Data quality and it's correlation with Routine health information system structure and input at public health centers in Addis Ababa, Ethiopia.

Wondimu Ayele[1], Ephrem Biruk[1], Tigist Habtamu[1], Girma Taye[1*], Mulugeta Tamire[1], Adamu Addissie[1]

Abstract

Background*:* The Government of Ethiopia, together with its partners, has made significant progress over the years in the standardization and implementation of health information system (HIS). The sector continues to be challenged by its lack of accurate, timely and thorough data, which therefore has affected the quality of care, planning and management systems in the country. This study assessed HIS for managing health care data and data quality in the Addis Abeba City Administration in Ethiopia.

Methods*:* A cross-sectional study was conducted to determine the quality of the data. The study was conducted in 25 health centers in Addis Ababa City. Connected woreda assessment tools have been used. Composite analysis was carried out to determine the implementation of routine health information system structure and input. Univariate and multiple linear regression are used to identify predictors of overall data quality,reporting findings using a regression coefficient and 95 % confidence interval.

Result: The overall |implementation of RHIS structure and input was 63.9% at health facilities. The mean score of RHIS structure and input was 19.2/30 + 4.7. The overall data quality was found to be 57.9% with a 95 Confidence interval of (95%CI (51.0-64.9%). Overall data accuracy, completeness, and timeliness in all assessed health facilities was 69.6% (95 IC 59.8-79.3%), 49.5% (95 CI 38.3-60.7%), and 56% (95 CI, 48.8_63.2), respectively. Supportive supervision and mentorship found to be associated to data quality, as supervision mean score increase by one-unit data quality increases by 1.42 with 95% CI (0.10-2.76) given another variable held constant.

Conclusion and recommendation: Overall data quality was much lower than the national acceptable level of less than 90%. Supportive supervision and mentorship has a significant correlation with data quality. A considerable number of health facilities have not yet fulfilled all the input required to strengthen the HIS. Strengthen support supervision and mentorship is an opportunity to improve data quality at the level of health facilities. [*Ethiop. J. Health Dev.* 2021; 35(SI-1):33 - 41]

Keywords: Data quality, RHIS structure and input, healthcare data

Introduction

The Government of Ethiopia, together with its partners, has achieved significant achievements over the years in the standardization and implementation of Rouine health information system (RHIS). The main objective of HIS is to ensure better measurement, through the strengthening of standardized health information and data management systems that ensure better data – better decision-making – better performance of health systems and improved health status of citizens (1).

In order to strengthen the country's HIS, Ethiopia has embarked on a wide-ranging reform and redesign of health management and information systems. The reform has taken major steps in response to a lack of accurate, timely and comprehensive data that has therefore affected the quality of care, decision making, planning and management systems at all levels of the health care systems (2).

However, findings of a previous assessment revealed that poor quality of data poses a major challenge at all levels (1). Moreover, data generated at different levels of the health system are very often shallow, incomplete, and lack analytical perspective due to a number of issues related to the use of information (3,4). This shows that ensuring data quality, proper management, analysis, and meaningful interpretation and culture of information use at all levels remains a challenge in the Ethiopian health system (1-6).

Enhanced quality of health data in patient health records may have an impact on clinical and administrative decision-making in the health economy and on patient safety (7). Despite the importance of medical records for effective and efficient management of medical information, it has rarely been a priority and has usually been undermind and mishandled in the country. The study in a health facility in Ethiopia shows that only 45.7% of the medical information had been completed (8). A facility-based cross-sectional study was conducted at Ayder Referral Hospital and 36.7% of the data were incorrect (9).

The study conducted at Dalefage Primary Hospital, West Afar, Ethiopia, showed that the completeness and reporting of inpatient medical records was 73.6%, which was national target(10). In Menelik II Referral Hospital, inpatient patient record completeness was shown to be 73% , below expected threshold of 90% (11).

This is expected to lead to dynamic advances in the healthcare system's monitoring and evaluation system. The quality of health care data depends on the underlying data management and reporting systems; stronger systems should produce better quality data (8). In other words, for the production and flow of good quality data through a data management system, key functional components must be in place at all levels of the system, particularly at the service delivery point.

Further to the assessment of the quality of the data, the assessment of the system that produces the data to be used for decision-making in health care is therefore necessary to support successful future improvement and implementation. The aim of this study was therefore to

[1]School of Public Health, College of health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

assess the quality of routine health data and its correction with the RHIS structure and input in the public health centres.

