

# BMJ Open Knowledge level and factors influencing prevention of COVID-19 pandemic among residents of Dessie and Kombolcha City administrations, North-East Ethiopia: a population-based cross-sectional study

Ayesheshim Muluneh Kassa,<sup>1</sup> Asnakew Molla Mekonen,<sup>2</sup> Kedir Abdu Yesuf ,<sup>3</sup> Abay Woday Tadesse ,<sup>4</sup> Getahun Gebre Bogale <sup>5</sup>

**To cite:** Kassa AM, Mekonen AM, Yesuf KA, *et al.* Knowledge level and factors influencing prevention of COVID-19 pandemic among residents of Dessie and Kombolcha City administrations, North-East Ethiopia: a population-based cross-sectional study. *BMJ Open* 2020;**10**:e044202. doi:10.1136/bmjopen-2020-044202

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-044202>).

Received 26 August 2020  
Revised 24 October 2020  
Accepted 28 October 2020



© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

## Correspondence to

Getahun Gebre Bogale;  
getahungebre21@gmail.com

## ABSTRACT

**Objective** In Ethiopia, community-level knowledge about the current COVID-19 pandemic has not been well studied. This study is aimed to assess knowledge level and factors influencing the prevention of the COVID-19 pandemic among residents of Dessie and Kombolcha city administrations, Ethiopia.

**Design** Community-based cross-sectional study.

**Settings** Dessie and Kombolcha city administrations.

**Participants** Participants were household heads or members (n=828, >18 years) who have lived in the study area for at least 2 months preceding the survey.

**Methods** Binary logistic regression was used for a single outcome and multiple response variables. In the multivariable regression model, a value of p<0.05 and adjusted OR (AOR) with 95% CI were used to identify factors associated with knowledge level of the community. Epi Info V.7.2 and SPSS V.20 software were used for data entry and analysis, respectively.

**Outcome** Knowledge level.

**Results** A total of 828 participants was involved with a response rate of 98%. Women were 61.7%. Participants' mean (±SD) age was 39 (±14) years. Of the total participants 54.11% (95% CI 50.6% to 57.6%) had inadequate knowledge about COVID-19 prevention. Significant associations were reported among women (AOR=1.41; 95% CI 1.03 to 1.92); age ≥65 years (AOR=2.72; 95% CI 1.45 to 5.11); rural residence (AOR=2.69; 95% CI 1.78 to 4.07); unable to read and write (AOR=1.60; 95% CI 1.02 to 2.51); information not heard from healthcare workers, mass media and social media (AOR=1.95; 95% CI 1.35 to 2.82), (AOR=2.5; 95% CI 1.58 to 4.19) and (AOR=2.13; 95% CI 1.33 to 3.42), respectively, with inadequate knowledge.

**Conclusion** These findings revealed that more than 50% of participants had inadequate knowledge about COVID-19. It highlights the need for widespread awareness campaigns about COVID-19 through mass media, healthcare professionals and social media as sources of information. House-to-house awareness creation is recommended to address older adults who are more vulnerable to the pandemic.

## Strengths and limitations of this study

- This is the first community-level study in North-East Ethiopia to extract information regarding participants' knowledge about COVID-19 prevention.
- The study addressed hot spot areas of COVID-19 which are the corridors for many entries in North-East Ethiopia.
- This study is limited due to its cross-sectional design/behaviour which lacks a cause and effect relationship.

## INTRODUCTION

COVID-19 was first detected in Wuhan, China, in December 2019, and on 30 January 2020, when the virus caused a large burden of morbidity and mortality in China and other international locations, the WHO declared the current outbreak a public health emergency of international concern.<sup>1</sup> Globally, there have been more than 34 161 721 infections and nearly 10 169 86 fatalities after the declaration of the pandemic by the WHO. In Africa, there are about 1191 323 confirmed cases and 26 148 deaths reported as of 05:04 pm CEST (Central European Summer Time), 2 October 2020.<sup>2</sup> International and national borders have been locked down, travels restricted, economies slashed and billions of people have been isolated within their own homes as a measure of containing the outbreak.

COVID-19 prevention interventions are getting more appropriate in communities as knowledge regarding the new infection improves the preparedness of both the healthcare professionals and the general public.<sup>3 4</sup> The virus was rapidly transmitted



to many countries across Africa, and the fatality rate due to COVID-19 has seen an increase in the fastest time. In the continent, the infection rate of COVID-19 may have increased due to a lesser detection rate, living in crowded places and a weak health system.<sup>15-7</sup>

Ethiopia is one of the countries threatened by COVID-19, with a total of 76 098 confirmed cases and 1204 registered deaths.<sup>2</sup> Although the country has not instituted a nationwide lockdown, a state of emergency has been declared since 14 April 2020.<sup>8</sup> In Ethiopia, many organisations, including the government sector, have been implementing different measures to prevent the virus. Despite the advocacy strategies by the media and numerous organisations to curb the spread of the pandemic, there still exists a gap in adoption and adherence to preventive mechanisms within communities. The reasons are mostly due to a lack of knowledge of the disease prevention techniques.<sup>5-9</sup> Community-level knowledge concerning the COVID-19 pandemic plays a crucial role both in the choice of institutionally approved 'top-down' medical policies and in grass roots strategies adopted by communities.<sup>10-11</sup>

In Ethiopia, the positivity rate of COVID-19 has increased with time.<sup>12</sup> Findings show that gender, age, residence, education and occupation are associated with the community's knowledge about the pandemic.<sup>4-9-11-13</sup> However, community-level studies are lacking, particularly in the areas of COVID-19 prevention.

