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Utilisation of health management information and its determinant factors among health professionals working at public health facilities in North Wollo Zone, Northeast Ethiopia: a cross-sectional study

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ABSTRACT

Objective The study aimed to assess health management information utilisation and associated factors among health professionals working at public health facilities in North Wollo Zone, Northeast Ethiopia.

Setting The study was conducted at public health facilities in the North Wollo Zone, Northeast Ethiopia.

Participants A total of 664 (56.3% male and 43.7% female) health professionals participated in the study. All health professionals permanently working in North Wollo Zone were included in this study. However, health professionals who were not present during the data collection period by any means and who had less than 6 months of experience were not included in this study.

Primary and secondary outcome measures The main outcome measure was health management information utilisation.

Result About 58.4% (n=388) (95% CI: 54.4% to 62.0%) of the study participants use health management information. The multivariable logistic regression model indicated that participants who had managerial positions are more likely to use health management information with an adjusted OR (AOR) of 3.11 and 95% CI 1.84 to 5.24. Similarly, having a good motivation level (AOR=4.42 (95% CI: 2.82 to 6.93)), perceived good culture of health information (AOR=6.17 (95% CI: 3.35 to 11.36)), a standard set of indicators (AOR=4.11 (95% CI: 2.65 to 6.38)), having good governance of health information system (AOR=1.75 (95% CI:1.13 to 2.72)) and health management information system (HMIS) training (AOR=3.10 (95% CI: 1.89 to 5.07)) were the predictors positively associated with higher utilisation of health management information.

Conclusion This study revealed that utilisation of health management information was still inadequate. Enhancing motivation, building a culture of information use, having standardised indicators, strengthening the governance of health information systems and comprehensive HMIS training were measures to be taken to improve utilisation of health management information in this study setting.

Strengths and limitations of this study

- The study covers all types of health facilities: health posts, health centres and hospitals with a large sample size, which increases its generalisability.
- Recall bias might lower health management information utilisation level.
- The study was not supported by the qualitative findings.
- The mean score of health management information utilisation questions may also be a limitation of this study.
- The data collection was based on self-reported information, which might lead to overestimation of participants' real utilisation practice.

BACKGROUND

A health information system (HIS) is an integral part of the healthcare system whose operational boundaries include all resources, organisations, and actors that are involved in the regulation, financing, and provision of actions whose primary intent is to protect, promote and improve health.[1 2] Health management information system (HMIS) is a subsystem under HIS that is specially designed to assist the management and planning of health programmes as opposed to delivery of care that provides decentralised decision-making and planning.[3 4]

HMIS is a system that allows for the collection, storage, compilation, transmission, analysis, and usage of health data that assist decision-makers and stakeholders in managing and planning resources at every level of health services.[3 5 6] The main purpose of HMIS is to routinely generate quality health information that provides specific

information support to the decision-making process at each level of the health system for improving the performance of health services.[7]

The Ethiopian HMIS has been implemented since 2008 to capture and provide core monitorable indicators used to improve the provision of health services, and ultimately, to improve the health status of the population. The Ethiopian HMIS was revised later in 2017.[8] Since then, the health sector showed significant achievements in planning, budgeting, decentralising, reviewing plans and progress, involving partners and utilising information on decision-making.[4 9] The current Ethiopia National Health Sector Transformation Plan (2015–2019) notes that HMIS is a major source of information for monitoring and adjusting policy implementation and resource use.[9]

Moreover, the government of Ethiopia gives due recognition to HMIS as a management support system for improving the health system in Ethiopia by providing continuous information support to the decision-making process at each level of health institutions such as the Federal Ministry of Health, Regional Health Bureau, Zonal Health Department (ZHD), Woreda Health Office, health centres, health posts and hospitals.[10]

Even if more attention has been given to strengthening evidence-based decisions through good governance, transparency and accountability, HMIS utilisation is poorly practised in developing countries.[11–16] Evidence in Africa showed that HMIS utilisation remains very weak and data are sitting in reports, shelves, cabinets and databases, which are left unanalysed to be sufficiently used for policy and programme improvements.[12 17–20] A study done in Ghana revealed only 26% of the facilities used health information data for health service decision-making.[21] Similarly, a study conducted in Kenya showed that 22% of health professionals used district HIS (DHIS) data.[22]

Another study in Botswana showed the utilisation of HIS data for evidence-based decision-making was 11%.[23] A study finding from Cote d'Ivoire and South Africa indicated that the overall percentages of HMIS information use were 38%[24] and 53%,[25] respectively. In Ethiopian context, the use of routine health information varied in different areas of the country and it is also considered as partial, not uniform, which is ranging from 32.9% to 78.5%.[4 11 26–41]

Factors for not using health management information include workload,[11] HMIS knowledge, staff motivation,[27] attitude toward HMIS,[28] competency,[37] information use culture,[42] data analysis skill,[37] friendly format,[28] standardised indicator,[31 37 43] supervision,[28 30 36 37] feedback,[28 36 37 44] governance,[37] management support and receiving senior directives,[30] training,[11 28 37 44] resource shortage,[11] decisions based on superior directives,[27] computer access,[11] reference material,[11] reporting format,[11] performance monitoring by health professionals,[27 30 45] completeness of data format,[31] consistency of data,[31 46] using HMIS data for target setting,[30] work location,[30 47] catchment population profile charts presentation and quarter plan performance monitoring.[26]

Previous studies in Ethiopia did not widely address organisational factors and we argue that the relevance of those untouched factors was undeniable, which poses challenges to using health management information. Moreover, studies assessing the utilisation of health management information in Northeast Ethiopia were limited. Our review showed inconsistent findings from previous studies in different parts of Ethiopia. It indicated that there is not a uniform level of utilisation in this country. This means there is low generalisability of those results to the current study setting.

Accordingly, addressing those problems will have a practical benefit for improving coverage and quality of healthcare services. Therefore, this study proposes assessing health management information utilisation and its associated factors among health professionals working at public health facilities in Northeast Ethiopia. The study has valuable contributions to the researchers, programmers, planners, policymakers, academic communities, service providers, healthcare professionals and non-governmental organisations working in this area.

METHODS

Study design and setting

An institutional-based cross-sectional study design was conducted to assess utilisation of health management information and determinant factors among health professionals working at public health facilities in North Wollo Zone, Northeast Ethiopia from May to June 2020. North Wollo, which is 1 of 11 zones of the Amhara Region, consists of 15 districts (4 urban and 11 rural districts). The city of North Wollo is Woldia, which is placed 521 km driving distance northeast from the capital city of Ethiopia, Addis Ababa. About 2132 health professionals work within 6 hospitals (1 referral hospital, 1 general hospital and 4 primary hospitals) and 64 health centres. Additionally, a total of 736 health extension workers within 280 health posts are found in this zone.

Study participants, sample size and sampling procedure

The sample size was calculated using single population proportion formula, considering the following assumptions: a 95% level of confidence, a 5% margin of error and a design effect of 2. Additionally, we used p=78.5% from a study conducted in Northwest Ethiopia which has a similar population and study setting as the current study.[37] A 5% of non-response rate was considered. Finally, a minimum sample size of 570 was obtained.

There are 6 hospitals, 64 health centres and 280 health posts in the North Wollo Zone. Five districts (small administrative unit next to zone) were selected randomly and all public health facilities within those clusters of districts were included. Accordingly, a total of 2 hospitals and 28 health centres and health posts were included using the cluster sampling technique. We got and approached a total number of 721 healthcare professionals within the selected districts.

Data collection tool and procedure

Data were collected using a pretested self-administered questionnaire and an observation checklist that was adopted from the Performance of Routine Information System Management (PRISM) tools[48 49] and related studies.[4 11 26 30 31 37 50] A pretested self-administered questionnaire was filled out by health professionals. The questionnaire consists of six main parts. Part 1 includes sociodemographic factors (measured with 9 items), part 2 is related to behavioural factors (measured with 31 items), part 3 assessed technical factors (measured with 4 items), part 4 was about organisational factors (measured with 35 items), and part 5 was about the health management information use (measured with 13 items). The final section of the questionnaire consisted of eight items of an observational checklist.