Method

Study area and period

The study was conducted in the selected health facilities of Addis Ababa from April to May 2020 to assess the availability of RHIS structure and input and data quality. This study was conducted in a public health centers in three selected sub-cities in Addis Ababa city. Addis Ababa city is the capital city of the country. The city has ten sub-cities, and 116 woredas, and an estimated total population of 4.5 million in 2018. Currently, there are 86 health centers owned by the city administration. The study was conducted in Gulele, Addis Ketama, and Kirkos sub-city.

Study design

A cross-sectional study was conducted using quantitative approaches to determine data quality at the service delivery point using connected woreda assessment tools.

Populations

Source population: All public health centers in Addis Ababa city administration were the source population for the study.

Study population: The study population were the entire all public health facilities and selected health workers in the three sub-cities.

Sampling Size and Sampling Procedure

This method involves the random selection of several sites that together are representative of all the sites where activities supporting the indicator(s) under study are being implemented. Study sites are widely distributed and the various administrative levels are not of equal size, hence the need to have a sampling frame that involves the selection of clusters accordingly. In the first phase, the sub-cities were clustered into three based on existing evidence on data quality in consultation with Addis Ababa health bureau planning and monitoring and evaluation sub-process. Then one sub-city was randomly selected from each cluster, a total of three sub-cities (Gulele, Addis Ketama, and Kirkos) were randomly selected from the city administration. There were 27 health centers in the three sub-cities, of which two health center are being usedas a COVID 19 treatment center. Data were, thus, collected from the remaining 25 public health centers in the three sub-cities.

Data collection procedures

Comnnected woreda assessment tool, semi-structured guides, checklists and review of documents were used for the data collection. Data collectors were recruited and assigned to each study health facility to collect primary and secondary data as per agreed tools and methodologies. Accordingly, a systems assessment protocol and data verification protocol was carried out to assess routine health data quality. Monitoring and evaluation structure, functionality and capability, indicator definitions and reporting guidelines, data collection and reporting forms and tools, and data management process were assessed using system assessment protocol.

Variables of the study

Dependent variable: Data quality (completeness, timeliness, accuracy).

Independent variable: availability RHIS input such as standard shelve, availability of guideline manuals, recording and reporting tools, RHIS focal person, dedicated desk and office in RHIS unit, budget allocation, supportive supervision and mentorship, supportive supervision feedback, RHIS implementation, training, and availability of performance monitoring team (PMT) review.

Operational definition

Accuracy - All relevant facts pertaining to the episode of care are accurately recorded. There were two questions, with maximum score of twelve and minimum of score of zero, used to determine data accuracy.

Completeness - This refers the extent to which facility and health worker filled all data elements in the reports or data base for all reportable events. There were two questions on data completeness and report completeness, with maximum score of twelve and minimum score of zero, used to determine completeness.

Timeliness – It refers to if all expected reports are compiled and prepared within a specified time frame, having been checked, verified and sent to the next level with in a due date. There were two questions, with maximum score of eight and minimum score of zero, used to determine timeliness.

RHIS structure and Inputs: availability of fucational M&E units, focal person, recording and reporting tools, recording and reporting guidline etc for implementation of RHIS. There were thirteen questions with five dimensions with a maximum score of thirty and minimum of zero used to to measure RHIS structure and inputs.

Data quality: Data quality was computed using an overall of six questions which have three data quality dimensions. These dimensions are data accuracy, completeness, and timeliness, where each accounts for 10, 12, and 8 maximum scores, respectively.

Data management and analysis

The collected data was cleaned for missing, inconsistency, and incompleteness. Performance of Routine Information System Management (PRISM) analysis method were used to determine composite score of RHIS structure and inputs, data accuracy, completeness, timeliness and overall data quality. Statistical software SPSS was used for further data management and analysis. Descriptive statistics of proportions (percentages), measures of central tendency, and measures of dispersion were used to describe the findings of the data. Linear regression was used to assess the correlation between the outcome

variable and independent variables. The final model result was presented using regression coefficient and 95 % CI.

Ethical clearance:

Ethical clearance was secured from the College of Health Sciences (CHS), Addis Ababa University (AAU), institutional review board. A permission letter was obtained from the Addis Ababa health bureau and sub-city health office. Health facilities' managers were briefed about the objective of the study. Written informed consent was taken from all study participants.

