

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Knowledge level and influencing factors towards prevention of COVID-19 epidemic among residents of Dessie and Kombolcha city administrations, northeast Ethiopia: A population-based cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-044202
Article Type:	Original research
Date Submitted by the Author:	26-Aug-2020
Complete List of Authors:	Kassa, Ayesheshim ; Dessie Health Science College , Nursing Mekonen, Asnakew ; Wollo University, Health System Management Yesuf, Kedir; Dessie Health Science College , Basic Health Science Woday, Abay; Samara University, Public Health Bogale, Getahun; Wollo University, Health Informatics
Keywords:	Epidemiology < INFECTIOUS DISEASES, PUBLIC HEALTH, Public health < INFECTIOUS DISEASES

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3 **1 Knowledge level and influencing factors towards prevention of COVID-19**  
4  
5  
6 **2 epidemic among residents of Dessie and Kombolcha city administrations,**  
7  
8  
9 **3 northeast Ethiopia: A population-based cross-sectional study**  
10

11  
12 4 Ayesheshim Muluneh Kassa<sup>1</sup>, Asnakew Molla Mekonnen<sup>2</sup>, Kedir Abdu Yimer<sup>3</sup>, Abay Woday  
13  
14 5 Tadesse<sup>4</sup>, Getahun Gebre Bogale<sup>5\*</sup>  
15

16  
17 **6 Affiliations**  
18

19  
20 7 <sup>1</sup>Department of Nursing, Dessie Health Science College, Dessie, Ethiopia  
21

22 8 <sup>2</sup>Department of Health System Management, School of Public Health, College of Medicine and  
23  
24 9 Health Sciences, Wollo University, Dessie, Ethiopia  
25

26  
27 10 <sup>3</sup>Department of Basic Health Science, Dessie Health Science College, Dessie, Ethiopia  
28

29 11 <sup>4</sup>Department of Public Health, College of Health Sciences, Samara University, Samara, Ethiopia  
30

31 12 <sup>5</sup>Department of Health Informatics, School of Public Health, College of Medicine and Health  
32  
33 13 Sciences, Wollo University, Dessie, Ethiopia  
34  
35

36 14

37  
38 15 \*Correspondence: Getahun Gebre Bogale  
39

40  
41 16 Email: [getahungebre21@gmail.com](mailto:getahungebre21@gmail.com)  
42  
43 17  
44  
45  
46 18  
47  
48  
49 19  
50  
51  
52 20  
53  
54  
55 21  
56  
57  
58  
59  
60

## 22 Abstract

23 **Objective:** The knowledge level which might be affected by several factors has not been well  
24 studied. This study is aimed to assess the level of knowledge and influencing factors towards the  
25 prevention of the COVID-19 epidemic among residents of Dessie and Kombolcha city  
26 administrations, northeast Ethiopia.

27 **Design:** Community-based cross-sectional study

28 **Settings:** Dessie and Kombolcha city administrations

29 **Participants:** Eligible participants were household heads and/or the age of above 18 years old,  
30 who have been living in the study area in the past two months ago and available during the study  
31 period (n=828). Then, they were interviewed at their houses using an interviewer administered  
32 structured questionnaire.

33 **Methods:** A binary logistic regression analysis was done. In the multivariable logistic regression  
34 analysis, a p-value of <0.05 and adjusted odds ratio (AOR) with 95% confidence interval were  
35 used to identify factors statistically associated with level of knowledge of the community.

36 **Outcome:** Knowledge level

37 **Results:** A total of 828 participants were involved with a response rate of 98%. Of the total  
38 participants; 54.11% (95% CI: 50.6, 57.6) had poor knowledge towards COVID-19 prevention.  
39 Significant associations reported among females (AOR=1.41; 95% CI: 1.03, 1.92); age  $\geq$  65years  
40 (AOR=2.72; 95% CI: 1.45, 5.11); rural residence (AOR=2.69; 95% CI: 1.78, 4.07); unable to read  
41 and write (AOR=1.60; 95% CI: 1.02, 2.51); information not heard from health care workers, mass  
42 media, and social media (AOR=1.95; 95% CI: 1.35, 2.82), (AOR=2.5; 95% CI: 1.58, 4.19) and  
43 (AOR=2.13; 95% CI: 1.33, 3.42) respectively with poor knowledge.

1  
2  
3 44 **Conclusion:** The findings revealed poor knowledge towards COVID-19 prevention. This study  
4  
5 45 highlights the need for widespread awareness campaigns about COVID-19 prevention through  
6  
7 46 mass media, healthcare professionals and social media as a source of information, house to house  
8  
9 47 awareness creation might be important to address elders who are more vulnerable to the epidemic  
10  
11 48 of COVID-19.

12  
13  
14  
15 49 **Keywords:** Knowledge, Influencing factors, COVID-19, Dessie, Kombolcha, Ethiopia

### 16 17 18 50 **Strengths and limitations of this study**

- 19  
20  
21 51 • This is the first community level study in northeast Ethiopia which extracted information  
22  
23 52 regarding participants' knowledge towards COVID-19 prevention
- 24  
25 53 • The study addressed hotspot areas of COVID-19 where these are the corridor sites for many  
26  
27 54 entries in northeast Ethiopia
- 28  
29 55 • The quantitative study did not supported by qualitative study
- 30  
31 56 • This study is limited due to its cross-sectional design/behavior which lacks cause and effect  
32  
33 57 relationship.

## 34 35 36 37 38 58 **INTRODUCTION**

39  
40  
41 59 Coronavirus disease 2019 (COVID-19) was first detected in Wuhan, China, in December 2019  
42  
43 60 and on 30 January 2020. World Health Organization (WHO) declared that the current outbreak  
44  
45 61 constituted a public health emergency of international concern based on growing case notification  
46  
47 62 rates on Chinese and international locations when the virus cause a large burden of morbidity and  
48  
49 63 mortality.<sup>1</sup> COVID-19 has threatened the world with a public health crisis. Globally, more than  
50  
51 64 15.5 million are infected and nearly 635,173 fatalities after being declared as a pandemic by the  
52  
53  
54 65 WHO. In Africa, there are about 679,962 confirmed cases and 11,340 deaths reported since July

1  
2  
3 66 25, 2020, 10:00 CEST.<sup>2</sup> International borders have been locked down, travel restricted, economies  
4  
5 67 slashed and billions are isolated at their own homes, as a measure to contain the outbreak.  
6  
7

8  
9 68 Effectiveness, applicability and feasibility are attributes which indicate that the interventions are  
10  
11 69 going to be more appropriate in the community as the knowledge regarding any new infection  
12  
13 70 improves the preparedness in both the healthcare professionals and the general public.<sup>2,3</sup> The virus  
14  
15 71 rapidly transmitted many countries across Africa and fatality related to COVID-19 has been an  
16  
17 72 increase in the fastest time. The infection rate of the COVID-19 will increase due to failure to  
18  
19 73 control the virus, and because of this continent has less detection rate, live in crowded place and  
20  
21 74 weak health system.<sup>1,4</sup>  
22  
23  
24  
25

26 75 Ethiopia is one of the countries threatened by COVID-19, a total of 12,693 confirmed cases, 200  
27  
28 76 deaths registered <sup>2, 5</sup> and 5,966 recovered.<sup>6</sup> The country has not taken national wide lockdown,  
29  
30 77 but the country declared state of emergency. In Ethiopia, many organizations, including  
31  
32 78 government sector has implemented different measurement that plans to prevent the virus. In  
33  
34 79 community still there is gap in using prevention mechanism despite many media and organization  
35  
36 80 mobilizes the community and advocacy strategy to curb the pandemic. Most of the reason goes to  
37  
38 81 inadequate knowledge of the disease of prevention technique.<sup>4, 7</sup> Community level knowledge  
39  
40 82 concerning COVID-19 epidemic plays a crucial role both in choice of institutionally approved  
41  
42 83 "top-down" medical policies and in grass-roots strategies adopted by communities. <sup>8,9</sup>  
43  
44  
45  
46  
47

48 84 In Ethiopia, the positivity rate of the COVID-19 epidemic is increased from time to time.<sup>10</sup>  
49  
50 85 Findings showed that gender, age, residence, education, and occupation were associated with  
51  
52 86 knowledge of the public. <sup>3, 7,9,11</sup> However, community level studies are lacking, particularly in the  
53  
54 87 study areas towards COVID-19 prevention.  
55  
56  
57  
58  
59  
60

1  
2  
3 88 There is a huge gap in preventing viruses since it is new emerging little is known about the  
4  
5 89 awareness of the disease communications by general public.<sup>12</sup> This all show the need for research  
6  
7  
8 90 in every aspect, but in developing countries the prioritize prevention is the only effective way to  
9  
10 91 cut virus so to do this the community must know and prevent prevention mechanism. For the  
11  
12 92 intervention need to have evidence that show levels of intervention and to continue it. Therefore,  
13  
14 93 this research is aimed to assess the level of the knowledge and influencing factors towards COVID-  
15  
16 94 19 prevention in Dessie and Kombolcha city administrations where these are the corridor sites for  
17  
18 95 many entries in northeast Ethiopia.

## 96 **METHODS**

### 97 **Study settings**

98 The study was conducted from June 7-14, 2020, in Dessie and Kombolcha city administrations,  
99 Amhara National Regional State, North-East Ethiopia. Dessie is 401 kilometers and Kombolcha  
100 376 away from Addis Ababa, the capital city of Ethiopia respectively. Dessie city has 26 *Kebeles*  
101 (*the lowest administrative level in Ethiopia*) 18 urban 8 rural and Kombolcha has 11 *Kebeles* 5  
102 urban and 6 rural a total of 37 *Kebeles* in the two city administrations. According to 2012 E.C  
103 population projection, in Dessie 91,870 households and in Kombolcha 34,097 households. A total  
104 of 125,967 households in the two city administrations. The total population of Dessie is 385,850  
105 and Kombolcha 143,214. The two city administrations have 529,064 inhabitants, of which 262,157  
106 males and 266,907 are females.<sup>13</sup>

107 Dessie is the 2<sup>nd</sup> populated metropolitan city and the corridor site of many entries in Amhara  
108 regional state, north-East, Ethiopia. Kombolcha as the twin city of Dessie which lies some 25 km  
109 to the northwest. Kombolcha is connected with Dessie through road transportation. This city  
110 shares Kombolcha Airport with neighboring Dessie. The city is served by a station on the Awash–



1  
2  
3 111 Weldiya Railway and neighbors with Afar region. It is a gate site where foreigners and migrants  
4  
5 112 live that mainly came from Djibouti and Arab countries. <sup>14</sup>  
6  
7

### 8 113 **Study design and period**

9  
10 114 Population-based cross-sectional study was conducted to assess KAP and factors about COVID-  
11  
12 115 19 among the residents of Dessie and Kombolcha City administrations from July 01-07, 2020.  
13  
14  
15

### 16 116 **Population**

17  
18 117 The source of population was all the residents of Dessie and Kombolcha city administrations  
19  
20 118 Amhara Regional State, Northeast Ethiopia. The study population was residents found in the  
21  
22 119 selected *Kebeles* in Dessie and Kombolcha City administrations who had the chance to be included  
23  
24 120 in the sample.  
25  
26  
27

### 28 121 **Inclusion and exclusion criteria**

29  
30 122 Household heads and/or the age of above 18 years old, who have been living in the study area in  
31  
32 123 the past two months ago and available during the study period were included in the study. Whereas,  
33  
34 124 participants to critically and mentally ill during the study period were excluded from the study.  
35  
36  
37

### 38 125 **Sample size determination and Sampling procedures**

39  
40 126 Since, COVID-19 is the new emerging disease and scientific information related COVID-19 is not  
41  
42 127 available at national level. Therefore, using single population proportion formula, the estimation  
43  
44 128 of the sample size was done by assuming a prevalence of 50%, 95% of confidence level and 5%  
45  
46 129 of margin of error. The calculated sample size of this study was 768 participants with design effect  
47  
48 130 of two. By adding tolerable non-response rate (10%), the total sample size was 845 participants.  
49  
50  
51

52  
53 131 
$$n = \frac{(Z\alpha/2)^2 * p(1-p)}{w^2} * DE \Rightarrow n = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} * 2 = 768$$
  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 132 By adding 10% non-response rate= 845

4  
5 133 Where, prevalence (p) =50%; w=tolerable margin of error=5%;  $Z^{\alpha/2}$  at 95%=1.96;

6  
7 134 DE= Design effect

8  
9  
10 135 By using double population proportion formula, possible sample sizes were estimated using the  
11  
12 136 assumptions of 80% power, and 95% confidence level as below (Table 1).

13  
14  
15 137 Table 1. Sample size determinations for fourth to sixth objectives for the study conducted on level  
16  
17 138 KAP and factors towards COVID-19 prevention among residents of Dessie and Kombolcha city  
18  
19 139 administrations, northeast Ethiopia

Variables name	References	Percentage of unexposed	80% power	95% CI	Odds ratio	Sample size	Design effect	10% NRR	Final sample size
Sex	15	74	80	0.05	0.40	186	2	37	409
Education	15	51.7	80	0.05	6.30	62	2	12	136
Occupation	16	9.3	80	0.05	5.7	86	2	17	189

20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33 140  
34  
35  
36 141 A two-stage sampling technique was employed to select the study participants. A total of 845  
37  
38 142 participants from their respective households were included in the study. Simple random sampling  
39  
40 143 technique was applied to select *Kebeles* to eliminate selection bias. In the first stage, nine *Kebeles*  
41  
42 144 were selected out of 37 *Kebeles* using a lottery method. In the second stage, data were collected  
43  
44 145 from participants at households using systematic sampling technique (every 36<sup>th</sup> values were  
45  
46 146 included). Then, based on their population size, the sample size was proportionally allocated to  
47  
48 147 each sampled *Kebeles*. Dessie has 26 *Kebeles* (18 urban and 8 rural), and Kombolcha has 11  
49  
50 148 *Kebeles* (5 urban and 6 rural). The two city administrations have a total of 37 *Kebeles*.