Utilisation of health management information of the respondents was assessed using 5-point Likert scale questions that ranged from '1=strongly disagree' to '5=strongly agree'. The observational checklist was used to collect data on the availability of reference material, health information resources and documents. A total of 3 degree holder health professionals as supervisors and 12 health information technologists as data collectors participated in the data collection process after 2-day training was given before the data collection period. During data collection, participants were informed about the objective and processes of the study and the confidentiality of the information.

Operational definition

Health management information utilisation

Health management information utilisation was defined as the use of such information for treating patients, disease prioritisation, drug procurement, the day-to-day monitoring of health service activities, checking data quality, resource allocation, planning, department performance evaluation, evaluation of staff performance, selection of best experience within the health facility, sharing of health data with other facilities and stakeholders, decision-making, and community mobilisation and discussion.[11 28 37]

All these components of behavioural factors, the outcome variable, and some of the organisational factors, have a 5-point Likert scale measure, ranging from '1=strongly disagree' to '5=strongly agree'. The mean score of health professionals was calculated by summing up the scores of respondents for each item first (rated from 1 to 5) and then divided by total respondents. Health professionals who scored greater than or equal to the mean value of Likert scale questions provided to measure health management information use were labelled as good use of health management information, whereas health professionals who scored less than the mean value of Likert scale questions were labelled as poor use of health management information.

In this study, health professionals are defined as those employees who had at least a diploma certificate in the health profession and who are collecting health data to use health information for the improvement of health status including medical doctors, public health officers, nurses, pharmacists, midwives, laboratory personnel, health extension workers, radiology technicians and so on.

HMIS knowledge

It focuses on the specific knowledge of knowing how to collect, store, compile, check the quality, analyse data, and why or for what to use HMIS data.[51] The question for measuring knowledge encompasses know-how for collecting or using aggregated data (in different categories of age, sex, season and disease type), reasons for collecting or using geographical data or residence, and the reasons for using population data. Additionally, the respondents' know-how about the overall HMIS, that is, consistent, accurate and reliable data was considered to measure their knowledge,

Accordingly, HMIS knowledge was measured by eight items with three response categories (1=True, 2=False and 3=I don't know). Finally, the responses were dichotomised into two as '0' and '1'. If respondents got the answer for the item, it was recoded as '1', otherwise it was recoded as '0'. The normality test showed knowledge was not normally distributed, so we computed median and health professionals who responded correctly above the median were labelled as having good knowledge of HMIS, whereas health professionals who scored below the median were considered as having poor knowledge.[28 37 51]

Attitude toward HMIS

The attitude of the respondents was measured by eight Likert scale questions ranging from '1=strongly disagree' to '5=strongly agree'. In this regard, health professionals were asked to rate their opinions regarding HMIS. For instance, they were asked their level of agreement for questions/statements like: 'Collecting, analysing, reporting and using data are not time-consuming'. Health professionals who scored greater than or equal to the mean were considered as having a good attitude. On the contrary, health professionals who scored below the mean were considered as having a poor attitude toward HMIS.[28 31 37]

Perceived self-efficacy of HMIS tasks

Perceived self-efficacy is an individual belief in his or her capacity to execute HMIS tasks. The tool used in measuring perceived self-efficacy incorporated three constructs such as perceived self-efficacy in analysing data (two-item questions), perceived self-efficacy in interpreting data (two-item questions) and perceived self-efficacy in using information (four-item questions).[48] Overall, eight-item Likert scale questions ranging from '1=strongly disagree' to '5=strongly agree' were used to measure it. Health professionals who scored greater than

or equal to 75% were considered as having high competence, according to the recommendation of the PRISM framework.[38]

Good management support

Management support is any support from a superior manager to perform HMIS tasks which was measured by six Likert scale questions ranging from '1=strongly disagree' to '5=strongly agree'. In this case, respondents were asked to rate the level of management support at their health facility. For instance, the respondents were asked whether their superior manager encourages gathering data to find the root cause(s) of the problem. In this study, management support was not normally distributed. Therefore, we computed the median score. Study participants who scored greater than or equal to the median of Likert scale questions prepared in this study were considered as having good management support.[37]

Perceived culture of health information uses the pattern of behaviours and attitudes that express health professionals' orientation toward information use, which was measured by eight-item Likert scale questions ranging from '1=strongly disagree' to '5=strongly agree'. For more clarification, the respondents were asked to rate their level of agreement regarding the culture of information in their working unit. For instance, the respondents were asked to rate their level of agreement for questions or statements like: 'Health department encourages staff to use data for developing future action plans'. Health professionals who scored greater than or equal to the mean score were labelled as having good perceived culture of health information. On the other hand, health professionals who scored below the mean were considered as having poor perceived culture of health information.[48]

Motivation toward HMIS

Motivation toward HMIS is the level of desire to use HMIS data, and their level of commitment to perform HMIS tasks such as data collection, compilation, quality checking and reporting. It was measured by seven-item Likert scale questions ranging from '1=strongly disagree' to '5=strongly agree'. For instance, respondents were asked to rate their level of commitment to monitoring data collection in their department to make HMIS data better. Health professionals who scored greater than or equal to the mean score were labelled as having a good motivation toward HMIS[29 48] (see online supplemental file 1 for more details).

Data processing and analysis

Data were entered into EpiData V.4.6. Then, it was exported to STATA V.15 software for further analysis. Descriptive statistics mean and the percentage were calculated. Multicollinearity was tested by running a false linear regression iterating the independent variables as a dependent variable. Its result showed all the variance inflation factor values less than 3 and tolerance greater than 0.7, which demonstrated the absence of multicollinearity.[52]

The data were also checked for outliers by box plot and no outshining outlier effect was observed. Finally, both bivariable and multivariable logistic regression analyses were used to measure associations between the independent variables and the dependent variable (health management information use).

Accordingly, a bivariable analysis was conducted, and predictor variables that were significant at $p<0.2$ were entered into the multivariable analysis to check for confounding effects on the association from the bivariable analysis. A stepwise forward selection of variables was used to build the multivariable model. The strength of association was described at 95% CI and p value less than 0.05 was considered for multivariable logistic regression analysis.

Patient and public involvement

No patient involved.

RESULT

Sociodemographic characteristics

Out of 721 distributed questionnaires, 664 responses were received with a response rate of 92.1%. More than half (373; 56.2%) of the respondents were male with the mean age of participants 33.24±8.3 years. In terms of educational level, this study revealed that the majority (387; 58.3%) of the respondents were degree holders. The rest, 243 (36.6%), and 24 (3.6%) had diplomas and master's degrees, respectively. Regarding their residence, more than half (375; 56.5%) of the study participants lived in rural areas (see table 1 for details).

Behavioural factors

This study implied that health professionals who had good HMIS knowledge were found to be 55.1% (95% CI: 50.4% to 58.7%). Health professionals who had good motivation toward HMIS were found to be 64.3% (95% CI: 59.3% to 68.5%). Perceived culture of health information use of health professionals was 46.7% (95% CI: 42.6% to 49.2%) and routine HIS (RHIS) task self-efficacy was 46.7% (95% CI: 42.6% to 49.2%).