There is a huge gap in preventing the pandemic since it is a new phenomenon, and the general public has little knowledge of the disease.<sup>14</sup> This indicates the need for research in every aspect, but in developing countries, prioritising prevention is the only effective way to curb the pandemic. To do this, the community must know and implement prevention mechanisms. For the intervention to be successful, there is a need to have evidence that shows the level of the knowledge towards COVID-19 prevention strategies at the community level. Therefore, this research is aimed at assessing the level of the knowledge and influencing factors of COVID-19 prevention in Dessie and Kombolcha city administrations that are the corridor sites for many entries in North-East Ethiopia.

## METHODS

### Study settings

The study was conducted from 7 June to 14 June 2020 in Dessie and Kombolcha city administrations, Amhara National Regional State, North-East Ethiopia. Dessie is 401 km and Kombolcha 376 km away, respectively, from Addis Ababa, the capital city of Ethiopia. Dessie city has 26 *Kebeles* (the lowest administrative level in Ethiopia) (18 urban and 8 rural), and Kombolcha has 11 *Kebeles* (5 urban and 6 rural), a total of 37 *Kebeles* in the two city administrations. *Kebeles* are the lowest administrative level in Ethiopia. According to the 2012 EC (Ethiopian Calendar) populations projection, there are 91 870 households in Dessie and 34 097 households in Kombolcha; that is a total of

125 967 households in the two city administrations. The total population of Dessie is 385 850 and Kombolcha 143 214. The two city administrations have 529 064 inhabitants, of which 262 157 are male and 266 907 female.<sup>15</sup>

Dessie is the second most populated metropolitan city and the corridor site of many entries in Amhara Regional State, North-East, Ethiopia. Kombolcha is the twin city of Dessie which lies some 25 km to its north-west. Kombolcha is connected to Dessie by road. This city shares Kombolcha Airport with neighbouring Dessie. The city is served by a station on the Awash–Weldiya Railway and neighbours the Afar region. It is a gate area where foreigners and migrants, that have mainly come from Djibouti and the Arab countries, live.<sup>16</sup>

### Study design and period

A population-based cross-sectional study was conducted to assess the knowledge level and factors influencing COVID-19 prevention strategies among the residents of Dessie and Kombolcha city administrations from 07 June to 14 June 2020.

### Population

The source population was all the residents of Dessie and Kombolcha city administrations in Amhara Regional State, North-East Ethiopia. The study population included residents of the selected *Kebeles* in Dessie and Kombolcha City administrations who had the chance to be included in the sample.

### Inclusion and exclusion criteria

Household heads or anyone in the house aged above 18 years were included in the study. They should have been living in the study areas for the 2 months preceding the survey. Participants who were critically and mentally ill during the study period were excluded from the study.

### Sample size determination and sampling procedures

This study had two objectives, namely, to assess the knowledge level and to identify factors influencing the knowledge about the COVID-19 pandemic. Since COVID-19 is a new emerging disease and related evidence is not available at the national level, a single population proportion formula was used to estimate the sample size (for knowledge level) by assuming a prevalence of 50%, 95% of the confidence level and 5% of the margin of error. The calculated sample size of this study was 768 participants with a design effect of 2. By adding a tolerable non-response rate (10%), the total sample size was 845 participants.

$$n = \frac{(Z_{\alpha/2})^2 \times p(1-p)}{w^2} \times DE \Rightarrow n = \frac{(1.96)^2 \times 0.5(1-0.5)}{(0.05)^2} \times 2 = 768$$

where, prevalence (p)=50%; w=tolerable margin of error=5%;  $Z^{\alpha/2}$  at 95%=1.96; DE=design effect.

For the second objective, a double population proportion formula was used to estimate and maximise possible

**Table 1** Sample size are determined for the second objective of the study to assess knowledge level and factors influencing COVID-19 prevention among residents of Dessie and Kombolcha city administrations, North-East Ethiopia

Variable name	References	Percentage of unexposed	80% power	95% CI	OR	Sample size	Design effect	10% NRR	Final sample size
Sex	<sup>36</sup>	74	80	0.05	0.40	186	2	37	409
Education	<sup>36</sup>	51.7	80	0.05	6.30	62	2	12	136
Occupation	<sup>37</sup>	9.3	80	0.05	5.7	86	2	17	189

NRR, non-response rate.

sample sizes using the assumptions of 80% power and 95% confidence level (table 1).

