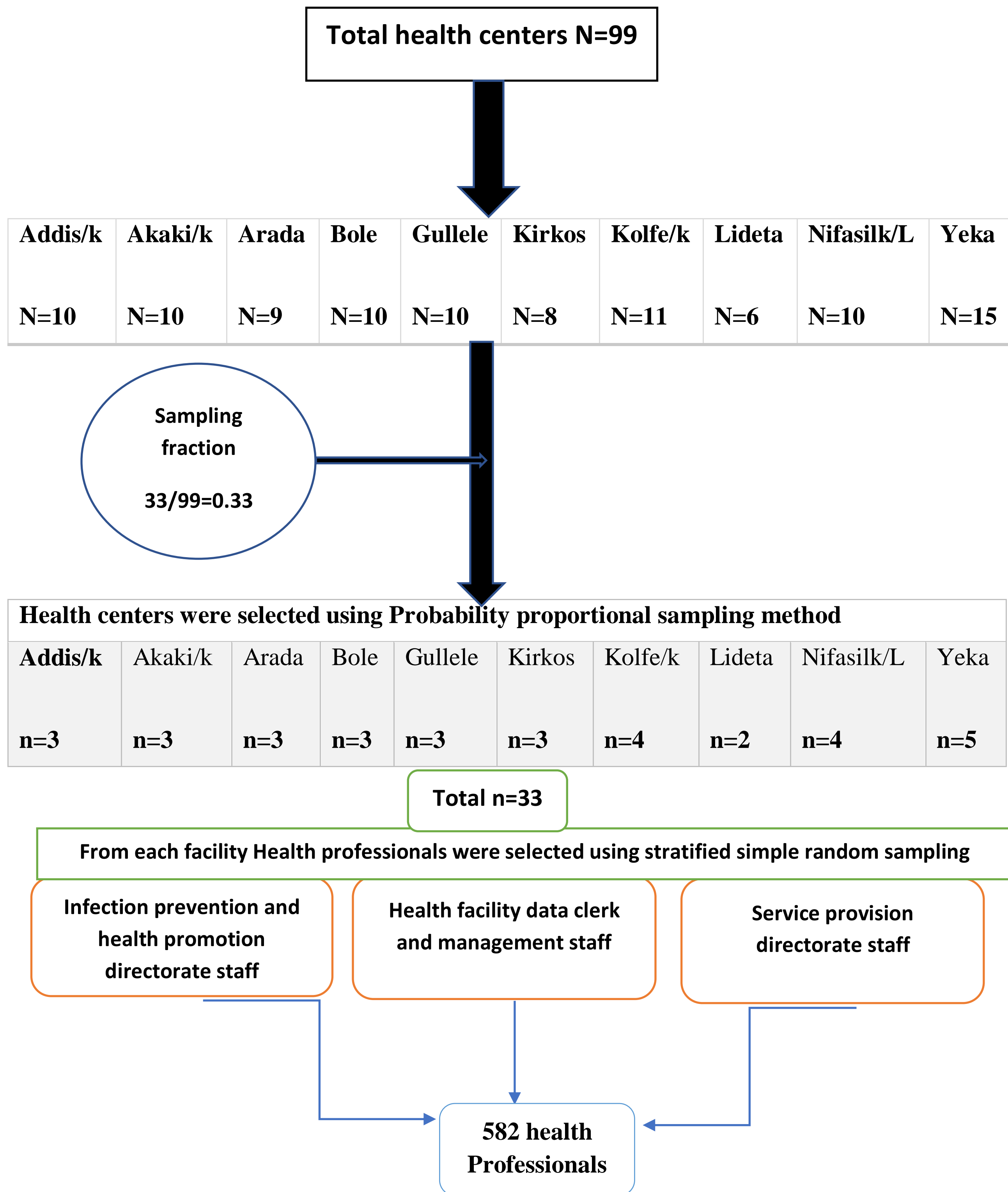

Figure 2: Schematic representation of the sampling procedure, Addis Ababa, Ethiopia,2020.

4.5. Data collection procedures

Quantitative Data

Data was collected using the customized performance of routine health information system management tools. These tools were developed for the evaluation of RHIS performance. OBAT, MAT, and facility checklist tools were used to collect behavioral and organizational determinants of routine health data quality. Three pairs of a nurse and a health information technician group of data collectors were assigned to collect these data and source document data.

Indicators selection for assessing completeness, accuracy, and consistency was based on WHO core indicators recommendation. Data were extracted from the City administration DHIS2 database covering all sampled facilities reports from May 2019 through April 2020.

Qualitative Data

A key informant interview was the method used to collect the data. After a convenient time and place were selected for the key informants, a semi-structured interview guide was used to interview key informants. To identify factors that affect data quality, Service provider staff in health centers, HMIS focal persons, facility managers, sub-cities, and regional health bureau officials were interviewed. The interview was conducted face to face by the researcher using an audio recording device and then field notes were also taken.

4.6. Data Analysis procedure

Data quality dimensions of accuracy, report and content completeness, timeliness, and consistency was determined according to PRISM data analysis techniques

Data were entered using Epi-info version 7 and cleaned for missing value using multiple imputation method, 29(55.77%),85(15.15%),and 140(0,48%) variables,cases,and values were incomplete; respectively. The missing patter was missing completely at random. Descriptive statistics using mean, median, and modified standard deviation estimates are used for measuring dimensions of data quality. Besides, one-way ANOVA, correlation, and non-parametric tests were conducted using to SPSS version 23 .

Data quality analysis

Health facility data quality was assessed using four-dimensions completeness, Timeliness, Consistency, and accuracy. A weighted average of those dimensions was used to compute a single weighted measure of data quality(48).

Table1: Weight given for data quality dimensions

Dimension	Weight
Accuracy	**0.40**
Completeness	**0.30**
Timeliness	**0.20**
Consistency	**0.10**

1. Completeness

To calculate Completeness three metrics which are completeness of facility report, completeness of indicator data, and source document completeness was assessed, (0.40, 0.20, and 0.40) weight given respectively.

1.1 completeness of facility reports: This metric measures facility performance on completeness of reporting. DHIS2 generated a three-month report completeness score that was used for this metric.

1.2 Completeness of indicator data metrics: This metric is used to assess the extent to which facilities that are supposed to report data on the selected indicators are doing so. Indicators selected for data completeness review are 6,9,18,19 and 22 (see annex I).

1.3 Source document completeness: This metric is used to evaluate the completeness of source documents for essential data elements.

Nine register books from different service areas were reviewed. Twenty recent records on each specific register book were evaluated whether necessary data elements were filled.

Fifteen patient medical folders from each sampled health center were also assessed for demographic and medical data completeness such as age, sex, date of examination, laboratory results, etc.

2. Timeliness of facility reporting is measured by whether the facility date of report submission to the highest level is not beyond the deadline. DHIS2 generated health center's timeliness score was used for this metric.

3. Internal consistency of reporting data

3.1 Internal consistency of reporting data

Consistency of reported data from 12 program indicators over one year was assessed. The percentage of extreme outlier months within the health facility report for the selected indicators were computed. A modified Z-score analysis technique was used to identify an outlier monthly report. Any monthly value with the absolute value of modified Z-score > 3.5 was considered as an outlier.

Mi = 0.6745 * (Xi -Median(Xi)) / MAD

MAD = Median(|Xi - (X*m*)|), where X*m* is the median of the series.

3.2 Consistency between related indicators

Consistency between the number of children under one year of age who have received the third dose of pentavalent vaccine and the number of children under one year of age who have received the third dose of pneumococcal vaccine was assessed.

4. Accuracy

Fourteen indicators were selected for assessing data accuracy (1,6-16,21,22 see annex I). DHIS 2 Generated report for February, March, and April 2020 cross-matched with recounted data element for the corresponding months.

The verification factor is the key metric for assessing the accuracy of reported data. It is calculated by dividing recounted data from the source document for selected indicators in the sampled facility by reported value.

The ideal value of the Verification factor is 100% which means reported data exactly matches with data available at the service point. For a report to be considered accurate it must be in an acceptable range of ±10% precision (90% to 110%).

$$\text{Verification factor} = 100 \times \frac{\text{Recounted number of events from source documents}}{\text{The reported number of events from the HMIS}}$$

Data accuracy = 100% - (100% -average absolute value of VF)

To identify factors that affect the quality of routine health data a composite score of Likert scale items answers to multiple questions are combined to create a score for a specific independent variable.

1= Strongly disagree

2= Not agree

3= Neutral

4= Agree

5=Strongly agree

Qualitative data analysis

The audio files were translated and then transcribed into the English language carefully following that coding and Thematic analysis method which enables to identify patterns within qualitative data(49) was done using ATLAS ti version 7.5 software and networks were created among the codes and following that codebook was prepared. As such the researcher achieved to collect the required data from the study population as per stipulated data collection procedures

Operational definition

Good quality of data is

1. data accuracy score ranges from 90% to 110% **and**

2. completeness scores greater than 95% **and**

3. consistency Modified Z- score below 3.5

4.7. Data quality management

A two-day training was given to three BSc degree nurse graduates and three diploma graduate health informative technicians data collectors and two MPH graduate supervisors.

The pretest was done at the Alem-bank health center and on 20 health Professionals to identify survey items that need modification. The OBAT competence part of the questionary was modified after the pretest.

Data collectors used field books to attain the maximum level of completeness for the OBAT part. Supervision was carried out and about 10% of collected samples were rechecked daily by supervisors and investigators. The audio recorded files were translated and transcribed into the English language carefully by an experienced expert.

4.8. Ethical consideration

Ethical clearance was obtained from the institutional research review board of Addis Ababa university college of Health science and Addis Ababa public health research and emergency management directorate. Permission was also served by the respective health center management.

Informed written consent was gained from each respondent. Anonymity was maintained during data collection and use of data and each study participant was informed about the objective of the study.

4.8 dissemination of results

The result of this study will be presented to Addis Ababa University and submitted to the School of Public Health as partial fulfillment of a master's degree in Epidemiology and biostatics. The result will be disseminated to Addis Ababa public health research and emergency management directorate and DDCF project office. it will be presented in seminars and conferences to give tangible evidence to different stakeholders. Furthermore, it will be disseminated to the administrators of all health centers and will be published to give a piece of evidence for policymakers and other researchers.

5. Result

5.1. Data Quality

The overall regional data quality was 76.22% ranges from 68% at Yeka health center to 92% at Shiromeda health center (see annex xiv). The table below presents the data quality level of health centers aggregated by their sub-city.

Table 2: Data Quality status of Health centers aggregated by sub-city in AA, May 2020

Sub-city	Completeness	Timeliness	Accuracy	Consistency	Data Quality
Addis ketema	87.22	66.67	78.00	96.27	80.33
Akaki Kality	93.14	22.22	77.00	96.20	72.81
Arada	92.13	66.67	64.67	97.90	76.63
Bole	85.96	55.56	80.33	96.97	78.73
Gulele	93.30	33.33	73.00	96.98	73.55
Kirkos	93.65	77.78	71.00	97.90	81.84
Kolfe Keraniyo	92.36	25.00	92.00	98.23	79.33
Lideta	93.42	16.50	77.50	97.90	72.12
Nifas-silk Lafto	89.18	41.67	74.25	96.18	74.40
Yeka	91.16	13.33	82.20	96.52	72.55
Regional	**91.15**	**41.87**	**77.00**	**97.11**	**76.22**

5.1.1. Consistency

From a total of 4752 monthly reports, 148 monthly reports were an outlier. Thus, about 3% of reports from health centers in Addis Ababa city were inconsistent. Of 148 outlier monthly indicator reports 29(19.56%) were in April, 7.26% of indicators reported in April were outliers. (see annex xv).

Consistency between related indicators is evaluated. Penta 3 was compared with PCV 3 Data seem pretty good – no sub-city has a largely discrepant value, (Regional ratio was 100%, Sd =1.37%).

Table 3: Consistency between related indicators in Addis Ababa city administrative health centers,2020

Sub-city	Penta 3	PCV 3	Ratio Penta3 to PCV3	Sub-cityratio/Regional ratio
Addis Ketema	1609	1609	1.00	1.00
Akaki Kality	4216	4302	0.98	0.98
Arada	2177	2170	1.00	1.00
Bole	4941	4906	1.01	1.00
Gulele	2694	2710	0.99	0.99
Kirkos	1879	1857	1.01	1.01
Kolfe keraniyo	7399	7416	1.00	0.99
Lideta	1218	1214	1.00	1.00
Nifas silk Lafto	9079	8852	1.03	1.02
Yeka	1579	1592	0.99	0.99
Regional	**36791**	**36628**	**1.00**	

5.1.2. Accuracy

The average report accuracy in Addis Ababa city administration health centers is 77.67%, sd =9.65 (see annex xiv). Median verification factor calculation of program indicators shows that only 8 out of 14 were in an acceptable range of deviation. The number of malaria tests and total contraceptive acceptors was over-reported by 11%. The number of adults and pediatric patients with an undetectable viral load in the reporting period was under-reported by 11%.

One-sample Wilcoxon signed-rank was conducted to test the median verification factor of each indicator is equal to the ideal value of 1. The test results showed, median VF for the number of diabetic patients visiting in the reporting month and the total number of contraceptive acceptors were significantly different from the ideal median value of 1 (see table 4 below).