Organisational and technical factors

More than half (372; 56.0%) of health professionals were supervised at least once within 3 months and 309 (46.5%) of them got feedback at least within a year. Likewise, 203 (30.6%) of health professionals had taken training on data management. The study also showed that 351 (52.9%) of respondents faced difficulties in understanding report formats. Among those respondents who faced difficulties, 39.9% faced unspecific terms and 46.6% of them faced inconsistent format, and 13.5% faced abbreviations. On the other hand, more than half (330; 49.7%) of the respondents had difficulties in the reporting systems. Most of the respondents (579; 87.2%) responded that no existence of appropriate technology was used for managing data. Regarding management

Table 1 Sociodemographic and economic characteristics of health professionals in North Wollo Zone, Northeast Ethiopia, April 2020 (n=664)

Variables	Frequency (#)	Percent (%)
Location of health facility		
Urban	289	43.5
Rural	375	56.5
Health facility		
Hospital	231	34.8
Health centre	317	47.7
Health post	116	17.5
Age in years		
≤30	275	41.4
>30	389	58.6
Educational level		
Diploma	243	36.6
Degree	397	59.8
Master's	24	3.6
Department/working unit		
Out patient department (OPD)	237	35.7
In patient department (IPD)	187	28.2
Maternal and child health (MCH)	121	18.2
Other	119	17.9
Work experience		
≤6	267	40.2
>6	397	59.8
Workload		
Yes	378	56.9
No	286	43.1
Salary (in dollars)		
≤100	160	24.1
101–150	334	50.3
151–200	72	10.8
201–250	52	7.8
Professional category		
Nurse	218	32.8
Medicine	18	2.7
Health officer	76	11.4
Laboratory	48	7.2
Pharmacy	42	6.3
Midwife	125	18.8
HEW	116	17.5
Other	21	3.2

Table 2 Organisational factors of health professionals in North Wollo Zone, Northeast Ethiopia, April 2020 (n=664)

Variables	Frequency (#)	Percent (%)
Supervision		
Yes	372	56.0
No	292	44.0
Frequency of supervision within a month		
Once	156	42.0
Two times	140	37.6
Three times	76	20.4
Feedback		
Yes	309	46.5
No	355	53.5
Frequency of feedback		
Monthly	103	33.4
Quarterly	78	25.2
Every 6 months	115	37.2
Yearly	13	4.2
Functional computer		
Yes	103	15.5
No	561	84.5
Graph paper		
Yes	381	57.4
No	283	42.6
Tally sheet		
Yes	442	66.6
No	222	33.4
Availability of reference		
Yes	475	71.5
No	189	28.5
Reporting format		
Yes	463	69.7
No	201	30.3
Management support		
Good	311	46.8
Poor	353	53.2
HIS governance		
Good	418	63.0
Poor	246	37.0

HIS, health information system.

support, 311 (46.8%) of the respondents agreed that they got good support from their senior managers (see table 2 for details).

Health management information utilisation

The finding implied that 353 (53.2%) of the respondents used routine health data for treating patients, 453 (68.2%) for disease prioritisation, 432 (65%) for drug procurement and 379 (57.1%) of them used data for monitoring day-to-day health service activities. Additionally, 454 (68.3%) of those respondents used HMIS data for checking data quality, 351 (52.8%) for resource allocation and 353 (53.2%) for planning. The number of respondents who used HMIS data for department performance evaluation was 420 (63.3%).

About 438 (66%) of the study participants used HMIS data for evaluation of staff performance, and 392 (59%)

Table 3 Health management information utilisation among health professionals working at public health facilities in North Wollo Zone, Northeast Ethiopia, April 2020 (n=664)

Activities used from health management information utilisation	Yes
For treating patient	353 (53.2%)
For disease prioritisation	453 (68.2%)
For drug procurement	432 (65%)
For monitoring day-to-day health service activities	379 (57.1%)
For checking data quality	454 (68.3%)
For resource allocation	351 (52.8%)
For departments' performance evaluation	420 (63.3%)
For planning	353 (53.2%)
For monitoring the performance of staff	438 (66.0%)
For selecting best experience within the facility	392 (59.0%)
For sharing of best experience with other facilities and stakeholders	388 (58.4%)
For decision-making	320 (48.2%)
For community mobilisation and discussion	329 (49.6%)

for selection of best experience within a health facility. On the other hand, 388 (58.4%) of the study participants used HMIS data for sharing health data with other facilities and stakeholders, 320 (48.2%) for decision-making, and 329 (49.6%) of them used for community mobilisation and discussion. Overall, good routine health management information utilisation was noted among 58.4% (n=388) (95% CI: 54.4% to 62.0%) of the health professionals (see table 3 for details).

Factors associated with health management information utilisation

In the bivariable logistic regression analysis, position, knowledge about HMIS, motivation level, the perceived culture of information use, RHIS self-efficacy, standardised indicator, management support, governance of HIS, availability of reference material, training for HMIS and supervision were factors associated with good routine health information utilisation at a p value of less than 0.2. Consequently, these variables were subjected to the multivariable logistic regression analysis to control potential confounders, and it was noted that position, motivation level, the perceived culture of information use, standardised indicator, training for HMIS and governance of HIS were significantly associated with good data management practice at a p value of less than 0.05.

In this study, higher odds of good RHIS utilisation were noted among health professionals who had a position (adjusted OR (AOR)=3.11; 95% CI: 1.84 to 5.24), good motivation level (AOR=4.42; 95% CI: 2.82 to 6.93), good perceived culture of information (AOR=6.17; 95% CI: 3.35 to 11.36), standardised indicator (AOR=4.11; 95% CI: 2.65 to 6.38), good governance of HIS (AOR=1.75; 95% CI: 1.13 to 2.72), and among those who took HMIS training (AOR=3.10; 95% CI: 1.89 to 5.07) (see table 4 for details).

DISCUSSION

In this paper, we have examined the determinants of health management information utilisation using tools adopted from the PRISM framework. The finding showed that the utilisation of health management information was 58.4% (95% CI: 54.4% to 62.0%). From this finding, we can understand the utilisation of health management information was inadequate, according to WHO standards. In general, the result implied managerial decisions in this study setting were made without health information evidence.

The finding was almost in line with a study finding in Hadiya Zone, Oromia Regional State, and Southwest Ethiopia, where utilisation of HMIS at health facilities was 54.9%,[32] 57.9%,[27] and 57.3%,[39] respectively. This finding was also consistent with a previous study report in Ethiopia where the level of good utilisation was 57.42%.[40] In addition, the finding in this study was similar to the study conducted in Tanzania, in which 60%[43] of health professionals were good at using HMIS data.

The finding in the current study was also higher than another study in Kenya where 22% of health professionals were good at using DHIS.[22] The possible explanation for this study could be the structure of the HIS between our study setting and in the study conducted in Kenya. In this regard, Kenya fully deployed the DHIS system, whereas Ethiopia is in the initial stage of deploying the DHIS and used HMIS until the data collection period of this study. On the other hand, the study conducted in Kenya was on three purposively selected district health systems which could be the reason for this discrepancy.

Our finding is also higher than the study reported in Ghana, in which 26% of health professionals had good utilisation of routine health information for health service decision-making.[21] The possible justification for this variation could be the study population. The study in Ghana was conducted among district directorates and district hospitals, whereas the current study was conducted at health posts, health centres and hospitals. Additionally, utilisation was assessed based on documented evidence in a study in Ghana, which might be the reason for this variation.

On the other hand, our finding is higher than the study finding from Cote d'Ivoire and South Africa, where the overall percentages of HMIS information use were 38%[24] and 53%.[25] This could be due to the difference in HIS structure between countries and also the motivation of health professionals toward performing HMIS tasks. Moreover, the study conducted in Cote d'Ivoire used an intervention study that has a methodological difference from the current study that could be another possible justification for this variation.

The other possible reason for this variation might be due to the difference in ways of measuring utilisation of

Table 4 Factors associated with utilisation of health management information among health professionals at public health facilities in North Wollo Zone, Northeast Ethiopia, April 2021 (n=664)

Variable	Category	Good health management information utilisation, n (%)	OR (95% CI)	
			Crude	Adjusted
Position	Staff	258 (66.5)	1	1
	Management member	130 (33.5)	3.98 (2.59 to 6.12)	3.11 (1.84 to 5.24)*
HMIS knowledge	Poor	164 (42.3)	1	
	Good	224 (57.7)	1.51 (1.11 to 2.06)	
Motivation level	Poor	69 (17.8)	1	1
	Good	319 (82.2)	8.80 (6.15 to 12.62)	4.42 (2.82 to 6.93)*
Perceived culture of information use	Poor	158 (40.7)	1	1
	Good	230 (59.3)	4.20 (2.99 to 5.89)	6.17 (3.35 to 11.36)*
RHIS task self-efficacy	Low	209 (53.9)	1	
	High	179 (46.1)	1.42 (1.03 to 1.94)	
Standardised indicator	No	139 (35.8)	1	1
	Yes	249 (64.2)	5.27 (3.75 to 7.42)	4.11 (2.65 to 6.38)*
Management support	Poor	193 (49.7)	1	
	Good	195 (50.3)	1.39 (1.02 to 1.90)	
Governance of HIS	Poor	102 (26.3)	1	1
	Good	286 (73.7)	3.06 (2.21 to 4.24)	1.75 (1.13 to 2.72)*
Availability of reference material	No	105 (27.1)	1	
	Yes	283 (72.9)	1.42 (1.01 to 1.98)	
Supervision	No	232 (59.8)		
	Yes	156 (40.2)	1.39 (1.01 to 1.92)	
HMIS training	No	223 (57.5)	1	1
	Yes	165 (42.5)	4.63 (3.12 to 6.89)	3.10 (1.89 to 5.07)*

1=reference, n=frequency.
*Variable significant at p value less than 0.05.
HIS, health information system; HMIS, health management information system; RHIS, routine HIS.