51  
52  
53  
54  
55 149 **Data collection**

1  
2  
3 150 Data on socio-demographic variables, availability of household materials/related variables, source  
4  
5 151 of information related variables, and knowledge related variables were collected through pretested  
6  
7 152 and structured interviewer administered questionnaire. The questions were adapted from WHO  
8  
9 153 COVID-19 guideline,<sup>17</sup> and similar study done in China.<sup>18</sup>  
10  
11  
12

### 13 154 **Measurement of COVID-19 - related Knowledge (Dependent variable)**

14  
15 155 The knowledge section of the questionnaire had 35 questions. The questions were intended to  
16  
17 156 assess the participants' knowledge of COVID-19 plausibly influencing their health care seeking  
18  
19 157 behavior. Yes/correct responses were labeled as "1", and incorrect/no/I don't know responses were  
20  
21 158 labeled as "0". The scores were added up to create knowledge ranking for the aforementioned  
22  
23 159 categories. The pooled scores of questions were classified into poor and good knowledge using  
24  
25 160 median (50%) score values. Poor Knowledge was labeled as "1", and Good Knowledge was  
26  
27 161 labeled as "0".  
28  
29  
30  
31

### 32 162 **Operational definitions**

33  
34 163 The respondent was classified as having "**Poor Knowledge**" when he/she answered correctly  
35  
36 164 below 50% of COVID-19 related knowledge questions. Whereas, the respondent was classified as  
37  
38 165 having "**Good Knowledge**" when he/she answered correctly 50% and above of COVID-19 related  
39  
40 166 knowledge questions.  
41  
42  
43

### 44 167 **Data quality assurance**

45  
46  
47 168 Pre-test was conducted on 5% of the total sample size in Kalu district and the amendment was done  
48  
49 169 according to the finding. Training on the objectives of the study was given to data collectors and supervisors  
50  
51 170 before a day of data collection. Regular supervision, control as well as support data collectors by the  
52  
53 171 supervisors were made daily and each completed questionnaire was checked and the necessary feedback  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 172 was offered to interviewers. The collected data were properly handled, reviewed and checked for  
4  
5 173 completeness and consistency by the supervisors and before commencing analysis each day.  
6  
7

## 8 174 **Data processing and analysis**

9

10 175 The collected data were coded, edited, entered into Epi-Info version 7.2 and analyzed using the  
11  
12 176 Statistical Package for the Social Sciences (SPSS) version 20. Internal consistency of the knowledge  
13  
14  
15 177 measures was tested using a reliability test where the Cronbach alpha coefficient aided in  
16  
17 178 determining the reliability of the variables. The results showed that the Cronbach alpha for  
18  
19 179 knowledge questions was 0.801. The result added credibility where, according to Griethuijsen, the  
20  
21 180 range of Cronbach alpha within 0.6 to 0.7 is considered adequate and reliable.<sup>19</sup> It is proved that  
22  
23 181 the items used to measure knowledge on COVID-19 are therefore acceptable. Descriptive  
24  
25 182 summary statistics such as mean  $\pm$  SD, median  $\pm$  IQR, frequencies and proportions were presented  
26  
27 183 as appropriate. Binary logistic regression analysis was done and all independent variables at  
28  
29 184  $p < 0.20$  were taken to multivariable logistic regression analysis to identify associated factors with  
30  
31 185 outcome variables. The statistical significance of variables at final model was declared at  $p < 0.05$   
32  
33 186 and 95% confidence level for adjusted odds ratio. The Hosmer and Lemeshow statistics and  
34  
35 187 deviance coefficient were used to check the goodness of fit of the model.  
36  
37  
38  
39  
40

## 41 188 **RESULTS**

42

### 43 189 **Socio-demographic characteristics of participants**

44

45  
46 190 By excluding incomplete and irrelevant questionnaires, the response rate was 828 (98%). Among the study  
47  
48 191 participants, 541 (65.3%) reside in Dessie, and the rest of Kombolcha cities. Among the participants, 511  
49  
50 192 (61.7%) were females, 423 (51.1%) were Muslim followed by Orthodox Tewahido (385 (46.5%)) religion's  
51  
52 193 followers. The mean ( $\pm$  SD) age of the study participants was 39 ( $\pm$ 14) years. From all participants, 672  
53  
54 194 (81.2%) were living in urban settings, 576 (69.6%) married, 167 (20.2) were single headed participants. Of  
55  
56  
57  
58  
59  
60

195 the study participants, 218 (26.4%) had no formal education. Regarding their occupational status, 246  
 196 (29.7%) were housewives followed by government employees, 176 (21.3%) (Table 2).

197 **Table 2.** Socio-demographic characteristics of participants in Dessie and Kombolcha city  
 198 Administrations, northeast 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</b>			39 ( $\pm$ 14)
18-35	422	51.0	
36-64	341	41.2	
$\geq$ 65	65	7.9	
<b>Religion</b>			
Orthodox Tewahedo	385	46.5	
Muslim	423	51.1	
Catholic	8	1.0	
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	30.0	
<b>Main occupation</b>			
House wife	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	

199

200 **Household level and Media related characteristics**

201 The median ( $\pm$ interquartile range) for family size of the participants was 4.42 ( $\pm$ 1.8). The median  
 202 ( $\pm$ IQR) income of the participants was 3,000 ( $\pm$ 2500) ETB. Of the participants, 29 (3.5%) are using  
 203 their water from spring water source (any type: protected or unprotected). Among them, 584  
 204 (70.5%) had lack adequacy of water ( $<$ 20L/C/D) and, 789 (95.3%) access their source of water  
 205 within less than 30 minutes (1km round trip). About 720 (87%) had a functional TV in the  
 206 household, 78 (94.3%) had a cell phone (Table 3).

207 Table 3. House hold level and media related characteristics of participants in Dessie and  
 208 Kombolcha city Administration, northeast Ethiopia, 2020

HH and media characteristics	Frequency	Percentage	Median ( $\pm$ IQR)
Family size			
1-3	251	30.3	4.42( $\pm$ 1.8)
4-6	476	57.5	
$>$ 6	101	12.2	
Monthly Income at household level			3000( $\pm$ 2500)
Type of water sources			
Piped water in dwelling	136	16.4	13.15( $\pm$ 12.00)
Piped water at yard	585	70.7	
Communal "Bono"	78	9.4	
Spring (any type: protected or unprotected)	29	3.5	
Amount of water in Litter/Capita/Day			
No access ( $<$ 20L/C/D)	584	70.5	2.00( $\pm$ 2.00)
Basic access ( $\geq$ 20L/C/D)	244	29.5	
Time to take water in minutes			
$\leq$ 30 minutes (1 km round trip)	789	95.3	2.00( $\pm$ 2.00)
$>$ 30 minutes ( $>$ 1 km round trip)	39	4.7	
Functional TV in the household			
No	108	13.0	87.0
Yes	720	87.0	
Functional radio in the household			
No	347	41.9	58.1
Yes	481	58.1	
Functional cell phone in the household			
No	47	5.7	94.3
Yes	781	94.3	

209

## 210 **Factors associated with Knowledge of participants towards COVID-19 epidemic**

211 In the bivariate logistic regression (first model), seventeen independent variables were entered. In  
212 the multivariable logit regression (second model), only seven variables were significantly  
213 associated with poor knowledge of participants towards COVID-19. Variables associated with poor  
214 knowledge towards COVID-19 prevention were sex, age, residence, educational level, information  
215 from health care workers, mass media and social media.

216 Female participants were 41% more likely to have poor knowledge towards COVID-19 as  
217 compared to their counterparts (AOR=1.41, 95% CI; 1.03, 1.92). Participants whose age group  
218  $\geq 65$  years were 2.72 times more likely to have poor knowledge of COVID-19 as compared to the  
219 age groups of 18-35 years (AOR= 2.27, 95% CI; 1.45, 5.11). People who live in rural areas 2.70  
220 times more likely to have poor knowledge when compare with urban dwellers. The participants  
221 who were unable to read and write were 60% times more likely to have poor knowledge compared  
222 to those who were attending high level education (AOR=1.60, 95% CI; 1.02, 2.51). Participants  
223 who did not receive information from health care workers towards COVID-19 were 95% times  
224 more likely to have poor knowledge as compared to those who received from health care workers  
225 (AOR=1.95, 95% CI; 1.35, 2.82). Among the participants who were not receiving information  
226 towards COVID-19 from mass media 2.6 times more likely to have poor knowledge compared to  
227 those who received information from mass media (AOR=2.57, 95% CI; 1.58, 4.19]. In addition to,  
228 participants who were not receiving information from social media were 2.13 times more likely to  
229 have poor knowledge towards COVID-19 as compared to those who received from social media  
230 (AOR= 2.13, 95% CI; 1.33, 3.42) (Table 4).

## 231 **DISCUSSION**

1  
2  
3 232 This finding showed that the proportion of poor knowledge towards COVID-19 prevention was  
4  
5 233 54.11% (95% CI: 50.6, 57.6), which is higher than studies conducted in Debre Birhan University,  
6  
7 234 Ethiopia (26.2%),<sup>20</sup> Syrians (40%),<sup>21</sup> Iran (39.2%),<sup>22</sup> Bangladesh (51.7%),<sup>23</sup> Saudi Arabia  
8  
9 235 (18.4%),<sup>24</sup> across the world (20.1%),<sup>25</sup> Malaysia (19.5%),<sup>26</sup> India (13.3%),<sup>27</sup> three Middle Eastern  
10  
11 236 countries (Jordan, Saudi Arabia and Kuwait) (33.9%)<sup>9</sup> and Sudan (9.4%).<sup>28</sup> The differences in  
12  
13 237 level of knowledge have been subjected to variation in the cut-values. In addition, the discrepancies  
14  
15 238 might be due to differences in reach of community awareness creation through mass media and  
16  
17 239 social media.  
18  
19  
20  
21

22 240 In this study, the odds of poor knowledge towards COVID-19 were 1.4 times higher among female  
23  
24 241 participants compared to male participants. This finding is similar to studies conducted in Iran,<sup>22</sup>  
25  
26 242 Bangladesh,<sup>29, 30</sup> Sudan.<sup>28</sup> In Ethiopia, most of home-based activities are left for females.  
27  
28 243 Therefore, females may not get access for media because of their busy time in take care of the  
29  
30 244 family members. Consequently, they are prone to poor knowledge of COVID 19 compared to  
31  
32 245 males.  
33  
34  
35  
36

37 246 The study indicated that elderly people (i.e. 65 and above years of age) had 3-folds greater odds  
38  
39 247 of poor knowledge towards COVID 19 compared to adults. This finding is similar to studies  
40  
41 248 conducted at the Debre Birhan University, Ethiopia,<sup>20</sup> Iran,<sup>22</sup> Bangladesh,<sup>23, 30</sup> medical college in  
42  
43 249 Uttarakhand, India.<sup>27</sup> In most of the cases, elderly People are not accessible to modern technologies  
44  
45 250 in Ethiopia. Hence, they will have poor knowledge towards COVID 19 compared to adults due to  
46  
47 251 shortage of information.  
48  
49  
50

51 252 The odds of poor knowledge were 2.7 times higher among participants who were residing in rural  
52  
53 253 areas compared to those who were living in urban dwellers. This finding is similar to studies  
54  
55 254 conducted in Bangladesh,<sup>29, 31</sup> Sudan.<sup>28</sup> In Ethiopia, most of the people are living in rural areas  
56  
57  
58  
59  
60



1  
2  
3 255 which is hard to reach for awareness creation using mass media or social media (telegram,  
4  
5 256 Facebook, whatsapp and Instagram). Thus, people in rural settings had poor knowledge of COVID-  
6  
7  
8 257 19 prevention and control measures compared to urban populations who are easily accessible to  
9  
10 258 different source of media to acquire information regarding COVID-19.

11  
12  
13 259 Moreover, participants who were unable to read and write were 1.6 times more likely had poor  
14  
15 260 knowledge of COVID-19 compared to those were attended tertiary level educations. This finding  
16  
17 261 is similar to studies conducted in Syrians,<sup>21</sup> Iran,<sup>22</sup> rural residents in China,<sup>32</sup> Sudan,<sup>28</sup>  
18  
19 262 Bangladesh,<sup>29</sup> Nepal.<sup>33</sup> In Ethiopia, most of the unable to read and write segment of the population  
20  
21 263 are found in rural areas. Those unable to read and write people are not accessible to media which  
22  
23 264 are the ultimate source of information to acquire basic knowledge regarding prevention and control  
24  
25 265 modalities of COVID-19 infections. Thus, participants who were unable to read and write are less  
26  
27 266 knowledgeable regarding COVID-19 compared to tertiary educated participants.