Finally, by comparing the optional sample size estimations above, the maximum sample size, 845, was taken as the final for this study.

A two-stage sampling technique was employed to select the study participants. A total of 845 participants from their respective households were included in the study. Simple random sampling technique was applied to select *Kebeles* to eliminate selection bias. In the first stage, 9 *Kebeles* were selected out of 37 *Kebeles* using a lottery method. In the second stage, data were collected from the participants in the households using a systematic sampling technique (every 36th value was included). Then, based on the population size, the sample size was proportionally allocated to each of the sampled *Kebeles*. Dessie has 26 *Kebeles* (18 urban and 8 rural), and Kombolcha has 11 *Kebeles* (5 urban and 6 rural). The two city administrations have a total of 37 *Kebeles*.

### Data collection

Data on sociodemographic variables, availability of household materials/related variables, source of information related to variables, and knowledge-related variables were collected through a pretested and structured interviewer-administered questionnaire. The questions were adapted from the WHO COVID-19 guideline<sup>17</sup> and a similar study done in China.<sup>18</sup>

### Measurement of COVID-19-related knowledge (dependent variable)

The knowledge section of the questionnaire had 35 questions. The questions were intended to assess the participants' knowledge of COVID-19 plausibly influencing their healthcare-seeking behaviour. Yes/correct responses were labelled as '1', and incorrect/no/I don't know responses were labelled as '0'. The scores were added up to create knowledge ranking for the aforementioned categories. The pooled scores of questions were classified into inadequate and adequate knowledge using median (50%) score values. Inadequate knowledge was labelled as '1', and adequate knowledge was labelled as '0'.

### Operational definitions

The respondent was classified as having 'Inadequate Knowledge' when he/she answered correctly less than 50% of COVID-19-related knowledge questions. Whereas, the respondent was classified as having 'Adequate

Knowledge' when he/she answered correctly 50% and above of COVID-19-related knowledge questions.

### Data quality assurance

Pretest was conducted on 5% of the total sample size in Kalu district, and the amendment was done according to the finding. Training on the objectives of the study was given to data collectors and supervisors before the day of the data collection. Regular supervision, control as well as support of data collectors by the supervisors were made daily, and each completed questionnaire was checked and the necessary feedback was offered to the interviewers. The collected data were properly handled, reviewed and checked for completeness and consistency by the supervisors before the analysis was completed each day.

### Data processing and analysis

The collected data were coded, edited, entered using Epi Info V.7.2 and analysed using the Statistical Package for Social Sciences (SPSS) V.20. Internal consistency of the knowledge measures was tested using a reliability test where the Cronbach's alpha coefficient was used to determine the reliability of the variables. The results showed that Cronbach's alpha for questions on knowledge was 0.801. The result added credibility where, according to Griethuijsen, the range of Cronbach's alpha from 0.6 to 0.7 is considered adequate and reliable.<sup>19</sup> It is proved that the items used to measure knowledge on COVID-19 are therefore acceptable. Descriptive summary statistics such as mean±SD, median±IQR, frequencies and proportions were presented as appropriate. Since the cross-sectional survey was conducted for a single outcome variable and multiple response variables, a binary logistic regression analysis was done. All independent variables at p<0.20 were taken to a multivariable logistic regression analysis<sup>20</sup> to identify associated factors with outcome variables. The statistical significance of the variables at the final model was declared at p<0.05% and 95% CI for the adjusted odds ratio (AOR). The Hosmer-Lemeshow statistics and the deviance coefficient were used to check the goodness of the fit of the model.

## RESULTS

### Sociodemographic characteristics of participants

A total of 828 participants was involved with a response rate of 98%. Of the study participants, 541 (65.3%) were from Dessie city and the rest from Kombolcha

city. Of the participants, 511 (61.7%) were female; 423 (51.1%) were Muslim and 385 (46.5%) were followers of orthodox Tewahedo religions. The mean (SD) age of the study participants was 39 ( $\pm 14$ ) years. Of all the participants, 672 (81.2%) were living in urban

settings; 576 (69.6%) were married, 167 (20.2) were unmarried participants; 218 (26.4%) had no formal education. Regarding their occupational status, 246 (29.7%) were housewives and 176 (21.3%) government employees (table 2).

