Household drinking water quality and its predictors in flood-prone settings of Northwest Ethiopia: a cross- sectional community-based study

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Abstract

Background

In many nations, the deterioration of drinking water quality is a major problem that may be caused by a variety of interrelated biological, physical, and chemical causes. Human feces, animal waste, and effluent farming activities are the main pollutants of water supplies. Even if the source is clean, the process of collecting, transporting, storing, and drawing water in the home can all lead to faecal contamination. In addition, without improved water storage and sanitation, a better water supply doesn't always result in full health benefits. Because of this, it's important to have regular quality control procedures. This study is aimed to assess the level of physioco-chemical and bacteriological quality of hosehold drinking water and its contributing factors in flood-prone settlements of South Gondar Zone, Ethiopia.

Methods

In villages in the South Gondar Zone that are prone to flooding, a community-based cross-sectional study was conducted from January to March 2021. Using standardized water sampling methods, samples of household water were gathered from each residence. Data on socioeconomic conditions and behavioral patterns were gathered through in-person interviews with structured questionnaires. Logistic regression models were used for both univariate and multivariate studies.

Results

The survey included a total of 675 households. The South Gondar Zone's settlements that are prone to flooding had a prevalence of 62.2 percent (n = 417) with [95% CI (53–60)] positive fecal coliform in household water samples. Family size [AOR = 2.205, 95% CI (1.375–3.536), latrine presence [AOR = 3.449, 95% CI (1.349–8.823)], and utilizing a separate container to draw water from its storage [AOR = 0.454, 95% CI (0.249–0.827)] are variables identified as predictors for fecal coliform contamination of household water.

Conclusion

In this study, there was a high proportion of fecal contamination in drinking water. The presence of fecal coliforms in household drinking water was found to be significantly related to family size, the availability of a toilet, and the usage of a separate can to draw water from its storage.

Introduction

Water is the essence of life and safe drinking water is a basic human right essential to all, and for sustainable development (Kumar et al., WHO, 2006, Amenu et al., 2013b). Water quality is a critical factor affecting human health and welfare (Werkneh et al., 2015). Access to safe water is an important global public health concern. Improving access to safe drinking water can result in tangible benefits to health, can boost countries' economic growth, and contribute greatly to poverty reduction (WHO, 2019). In many nations, the decline of quality of drinking water is a significant problem that may be caused by a variety of interrelated biological, physical, and chemical variables (Garoma et al., 2018). People living in flood-prone areas are faced with so many challenges such as poor sanitary systems; overflowing toilets, and poor drainage which affect their lives negatively. The primary pollutants in water sources include human excreta, animal waste, effluent agricultural practices, floods, and droughts as well as a lack of knowledge among end-users about hygiene and environmental cleanliness; storage and disposal must be taken in to account for the protection of water resources (Amenu et al., 2012, Meride and Ayenew, 2016). Children are more susceptible to microbiological pollutants due to their immature immune systems (WHO, 2019), and they also tend to consume more water than adults do compared to their body mass and are more exposed to pollutants in drinking water (EPA, 2015). These microorganisms are responsible for the spread of illnesses like cholera, dysentery, diarrhea, hepatitis A, typhoid, and polio (WHO, 2019). As a result, the majority of rural populations get their water from tainted or questionable sources, exposing them to a variety of water-borne ailments (Amenu et al., 2012, Meride and Ayenew, 2016). Even if the source is clean, the process of collecting, transporting, storing, and drawing water in the home can all lead to faecal contamination (Amenu et al., 2013a). Unless the water is made safe or treated for human consumption, it may be hazardous to health and transmit diseases.