Table 4: Median VF of data elements and deviations from the ideal value, Addis Ababa,2020

Indicator	Median	Minimum	Maximum	Range	P-value
DM	1.02	0.91	25.35	24.44	.044
HTN	1.03	0.52	30.91	30.39	.114
ANC1	1.01	0.88	1.54	0.66	.060
ANC4	1.00	0.82	1.89	1.07	.696
VL	1.11	0.51	6.33	5.82	.057
Malaria test	0.89	0.04	3	2.96	.513
Penta3	1.00	0.18	2.19	2.01	.398
VCT	1.00	0.17	1.99	1.82	.069
Prescription	1.00	0.41	38.29	37.88	.211
TT1	1.00	0.45	1.41	0.96	.452
New contraceptive acceptors	0.97	0.52	18.69	18.17	.100
Total contraceptive accepters	0.89	0.28	1.95	1.67	.014
New TB case	1.00	0.23	1.17	0.94	.655
TB case on treatment	1.00	0.23	1.17	0.94	.655

5.1.3. Timeliness

The timeliness of the health centers report was assessed using the DHIS2 generated timelines report. The median report timeliness score health centers are 33.33%, range from 0%-100%.

5.1.4. Completeness

5.1.4.1. Report completeness

Three-month report completeness of 33 health centers under 10 sub-cities in Addis Ababa was computed. Regional report completeness is 93.93%, which means, of the expected 99 reports from 33 Health centers the actual report was 93.

5.1.4.2. Source document completeness

33 HCs were assessed, and regional source document completeness is 96%. In almost All health centers, indicators data elements on register books were complete. However, only 73% of data elements were completed for the number of clients who received prescribed drugs.

Table 5: Completeness of source document indicator data in Addis Ababa, Ethiopia 2020

Indicator	Completeness
ANC1	98%
PENTA3	99%
OPD visit	99%
LBI	99%
LAFP	100%
TB	100%
VCT	100%
Prescription	73%
Malaria	94%
Total	**96%**

5.1.4.3. Indicator completeness

The Average percentage of monthly value for five indicators that are non-missing for one-year ranges from 52% to 100%. The monthly Report form shows no missing value for ANC1 and PENTA1 throw-outs the year however, almost half of the annual reports miss to fill value for the indicator “Number of DM patients visited facility “.

Table 6: Completeness of indicator data in Health centers A.A, Ethiopia 2020

	Sub-City	ANC1	Penta1	DM patients visited the facility	Number of OPD visits	received 100% of prescribed drugs
1	Addis ketema	100%	100%	38.9%	100%	50%
2	Akaki /Kality	100%	97%	44.4%	100%	86%
3	Arada	100%	100%	41.6%	97%	86%
4	Bole	100%	100%	44.4%	100%	56%
5	Gulele	100%	100%	44.4%	100%	100%
6	kirkos	100%	100%	42%	100%	100%
7	Kolfe	100%	100%	41.6%	100%	100%
8	Lideta	100%	100%	45.8%	100%	100%
9	Nifas silk	100%	100%	37.5%	96%	64.5%
10	Yeka	100%	100%	36.6%	90%	73.3%
Reginal		100%	99.7%	41.72%	98.30%	81.58%

One sample T-test was conducted to test whether this completeness is below the acceptable level of 95%. One-sample Wilcoxon signed-rank test was also conducted for non-normally distributed data sets. Test results show monthly reports significantly lack to incorporate indicators for DM patients visited the facility and the client received 100% of prescribed drugs.

Table 7: Test statistics of completeness of indicator data in Addis AA health centers, Ethiopia 2020.

Indicator	**Test**	**P-value**
DM patients visited the facility	One-sample Wilcoxon signed-rank test	0.012
Number of OPD visits	One-sample Wilcoxon signed-rank test	0.064
received 100% of prescribed drugs	One- sample T-test	0.004

From selected 495 medical records from the service register all of them were available. From selected medical folders components, Date of service, History of physical illness, and physical examination have shown 73%,74%and73% completeness score; respectively.

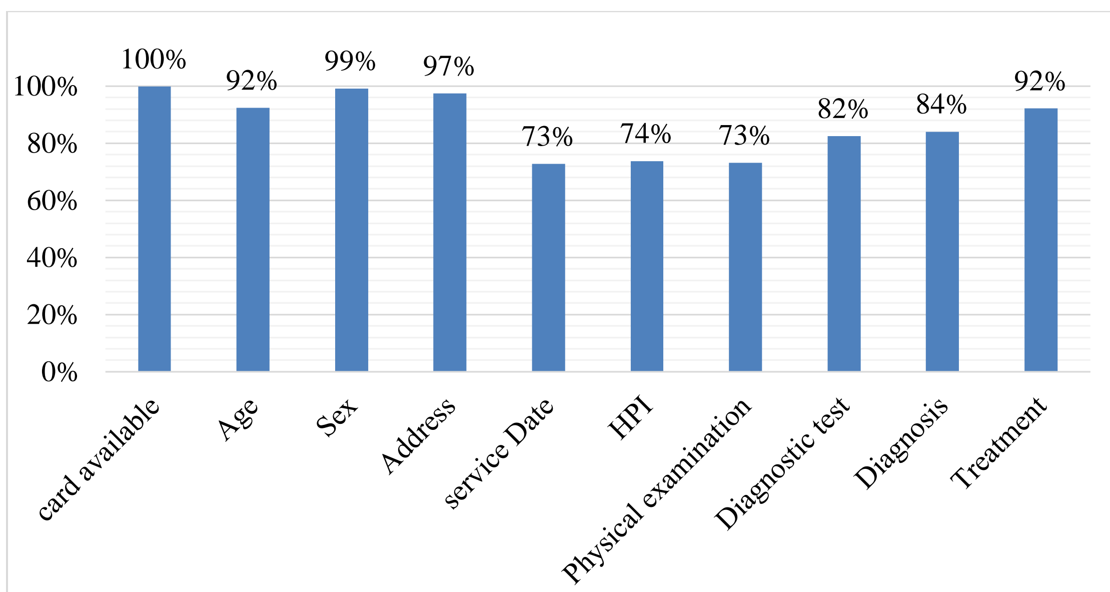

Figure 3: Medical folder completeness of health centers in Addis Ababa, Ethiopia 2020

A parametric and non-parametric statistical test was conducted to assess whether data quality dimensions scores of health centers vary across sub-cities.

A one-way analysis of variance was conducted to evaluate the null hypothesis that there is no difference in health centers' scores of data accuracy dimensions based on their sub-city.

The independent variable accuracy includes 10 groups (mean=77.76, SD=9.65, N=33).

The assumption of homogeneity of variance was tested and found acceptable using Levene's Test, (F(9,23)=0.75, P=0.13).

The assumption of normality was evaluated using histography (see figure 4 below) and the Shapiro-Wilk test of normality and found tenable for all groups.

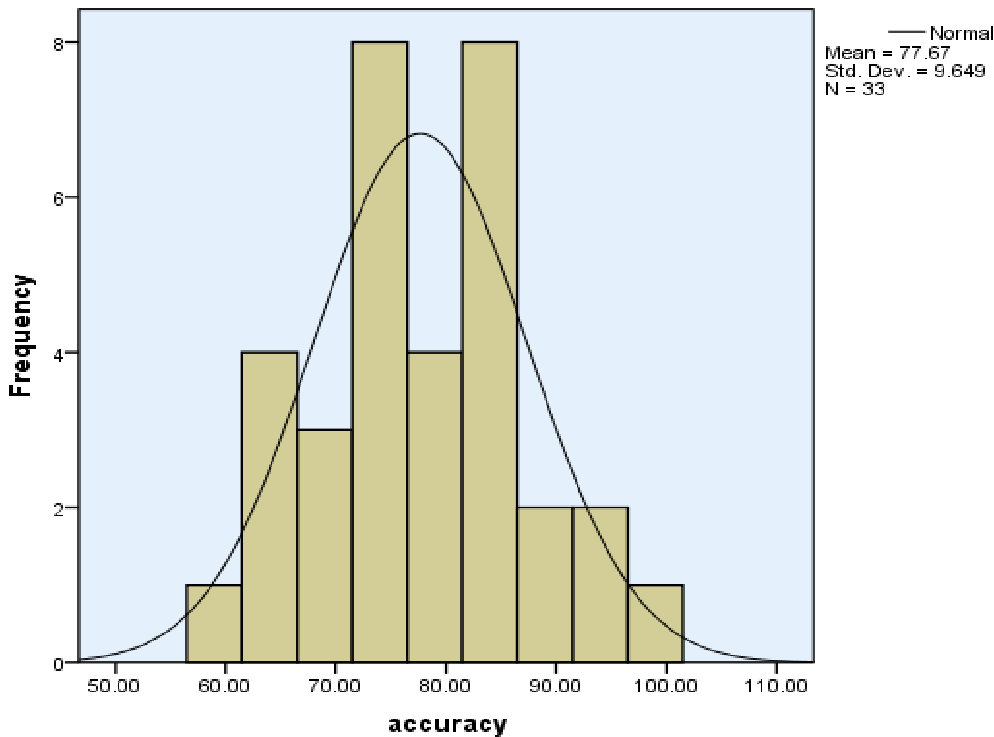

Figure 4: Histography for accuracy of health centers reports in Addis Ababa, Ethiopia 2020

The ANOVA output showed significant differences between the sub-cities (F(9,23) =3.40, P=.009), □ =0.57. Thus, there is evidence to reject the null hypothesis and conclude there is a

significant difference in the accuracy of health center reports between sub-cities.57% of the total variance among health centers in their accuracy score is accounted for by subcity

Post hoc comparisons to evaluate pairwise differences among group means were conducted with the use of Hochberg's GT2 test. Tests revealed a significant pairwise difference between the mean score of kolfe keraniyo sub-city with the other two sub-cities (see annex XIII).

For other dimensions of data quality since the normality assumption was not fulfilled, a non-parametric test conducted and only the Timeliness of reports were significantly different across sub-cities. Kruskal-Wallis test shows a statistically significant (p-value<.001) mean difference of timeliness of report between sub-cities. So, we reject the null hypothesis that the distribution of timeliness of the report is the same across sub-cities. Post hoc comparations between sub-cities show timeliness score of Kolfe keraniyo and yeka sub-cities is significantly lower than the other two sub-cities (see annex XIV).

From the above analysis, unlike other data quality dimensions, accuracy, and timeliness of reports were significantly different across sub-cities. A bivariate correlation test between accuracy and timeliness of reports was conducted to investigate the relationship and Spearman rank correlation analysis of accuracy and timeliness of monthly reports from 33 health centers revealed a moderate negative relationship between accuracy and timeliness score of health centers r(31)=-.36, p=.038).

5.2. Factors of Data Quality

5.2.1. Behavioral factors

Socio-demographic characteristics of staff from 33 health centers in Addis Ababa city were included in the study. A total of 568 respondents from different departments and service areas were included making the overall response rate to be 97.6%. Regarding service year, 277 (48.8%) of them have less than five years of experience. Related to position in the organization from the total of respondents, 406(71.5%), 101(17.8%), and 61(10.7%) were medical staff, department heads, and data clerks; respectively.

Table 8: Sociodemographic characteristics of study subjects in the health centers of A. A. May 2020 (n=568).

Variable	Frequency	Percentage
Sex		
Male	181	31.9
Female	385	68.1
Total	566	100
Level of education		
Diploma	139	24.5
Degree	415	73.2
Post-graduation	13	2.3
Total	567	100
Ever receive training	281	49.5
receive training in the last year?	96	16.9
Respondent position in the organization		
HMIS data clerk	52	9.2
Admin staff	110	19.4
Clinical Staff	406	71.4
Total	568	100
Year of service		
<5 year	277	48.8
5-9 year	224	39.4
10-14 year	51	9.0
15-19year	9	1.6
>20 year	7	1.2
Total	568	100

From a total of 568 responders, 68% and 64% of them perceive that their organization promotes problem-solving skills and a culture of evidence-based decision making, respectively.

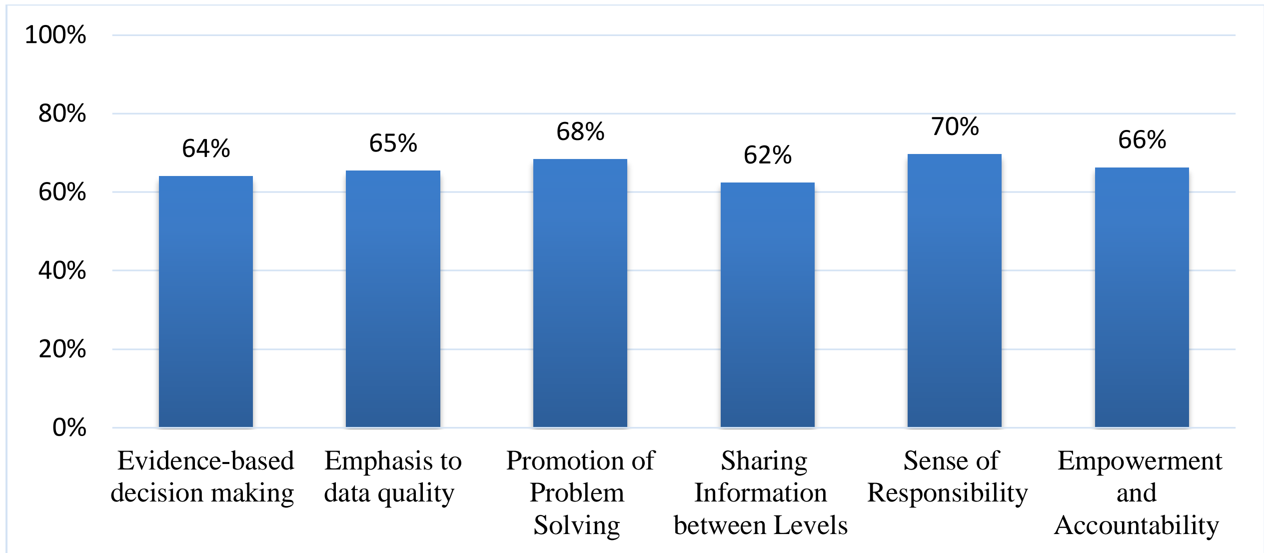

Figure 5: perceived Culture of information use in Health centers, Addis Ababa Ethiopia 2020

74%,83%, and 72% of respondents perceived that they could perform data quality checks, interpret data, and prepare data visuals, respectively.