**Table 2** Sociodemographic characteristics of participants in Dessie and Kombolcha city administrations, North-East Ethiopia, 2020 (n=828)

Demographic characteristics	Frequency	Percentage	Mean ( $\pm$ SD)
<b>City name</b>			
Dessie	541	65.3	
Kombolcha	287	34.7	
<b>Sex</b>			
Male	317	38.3	
Female	511	61.7	
<b>Age group, years</b>			39 ( $\pm 14$ )
18–35	422	51	
36–64	341	41.2	
$\geq 65$	65	7.9	
<b>Religion</b>			
Orthodox Tewahedo	385	46.5	
Muslim	423	51.1	
Catholic	8	1	
Protestant	12	1.4	
<b>Place of residence</b>			
Urban	672	81.2	
Rural	156	18.8	
<b>Marital status</b>			
Single	167	20.2	
Married	576	69.6	
Divorced	47	5.7	
Widowed	38	4.6	
<b>Education level</b>			
Unable to read and write	153	18.5	
Able to read and write with informal education	65	7.9	
Primary school (grade 1–8)	158	19.1	
Secondary school (grade 9–12)	204	24.6	
Above 12 grades (University/ College/TVET)	248	30	
<b>Main occupation</b>			
Housewife	246	29.7	
Merchant	168	20.3	
Farmer	37	4.5	
Government employee	176	21.3	
NGO employee	63	7.6	
Labourer	82	9.9	
Student	56	6.8	

TVET, Technical Vocational Education and Training.

**Table 3** Household-level and media-related characteristics of participants in Dessie and Kombolcha city administrations, North-East Ethiopia, 2020

HH and media characteristics	Frequency	Percentage	Median ( $\pm$ IQR)
Family size			4.42 ( $\pm$ 1.8)
1–3	251	30.3	
4–6	476	57.5	
>6	101	12.2	
Monthly income at the household level (in Ethiopian Birr)			3000 ( $\pm$ 2500)
Type of water sources			
Piped water in the dwelling	136	16.4	
Piped water in the yard	585	70.7	
Communal ‘Bono’	78	9.4	
Spring (any type: protected or unprotected)	29	3.5	
Amount of water in litres/capita/day			13.15(12.00)
No access (<20 L/C/D)	584	70.5	
Basic access ( $\geq$ 20 L/C/D)	244	29.5	
Time to take water in minutes			2.00 ( $\pm$ 2.00)
$\leq$ 30 min (1 km round trip)	789	95.3	
>30 min (>1 km round trip)	39	4.7	
Functional TV in the household			
No	108	13	
Yes	720	87	
Functional radio in the household			
No	347	41.9	
Yes	481	58.1	
Functional cellphone in the household			
No	47	5.7	
Yes	781	94.3	

HH, household.

### Household-level and media-related characteristics

The median ( $\pm$ IQR) family size of the participants was 4.42 ( $\pm$ 1.8). The median ( $\pm$ IQR) income of the participants was Ethiopian Birr (ETB)3000 ( $\pm$ 2500). Of the participants, 29 (3.5%) obtained water from a spring water source (any type: protected or unprotected); 584 (70.5%) lacked adequate water (<20 litre/capita/day) and 789 (95.3%) could access their source of water from within less than 30 min (1 km round trip). About 720 (87%) had a functional TV in the household, 78 (9.4%) had a cellphone (table 3).

### Factors associated with the participants’ knowledge about the prevention of the COVID-19 pandemic

In the bivariate logistic regression (first model), there were 17 independent variables. In the multivariable logistic regression (second model), only seven variables were significantly associated with participants’ inadequate knowledge about prevention of the COVID-19 pandemic. Variables associated with inadequate knowledge on COVID-19 prevention were sex, age, residence,

educational level, information from healthcare workers, mass media and social media.

Female participants were 41% more likely to have inadequate knowledge about COVID-19 as compared with their male counterparts (AOR=1.41, 95% CI 1.03 to 1.92). Participants in the  $\geq$ 65 years age group were 2.72 times more likely to have inadequate knowledge of COVID-19 as compared with the 8–35 years age group (AOR=2.27, 95% CI 1.45 to 5.11). People living in rural areas were 2.70 times more likely to have inadequate knowledge as compared with urban dwellers. The participants who were unable to read and write were 60% times more likely to have inadequate knowledge compared with those who were attending high-level education (AOR=1.60, 95% CI 1.02 to 2.51). Participants who did not receive information from healthcare workers about COVID-19 were 95% times more likely to have inadequate knowledge as compared with those who received information from healthcare workers (AOR=1.95, 95% CI 1.35 to 2.82). Participants who were not receiving information about

COVID-19 from the mass media were 2.6 times more likely to have inadequate knowledge compared with those who received information from the mass media (AOR=2.57, 95% CI 1.58 to 4.19). In addition, participants who were not receiving information from the social media were 2.13 times more likely to have inadequate knowledge about COVID-19 as compared with those who received it (AOR=2.13, 95% CI 1.33 to 3.42) (table 4).