HMIS and the study population. Concerning this, in the study in Cote d'Ivoire, RHIS data use was measured based on three indicators such as: whether RHIS information was discussed in staff meetings, whether decisions evolved from these discussions and whether the decisions were referred to upper management for action.[24] However, in the current study, we used 13-item questions developed from the PRISM framework to measure information use, which might be the possible justification for this variation.

The finding in Botswana implied only 11%[23] of the participants used health information effectively, which has a higher variation than the current study finding. The variation could be due to the very small sample size used in research conducted in Botswana and the study population was district management teams; while in our study, all health professionals at public health facilities were involved. Additionally, the health information structure might be different between Botswana and Ethiopia. In this regard, the DHIS was fully deployed in Botswana. In the study in Botswana, health management information use was measured with a single-item question which could be another reason for the variation of the result compared with our finding.

Our finding is lower than the result reported from the North Gondar Zone and findings in South Ethiopia where the levels of information use were 78.5%,[37] 69.3%[31] and 62.7%.[29] This could be due to the variation of the study population and setting for that the RHIS governance could vary within it. The study in the North Shewa Zone reported 71.6%[41] of good routine health information utilisation, which was higher than the current finding. The possible justification for this discrepancy was the sampling technique and study setting. In this regard, the study in North Shewa Zone used the purposive sampling technique to select managers of hospitals as study units. Accordingly, the study design and study participants might be the reason for this discrepancy.

Furthermore, this finding is higher than the study reported in different parts of Ethiopia, in which the overall routine health information use at facility level was 31% in Jimma,[26] 41.7% in Addis Ababa,[4] 53.1%[35] in Eastern Ethiopia and 54.2% in East Wollega.[34] This discrepancy could

be due to the study period and study population. Those previous studies were conducted before 5 years, which might be a significant change in HIS structure and health professionals' motivation could be changed. The study populations in those previous studies were health professionals at the primary healthcare unit, whereas health professionals working at primary, secondary, and tertiary health facilities were represented in the current study. The other possible justification could be the difference in sampling technique and data collection method. Those previous studies prefer small sample size, which could lower the generalisability to the current study setting.

Our finding was higher than the report in the Oromia Special Zone, in which the level of utilisation was 52.8%.[38] The difference could be due to sample size and study setting. The study in the Oromia Special Zone used purposive sampling, which could be the reason for this variation. It was also higher than the result reported from a study finding at health facilities in Western Amhara in which good utilisation of RHIS was 38.4%.[11] This could be due to the fact that the study in Western Amhara was conducted at selected health centres and it used a small sample size.

Our finding was also higher than the report in the Gojam Zone and Amhara Regional State as a whole where the levels of overall RHIS utilisation were 45.8%[28] and 46.0%,[30] respectively. This difference could be due to the study period and within this gap, the government made immense efforts to enhance the culture of routine health information use including information revolution road map.[47] In the current study, 24.2% were management members that could inflate the overall utilisation of health management information[28] since managers' responsibility could enforce them to use health management information more than the staff. In this regard, our finding implied that health professionals who were management staff were more likely to use health management information compared with the staff. This implied that a high gap in not using health management information is found among health professionals who were not management staff. Hence, intervention should focus on those groups to increase the utilisation of health information.

Based on the multivariable logistic regression analysis, motivated health professionals were more likely to use health management information. This was consistent with studies reported elsewhere.[27] This could be due to motivated health professionals being more eager and confident to make decisions based on evidence.

Health professionals who had good perceived culture of information were more likely to use health management information. This is supported by the study finding elsewhere in the world.[29] This could be due to the culture of information improving the socially shared patterns of behaviours, norms and values, and having good culture of information enables one to understand the significance of using health management information to the improvement of accessibility of health services.

The finding of this study also indicates that professionals who had a standard set of indicators were more likely to use HMIS as compared with those who did not have such indicators. This is supported by the previous studies conducted in Northwest Ethiopia[37] and Southern Ethiopia.[29] This could be as a result of standard indicators helping as a source of information and standard to use health management information.

Moreover, respondents who had good governance of HIS were more likely to use health management information. This is supported by the studies in Northwest Ethiopia.[37] The possible explanation for this could be good governance of HIS could enhance the commitment level and improve the accountability of health professionals to make every decision based on evidence. Furthermore, it helps to get the required technical support during processing data into information.

Like other studies conducted elsewhere,[11 28 29 37] the odd of health management information utilisation in this study was higher among health professionals who got HIS training than those who did not get this training. A pre/post-interventional study in Northwest Ethiopia also strengthened this finding which stressed training intervention improved health information utilisation.[44] This might be the case since HIS training built health professionals' capacity to analyse, interpret data, and prepare data for utilisation, and it might create skilled human resources that are confident and motivated to use health management information. Additionally, training could capacitate health professionals on how to change data to information and use it.

Conclusion

In summary, this study revealed that utilisation of health management information was inadequate. Enhancing motivation, building a culture of information, having standardised indicators, strengthening the governance of HIS and having comprehensive HMIS training were measures to be taken to improve utilisation of health management information.

Limitation of the study

This study was aimed to assess the major determinant factors of routine health management information use in which the study covers all types of health facilities: health posts, health centres and hospitals with a large sample size that increases its generalisability. However, it was not supported by qualitative findings. Additionally, this study used a cross-sectional study design which leads to not showing temporal relationships that might lead to recall bias. In this study, an observational checklist was used, which might be of help to overcome some of those limitations. Moreover, the data collection was based on self-reported information, which might lead to overestimation of participants' real utilisation practice. In this regard, we used the mean score of health management information utilisation questions that might also be a limitation of this study.

Measuring health management information utilisation with a Likert scale (strongly disagree to strongly agree) is another limitation of this study. For instance, some respondents who are not willing to answer a particular question might put a check on 'neutral'. The context of 'neutral' for such respondents is an escape and the true essence might not be achieved. Additionally, the frequency distribution for individual items of HMIS utilisation was done with limitation by converting the Likert scale to dichotomy (0=no, 1=yes). This study did not include health officers at the district health office and ZHD. We recommend that future investigators include all health institutions and support it by a qualitative study.

Implication

Policymakers, healthcare providers, and planners should be concerned about the training of all health professionals, as well as improving motivation, the culture of information and RHIS governance. Redesigning standardised indicators is encouraged to improve HMIS utilisation. Finally, we, the authors of this study, recommend that future investigators support our finding by using a qualitative study.

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Ethics approval This study involves human participants and ethical clearance was obtained from the ethical review board of the Institute of Public Health, the University of Gondar (no. /IPH/837/06/2012). The supporting letter was obtained from Amhara Region Public Health Institute and the North Wollo health department. Informed consent was obtained from each study participant after they were informed of the objective and benefits of the study. To keep the confidentiality of information provided by the study subjects, the data collection procedure was anonymous.