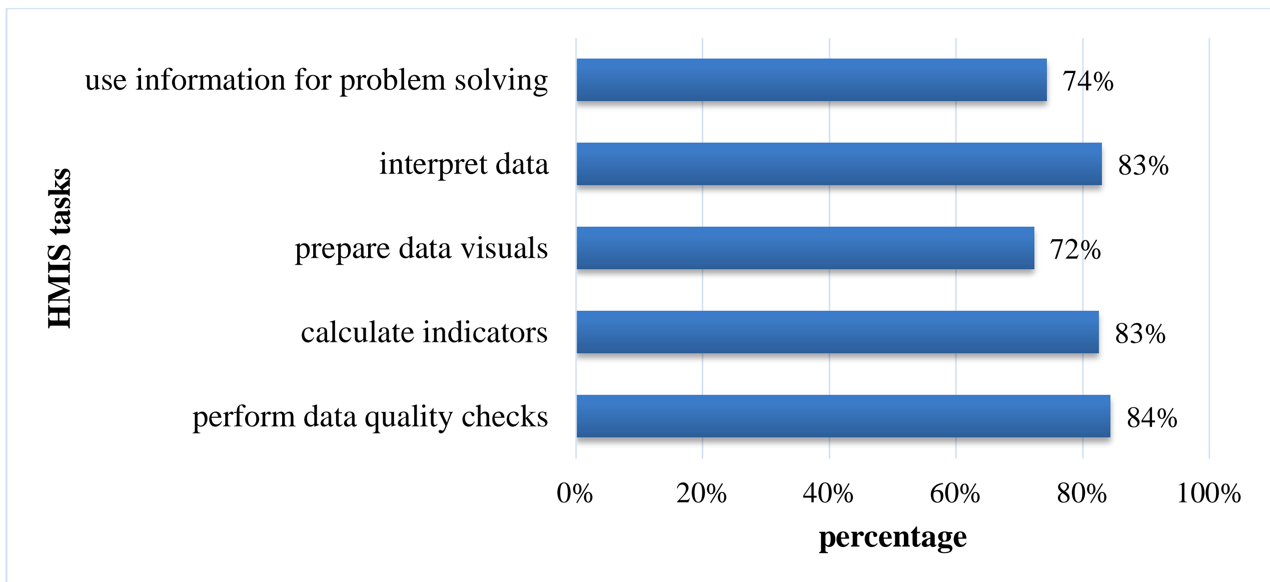

Figure 6**:** Perceived Confidence Level for HMIS Tasks staff in Health centers in A.A, Ethiopia 2020

The result of the spearman correlation indicates that the motivation of service providers and health center data quality was found to be strongly positively correlated, ($r(31) = .71, p < .001$).

key informants also mentioned a lower motivation level as a root cause for poor data quality. Some health professionals do not consider recording and reporting as part of their routine activities or they just give more priority to the clinical part and lesser attention to data quality.

The quantitative part of this study also strengthens this finding, 58.69% of respondents included in the survey find collecting or recording data to be tedious activity and 52.72% of participants feel that data collection/recording is not the responsibility of healthcare providers. This behavior is mainly manifested by physicians at health centers but not limited to them. A respondent emphasized this like:

"The problem is with the physicians (since now health center is being assigned a physician), some physicians think recording and reporting isn't part of their routine responsibilities especially when there are no nurses assigned with them. To be honest it is upsetting that they were supposed to be role models for the nurses and health officers instead of reflecting such behaviors. In our facility physicians work at OPDs and sometimes they do not record and report for 3 or 4 days. But we have tried to explain the relevance of it to them." (KII R5)

And another HIT also stressed this problem as:

"The staff as well tend to give less attention to reporting and they don't give it as much value as treating patients when there's workload...Some staff members even asked me what am being paid for and that it's just my job/responsibility" which in her own words as *"አንቺ ምን ሰርተሽ ልትበይ ነው የሚሉም አሉ"*.(KII R7)

An administrative unit key respondent also emphasized the lower motivation level among HITs which could either be caused by motives such as salary or administrative issues at their respective service provision units as: *"The problem is not with the training. It is with the staff's (mainly the HIT's) motivation for work. They are all been tired of reporting (because of the salary and administrative issues). So, I believe that's the reason*" (KII R4)

The Presence of parallel reporting and unstandardized source documents have also their owned implications on service provider's perception toward routine health data collection practice. The respondent emphasis this like:

"*The problem arises when there are other organizations/partners that have their own need too and this is mainly shown in HIV/AIDS programs. For instance, if u go and see the ART room there are more than 10 registry forms and I know this should be harmonized and integrated into the ministry of health and this problem has been there for a long time and hasn't yet been solved*" (KII R1)

Results of the Spearman correlation indicated that there was no linear correlation between data quality of health center and service provider's knowledge on HIS, ($r(31) = -.06$, $p = .70$). perceived and actual HIS task competence has also shown no linear correlation with data quality.

However, when asked about the overall task competence of data clerks and health professionals about data quality, a key informant replied that it goes to the extent of reporting wrong data elements such as cases that aren't expected in Addis Ababa, incorrect PICT reports, and misclassification of newly added indicators. The unfamiliarity of the staff with the DHIS2 tool extends from health facilities up to regional health bureaus. A respondent confirmed this as:

"The other challenge is lack of capacity… our main problem is they don't sometimes understand the tool well enough, so data elements are entered in the wrong places sometimes. Not just with the health professionals *at facilities but also with a higher administrative level like us (the M&E and HITs) too"* (KII R11)

The result of spearman correlation indicates that there was a strong positive correlation between organizational data quality score and staff perception that their organization promotes a bidirectional flow of feedback($r(31)=.75, p<.001$).

Perception of staff that the organization supports information use and data quality were found to be strongly positively correlated, ($r(31) = .74$, $p<.001$).

Perception of staff that the organization gives due emphasis to data quality and health center data quality was found to be strongly positively correlated, ($r(31) = .72$, $p<.001$).

Results of the Spearman correlation indicated that there was a strong positive association between health center data quality level and the percentage of staff who perceive that the organization promotes a culture of evidence-based decision making,($r(31) = .78$, $p<.001$).

Data quality of health center were found to be moderately and positively correlated with perception of staff that the organization has a culture that instills a sense of responsibility,

recognizes and reward good performance, promotes a culture of problem-solving (r (31) =.59, p<.001), (r(31)=.52, p=.002), (r(31)=.52, p=.002), respectively.

Health center's data quality has also shown a positive moderate correlation with the perception of staff that the organization empowers people to ask questions, seek improvement, learn, and improve quality through useful information(r(31)=.67,p<.001).

5.2.2. Technical factors

The study result shows that technical determinants affecting the data quality of facilities. Those problems arise from either the complexity of the system or the perception of the staff (including both the administrative and service provider units) about the system.

When we begin from the firs DHIS2 challenge, the misunderstanding refers to facilities claiming the system "hide" or "increase" the report or not understanding the "cash cleaner" feature of DHIS2 causing previous reports to pop-up instead of new ones which indicates the confusion of the staff with the tool. An administrative key informant reassured this by saying:

"*DHIS wasn't complete when it was first launched and it got better after some time but it's still got problems like duplicating the reports(I believe that's an issue related with capacity since nationally all data from the country's regions is integrated into that server and that might make it busy. For instance what I do is I either get to work very early or use the internet connection I have at home and when at work, from 6 to 9 A.M also in the afternoon after 3 P.m. is a good time. And the time in between those is when the system gets so busy since everybody is accessing it at that time). Facilities sometimes claim that the system increase or hides their reports. this is caused by misunderstanding the system or its due to the cash cleaner feature of the system which saves your previous analysis*" (KII R11)

DHIS2 considers the last date of the data edition for timeliness report and every data correction of a given monthly report after deadline day, the timeliness score will be reduced by 10%.

Due to this, in order not to lower the monthly performance, some HMIS focal prefers to adjust incorrect data elements lately even after quarter reports had been submitted.

That is why correlation analysis between the monthly health center's timeliness and accuracy score shows a mild negative correlation, (r(31) =-.36,p=0.038).

DHIS2 software system's validation rule for data quality consistency like flagging PCV3 report when it gets higher than PCV1 was mentioned by key respondents as having trouble with this feature because in a city like Addis Ababa with dynamic urban population finding a higher number of PCV3 than PCV1 at the facility level is common. DHIS2 system design-related challenges were also mentioned. A key informant responded as:

"*concerning the system, it is only free when it's not reporting time but when it's reporting time it's usually jammed up since the megabyte we can access is limited and the facilities are too much for it*" (KII R10)

Regarding data quality dimensions such as accuracy, some disease indicators like ANC1, ANC 4 has good data quality while indicators like hypertension, diabetes has accuracy problems. When a key informant was asked of the reason for it:

"*one factor is those indicators are recent and it doesn't have cohort data like HIV, TB but they're still chronic disease so, we have added indicators such as new incidents, newly screened individuals, newly treated among the diagnosed, newly follow-ups last year and this wasn't included in the revised HMIS. so, due to that when they collect data in the OPDs the registries don't have those newly added indicators so they just tick the ones who got diagnosed with hypertension and pass it (they have their truth because the registries don't have sections for the newly added indicators). some sub-cities like for instance Arada sub-city has printed out that section to fill in the added indicators and report using that.so what we do for the near future is that there's a new form of registry ordered so the facilities are supposed to be using that afterward since we already gave them the softcopy*"

5.2.3. Organizational factors

From the reviewed three months 93.9% of health centers had at least two recorded PMT meetings. All health centers have access to financial and logistics resources for HMIS activities. All health centers have assigned staff to Compile and Analyze Data and 98.40% of them had taken training related to HIS.

From the sampled 33 health centers 13(39%) of them had an adequate supply of RHIS recording and reporting forms the rest facilities fulfilled partially. However, the chi-square test results show no significant difference in the data quality of health centers score being above or below regional data quality score, (X^2 (1, N=33) =2.79, p=.09).

From the sampled 33 health centers 16(48.5%)of them had received a supervisory visit within the last three months. A chi-square test of independence was performed to examine the relationship between health facility data quality and having a supervisory visit and the relation between these variables was significant, X^2 (1, N = 33) = 6.79, p = .009. Facilities that received supervisory visits were more likely to have better data quality than those without.

The non-functional PMT meeting was mentioned as the main cause of the data quality problems by the administrative unit key informants. The performance monitoring meetings that were designed for the sole purpose of improving data quality aren't functional enough to increase data quality and there are even missed PMTs or PMTs that don't encourage data to use culture at the facility and bureau level. When asked about the functionality of PMT meetings, an administrative level participant said this:

"We have noticed that all of the meetings are written and signed by one person. We have even observed in some facilities people trying to run around to get the signatures of the medical director and the core processor on the PMT agenda notebook when we do sudden visits" (KII R10)

Another participant emphasized by saying:

"And in addition to this, some medical directors do not attain at PMT they just left it to the HIT to do it so, I would recommend avoiding doing that type of behavior" (KII R4).

The survey result shows that from a total of 568 respondents, only 96(16.9%) had received training in the last year. This could be the cause of the skill gap which is mainly shown in newly

hired staff. A respondent confirms this when asked about the reason for variation/inconsistency among what is reported on tallies, registries, and DHIS2 as:

"*I ask and inform them when there's such discrepancy. I have once told the staff that she has done a mistake on her report (repeatedly) but she has denied doing it and told me she hasn't taken any training. So I would recommend facilitating training since the above-mentioned problems are mostly seen on newly hired staff members*" (KII R2).

About half of respondents 281(49.5%) had received at list one training related to RHIS throughout their carrier, but despite the availability of several pieces of training related to RHIS, there is still a gap on staff who collect, analyze, use the data which gets one curious about the quality or the content of the training. 69.7% of respondents could not be able to draw a trend line graph for the given data. A key informant responded to the reason behind the inefficient training when asked about the cause for the skill gap despite the effort:

"*There seems to be redundancy on topics of training, and I have commented on that too, and the topics are actually on issues they want to press more attention and not on our needs. Plus, it seems like it is being done just for the sake of saying they have given training. The contents should be given more attention based on their relevance/importance for data quality and newer information should always be prioritized. Since DHIS 2 is a new system they have trained us on it but overall, I would have to say it's not satisfactory*" Which in his words "ስልጠናዎች አብዛኛውን ግዜ የ ለብለብ ናቸው"(KII R8).

In addition to this, another respondent confirmed the inefficiency of the training by saying:

"*This is a really good question because I also raise this as an issue when we discuss in the bureau .we don't do post-training assessment so they just came in and we give them the training and they just go. We should have given them post-training assessment so that we could know how much it has changed them and understood the aim of it… so I believe the solution for this would be for us to change our modalities, change the ways we give training and doing post-training assessments would bring change*" (KII R1).

An administrative level key informant was asked about the management related challenges and mentioned the poor culture of data quality assessment at the facility level.

"Problems/issues that are raised in the previous times are still here for instance last February 3 health facilities reported around 700 pneumonia deaths in fact when there is none. So, we did further analysis down to the facilities and discovered there is none" (KII R 11).

6. Discussion

This study tries to assess the quality of routine health data and factors affecting it in health centers of Addis Ababa city administration. The result of this study showed there was still low data quality at health centers, emphasizing the need to work hard on the attitude and motivation of health care professionals toward routine health information systems to improve the quality of health-related data in the health centers.