28  
29  
30  
31  
32 267 The study revealed that the odds of poor knowledge were twofold times higher among participants  
33  
34 268 who were not receiving information regarding COVID-19 from health care workers compared to  
35  
36 269 those were receiving from health care workers. Moreover, the odds of poor knowledge were 2.5  
37  
38 270 times higher among participants who were not receiving information regarding COVID-19 from  
39  
40 271 mass media (TV/Radio) compared to their counterparts. Furthermore, the odds of poor knowledge  
41  
42 272 were 2 times higher among participants who were not receiving information regarding COVID  
43  
44 273 from social media compared to those were get receiving from social media. This finding is similar  
45  
46 274 to a study conducted in eight referral hospitals, Ethiopia.<sup>34</sup> The community may get information  
47  
48 275 regarding COVID-19 epidemic from different sources. These sources include health care workers,  
49  
50 276 mass media (TV, radio, newspapers, and magazines), social media (telegram, Facebook,  
51  
52 277 WhatsApp, Instagram, tweeters), and religious leaders. Thus, community members who are not  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 278 accessible to these sources are less knowledgeable regarding COVID-19 compared to those who  
4  
5 279 are accessible to the listed sources of information.  
6  
7

8 280 This study extracted community level information regarding participants' knowledge towards  
9  
10 281 COVID-19 prevention from the hotspot areas of COVID-19. However, this study is limited due  
11  
12 282 to its cross-sectional design/behavior which lacks cause and effect relationship.  
13  
14  
15

## 16 283 **CONCLUSIONS**

17  
18 284 In this study, more than half of the study participants had poor knowledge towards COVID-19  
19  
20 285 prevention among residents of Dessie and Kombolcha city administrations, northeast Ethiopia.  
21

22 286 Findings from this study showed that sex, age, residence, educational level, information seeking  
23  
24 287 from health care workers, mass media and social media were significantly associated with poor  
25  
26 288 knowledge. The findings may have implications in the prevention campaign/program of the new  
27  
28 289 corona virus epidemic particularly in the study settings. It helps other researchers as a baseline  
29  
30 290 information for community level studies. This finding may enforce the local as well as national  
31  
32 291 Anti-COVID-19 programmers to revise their campaign plans to strengthen the efforts against  
33  
34 292 COVID-19 epidemics.  
35  
36  
37  
38

39 293 It is recommended to revise COVID-19 prevention plan to increase community awareness towards  
40  
41 294 COVID-19. Strengthening the community to consider the health care workers and mass media as  
42  
43 295 a source of COVID-19 related information might be encouraged. House to house awareness  
44  
45 296 creation might be important to address elders who are more vulnerable to the epidemics. Females'  
46  
47 297 empowerment in formal education shall be strengthened to increase their awareness and exposure  
48  
49 298 to the latest information. The city administrations shall focus on their rural residents to access and  
50  
51 299 have an appropriate information towards COVID-19 prevention.  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **300 List of abbreviations**  
4

5 301 AOR: adjusted odds ratio; CI: confidence interval; COVID-19: Coronavirus disease 2019; IQR:  
6  
7  
8 302 interquartile range; L/C/D: liter per capita per day; OR: odds ratio; SD: standard deviation  
9

10  
11 **303 Declarations**  
12

13 **304 Ethics approval and consent to participate**  
14

15 305 Ethical clearance was obtained from Ethical Review Committee [**Reference number:**  
16  
17  
18 306 **CMHS/311/036/12**] of College of Medicine and Health Sciences, Wollo University. Permission  
19  
20 307 letter was obtained from Dessie and Kombolcha town administrations health department and  
21  
22 308 offices, then from kebele administrations involved in the study. Informed verbal consent was  
23  
24 309 obtained from each study participant. The information gathered from the participants was used for  
25  
26 310 research purpose and confidentiality kept. Participation in the study was on a voluntary basis and  
27  
28 311 participants who were unwilling to participate in the study and those who wish to quit from the  
29  
30 312 study at any point in time informed to do so without any restriction.  
31  
32  
33

34 **313 Consent for publication**  
35

36 314 Not applicable.  
37  
38

39 **315 Availability of data and materials**  
40

41 316 The data used to produce this manuscript are available in Epi-Info version 7.2 and SPSS version  
42  
43 317 20 databases and the authors are prepared to share their data on request recognizing the benefits of  
44  
45 318 such transparency.  
46  
47  
48

49 **319 Competing interests**  
50

51 320 No competing interests for any authors.  
52  
53

54 **321 Patient and public involvement**  
55  
56  
57  
58  
59  
60

1  
2  
3 322 Patients and/or the public were not involved in the design, or conduct, or reporting, or  
4  
5 323 dissemination plans of this research.  
6  
7

### 8 324 **Funding**

9  
10 325 This work was supported by Dessie Health Science College (grant number 151/09/12). The funder  
11  
12 326 had no role in the study design, data collection and analysis, decision to publish or preparation of  
13  
14 327 the manuscript.  
15

### 16 328 **Contributors**

17  
18 329 Conception and design of the study: AMK. Conduct of the study: AMK, GGB, AMM, KAY, and  
19  
20 330 AWT. Analysis and interpretation of data: AMK, GGB and AMM. Drafting the manuscript and  
21  
22 331 revising it critically: AMK, GGB, AMM, KAY, and AWT.. All authors have given final approval  
23  
24 332 for the manuscript to be published.  
25  
26  
27  
28  
29

### 30 333 **Acknowledgements**

31  
32 334 The authors are very grateful to Institutional Review Board (IRB) of College of Medicine and  
33  
34 335 Health Sciences, Wollo University for the approval of the ethical clearance. We would like to  
35  
36 336 thank the health departments of the two city administrations for their cooperation. We also thank  
37  
38 337 all individuals participated in this study for their cooperation in taking part in this study.  
39  
40  
41

### 42 338 **REFERENCES**

- 43  
44 339 1. Velavan TP, Meyer CG. The COVID-19 epidemic. *Tropical medicine & international health*.  
45 340 2020;25(3):278.  
46 341 2. Organization WH, organization Wh. Coronavirus disease (COVID-2019) situation reports. 2020.  
47 342 3. Zegarra-Valdivia J, Vilca BNC, Guerrero RJA. Knowledge, perception and attitudes in Regard to  
48 343 COVID-19 Pandemic in Peruvian Population. 2020.  
49 344 4. Tavakoli A, Vahdat K, Keshavarz M. Novel coronavirus disease 2019 (COVID-19): an emerging  
50 345 infectious disease in the 21st century. *ISMJ*. 2020;22(6):432-50.  
51 346 5. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard 2020 [cited 2020 July  
52 347 25, 2:18pm CEST]. Available from: <https://covid19.who.int/table>.  
53 348 6. Worldometer. COVID-19 CORONAVIRUS PANDEMIC 2020 [cited 2020 July 25 at 21:24 GMT].  
54 349 Available from: <https://www.worldometers.info/coronavirus/#countries>.  
55  
56  
57  
58  
59  
60

- 1
- 2
- 3 350 7. Haque T, Hossain KM, Bhuiyan MMR, Ananna SA, Chowdhury SH, Islam MR, et al. Knowledge,
- 4 351 attitude and practices (KAP) towards COVID-19 and assessment of risks of infection by SARS-CoV-2
- 5 352 among the Bangladeshi population: An online cross sectional survey. 2020.
- 6 353 8. Adhikari SP, Meng S, Wu Y-J, Mao Y-P, Ye R-X, Wang Q-Z, et al. Epidemiology, causes, clinical
- 7 354 manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the
- 8 355 early outbreak period: a scoping review. *Infectious diseases of poverty*. 2020;9(1):1-12.
- 9 356 9. Naser AY, Dahmash EZ, Alwafi H, Alsairafi ZK, Al Rajeh AM, Alhartani YJ, et al. Knowledge and
- 10 357 practices towards COVID-19 during its outbreak: a multinational cross-sectional study. *medRxiv*.
- 11 358 2020.
- 12 359 10. Deribe K. COVID-19 in Ethiopia: status and responses 2020 [cited 2020 July 25]. Available from:
- 13 360 <https://rstmh.org/news-blog/news/covid-19-in-ethiopia-status-and-responses>.
- 14 361 11. Abdelhafiz AS, Mohammed Z, Ibrahim ME, Ziady HH, Alorabi M, Ayyad M, et al. Knowledge,
- 15 362 perceptions, and attitude of egyptians towards the novel coronavirus disease (COVID-19). *Journal of*
- 16 363 *Community Health*. 2020:1-10.
- 17 364 12. Austrian K, Pinchoff J, Tidwell JB, White C, Abuya T, Kangwana B, et al. COVID-19 related knowledge,
- 18 365 attitudes, practices and needs of households in informal settlements in Nairobi, Kenya. 2020.
- 19 366 13. CSA (Ethiopia). Population Projections for Ethiopia - Central Statistical Agency 2019 [cited 2020 July
- 20 367 25]. Available from: [http://www.csa.gov.et/census-report/population-projections/category/368-](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037)
- 21 368 [population-projection-2007-2037?download=936:population-projection-2007-2037](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037).
- 22 369 14. Tadesse Tamrat. Kombolcha city 2019 [Available from: <https://en.wikipedia.org/wiki/Kombolcha>].
- 23 370 15. Hayat K, Rosenthal M, Xu S, Arshed M, Li P, Zhai P, et al. View of Pakistani Residents toward
- 24 371 Coronavirus Disease (COVID-19) during a Rapid Outbreak: A Rapid Online Survey. *Int J Environ Res*
- 25 372 *Public Health*. 2020;17(10):3347.
- 26 373 16. Kebede Y, Yitayih Y, Birhanu Z, Mekonen S, Ambelu A. Knowledge, perceptions and preventive
- 27 374 practices towards COVID-19 early in the outbreak among Jimma university medical center visitors,
- 28 375 Southwest Ethiopia. *PLoS One*. 2020;15(5):e0233744-e.
- 29 376 17. Organization WH. Critical preparedness, readiness and response actions for COVID-19: interim
- 30 377 guidance, 7 March 2020. World Health Organization; 2020.
- 31 378 18. Zhong B-L, Luo W, Li H-M, Zhang Q-Q, Liu X-G, Li W-T, et al. Knowledge, attitudes, and practices
- 32 379 towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak:
- 33 380 a quick online cross-sectional survey. *International journal of biological sciences*. 2020;16(10):1745.
- 34 381 19. Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices
- 35 382 towards COVID-19: A cross-sectional study in Malaysia. *PLoS One*. 2020;15(5):e0233668-e.
- 36 383 20. Aynalem YA, Akalu TY, Gebresellassie B, Sharew NT, Shiferaw WS. Assessment of undergraduate
- 37 384 student knowledge, practices, and attitude towards COVID-19 in Debre Berhan University, Ethiopia.
- 38 385 21. Al Ahdab S. Knowledge, Attitudes and Practices (KAP) towards pandemic COVID-19 among Syrians.
- 39 386 2020.
- 40 387 22. Erfani A, Shahriarirad R, Ranjbar K, Mirahmadizadeh A, Moghadami M. Knowledge, attitude and
- 41 388 practice toward the novel coronavirus (COVID-19) outbreak: A population-based survey in Iran. *Bull*
- 42 389 *World Health Organ, E-pub*. 2020;30.
- 43 390 23. Byanaku A, Ibrahim M. Knowledge, attitudes, and practices (KAP) towards COVID-19: A quick online
- 44 391 cross-sectional survey among Tanzanian residents. *medRxiv*. 2020.
- 45 392 24. Al-Hanawi M, Angawi K, Alshareef N, Qattan A, Helmy H, Abudawood Y, et al. Knowledge, Attitude
- 46 393 and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional
- 47 394 Study. *Front. Public health*. 2020;8:217.
- 48 395 25. Ali M, Uddin Z, Banik PC, Hegazy FA, Zaman S, Ambia ASM, et al. Knowledge, attitude, practice and
- 49 396 fear of COVID-19: A cross-cultural study. *medRxiv*. 2020.

- 1  
2  
3 397 26. Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices  
4 398 towards COVID-19: A cross-sectional study in Malaysia. Plos one. 2020;15(5):e0233668.  
5 399 27. Maheshwari S, Gupta PK, Sinha R, Rawat P. Knowledge, attitude, and practice towards coronavirus  
6 400 disease 2019 (COVID-19) among medical students: A cross-sectional study. Journal of Acute Disease.  
7 401 2020;9(3):100.  
8 402 28. Mohamed A, Elhassan E, Mohamed AO, Mohammed AA, Mahgoop MA, Sharif ME, et al. Knowledge,  
9 403 attitude and practice of the Sudanese people towards COVID-19: An online survey. 2020.  
10 404 29. Karim A, Akter M, Mazid AT, Pullock OS, Aziz TT, Hayee S, et al. Knowledge and attitude towards  
11 405 COVID-19 in Bangladesh: Population-level estimation and a comparison. Nature. 2020;5(4):536-44.  
12 406 30. Paul A, Sikdar D, Hossain MM, Amin MR, Deeba F, Mahanta J, et al. Knowledge, Attitude and  
13 407 Practice Towards Novel Corona Virus among Bangladeshi People: Implications for mitigation  
14 408 measures. medRxiv. 2020.  
15 409 31. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia J. Knowledge, attitude, and  
16 410 practice regarding COVID-19 outbreak in Bangladeshi people: An online-based cross-sectional study.  
17 411 medRxiv. 2020.  
18 412 32. Lihua M, Ma L, Liu H, Jiang N, Wang S, Jiang X. Knowledge, beliefs/attitudes and practices of rural  
19 413 residents in the prevention and control of COVID-19: An online questionnaire survey. 2020.  
20 414 33. Paudel S, Shrestha P, Karmacharya I, Pathak OK. Knowledge, attitude, and practices (KAP) towards  
21 415 COVID-19 among Nepalese residents during the COVID-19 outbreak: An online cross-sectional study.  
22 416 2020.  
23 417 34. Jemal B, Ferede ZA, Mola S, Hailu S, Abiy S, Wolde GD, et al. Knowledge, attitude and practice of  
24 418 healthcare workers towards COVID-19 and its prevention in Ethiopia: a multicenter study. 2020.  
25  
26  
27  
28  
29  
30

31 420 Table 4. Bi-variable and multivariable logistic regression of knowledge towards COVID-19  
32 421 epidemic among residents of Dessie and Kombolcha city administration, northeast Ethiopia, 2020  
33 422 (n=828).