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REFERENCES

1 Moucheraud C, Schwitters A, Boudreaux C, *et al*. Sustainability of health information systems: a three-country qualitative study in southern Africa. *BMC Health Serv Res* 2017;17:23.
2 WHO. Framework for health information systems and core indicators for monitoring health situation and health system performance (2015), 2017. Available: https://applications.emro.who.int/ [Accessed 5 May 2021].
3 Nyamtema AS. Bridging the gaps in the health management information system in the context of a changing health sector. *BMC Med Inform Decis Mak* 2010;10:36.
4 Adane T, Tadesse T, Endazenaw G. Assessment on utilization of health management information system at public health centers Addis Ababa City administrative, Ethiopia. *IOTCC* 2017;5:7–18.
5 Feldman SS, Schooley BL, Bhavsar GP. Health information exchange implementation: lessons learned and critical success factors from a case study. *JMIR Med Inform* 2014;2:e19.
6 Tadesse K, Gebeyoh E, Tadesse G. Assessment of health management information system implementation in Ayder referral hospital, Mekelle, Ethiopia. *IJIIS* 2014;3:34.
7 Mucee EM, Kaburi L, Kinyamu RK. Routine health management information use in the public health sector in Tharaka Nithi County, Kenya, 2016. Available: http://repository.kemu.ac.ke:8080/xmlui/handle/123456789/255 [Accessed 9 Jul 2021].
8 MOH. Health management information system (HMIS) / monitoring and evaluation (M&E) strategic plan for Ethiopian health sector. *Strateg Plan Ethiop Sect [online]* 2012 https://www.measureevaluation.org
9 MOH. Ethiopian federal Ministry of health: health sector transformation plan (2015/16-2019/20), 2015. Available: https://www.globalfinancingfacility.org/ [Accessed 20 Apr 2021].
10 MOH. Health Management Information System (HMIS): facilitator's guide for training of trainers Version 1.1. measure evaluation, 2010. Available: https://www.measureevaluation.org/ [Accessed 18 Mar 2021].
11 Asemahagn MA. Determinants of routine health information utilization at primary healthcare facilities in Western Amhara, Ethiopia. *Cogent Med* 2017;4:1387971–142.
12 Wandera SO, Kwagala B, Nankinga O, *et al*. Facilitators, best practices and barriers to integrating family planning data in Uganda's health management information system. *BMC Health Serv Res* 2019;19:327.
13 Walsham G. Health information systems in developing countries: some reflections on information for action. *Inf Technol Dev* 2020;26:194–200.
14 Lemma S, Janson A, Persson Lars-Åke, *et al*. Improving quality and use of routine health information system data in low- and middle-income countries: a scoping review. *PLoS One* 2020;15:e0239683.
15 Gebreslassie A*et al*. Enhancing health facility-based data quality and use for decision making at primary health care units to improve health service delivery of maternal newborn child and adolescent health, Tigray Ethiopia 2018. *Arch Community Med Public Health* 2020;6:031–5.
16 Braa J, Heywood A. *Sahay improving quality and use of data through data-use workshops*. Zanzibar: United Republic of Tanzania, 2012: 90. 379–84.
17 Gimbel S, Mwanza M, Nisingizwe MP, *et al*. Improving data quality across 3 sub-Saharan African countries using the consolidated framework for implementation research (CFIR): results from the African health initiative. *BMC Health Serv Res* 2017;17:828.
18 Maïga A, Jiwani SS, Mutua MK, *et al*. Generating statistics from health facility data: the state of routine health information systems in eastern and southern Africa. *BMJ Glob Health* 2019;4:e001849.
19 Koumamba AP, Bisvigou UJ, Ngoungou EB, *et al*. Health information systems in developing countries: case of African countries. *BMC Med Inform Decis Mak* 2021;21:232.
20 Manya A, Nielsen P. Reporting practices and data quality in health information systems in developing countries: an exploratory case study in Kenya. *J Health Inform Develop Count* 2016.

21 Odei-Lartey EO, Prah RKD, Anane EA, *et al*. Utilization of the national cluster of district health information system for health service decision-making at the district, sub-district and community levels in selected districts of the Brong Ahafo region in Ghana. *BMC Health Serv Res* 2020;20:514.
22 Odhiambo-Otieno GW. Evaluation of existing district health management information systems: a case study of the district health systems in Kenya. *Int J Med Inform* 2015;74:733–44.
23 Seitio-Kgokgwe O*et al*. Utilization of the district health information software (DHIS) in Botswana: from paper to electronic based system. *IST-Africa Week Conference* 2016:1–10.
24 Nutley T, Gnassou L, Traore M, *et al*. Moving data off the shelf and into action: an intervention to improve data-informed decision making in Côte d'Ivoire. *Glob Health Action* 2014;7): :25035.
25 Nicol E, Hanmer LA. Routine Health Information Systems in South Africa--Opportunities for Improvement. *Stud Health Technol Inform* 2015;216:78–82.
26 Abajebel S, Jira C, Beyene W. Utilization of health information system at district level in jimma zone oromia regional state, South West Ethiopia. *Ethiop J Health Sci* 2011;21:65–76.
27 Yarinbab TE, Assefa MK. Utilization of HMIS data and its determinants at health facilities in East Wollega zone, Oromia regional state, Ethiopia: a health facility based cross-sectional study. *J Medi Health Sci* 2018;7.
28 Shiferaw AM, Zegeye DT, Assefa S, *et al*. *Routine health information system utilization and factors associated thereof among health workers at government health institutions in East Gojjam Zone,* Northwest Ethiopia. *BMC Med Inform Decis Mak* 2017;17:116.
29 Wude H, Woldie M, Melese D, *et al*. Utilization of routine health information and associated factors among health workers in Hadiya zone, southern Ethiopia. *PLoS One* 2020;15:e0233092.
30 Chanyalew MA, Yitayal M, Atnafu A, *et al*. Routine health information system utilization for evidence-based decision making in Amhara national regional state, Northwest Ethiopia: a multi-level analysis. *BMC Med Inform Decis Mak* 2021;21:28.
31 Abera E, Daniel K, Letta T, *et al*. Utilization of health management information system and associated factors in Hadiya zone health centers, Southern Ethiopia. *Res Health Sci* 2016;1:98.
32 Feleke AA*et al*. Utilization of routine health management information and associated factors among health professionals Workingat public health facilities of Hadiya zone southern Ethiopia. *PLoS One* 2019;21:25–37.
33 Kebede M, Adeba E, Chego M. Evaluation of quality and use of health management information system in primary health care units of East Wollega zone, Oromia regional state, Ethiopia. *BMC Med Inform Decis Mak* 2020;20:107.
34 Emiru K, Oljira H, Ifa M. Assessment of utilization of health information and associated factors at district level in East Wollega Zone, Oromia Regional State, West Ethiopia. *J Med Physiol Biophy* 2018;44:123–36.
35 Teklegiorgis K*et al*. Factors associated with low level of health information utilization in resources limited setting, eastern Ethiopia. *Int J Int Inform Sys* 2014;3:69.
36 Zegeye AH*et al*. Utilization of community health information system and associated factors in health posts of Hadiya zone, southern Ethiopia. *J Med Physiol Biophys* 2020;63:13–22.
37 Dagnew E, Woreta SA, Shiferaw AM. Routine health information utilization and associated factors among health care professionals working at public health institution in North Gondar, Northwest Ethiopia. *BMC Health Serv Res* 2018;18:685.
38 Seid MA, Bayou NB, Ayele FY, *et al*. Utilization of routine health information from health management information system and associated factors among health workers at health centers in Oromia special zone, Ethiopia: a multilevel analysis. *Risk Manag Healthc Policy* 2021;14:1189–98.
39 Kanfe SG, Debele GR, Berhanu RD, *et al*. Utilisation of district health information system and its associated factors among health professionals working at public health facilities of the southwest of Ethiopia: cross-sectional survey. *BMJ Open* 2021;11:e046578.
40 Mekonnen BD, Gebeyehu SB. Routine health information utilization and associated factors among health care workers in Ethiopia: a systematic review and meta-analysis. *PLoS One* 2021;16:e0254230.
41 Tulu G, Demie TG, Tessema TT. Barriers and associated factors to the use of routine health information for decision-making among managers working at public hospitals in North Shewa zone of Oromia regional state, Ethiopia: a Mixed-Method study. *J Healthc Leadersh* 2021;13:157–67.
42 Chikumba PA, Ramussen SL. Management and use of health information in Malawi and Burkina Faso: the role of technology. *IST-Africa Week Conference* 2016:1–9.
43 Mboera LEG, Rumisha SF, Mbata D, *et al*. Data utilisation and factors influencing the performance of the health management information system in Tanzania. *BMC Health Serv Res* 2021;21:498.
44 Gonete TZ, Yazachew L, Endehabtu BF. Improving data quality and information utilization at Metema primary Hospital, Amhara national regional state, Northwest Ethiopia 2018: Capstone project. *Health Informatics J* 2021;27:146.
45 Hotchkiss DR, Diana ML, Foreit KGF. How can routine health information systems improve health systems functioning in low- and middle-income countries? Assessing the evidence base. *Adv Health Care Manag* 2012;12:25–58.
46 MOH. Ministry of health federal democratic Republic of Ethiopia: HMIS information use guide technical standards area 4 version 2. Measure evaluation, 2013. Available: https://www.measureevaluation.org [Accessed 26 Apr 2021].
47 MOH. Ethiopian federal Ministry of Health: information revolution roadmap. Measure evaluation, 2016. Available: http://repository.iifphc.org [Accessed 13 May 2021].
48 Hotchkiss DR, Aqil A, Lippeveld T, *et al*. Evaluation of the performance of routine information system management (PRISM) framework: evidence from Uganda. *BMC Health Serv Res* 2010;10:188.
49 Aqil A, Lippeveld T, Hozumi D. PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. *Health Policy Plan* 2009;24:217–28.
50 Bedru A, Shukure R, Derese K. Assessment of health management information system practice on HIV/AIDS related commodities in public health facility found in Harar town, Ethiopia. *Int J Sus Manag Inform Tech* 2019;5:11
51 Yitayew S, Asemahagn MA, Zeleke AA. Primary healthcare data management practice and associated factors: the case of health extension workers in Northwest Ethiopia. *Open Med Inform J* 2019;13:258
52 O'brien RM. A caution regarding rules of thumb for variance inflation factors. *Qual Quant* 2007;41:673–90.

