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Onsite training-mentoring intervention improves data quality: an implementation research

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Abstract

Background The quality of health data is not satisfactory in Low and Middle Income Countries (LMICs). Haramaya University, in collaboration with Ministry of Health and Regional Health Bureau, conducted an implementation research in selected public health facilities and administrative units. This research was aimed to test the onsite training-mentoring (OTM) intervention and adaptation of the implementation strategy to improve the routine health information system (RHIS) data quality in the context of public health sector.

Methods An interrupted time series design with an onsite training-mentoring intervention was used to improve data quality in public health sector of Jigjiga Woreda, eastern Ethiopia from July 2021 to June 2022. Both the pre and post intervention assessments data were collected by experienced and trained public health professionals using interviewer guided self-administered interview, record review and observation data collection techniques. Data were analyzed using descriptive, bivariate, and multivariate logistic models to identify predictors of data quality.

Results The overall data accuracy was increased from 88.12% before to 95.0% after intervention; and it was above 90% in all the facilities. The overall data content completeness was increased from 75.75% to 89.9%, though it varied among the facilities. The timeliness and report completeness were 100% in all the facilities. The odds of those health workers who had poor knowledge were less likely to ensure data quality (AOR = 0.39; 95%CI: 0.19, 0.83) than their counterparts.

Conclusions The intervention was brought substantial changes of data quality in the study setting. Knowledge of the workers towards data quality is a crucial factor to ensure data quality in the sector. Thus, collective efforts is required to continue this tested intervention to ensure the quality of the routine health information system in the lower levels of the sector.

Keywords Data quality, Implementation research, Onsite training-mentoring intervention, Public health facilities, Ethiopia

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Introduction

Health management information system (HMIS) is one of the six building blocks of health system that integrate data collection, processing, reporting, and use of the information [1]. Low and middle income countries (LMICs) use health information systems as a component of health system reform, though they are experiencing challenges to produce quality data [2, 3]. The quality of health data is an important factor in making decisions and transforming the health sector in order to improve equity and the quality of health care services [1, 4]. The data quality and use remain weak within the health sectors of most LMICs, including Ethiopia [1, 5–7].

It is crucial to improve the routine health information system (RHIS) data quality to provide timely information for service provision and to guide intervention strategies in the health sector [4, 8–10]. However, there are many challenges to have accurate, timely, and accessible health care data at health care services of most LMICs countries [1, 4]. In Ethiopia, RHIS data quality is not satisfactory for most indicators [11], despite the efforts made to strengthen the health information systems [12, 13]. Accuracy and completeness of facility-based routine data remains a big problem in the country [11, 14, 15]. Thus the quality of data has become a growing concern in the sector, which requires reliable data registration, storage, and management at the facilities and all the health care system [16, 17].

Implementation research aims at scientifically studying the implementation of health interventions, including policies, programs and services, in different real-world settings and within the existing range of health systems [18–20]. It is also consider as an efficient and effective tool to accelerate universal health coverage [21, 22]; and more beneficial to sustain evidence based intervention in the health sector [23, 24]. Thus, this implementation research aimed to test the onsite training-mentoring (OTM) intervention and adaptation of the implementation strategy to improve RHIS data quality in the context of public health sector..

Study setting and period

This implementation research was conducted in selected public health facilities of Jigjiga woreda, Jigjiga Woreda Health Office and Regional Health Bureau of Somali Regional State, Ethiopia. The region shares international borders with Kenya to the south, Somalia to the south-east, and Djibouti to the north-west. The region has 11 administrative zones subdivided into 96 districts (Woreda), and 6 town councils [25]. The region has an estimated total population of 6,506,235 by 2022 (3, 454, 673 males and 3,051,562 females) [26]. Pastoralism, whether nomadic or agro-pastoralism, is practiced by more than 85% of the population. The Regional Health Bureau (RHB), which administers Woreda/District Health Offices (WoHO) and hospitals, is at the top of the health-system structure. The WoHO, in turn, manages health centers and health posts in each district. According to the 2022/2023 Health and Health Related Indicators published by MoH, Ethiopian Somali region has 18 Hospitals, 229 Health Centers and 1496 Health Posts [27]. An onsite training-mentoring intervention strategy was used to improve data quality in public health facilities of Jigjiga woreda from July 2021 to June 2022. Following the intervention, the endline assessment was conducted from July 13 to30, 2022.