Variables	Knowledge level, n (%)		Crude odds ratio (COR)		Adjusted odds ratio (AOR)	
	Poor	Good	OR	95% CI	OR	95% CI
Sex						
Male	156(49.2)	161(50.8)	1		1	
Female	292(57.1)	219(42.9)	1.38	1.04, 1.82*	1.41	<b>1.03, 1.92*</b>
Age						
18-35	215(50.9)	207(49.1)	1		1	
36-64	185(54.3)	156(45.7)	1.14	0.86, 1.52	1.14	0.83, 1.57
>=65	48(73.8)	17(26.2)	2.72	1.51, 4.88*	2.72	<b>1.45, 5.11*</b>
Place of residence						
Urban	333(49.6)	339(50.4)	1		1	
Rural	115(73.7)	41(26.3)	2.86	1.94, 4.21*	2.69	<b>1.78, 4.07*</b>
Marital status						
Single	92(55.1)	75(44.9)	1		1	
Married	307(53.3)	269(46.7)	0.93	0.66, 1.32	-	-
Divorced	27(57.4)	20(42.6)	1.10	0.57, 2.12	-	-

1							
2							
3	Widowed	22(57.9)	16(42.1)	1.12	0.55, 2.29	-	-
4	Education level						
5	Unable to read and write	94(61.4)	59(38.6)	2.48	1.64, 3.75*	1.60	<b>1.02, 2.51*</b>
6	Able to read and write with	46(70.8)	19(29.2)	3.77	2.09, 6.81*	2.29	<b>1.22, 4.30*</b>
7	informal education						
8	Primary school (grade 1-8)	98(62.0)	60(38.0)	2.54	1.69, 3.83*	1.67	<b>1.08, 2.60*</b>
9	Secondary school (grade 9-12)	113(55.4)	91(44.6)	1.93	1.33, 2.82*	1.50	<b>1.01, 2.24*</b>
10	Above 12 grade	97(39.1)	151(60.9)	1		1	
11	(University/College/TVET)						
12	Main occupation						
13	House wife	142(57.7)	104(42.3)	1.37	0.76, 2.44	0.73	0.38, 1.44
14	Merchant	84(50.0)	84(50.0)	1.00	0.55, 1.83	0.74	0.38, 1.44
15	Farmer	24(64.9)	13(35.1)	1.85	0.79, 4.34	0.67	0.25, 1.83
16	Government employee	83(47.2)	93(52.8)	0.89	0.49, 1.63	0.99	0.50, 1.95
17	NGO employee	31(49.2)	32(50.8)	0.97	0.47, 1.99	0.88	0.40, 1.92
18	Labourer	56(68.3)	26(31.7)	2.15	1.07, 4.34*	1.37	0.63, 2.96
19	Student	28(50.0)	28(50.0)	1		1	
20	Family size						
21	1-3	137(54.6)	114(45.4)	1		1	
22	4-6	255(53.6)	221(46.4)	0.96	0.71, 1.31	-	-
23	>6	56(55.4)	45(44.6)	1.04	0.65, 1.65	-	-
24	Type of water sources						
25	Piped water in dwelling	64(47.1)	72(52.9)	1		1	
26	Piped water at yard	307(52.5)	278(47.5)	1.24	0.86, 1.81	1.08	0.72, 1.62
27	Communal "Bono"	53(67.9)	25(32.1)	2.39	1.33, 4.27*	1.08	0.54, 2.17
28	Spring (any type: protected or	24(82.8)	5(17.2)	5.40	1.95,	2.58	0.77, 8.67
29	unprotected)				14.99*		
30	Amount of water in						
31	Litter/Capita/Day						
32	No access (<20L/C/D)	324(55.5)	260(44.5)	1.21	0.89, 1.63	-	-
33	Basic access (>=20L/C/D)	124(50.8)	120(49.2)	1		1	
34	Time to take/fetch water in						
35	minutes						
36	<=30 minutes (1 km round trip)	419(53.1)	370(46.9)	1		1	
37	>30 minutes (>1 km round trip)	29(74.4)	10(25.6)	2.56	1.23, 5.33*	0.69	0.25, 1.92
38	Functional TV/radio in the						
39	household						
40	No	73(67.6)	35(32.4)	1.92	1.25, 2.95*	0.97	0.58, 1.62
41	Yes	375(52.1)	345(47.9)	1		1	
42	Functional cell phone in the						
43	household						
44	No	31(66.0)	16(34.0)	1.69	0.91, 3.14*	0.96	0.47, 1.95
45	Yes	417(53.4)	364(46.6)	1		1	
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

1							
2							
3	COVID-19 Information heard						
4	from family members						
5	No	376(53.1)	332(46.9)	0.76	0.51, 1.12*	0.80	0.50, 1.28
6	Yes	72(60.0)	48(40.0)	1		1	
7							
8	COVID-19 Information heard						
9	from health care workers						
10	No	355(57.5)	262(42.5)	1.72	1.25, 2.36*	1.95	<b>1.35, 2.82*</b>
11	Yes	93(44.1)	118(55.9)	1		1	
12							
13	COVID-19 Information heard						
14	from mass media (TV,...						
15	No	79(71.2)	32(28.8)	2.33	1.51, 3.60*	2.57	<b>1.58, 4.19*</b>
16	Yes	369(51.5)	348(48.5)	1		1	
17							
18	COVID-19 Information heard						
19	from social mass (FB, ...						
20	No	414(57.6)	305(42.4)	2.99	1.95, 4.61*	2.13	<b>1.33, 3.42*</b>
21	Yes	34(36.2)	75(68.8)	1		1	
22							
23	COVID-19 Information heard						
24	from religious leader's						
25	No	428(55.8)	339(44.2)	2.59	1.49, 4.50*	1.16	0.60, 2.28
26	Yes	20(32.8)	41(67.2)	1		1	

423 \*for p<0.20 at bivariate analysis; \*and bold for p<0.05 at multivariable analysis

424



1  
2 Research checklist

3  
4 STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2, 5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	1
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	n/a
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	n/a
		(c) Explain how missing data were addressed	9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-12
		(b) Indicate number of participants with missing data for each variable of interest	9-12
Outcome data	15*	Report numbers of outcome events or summary measures	12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted	12

		estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	2
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Knowledge level and influencing factors towards prevention of COVID-19 pandemic among residents of Dessie and Kombolcha city administrations, northeast Ethiopia: A population-based cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-044202.R1
Article Type:	Original research
Date Submitted by the Author:	06-Oct-2020
Complete List of Authors:	Kassa, Ayesheshim ; Dessie Health Science College , Nursing Mekonen, Asnakew ; Wollo University, Health System Management Yesuf, Kedir; Dessie Health Science College , Basic Health Science Woday, Abay; Samara University, Public Health Bogale, Getahun; Wollo University, Health Informatics
<b>Primary Subject Heading</b>:	Infectious diseases
Secondary Subject Heading:	Public health
Keywords:	Epidemiology < INFECTIOUS DISEASES, PUBLIC HEALTH, Public health < INFECTIOUS DISEASES

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3 **1 Knowledge level and influencing factors towards prevention of COVID-19**  
4  
5  
6 **2 pandemic among residents of Dessie and Kombolcha city administrations,**  
7  
8  
9 **3 northeast Ethiopia: A population-based cross-sectional study**  
10

11  
12 4 Ayesheshim Muluneh Kassa<sup>1</sup>, Asnakew Molla Mekonen<sup>2</sup>, Kedir Abdu Yesuf<sup>3</sup>, Abay Woday  
13  
14 5 Tadesse<sup>4</sup>, Getahun Gebre Bogale<sup>5\*</sup>  
15

16  
17 **6 Affiliations**  
18

19  
20 7 <sup>1</sup>Department of Nursing, Dessie Health Science College, Dessie, Ethiopia  
21

22 8 <sup>2</sup>Department of Health System Management, School of Public Health, College of Medicine and  
23  
24 9 Health Sciences, Wollo University, Dessie, Ethiopia  
25

26  
27 10 <sup>3</sup>Department of Basic Health Science, Dessie Health Science College, Dessie, Ethiopia  
28

29 11 <sup>4</sup>Department of Public Health, College of Health Sciences, Samara University, Samara, Ethiopia  
30

31 12 <sup>5</sup>Department of Health Informatics, School of Public Health, College of Medicine and Health  
32  
33 13 Sciences, Wollo University, Dessie, Ethiopia  
34  
35

36 14  
37  
38 15 \*Correspondence: Getahun Gebre Bogale  
39

40 16 Email: [getahungebre21@gmail.com](mailto:getahungebre21@gmail.com)  
41  
42  
43 17  
44  
45  
46 18  
47  
48  
49 19  
50  
51  
52 20  
53  
54  
55 21  
56  
57  
58  
59  
60

## 22 Abstract

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

27 **Design:** Community-based cross-sectional study

28 **Settings:** Dessie and Kombolcha city administrations

29 **Participants:** Participants were household heads or anyone from the house with age >18 years.  
30 They have been living in the study areas for the past two months preceding the survey (n=828).

31 **Methods:** A binary logistic regression was used for a single outcome and multiple response  
32 variables. In the multivariable regression model, a  $p < 0.05$  and adjusted odds ratio (AOR) with  
33 95% confidence interval were used to identify factors associated with knowledge level of the  
34 community. Epi-Info version 7.2 and SPSS version 20 software are used for data entry and analysis  
35 respectively.

36 **Outcome:** Knowledge level

37 **Results:** A total of 828 participants were involved with a response rate of 98%. Females were  
38 61.7%. Participants' mean ( $\pm$ SD) age was 39 ( $\pm$ 14) years. From the total participants; 54.11%  
39 (95% CI: 50.6, 57.6) had inadequate knowledge about COVID-19 prevention. Significant  
40 associations reported among females (AOR=1.41; 95% CI: 1.03, 1.92); age  $\geq$ 65years (AOR=2.72;  
41 95% CI: 1.45, 5.11); rural residence (AOR=2.69; 95% CI: 1.78, 4.07); unable to read and write  
42 (AOR=1.60; 95% CI: 1.02, 2.51); information not heard from healthcare workers, mass media,

1  
2  
3 43 and social media (AOR=1.95; 95% CI: 1.35, 2.82), (AOR=2.5; 95% CI: 1.58, 4.19) and  
4  
5 44 (AOR=2.13; 95% CI: 1.33, 3.42) respectively with inadequate knowledge.  
6  
7

8 45 **Conclusion:** These findings revealed >50% of participants had inadequate knowledge about  
9  
10 46 COVID-19. It highlights the need for widespread awareness campaigns about COVID-19 through  
11  
12 47 mass media, healthcare professionals and social media as a source of information. House-to-house  
13  
14 48 awareness creation is recommended to address older adults who are more vulnerable to the  
15  
16 49 pandemic.  
17  
18

19  
20 50 **Keywords:** Knowledge, Influencing factors, COVID-19, Dessie, Kombolcha, Ethiopia  
21  
22

## 23 51 **Strengths and limitations of this study**

- 24  
25  
26 52 • This is the first community-level study in northeast Ethiopia which extracted information  
27  
28 53 regarding participants' knowledge towards COVID-19 prevention  
29  
30 54 • The study addressed hotspot areas of COVID-19 where these are the corridor sites for many  
31  
32 55 entries in northeast Ethiopia  
33  
34 56 • The quantitative study did not supported by qualitative study  
35  
36 57 • This study is limited due to its cross-sectional design/behavior which lacks cause and effect  
37  
38 58 relationship.  
39  
40  
41  
42

## 43 59 **INTRODUCTION**

44  
45  
46 60 Coronavirus disease 2019 (COVID-19) was first detected in Wuhan, China, in December 2019  
47  
48 61 and on 30 January 2020. When the virus causes a large burden of morbidity and mortality in China  
49  
50 62 and international locations, the World Health Organization (WHO) declared the current outbreak  
51  
52 63 a public health emergency of international concern.<sup>1</sup> Globally, more than 34,161,721 were infected  
53  
54 64 and nearly 1,016,986 fatalities after being declared as a pandemic by the WHO. In Africa, there  
55  
56  
57  
58  
59  
60

1  
2  
3 65 are about 1,191,323 confirmed cases and 26,148 deaths reported as of 5:04 pm CEST, 2 October  
4  
5 66 2020.<sup>2</sup> International and national borders have been locked down, travel restricted, economies  
6  
7 67 slashed and billions are isolated at their own homes, as a measure to contain the outbreak.  
8  
9

10  
11 68 The COVID-19 prevention interventions are more appropriate in the community as the knowledge  
12  
13 69 regarding the new infection improves the preparedness of both the healthcare professionals and  
14  
15 70 the general public.<sup>3,4</sup> The virus was rapidly transmitted to many countries across Africa, and the  
16  
17 71 fatality related to COVID-19 has been an increase in the fastest time. In the continent, the infection  
18  
19 72 rate of the COVID-19 may be increased due to less detection rate, live in a crowded place and a  
20  
21 73 weak health system.<sup>1,5-7</sup>  
22  
23  
24  
25

26 74 Ethiopia is one of the countries threatened by COVID-19, a total of 76,098 confirmed cases, 1,204  
27  
28 75 deaths registered.<sup>2</sup> Although the country has not instituted a nation-wide lockdown, a state of  
29  
30 76 emergency has been declared since 14 April 2020.<sup>8</sup> In Ethiopia, many organizations, including the  
31  
32 77 government sector, have been implementing different measures that plans to prevent the virus.  
33  
34 78 Despite the advocacy strategies by the media and numerous organizations to curb the spread of the  
35  
36 79 pandemic, there still exists a gap in adoption and adhering to preventive mechanisms within  
37  
38 80 communities. Most of the reason goes to inadequate knowledge of the disease of prevention  
39  
40 81 technique.<sup>5,9</sup> Community-level knowledge concerning the COVID-19 pandemic plays a crucial  
41  
42 82 role both in the choice of institutionally approved "top-down" medical policies and in grass-roots  
43  
44 83 strategies adopted by communities.<sup>10,11</sup>  
45  
46  
47  
48  
49

50 84 In Ethiopia, the positivity rate of the COVID-19 pandemic is increased from time to time.<sup>12</sup>  
51  
52 85 Findings showed that gender, age, residence, education, and occupation were associated with  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 86 knowledge of the community towards the pandemic.<sup>4,9,11,13</sup> However, community level studies are  
4  
5 87 lacking, particularly in the study areas towards COVID-19 prevention.  
6  
7

8  
9 88 There is a huge gap in preventing the pandemic since it is a new phenomenon, and little is known  
10  
11 89 about the knowledge level of the disease by the general public.<sup>14</sup> This indicates the need for  
12  
13 90 research in every aspect, but in developing countries, prioritizing prevention is the only effective  
14  
15 91 way to curb the pandemic. So to do this, the community must know and implement prevention  
16  
17 92 mechanisms. For the intervention to be successful, it is needed to have evidence that shows the  
18  
19 93 level of the knowledge towards COVID-19 prevention strategies at the community level.  
20  
21 94 Therefore, this research is aimed to assess the level of the knowledge and influencing factors  
22  
23 95 towards COVID-19 prevention in Dessie and Kombolcha city administrations where these are the  
24  
25 96 corridor sites for many entries in northeast Ethiopia.  
26  
27  
28  
29