According to estimates from the World Health Organization (WHO), unclean water, inadequate sanitation, and poor hygiene are to blame for up to 80% of diseases, 3.1% of fatalities (1.7 million), and 3.7% of disability-adjusted life years (54.2 million) worldwide (WHO, 2006, Werkneh et al., 2015). Worldwide water borne diseases are the cause of death and suffering of millions of people, especially children in developing countries (Mulamattathil et al., 2015, WHO, 2006). In sub-Saharan Africa, over 275 million people rely on unsafe drinking water sources from lakes, rivers, and open wells. Consequently, many water-borne diseases are responsible for significant morbidity and mortality among children (Too et al., 2016). In Ethiopia, poor environmental health conditions resulting from subpar water quality and inadequate hygiene and sanitation standards are to blame for more than 60% of infectious infections (WHO, 2004b, Amenu et al., 2013a). This is the least of any country on the continent, with 80% of the rural and 20% of the urban population have no access to clean water. Children in the country suffer from communicable diseases caused by the environment, particularly poor water quality and sanitary conditions, which account for three-fourths of all child health issues (Amenu et al., 2013a, Meride and Ayenew, 2016). In rural locations where water sources are communally shared and exposed to several fecal-oral transmission channels in their local boundaries, bacterial contamination of drinking water is a primary cause of water-borne infections (Gwimbi et al., 2019). The contamination of the water can also be linked to the presence of pathogens such as fecal coliforms and *Escherichia coli* (Ladokun and Oni, 2015). They can therefore be viewed as a sign of fecal contamination and potentially declining water quality when found in drinking water. Frequent testing of fecal indicator organisms is still the most accurate method for determining the quality of water in Ethiopia (Berhanu and Hailu, 2015). Fecal Coli forms are so frequently employed to express the microbiological quality of water and as a measure to predict the risk of diarrheal illness as a result of consuming fecally polluted water. They have been seen as a sign of fecal contamination. As a result, this research will assist them in evaluating the drinking water quality and related aspects in northwest Ethiopia's flood-prone districts.

Methods

Study design and area

A community-based cross-sectional study was employed in flood-prone settings of Fogera and Libokemkem districts of the south Gondar administrative Zone from January-March; 2021. These areas are located about 650 kilometers northwest of the capital Addis Ababa, about 70 kilometers from Bahir Dar town, the capital of the Amhara region, and about 110km from Gondar Town. According to the 2009 census, the population of Fogera and Libo Kemkem was 226,595 and 198,374 respectively; and also have 44 and 33 kebeles respectively (Herrador et al., 2014). According to the Amhara mass media agency report on September 15, 2020; about 2,439 households from Fogera and 1,750 households from Libo Kemkem districts were affected and displaced by the recent flooding.

Source and study population

All households with under-five children in flood-prone settlements in Fogera and Libo Kemkem districts, Northwest Ethiopia will be the source population. All households with under-five children in purposively selected kebeles of flood-prone settlements in Fogera and Libo Kemkem districts, Northwest Ethiopia. All households with under-five children were selected through systematic sampling in selected kebeles of flood-prone settlements in Fogera and Libo Kemkem districts, Northwest Ethiopia.

Sample size and sampling technique

The sample size was determined using single population proportion formula with the following assumptions: 30% of households in rural areas had faecally contaminated drinking water sources (Tsega et al., 2013), with a 5% margin of error (d) and 95% confidence interval.

$$n = \frac{(Za_{/2})^2 * P(1-P)}{d^2} \qquad n = \frac{(1.96)^2 * 0.3(1-0.3)}{(0.05)^2} = 323$$

By taking 10% of the non-response rate and design effect of 2, then the total sample size was 710. Three kebeles in each of the two districts *Aboa Kokit*, *Shaga*, and *Sefatera kebeles* from Fogera district; and *Bura*, *Shena*, and *Banbiko kebeles* from Libo Kemkem district are selected purposively based on their proximity to Ribb River and Suffers with the common flooding and overflow of the river. Then households are allocated proportionally and selected using systematic sampling from each of the six kebeles to have a total sample size of 710 households with under-five children.

Data collection procedures and tools

The samples of household drinking water were collected to conduct the physicochemical and bacteriological examinations. The American Public Health Association (APHA) recommendations for drinking water quality assessment were followed when collecting water samples from each residential water source. The APHA (2005) standard techniques were used to determine all physicochemical assessments of water (APHA, 2005). The pH, temperature, electrical conductivity, and TDS were measured *in situ*, whereas other parameters turbidity and free residual were done at the laboratory of the Environmental and Occupational Health and Safety department. The pH was analyzed using a portable digital pH meter (Wagtech model, UK). The pH meter was calibrated just before analysis using PH 4.0, PH 7.0, and PH 10.0. Conductivity, Total dissolved salts (TDS), and temperature were analyzed using a portable digital conductivity meter (wagtech model, UK). The analysis of conductivity was done after calibration of the conductivity meter using 0.1M of potassium chloride. With regard to turbidity, it was measured using a portable microprocessor turbidity meter (wagtech model, UK) after calibrating with the standard solutions of 800, 100, 20, and 0.02NTU. A free residual chlorine test was done using a spectrophotometer (wagtech model 1700, UK) through DPD (diethyl para-phenylenediamine) method (Hailu, 2017, APHA, 2005).