Code_____(filled by data collector)

Tools used to assess Determinant of health management information Utilization

Part One: Socio Demographic Factors

Please, encircle or fill your appropriate opinions for each question		
No.	Questions	Responses
101	Type of health facility	A. Hospitals B. Health center
102	Residence	A. Urban B. Rural
103	Gender	A. Male B. Female
104	Age in years	_____
105	Educational level	A)Diploma B) Bsc degree C) Master D) Other specify_____
106	specialized field of study	A)Nurse B)Medicine C)Midwifery D)Pharmacy E)Health officer F)Laboratory G)Other(Specify)_____
107	Working experience in years	_____
108	Unit/department you are working now	A. IPD B. OPD C. ANC D. Laboratory A. Other(Specify)_____
109	Your position in the department	A. Facility manager B. Department head B. Performance monitoring team member C. Coordinator D. Health professional only E. Other role (specify)_____
110	Monthly salary	_____
111	How many patients or clients do you treat/serve per a day on average	_____
112	How many hours do you work per a day on average	_____
Section Two : Health Management information use		

Code_____(filled by data collector)

Please rate your level of agreement on the following statements regarding the **Health Management information use**. The statements are expressed using the Likert scale; 1-Strongly Disagree, 2 Disagree, 3-Neither Agree or Disagree, 4-Agree 5-Strongly agree.					
Part Two: Routine health information used for :					
201. Treating patient	**1**	**2**	**3**	**4**	**5**
202. Disease prioritization	**1**	**2**	**3**	**4**	**5**
203. Drug procurement	**1**	**2**	**3**	**4**	**5**
204. Monitoring day to day health service activities	**1**	**2**	**3**	**4**	**5**
205. Checking data quality	**1**	**2**	**3**	**4**	**5**
206. Resource allocation	**1**	**2**	**3**	**4**	**5**
207. Departments performance evaluation	**1**	**2**	**3**	**4**	**5**
208. Planning	**1**	**2**	**3**	**4**	**5**
209. Monitoring the performance of staffs	**1**	**2**	**3**	**4**	**5**
2010. Selecting good experience with in the facility	**1**	**2**	**3**	**4**	**5**
2011. Sharing of best experience for other facility and stakeholders	**1**	**2**	**3**	**4**	**5**
2012. Decision making	**1**	**2**	**3**	**4**	**5**
2013. Community mobilization and discussion	**1**	**2**	**3**	**4**	**5**

Part Three: Behavioral Factors; This is to measure your knowledge on health management information system; please, encircle your appropriate opinions for each questions		
301	**Indicate possible reasons for collecting or using aggregated data on a monthly basis for the following data types. If it is reason encircle <u>YES</u> , if it is not a reason encircle <u>NO.</u>**	
	Which are the reasons for collecting or using aggregated diseases data:	Responses(encircle)
	a. To provide individual level care	**A. Yes B. No C. I don't know**
	b. To know changes in magnitude/burden of selected diseases	**A. Yes B. No C. I don't know**
	c. To triage patients who need urgent care and those who can wait for some time	**A. Yes B. No C. I don't know**
	d. To identify disease outbreaks and take action to address epidemics	**A. Yes B. No C. I don't know**

Code_____(filled by data collector)

	e. To plan preventive and primitive activities	**A. Yes B. No C. I don't know**
302	**Which can be the reasons for collecting or using aggregated immunization data: (If it can be the reason encircle <u>Yes</u> in front of it; if it can't be encircle <u>No</u>)**	
	a. To know the coverage of effective intervention (immunization) for improving maternal or child health	**A. Yes B. No C. I don't know**
	b. To improve diagnosis and treatment of under five children	**A. Yes B. No C. I don't know**
	c. To take action for providing necessary resources (eg. staffing, equipment, vaccines, etc)	**A. Yes B. No C. I don't know**
	d. To plan for immunization activities – developing targets for immunization	**A. Yes B. No C. I don't know**
303	**The reasons for collecting or using aggregated age/sex of patients/clients (If it can be the reason encircle <u>Yes</u> in front of it; if it can't be the reason encircle <u>No</u>)**	
	a. To ensure equitable service coverage across people of all groups	**A. Yes B. No C. I don't know**
	b. To know which group is affected by certain disease	**A. Yes B. No C. I don't know**
	c. To get more funding	**A. Yes B. No C. I don't know**
	d. To calculate workload of OPD and under-five clinic	**A. Yes B. No C. I don't know**
	e. To know if the appropriate group is getting the relevant services	**A. Yes B. No C. I don't know**
304	**Which can be the reasons for collecting or using geographical data or residence of patients for example where they come from (If it can be the reason encircle <u>Yes</u> in front of it; if it can't be the reason encircle <u>No</u>)**	
	a. To plan preventive and promotive activities targeted to certain geographic areas	**A. Yes B. No C. I don't know**
	b. To improve access and utilization of health services	**A. Yes B. No C. I don't know**
	c. To determine the behavior of clients/population group	**A. Yes B. No C. I don't know**
	d. For disease surveillance (to control epidemic/disease outbreaks)	**A. Yes B. No C. I don't know**
305	**Why population data are needed (example total number of people living in the catchment area)?(If it can be answer encircle <u>Yes</u> in front of it otherwise encircle <u>No</u>)**	
	a. To use as denominator for calculating of indicators	**A. Yes B. No C. I don't know**

Code_____(filled by data collector)

	b. To plan the provision of various health services	**A. Yes B. No C. I don't know**
	c. To calculate the workload of health facilities	**A. Yes B. No C. I don't know**
	d. To know the knowledge and skill of health professionals	**A. Yes B. No C. I don't know**
306	How can we know data are consistent?	**A. Yes B. No C. I don't know**
	A. if it is submitted by all(most) reporting facilities	**A. Yes B. No C. I don't know**
	B. .if there is no mathematical errors	**A. Yes B. No C. I don't know**
	C. if the data are within the normal ranges	**A. Yes B. No C. I don't know**
307	What does complete data mean?	**A. Yes B. No C. I don't know**
	A. if it is submitted by all(most) reporting facilities	**A. Yes B. No C. I don't know**
	B. .if there is no mathematical errors	**A. Yes B. No C. I don't know**
	C. if the data are within the normal ranges	**A. Yes B. No C. I don't know**
308	When we say data are Accurate?	
	A. if it is submitted by all(most) reporting facilities	**A. Yes B. No C. I don't know**
	B. .if there is no mathematical errors	**A. Yes B. No C. I don't know**
	C. if the data are within the normal ranges	**A. Yes B. No C. I don't know**

3. 2. Please rate your perceived self-efficacy to HMIS activities in your health facility (circle the appropriate answer for strongly disagree=1, for disagree =2, for neutral =3, for agree=4, for strongly agree=5(high confidence))