Study design and implementation strategy

This research was used an interrupted time series design. The research was guided by a Consolidated Framework Implementation Research (CFIR) framework to identify the main constructs of RHIS data quality and how they apply in the context of the study setting [28]. The research was also aligned with the WHO implementation research steps [20]. This research was used stepwise or cyclic process: Firstly, data quality problems were identified in discussion with implementing institutions. Then, formative assessment was conducted to identify barriers and facilitators to improve data quality in the setting. In this assessment, 179 health care workers were participated in guided self-administered data collection. Additionally, three public health facilities, the Woreda Health Office and the Regional Health Bureau were participated in desk review and observational assessments; while 17 key informants were participated in in-depth interviews of the qualitative study. This assessment found technical, behavioral and organizational problems to improve data quality in the study setting [29, 30].

Secondly, onsite intervention package was developed based on the identified problems of the formative assessment and in consultation with the regional health bureau and health facility managers. The intervention was set based on the context of the study setting to achieve the implementation strategy outcomes. Thirdly, the new intervention was tested and adapted at pre intervention phase. As a result, the intervention strategy modified from horizontal to bottom up approach in consultation with the local stakeholders (Fig. 1). Fourthly, the intervention was implemented for one year with continuous supervision and quarterly review meetings to assess the extent to which implementation intervention was effective and to optimize intervention benefits, and sustain the intervention in the study setting. Finally, post intervention assessment was conducted to assess the improvement of data quality in the study setting. The intervention was focused to improve RHIS data quality, including data

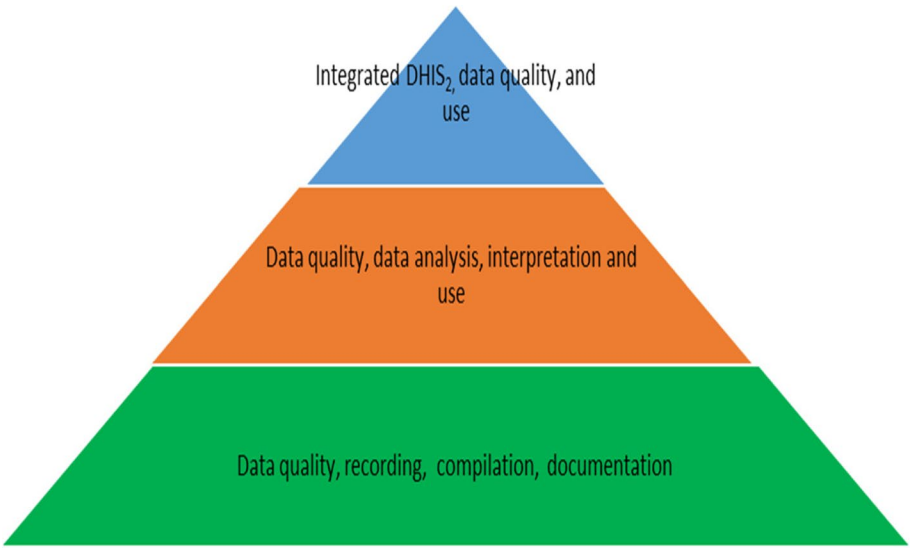

Fig. 1 Bottom up onsite training-mentoring intervention of health workers in public health sector of Jigjiga woreda, eastern Ethiopia

recording, documentation, reporting, data analysis and data use. The focus of each level of the intervention was indicated on Fig. 1. A total of seven onsite intervention sessions were given for 154 health workers of the sector in the one year intervention period: First, three round training-mentoring session were given for 67 health workers, who had no prior HIS and related trainings. These training-mentoring sessions were given on data quality, data recording, compilation and documentation. Secondly, two round training-mentoring sessions were given for 44 health workers, who had prior HIS and related trainings. These sessions were focused on data quality, data analysis, interpretation and use. Lastly, two round training-mentoring sessions were given for 43 performance monitoring teams (PMTs) and Woreda and Regional Office workers, who are working on HMIS and leadership positions. These two sessions were focused on integrated $DHIS_2$ data quality and use. The intervention was given by six trained and experienced public health professionals of the Regional Health Bureau and Haramaya University. Additional, continuous supervision and subsequent review meetings were conducted during the implementation phase.