Data accuracy is one of the most important dimensions of data quality and was assessed by comparing the monthly reports of DHIS2 with recounted source document data. In this study majorities of health centers, reported data were not within the expected threshold level of accuracy(90%-110%), Only 22.3% of facilities reported accurately which is lower than the study conducts in Nigeria where 54.17% of facilities reported accurately(50). One reason for this difference is the tighten 10% tolerance of data accuracy in this study compared to 15% of tolerance taken by the later study. The overall data quality of health centers under Addis Ababa city Administration is found to be 76.5% consistent with 75% RHIS data accuracy in Uganda(51). In this study, the data quality problems were observed in all indicators. Nevertheless, the data accuracy assessment was not equally poor across program areas. An evaluation of the accuracy of health information system data in SNNPR, Ethiopia(52) supports the concern that there is a systematic inaccuracy of reports between indicators. Even if errors were found in nearly all reviewed indicators Majority of facilities overreported services indicators while under-reporting diseases.

Non-communicable diseases are becoming a growing challenge in developing countries(53,54). Millions of people in Africa are to die from non-communicable disease and by 2030 NCDs related mortality and morbidity will likely surpass the toll of infectious disease (55). A study conduct in the southwest, Ethiopia also showed a high prevalence (8.9%) of chronic non-communicable disease(56). The study also revealed a largely hidden burden of diabetes and Hypertension. However, in our study data quality of indicators related to diabetes and hypertension is drastically compromised, majorities of health centers missed to incorporate NCD data elements in their report and these reports were inaccurate. This could be due to the concern given to these diseases is still low since most non-government organizations partaking in

improving the health sector service provision focused on communicable diseases(57–59). Indicators related to NCDs have been neglected during data quality assessment.

Unlike other studies(12,52,60) in this study, indicators related to maternal and child health have shown promising results and almost all health center reported accurately for TB related indicators. It might be due to strict follow-up in those program areas.

In this study, the weighted mean of completeness is 91%. likewise, a study on data quality of indicators related to ANC and delivery conduct in Gana Accra(61) also established a mean completeness of 94.3%. Unlike a study done in Tanzania (25) with 64.2% completeness of data book, in this study, a High source document completeness(96%) was observed, which is in line with the 99.5% content completeness report of a study done in three districts of Jima, Ethiopia(12).

Report completeness of health centers in this study is 96%. Like this, a study on the assessment of health facility data from 14 countries of the Eastern and Southern Africa region showed median report completeness of 95% (62). A lower completeness of PMTC related indicators report was reported in South Africa with a value of 50.3% (63). A study was done on maternal and newborn indicators in Nigeria, Gombe state also find report completeness of 40% (60). Likewise, another study in Ethiopia on MCH indicators find low report completeness ranges from 33.5 to 75.8%(12).

The high completeness score in this study could be due to all facilities reviewed where governmental facilities as several studies' results show, regarding data quality public facilities perform significantly better than privately owned facilities. In addition to this introduction of web-based RHIS in the study area have also its contribution to data quality especially for report completeness.

For data to be of good quality not only has to be accurate and consistent but also it should have to avail on time. Nevertheless, in this study from assessed data quality dimensions timeliness of reports was found to be the lowest where only half of the facilities submitted their report on-time. Even in some facilities in all reviewed months reports were submitted after deadline day.

The explanation for the lower timeliness of the report could be due to this study use DHIS2 generated timeliness score and DHIS2 consider the last date of data edition for given month report timeliness calculation. However, study conduct in Nigeria on data quality of indicators using the DHIS2 report 84% of monthly reports were submitted on-time (60). The low timeliness of report is indicative of a lack of a performance monitoring team. Performance Monitoring Team is a team of the multidisciplinary health workforce that is primarily responsible to improve data quality and use information regularly. Members meet on a monthly bias before the report is submitted to the next level to monitor progress and improve performance (64). A study done in Addis Ababa reports All sampled health centers had PMT. However, the descriptive part of the study exposes there were gaps in the consistency of the meeting (19). Likewise, in this study, all sampled health centers have PMT and logbook assessment results shows, from the selected three months for review, all health centers had at least two recorded meetings. However, the qualitative part of this study reveals performance monitoring teams were not functional. Majorities of reports were submitted without content review even massive data errors that could be spotted by eyeball scanning were also observed during analysis. This has a huge impact on data quality especially for timeliness of reports where multiple components of reports were adjusted after feedbacks received from higher levels after the facility already summated monthly reports.

Feedback, supervision, and Data quality review are crucial to improving data from RHIS. (65–68) Studies specifically considering web-based reporting systems, including DHIS2, noted that while digitalizing of the reporting systems can make reviews of completeness and internal consistency feedback and supervision remain essential to achieving and maintaining improvements in data quality. (69–72) In this study on average 51.5% of health centers reported receiving at least one sub-city supervisory visit in the last 3 months. However, only 52.94% of health centers have copies of the reports of HMIS supervisory visits with action points conducted. These results show the need for improving supervision quality.

The shortage of Skill health workers remains challenging in many sub-Saharan countries. (73–75) a study from North Gondar, Ethiopia also reported only 23.8% of staff received HMIS related training(4). However, in this study 49.5% of staff and 98.4%, HMIS focal persons are trained. The difference could be due to Addis Ababa University's capacity building and

mentorship project support to the regional health bureau. Like this, another study in Addis Ababa has also reported all HMIS focal persons were trained (19). However, despite those efforts on capacity building data quality still need improvement. This might be due to health professionals' attitudes toward RHIS activities. Health professionals are more likely to give attention and time to clinical duties and tend to pay less attention to activities related to HMIS. Finding from this study also support this argument 52.72% of health professionals do not consider data recording as their duty.

Although DHIS2 is introduced in Ethiopia in 2018, most of the data management is paper-based. Daily services provisions are recorded on government-approved registers. Staff in each department are expected to complete these registers which are then aggregated into monthly summary forms at the end of the month. That is why 58.69% of staff included in this study feel recording and collecting data is a burdensome activity. This study also finds the introduction of additional new register books from different partners, which affects the burden of the report by health workers. This would have an impact on the quality of the data. Previous studies also highlight motivation and perception of staff to HIS tasks have a substantial link up with data quality(76–78).

As the study was conducted after the co-vid 19 pandemic happened in the country Performance monitoring team meeting were decrease. Monthly report consistency analysis of the last one-year report showed that recent monthly reports are found to be an outlier. These could be explained by the effect of the co-vid 19 pandemics resulting in the dropping of service utilization, as the study showed that the total OPD attendants were declined after the pandemic (see annex XI). Likewise, capacity building and mentorship project annual reports from three sub-cities in Addis Ababa also reported a reduction of service utilization. Outpatient and inpatient attendants were decreased by 25% and 34% respectively. (79).

Although the study was conducted in health centers sampled from all sub-cities in this study private facilities were not included. Also, public hospitals were not included in this study In this study Incorporating a comparison of data from RHIS with population survey results could have given further insight into the consistency of routine health data.

Getting ethical clearance from each facility extended the data collection period. Due to this, there might be information contamination, which probably affects the document completeness and PMT logbook assessment result of this study.

7. Conclusion and Recommendation

7.1 Conclusion

Assessment of routine data quality in Addis Ababa Health centers have shown good source document and report completeness. however, Overall data quality was found to be below the national expectation level. The accuracy and timeliness of reports generated from DHIS2 still need improvement. Enabling the existing performance monitoring team to be functional is a key to improve those gaps. Building a skillful and motivated workforce have also a substantial role in the betterment of data quality generated from the routine health system.

7.2 Recommendation

To FMOH: Standardizing source documents as short-term and transforming the paper-based service registration to an electronic-based medical recording system in long term will reduce the burden on the health staff in compiling data. Reducing the workload will ensure improvement in data quality.

To AARHB: Introducing audiovisual PMT meetings will help to return nonfunctional PMT to the track as well as help to withstand the effect of co-vid 19 on the PMT meeting. Strengthening the PMT through supporting supervision is crucial in minimizing data errors in monthly reports.

Better data quality observed on some indicators indicates the emphasis given to the programs, this can be used to improve data quality in other indicators.

To Governmental and Non-governmental organizations working on CBMP: Training is a key to equip newly hired staff to play a part in end-to-end data quality. Health professionals are formally trained in ‘how to do the routine HIS tasks’ However, health professionals need to be upskilled and trained within the data quality realm and understand why data should be treated as a health asset. This will help to reduce any weak links related to the perception of health professionals toward HIS tasks

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Annex's

Annex I

	Indicators
1	Pentavalent third dose (penta3) in children under 1 year
2	Number of children receive Measles vaccine
3	Number of neonates treated for sepsis
4	Number of under-five children with pneumonia
5	Number of sick young infant treated for local bacterial infection
6	Number of clients who received a prescription
7	Contraceptive new acceptors
8	Total number of women received modern contraceptive methods
9	Number of pregnant women attended antenatal care at list once during their pregnancy
10	Number of pregnant women attended four or more antenatal care during their pregnancy
11	Number of pregnant women who received the 1st dose of tetanus-toxoid vaccine
12	Number of notified new and relapse cases of TB
13	Number of new TB cases start treatment
14	Total number of slides performed for malaria
15	Clients receiving HIV test results at VCT
16	Number of adult and pediatric ART patients at 12 months (yearly) Viral load suppression
17	Number of adult and pediatric ART patients at 12 months (yearly) viral load test in the reporting period
18	Total outpatient visit
19	Number of children under one year of age who have received the first dose of pentavalent vaccine
20	Number of children under one year of age who have received the third dose of pneumococcal vaccine
21	Number of hypertensive patients visited the facility during the reporting period
22	Number of diabetic patients visited the facility during the reporting period

Annexes II

Information sheet and consent form

Information Sheet and Consent Form Prepared for the person who is going to participate in

Research Project: Assessment of routine health information system (RHIS) data quality in Addis Ababa City Administration, Ethiopia 2019

Name of principal investigator Binyam Haftu

Name of the organization Addis Ababa university

Name of sponsor DDCF

Introduction

This information sheet and consent form are prepared to explain the study you are being asked to know the status of health data quality in Addis Ababa city administrative. Please listen carefully and ask any questions about the study before you agree to join. You may ask questions at any time after joining the study. The investigator includes final year epidemiology and biostatics masters graduate student from the Addis Ababa university school of public health and two advisors from the Addis Ababa University.

Purpose of Research Project: To access the level of data quality collected through the health management information system in Addis Ababa city Administration and factors contribute to it. The study will be helpful as evidence for health service managers, donors, policymakers, and researchers to evaluate the quality of data from the routine health information system.

Procedure: If you are willing to participate in this project, you need to understand and sign the agreement form. Then, you will be interviewed by the data collector to give your response. to Assess the data accuracy, timeliness, and completeness data collectors will request HMIS reports and register books. You do not need to tell your name to the data collector and all your responses and the results obtained will be kept confidentially by using a coding system whereby no one will have access to your response.

Risk/ Discomfort: By participating in this research project, you may feel that it has some discomfort especially on wasting time about 15 minutes. We hope you will participate in the study for the sake of the benefit of the research result. There is no risk in participating in this research project.

Benefits: If you participate in this research project, there may not be a direct benefit to you but your participation is likely to help us to know the current status of data quality of health management information system in Addis Ababa health facilities.

Incentives: You will not be provided any incentives or payment to take part in this project.

Confidentiality: The information collected from this research project will be kept confidential and information from this facility that will be collected by this study will be stored in a file, without your name, but a code number assigned to it. And it will not be revealed to anyone except the principal investigator and will be kept locked with a key.

Right to refuse or withdraw: You have the full right to refuse from participating in this research. You can choose not to respond to some or all questions if you do not want to give your response. You have also the full right to withdraw from this study at any time you wish, without losing any of your rights.

Persons to contact: If you have any questions, please contact the following person.

1. Binyam Haftu (Bsc)

Phone number +251-910-866-806

Email: binyamhaftu@gmail.com

2.Girma Taye

Email: Girmataye2009@gmail.com

3.Wondimu Ayele

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Annex III

Consent form

Addis Ababa University School of public health

A questionnaire prepared for the quality assessment of Routine health information system data quality in Addis Ababa city administration, Ethiopia, 2019

READ THE FOLLOWING TEXT TO THE MANAGER, THE PERSON IN CHARGE OF THE FACILITY, OR THE MOST SENIOR HEALTH WORKER RESPONSIBLE FOR OUTPATIENT SERVICES WHO IS PRESENT AT THE FACILITY:

Dear participant; my name is ________________. I am working with Binyam Haftu conducting a survey of health facilities, who is doing a research as partial fulfillment for the requirement of Master of Epidemiology and biostatistics in Addis Ababa University

Your health facility was randomly selected to participate in this study. We will be asking you questions about various health services and routine reporting. This information may be used by Minster of health, organizations supporting health services, and researchers, to plan service improvements or to conduct more studies of health services. Neither your name nor the names of any other respondent participating in this study will be included in the data set or any report. However, there is a small chance that any of these respondents may be identified later. Nevertheless, we are asking for your help to ensure that the information we collect is accurate. You may refuse to answer any question or choose to stop the interview at any time. However, we hope you will answer all of the questions, which will benefit the clients you serve and the nation. If there are questions that would be more accurately answered by someone better informed of any specifics we ask about, we would appreciate if you would introduce us to that person to help us collect any missing or incomplete information. At this point, do you have any questions about the study? Do I have your agreement to proceed?