## 30 31 97 **METHODS**

### 32 33 98 **Study settings**

34  
35 99 The study was conducted from June 7-14, 2020, in Dessie and Kombolcha city administrations,  
36  
37 100 Amhara National Regional State, North-East Ethiopia. Dessie is 401 kilometers and Kombolcha  
38  
39 101 376 kilometers away from Addis Ababa, the capital city of Ethiopia respectively. Dessie city has  
40  
41 102 26 *Kebeles* (the lowest administrative level in Ethiopia) (18 urban and 8 rural), and Kombolcha  
42  
43 103 has 11 *Kebeles* (5 urban and 6 rural), a total of 37 *Kebeles* in the two city administrations. *Kebeles*  
44  
45 104 are the lowest administrative level in Ethiopia. According to 2012 E.C populations projection, in  
46  
47 105 Dessie 91,870 households and in Kombolcha 34,097 households. A total of 125,967 households  
48  
49 106 in the two city administrations. The total population of Dessie is 385,850 and Kombolcha 143,214.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 107 The two city administrations have 529,064 inhabitants, of which 262,157 males and 266,907 are  
4  
5 108 females.<sup>15</sup>  
6  
7

8 109 Dessie is the 2<sup>nd</sup> populated metropolitan city and the corridor site of many entries in Amhara  
9  
10 110 regional state, north-East, Ethiopia. Kombolcha as the twin city of Dessie which lies some 25 km  
11  
12 111 to the northwest. Kombolcha is connected with Dessie through road transportation. This city  
13  
14 112 shares Kombolcha Airport with neighboring Dessie. The city is served by a station on the Awash–  
15  
16 113 Weldiya Railway and neighbors with the Afar region. It is a gate site where foreigners and migrants  
17  
18 114 live that mainly came from Djibouti and Arab countries. <sup>16</sup>  
19  
20  
21  
22

### 23 115 **Study design and period**

24  
25 116 Population-based cross-sectional study was conducted to assess the knowledge level and  
26  
27 117 influencing factors towards COVID-19 prevention strategies among the residents of Dessie and  
28  
29 118 Kombolcha City administrations from July 01-07, 2020.  
30  
31  
32

### 33 119 **Population**

34  
35 120 The source of population was all the residents of Dessie and Kombolcha city administrations of  
36  
37 121 Amhara Regional State, Northeast Ethiopia. The study population was residents found in the  
38  
39 122 selected *Kebeles* in Dessie and Kombolcha City administrations who had the chance to be included  
40  
41 123 in the sample.  
42  
43  
44

### 45 124 **Inclusion and exclusion criteria**

46  
47 125 Household heads or anyone from the house with the age of above 18 years were included in the  
48  
49 126 study. They have been living in the study areas in the past two months preceding the survey.  
50  
51 127 Whereas, participants who were critically and mentally ill during the study period were excluded  
52  
53 128 from the study.  
54  
55  
56  
57  
58  
59  
60

### 129 **Sample size determination and Sampling procedures**

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

$$137 \quad n = \frac{(Z_{\alpha/2})^2 * p(1-p)}{w^2} * DE \Rightarrow n = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} * 2 = 768$$

138 By adding 10% non-response rate= 845

139 Where, prevalence (p) =50%; w=tolerable margin of error=5%;  $Z^{\alpha/2}$  at 95%=1.96;

140 DE= Design effect

141 For the second objective, a double population proportion formula was used to estimate and  
 142 maximize possible sample sizes using the assumptions of 80% power, and 95% confidence level  
 143 as below (Table 1).

144 Table 1. Sample size determinations for the second objective of the study are conducted to assess  
 145 knowledge level and factors towards COVID-19 prevention among residents of Dessie and  
 146 Kombolcha city administrations, northeast Ethiopia

Variables name	References	Percentage of unexposed	80% power	95% CI	Odds ratio	Sample size	Design effect	10% NRR	Final sample size
Sex	17	74	80	0.05	0.40	186	2	37	409
Education	17	51.7	80	0.05	6.30	62	2	12	136

Occupation	<sup>18</sup>	9.3	80	0.05	5.7	86	2	17	189
------------	---------------	-----	----	------	-----	----	---	----	-----

147

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

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

### 158 **Data collection**

159 Data on socio-demographic variables, availability of household materials/related variables, source  
160 of information related to variables, and knowledge related variables were collected through a  
161 pretested and structured interviewer administered questionnaire. The questions were adapted from  
162 the WHO COVID-19 guideline,<sup>19</sup> and similar study done in China.<sup>20</sup>

### 163 **Measurement of COVID-19 - related knowledge (Dependent variable)**

164 The knowledge section of the questionnaire had 35 questions. The questions were intended to  
165 assess the participants' knowledge of COVID-19 plausibly influencing their health care seeking  
166 behavior. Yes/correct responses were labeled as "1", and incorrect/no/I don't know responses were  
167 labeled as "0". The scores were added up to create knowledge ranking for the aforementioned  
168 categories. The pooled scores of questions were classified into inadequate and adequate knowledge

1  
2  
3 169 using median (50%) score values. Inadequate Knowledge was labeled as “1”, and Adequate  
4  
5 170 Knowledge was labeled as “0”.

### 171 **Operational definitions**

172 The respondent was classified as having “**Inadequate Knowledge**” when he/she answered  
173 correctly below 50% of COVID-19 related knowledge questions. Whereas, the respondent was  
174 classified as having “**Adequate Knowledge**” when he/she answered correctly 50% and above of  
175 COVID-19 related knowledge questions.

### 176 **Data quality assurance**

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

### 183 **Data processing and analysis**

184 The collected data were coded, edited, entered Epi-Info version 7.2 and analyzed using the  
185 Statistical Package for the Social Sciences (SPSS) version 20. Internal consistency of the knowledge  
186 measures was tested using a reliability test where the Cronbach alpha coefficient aided in  
187 determining the reliability of the variables. The results showed that the Cronbach alpha for  
188 knowledge questions was 0.801. The result added credibility where, according to Griethuijsen, the  
189 range of Cronbach alpha from 0.6 to 0.7 is considered adequate and reliable.<sup>21</sup> It is proved that the  
190 items used to measure knowledge on COVID-19 are therefore acceptable. Descriptive summary  
191 statistics such as mean  $\pm$  SD, median  $\pm$  IQR, frequencies and proportions were presented as

192 appropriate. Since the cross-sectional survey was conducted for a single outcome variable and  
 193 multiple response variables, binary logistic regression analysis was done and all independent  
 194 variables at  $p < 0.20$  were taken to a multivariable logistic regression analysis<sup>22</sup> to identify  
 195 associated factors with outcome variables. The statistical significance of the variables at the final  
 196 model was declared at  $p < 0.05$  and 95% confidence level for the adjusted odds ratio. The Hosmer  
 197 and Lemeshow statistics and the deviance coefficient were used to check the goodness of the fit of  
 198 the model.

## 199 RESULTS

### 200 Socio-demographic characteristics of participants

201 A total of 828 participants were involved with a response rate of 98%. Among the study participants,  
 202 541 (65.3%) are from Dessie city, and the rest are from Kombolcha city. Among the participants, 511  
 203 (61.7%) were females; 423 (51.1%) were Muslim followed by 385 (46.5%) Orthodox Tewahido religions'  
 204 followers. The mean (Standard Deviation) age of the study participants was 39 ( $\pm 14$ ) years. From all  
 205 participants, 672 (81.2%) were living in urban settings; 576 (69.6%) were married, 167 (20.2) were single  
 206 headed participants; 218 (26.4%) had no formal education. Regarding their occupational status, 246  
 207 (29.7%) were housewives followed by 176 (21.3%) government employees (Table 2).

208 **Table 2.** Socio-demographic characteristics of participants in Dessie and Kombolcha city  
 209 Administrations, northeast 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</b>			39 ( $\pm 14$ )
18-35	422	51.0	
36-64	341	41.2	
$\geq 65$	65	7.9	

<b>Religion</b>		
Orthodox Tewahedo	385	46.5
Muslim	423	51.1
Catholic	8	1.0
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	30.0
<b>Main occupation</b>		
House wife	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

210

211 **Household level and Media related characteristics**

212 The median ( $\pm$ interquartile range) for family size of the participants was 4.42 ( $\pm$ 1.8). The median

213 ( $\pm$ IQR) income of the participants was 3,000 ( $\pm$ 2500) ETB. Of the participants, 29 (3.5%) use their

214 water from a spring water source (any type: protected or unprotected). Among them, 584 (70.5%)

215 had lack adequacy of water (<20L/C/D) and, 789 (95.3%) access their source of water within less

216 than 30 minutes (1km round trip). About 720 (87%) had a functional TV in the household, 78

217 (94.3%) had a cell phone (Table 3).

218 Table 3. Household level and media related characteristics of participants in Dessie and

219 Kombolcha city Administration, northeast Ethiopia, 2020

<b>HH and media characteristics</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Median (±IQR)</b>
Family size			
1-3	251	30.3	4.42(±1.8)
4-6	476	57.5	
>6	101	12.2	
Monthly Income at household level			3000(±2500)
Type of water sources			
Piped water in dwelling	136	16.4	13.15( 12.00)
Piped water at yard	585	70.7	
Communal "Bono"	78	9.4	
Spring (any type: protected or unprotected)	29	3.5	
Amount of water in Litter/Capita/Day			
No access (<20L/C/D)	584	70.5	2.00(±2.00)
Basic access (≥20L/C/D)	244	29.5	
Time to take water in minutes			
≤30 minutes (1 km round trip)	789	95.3	
>30 minutes (>1 km round trip)	39	4.7	
Functional TV in the household			
No	108	13.0	87.0
Yes	720	87.0	
Functional radio in the household			
No	347	41.9	58.1
Yes	481	58.1	
Functional cell phone in the household			
No	47	5.7	94.3
Yes	781	94.3	

220

## 221 **Factors associated with Knowledge of participants towards prevention of COVID-19**

### 222 **pandemic**

223 In the bivariate logistic regression (first model), seventeen independent variables were entered. In  
 224 the multivariable logistic regression (second model), only seven variables were significantly  
 225 associated with inadequate knowledge of participants towards the prevention of the COVID-19  
 226 pandemic. Variables associated with inadequate knowledge towards COVID-19 prevention were  
 227 sex, age, residence, educational level, information from health care workers, mass media and social  
 228 media.



1  
2  
3 229 Female participants were 41% more likely to have inadequate knowledge towards COVID-19 as  
4  
5 230 compared to their counterparts (AOR=1.41, 95% CI; 1.03, 1.92). Participants whose age group  
6  
7 231  $\geq 65$  years were 2.72 times more likely to have inadequate knowledge of COVID-19 as compared  
8  
9 232 to the age groups of 18-35 years (AOR= 2.27, 95% CI; 1.45, 5.11). People who live in rural areas  
10  
11 233 are 2.70 times more likely to have inadequate knowledge as compared to urban dwellers. The  
12  
13 234 participants who were unable to read and write were 60% times more likely to have inadequate  
14  
15 235 knowledge compared to those who were attending high level education (AOR=1.60, 95% CI; 1.02,  
16  
17 236 2.51). Participants who did not receive information from health care workers towards COVID-19  
18  
19 237 were 95% times more likely to have inadequate knowledge as compared to those who received  
20  
21 238 information from health care workers (AOR=1.95, 95% CI; 1.35, 2.82). Among the participants  
22  
23 239 who were not receiving information about COVID-19 from mass media, they were 2.6 times more  
24  
25 240 likely to have inadequate knowledge compared to those who received information from mass  
26  
27 241 media (AOR=2.57, 95% CI; 1.58, 4.19]. In addition, participants who were not receiving  
28  
29 242 information from social media were 2.13 times more likely to have inadequate knowledge about  
30  
31 243 COVID-19 as compared to those who received it from social media (AOR= 2.13, 95% CI; 1.33,  
32  
33 244 3.42) (Table 4).