Result

Routine health information system structure (RHIS input, Budget allocation, and HIS implementation)

Of the total assessed health facilities, 15(60%) have standard shelve, 14(56%) properly filled individual medical record, 15(60%) assigned dedicated desk and office and 13(52%) Health Management Information System (HMIS) unit with fully staffed. All health facilities reported that their medical record units are assisted by the use of an electronic system. Regarding to eHealth implementation, all assessed health facilities have computer dedicated for DHIS2 in place, implementing DHIS2, and have a functional Health Net. However, just 11(44%) health facilities have a functional Local Area Network (LAN). Of the total assessed health facilities, 11(44%) were supervised by sub-cities health office quarterly and only 8(32%) reported that the supervisors checked data quality during sueprvsion (Table 1).

Table 1 RHIS structure and implementation status study health facilities, Addis Ababa, Ethiopia, 2020

Has facilities with RHIS structure and Inputs	Number	Percent
Standardized Shelves	13	52%
Individual medical cards are properly filed and easily accessible for clients	14	56%
The medical record unit is assisted by the use of an electronic system	25	100%
Dedicated desk/ office	15	60%
A computer dedicated to DHIS 2 is in place	25	100%
The HMIS unit is fully staffed	13	52%
Assigned budget to strengthen RHIS	11	44%
Implemented DHIS 2	25	100%
Functional Health Net	25	100%
Functional Local area Network	11	44%
Sub-city supervisor visit per quarter	11	44%
Used standard checklist during supervision	11	44%
Data quality checked during supervisions	8	32%
The supervisor discussed the facility's performance based on HMIS information	11	44%
Supervision helps to make a decision or corrective action based on the discussion?	15	60%
Provide written feedback to the health facility after supervision	13	52%
Conduct internal supportive/supervision/mentorship	11	44%

The overall HIS structure implementation, 63.9% of health facilities fulfiled the standard. The average score of health facilities regarding structure and implementation of HIS was 19.2/30 with a standard deviation of 4.7. Of these, the mean score for "health facilities has RHIS input availability to strengthen HIS" was 11.6/18 + 3.4, the mean score for "the health facilities has implementing HIS and assigned budget" 4.3/6 + 1.2 and the mean score for "supportive supervision and mentorship" 3.2/6 +1.61. Of the health facilities with RHIS manual and guideline to facilitate the implementation of HIS, 17(68% health facilities have diseases classification (NCoD) guideline, 15(60%) have data quality and information guideline and 13(52%) have RHIS indicator definition (Figure 1).

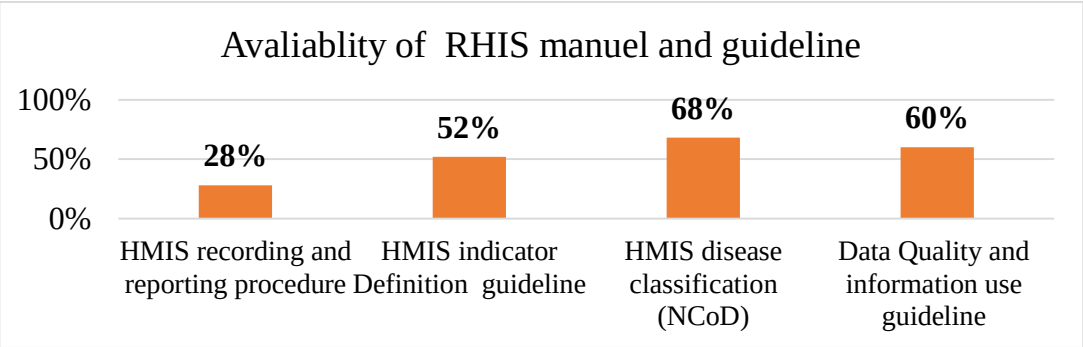

Figure 1. **Overall Routine health information system structure and implementation status in health facilities of three sub-cities**

Out of the assessed health facilities, 6(24%) have implemented RHIS and allocated RHIS budget to strengthen RHIS. RHIS was implemented in all health facilities of Addis Ketam Sub-city. Overall RHIS structure implementation was 73.3%, 56.7%, and 56.3% in Gullele, Addis Ketam, and Kirkos sub-city, respectively. Of the studied health facilities, 14(56%) score below 65% in RHIS structure and implementation

status,while 10(44%) score between 65 to 90% score. Two health centers did not receive any supervision in the Addis Ketam sub-city.