_________ / _________ / _________

Interviewer signature indicating consent obtained date month year

	May I begin the interview?	1. Yes 2. No End survey

Annex IV OBAT assessment form Amharic Version

ኮድ	ጥያቄዎች	መልሶች
OBI1	የመላሹ የስራ ድርሻ(መልሱን ይክበቡ)	Health facility head Health facility HMIS focal person/data management staff Health care provider Other (specify)
OBI2	ጾታ	1 ወንድ 2 ሴት
OBI3a	ከፍተኛ የትምህርት ደርጃ. ((መልሱን ይክበቡ))	Diploma..................1 Degree ....2 Post-graduation 3
OBI 3b	መደበኛ ስልጠና ከወሰዱ, የወሰዱትን ስልጠና ይጥቀሱ. ((መልሱን ይክበቡ)	MSc in Health informatics……………………..1 Master’s in Public health or related………..….2 Health officer...3 Nurse/Midwife ....4 Laboratory……………………………………...5 Pharmacist ……………………………………6 HIT/IT...7 Other (specify)____________________96
OBI 4a	አጠቃላይ የአገልግሎት ጊዜ ብዛት	አመት: ___ ወር: ___
OBI 5a	ከመጀመሪያ ጀምሮ ፡ በ RHIS/HMIS/CHIS ዙሪያ መደኛ ስልጠና ወስደው ያውቃሉ?	አዎ አይደለም
OBI 5b	መልስዎ አዎ ከሆነ, ባለፈው አንድ አመት ውስጥ ፡ በRHIS/HMIS/CHIS RHIS ዙሪያ ስልጠና ወስደው ያውቃሉr?	አዎ አይደለም
OBI 5c	መልስዎ አዎ ከሆነ , ምን አይነት መደበኛ ስልጠና ነው የወሰዱት?	Health statistics ....1 HMIS/CHIS (data collection, transmission, storage, and/or data quality assurance)...........................2 Data analysis and use ....3 General M&E ....4 ICT...5 Other (specify)________________________96

ኮድ	ጥያቄዎች	መልሶች
Section 1.2:የመረጃ መጠቀም ባህል		
የጤና መረጃ ስረአቱን በተመለከት : በተቋሞ ጋር በተገናኘ ያሎትን አመለካከት (ምን ያህል እንደሚስማሙ ና እንድማይስማሙ) ያሳዩ። ትክክለኛ ወይም የተሳሳተ መልስ መልስ የሚባል ነገር የለም። እዚህ የተፈለገው የእርሶን አስተያየ/አመላካከት መለኪያ ስኬል ላይ በማስቀመጥ ለመለካት ብቻ ነው።		
ከሚከተሉትን ሃሳቦች ጋር ምን ያህል እንደሚስማሙ/እንደማይስማሙ ከ 1 እስከ 5 ነጥብ በመስጠት ያሳዩ? (ለእያንዳንዱ ጥያቄ አንድ መልስ ብቻ ያክብቡ)		

ኮድ	**በጤና ተቋሙ ዉሳኔ የሚወሰነው**	በፍጹም አልስማማ ም	አልስማማ ም	ገለልተኛ ነኝ	እስማማ ለሁ	በጣም እስማማለሁ
D1	በውሳኔ ሰጪው ፍላጎት/ምርጫ	1	2	3	4	5
D2	ከበላይ ትዛዝ	1	2	3	4	5
D3	በመረጃ	1	2	3	4	5
D4	በቀድሞ ልምድ ወይም አሰራር	1	2	3	4	5
D5	በ ገንዘብ ለጋሾች ትዛዝ	1	2	3	4	5
D6	በፖለቲካ አካሄድ	1	2	3	4	5
D7	በይፋ በተቀመጡ እስትራቴጂክ እቅዶች መሰረት	1	2	3	4	5
D8	የህብረተሰቡን ፍላጎት ባማከለ	1	2	3	4	5
D9	የተላያዩ ፕሮጀክቶች የሚጠይቁት የወጪ መጠን በማወዳደር	1	2	3	4	5
D10	የሚመለከታቸውን ባለሞያዎች ሃሳብ ከግምት ውስጥ በማስገባት	1	2	3	4	5

የበላይ ሀላፊዎ		1.በፍጹም አልስማማም	2.አልስማማም	3.ገለልተኛ ነኝ	4.እስማማለሁ	5.በጣም እስማማለሁ
S1	ከባላሞያዎች የሃሳብ ግባአት ይጠይቃል/ትጠይቃለች?	1	2	3	4	5
S2	ሪፖርት በሚሰራበት ወቅት በመረጃ ጥራት ላይ ትኩረት እንዲደረግ ያደርጋል/ታደርጋለች ?	1	2	3	4	5
S3	በስራተኞች መሃከል እንዲሁም ከበላይ እና ከበታች ያሉ የጤና ተቋማት መሃከል የግብረ መልስ እና የመረጃዎች ለውውጥ እንዲኖር ያበረታታል/ታበረታታለች ?	1	2	3	4	5
S4	የጤና አገልግሎት አፈጻጸምን ለመከታተል እና ኢላማ ለመወሰን የጤና መረጃን ይጠቀማል/ትጠቀማለች ?	1	2	3	4	5
S5	የጤና አገልግሎት ተደራሽነት ፍትሃዊነትና ልዩነቶችን ለመለየት የጤና መረጃን መጠቀም ያበረታታል/ታበረታታለች?	1	2	3	4	5
S6	የጤና መረጃ በሚሰበስብበት ፡ በሚቀመርበት ፡ በሚጠቃለልበት ስፍራ በመግኘት መደበኛ የመረጃ ጥራት የማረጋገጥ ስራ ያከናውናል/ታከናውናለች?	1	2	3	4	5
S7a	አፈጻጸምን በተመለከተ ፡ የጤና መረጃዎች በአግባቡ እንዲታዩ እና በመደባኛ ስብሰባዎች ውይይት እንዲደረግባቸው ያደርጋል/ታደርጋለች?	1	2	3	4	5
S7b	በሚቀርቡ መረጃዎች ላይ በመመርኮዝ ፡ በመደበኛ የ PMT ስብሰባዎች ላይ ውስኔ እንዲተላለፍ እንዲሁም በቀጣይ ትኩረት የሚሹ ጉዳዮች ክትትል እንዲደረግባቸው ያደርጋል/ታደርጋለች?	1	2	3	4	5
S8	በባለሞያዎች ሪፖርት በሚደረጉ መረጃዎች ላይ (ሪፖርት የሚደረጉ መረጃ ትክክለኛነት) ግብረ መልስ ይሰጣል/ትሰጣለች?	1	2	3	4	5
S9	ጥሩ የስራ አፈጻጸም ያላቸውን ሰራተኞች ይሸልማል ወይም ያበረታታል/ታበረታታለች?	1	2	3	4	5

እርሶ በጤና ተቋም ዉስጥ		1. በፍጹም አልስማማም	2.አልስማማም	3.ገለልተኛ ነኝ	4.እስማማለሁ	5.በጣም እስማማለሁ
P1	የጤና መረጃ ስራን ይሰራሉ ? (መመዝገብ : ሪፖርት መረጃ ማጠቃለል መረጃ መተንተን)	1	2	3	4	5
P2	የመረጃ ጥራትን ለማስጠበቅ እና በመረጃ ላይ የተመረኮዘ ውሳኔ ለመስጠት ቁርጠኝነት ያሳያሉ?	1	2	3	4	5
P3	የአገራዊ ጠቋሚ እቅድን ከግምት ውስጥ በማስገባት ለአካባቢው ተጨባጭ ሁኔታ የሚሆን መሰረታዊ የጤና ዓገልግሎት ዒላማ ያወጣሉ?	1	2	3	4	5
P4	ላልተሳካ የስኬት ዒላማ ሃላፊነትን ይወስዳሉ?	1	2	3	4	5
P5	የጤና መረጃን በመጠቀም የእለትተለት የጤና ድርጅት እና የወረዳን አስተዳደርና አመራር ስራ ይሰራሉ (ለምሳሌ አገልግሎት መስጠት : የፋይናንስ : የቁሳቁስ : የሰው ሃብት አመራር ማካሄድ)	1	2	3	4	5
P6	የጤና መረጃን በመጠቀም በአገልግሎት አሰጣጥ ዙሪያ ያሉ ችግሮችን ይፈታሉ?	1	2	3	4	5
P7	የጤና መረጃን በመጠቀም በአገልግሎት አሰጣጥ ዙሪያ ጋር በተገናኘ የፍትሃዊ ተጠቃሚነት ጋር የተገናኙ ችግሮችን ለመለየት እና ለመፍታት ይጠቀማሉ?	1	2	3	4	5
P8	መረጃን ለእይታ ለማቅረብና ለማሳየት የሚረዱ አጋዦችን (ግራፍ፤ ሰንጠረዥ፤ ካርታ) በመጠቀም አፈጻጸምን ከዒላማ ጋር ማወዳደር (ጠቋሚ በጊዜ ወይም በቦታ ወይም በሁኔታ ምልከታ)	1	2	3	4	5
P 9	አንድ ተግባር ዒላማውን መምታቱን መከታተል ይችላሉ?	1	2	3	4	5
P10	በመረጃ ላይ በመመርኮዝ በራሳቸው ውሳኔ መስጠት ይችላሉ?	1	2	3	4	5
P11	ለዝቅተኛ አፈጻጸም/የአፈጻጸም መዉረድ ተጠያቂነት ተግባራዊ መደረጉ (ለምሳሌ፤ የሪፖርት ማድረጊያ ጊዜን ማሳለፍ)	1	2	3	4	5
P12	ከመረጃ አስተዳደር (ትንተና፣ማጠናቀር፣መሰብሰብ….) ጋር ሊከሰቱ የሚችሉ ስህተትን ተቀብሎ ማስተካከል	1	2	3	4	5

BC1	የመዘገብኩት፣ የሰበሰብኩት መረጃ ዉሳኔ ለመስጠት ጥቅም ላይ ሳይዉል ሲቀር ጥሩ ስሜት እንዳይኖረኝ ያደርጋል	1	2	3	4	5
BC2	የጤና መረጃ አመራር ስርዓትን/የማህበረሰብ ጤና መረጃ ስርዓትን ለመመዝገብ እና ለመሰብሰብ አሰልቺ/አድካሚ ነዉ	1	2	3	4	5
BC3	ለእኔ መረጃን መሰብሰብ ትርጉም/ጥቅም አለዉ	1	2	3	4	5
BC4	እኔ የሰበሰብኩት/ያለኝ መረጃ የተቋሙን የአገልግሎት አፈጻጸም ለመከታተል እንደሚያስችል ይሰማኛል	1	2	3	4	5
BC5	መረጃ መሰብሰብ በተቆጣጣሪወቸ ዋጋ ይሰጠዋል/እንደ ስራ ይቆጠራል	1	2	3	4	5
BC6	መረጃን መመዝግብ እና መሰብሰብ የአገልግሎት ሰጪዉ/ባለሙያዉ መሆን የለበትም	1	2	3	4	5

ተራ ቁጥር	**ጥያቄ Question**	**ዉጤት Result**										
የዚህ ክፍል መጠይቆች ከጤና መረጃ ጋር ተያይዞ አመለካከትን/አቀባበልን እና የመፈጸም አቅምን ለማወቅ የሚረዳ ክፍል ነዉ:: ይህም ምን ያህል መደበኛዉ ን የጤና መረጃ ስርዓት አፈጻጸም ስራን የመስራት አቅም እንዳላችሁ ለማወቅ ይረዳል. ስትሞሉ በጥንቃቄ እና በታማኝነት መሙላት ያስፈልጋል. አሞላሉ ከ 0-10 ሲሆን 0 ማለት አቅም የለኝም ማለት ሲሆን 10 ማለት ደግሞ ከፍተኛ አቅም አለኝ ማለት ነዉ::												
OBSE1	የመረጃ ትክክለኛነትን ለማረጋገጥ እችላለሁ	0	1	2	3	4	5	6	7	8	9	10
OBSE2	ንጽጽር /መቶኛን /ፐርሰንቴጅን ማስላት እችላለሁ	0	1	2	3	4	5	6	7	8	9	10
OBSE3	የዝማሚያ/ትሬንድ መስመርን ግራፍ ላይ መሳል እችላለሁ	0	1	2	3	4	5	6	7	8	9	10
OBSE4	የተተነተነ መረጃ የሚያሳየዉን ዉጤት መረዳት እና መግለጽ እችላለሁ	0	1	2	3	4	5	6	7	8	9	10
OBSE5	የአፈጻጸም ክፍተትን ለመለየት መረጃን እጠቀማለሁ(ለምሳሌ፤አገልግሎት፣የፕሮግራም፣ የማኔጅመንት ክፍተቶችን ለማወቅ)	0	1	2	3	4	5	6	7	8	9	10
OBSE6	መረጃን ለአስተዳደራዊ አመራር እጠቀማለሁ (አገልግሎት አሰጣጥ፣ሃብት ለመመደብ/ለማስመደብ)	0	1	2	3	4	5	6	7	8	9	10

OBK	መልስዎን 1. አዎ ወይም 2. የለም/አይደለም በማለት ይምረጡ	መልስ
OBK1	**የበሽታዎችን ስብስብ መረጃ መሰብሰብ/መጠቀም ለምን አስፈለገ**	
	A. በግለሰብ ደረጃ/ግለሰባዊ አገልግሎት ለመስጠት	1. አዎ 2. አይደለም
	B. በሚፈለግ /በተመረጠ በሽታ ላይ ያለዉን ለዉጥ መጠን እና ክብደት ለማወቅ	1. አዎ 2. አይደለም
	C. አፋጣኝ ህክምና አገልግሎት የሚያስፈልጋቸዉን ከማያስልጋቸዉ ህሙማንን እና ለመለየት	1. አዎ 2. አይደለም
	D. ወረርሽኝ መከሰት/አለመከሰቱን ለማዎቅ እና እርምጃ ለመዉሰድ	1. አዎ 2. አይደለም
	E. የመከላከል እና የማዳን ስራዎችን ለማቀድ	1. አዎ 2.አይደልም
OBK2	**የክትባት መረጃን መሰብሰብ የተሰበሰበዉን ድምር መተቀም ለምን አስፈለገ**	
	A. የእናቶች እና ህጻናት ጤናን ለማሻሻል የተወሰዱ እርምጃዎችን ዉጤት ሽፋን ለማዎቅ	1. አዎ 2.አይደልም
	B. ከ አምስት ዓመት በታች የሆኑ ህጻናትን ምርመራ እና ህክምናን ለማሻሻል	1. አዎ 2.አይደልም
	C. አስፈላጊ ግብዓቶችን ለማሟላት ዉሳኔ ለማስተላለፍ	1. አዎ 2.አይደልም
	D. የክትባት ስራዎችን ለማቀድ- መድረሻን ለማዉጣት–	1. አዎ 2.አይደልም
OBK3	**የታካሚዉ በእድሜ/በጾታ አግርጌት የሆነ መረጃ የምንሰብስብ ለምንድን ነዉ**	
	A. በ ሁሉም እድሜ ክልል ዙሪያ እኩል /ፍትሃዊ የሆነ አገልግሎት መሰጠቱን ለማረጋገጥ	1. አዎ 2.አይደልም
	B. በበሽታ የተጠቃን ቡድን/ግሩፕ ለማወቅ	1. አዎ 2.አይደልም