## 245 **DISCUSSION**

246 This finding showed that the proportion of inadequate knowledge towards COVID-19 prevention  
247 was 54.11% (95% CI: 50.6, 57.6), which is higher than studies conducted in Debre Birhan  
248 University, Ethiopia (26.2%),<sup>23</sup> Syrians (40%),<sup>24</sup> Iran (39.2%),<sup>25</sup> Bangladesh (51.7%),<sup>26</sup> Saudi  
249 Arabia (18.4%),<sup>27</sup> across the world (20.1%),<sup>28</sup> Malaysia (19.5%),<sup>29</sup> India (13.3%),<sup>30</sup> three Middle  
250 Eastern countries (Jordan, Saudi Arabia and Kuwait) (33.9%)<sup>11</sup> and Sudan (9.4%).<sup>31</sup> The  
251 differences in level of knowledge have been subjected to variation in the cut-values. In addition,

1  
2  
3 252 the discrepancies might be due to differences in the reach of community awareness creation  
4  
5 253 through mass media and social media.  
6  
7

8 254 In this study, the odds of inadequate knowledge towards COVID-19 were 1.4 times higher among  
9  
10 255 female participants compared to male participants. This finding is similar to studies conducted in  
11  
12 256 Iran,<sup>25</sup> Bangladesh,<sup>32,33</sup> Sudan.<sup>31</sup> In Ethiopia, most of home-based activities such as food  
13  
14 257 preparation and food serving, child feeding, cloth hygiene, and home-based sanitation are left for  
15  
16 258 females. Therefore, females may not get access to media because of their busy time taking care of  
17  
18 259 the family members. Consequently, they are prone to inadequate knowledge of COVID-19  
19  
20 260 compared to males.  
21  
22  
23  
24

25 261 The study indicated that older adults (i.e. 65 and above years of age) had 3-folds greater odds of  
26  
27 262 inadequate knowledge towards COVID 19 compared to adults. This finding is similar to studies  
28  
29 263 conducted at Debre Birhan University, Ethiopia,<sup>23</sup> Iran,<sup>25</sup> Bangladesh, <sup>26,33</sup> medical college in  
30  
31 264 Uttarakhand, India.<sup>30</sup> In most of the cases, older adults are not accessible to modern technologies  
32  
33 265 in Ethiopia. Hence, they will have inadequate knowledge towards COVID-19 compared to adults  
34  
35 266 due to the shortage of information.  
36  
37  
38  
39

40 267 The odds of inadequate knowledge were 2.7 times higher among participants who were residing  
41  
42 268 in rural areas compared to those who were living in urban dwellers. This finding is similar to  
43  
44 269 studies conducted in Bangladesh, <sup>32,34</sup> Sudan.<sup>31</sup> In Ethiopia, most of the people are living in rural  
45  
46 270 areas which is hard to reach for awareness creation using mass media or social media (telegram,  
47  
48 271 Facebook, WhatsUp and Instagram). Thus, people in rural settings had inadequate knowledge of  
49  
50 272 COVID-19 prevention and control measures compared to urban populations who are easily  
51  
52 273 accessible to different sources of media to acquire information regarding COVID-19.  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 274 Moreover, participants who were unable to read and write were 1.6 times more likely to have  
4  
5 275 inadequate knowledge of COVID-19 compared to those who attended tertiary level educations.  
6  
7 276 This finding is similar to studies conducted in Syrians,<sup>24</sup> Iran,<sup>25</sup> rural residents in China,<sup>35</sup> Sudan,<sup>31</sup>  
8  
9 277 Bangladesh,<sup>32</sup> Nepal.<sup>36</sup> In Ethiopia, most of the unable to read and write segment of the population  
10  
11 278 are found in rural areas. Those unable to read and write people are not accessible to media which  
12  
13 279 are the ultimate source of information to acquire basic knowledge regarding prevention and control  
14  
15 280 modalities of COVID-19 infections. Thus, participants who were unable to read and write are less  
16  
17 281 knowledgeable about COVID-19 compared to tertiary educated participants.  
18  
19  
20  
21

22 282 The study revealed that the odds of inadequate knowledge were twofold times higher among  
23  
24 283 participants who were not receiving information regarding COVID-19 from health care workers  
25  
26 284 compared to those who were receiving from health care workers. Moreover, the odds of inadequate  
27  
28 285 knowledge were 2.5 times higher among participants who were not receiving information  
29  
30 286 regarding COVID-19 from mass media (TV/Radio) compared to their counterparts. Furthermore,  
31  
32 287 the odds of inadequate knowledge were 2 times higher among participants who were not receiving  
33  
34 288 information regarding COVID-19 from social media compared to those who were received from  
35  
36 289 social media. This finding is similar to a study conducted in eight referral hospitals, Ethiopia.<sup>37</sup>  
37  
38 290 The community may get information regarding the COVID-19 pandemic from different sources.  
39  
40 291 These sources include health care workers, mass media (TV, radio, newspapers, and magazines),  
41  
42 292 social media (telegram, Facebook, WhatsApp, Instagram, tweeters), and religious leaders. Thus,  
43  
44 293 community members who are not accessible to these sources are less knowledgeable about  
45  
46 294 COVID-19 compared to those who are accessible to the listed sources of information.  
47  
48  
49  
50  
51

52 295 The findings may have implications in the prevention campaign/program of the new corona virus  
53  
54 296 pandemic, particularly in the study settings. This study helps other researchers as a baseline  
55  
56  
57  
58  
59  
60

1  
2  
3 297 information for community-level studies. This finding may enforce the local as well as national  
4  
5 298 Anti-COVID-19 programmers to revise their campaign plans to strengthen the efforts against the  
6  
7  
8 299 COVID-19 pandemic. This study extracted community level information regarding participants'  
9  
10 300 knowledge about COVID-19 prevention from the hotspot areas of COVID-19. However, this study  
11  
12 301 is limited due to its cross-sectional design/behavior which could not show cause and effect  
13  
14  
15 302 relationship.

### 16 17 18 303 **CONCLUSIONS**

19  
20 304 In this study, more than half of the study participants had inadequate knowledge about COVID-19  
21  
22 305 prevention among residents of Dessie and Kombolcha city administrations, northeast Ethiopia.  
23  
24 306 Findings from this study showed that sex, age, residence, educational level, information seeking  
25  
26  
27 307 from health care workers, mass media and social media were significantly associated with  
28  
29 308 inadequate knowledge.

30  
31  
32 309 This study recommends revising the COVID-19 prevention plan to increase community awareness  
33  
34 310 towards the COVID-19 pandemic. Strengthening the community to consider health care workers  
35  
36  
37 311 and mass media as a source of COVID-19 related information might be encouraged. House to  
38  
39 312 house awareness creation might be important to address older adults who are more vulnerable to  
40  
41 313 the pandemic. Females' empowerment in formal education shall be strengthened to increase their  
42  
43  
44 314 awareness and exposure to the latest information. The city administrations shall focus on their rural  
45  
46 315 residents to access and have an appropriate information towards COVID-19 prevention.

### 47 48 49 316 **List of abbreviations**

50  
51 317 AOR: adjusted odds ratio; CI: confidence interval; COVID-19: Coronavirus disease 2019; IQR:  
52  
53  
54 318 interquartile range; L/C/D: liter per capita per day; OR: odds ratio; SD: standard deviation  
55  
56  
57  
58  
59  
60

## 319 **Declarations**

### 320 **Ethics approval and consent to participate**

321 Ethical clearance was obtained from Ethical Review Committee [**Reference number:**  
322 **CMHS/311/036/12**] of College of Medicine and Health Sciences, Wollo University. Permission  
323 letter was obtained from Dessie and Kombolcha town administrations health department and  
324 offices, then from kebele administrations involved in the study. Informed verbal consent was  
325 obtained from each study participant. The information gathered from the participants was used for  
326 research purpose and confidentiality kept. Participation in the study was on a voluntary basis and  
327 participants who were unwilling to participate in the study and those who wish to quit from the  
328 study at any point in time informed to do so without any restriction.

### 329 **Consent for publication**

330 Not applicable.

### 331 **Data sharing statement**

332 The data used to produce this manuscript are available in Epi-Info version 7.2 and SPSS version  
333 20 databases and the authors are prepared to share their data on request recognizing the benefits of  
334 such transparency.

### 335 **Competing interests**

336 No competing interests for any authors.

### 337 **Patient and public involvement**

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

### 340 **Funding**

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

#### 344 **Contributors**

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

#### 349 **Acknowledgements**

350 The authors are very grateful to Institutional Review Board (IRB) of College of Medicine and  
351 Health Sciences, Wollo University for the approval of the ethical clearance. We would like to  
352 thank the health departments of the two city administrations for their cooperation. We also thank  
353 all individuals participated in this study for their cooperation in taking part in this study.

#### 354 **Additional information**

355 The questionnaire used for this study was available here (**Supplementary file**).

#### 356 **REFERENCES**

- 357 1 Velavan, T. P. & Meyer, C. G. The COVID-19 epidemic. *Tropical medicine & international health* **25**,  
358 278 (2020).
- 359 2 World Health Organization. *WHO Coronavirus Disease (COVID-19) Dashboard*,  
360 <<https://covid19.who.int/>> (2020).
- 361 3 Organization, W. H. & organization, W. h. (2020).
- 362 4 Zegarra-Valdivia, J., Vilca, B. N. C. & Guerrero, R. J. A. Knowledge, perception and attitudes in Regard  
363 to COVID-19 Pandemic in Peruvian Population. (2020).
- 364 5 Tavakoli, A., Vahdat, K. & Keshavarz, M. Novel coronavirus disease 2019 (COVID-19): an emerging  
365 infectious disease in the 21st century. *ISMJ* **22**, 432-450 (2020).
- 366 6 Chukwuorji, J. C. & Iorfa, S. K. Commentary on the coronavirus pandemic: Nigeria. *Psychological*  
367 *Trauma: Theory, Research, Practice, and Policy* **12**, S188 (2020).
- 368 7 Olusola, A., Olusola, B., Onafeso, O., Ajiola, F. & Adelabu, S. Early geography of the coronavirus  
369 disease outbreak in Nigeria. *GeoJournal*, 1-15 (2020).

- 1  
2  
3 370 8 Ethiopia Embassy UK. (2020).  
4 371 9 Haque, T. *et al.* Knowledge, attitude and practices (KAP) towards COVID-19 and assessment of risks  
5 372 of infection by SARS-CoV-2 among the Bangladeshi population: An online cross sectional survey.  
6 373 (2020).  
7  
8 374 10 Adhikari, S. P. *et al.* Epidemiology, causes, clinical manifestation and diagnosis, prevention and  
9 375 control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review.  
10 376 *Infectious diseases of poverty* **9**, 1-12 (2020).  
11 377 11 Naser, A. Y. *et al.* Knowledge and practices towards COVID-19 during its outbreak: a multinational  
12 378 cross-sectional study. *medRxiv* (2020).  
13 379 12 Deribe, K. *COVID-19 in Ethiopia: status and responses*, <[https://rstmh.org/news-blog/news/covid-](https://rstmh.org/news-blog/news/covid-19-in-ethiopia-status-and-responses)  
14 380 [19-in-ethiopia-status-and-responses](https://rstmh.org/news-blog/news/covid-19-in-ethiopia-status-and-responses)> (2020).  
15 381 13 Abdelhafiz, A. S. *et al.* Knowledge, perceptions, and attitude of egyptians towards the novel  
16 382 coronavirus disease (COVID-19). *Journal of Community Health*, 1-10 (2020).  
17 383 14 Austrian, K. *et al.* COVID-19 related knowledge, attitudes, practices and needs of households in  
18 384 informal settlements in Nairobi, Kenya. (2020).  
19 385 15 CSA (Ethiopia). *Population Projections for Ethiopia - Central Statistical Agency*,  
20 386 <[http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037)  
21 387 [2007-2037?download=936:population-projection-2007-2037](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037)> (2019).  
22 388 16 Tadesse Tamrat. *Kombolcha city*, <<https://en.wikipedia.org/wiki/Kombolcha>> (2019).  
23 389 17 Hayat, K. *et al.* View of Pakistani Residents toward Coronavirus Disease (COVID-19) during a Rapid  
24 390 Outbreak: A Rapid Online Survey. *Int J Environ Res Public Health* **17**, 3347,  
25 391 doi:10.3390/ijerph17103347 (2020).  
26 392 18 Kebede, Y., Yitayih, Y., Birhanu, Z., Mekonen, S. & Ambelu, A. Knowledge, perceptions and  
27 393 preventive practices towards COVID-19 early in the outbreak among Jimma university medical  
28 394 center visitors, Southwest Ethiopia. *PLoS One* **15**, e0233744-e0233744,  
29 395 doi:10.1371/journal.pone.0233744 (2020).  
30 396 19 Organization, W. H. Critical preparedness, readiness and response actions for COVID-19: interim  
31 397 guidance, 7 March 2020. (World Health Organization, 2020).  
32 398 20 Zhong, B.-L. *et al.* Knowledge, attitudes, and practices towards COVID-19 among Chinese residents  
33 399 during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey.  
34 400 *International journal of biological sciences* **16**, 1745 (2020).  
35 401 21 Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H. & Mohamad, E. Public knowledge, attitudes and  
36 402 practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One* **15**, e0233668-e0233668,  
37 403 doi:10.1371/journal.pone.0233668 (2020).  
38 404 22 Hidalgo, B. & Goodman, M. Multivariate or multivariable regression? *American journal of public*  
39 405 *health* **103**, 39-40 (2013).  
40 406 23 Aynalem, Y. A., Akalu, T. Y., Gebresellassie, B., Sharew, N. T. & Shiferaw, W. S. Assessment of  
41 407 undergraduate student knowledge, practices, and attitude towards COVID-19 in Debre Berhan  
42 408 University, Ethiopia.  
43 409 24 Al Ahdab, S. Knowledge, Attitudes and Practices (KAP) towards pandemic COVID-19 among Syrians.  
44 410 (2020).  
45 411 25 Erfani, A., Shahriarirad, R., Ranjbar, K., Mirahmadzadeh, A. & Moghadami, M. Knowledge, attitude  
46 412 and practice toward the novel coronavirus (COVID-19) outbreak: A population-based survey in Iran.  
47 413 *Bull World Health Organ, E-pub* **30** (2020).  
48 414 26 Byanaku, A. & Ibrahim, M. Knowledge, attitudes, and practices (KAP) towards COVID-19: A quick  
49 415 online cross-sectional survey among Tanzanian residents. *medRxiv* (2020).  
50 416 27 Al-Hanawi, M. *et al.* Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the  
51 417 Kingdom of Saudi Arabia: A Cross-Sectional Study. *Front. Public health* **8**, 217 (2020).  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 418 28 Ali, M. *et al.* Knowledge, attitude, practice and fear of COVID-19: A cross-cultural study. *medRxiv*  
4 419 (2020).  
5 420 29 Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H. & Mohamad, E. Public knowledge, attitudes and  
6 421 practices towards COVID-19: A cross-sectional study in Malaysia. *Plos one* **15**, e0233668 (2020).  
7 422 30 Maheshwari, S., Gupta, P. K., Sinha, R. & Rawat, P. Knowledge, attitude, and practice towards  
8 423 coronavirus disease 2019 (COVID-19) among medical students: A cross-sectional study. *Journal of*  
9 424 *Acute Disease* **9**, 100 (2020).  
10 425 31 Mohamed, A. *et al.* Knowledge, attitude and practice of the Sudanese people towards COVID-19: An  
11 426 online survey. (2020).  
12 427 32 Karim, A. *et al.* Knowledge and attitude towards COVID-19 in Bangladesh: Population-level  
13 428 estimation and a comparison. *Nature* **5**, 536-544 (2020).  
14 429 33 Paul, A. *et al.* Knowledge, Attitude and Practice Towards Novel Corona Virus among Bangladeshi  
15 430 People: Implications for mitigation measures. *medRxiv* (2020).  
16 431 34 Ferdous, M. Z., Islam, M. S., Sikder, M. T., Mosaddek, A. S. M. & Zegarra-Valdivia, J. Knowledge,  
17 432 attitude, and practice regarding COVID-19 outbreak in Bangladeshi people: An online-based cross-  
18 433 sectional study. *medRxiv* (2020).  
19 434 35 Lihua, M. *et al.* Knowledge, beliefs/attitudes and practices of rural residents in the prevention and  
20 435 control of COVID-19: An online questionnaire survey. (2020).  
21 436 36 Paudel, S., Shrestha, P., Karmacharya, I. & Pathak, O. K. Knowledge, attitude, and practices (KAP)  
22 437 towards COVID-19 among Nepalese residents during the COVID-19 outbreak: An online cross-  
23 438 sectional study. (2020).  
24 439 37 Jemal, B. *et al.* Knowledge, attitude and practice of healthcare workers towards COVID-19 and its  
25 440 prevention in Ethiopia: a multicenter study. (2020).  
26  
27  
28  
29  
30 441  
31