Sample size and sampling techniques

A single population proportion with a finite population correction formula was used for the post intervention assessment using the following assumption: 77.75% proportion of data content completeness [29], 95% confidence level, 80% power, and a 0.05 margin of error, and a 10% non-response. The total number of health care workers in the study setting was 420. Thus, a correction formula was used. Finally, 187 HCWs were participated on the post intervention assessment.

$$n = Z_{\frac{\alpha}{2}}{}^2 \frac{P(1-P)}{d^2}$$

Initially, Jigjiga woreda was selected from the region for the Doris Duke Charitable Foundation (DDCF) project. Then, three public health facilities were randomly selected from the Woreda (Kara Mara hospital, Jigjiga primary hospital and Ayardaga health center), and the health workers, working in the facilities and who had a direct involvement at least in data recording, compilation and reporting were random selected from each unit in proportion to the size of HWs in each facility. Accordingly, 103 from Kara Mara general hospital, 59 from Jigjiga primary hospital, and 25 from Ayardaga health center were included in the quantitative assessment. Additionally, Jigjiga Woreda Health Office and the Regional Health Bureau of Somali Regional State were included in the qualitative assessment.

Data collection tools and techniques

Similar data collection tools and techniques were used for formative and post intervention assessment surveys. Both the formative and post assessments were collected through a guided self-administered survey, a desk review, and an open observation. A pretest was conducted on neighboring district, Hararays Woreda Health Office and Hararays health center. This pretest was conducted before the formative assessment, which aimed to check the clarity and the flow of questions of the data

collection tools and administration of the data collection procedures.

All unites of the health center, the Woreda HMIS focal person, and eight health workers from the facility were participated on the pretest. Accordingly, few questions were slightly modified and also the flow of some questions in the questionnaire and desk review checklist were rearranged. A semi-structured and pre-tested questionnaire and check list were used for data collection. The questionnaire was adapted from previous studies (PRISM) and a WHO document. The questionnaire included questions regarding socio-demographics, knowledge and perception of HIS, HIS training, and basic data analysis and data quality checking related questions. The facility document review check list included questions related with types of services, data sources, documents availability, data reporting, data completeness, timeliness of the reports, and other related questions.

The data quality status of the health facilities was assessed using accuracy/consistency, report/ content completeness, and timeliness of the reports [31].The quality of RHIS data was measured using eight selected main indicators (antenatal care, institutional birth, immunization, VCT, inpatient, tuberculosis, pneumonia and sever acute malnutrition).

The data was collected by six trained and experienced Public Health professionals and three supervisors. The document review assessed the previous three-month reports of the survey for data accuracy/consistency and content completeness, and the previous six-month reports for timeliness and report completeness for the facilities and offices. The desk review was made in all the units where the quantitative data was collected.

Operational definitions

Data accuracy: measured as a similarity between what was in the report and what was in the registrations and/ tally sheets. A 10% tolerance level was used to judge the accuracy of data. Based on the 10% tolerance for accuracy, data was classified as follows: Over reporting (110%) respectively [31].

Completeness of facility reporting: Percentage of expected monthly facility reports received for a specified period time. Total number of facility reports received at the unit/total number of expected facility reports at that unit [32].

Data completeness on data recording tools (Registers, cards/forms): This refers to all necessary data elements on registers/forms/cards which should be filled immediately after provision of the service by the care provider [31].

Perceptions of the HWs was collected using five point Likert scale, which ranges from strongly disagree to strongly agree. This dichotomized into do not agree if answer 1 to 3, otherwise coded as agree.

Timeliness of facility reporting is defined as the proportion of reports received from health facilities by subnational administrative units by the deadline for reporting [32].

The HWs HIS Knowledge level was measured using 27 item knowledge questions; and it is coded as "1" if it is correctly answered, otherwise it is coded as "0". A health workers said to have good knowledge if he/she responds knowledge questions above respondents mean score.

Data quality assurance

We used the same data collection tools and techniques for formative and post intervention assessment surveys. The questionnaire was adapted from previous studies (PRISM) [15, 33] and a WHO document [4]. Refreshment training was given for data collectors and supervisors before the post intervention assessment. There was continuous supervision and monitoring of the data collection process by the supervisors and the investigators.