309	Perceived self-efficacy in analyzing data	I can calculate percentage/rate correctly	**1**	**2**	**3**	**4**	**5**
310		I can compute data by months or year	**1**	**2**	**3**	**4**	**5**
311	Perceived self-efficacy in interpreting data	I can compute trend from bar chart	**1**	**2**	**3**	**4**	**5**
312		I can compare data from bar chart	**1**	**2**	**3**	**4**	**5**
313	Perceived self-efficacy in using information	I can use data for identifying gaps	**1**	**2**	**3**	**4**	**5**
314		can use data for planning future actions	**1**	**2**	**3**	**4**	**5**
315		I can use data for monitoring change in indicators	**1**	**2**	**3**	**4**	**5**

Code_____(filled by data collector)

316		I can use data for advocacy					

3.3. Attitude: Please rate your attitude towards toward HMIS data (circle your own opinion for strongly disagree=1, for disagree =2, for neutral =3, for agree=4, for strongly agree=5)

Question		**1**	**2**	**3**	**4**	**5**
317	Are you Eager to undergo training on data management	**1**	**2**	**3**	**4**	**5**
318	Are filling forms are easy and worthwhile exercise	**1**	**2**	**3**	**4**	**5**
319	Are you interested in filling Forms	**1**	**2**	**3**	**4**	**5**
320	Collecting, analysis, reporting and utilizing data is not time consuming	**1**	**2**	**3**	**4**	**5**
321	Collecting, storing, analysis, reporting and utilizing data is useful exercise	**1**	**2**	**3**	**4**	**5**
322	Collecting, analysis and reporting information which is not used for decision making encourages me	**1**	**2**	**3**	**4**	**5**
323	Collecting, analysis and reporting information gives me the feeling that data is needed for monitoring facility performance	**1**	**2**	**3**	**4**	**5**
324	Managing data is part of my duty/responsibility	**1**	**2**	**3**	**4**	**5**

.3.4 Motivation: Please rate your Motivation towards toward HMIS activities (circle your own opinion for strongly disagree=1, for disagree =2, for neutral =3, for agree=4, for strongly agree=5)

S/N	Questions	Possible answers				
325	I always like to be guided by HMIS data to make decisions	**1**	**2**	**3**	**4**	**5**
326	I put a great deal of effort into analyzing and interpreting HMIS data.	**1**	**2**	**3**	**4**	**5**
327	I am committed to monitor data collection in my department to make HMIS data better.	**1**	**2**	**3**	**4**	**5**
328	I am dedicated to using HMIS data for decision making.	**1**	**2**	**3**	**4**	**5**
329	I devote my time for the sake of using HMIS data for decision making.	**1**	**2**	**3**	**4**	**5**
330	I put a great deal of effort into understand the information needs of my facility (Department).	**1**	**2**	**3**	**4**	**5**
331	I am devoted to accessing HMIS data as needed for managing a program.	**1**	**2**	**3**	**4**	**5**

No	**Part Four: Technical factors;** please encircle Yes/No for the following technical factors	
401	Is there standardized set of indicator in your facility?	A. Yes B. No

Code_____(filled by data collector)

402	Is there friendly format for data collection and reporting	A. Yes B. No
403	If your answer is No for Question 402, what makes the formats to be unfriendly or difficult to understand for you?	A. Uncommon words/terms B. abbreviations C. formats are inconsistent D. If other specify _____
404	There is a use of appropriate technology for data analysis, transfer and presentation?	1. Yes 2. No

5. Part Five: Organizational Factors: Please rate your facility management support (circle the appropriate answer for strongly disagree=1, for disagree =2, for neutral =3, for agree=4, for strongly agree=5)

	Question about your facility/health department management					
501	My superior manager Use HMIS data for day to day management of the health center	**1**	**2**	**3**	**4**	**5**
502	My superior manager encourages to display data for monitoring their set target	**1**	**2**	**3**	**4**	**5**
503	My superior manager encourages to gather data to find the root cause(s) of the problem	**1**	**2**	**3**	**4**	**5**
504	My superior manager encourages to develop appropriate criteria for selecting interventions for a given problem	**1**	**2**	**3**	**4**	**5**
505	My superior manager encourages to develop appropriate outcomes for a particular intervention	**1**	**2**	**3**	**4**	**5**
506	My superior manager encourages to evaluate whether the targets or outcomes have been achieved	**1**	**2**	**3**	**4**	**5**

Organizational factors continue… culture of health information						
507	Health department encourages staff to use data to monitor changes in health service indicators	**1**	**2**	**3**	**4**	**5**
508	Health department encourages staff to use data monitor changes in health service indicators	**1**	**2**	**3**	**4**	**5**
509	Health department encourages staff to use data for developing future action plans	**1**	**2**	**3**	**4**	**5**
510	Health department encourages staff to use data for community actions	**1**	**2**	**3**	**4**	**5**
511	Health department encourages staff/managers to check evidence before making decisions	**1**	**2**	**3**	**4**	**5**
512	Health department makes staff accountable for their decisions and actions	**1**	**2**	**3**	**4**	**5**
513	Health department encourages supervisors to reward good work	**1**	**2**	**3**	**4**	**5**
514	Health department makes staff feel important by recognizing their work	**1**	**2**	**3**	**4**	**5**

Please, encircle or fill each question

Code_____(filled by data collector)

515. Are reference materials available for data management in your department?

A) Yes B) No C) Yes but not adequate

516. If your answer is yes for question 507, which type of reference materials are available (more than one answer is possible)

A. Indicator reference sheet

B. Data management guideline

C. HMIS information user guideline

D. HMIS diseases classification E. Other (specify)_____

517. Are report formats available in your department? A) Yes B) No C)Yes but not adequate

518. Is internet available in your department? A) Yes B) No

519. Are tally sheets available in your department

A) Yes B) No C)Yes but not adequate

520. Does your facility provide pen, pencil or marker?

A)Yes B) No C) Yes but not adequate

521. Are graph papers available in your department?

A) Yes B) No C)Yes but not adequate

522. Are white papers available in your department?

A) Yes B) No C)Yes but not adequate

523. Have you ever received a formal routine health information /health management information training before? A. Yes B. No

524. If you say yes in question No. 515, what type of training you took?

A. Health statistics
B. Data management(Data collection, storage, processing, analysis, quality checking, reporting and use)
C. Monitoring and evaluation
D. Other (specify)_____

525. Does your health facility have computer that can be used only for routine HMIS or data management task processing? A. Yes B. No

526. If your answer for question number 517 is "Yes", do you think the computers are adequate? A. Yes B. No

527. For what purpose do you use the computers?(More than 1 answer is possible)

A. To record or register patient visits D. To schedules or appoint patients

B. For Administration and finance routines E. other(specify)_____

C. To store and retrieve electronic patient information

Code_____(filled by data collector)

528. In the past 3 months did you get supervision from higher officials?

A. Yes B. No

529. If yes for the above question 520, how many times the unit/department supervised.

A. Onetime B. Two times C. Three times

530. Did supervisor check the data management practices such as the way you are recording, analysis, reporting, data quality and utilization during supervision?

A. Yes B. No

531. Did the supervisor discuss on data management activities based on HMIS information when he/she visited your facility? A. Yes B. No

532. Have you received feedback from higher levels A. Yes B. No

533. If your answer for question number 524 is yes, in what interval have you received feedback?

A. Monthly B. Quarterly C. Every six month D. Annually

534. Are there any incentives for Data management process such as recording, processing, storage, data quality assurance, report and using?