	C. የተሸላ የእርዳታ በጀት/ገንዘብ ለማግኘት	1. አዎ 2.አይደልም
	D. የተመላላሽ ህክምና እና ከአምስት ዓማት በታች ህጻናት ክፍልን የስራ ጫና ለማስላት/ለማወቅ	1. አዎ 2.አይደልም
	E. ትክክለኛው አገልግሎት የሚያስፈልገዉ አካል አገልግሎቱን ስለማግኘቱ ለማወቅ	1. አዎ 2.አይደልም
OBK4	**የታካሚዉን መኖሪያ አካባቢ/ቦታ ወይም ከየት እንደመጣ ለማወቅ የምንፈልገበት ምክንያት ምንድነዉ?**	
	A. የመከላከል እና የማብቃት ስራዎችን አገልግሎት ለሚያስፈልጋቸዉ በተለዩ አካለት ላይ ስራን ለማቀድ	1. አዎ 2.አይደልም
	B. የጤና አገልግሎት ተጠቃሚነትን እና ተደራሽነትን ለማሳደግ	1. አዎ 2.አይደልም
	C. የማህበረሰቡን/ተገልጋዩን ባህሪ ለመወሰን	1. አዎ 2.አይደልም
	D. ለበሽታዎች ሰርቬላንስ (ወረርሽኝን እንዳይከሰት ለመከላከል	1. አዎ 2.አይደልም
OBK5	**የስነ ህዝብ መረጃ ለምን ያስፈልጋል (ለምሳሌ በተቋሙ አካባቢ አገልግሎት ለማግኘት ያለ ማህበረሰብ**	
	A. ለጠቋሚዎች ስሌት ለመጠቀም	1. አዎ 2.አይደለም
	B. የተለያዩ የጤና አገልግሎት አሰጣጥን ለማቀድ	1. አዎ 2አይደለም
	C. የጤና ተቋሙን የስራ ጫና ለማወቅ	1. አዎ 2. አይደለም
	D. የጤና ባለሙያዎችን ክህሎት እና እዉቀት ለማወቅ	1. አዎ 2. አይደለም
CS2	ከ12-23 ወር ያሉ ህጻናት ሙሉ በሙሉ ሁሉንም ክትባቶች የወሰዱ ህጻናት አፈጻጸም ለ 2004፣2005፣ 2006፣2007፣2008 እንደሚከተዉ በቅደም ተከተ ል ይሆናል60 50፣30፣40፣40፣ .	

CS2a	ከላይ የተጠቀሱትን 12-23 ወራት ያለዉን የክትባት አፈጻጸም በline ግራፍ አሳይ

Annex v

OBAT English version

code	Questions	Answers
SECTION 1.1: RESPONDENT BACKGROUND		
OBI1	Current job title	Health facility head..1 Health facility HMIS focal person/data management staff …..2 Health care provider...................................... 3 Other (specify)_____________________96
OBI2	sex	1 Male 2 Female
OBI3a	Highest level of education achieved	Diploma.................1 Degree ....2 Post-graduation 3
OBI 3b	If you received formal medical training, specify what type	MSc in M&E...1 MSc in Health informatics ....2 Other master's in Public health or related ....3 Physician ....4 Health officer..5 Nurse/Midwife ....6 HIT/IT..7 HEW ....8 Other (specify)______________________96
OBI 4a	Number of years of employment (not just in the current role	Year | Month (blank)
OBI 5a	Have you ever received formal RHIS training?	1. Yes 2. No

OBI 5b	Did you receive training in RHIS-related activities in the past year?	1. Yes 2. No
OBI 5c	If yes, what type of formal RHIS training have you received in the past? (Circle answer)	Health statistics ....1 HMIS/CHIS (data collection, storage, and/or data quality assurance)....................................2 Data analysis and use ....3 General M&E ....4 ICT...5 Other (specify)________________________96

code	Questions	Answer
Section 1.2 PROMOTION OF INFORMATION CULTURE		

We would like to know your opinion (how strongly you agree or disagree) regarding certain aspects of the RHIS in (COUNTRY). There is no right or wrong answer, only an expression of your opinion based on a scale. The scale assesses the intensity of your belief and ranges from "strongly disagree" (score of 1) to "strongly agree" (score of 5). This information will remain confidential and will not be shared with anyone, except presented as an aggregated data report. Please be frank and choose your answers honestly.

strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

To what extent, do you agree with the following statements, on a scale of 1-5?

code	In the health department, decisions are based on:	strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
D1	Personal preference of decision makers	1	2	3	4	5
D2	Superiors' directives	1	2	3	4	5

D3	Evidence/facts/data	1	2	3	4	5
D4	History, what was done last year	1	2	3	4	5
D5	Funding directives from higher levels	1	2	3	4	5
D6	Political considerations	1	2	3	4	5
D7	Official health sector strategic objectives	1	2	3	4	5
D8	Health needs of the catchment population as identified locally	1	2	3	4	5
D9	The relative cost of interventions	1	2	3	4	5
D10	Participatory by taking inputs from relevant staff	1	2	3	4	5

To what extent, do you agree with the following statements, on a scale of 1-5?						
code	In the health department,superiors (managers or higher-level supervisors):	strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
S1	Seek input from relevant staff	1	2	3	4	5
S2	Emphasize that data quality procedures be followed in the compilation and submission of periodic reports (e.g., monthly reports)	1	2	3	4	5
S3	Promote feedback mechanisms to share/present information within the team, and to lower and upper levels of the health system	1	2	3	4	5

S4	Use RHIS data for service performance monitoring and target setting	1	2	3	4	5
S5	Emphasize the need to use RHIS data to identify potential disparities in service delivery or use	1	2	3	4	5
S6	Conduct routine data quality checks at points where data are captured, processed, or aggregated	1	2	3	4	5
S7a	Ensure that performance data are reviewed and discussed in the regular meetings	1	2	3	4	5
S7b	Ensure that decisions are made and follow-up actions identified in PMT meetings based on presented data	1	2	3	4	5
S8	Provide regular feedback on reported data quality (e.g., accuracy of data compilation/reporting) to the staff responsible for compiling and reporting the data	1	2	3	4	5
S9	Recognize or reward staff for good work performance	1	2	3	4	5

To what extent, do you agree with the following statements, on a scale of 1-5?						
code	In the health department, staff:	strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
P1	Complete RHIS tasks (recording, reporting, processing/aggregation, and/or analysis) in a timely manner.	1	2	3	4	5
P2	Display commitment to ensure data quality andevidence-based decision-making	1	2	3	4	5

To what extent, do you agree with the following statements, on a scale of 1-5?						
code	In the health department, staff:	strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
P3	Pursue indicative national targets and set feasible local targets for essential service performance	1	2	3	4	5
P4	Feel "personal responsibility" for failing to reach performance targets	1	2	3	4	5
P5	Use RHIS data for day-to-day management of the facility and Woreda (e.g., service delivery, financial, commodities, and human resource management)	1	2	3	4	5
P6	Use RHIS data to solve common problems in service delivery	1	2	3	4	5
P7	Use disaggregated RHIS data to identify and/or solve health equity related problems in service delivery	1	2	3	4	5
P8	Prepare data visuals (graphs, tables, maps, etc.) showing achievement toward targets (indicators, geographic and/or temporal trends, or situation data)	1	2	3	4	5
P9	Can monitor whether an initiative/ intervention achieved the targets or goal	1	2	3	4	5
P10	Are able to make decisions within their scope in response to the findings of data analysis (e.g., changes in service delivery or management practices)	1	2	3	4	5
P11	Are held accountable for poor performance (e.g., failure to meet reporting deadlines)	1	2	3	4	5

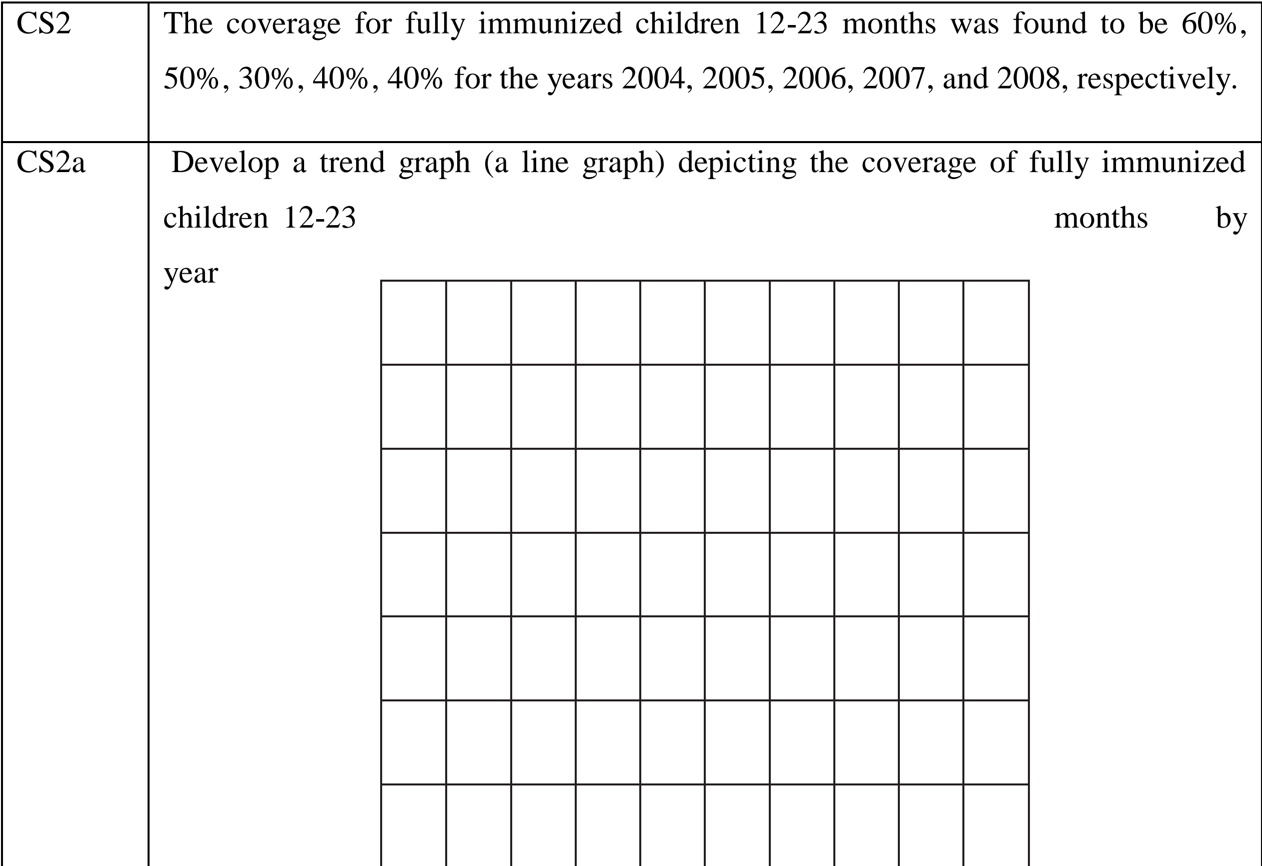
To what extent, do you agree with the following statements, on a scale of 1-5?						
code	In the health department, staff:	strongly disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
P12	Admit mistakes if/when they occur and take corrective action	1	2	3	4	5

TO WHAT EXTENT, DO YOU AGREE WITH THE FOLLOWING ON A SCALE OF 1-5? 1-5 **(Circle one for each question)**						
code	**Personal Feelings:**	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
BC1	I feel discouraged when the data that I collect /record are not used for taking action (either for monitoring or decision making)	1	2	3	4	5
BC2	I find collecting /recording HMIS/CHIS data tedious	1	2	3	4	5
BC3	Collecting data is meaningful/useful for me	1	2	3	4	5
BC4	I feel that the data I collect or I have are important for monitoring (facility) service performance	1	2	3	4	5
BC5	My work of collecting data is appreciated and valued by supervisors	1	2	3	4	5
BC6	I feel that data collection/recording is not the responsibility of health care providers	1	2	3	4	5