The analysis of fecal coliform (FC) was done within 4 hours of sample collection using the membrane filtration (MF) method according to standard methods for the examination of water (APHA, 2005). Membrane lauryl sulfate broth was prepared and autoclaved at 121^0C for 15 minutes before being inoculated with membrane filters. Then, a 100 ml water sample was drawn and filtered with a sterile membrane filter of 0.45 µm and the filter membrane was then placed aseptically on reusable aluminum Petri dish with an absorbent pad soaked with membrane lauryl sulfate broth. Then the plate was incubated at 44.5^0C for 24 hours to determine the fecal coliform bacteria. Then, all yellow colonies will be counted as FC (Eliku and Sulaiman, 2015). Then, when the CFU/100ml of water was zero, the results were classified as "Negative," and when it was larger than zero, they were classified as "Positive".

In order to collect socioeconomic and behavioral variables, face-to-face interviews were performed using standardized questionnaires. Trained experts made observations using a standardized sanitary survey checklist to determine the risk of contamination of drinking water sources.

Data quality control

Data collectors and supervisors received three days of training on data gathering processes, techniques, and methods. The data collecting tools were pretested on a neighboring district that was not part of the real data collection prior to the start of the actual data collection procedure. Moreover, during the data gathering procedure, there was constant and tight oversight.

Water samples were collected in sanitized glass bottles from each residential water source. Trained laboratory technicians took all of the water samples. Before collecting samples, all sampling vials were properly labeled. The samples were collected using recognized drinking water sampling techniques. The collected water samples were held at a temperature of 4^oC while in transit and then examined in a lab.

Prior to analysis, the necessary laboratory equipment and culture media were sterilized. Furthermore, blank samples were examined using the same technique to confirm the authenticity of the results.

Data processing and analysis

The SPSS version 20.0 Software was used to evaluate the data after it had been entered using Epi-Info version 7.1. The potential contributing factors were found using multivariate logistic regression analysis. A P-value of less than 5% was used to declare the association between factors and the dependent variable.

Results

Socio-demographic characteristics of respondents

From a total of 675 respondents of households who participated, the mean (± SD) age was 27.8 ± 5.5 years, and about 288 (42.7%) respondents were aged less than 25 years. The majority, 592(87.7%), of the participants were married, and more than half of the respondents 369(54.7%) were unable to read and write. Most of the respondents, 654(96.9%), were Orthodox Christian. The majority, 468(69.3%), of the respondents had a family size of fewer than five individuals and 369(54.7%) of the respondents had income less than 1000 ETB (Table 1).

Table 1
Distribution of socio-demographic features of respondents in flood-prone settlements of south Gondar zone (Fogera and Libokemkem districts), Ethiopia, 2021 (n = 675).

Age	≤ 25	288	42.7
	26–30	225	33.3
	31–35	108	16.0
	≥ 36	54	8.0
Marital status	Married	592	87.7
	Single	19	2.8
	Divorced	47	7.0
	Widowed	17	2.5
Religion	Orthodox	654	96.9
	Muslim	15	2.2
	Protestant	6	.9
Education level	Not read and write	369	54.7
	Read and write	180	26.7
	Primary education	99	14.7
	Secondary	27	4.0
Occupation	Farmer	612	90.7
	Merchant	63	9.3
Family size	≤ 5	468	69.3
	> 5	207	30.7
Family monthly income	< 1000ETB	369	54.7
	1000–2000 ETB	162	24.0
	> 2000 ETB	144	21.3
N.B: ETB = Ethiopian Birr (1 ETB = 0.023$, on July 07, 2021)			

Environmental characteristics of respondents

The majority, 666 (98.7%), of the respondents had households with mud floor types. Most of the respondents 639 (94.7%) have no latrine and practice open defecation, and nearly half of the respondents

324 (48%) used protected wells and springs as a source of potable water. About 144 (21.3%) of the participants experience animals can access the water storage containers (Table 2).

Table 2
Pattern of household environmental features of respondents in flood-prone settlements of south Gondar zone (Fogera and Libokemkem districts), Ethiopia, 2021 (n = 675).