A. Yes B. No

535. If your answer for question number 526 is yes, what kind of incentives

A. Training B. Money C. Recognition D. Other(specify)_____

Observation Checklist

Health Facility :		
Observer:	Date :	
Items	YES	NO
Presence of health facility RHIS targets displayed		
Presence of health facility indicator performance charts, graphs and table displayed		
Presence of staff meeting minutes reflecting reports, data and feedback from health facility or district discussed		
Presence of action work plan relating identified data gaps and how they were addressed		
Presence of RHIS training manual and guide		
Presence of RHIS supervisory checklist		
presence of RHIS supervisory report		
presence of data quality assurance checklist		

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	**Utilization of Health Management Information and Its Determinant Factors among Health Professionals Working at Public Health Facilities in North Wollo Zone, Northeast Ethiopia: A Cross-Sectional Study**	Page 1
		The study aimed to assess health management information utilization and associated factors among health professionals working at public health facilities in North Wollo zone, Northeast Ethiopia. A total of 664 (56.3% male and 43.7% female) health professionals participated in the study. The finding from this study revealed that enhancing motivation, building a culture of information use, having standardized indicators, strengthening the governance of health information system and a comprehensive HMIS training were measures to be taken to improve utilization of health management information in this study setting.	Page 2
Introduction			
Background/ rationale	2	A Health Information System (HIS) is an integral part of the healthcare system. Previous research finding implied that weak routine health information use in developing country. However, previous studies in Ethiopia weren't widely addressed organizational factors and we argue that the relevance of those untouched factors was undeniable which poses challenges to utilizing health management information. Our review showed that inconsistent findings from previous studies in different parts of Ethiopia. It indicated that not a uniform level of utilization in this country. This means low generalizability of those results to the current study setting, and study area specific finding is required in Northeast Ethiopia.	Page 4-5
Objectives	3	✚ To determine health management information use among health professionals working at public health facilities in North Wollo zone, Northeast Ethiopia ✚ To identify factors associated with data management practice among health professionals working at public health facilities in North Wollo zone, Northeast Ethiopia	Page 5
Methods			
Study design	4	An institution-based cross-sectional study was employed by using a quantitative approach.	Page 6
Setting	5	The study was conducted at public health facilities in North Wollo zone, Northeast Ethiopia.	Page 6
Participants	6	All health professionals permanently working in North Wollo were eligible in this study. However, health professionals who had less than six months of experience or not permanent employees weren't including in this study. Accordingly, a total of	Page 6

		664 (56.3% male and 43.7% female) health professionals were approached.	
Variables	7	**Outcome measure:** The outcome variables were health management information utilization. **Independent Variables or Predictors:** were grouped in to four classes. **First**, **organizational factors** such as training, supervision, feedback, and so on. **Second: Behavioral factors** such as competence, attitude and knowledge of health professionals. **Third**: **Technical factors** such as user friendliness of reporting tools, standardized indicator and availability of appropriate technology. **Fourth**: **Socio demographic factors:** Age, gender, residence, educational level, and so on.	Page 7 to 8
Data sources/ measurement	8*	A structured self-administered questionnaire was used to collect data among healthcare professionals. Two-day training was given for data collectors and supervisors.	Page 7
Bias	9	Participants were selected randomly and the study tool was also pre-tested in Ethiopian context.	Page 6
Study size	10	The sample size was calculated using single population proportion formula, considering the following assumptions: a 95% level of confidence, a 5% of margin of error, a design effect of 2, P= 78.5% from previous study and a 5% of non-response rate. Finally, we got and approached a total number of 721 health care professionals within the selected clusters.	Page 6
Quantitative variables	11	The quantitative variables were measured using different item questions. Health management information use was assessed using Likert scale questions rated on a five-point Likert scale (ranging from "1=strongly disagree" to "5=strongly agree) and finally interpreted as good and poor utilization. Mean of health professionals score were calculated by first sum-up score of respondent for each item then divided for total respondents. Health professionals who scored greater than or equal to the mean value of likert scale questions provided to measure health management information use were labeled as good use of health management information.	Page 7 to 8
Statistical methods	12	Both bi-variable and multi-variable logistic regression analyses were used to measure associations between the independent variables and the dependent variable. Variables who were significant at P-value <=0.02 were subjected to binary logistic regression to control confounding effect. P-value <=0.05 was considered as cut point for multi-variable logistic regression. Descriptive analyses (mean and percentage) were used to describe variables. A stepwise forward selection of variables was used to build the multi-variable model.	Page 7 to 8
		Chi-square test was employed.	Page 10
		We have planned to restrict the analysis to subjects with complete data. The data was assessed for the missing values; there was no missing data in our study.	Page 10
		Participants were selected based on simple random sampling technique.	Page 10

		Assumption was checked for binary logistic regression.	Page 10
Results			
Participants	13*	A total of 664 (56.3% male and 43.7% female) health professionals participated in the study. All health professionals permanently working in North Wollo Zone were included in this study. However, health professionals that weren't present during the data collection period by any means and who had less than six months of experience weren't included in this study.	Page 6
		Health professionals who were worked for less than six months or not permanent employee and those who were on annual leave, sick leave, who left for a long time education during data collection period were excluded from the study.	Page 6
		We have provided flow diagram to show selection of participants in the study.	Supplementary file 1
Descriptive data	14*	More than half 373(56.2%) of the respondents 373(56.2%) were male with the mean age of participants was 33.24 ± 8.3 years. In terms of educational level, this study revealed that, a large number the majority of 387(58.3%) of the respondents were degree holders 387(58.3%). Regarding to their residence, more than half 375(56.5%) of the study participants were lived in rural residents 375(56.5%). This study implied that health professionals who had good HMIS knowledge on data management were found to be 55.1% [95% CI: 50.4 to, 58.7]. Health professionals who had good motivation toward HMIS were found to be 64.3% [95% CI: 59.3, to 68.5]. Perceived culture of health information use of health professionals was 46.7% [95% CI: 42.6, to 49.2] and RHIS tasks self-efficacy was 46.7% [95% CI: 42.6 to, 49.2].5%) of them got feedback at least within a year.	Page 9 to14
		There was no missing data	
Outcome data	15*	Overall good routine health management information utilization was noted among 58.4% (n = 388) [95% CI of 54.4% to 62.0%] of the health professionals.	Page 14 to 15
Main results	16	In the bi-variableate logistic regression analysis, Position, knowledge to HMIS, motivation level, the perceived culture of information use, RHIS self-efficacy, standardized indicator, management support, governance of HHIS, availability of reference material, training of HMIS, and supervision were factors associated with good routine health information utilization at a p-value of less than 0.2. Consequently, these variables were subjected to the multivariable logistic regression analysis to control potential confounders, and it was noted that, position, motivation level, perceived culture of information use, standardized indicator, training of HMIS, and governance of HIS were significantly associated with good data management practice at a P-value of less than 0.05.	Page 14 to 15
		Based on validated HMIS assessment tool utilization of participants was,	Page 6

		categorized in two: health professionals who scored above the mean were considered as good in using health information and who scored below mean were considered as poor ion utilizing health management information.	
		Not-applicable	
Other analyses	17	The chi-square test was used to evaluate the statistical significance of the differences between the responses of the participants.	Page 9
Discussion			
Key results	18	The finding showed that the utilization of health management information was 58.4% (n = 388) [95% CI of 54.4% to 62.0%]. Accordingly, health management information use was inadequate. In this study, higher odds of good routine health information system utilization were noted among health professionals who had position[AOR = 3.11; 95% CI: 1.84, 5.24], good motivation level[AOR = 4.42; 95% CI: 2.82, 6.93], good perceived culture of information [AOR = 6.17; 95% CI: 3.35, 11.36], standardized indicator [AOR = 4.11; 95% CI: 2.65, 6.38], good governance of HIS [AOR = 1.75; 95% CI: 1.13, 2.72], and among who took HMIS training [AOR = 3.10; 95% CI: 1.89,5.07].	Page 16-20
Limitations	19	This study was not supported by qualitative finding. Additionally, this study used cross-sectional study design which leads to recall bias. The data collection was based on self-reported information which might lead to overestimation of participants' real utilization practice. In this regard we used. The mean score of health management information utilization questions might also be a limitation to this study.	Page 20
Interpretation	20	In summary, this study revealed that utilization of health management information was inadequate. Enhancing motivation, build culture of information, having standardized indicator, strengthening governance of health information system and a comprehensive HMIS training were measures to be taken to improve utilization of health management information.	Page 18-19
Generalisability	21	In general, in resource-limited settings evidence based decision has a potential to enhance patient care. Our study indicated, government and other responsible bodies should consider encouraging mechanisms and enforce strategies based on the identified results and predictors. At the organizational level, managements should convey their capacity building efforts towards the provision of trainings and building information culture. The study was done at health post, health centers, primary hospital, general hospital and referral hospitals with a large sample size this increases its generalizability.	Page 20
Other information			
Funding	22	No funding was received for this study.	Page 21