1.3: RHIS KNOWLEDGE		
OBK	Indicate possible reasons for collecting or using aggregated data monthly for the following data types. **(Circle your response either 1. Yes or 2. No.)**	**Answer**
OBK1	The reasons for collecting or using aggregated diseases data:	
	A. To provide individual level care	1. Yes 2. No
	B. To know changes in magnitude/burden of selected diseases	1. Yes 2. No
	C,To triage patients who need urgent care and those who can wait for some time	1. Yes 2. No
	D To identify disease outbreaks and take action to address epidemics	1. Yes 2. No
	E To plan preventive and promotive activities	1. Yes 2. No
OBK2	The reasons for collecting or using aggregated immunization data:	
	A. To know the coverage of effective intervention (immunization) for improving maternal or child health	1. Yes 2. No
	BTo improve diagnosis and treatment of under five children	1. Yes 2. No
	C. To take action for providing necessary resources (eg. staffing, equipment, vaccines, etc)	1. Yes 2. No
	D. To plan for immunization activities – developing targets for immunization	1. Yes 2. No
OBK3	The reasons for collecting or using aggregated age/sex of patients/clients	
	A. To ensure equitable service coverage across people of all groups	1. Yes 2. No
	B. To know which group is affected by certain disease	1. Yes 2. No
	C. የTo get more funding	1. Yes 2. No
	D. To calculate workload of OPD and under-five clinic	1. Yes 2. No
	E. To know if the appropriate group is getting the relevant services	1. Yes 2. No
OBK4	. The reasons for collecting or using geographical data or residence of patients, i.e., where they come from	
	A. promotive To plan preventive and promotive activities targeted to certain geographic areas	1. Yes 2. No
	B. To improve access and utilization of health services	1. Yes 2. No
	C. To determine the behavior of clients/population group	1. Yes 2. No

	D. For disease surveillance (to control epidemic/disease outbreaks)	1. Yes 2. No
OBK5	Why are population data needed (e.g., number of people living in the catchment area)?	
	A. To use as denominator for calculating of indicators	1. Yes 2. No
	B. To plan the provision of various health services	1. Yes 2. No
	C. To calculate the workload of health facilities	1. Yes 2. No
	D. To know the knowledge and skill of health professionals	1. Yes 2. No

Number	Question	Result										
1.4: SELF PERCEPTION OF COMPETENCY TO PERFORM RHIS TASKS												
This part of the questionnaire is about how you perceive your competence in performing tasks related to health information systems. We are interested in knowing how competent you feel in performing RHIS-related tasks. Please be frank and rate your competence honestly. **Please rate your competence to accomplish the various RHIS activities on a scale from 0-10, where 0 is no competency and 10 is best**												
OBSE1	I can check data accuracy	0	1	2	3	4	5	6	7	8	9	10
OBSE2	I can calculate percentages/rates correctly	0	1	2	3	4	5	6	7	8	9	10
OBSE3	I can plot a trend on a chart	0	1	2	3	4	5	6	7	8	9	10
OBSE4	I can explain the findings of the data analysis and their implications	0	1	2	3	4	5	6	7	8	9	10
OBSE5	I can use data for identifying performance gaps (e.g., service, program, managerial, ...) and its root cause	0	1	2	3	4	5	6	7	8	9	10
OBSE6	I can use data for making operational/ management decisions, e.g., for service delivery, setting performance targets budget allocation, distribution of roles and responsibilities, staff assignment, logistics distribution.	0	1	2	3	4	5	6	7	8	9	10



CS2	The coverage for fully immunized children 12-23 months was found to be 60%, 50%, 30%, 40%, 40% for the years 2004, 2005, 2006, 2007, and 2008, respectively.
CS2a	Develop a trend graph (a line graph) depicting the coverage of fully immunized children 12-23 months by year

Annex VI

Patient folder record completeness checklist

Facility code………

no	age	sex	Address	date of service provision	HPI	P/E record	DX Test result recorded	DDX recorded	RX recorded	Total√
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

*HPI history of present illness

*P/E physical examination

*DX diagnostics

*DDX Assessment/final diagnosis

* RX treatment

Annex VII Data Accuracy cheek list **Facility code ……………………**

Indicator	Recounted data from source documents			DHIS reported Data		
	Feb	Mar	Apr	Feb	Mar	Apr
1. Number of ANC1 visits						
2. Number of ANC4 visits						
3. Total number of women receive modern contraceptive						
4. Total number of new Contraceptive acceptors						
5. Tetanus toxoid 1st dose						
6. Number of Penta3 given in children under one year						
7. Total number of slides performed for malaria						
8. Number of neonates treated for sepsis						
9. Number of new TB cases notified (all types)						
10. Number of new TB cases start treatment						
11. Clients receive HIV test result at VCT						
12. HIV Viral load suppression						
13. Number of clients receive prescription						
14. Number of diabetic patients visited facility during the reporting period						
15. Number of hypertensive patients visited facility during the reporting period						
16. Number of women aged 30 - 49 screened with VIA for cervical cancer Precancerous lesion						

Annex VIII

Indicator data completeness checklist

indicator										Total
ANC1		**MUAC**	**Age**	**Date**	**MRN**	**LNMP**				
	Yes									
penta3		**Sex**	**Age**	**Date**	**MRN**					
	Yes									
OPD		**Sex**	**Age**	**Date**	**MRN**	**Address**	**NcoD**	**TB +/-**	**New /Re**	
	Yes									
Sepsis <2 month		**Sex**	**Age**	**Date**	**MRN**					
	Yes									
LAFP		**Sex**	**Age**	**Date**	**MRN**	**New/r**	**Type**			
	Yes									
TB cases (all types)		**Sex**	**Age**	**Date**	**MRN**	**Tape of Tb**	**Address**			
	Yes									
HIV test results at VCT		**Sex**	**Age**	**Date**	**Popn Group**	**Test result**				
	Yes									
prescription		**sex**	**Age**	**Date**	**MRN**	**Dx**	**Rx**			
	Yes									
positive malaria		**Sex**	**Age**	**Date**	**MRN**	**result**	**Malaria type**			

Annex IX Facility and management assessment questionnaire

OMA1	How money staffs have taken HMIS related training		
OMA2	Does the health facility have dedicated desk/office for HMIS staff	Yes	No
OMA3	Does this office have a functioning computer in place dedicated for DHIS2?	Yes	No
OMA4	Does the health facility have a budget for HMIS supplies (e.g., registers, forms, guidelines, etc.)?	Yes	No
OMA5	Does the HMIS/M&E unit within the health facility have access to financial and logistics resources for HMIS supervision?	Yes	No
OMA6	Does the health facility maintain a schedule for HMIS supervisory visits?	Yes	No
OMA7	Does the facility have copies of the reports of HMIS supervisory visits with action points conducted in the last three months?	Yes	No
OMA8	Does the health facility have copies of a guideline that helps to conduct HMIS supportive supervisory visits?	Yes	No
OMA9	Have you run out of register and forms for the past 6 months	Yes	No

Does the health facility have standard written definitions for the following indicators?	1.Yes	2.No
ID1. Number of ANC1 visits		
ID2. Number of Penta3 in children under one		
ID3. Number of clients currently on art		
ID4. Number of TB cases notified (all types)		
ID5. Tetanus toxoid 1st dose		
ID6. Are there written guidelines available at the health facility on reporting protocols for the program/HMIS		
ID7. Does the health facility prepare data visuals (graphs, tables, maps, etc.) showing positions related to health information?		
ID8. Number of performance monitoring team meeting for the past there months		

Annex X

Key informant interview questionnaire

Facility Code:

Questions

1. What is your specific role in this health facility?

2. What is your educational background?

3. Can you please describe the routine process of collating data in your health facility per day, per week and per month?

4. Are there any challenges you encounter in data management in your health facility? Please describe.

5. Do you work with anyone to ensure data quality in the health facility? Please describe.

6. Do you attend trainings on data management and specifically data quality? How often in a year?

7. What is your understanding of data quality?

8. Do you use any data quality assurance mechanisms? Please describe.

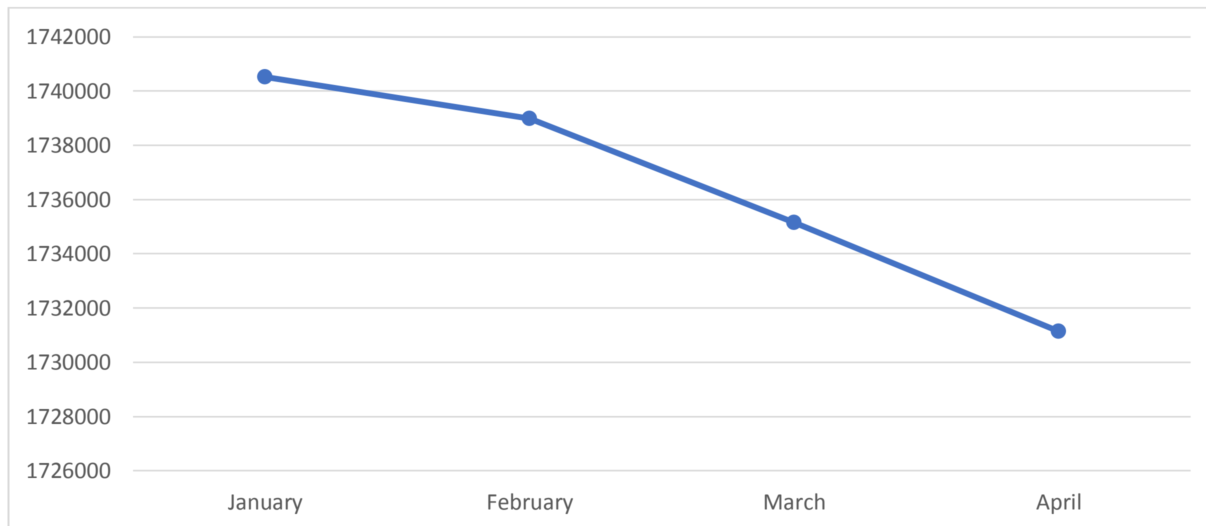
9. How do you ensure data quality in your health facility?

10. What are the challenges you encounter ensuring data quality in your facility

Prob : Staff, organizational and technical related challenges

Annex XI

Number of Total outpatient visits in Addis Ababa health centers Jan-Apr 2020 (n=33)



Annex XII

Test of normality for accuracy of report across sub-cities

	Sub-city	Shapiro-Wilk		
		Statistic	df	Sig.
Accuracy	Addis ketema sub-city	.996	3	.886
	Akaki kality sub-city	1.000	3	1.000
	Arada sub-city	.997	3	.900
	Bole sub-city	.800	3	.114
	Kirkos sub-city	.992	3	.826
	Gulele sub-city	.871	3	.298
	Kolfe Keraniyo sub-city	.900	4	.430
	Nifasilk lafto sub-city	.978	4	.889
	Yeka sub-city	.806	5	.090

Annex XIII

Post-hoc test out-put for accuracy of report

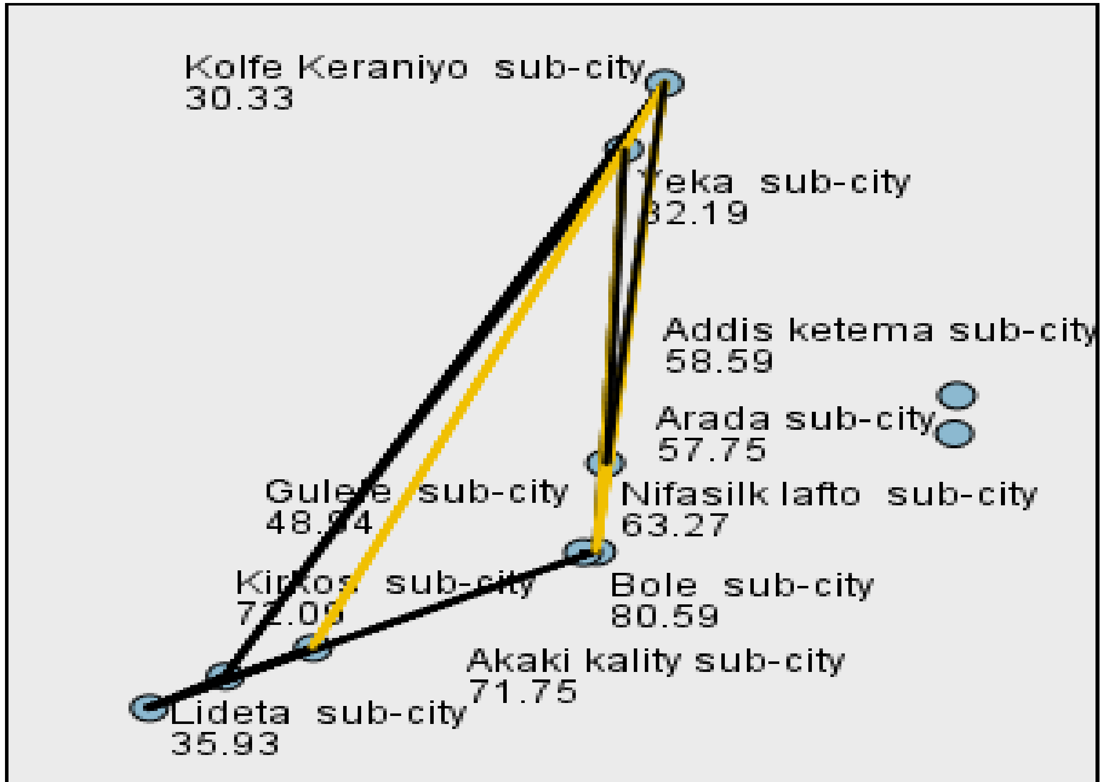
(I) sub-city	(J) sub-city	Sig.	95% Confidence Interval	
			Lower Bound	Upper Bound
Addis ketema sub-city	Akaki kality sub-city	1.000	-21.2783	23.2783
	Arada sub-city	.708	-8.9450	35.6117
	Bole sub-city	1.000	-24.6117	19.9450
	Kirkos sub-city	1.000	-17.2783	27.2783
	Gulele sub-city	1.000	-15.2783	29.2783
	Kolfe Keraniyo sub-city	.513	-34.8395	6.8395
	Lideta sub-city	1.000	-24.4079	25.4079
	Nifasilk lafto sub-city	1.000	-17.0895	24.5895
	Yeka sub-city	1.000	-24.1263	15.7263
Akaki kality sub-city	Addis ketema sub-city	1.000	-23.2783	21.2783
	Arada sub-city	.816	-9.9450	34.6117
	Bole sub-city	1.000	-25.6117	18.9450
	Kirkos sub-city	1.000	-18.2783	26.2783
	Gulele sub-city	1.000	-16.2783	28.2783
	Kolfe Keraniyo sub-city	.394	-35.8395	5.8395
	Lideta sub-city	1.000	-25.4079	24.4079
	Nifasilk lafto sub-city	1.000	-18.0895	23.5895
	Yeka sub-city	1.000	-25.1263	14.7263
Arada sub-city	Addis ketema sub-city	.708	-35.6117	8.9450
	Akaki kality sub-city	.816	-34.6117	9.9450
	Bole sub-city	.434	-37.9450	6.6117
	Kirkos sub-city	.997	-30.6117	13.9450
	Gulele sub-city	1.000	-28.6117	15.9450
	Kolfe Keraniyo sub-city	.003	-48.1728	-6.4939
	Lideta sub-city	.891	-37.7413	12.0746
	Nifasilk lafto sub-city	.961	-30.4228	11.2561
	Yeka sub-city	.131	-37.4597	2.3930
Bole sub-city	Addis ketema sub-city	1.000	-19.9450	24.6117
	Akaki kality sub-city	1.000	-18.9450	25.6117
	Arada sub-city	.434	-6.6117	37.9450
	Kirkos sub-city	1.000	-14.9450	29.6117
	Gulele sub-city	.987	-12.9450	31.6117