Data processing and analysis

Data were entered into EpiData 3.1 and exported to SPSS 22.0 Version for data processing and analysis. Descriptive statistical tests like frequency of the outcome variables and other categorical independent variables, as well as mean and standard deviation of continuous independent variables were computed. Then, bivariate analysis using odds ratio was used to compute the strength of the association and statistical significance of the categorical independent variables and the binary outcome variables. Accordingly, HIS knowledge level of the workers, data analysis and presentation skills, socio-demographic variables, HIS training and data recording/documentation valued by PMT variables were considered.

Variables with a P value of 0.25 at bivariate were used as a cutoff point for including independent variables in the final binary logistic regression model. Finally, multivariable binary logistic regression with the enter method was used to identify predictors of the data quality. The odds ratio was calculated with a 95 percent confidence interval to determine the relationship between the dependent and independent variables, and statistical significance was fixed at 0.05. Multi-collinearity was checked using standard errors, all the variables in the model had less than 2.0; and model fitness was checked using the Hosmer–Lemeshow model fitness test, which resulted P value > 0.43.

Results

Characteristics of the participants

In the post assessment, a total 187 study participants were involved in the post intervention assessment. The

mean age of the respondents was 27.9 (± 5.68) years old, with a range of 20 to 58 years (Table 1).

Perception of health workers on the data quality

Following the one year intervention period, the perceptions of health workers towards data quality was not improved significantly, even some of the variables proportions declined at the endline assessment (Table 2).

Data accuracy and content completeness

The endline survey showed that data content completeness was 75% in Ayardaga health center, 83% in Jigjiga Primary hospital, and 99% in Kara Mara general hospital (Table 3). The overall data accuracy and content completeness after the intervention were 95.0% and 89.86%, respectively. The timeliness of both the receiving and sending period were reported as 100% in all the three facilities (Table 4).

Overall, the percentage change of data quality was increased**,** indicating an increase in knowledge and skills of the workers as a result of the onsite intervention. The data accuracy and content completeness of almost all the indicators/data elements were improved (Table 4). Additionally, report timeliness and documentation was also improved in Jigjiga primary hospital and Ayardaga health center, also indicating these were among the areas the health workers showed improvement most from.

Factors associated with data content completeness

Of the studied technical, organizational, and behavioral factors, the following variables were included in the final model: Sex, educational status of the respondents, work experience, knowledge about data quality, value given for data recording and documentation, some basic computational skills, and HIS and related training. Of these, data quality knowledge was a significant independent predictor of data quality in the study setting. The odds of those health workers who had poor knowedge were less likely to ensure data quality (AOR = 0.39; 95%CI: 0.19, 0.83) than their counterparts (Table 5).

Table 1 Socio demographic characteristics of the health workforces in public health facilities of Jigjiga Woreda, eastern Ethiopia, 2022

Variables	Frequency	Percentage (%)
Sex		
Male	80	43.5
Female	104	56.5
Age categories (years)		
≤ 30	142	79.3
31 – 40	30	16.8
41 – 50	5	2.8
50—60	2	1.1
Professions		
Medical doctors	4	2.2
Health officers	12	6.7
Nurses	76	42.7
Midwifery	54	30.3
Pharmacy	15	8.4
MLT	2	1.1
HIT	8	4.5
Others	7	3.9
Educational status		
Masters	14	7.8
First Degree	131	72.4
Diploma	34	18.8
Others	2	1.1
Role and responsibility		
Staff	163	88.6
Facility & department heads, coordinators	21	11.4
Work experience (years)		
≤ 5	106	61.3
6 – 10	51	29.5
≥ 11	16	9.2

Discussion

Quality of data is a key factor in generating reliable health information that enables monitoring progress and making decisions for continuous improvement. This implementation research showed improvement of data accuracy, data content and report completeness, and report timeliness in the study setting. The overall data accuracy and content completeness were increase from 88.12% to 95.0% and from 75.75 to 89.86%, respectively. Knowledge of the workers were an important predictor of data content completeness in the study setting. Thus, this tested collaborative onsite intervention strategy should sustains to improve the RHIS data quality in the public health sector of the region.