Variables		Frequency	Percent
Household floor type	Mud	666	98.7
	Cement	9	1.3
Household Roof cover	Thatched	243	36.0
	Corrugated iron sheet	432	64.0
Household cleanness	Good	171	25.3
	Moderate	423	62.7
	Poor	81	12.0
Presence Latrine	Yes	36	5.3
	No	639	94.7
Child feces on House	Yes	342	50.7
	No	333	49.3
Source Drinking water	Protected well/spring	324	48.0
	Unprotected well/spring	351	52.0
Daily Water access	Yes	495	73.3
	No	180	26.7
Separate Can to take water	Yes	288	42.7
	No	387	57.3
Animal access to water storage	Yes	144	21.3
	No	531	78.7

Behavioral characteristics of respondents

The vast majority of respondents, 639 (94.7%), dispose their solid trash onto a field that is not fenced in. Similar to this, 630 respondents (93.3%) discard of their liquid waste in an open area. The majority of respondents (432, or 64%) do regular housecleaning. About 360 of the respondents (53.3%), cleaned their hands using water merely. (Table 3).

Table 3
Pattern of behavioral features of respondents in samples in flood-prone settlements of south Gondar zone (Fogera and Libokemkem districts), Ethiopia, 2021 (n = 675).

Variables		Frequency	Percent
Solid Waste Disposal mechanism	Pit	9	1.3
	Burning	27	4.0
	Open dump	639	94.7
Liquid Waste Disposal mechanism	Dispose into absorption pit	45	6.7
	open field	630	93.3
Regular cleaning of the house	Yes	243	36.0
	No	432	64.0
Cover of Storage	Covered	396	58.7
	not covered	279	41.3
Critical time Hand wash	Before eating	315	46.7
	After latrine use	63	9.3
	After handling the baby's diaper/feces	18	2.7
	After eating	108	16.0
	Before feeding child	27	4.0
	Before food preparation	108	16.0
	Wash under all conditions	450	66.67
Hand washing Material	only water	360	53.3
	soap and water	297	44.0
	Ash and water	18	2.7

Physicochemical and bacteriological quality of drinking water

The prevalence of positive fecal coliforms was found to be 62.2% in water samples examined from households in flood-prone villages in the south Gondar zone.

Factors associated with fecal contamination of drinking water

In the univariable binary logistic regression analysis, marital status, educational status, family size, presence of latrine, source of drinking water, presence of separate can to take water, animal access to the storage, and the water storage cover conditions had a p-value less than 0.2 and further analyzed by multivariable binary logistic regression. Finally, the presence of fecal coliform in household drinking water was significantly associated with family size, the presence of a latrine, and having a separate can to draw water from its storage.

There was a 2.2-fold increase in the likelihood of fecally polluted home drinking water among respondents with families larger than five [AOR = 2.205, 95 percent CI (1.375–3.536)]. In comparison to respondents who used separate cans, those who did not experienced a 55.6 percent higher likelihood of fecal coliform contamination in their household drinking water [AOR = 0.454, 95 percent CI (0.249–0.827)]. The likelihood of fecal coliform contamination in household drinking water was 3.449 times greater in respondents who had latrines [AOR = 3.449, 95% CI (1.349–8.823)]. (Table 4).

Table 4
Multivariable analysis of factors associated with the presence of fecal coliform in household drinking water in flood-prone settings of south Gondar zone (Fogera and Libokemkem districts), Ethiopia, 2021 (n = 675).

Variables	Fecal contamination		Crude OR (95% C.I.)	AOR (95% C.I.)
	Positive	Negative		
Marital status				
Married	371(54.9%)	221	1	1
Single	12	7	0.979(0.380–2.524)	0.550 (0.173–1.749)
Divorced	29	18	1.042(0.565–1.920)	1.538 (0.731–3.237)
Widowed	7	10	2.398(0.900-6.391	2.593 (0.857–7.842)
Educational status				
Unable to read and write	239	130	1.088(0.475–2.490)	0.979 (0.374–2.560)
read and write	114	66	1.158(0.492–2.724)	1.883 (0.735–4.824)
Primary	48	51	2.125(0.871–5.185)	2.092 (0.811-5.400)
Secondary and above	18	9	1	1
Family size				
≤ 5	305	163	**1**	**1**
> 5	114	93	**1.526(1.094–2.131)**	**2.205 (1.375–3.536)***
Presence of latrine to use				
Yes	27	9		**1**
No	392	247	**1.980(0.874–4.087)**	**3.449 (1.349–8.823)**