Data quality

Report and document to assess completeness and timeliness:

Of all assessed health facilities, 24(96%) have electronic data quality validation rules/system. Regarding maintaining records, 14(56%) health facilities maintained records of Lot Quality Assurance Sampling (LQSA) check sheet, 20(80%) health facilities maintain records of feedback to staff on data quality self-assessment findings and 21(84%) keep a logbook/uses an electronic system to track reporting completeness of case teams. Regarding report completeness, 11(44%) health facilities had less than 50% report completeness , 6(24%) between 50% to 90% and 8(32%) above 90%. Above two-thirds of health facilities, keeps logbook/uses an electronic system that helps to track report timeliness; 8(32%) health facilities received above 90% reports from their case teams on time according to the national reporting schedule. (Table 2).

Table 2. **Data quality and reporting in selected health facilities of three sub-cities Addis Ababa, Ethiopia, 2020**

Health facilities		Number	Percent
Have data quality self-assessment tools and electronic data quality validation rule/system	No	1	4.0%
	Yes	24	96.0%
Conducted LQAS in the review of three months?	No	1	4.0%
	Yes	24	96.0%
Maintain a record of LQAS check sheets	No	11	44.0%
	Yes	14	56.0%
Maintain records of feedback to staff on data quality self-assessment findings	No	5	20.0%
	Yes	20	80.0%
Keeps a logbook/uses an electronic system to track reporting completeness of case teams	No	4	16.0%
	Yes	21	84.0%
Reporting completeness	below 50%	11	44.0%
	50-90%	6	24.0%
	Greater than 90%	8	32.0%
Complete report submission to next level	Any missing report	12	48.0%
	All expected report	13	52.0%
Received complete report from each case team	Missed any report	16	64.0%
	all the expected reports	9	36.0%
Content completeness	<50%	12	48.0%
	50%-90%	7	28.0%
	more than 90%	6	24.0%
Keeps logbook/uses an electronic system to track report timeliness	No	8	32.0%
	Yes	17	68.0%
Report received from each cases team on time	<50%	11	44.0%
	50%-90%	6	24.0%
	Above 90%	8	32.0%
Report submitted on time	<50%	9	36.0%
	50%-90%	9	36.0%
	Above 90%	7	28.0%

In this baseline assessment, the overall data quality was found to be 57.9% with a 95 Confidence interval (95%CI,51.0-64.9%). Overall data accuracy, completeness, and timeliness in all assessed health facilities were 69.6% (95 CI 59.8-79.3%), 49.5%(95 CI 38.3-60.7%), and 56%(95 CI, 48.8-63.2), respectively (Figure 2).

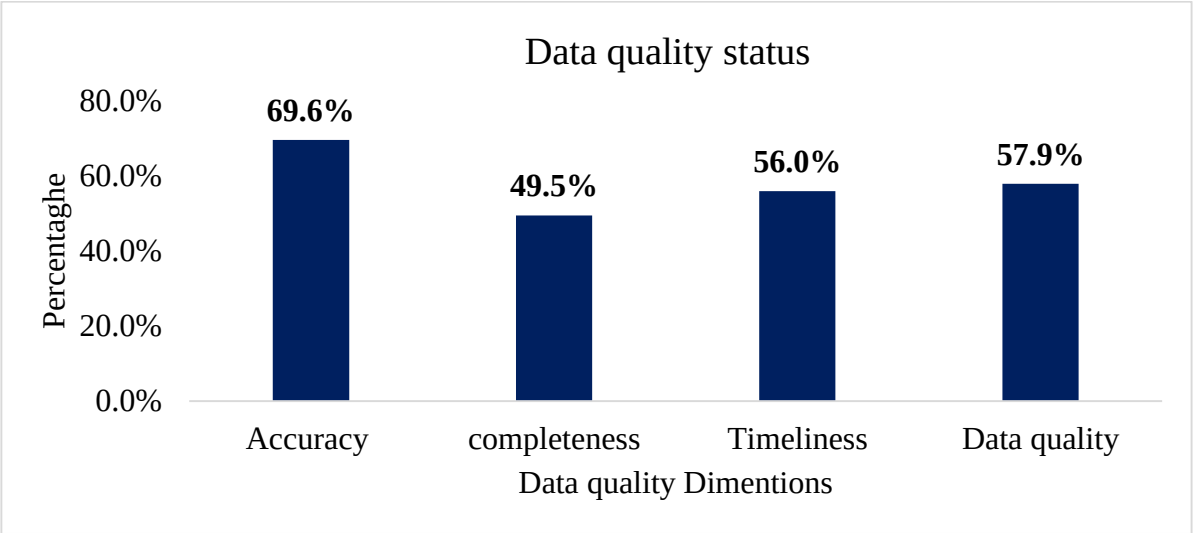

Figure 2. **overall data accuracy, completeness, timeliness, and quality in health facilities.**