## DISCUSSION

This finding showed that the proportion of inadequate knowledge about COVID-19 prevention was 54.11% (95% CI 50.6% to 57.6%), which is higher than studies conducted in Debre Birhan University, Ethiopia (26.2%),<sup>21</sup> Syria (40%),<sup>22</sup> Iran (39.2%),<sup>23</sup> Bangladesh (51.7%),<sup>24</sup> Saudi Arabia (18.4%),<sup>25</sup> across the world (20.1%),<sup>26</sup> Malaysia (19.5%),<sup>27</sup> India (13.3%),<sup>28</sup> three Middle Eastern countries (Jordan, Saudi Arabia and Kuwait) (33.9%)<sup>11</sup> and Sudan (9.4%).<sup>29</sup> The differences in the level of knowledge have been subjected to variations in the cut-off values. In addition, the discrepancies might be due to differences in community awareness creation through mass media and social media.

In this study, the odds of inadequate knowledge towards COVID-19 were 1.4 times higher among female participants compared with male participants. This finding is similar to studies conducted in Iran,<sup>23</sup> Bangladesh,<sup>30 31</sup> Sudan.<sup>29</sup> In Ethiopia, most of the home-based activities such as food preparation and food serving, child feeding, cloth hygiene, and home-based sanitation are left for women. Therefore, women may not get time to access the media because of being busy taking care of the family members. Consequently, they are prone to inadequate knowledge of COVID-19 compared with men.

The study indicated that older adults (ie, aged 65 years and above) had threefold greater odds of inadequate knowledge about COVID-19 compared with adults. This finding is similar to studies conducted at Debre Birhan University, Ethiopia,<sup>21</sup> Iran,<sup>23</sup> Bangladesh,<sup>24 31</sup> and the medical college in Uttarakhand, India.<sup>28</sup> Older adults mostly do not have access to modern technologies in Ethiopia. Hence, they have inadequate knowledge about COVID-19 compared with adults, due to the lack of information.

The odds of inadequate knowledge were 2.7 times higher among participants who were residing in rural areas compared with those who were living in urban areas. This finding is similar to that of studies conducted in Bangladesh<sup>30 32</sup> and Sudan.<sup>29</sup> In Ethiopia, most of the people are living in rural areas; this makes it hard to reach for awareness creation using mass media or social media (Telegram, Facebook, WhatsApp and Instagram). Thus, people in rural settings had inadequate knowledge of COVID-19 prevention and control measures compared with urban populations who could easily access different sources of media to acquire information regarding COVID-19.

Moreover, participants who were unable to read and write were 1.6 times more likely to have inadequate knowledge of COVID-19 compared with those who had attended tertiary-level education. This finding is similar to studies conducted in Syria,<sup>22</sup> Iran,<sup>23</sup> rural areas in China,<sup>33</sup> Sudan,<sup>29</sup> Bangladesh<sup>30</sup> and Nepal.<sup>34</sup> In Ethiopia, most of the unable-to-read-and-write segment of the population is found in rural areas. Those unable to read and write cannot access the media which is the ultimate source of information for acquiring basic knowledge about prevention and control modalities of COVID-19 infections. Thus, participants who are unable to read and write are less knowledgeable about COVID-19 compared with tertiary-level educated participants.

The study revealed that the odds of inadequate knowledge were two times higher among participants who were not receiving information regarding COVID-19 from healthcare workers compared with those who were receiving information from healthcare workers. Moreover, the odds of inadequate knowledge were 2.5 times higher among participants who were not receiving information regarding COVID-19 from the mass media (TV/radio) compared with those who were receiving information. Furthermore, the odds of inadequate knowledge were two times higher among participants who were not receiving information regarding COVID-19 from the social media compared with those who were receiving it from social media. This finding is similar to a study conducted in eight referral hospitals in Ethiopia.<sup>35</sup> The community can get information regarding the COVID-19 pandemic from different sources. These sources include healthcare workers, mass media (TV, radio, newspapers and magazines), social media (Telegram, Facebook, WhatsApp, Instagram, Twitter) and religious leaders. Thus, community members who do not have access to these sources are less knowledgeable about COVID-19 compared with those who have access to the listed sources of information.

The findings may have implications on the prevention campaign/programme of the new COVID-19 pandemic, particularly in the study settings. This study can help other researchers by serving as the baseline for community-level studies. These findings may help local as well as national anti-COVID-19 programmers to revise their campaign plans to strengthen the efforts against the COVID-19 pandemic. This study extracted community-level information regarding participants' knowledge about COVID-19 prevention from the hot spot areas of COVID-19. However, this study is limited due to its cross-sectional design/behaviour which could not show a cause and effect relationship.