This onsite intervention improved data report timeliness and completeness in all the studied facilities, which was reported as (100.0%). It is evidence that the routine information system requires daily compilation of data on key elements and immediate reporting of notifiable cases. Additionally, we observed that health facilities are updated their monthly graphs and constantly update the trend of disease and service coverage. There are evidence in sub-Saharan African countries that intervention components that aligned with user priorities and government systems were perceived to be relatively advantageous and more readily adapted and adopted [34]. Thus, the improvement of data quality documentation and reporting can be maintained with continuous supervision and

Table 2 Perceptions of the health workers on data quality and use in public health facilities of Jigjiga woreda, eastern Ethiopia, 2022

Variables	Baseline perceptions towards HIS		Endline perceptions towards HIS		P value
	Don't agree (%)	Agree (%)	Don't agree (%)	Agree (%)	
Feel discouraged when the data that I collect /record are not used for taking action (either for monitoring or decision making)	41 (23.03)	137 (76.97)	76(40.6)	111(59.4)	0.001
HMIS data collecting /recording is tedious	57 (32.57)	118 (67.43)	65(34.8)	122(65.2)	0.66
Collecting data is useful for me	26 (15.66)	140 (84.34)	50(26.7)	137(73.3)	0.01
Data are important for monitoring facility and or service performance	21 (11.93)	155 (88.07)	55(29.4)	132(70.6)	0.001
Collecting data is appreciated and valued by supervisors and gets feedback	42 (24.0)	133 (76.0)	66(35.3)	121(64.7)	0.02
Data collection/recording is not the responsibility of health care providers	119 (68.39)	55 (31.61)	87(46.5)	100(53.5)	0.001
I can check data accuracy	45 (25.86)	129 (74.14)	57(30.5)	130(69.5)	0.33
I can check data completeness	38 (22.49)	131 (77.51)	55(29.4)	132(70.6)	0.14
I can register the data in time (timelessness)	46 (26.44)	128 (73.56)	60(32.1)	127(67.9)	0.23
I can calculate percentages/rates correctly	42 (25.46)	123 (74.54)	60(32.1)	127(67.9)	0.17
I can plot disease or service trend on a chart	49 (28.66)	122 (71.34)	63(33.7)	124(66.3)	0.30
I can explain the findings of the data analysis and their implications	52 (29.21)	126 (70.79)	66(35.3)	121(64.7)	0.21
I can use data for identifying performance gaps	35 (20.0)	140 (80.0)	65(34.8)	122(65.2)	0.001
I can use data for making operational/ management decisions,	42 (23.73)	135 (76.27)	60(32.1)	127(67.9)	0.07
The recording and reporting tools in the department is complex	57 (32.39)	119 (67.61)	77(41.2)	110(58.8)	0.08

Table 3 Baseline and endline proportion of data accuracy, content completeness and report timelines among the selected public health facilities of Jigjiga Woreda, eastern Ethiopia, 2022

Health facilities	Data Accuracy		Content completeness		Timeline report received		Timeline report sent	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Karamara General Hospital	92.24%	94%	81.61%	99%	100	100%	100	100%
Jigjiga Primary hospital	83.10%	96%	81.21%	83%	100*	97.2%	100	100%
Ayardaga Health center	79.81%	98%	69.7%	75%	100*	100%	100	100%

*NB: * the report was not supported by documentation during desk review*

Table 4 Average proportion of data accuracy and content completeness among the selected public health facilities of Jigjiga Woreda, eastern Ethiopia, 2022

Health services	Data accuracy/consistency		Data content completeness	
	Baseline in %	Endline in %	Baseline %	Endline %
ANC	72.51	80.37	92.03	74.50
Delivery	98.67	94.33	66.87	89.00
Immunization	80.63	98.50	73.7	90.13
VCT	100	99.85	50.0	100.00
Inpatient	100	100.00	72.9	100.00
Tuberculosis	91.35	102.23	95.0	86.66
Adult pneumonia	65.14	84.70	85.1	78.60
SAM	96.67	100.00	70.37	100.00
Average proportion	88.12	95.00	75.75	89.86

follow up of immediate supervisors and PMT. There is also evidence that data quality cannot be improved without strong leadership commitment and dedication in the sector [35, 36]; and shared responsibility across levels of the health service system is also crucial to ensure data quality [37] and to facilitate data use for decision making [36].