The mean score of health facilities for data accuracy was 7.0/10 with a standard deviation of 2.4, for data completeness 5.9/12 + 3.3 and for timeliness 4.5/8 +1.4. Concerning score of data accuracy, 6(24%) score ten out of ten, 4(16%) six out of ten, 3(12%) seven out of ten, and 5(20%) less than five out of ten. Regarding completeness, 4(16%) health facilities score 88%, 11(44%) health facilities score above 60% and 3(12%) health facilities score 50%. Nine health facilities score five out of eight in timeliness while 5(20%) health facilities score three out of eight. The majority, 16(64%), of the health facilities score below 65% in data quality, 9(36%) health facilities score 65% and above, and no health facilities score 90% in data quality.

The average data quality were 67.4%, 56.7%, and 48.5% for health facilities of Gullele, Kirkose and Addis Ketam, respectively. Only one health center score 75% in data quality and the rest seven health facilities data quality below 60% in Addis ketam sub-city. While above half of the health centers from Gullele sub-city score 65% and above. (Table 3)

Table-3: **data accurcy, timelness, completeness and overall data quality in assessed health centers of three sub-city in addis Ababa, Ethiopia, 2020**

Sub-city	Health Center	Accuracy (n=10)	Timeliness(n=8)	Completeness(n=12)	Data quality
Addis Ketema	Abebe	10(1.0)	5(0.6)	2(17)	17.0(56.7)
	Abisiniy	5(0.5)	3(0.4)	4(33)	12.0(40.0)
	Addis Ketema	10(1.0)	5(0.6)	8(63)	22.5(75.0)
	Addis Raye	7(0.7)	3(0.4)	6(50)	16.0(53.3)
	Felegemeles	6(0.6)	3(0.4)	6(50)	15.0(50.0)
	KuasMeda	6(0.6)	2(0.3)	3(25)	11.0(36.7)
	Millinious	6(0.6)	3(0.4)	4(33)	13.0(43.3)
	Werda 03	5(0.5)	3(0.4)	2(17)	10.0(33.3)
	Average Sub-city	7(0.7)	3(0.4)	4(36)	14.6(48.5)
Gullele	Addis Gebeya	4(0.4)	5(0.6)	11(88)	19.5(65.0)
	Addis Hiwot	10(1.0)	6(0.8)	2(17)	18.0(60.0)
	Entot Fana	9(0.9)	7(0.9)	9(75)	25.0(83.3)
	Hidase	8(0.8)	5(0.6)	6(50)	19.0(63.3)
	Maychew	6(0.6)	5(0.6)	4(33)	15.0(50.0)
	Selam	3(0.3)	5(0.6)	11(88)	18.5(61.7)
	Shegole	4(0.4)	5(0.6)	11(88)	19.5(65.0)
	Shiromeda	8(0.8)	7(0.9)	9(75)	24.0(80.0)
	Tibebebekelechene	10(1.0)	6(0.8)	8(63)	23.5(78.3)
	Average Sub-city	7(0.7)	6(0.7)	8(64)	20.2(67.4)
Kirkos	Efoyita	7(0.7)	4(0.5)	4(33)	15.0(50.0)
	Felegehiwot	9(0.9)	5(0.6)	2(17)	16.0(53.3)
	Feres Meda	10(1.0)	5(0.6)	9(71)	23.5(78.3)
	Gotera	7(0.7)	4(0.5)	10(79)	20.5(68.3)
	Hiwot Amba	10(1.0)	6(0.8)	11(88)	26.5(88.3)
	Kazanchis	7(0.7)	4(0.5)	2(17)	13.0(43.3)
	Kirkos	3(0.3)	4(0.5)	8(63)	14.5(48.3)
	Meshualkiya	4(0.4)	2(0.3)	1(8)	7.0(23.2)
	Average Sub-city	7(0.7)	4(0.5)	6(47)	17.0(56.7)

Factor associated with data quality

As indicated below data quality increase when RHIS input such as availability manual guideline and computer including focal person score increase. eHIS and budget allocation score increases by one-unit data quality also increase by 0.44 point with 95%(-1.26-2.13). supportive supervision and mentorhsips were significant associated with data quality, as mean score of supervision and mentorship increases by one unit data quality increased by 1.42 with 95% CI (0.10-2.76), given other variables held constant. (See Table 4)