## CONCLUSIONS

In this study, more than half of the study participants, who were residents of Dessie and Kombolcha city administrations, North-East Ethiopia, had inadequate knowledge about COVID-19 prevention. Findings from this study

**Table 4** Bivariable and multivariable logistic regression of knowledge about the COVID-19 pandemic among residents of Dessie and Kombolcha city administrations, North-East Ethiopia, 2020 (n=828)

Variables	Knowledge level, n (%)		Crude OR (COR)		Adjusted OR (AOR)	
	Inadequate	Adequate	OR	95% CI	OR	95% CI
<b>Sex</b>						
Male	156 (49.2)	161 (50.8)	1		1	
Female	292 (57.1)	219 (42.9)	1.4	1.04 to 1.82*	1.4	<b>1.03 to 1.92*</b>
<b>Age, years</b>						
18–35	215 (50.9)	207 (49.1)	1		1	
36–64	185 (54.3)	156 (45.7)	1.1	0.86 to 1.52	1.1	0.83 to 1.57
≥65	48 (73.8)	17 (26.2)	2.7	1.51 to 4.88*	2.7	<b>1.45 to 5.11*</b>
<b>Place of residence</b>						
Urban	333 (49.6)	339 (50.4)	1		1	
Rural	115 (73.7)	41 (26.3)	2.9	1.94 to 4.21*	2.7	<b>1.78 to 4.07*</b>
<b>Marital status</b>						
Single	92 (55.1)	75 (44.9)	1		1	
Married	307 (53.3)	269 (46.7)	0.9	0.66 to 1.32	–	–
Divorced	27 (57.4)	20 (42.6)	1.1	0.57 to 2.12	–	–
Widowed	22 (57.9)	16 (42.1)	1.1	0.55 to 2.29	–	–
<b>Education level</b>						
Unable to read and write	94 (61.4)	59 (38.6)	2.5	1.64 to 3.75*	1.6	<b>1.02 to 2.51*</b>
Able to read and write with informal education	46 (70.8)	19 (29.2)	3.8	2.09 to 6.81*	2.3	<b>1.22 to 4.30*</b>
Primary school (grade 1–8)	98 (62.0)	60 (38.0)	2.5	1.69 to 3.83*	1.7	<b>1.08 to 2.60*</b>
Secondary school (grade 9–12)	113 (55.4)	91 (44.6)	1.9	1.33 to 2.82*	1.5	<b>1.01 to 2.24*</b>
Above 12 grade (university/college/TVET)	97 (39.1)	151 (60.9)	1		1	
<b>Main occupation</b>						
Housewife	142 (57.7)	104 (42.3)	1.4	0.76 to 2.44	0.7	0.38 to 1.44
Merchant	84 (50.0)	84 (50.0)	1	0.55 to 1.83	0.7	0.38 to 1.44
Farmer	24 (64.9)	13 (35.1)	1.9	0.79 to 4.34	0.7	0.25 to 1.83
Government employee	83 (47.2)	93 (52.8)	0.9	0.49 to 1.63	1	0.50 to 1.95
NGO employee	31 (49.2)	32 (50.8)	1	0.47 to 1.99	0.9	0.40 to 1.92
Labourer	56 (68.3)	26 (31.7)	2.2	1.07,4.34*	1.4	0.63 to 2.96
Student	28 (50.0)	28 (50.0)	1		1	
<b>Family size</b>						
1–3	137 (54.6)	114 (45.4)	1		1	
4–6	255 (53.6)	221 (46.4)	1	0.71 to 1.31	–	–
>6	56 (55.4)	45 (44.6)	1	0.65 to 1.65	–	–
<b>Type of water sources</b>						
Piped water in the dwelling	64 (47.1)	72 (52.9)	1		1	
Piped water in the yard	307 (52.5)	278 (47.5)	1.2	0.86 to 1.81	1.1	0.72 to 1.62
Communal 'Bono'	53 (67.9)	25 (32.1)	2.4	1.33 to 4.27*	1.1	0.54 to 2.17
Spring (any type: protected or unprotected)	24 (82.8)	5 (17.2)	5.4	1.95 to 14.99*	2.6	0.77 to 8.67
<b>Amount of water in litre/capita/day</b>						
No access (<20L/C/D)	324 (55.5)	260 (44.5)	1.2	0.89 to 1.63	–	–

Continued



Table 4 Continued

Variables	Knowledge level, n (%)		Crude OR (COR)		Adjusted OR (AOR)	
	Inadequate	Adequate	OR	95% CI	OR	95% CI
Basic access (>=20 L/C/D)	124 (50.8)	120 (49.2)	1		1	
Time to take/fetch water in minutes						
≤30 min (1 km round trip)	419 (53.1)	370 (46.9)	1		1	
>30 min (>1 km round trip)	29 (74.4)	10 (25.6)	2.6	1.23 to 5.33*	0.7	0.25 to 1.92
Functional TV/radio in the household						
No	73 (67.6)	35 (32.4)	1.9	1.25 to 2.95*	1	0.58 to 1.62
Yes	375 (52.1)	345 (47.9)	1		1	
Functional cellphone in the household						
No	31 (66.0)	16 (34.0)	1.7	0.91 to 3.14*	1	0.47 to 1.95
Yes	417 (53.4)	364 (46.6)	1		1	
COVID-19 information heard from family members						
No	376 (53.1)	332 (46.9)	0.8	0.51 to 1.12*	0.8	0.50 to 1.28
Yes	72 (60.0)	48 (40.0)	1		1	
COVID-19 information heard from healthcare workers						
No	355 (57.5)	262 (42.5)	1.7	1.25 to 2.36*	2	<b>1.35 to 2.82*</b>
Yes	93 (44.1)	118 (55.9)	1		1	
COVID-19 information heard from mass media (TV,...)						
No	79 (71.2)	32 (28.8)	2.3	1.51 to 3.60*	2.6	<b>1.58 to 4.19*</b>
Yes	369 (51.5)	348 (48.5)	1		1	
COVID-19 information heard from social media (FB, ...)						
No	414 (57.6)	305 (42.4)	3	1.95 to 4.61*	2.1	<b>1.33 to 3.42*</b>
Yes	34 (36.2)	75 (68.8)	1		1	
COVID-19 information heard from religious leaders						
No	428 (55.8)	339 (44.2)	2.6	1.49 to 4.50*	1.2	0.60 to 2.28
Yes	20 (32.8)	41 (67.2)	1		1	