32 442 Table 4. Bi-variable and multivariable logistic regression of knowledge towards COVID-19  
33 443 pandemic among residents of Dessie and Kombolcha city administration, northeast Ethiopia, 2020  
34 444 (n=828).  
35  
36  
37

Variables	Knowledge level, n (%)		Crude odds ratio (COR)		Adjusted odds ratio (AOR)	
	Inadequate	Adequate	OR	95% CI	OR	95% CI
Sex						
Male	156(49.2)	161(50.8)	1		1	
Female	292(57.1)	219(42.9)	1.38	1.04, 1.82*	1.41	<b>1.03, 1.92*</b>
Age						
18-35	215(50.9)	207(49.1)	1		1	
36-64	185(54.3)	156(45.7)	1.14	0.86, 1.52	1.14	0.83, 1.57
>=65	48(73.8)	17(26.2)	2.72	1.51, 4.88*	2.72	<b>1.45, 5.11*</b>
Place of residence						
Urban	333(49.6)	339(50.4)	1		1	
Rural	115(73.7)	41(26.3)	2.86	1.94, 4.21*	2.69	<b>1.78, 4.07*</b>
Marital status						
Single	92(55.1)	75(44.9)	1		1	
Married	307(53.3)	269(46.7)	0.93	0.66, 1.32	-	-



1							
2							
3	Divorced	27(57.4)	20(42.6)	1.10	0.57, 2.12	-	-
4	Widowed	22(57.9)	16(42.1)	1.12	0.55, 2.29	-	-
5							
6	Education level						
7	Unable to read and write	94(61.4)	59(38.6)	2.48	1.64, 3.75*	1.60	<b>1.02, 2.51*</b>
8	Able to read and write with informal education	46(70.8)	19(29.2)	3.77	2.09, 6.81*	2.29	<b>1.22, 4.30*</b>
9							
10	Primary school (grade 1-8)	98(62.0)	60(38.0)	2.54	1.69, 3.83*	1.67	<b>1.08, 2.60*</b>
11	Secondary school (grade 9-12)	113(55.4)	91(44.6)	1.93	1.33, 2.82*	1.50	<b>1.01, 2.24*</b>
12							
13	Above 12 grade (University/College/TVET)	97(39.1)	151(60.9)	1		1	
14							
15	Main occupation						
16	House wife	142(57.7)	104(42.3)	1.37	0.76, 2.44	0.73	0.38, 1.44
17	Merchant	84(50.0)	84(50.0)	1.00	0.55, 1.83	0.74	0.38, 1.44
18	Farmer	24(64.9)	13(35.1)	1.85	0.79, 4.34	0.67	0.25, 1.83
19	Government employee	83(47.2)	93(52.8)	0.89	0.49, 1.63	0.99	0.50, 1.95
20	NGO employee	31(49.2)	32(50.8)	0.97	0.47, 1.99	0.88	0.40, 1.92
21	Labourer	56(68.3)	26(31.7)	2.15	1.07, 4.34*	1.37	0.63, 2.96
22	Student	28(50.0)	28(50.0)	1		1	
23							
24	Family size						
25	1-3	137(54.6)	114(45.4)	1		1	
26	4-6	255(53.6)	221(46.4)	0.96	0.71, 1.31	-	-
27	>6	56(55.4)	45(44.6)	1.04	0.65, 1.65	-	-
28							
29	Type of water sources						
30	Piped water in dwelling	64(47.1)	72(52.9)	1		1	
31	Piped water at yard	307(52.5)	278(47.5)	1.24	0.86, 1.81	1.08	0.72, 1.62
32	Communal "Bono"	53(67.9)	25(32.1)	2.39	1.33, 4.27*	1.08	0.54, 2.17
33	Spring (any type: protected or unprotected)	24(82.8)	5(17.2)	5.40	1.95, 14.99*	2.58	0.77, 8.67
34							
35	Amount of water in Litter/Capita/Day						
36	No access (<20L/C/D)	324(55.5)	260(44.5)	1.21	0.89, 1.63	-	-
37	Basic access (>=20L/C/D)	124(50.8)	120(49.2)	1		1	
38							
39	Time to take/fetch water in minutes						
40	<=30 minutes (1 km round trip)	419(53.1)	370(46.9)	1		1	
41	>30 minutes (>1 km round trip)	29(74.4)	10(25.6)	2.56	1.23, 5.33*	0.69	0.25, 1.92
42							
43	Functional TV/radio in the household						
44	No	73(67.6)	35(32.4)	1.92	1.25, 2.95*	0.97	0.58, 1.62
45	Yes	375(52.1)	345(47.9)	1		1	
46							
47	Functional cell phone in the household						
48	No	31(66.0)	16(34.0)	1.69	0.91, 3.14*	0.96	0.47, 1.95
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

1							
2							
3	Yes	417(53.4)	364(46.6)	1		1	
4	COVID-19 Information heard						
5	from family members						
6	No	376(53.1)	332(46.9)	0.76	0.51, 1.12*	0.80	0.50, 1.28
7	Yes	72(60.0)	48(40.0)	1		1	
8	COVID-19 Information heard						
9	from health care workers						
10	No	355(57.5)	262(42.5)	1.72	1.25, 2.36*	1.95	<b>1.35, 2.82*</b>
11	Yes	93(44.1)	118(55.9)	1		1	
12	COVID-19 Information heard						
13	from mass media (TV,...						
14	No	79(71.2)	32(28.8)	2.33	1.51, 3.60*	2.57	<b>1.58, 4.19*</b>
15	Yes	369(51.5)	348(48.5)	1		1	
16	COVID-19 Information heard						
17	from social mass (FB, ...						
18	No	414(57.6)	305(42.4)	2.99	1.95, 4.61*	2.13	<b>1.33, 3.42*</b>
19	Yes	34(36.2)	75(68.8)	1		1	
20	COVID-19 Information heard						
21	from religious leader's						
22	No	428(55.8)	339(44.2)	2.59	1.49, 4.50*	1.16	0.60, 2.28
23	Yes	20(32.8)	41(67.2)	1		1	

445 \*for p<0.20 at bivariate analysis; \*and bold for p<0.05 at multivariable analysis

446

## Annex II: Questionnaire

## Part I: Socio-demographic and media related characteristics of the participants

Town/town/ name ----- kebele\_\_\_\_\_

Code	Questions	Responses	Skip
101.	Sex of the participant	1.Female 2.Male	
102.	Age in years	----- years	
103.	Place of residence	1.Urban 2.Rural	
104.	Marital status	1. Single 2. Married 3. Widowed 4. Divorced	
105.	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others: -----	
106.	Level of Education /What is the highest education level you have attended?	1. Unable to read and write 2. Read and write with informal education 3. Primary education/1-8/ 4. Secondary education 1/9-12/ 5. 12 + Education level	
107.	What is your main occupation?	1. House wife 2. Merchant 3. Farmer 4. Health care worker 5. Government employee	

		6. NGO employee 7. Daily labor 8. Student 9. Others: -----	
108.	Total family size	------(put in number)	
109.	Average monthly income	------(ETB)	
110.	Time to fetch water in minute from source	-----minutes	
111.	Availability of television	1. No 2. Yes	
112.	Availability of radio	1. No 2. Yes	
113.	Availability of mobile phone	1. No 2. Yes	
114.	Water source	1. Piped water in dwelling 2. Piped water at yard 3. Bono water 4. Spring water 5. River water 6. Ground water 7. Other-----	

## Part II: Knowledge related questions

Code	Questions	Responses	Skip
201.	Have you heard about the new coronavirus disease?	0. No 1. Yes	
202.	What do you know about the new coronavirus disease? (Only one option)	Choose one best answer: <b>1.</b> I don't know anything <b>2.</b> It's a virus that can cause a disease <b>3.</b> It's a government's program <b>4.</b> It's a TV/radio campaign	

		<b>5.</b> Others: -----	
203.	If yes Q201, from whom or from where did you hear about the new coronavirus disease? ( <i>Multiple response possible</i> )	<ol style="list-style-type: none"> <li>1. Family members</li> <li>2. Health care workers</li> <li>3. Mass media (TV/Radio)</li> <li>4. Social media (Facebook/telegram/etc....)</li> <li>5. Religious leaders</li> <li>6. Others (Specify)-----</li> </ol>	
204.	What kind of information have you received about the disease? ( <i>Multiple response possible</i> )	<ol style="list-style-type: none"> <li>1. How to protect yourself from the disease?</li> <li>2. Symptoms of the new coronavirus disease</li> <li>3. How it is transmitted</li> <li>4. What to do if you have the symptoms</li> <li>5. Risks and complications</li> <li>6. Other:-----</li> </ol>	
205.	Do you know coronavirus is highly contagious?	<ol style="list-style-type: none"> <li>1. Yes</li> <li>2. No</li> <li>3. Don't know</li> </ol>	
206.	How does the coronavirus spread? (Mark all the ways you think the disease spreads)	<ol style="list-style-type: none"> <li>1. Blood transfusion</li> <li>2. Droplets from infected people</li> <li>3. Airborne</li> <li>4. Direct contact with infected people.</li> <li>5. Touching contaminated objects/surfaces</li> <li>6. Sexual intercourse contact</li> <li>7. Contact with contaminated animals</li> <li>8. Mosquito bites</li> <li>9. Others: -----</li> </ol>	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	207. What are the main symptoms?(Mark all the symptoms you think are caused by the new coronavirus)	<ol style="list-style-type: none"> <li>1. Fever</li> <li>2. Dry Cough</li> <li>3. Shortness of breath and breathing difficulties</li> <li>4. Muscle pain</li> <li>5. Headache</li> <li>6. Diarrhea</li> <li>7. Don't know</li> <li>8. Others:-----</li> </ol>	
19 20 21 22 23 24	208. Does coronavirus have cure treatment?	<ol style="list-style-type: none"> <li>1. Yes</li> <li>2. No</li> <li>3. Don't know</li> </ol>	
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43	209. Do you know how to prevent it? (One or more options possible)	<ol style="list-style-type: none"> <li>1. Sleep under the mosquito net</li> <li>2. Wash your hands regularly using alcohol or soap and water</li> <li>3. Drink only treated water</li> <li>4. Cover your mouth and nose when coughing or sneezing</li> <li>5. Avoid close contact with anyone who has a fever and cough</li> <li>6. Keeping physical/social/distance</li> <li>7. Don't know</li> <li>8. Others: -----</li> </ol>	
44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	210. What more would you like to know about the disease?	<ol style="list-style-type: none"> <li>1.How to protect yourself from the disease</li> <li>2. Symptoms of the new coronavirus disease</li> <li>3. How it is transmitted</li> <li>4. What to do if you have the symptoms</li> </ol>	

		5. Most at risk groups	
		6. Other-----	
213	Do you feel that people in your community know (enough) about the coronavirus disease?  If yes for Q213 Why  If No for Q213 why	1. Yes 2. No  -----  -----	

The interview is ended. Thank you.

Interviewer's name \_\_\_\_\_ signature \_\_\_\_\_ date \_\_\_\_\_

Supervisor name \_\_\_\_\_ signature \_\_\_\_\_ date \_\_\_\_\_

## Research checklist

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

	Item No	Recommendation	Page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2, 5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	1
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	n/a
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	n/a
		(c) Explain how missing data were addressed	9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-12
		(b) Indicate number of participants with missing data for each variable of interest	9-12
Outcome data	15*	Report numbers of outcome events or summary measures	12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted	12



		estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	2
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Knowledge level and factors influencing prevention of COVID-19 pandemic among residents of Dessie and Kombolcha city administrations, northeast Ethiopia: A population-based cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-044202.R2
Article Type:	Original research
Date Submitted by the Author:	24-Oct-2020
Complete List of Authors:	Kassa, Ayesheshim ; Dessie Health Science College , Nursing Mekonen, Asnakew ; Wollo University, Health System Management Yesuf, Kedir; Dessie Health Science College , Basic Health Science Woday, Abay; Samara University, Public Health Bogale, Getahun; Wollo University, Health Informatics
<b>Primary Subject Heading</b>:	Infectious diseases
Secondary Subject Heading:	Public health
Keywords:	Epidemiology < INFECTIOUS DISEASES, PUBLIC HEALTH, Public health < INFECTIOUS DISEASES

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3 **1 Knowledge level and factors influencing prevention of COVID-19 pandemic**  
4  
5  
6 **2 among residents of Dessie and Kombolcha city administrations, northeast**  
7  
8  
9 **3 Ethiopia: A population-based cross-sectional study**  
10

11  
12 4 Ayesheshim Muluneh Kassa<sup>1</sup>, Asnakew Molla Mekonen<sup>2</sup>, Kedir Abdu Yesuf<sup>3</sup>, Abay Woday  
13  
14 5 Tadesse<sup>4</sup>, Getahun Gebre Bogale<sup>5\*</sup>  
15

16  
17 **6 Affiliations**  
18

19  
20 7 <sup>1</sup>Department of Nursing, Dessie Health Science College, Dessie, Ethiopia  
21

22 8 <sup>2</sup>Department of Health System Management, School of Public Health, College of Medicine and  
23  
24 9 Health Sciences, Wollo University, Dessie, Ethiopia  
25

26  
27 10 <sup>3</sup>Department of Basic Health Science, Dessie Health Science College, Dessie, Ethiopia  
28

29 11 <sup>4</sup>Department of Public Health, College of Health Sciences, Samara University, Samara, Ethiopia  
30

31 12 <sup>5</sup>Department of Health Informatics, School of Public Health, College of Medicine and Health  
32  
33 13 Sciences, Wollo University, Dessie, Ethiopia  
34  
35

36 14  
37  
38 15 \*Correspondence: Getahun Gebre Bogale  
39

40 16 Email: [getahungebre21@gmail.com](mailto:getahungebre21@gmail.com)  
41  
42  
43 17  
44  
45  
46 18  
47  
48  
49 19  
50  
51  
52 20  
53  
54  
55 21  
56  
57  
58  
59  
60

## 22 Abstract

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

27 **Design:** Community-based cross-sectional study

28 **Settings:** Dessie and Kombolcha city administrations

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

31 **Methods:** A binary logistic regression was used for a single outcome and multiple response  
32 variables. In the multivariable regression model, a  $p < 0.05$  and adjusted odds ratio (AOR) with  
33 95% confidence interval were used to identify factors associated with knowledge level of the  
34 community. Epi-Info version 7.2 and SPSS version 20 software were used for data entry and  
35 analysis respectively.