	Kolfe Keraniyo sub-city	.803	-32.5061	9.1728
	Lideta sub-city	1.000	-22.0746	27.7413
	Nifasilk lafto sub-city	1.000	-14.7561	26.9228
	Yeka sub-city	1.000	-21.7930	18.0597
Kirkos sub-city	Addis ketema sub-city	1.000	-27.2783	17.2783
	Akaki kality sub-city	1.000	-26.2783	18.2783
	Arada sub-city	.997	-13.9450	30.6117
	Bole sub-city	1.000	-29.6117	14.9450
	Gulele sub-city	1.000	-20.2783	24.2783
	Kolfe Keraniyo sub-city	.103	-39.8395	1.8395
	Lideta sub-city	1.000	-29.4079	20.4079
	Nifasilk lafto sub-city	1.000	-22.0895	19.5895
	Yeka sub-city	.960	-29.1263	10.7263
Gulele sub-city	Addis ketema sub-city	1.000	-29.2783	15.2783
	Akaki kality sub-city	1.000	-28.2783	16.2783
	Arada sub-city	1.000	-15.9450	28.6117
	Bole sub-city	.987	-31.6117	12.9450
	Kirkos sub-city	1.000	-24.2783	20.2783
	Kolfe Keraniyo sub-city	.047	-41.8395	-.1605
	Lideta sub-city	1.000	-31.4079	18.4079
	Nifasilk lafto sub-city	1.000	-24.0895	17.5895
	Yeka sub-city	.797	-31.1263	8.7263
Kolfe Keraniyo sub-city	Addis ketema sub-city	.513	-6.8395	34.8395
	Akaki kality sub-city	.394	-5.8395	35.8395
	Arada sub-city	.003	6.4939	48.1728
	Bole sub-city	.803	-9.1728	32.5061
	Kirkos sub-city	.103	-1.8395	39.8395
	Gulele sub-city	.047	.1605	41.8395
	Lideta sub-city	.668	-9.1297	38.1297
	Nifasilk lafto sub-city	.096	-1.5436	37.0436
	Yeka sub-city	.854	-8.5035	28.1035
Lideta sub-city	Addis ketema sub-city	1.000	-25.4079	24.4079
	Akaki kality sub-city	1.000	-24.4079	25.4079
	Arada sub-city	.891	-12.0746	37.7413
	Bole sub-city	1.000	-27.7413	22.0746
	Kirkos sub-city	1.000	-20.4079	29.4079
	Gulele sub-city	1.000	-18.4079	31.4079
	Kolfe Keraniyo sub-city	.668	-38.1297	9.1297
	Nifasilk lafto sub-city	1.000	-20.3797	26.8797
	Yeka sub-city	1.000	-27.5285	18.1285

Nifasilk lafto sub-city	Addis ketema sub-city	1.000	-24.5895	17.0895
	Akaki kality sub-city	1.000	-23.5895	18.0895
	Arada sub-city	.961	-11.2561	30.4228
	Bole sub-city	1.000	-26.9228	14.7561
	Kirkos sub-city	1.000	-19.5895	22.0895
	Gulele sub-city	1.000	-17.5895	24.0895
	Kolfe Keraniyo sub-city	.096	-37.0436	1.5436
	Lideta sub-city	1.000	-26.8797	20.3797
	Yeka sub-city	.979	-26.2535	10.3535
Yeka sub-city	Addis ketema sub-city	1.000	-15.7263	24.1263
	Akaki kality sub-city	1.000	-14.7263	25.1263
	Arada sub-city	.131	-2.3930	37.4597
	Bole sub-city	1.000	-18.0597	21.7930
	Kirkos sub-city	.960	-10.7263	29.1263
	Gulele sub-city	.797	-8.7263	31.1263
	Kolfe Keraniyo sub-city	.854	-28.1035	8.5035
	Lideta sub-city	1.000	-18.1285	27.5285
	Nifasilk lafto sub-city	.979	-10.3535	26.2535

Annex XIV

Post-hoc test out-put for pairwise comparison of Timeliness of report between sub-cities



Annex XV

Data quality level of health centers, in Addis Ababa, Ethiopia,2020

Health center	Completeness	Timeliness	Accuracy	Consistency	Data Quality
Abbissinya HC	94.02	33.33	79	94.4	75.92
woreda 03 HC	75.65	100.00	92	97.9	89.29
Millinium HC	92	66.67	63	96.5	75.79
Gelan HC	91.26	33.33	77	95.8	74.43
Saris HC	92	33.33	76	96.5	74.32
st.GC HC	96.16	0.00	78	96.3	69.68
Janmeda HC	89.35	66.67	59	97.2	73.46
Arada HC	92.98	33.33	70	96.5	72.21
Semen HC	94.07	100.00	65	100.0	84.22
Dilfre HC	80.74	33.33	75	96.5	70.54
Bulbula HC	87.21	66.67	90	98.6	85.36
Goro HC	89.93	66.67	76	95.8	80.3
Meshalekia HC	93.84	0.00	82	96.53	70.6
Kirkos HC	90.81	33.33	74	97.2	73.23
HiwotAmba HC	95.26	66.67	63	97.2	76.83
Machew HC	91.61	66.67	67	97.2	77.34
Shiromed HC	97.99	100.00	82	98.6	92.06
Addisu Gebeya HC	91.36	66.67	64	97.9	76.13
K/K sub-city Woreda06 HC	91.36	33.33	91	98.5	80.33
K/K sub-city woreda09 HC	93.19	66.66	97	97.2	89.81
kolfe HC	93.78	0.00	96	98.6	76.39
Lomi meda HC	91.11	0.00	84	98.6	70.79
W/ro Beltshachew HC	93.36	33.00	76	97.2	74.73
Lideta HC	93.48	0.00	79	98.6	69.51
NFS.L sub-city woreda01 HC	85.03	33.33	75	97.9	71.97

NFS.L sub-city Woreda02 HC	92.14	33.33	68	93.8	70.88
NFS.L sub-city woreda03 HC	90.98	0.00	82	96.5	69.75
NFS.L sub-city Woreda 11 HC	88.55	100.00	72	96.5	85.02
Yeka HC	93.56	0.00	75	99.3	68
entoto 01 HC	90.73	33.33	83	96.5	76.74
yekoria Zemach HC	91.66	0.00	84	97.2	70.82
Yeka Abado HC	91.11	33.33	86	95.8	77.98
Yeka woreda 13 HC	88.74	0.00	83	93.8	69.2

Annex xvi

Percentage of outlier monthly indicator report in sampled health centers aggregated by sub-city in Addis Ababa, Ethiopia,2020.

	May	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**
Addis ketema	8%	3%	3%	3%	14%	8%	0%	0%	0%	0%	0%	8%
Akaki kality	3%	14%	11%	0%	0%	0%	3%	0%	3%	0%	3%	6%
Arada	3%	0%	3%	0%	0%	6%	6%	3%	0%	0%	3%	6%
Bole	3%	0%	3%	6%	3%	0%	3%	6%	3%	0%	3%	17%
Gulele	8%	0%	0%	3%	8%	0%	0%	0%	0%	3%	3%	0%
Kirkos	0%	3%	0%	6%	11%	6%	3%	0%	3%	0%	3%	3%
Kolfe keraniyo	0%	2%	2%	0%	2%	0%	2%	4%	8%	0%	2%	2%
Lideta	0%	4%	0%	0%	0%	4%	0%	8%	0%	0%	0%	8%
Nifas silk lafto	3%	6%	14%	0%	3%	6%	6%	0%	3%	3%	3%	17%
Yeka	5%	3%	3%	2%	2%	2%	5%	3%	2%	3%	3%	7%

Annex xvii

Percentage of outlier indicator report by month, in Addis Ababa, Ethiopia,2020

Month	Percent of Outlier indicators report	Modified Z-score value
May	3.277778	0.390152
June	3.458333	0.562083
July	3.875	0.958848
August	1.833333	-0.9853
September	4.263889	1.329162
October	3.083333	0.204995
November	2.652778	-0.205
December	2.416667	-0.42983
January	2.111111	-0.72079
February	0.888889	-1.88463
March	2.208333	-0.62821
April	7.263889	4.185868

Annex xviii

Socio-demographic characteristics of Key informants' interview on data quality challenges on HMIS in Addis Ababa city Administration, Ethiopia, 2020

Respondents	Duration on HMIS	Education	Sub-city/ workstation	Position	Duration of interview
R1	3 years		AAHB	Planning department in Addis Abeba Health Bureau/ data use specialist	32'39"
R2	2 and half-year	Information Technology	Arada sub-city HC	HIT of Arada sub-city health center	8'41"
R3	5 years	Health officer	Arada sub-city HC	Medical director of Arada sub-city health center	15'46"
R4	1 year and 2 months	Junior health information technician	Arada sub-city sub-city health office	HIT of Arada sub-city sub-city health office	18'45"
R5	4 years	Health officer	Lideta sub-city HC	Medical director of Lideta sub-city health center	22'24"
R6	3 years	HIT	Nifas Silk sub-city woreda 01 HC	HIT at woreda 01 HC in Nifas Silk sub-city	8'38"
R7	4 years	HIT	Nifas Silk Lafto sub-city woreda 02 HC	HIT at woreda 02 HC in Nifas Silk Lafto sub-city	10'37"
R8	3 years	HIT	Nifas Silk lafto sub-city W 03	HIT or HMIS focal person at woreda 03 HC in Nifas Silk lafto sub-city	13'57"

R9	5 years	BSc Nurse	Nifas Silk sub-city W01	VCT nurse 01 HC Nifas Silk sub-city	11’24”
R10	3 years	HIT	Kolfe keranio sub-city health bureau	Kolfe keranio sub-city health bureau HIT	15’47”
R11	5 years		AAHB	HMIS data manager in Addis Abeba Health Bureau/ data use specialist	40’35”
R12	6 years		AAHB	monitoring and evaluation at Addis Abeba Health Bureau	38’07”

Annex XIX

Curriculum Vitae (CV)

1. Personal information

- Full name: - Binyam Haftu Tsadik Email: - binyamhaftu@gmail.com
- Sex: Male Phone number +251910866806
- Place of birth: Addis Ababa, Ethiopia or +251935234881
- Date of birth: -Jan 31, 1993
- Nationality: Ethiopia
- Physical condition: Healthy

2 Educational background:

- Elementary school (Grade 1-8) at Yemane Brhan primary school
- High school (Grade 9-10) at HOPE secondary school
- Preparatory (Grade 11-12) at Ayer Tena preparatory School
- Higher education: - University of Gondar
- Post Graduate student at Addis Ababa university

3. Qualification

- BSc degree in Public health officer
- M.Sc. in Public health (Epidemiology and Biostatistics) candidate

4. Skills

- Basic computer skills, SPSS, Epi -DATA, Epi info, Ms. Windows, Ms.-word, Ms.-excel, Ms.-power point Ms.- Access and Com-Care APP

5. Supportive trainings

- Training on national comprehensive HIV care and treatment (ART) organized by University of Gondar and CDC Gondar project

- Training on community-based management of severe acute malnutrition (CMAM) organized by Goal Ethiopia
- Basic in-service training on Compassionate respectful and caring(CRC) organized by wachemo university in collaboration with SNNPR-RHB
- Training on Health Care Quality improvement organized by Micronutrient initiative
- Training on Ethiopian health center reform implementation organized by Zonal Health District
- Training on revised Health Management Information System (HMIS) Organized by JSI HMIS scale-up project and SNNPR Regional Health Bureau

6. Work Experiences: - Three years and one month of work experience

Around 3 years and one month of progressive professional experience as a physician and focal person at Danema Health center and west Badawacho health office. I had been working for one year as OPD case team coordinator, OTP, and SC focal person. I have also experience working as HMIS focal person for six months, with a dedicated positive attitude, problems solving skills, excellent interpersonal communication skills, a strong orientation towards results & details, excellent leadership skills.

7. References

Dr Adnew Tesfahun (PhD) at University of Gondar

Email [atesfahun 1@gmail.com]

Wondimu Girma (Primary Health director at Danema Health center)

Email kebewendy17@gmail.com

Name of investigator: Binyam Haftu | Name of Advisor

Signature | Signature

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned MPH student declare that this thesis is my original work in fulfillment of requirement for the master of public health in Epidemiology and Biostatistics.

Name of the student: Binyam Haftu

Date.____________________ Signature________________

Approval of the primary Advisor

This thesis work has been submitted with our approval as the university advisor.

Name of the primary advisor: Dr. Girma Taye

Date.____________________ Signature __________