\*For  $p < 0.20$  at bivariate analysis; \*and bold for  $p < 0.05$  at multivariable analysis.

showed that sex, age, residence, education level, information seeking from healthcare workers, mass media and social media were significantly associated with inadequate knowledge.

This study recommends revising the COVID-19 prevention plan to increase community-level awareness of the COVID-19 pandemic. Strengthening the community to consider healthcare workers and mass media as a source of COVID-19-related information might be encouraged. Creation of a system of house-to-house awareness might be important to address older adults who are more vulnerable to the pandemic. Women's empowerment in formal education should be strengthened to increase their awareness and exposure to the latest information. The city administrations should focus on providing their rural residents with access to appropriate information on COVID-19 prevention.

#### Author affiliations

<sup>1</sup>Nursing, Dessie Health Science College, Dessie, Ethiopia

<sup>2</sup>Health System Management, Wollo University, Dessie, Ethiopia

<sup>3</sup>Basic Health Science, Dessie Health Science College, Dessie, Ethiopia

<sup>4</sup>Public Health, Samara University, Samara, Ethiopia

<sup>5</sup>Health Informatics, Wollo University, Dessie, Ethiopia

**Acknowledgements** The authors thank the Institutional Review Board (IRB) of College of Medicine and Health Sciences, Wollo University for the approval of the ethical clearance. The authors also thank the health departments of the two city administrations for their cooperation. The authors also thank all individuals who participated in this study for their cooperation in taking part in this study.

**Contributors** Conception and design of the study: AMK. Conduct of the study: AMK, GGB, AMM, KAY and AWT. Analysis and interpretation of data: AMK, GGB and AMM. Drafting the manuscript and revising it critically: AMK, GGB, AMM, KAY and AWT. All authors have given final approval for the manuscript to be published.

**Funding** Data collection was sponsored by Dessie Health Science College (grant number 151/09/12). The funder had no role in the study design, data collection and analysis, decision to publish or preparation of the manuscript.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not required.

**Ethics approval** Ethical clearance was obtained from Ethical Review Committee [Reference number: CMHS/311/036/12] of College of Medicine and Health

Sciences, Wollo University. Permission letter was obtained from Dessie and Kombolcha town administrations health department and offices, then from Kebele administrations involved in the study.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** All data relevant to the study are included in the article or uploaded as supplementary information.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