Table 4: **RHIS structure and implementation and information use variable factor associated with data quality**

RHIS structure and implementation and information use variable	Mean	Univariate Unstandardized coefficient (95%)	Multivariate Adjusted Regression coefficient(b) 95% CI
RHIS Input score	11.60	0.64(0.06-1.22)	0.309(-0.32,0.93)
HIS and Budget allocation	4.32	0.85(-0.91-2.61)	0.44(-1.26-2.13)
Supervision and mentorship score	3.24	1.79(0.69-2.89)	1.42(0.10-2.76)
Performance Mentoring score	8.20	0.096(-0.70-0.89)	-0.022-0.22

Discussion

The main aim of this study was to determine correlation between RHIS structure and inputs and data quality at the health facilities level in Addis Ababa city administration. We assessed routine health information structure and implementation status and RHIS inputs such as manual recording and reporting tools, HIS implementation, supportive supervision and mentorship, and budget allocation to strengthen RHIS at the health facilities level. We have also assessed the availability RHIS input and its correlation with data quality.

In our study, medical record units were assisted by the use of an electronic system and DHIS2 and health Net were implemented in all of the health facilities. This has played a crucial role in improving access to data as well as data quality. The majority of the health facilities has standard shelves and individual medical record properly filled, dedicated desk and fully staffed HMIS unit.

Studies from different parts of the countries documented that the availability of comprehensive national Standard Operating Procedures (SOP), recording and reporting formats, including assigning of dedicated staff to HMIS unit, showed improvement after a redesign of health information system in the country (34-36.) The RHIS input in our study was much higher than that of the study done in Eastern Ethiopia, where the majority of the health facilities did not have assigned HIS personnel, dedicated RHIS office and allocated budget to strengthen RHIS (35).

However, still a considerable number of health facilities have not yet fulfilled all the required input to strengthen the HIS. This finding is consistent with another study that showed RHIS structure and input was not fully implemented in most health facilities as per the recommended national standard (2,35). Four out of ten health facilities allocated a budget to strengthen RHIS in our study.

In our study, the overall data quality was 57.9% with an accuracy of 69.6%, completeness of 48.9%, and timeliness of 56%. This was much below the national acceptable level of RHIS report quality (34). The overall data quality in our study is higher than the study done in Kenya (37). The difference could be attributed to the fact that the study period and setting were different. Data completeness in our study was lower than that of the study done in Ayder Hospital, which reported 78.6%, and Eastern Ethiopia, which reported 77.4% (9,35). Our study's difference in data completeness could be attributed to the fact that we used PRISM contextualized analysis method to analyze data completeness and timeliness, which could lead to an underestimation. Only four in ten health facilities received supportive supervision as per the standard and discussion with health facilities during the supervision carried out based RHIS data. Moreover, one-third of supervisors were discussed data quality, which might contribute to poor data quality.

The findings of this study identify that RHIS input such as availability manual guideline, HMIS unit staffing, implementation of HIS, budget allocation, and availability of functional performance team has positive correction with data quality. Though, the results are not proved by statistical significance test, due to the small sample size. The study also identified that close follow up and consistent supportive supervision and mentorship with valuable feedback from the higher level to health centers contributed much more to the data quality of the health facilities. Studie from different setting showed that supportive suervsions associated with data quality (30-37). It is also well pronounced from the study result that the use of health information was found to be positively associated with a better quality of RHIS data. However, this study did not assess' behavioral factors such data management process knowledge and attitude of health worker and its effect on data quality in our study area.

Conclusion

Overall data quality was much lower than the national acceptable level of 90%. The lack of RHIS training, the availability of standard indicators, the availability of PMTs, and the availability of support supervision and mentoring have been correlated with the data quality level of health facilities. Continuous supervision and mentoring can be effective in improving the quality of health data. Health facilities should strengthen internal supporting supervision and allocate budget to improve data quality. The quality control of data on HMIS reports at the time of supervision and on-site support can improve the quality of the data.

Recommendations

To ensure availability and use of RHIS mauanl and guidline the Regional Health Bureau and Sub-Cities Health Office should avail HMIS guidelines and manuals for the health facilities.

Regular capacity building and follow-ups should be provided for the health professionals on data recording, management, and quality assurance.

Continuous supportive supervision and mentorship should be provided to improve data quality at the health facilities level.

Strengthening the Performance monitoring team through regular mentorship and capacity building is crucial to improve the healthcare data quality.

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