Data accuracy after the one year intervention was greater than 90% in all the facilities, which is above the national standard in the study setting [31]. Over the intervention period, we observed that health workers in departments/units were more comfortable to accurately recording clinical and service data at the point of care. Immunization data accuracy was increase from 80.63% before and 98.50% after the intervention; and data content completeness increased from 73.7% to 90.13%, though there are many systemic factors contribute to

Table 5 Factors independently related with data quality in public health facilities of Jigjiga Woreda, eastern Ethiopia, 2022

Variables	Data quality		COR(95% CI)	AOR (95%CI)
	Poor No (%)	Good No (%)		
Sex				
Male	40(47.6)	40(40.0)	1.36(0.76,2.45)	1.46(0.79,2.69)
Female	44(52.4)	60(60.0)		
Educational status				
Diploma	21(24.4)	21(20.8)	1.23(0.62,2.45)	1.11(0.53,2.30)
First degree and above	65(75.6)	80(79.2)		
Work experiences (years)				
5 and below	37(43.0)	39(38.6)	1.20(0.67,2.16)	1.23(0.69,2.35)
6 and above	49(57.0)	62(61.4)		
Data quality Knowledge				
Poor	17(19.8)	32(31.7)	0.53(0.27,1.05)	0.39(0.19,0.82)*
Good	69(80.2)	69(68.3)		
Data recording/documentation value by PMT				
Not agree	32(37.2)	34(33.7)	1.17(0.64,2.13)	1.19(0.56,2.53)
Agree	54(62.8)	67(66.3)		
Basic data calculation skills				
Correctly answered	31(36.0)	29(28.7)	1.34(0.76,2.59)	1.06(0.58,1.93)
Wrongly answered	55(64.0)	72(71.3)		
HIS training				
Yes	40(46.5)	43(42.6)	1.17(0.66,2.09)	1.06(0.58, 1.93)
No	46(53.5)	58(57.4)		

* *significant, P value < 0.05*

poor quality of immunization data [5]. Similarly data improvement intervention in South Africa showed that data completeness and accuracy significantly increased [38]. Thus, the efforts made by the regional health bureau and the partners showed improvement of data accuracy. As a result, the quality of routine HMIS data would be reliable enough to be used for planning, decision making at operational, and management levels. Evidence also showed that increases in data quality enhance data use and sustaining data-driven decision-making in the sector [37].

Data content completeness was improved in all the facilities, though Jigjiga primary hospital and Ayardaga health center which was lower than the national target. We have also observed that some registration format were not completely filled by the service providers at the time of service provision. The study also showed that health workers who had low knowledge about data quality were less likely to ensure data quality (AOR = 0.39; 95%CI: 0.19, 0.83). Thus, workers in health center and primary health hospital need more follow up and monitoring to ensure data quality than the referral hospitals, where the workers are more educated and experienced ones. There are also evidence that a combination of interventions which addressing both behavioral and technical factors improved data quality and use [39].

However, this district may not be representative of the region. The study settings were included under the Federal Ministry of Health Capacity Building and Mentorship Program (CBMP) initiative, which aimed to improve HIS in the health sector of the region. Additionally, the district has more access to health system supports from the regional health bureau than other district in the region, so the intervention may need to adapt to other public health facilities in the region. During the baseline and endline assessments, use of both qualitative and quantitative data collection approaches at individual and system levels can be considered as a strength of the study.

Conclusion

The intervention of this implementation research reveals that health data accuracy and content completeness was improved in the study setting. However, data content completeness in two facilities was below the national standard. Though there was overall improvement of data accuracy and content completeness, there was variation within the service areas, indicators and among facilities. Majority of the health workers had improved HIS related activities and data quality checking skills. Low knowledge of the health workers on the data quality was an independent predictor of data quality. Thus, continuous onsite intervention and collaborative efforts should be made at lower levels of the health care system to maintain and strengthen the data quality in the sector.

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Authors' contributions

T.G. Conceptualize the research, method, data analysis, and drafted the manuscript. D.B. Conceptualize the research, method, data analysis, and reviewed the manuscript. A.K. Conceptualize the research, method, and reviewed the manuscript. Y.W. Conceptualize the research, method, and reviewed the manuscript.

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Data availability

The datasets of the current study are not publicly available as the participants did not give their informed consent to share their responses public. However, the data are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Haramaya University College of Health and Medical Sciences Institutional Health Study Ethics Review Committee (IHRERC) granted ethical approval () and permission for this research project. Permission was obtained from all concerned health facilities and offices. All of study participants were involved, after obtaining their informed consent; and confidentiality were ensured during and after the data collection. This study was conducted in consideration of COVID 19 pandemic intervention measures.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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