Note: **Significant at P value < 0.01, ***Significant at P value < 0.001

Variables	Fecal contamination		Crude OR (95% C.I.)	AOR (95% C.I.)
	Positive	Negative		
Source of drinking water				
Protected well/spring	192	132	0.795(0.582–1.085)	0.721 (0.413–1.258)
Unprotected well/spring	227	124	1	1
Is there a separate can to take water from the storage				
Yes	**158**	**130**	**0.587(0.428–0.804)**	**0.454 (0.249–0.827)****
No	**261**	**126**	**1**	**1**
Animal access to the water storage				
Yes	105	39	1	1
No	314	217	1.861(1.239–2.793)	1.753 (0.991–3.103)
Cover condition of water storage				
covered	195	84	1	1
Not covered	224	172	1.783(1.289–2.464)	0.734 (0.426–1.265)
Note: **Significant at P value < 0.01, ***Significant at P value < 0.001				

Table 5
Physicochemical and bacteriological quality of household drinking water samples in flood-prone settlements of south Gondar zone (Fogera and Libokemkem districts), Ethiopia, 2021 (N = 675).

Physicochemical parameters	Units	Mean ± SD	WHO standards (WHO, 2006)
P^H	-	5.9 ± 1.03	6.5–8.5
Free residual chlorine	mg/l	0.02 ± 0.01	0.2–0.5
Conductivity	μs/cm	122.0 ± 59.0	1500
TDS	Ppm	75.0 ± 21.0	1000
Bacteriological parameters		**N (percentage)**	WHO standards
Fecal coliform	Positive	420 (62.2%)	Must not be detected
	Negative	255 (37.8%)	

Discussion

Drinking water is a potential source of human disease when it contains chemicals and microbes (Malek et al., 2019). Therefore, the purpose of this study was to ascertain the physicochemical and bacteriological quality of drinking water in the south Gondar zone, Ethiopia.

Physico-chemical quality of drinking water

Analysis of the pH of drinking water was conducted in the study areas as a physicochemical quality parameter. Since it impacts the physical and chemical properties of water, pH is one of the most important water quality factors (Water, 2014). In this study, the mean pH of the drinking water samples was found lower (5.9 ± 1.03) than WHO limits of 6.5–8.5. This indicated that exposure to such low pH values causes corrosive, irritation to the eyes, skin, and mucous membrane for persons (Ambica, 2014). Additionally, low pH values indirectly harm people by allowing heavy metals to enter the water supply through various networks, which has a cumulatively negative effect (Sorlini et al., 2013). Low pH also influences the impurity of drinking water and aesthetic issues because it cannot minimize corrosion (Ibrahim, 2019).

Turbidity dissolved solid, due to suspended chemical and biological elements, can have together water security and aesthetic consequences for drinking-water provisions (WHO, 2017). The results showed that the mean TDS readings were 75.0 ± 21.0 ppm, below both the WHO norm of 1000 ppm and the proposed TDS level of 600 ppm for tastiness of drinking water (WHO, 2004a). Thus, turbidity in this study area could represent a key issue regarding the microbiological quality and disinfection of water.

Comparing the mean value of free residual chlorine in the drinking water samples to the WHO guideline, it was found to be lower. Due to its rapid and extensive levels of bacterial and viral destruction, free chlorine residue is the most popular and effective residual disinfectant (Gray, 2014). The structure of pipelines, wall materials, such as corrosion level and pipe age, may have an impact on such low free residual chlorine concentration (Neff, 2018). As a result, free chlorine residuals might not last very long in the water. Free chlorine, on the other hand, has a significant potential as a stand-in signal of pathogenic infection.

According to the current study, conductivity is the ability of water to carry an electric current. The conductivity indicates the water mineralization which varies by the concentration of dissolved salts and is habitually subjective by temperature (Benrabah et al., 2016). This finding showed that the mean conductivity value of water samples was 122.0 ± 59.0 μs/cm. This result was lower than the WHO standard (1500 μs/cm).