#### ORCID iDs

Kedir Abdu Yesuf <http://orcid.org/0000-0002-0510-2239>

Abay Woday Tadesse <http://orcid.org/0000-0003-0499-4690>

Getahun Gebre Bogale <http://orcid.org/0000-0002-2594-9488>

#### REFERENCES

- Velavan TP, Meyer CG. The COVID-19 epidemic. *Trop Med Int Health* 2020;25:278–80.
- World Health Organization. WHO coronavirus disease (COVID-19) dashboard, 2020. Available: <https://covid19.who.int/>
- World Health Organization. COVID-19 STRATEGY UPDATE 14 April 2020. 2020.
- Zegarra-Valdivia J, Vilca BNC, Guerrero RJA. *Knowledge, perception and attitudes in regard to COVID-19 pandemic in Peruvian population*, 2020.
- Tavakoli A, Vahdat K, Keshavarz M, et al. Novel coronavirus disease 2019 (COVID-19): an emerging infectious disease in the 21st century. *Iran South Med J* 2020;22:432–50.
- Chukwuorji JC, Iorfa SK. Commentary on the coronavirus pandemic: Nigeria. *Psychol Trauma* 2020;12:S188–90.
- Olusola A, Olusola B, Onafeso O, et al. Early geography of the coronavirus disease outbreak in Nigeria. *GeoJournal* 2020:1–15.
- Ethiopia Embassy UK, 2020. Available: <https://www.ethioembassy.org.uk/ethiopia-declares-state-of-emergency-to-curb-transmission-of-coronavirus/> [Accessed 12 September 2020].
- Haque T, Hossain KM, Bhuiyan MR, et al. *Knowledge, attitude and practices (KAP) towards COVID-19 and assessment of risks of infection by SARS-CoV-2 among the Bangladeshi population: an online cross sectional survey*, 2020.
- Adhikari SP, Meng S, Wu Y-J, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious Dis Poverty* 2020;9:1–12.
- Naser AY, Dahmash EZ, Alwafi H, et al. Knowledge and practices towards COVID-19 during its outbreak: a multinational cross-sectional study. *medRxiv*2020.
- Deribe K. COVID-19 in Ethiopia: status and responses, 2020. Available: <https://rstmh.org/news-blog/news/covid-19-in-ethiopia-status-and-responses>
- Abdelhafiz AS, Mohammed Z, Ibrahim ME, et al. Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). *J Comm Health* 2020:1–10.
- Austrian K, Pinchoff J, Tidwell JB, et al. *COVID-19 related knowledge, attitudes, practices and needs of households in informal settlements in Nairobi, Kenya*, 2020.
- CSA (Ethiopia). Population projections for Ethiopia - central statistical agency, 2019. Available: <http://www.csa.gov.et/census-report/>
- population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037
- Tadesse Tamrat. Kombolcha city, 2019. Available: <https://en.wikipedia.org/wiki/Kombolcha>
- WHO. *Critical preparedness, readiness and response actions for COVID-19: interim guidance*. World Health Organization, 2020.
- Zhong B-L, Luo W, Li H-M, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci* 2020;16:1745–52.
- Azlan AA, Hamzah MR, Sern TJ, et al. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One* 2020;15:e0233668.
- Hidalgo B, Goodman M. Multivariate or multivariable regression? *Am J Public Health* 2013;103:39–40.
- Aynalem YA, Akalu TY, Gebresellassie B, et al. *Assessment of undergraduate student knowledge, practices, and attitude towards COVID-19 in Ethiopia Debre Berhan university*, 2020.
- Al Ahdab S. *Knowledge, attitudes and practices (KAP) towards pandemic COVID-19 among Syrians*, 2020.
- Erfani A, Shahriarirad R, Ranjbar K, et al. Knowledge, attitude and practice toward the novel coronavirus (COVID-19) outbreak: a population-based survey in Iran. *Bull World Health Organ* 2020;30.
- Byanaku A, Ibrahim M. Knowledge, attitudes, and practices (KAP) towards COVID-19: a quick online cross-sectional survey among Tanzanian residents. *medRxiv*2020.
- Al-Hanawi MK, Angawi K, Alshareef N, et al. Knowledge, attitude and practice toward COVID-19 among the public in the Kingdom of Saudi Arabia: a cross-sectional study. *Front Public Health* 2020;8:217.
- Ali M, Uddin Z, Banik PC, et al. Knowledge, attitude, practice and fear of COVID-19: a cross-cultural study. *medRxiv*2020.
- Azlan AA, Hamzah MR, Sern TJ, et al. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One* 2020;15:e0233668.
- Maheshwari S, Gupta PK, Sinha R, et al. Knowledge, attitude, and practice towards coronavirus disease 2019 (COVID-19) among medical students: a cross-sectional study. *Journal of Acute Disease* 2020;9:100.
- Mohamed A, Elhassan E, Mohamed AO, et al. *Knowledge, attitude and practice of the Sudanese people towards COVID-19: an online survey*, 2020.
- Karim A, Akter M, Mazid A, et al. Knowledge and attitude towards COVID-19 in Bangladesh: population-level estimation and a comparison. *Nature* 2020;5:536–44.
- Paul A, Sikdar D, Hossain MM, et al. Knowledge, attitude and practice towards novel corona virus among Bangladeshi people: implications for mitigation measures. *medRxiv*2020.
- Ferdous MZ, Islam MS, Sikder MT, et al. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: an online-based cross-sectional study. *PLoS One* 2020;15:e0239254.
- Lihua M, Ma L, Liu H, et al. *Knowledge, beliefs/attitudes and practices of rural residents in the prevention and control of COVID-19: an online questionnaire survey*, 2020.
- Paudel S, Shrestha P, Karmacharya I, et al. *Knowledge, attitude, and practices (KAP) towards COVID-19 among Nepalese residents during the COVID-19 outbreak: an online cross-sectional study*, 2020.
- Jemal B, Aweke Z, Molo S, et al. *Knowledge, attitude and practice of healthcare workers towards COVID-19 and its prevention in Ethiopia: a multicenter study*, 2020.
- Hayat K, Rosenthal M, Xu S, et al. View of Pakistani residents toward coronavirus disease (COVID-19) during a rapid outbreak: a rapid online survey. *Int J Environ Res Public Health* 2020;17:3347.
- Kebede Y, Yitayih Y, Birhanu Z, et al. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma University medical center visitors, Southwest Ethiopia. *PLoS One* 2020;15:e0233744.