Bacteriological quality of drinking water

The primary factor that should be considered in any water quality inspection is the bacteriological quality of the water. Particularly, fecal coliform serves as a marker for the presence of feces from warm-blooded animals and can be utilized as a bacteriological substitute for testing water quality (Motlagh and Yang, 2019). This finding has shown that 62.2% of households' drinking water samples were contaminated by fecal coliform. This is contrary to WHO guidelines for drinking water quality (WHO, 2006). This finding was also lower than similar previous studies conducted in Eastern Ethiopia (83.3%) (Alemeshet Asefa et al., 2021), India (80%) (Roopavathi et al., 2016), and Ghana (83%) (Boateng et al., 2013). However, this outcome was comparable to past research carried out in several regions of Ethiopia (58%) (Usman et al., 2016), and (55%) (Asfaw et al., 2016).; while it was higher than studies done in rural areas of North Gondar Zone, Ethiopia (56.5%) (Getachew et al., 2018), in rural parts of Ethiopia (58%) (Usman et al., 2017), households in Hyderabad, India (36%) (Eshcol et al., 2008), Uganda (Agensi et al., 2019). This difference could be due to variability in sociodemographic characteristics, study setting, sample size, and study period.

Family size, latrine availability, and the use of a separate can to take water were recognized as predictors of the bacteriological quality of drinking water among study subjects.

In contrast to families with a smaller family size, families with a large family size had a greater rate of fecal pollution in their drinking water (AOR = 2.205, 95 percent CI (1.375–3.536)). Studies conducted in Debre Tabor town of Ethiopia (Gebremichael et al., 2021) and in Pakistan(Rauf et al., 2015) support this finding. This could be because having a large family makes it difficult to maintain family hygiene standards and causes feces to contaminate drinking water.

There was a lower likelihood of fecal coliform contamination in the drinking water samples from the households that used separate cans to draw water from the storage than there was in the samples from the households that did not use a separate can to draw water from the storage [AOR = 0.454, 95% CI (0.249–0.827)]. This could be because families who do not have separate cans to take water from the storage may use contaminated cans, especially when dipping water from the storage, which could give a supply of fecal contaminated water. This finding is in line with studies done in Tehuledere woreda, northeast Ethiopia (Mereta et al., 2018).

The odds of drinking water fecal coliform contamination were higher among households with no latrine compared to households having a latrine facility [AOR = 3.449, 95%CI (1.349–8.823)]. This suggests that the presence of a latrine may reduce the risk of fecal contamination of water since it enhances human feces management that is released to water sources and open fields. The provision of latrines is one aspect of sanitation disruptions, which work to protect public health by safely containing feces and preventing their release into private and public areas (Ali, 2010). This finding is in promise with researches conducted in Debre Tabor northwest Ethiopia (Gebremichael et al., 2021), in rural parts of Northwest Ethiopia (Usman et al., 2017), in Shashemane Rural District, Ethiopia (Gobena et al., 2017), Southern Ethiopia (Admasie and Debebe, 2016), in Tanzania (Pickering et al., 2010).

Conclusion

This finding indicated that there are problems with drinking water quality based on physicochemical and microbiologically parameters in the study area. The mean value of pH, free residual chlorine, conductivity, and TDS of the drinking water samples was lower as compared with the WHO standard. Nearly three-fifths of the drinking water samples were contaminated by fecal coliform. Three factors were statistically significant predictors of the bacteriological quality of drinking water among study participants: family size, the availability of a toilet, and utilizing a separate can to draw water from the storage. Therefore, the local and regional health offices and concerned NGOs should work on the continuous application of chlorine and monitor its concentration in order to control microbiological contamination of drinking water. Furthermore, to supply safe drinking water those stakeholders should educate the community on how to use stored water and educate the advantage of having a latrine.

Declarations

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AUTHORS CONTRIBUTIONS

TAB was involved in the proposal-writing process as well as data collecting, laboratory testing, analysis, and publication. BD, HD, DE, JA, ZA, AD, GG, AG, AA, MG, GT, and AHT performed data analysis and revised later editions of the text. The final manuscript was read by all authors before being approved.

Data availability statement

Data are available from the corresponding author on reasonable request.

ETHICS DECLARATIONS

Conflict of interest

The authors affirm that they do not have any competing interests.

Ethical Approval

The Institutional Review Board of the University of Gondar granted the ethical permission. From the district's health offices, letters of permission were given. Privacy and secrecy were upheld throughout the interview. Therefore, the tools used to collect data only included code. Additionally, those who wished to refrain from taking part in the study did so at their own choice.

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