36 **Outcome:** Knowledge level

37 **Results:** A total of 828 participants were involved with a response rate of 98%. Females were  
38 61.7%. Participants' mean ( $\pm$ SD) age was 39 ( $\pm$ 14) years. From the total participants; 54.11%  
39 (95% CI: 50.6, 57.6) had inadequate knowledge about COVID-19 prevention. Significant  
40 associations were reported among females (AOR=1.41; 95% CI: 1.03, 1.92); age  $\geq$ 65years  
41 (AOR=2.72; 95% CI: 1.45, 5.11); rural residence (AOR=2.69; 95% CI: 1.78, 4.07); unable to read  
42 and write (AOR=1.60; 95% CI: 1.02, 2.51); information not heard from healthcare workers, mass

1  
2  
3 43 media, and social media (AOR=1.95; 95% CI: 1.35, 2.82), (AOR=2.5; 95% CI: 1.58, 4.19) and  
4  
5 44 (AOR=2.13; 95% CI: 1.33, 3.42) respectively with inadequate knowledge.  
6  
7

8 45 **Conclusion:** These findings revealed >50% of participants had inadequate knowledge about  
9  
10 46 COVID-19. It highlights the need for widespread awareness campaigns about COVID-19 through  
11  
12 47 mass media, healthcare professionals and social media as a source of information. House-to-house  
13  
14 48 awareness creation is recommended to address older adults who are more vulnerable to the  
15  
16 49 pandemic.  
17  
18

19  
20 50 **Keywords:** Knowledge, Factors, COVID-19, Dessie, Kombolcha, Ethiopia  
21  
22

## 23 51 **Strengths and limitations of this study**

- 24  
25  
26 52 • This is the first community-level study in northeast Ethiopia which extracted information  
27  
28 53 regarding participants' knowledge about COVID-19 prevention.  
29  
30  
31 54 • The study addressed hotspot areas of COVID-19 where these are the corridor sites for many  
32  
33 55 entries in northeast Ethiopia  
34  
35  
36 56 • This study is limited due to its cross-sectional design/behavior which lacks a cause and  
37  
38 57 effect relationship.  
39  
40

## 41 58 **INTRODUCTION**

42  
43 59 Coronavirus disease 2019 (COVID-19) was first detected in Wuhan, China, in December 2019  
44  
45 60 and on 30 January 2020. When the virus causes a large burden of morbidity and mortality in China  
46  
47 61 and international locations, the World Health Organization (WHO) declared the current outbreak  
48  
49 62 a public health emergency of international concern.<sup>1</sup> Globally, more than 34,161,721 were infected  
50  
51 63 and nearly 1,016,986 fatalities after being declared as a pandemic by the WHO. In Africa, there  
52  
53 64 are about 1,191,323 confirmed cases and 26,148 deaths reported as of 5:04 pm CEST, 2 October  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 65 2020.<sup>2</sup> International and national borders have been locked down, travel restricted, economies  
4  
5 66 slashed and billions of people are isolated at their own homes as a measure to contain the outbreak.  
6  
7

8  
9 67 The COVID-19 prevention interventions are more appropriate in the community as the knowledge  
10  
11 68 regarding the new infection improves the preparedness of both the healthcare professionals and  
12  
13 69 the general public.<sup>3,4</sup> The virus was rapidly transmitted to many countries across Africa, and the  
14  
15 70 fatality related to COVID-19 has been an increase in the fastest time. In the continent, the infection  
16  
17 71 rate of the COVID-19 may be increased due to less detection rate, live in a crowded place and a  
18  
19 72 weak health system.<sup>1,5-7</sup>  
20  
21  
22

23  
24 73 Ethiopia is one of the countries threatened by COVID-19, a total of 76,098 confirmed cases, 1,204  
25  
26 74 deaths registered.<sup>2</sup> Although the country has not instituted a nation-wide lockdown, a state of  
27  
28 75 emergency has been declared since 14 April 2020.<sup>8</sup> In Ethiopia, many organizations, including the  
29  
30 76 government sector, have been implementing different measures that plans to prevent the virus.  
31  
32 77 Despite the advocacy strategies by the media and numerous organizations to curb the spread of the  
33  
34 78 pandemic, there still exists a gap in adoption and adhering to preventive mechanisms within  
35  
36 79 communities. Most of the reason goes to lack of knowledge of the disease prevention technique.<sup>5,9</sup>  
37  
38 80 Community-level knowledge concerning the COVID-19 pandemic plays a crucial role both in the  
39  
40 81 choice of institutionally approved "top-down" medical policies and in grass-roots strategies  
41  
42 82 adopted by communities.<sup>10,11</sup>  
43  
44  
45  
46

47  
48 83 In Ethiopia, the positivity rate of the COVID-19 pandemic is increased from time to time.<sup>12</sup>  
49  
50 84 Findings showed that gender, age, residence, education, and occupation were associated with  
51  
52 85 knowledge of the community towards the pandemic.<sup>4,9,11,13</sup> However, community level studies are  
53  
54 86 lacking, particularly in the study areas towards COVID-19 prevention.  
55  
56  
57

1  
2  
3 87 There is a huge gap in preventing the pandemic since it is a new phenomenon, and little is known  
4  
5 88 about the knowledge level of the disease by the general public.<sup>14</sup> This indicates the need for  
6  
7  
8 89 research in every aspect, but in developing countries, prioritizing prevention is the only effective  
9  
10 90 way to curb the pandemic. So to do this, the community must know and implement prevention  
11  
12 91 mechanisms. For the intervention to be successful, it is needed to have evidence that shows the  
13  
14 92 level of the knowledge towards COVID-19 prevention strategies at the community level.  
15  
16  
17 93 Therefore, this research is aimed to assess the level of the knowledge and influencing factors  
18  
19 94 towards COVID-19 prevention in Dessie and Kombolcha city administrations where these are the  
20  
21 95 corridor sites for many entries in northeast Ethiopia.  
22  
23  
24

## 25 96 **METHODS**

### 26 27 97 **Study settings**

28  
29 98 The study was conducted from June 7-14, 2020, in Dessie and Kombolcha city administrations,  
30  
31 99 Amhara National Regional State, North-East Ethiopia. Dessie is 401 kilometers and Kombolcha  
32  
33 100 376 kilometers away from Addis Ababa, the capital city of Ethiopia, respectively. Dessie city has  
34  
35 101 26 *Kebeles* (the lowest administrative level in Ethiopia) (18 urban and 8 rural), and Kombolcha  
36  
37 102 has 11 *Kebeles* (5 urban and 6 rural), a total of 37 *Kebeles* in the two city administrations. *Kebeles*  
38  
39 103 are the lowest administrative level in Ethiopia. According to the 2012 E.C populations projection,  
40  
41 104 in Dessie 91,870 households and in Kombolcha 34,097 households. A total of 125,967 households  
42  
43 105 in the two city administrations. The total population of Dessie is 385,850 and Kombolcha 143,214.  
44  
45 106 The two city administrations have 529,064 inhabitants, of which 262,157 males and 266,907 are  
46  
47 107 females.<sup>15</sup>  
48  
49  
50  
51  
52

53 108 Dessie is the 2<sup>nd</sup> populated metropolitan city and the corridor site of many entries in Amhara  
54  
55 109 regional state, north-East, Ethiopia. Kombolcha is the twin city of Dessie which lies some 25 km  
56  
57  
58  
59  
60



1  
2  
3 110 to the northwest. Kombolcha is connected with Dessie through road transportation. This city  
4  
5 111 shares Kombolcha Airport with neighboring Dessie. The city is served by a station on the Awash–  
6  
7 112 Weldiya Railway and neighbors with the Afar region. It is a gate site where foreigners and migrants  
8  
9  
10 113 live that mainly came from Djibouti and Arab countries. <sup>16</sup>  
11  
12

### 13 114 **Study design and period**

15 115 Population-based cross-sectional study was conducted to assess the knowledge level and factors  
16  
17 116 influencing COVID-19 prevention strategies among the residents of Dessie and Kombolcha City  
18  
19  
20 117 administrations from July 01-07, 2020.  
21  
22

### 23 118 **Population**

25 119 The source of population was all the residents of Dessie and Kombolcha city administrations of  
26  
27  
28 120 Amhara Regional State, Northeast Ethiopia. The study population was residents found in the  
29  
30 121 selected *Kebeles* in Dessie and Kombolcha City administrations who had the chance to be included  
31  
32 122 in the sample.  
33  
34

### 35 123 **Inclusion and exclusion criteria**

37 124 Household heads or anyone from the house with the age of above 18 years were included in the  
38  
39  
40 125 study. They have been living in the study areas for the past two months preceding the survey.  
41  
42 126 Whereas, participants who were critically and mentally ill during the study period were excluded  
43  
44  
45 127 from the study.  
46  
47

### 48 128 **Sample size determination and Sampling procedures**

49  
50 129 This study has two objectives: namely; to assess knowledge level and to identify factors  
51  
52 130 influencing the knowledge of the COVID-19 pandemic. Since COVID-19 is a new emerging  
53  
54  
55 131 disease and related evidence is not available at the national level, a single population proportion  
56  
57

1  
2  
3 132 formula was used to estimate the sample size (for knowledge level) by assuming a prevalence of  
4  
5 133 50%, 95% of the confidence level and 5% of the margin of error. The calculated sample size of  
6  
7  
8 134 this study was 768 participants with a design effect of two. By adding a tolerable non-response  
9  
10 135 rate (10%), the total sample size was 845 participants.

$$13 136 \quad n = \frac{(Z_{\alpha/2})^2 * p(1-p)}{w^2} * DE \Rightarrow n = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} * 2 = 768$$

16 137 By adding 10% non-response rate= 845

18 138 Where, prevalence (p) =50%; w=tolerable margin of error=5%;  $Z^{\alpha/2}$  at 95%=1.96;

21 139 DE= Design effect

23 140 For the second objective, a double population proportion formula was used to estimate and  
24  
25 141 maximize possible sample sizes using the assumptions of 80% power and 95% confidence level  
26  
27  
28 142 as below (Table 1).

31 143 Table 1. Sample size determinations for the second objective of the study are conducted to assess  
32  
33 144 knowledge level and factors influencing COVID-19 prevention among residents of Dessie and  
34  
35 145 Kombolcha city administrations, northeast Ethiopia

Variables name	References	Percentage of unexposed	80% power	95% CI	Odds ratio	Sample size	Design effect	10% NRR	Final sample size
Sex	<sup>17</sup>	74	80	0.05	0.40	186	2	37	409
Education	<sup>17</sup>	51.7	80	0.05	6.30	62	2	12	136
Occupation	<sup>18</sup>	9.3	80	0.05	5.7	86	2	17	189

49 146  
50  
51 147 Finally, by comparing the optional sample size estimations above, the maximum sample size, 845,  
52  
53 148 was taken as the final for this study.

1  
2  
3 149 A two-stage sampling technique was employed to select the study participants. A total of 845  
4  
5 150 participants from their respective households were included in the study. Simple random sampling  
6  
7  
8 151 technique was applied to select *Kebeles* to eliminate selection bias. In the first stage, 9 *Kebeles*  
9  
10 152 were selected out of 37 *Kebeles* using a lottery method. In the second stage, data were collected  
11  
12 153 from participants at households using a systematic sampling technique (every 36<sup>th</sup> values were  
13  
14 154 included). Then, based on their population size, the sample size was proportionally allocated to  
15  
16 155 each of the sampled *Kebeles*. Dessie has 26 *Kebeles* (18 urban and 8 rural), and Kombolcha has  
17  
18 156 11 *Kebeles* (5 urban and 6 rural). The two city administrations have a total of 37 *Kebeles*.

### 157 **Data collection**

158 Data on socio-demographic variables, availability of household materials/related variables, source  
159 of information related to variables, and knowledge related variables were collected through a  
160 pretested and structured interviewer administered questionnaire. The questions were adapted from  
161 the WHO COVID-19 guideline,<sup>19</sup> and similar study done in China.<sup>20</sup>

### 162 **Measurement of COVID-19 - related knowledge (Dependent variable)**

163 The knowledge section of the questionnaire had 35 questions. The questions were intended to  
164 assess the participants' knowledge of COVID-19 plausibly influencing their health care seeking  
165 behavior. Yes/correct responses were labeled as "1", and incorrect/no/I don't know responses were  
166 labeled as "0". The scores were added up to create knowledge ranking for the aforementioned  
167 categories. The pooled scores of questions were classified into inadequate and adequate knowledge  
168 using median (50%) score values. Inadequate Knowledge was labeled as "1", and Adequate  
169 Knowledge was labeled as "0".

### 170 **Operational definitions**

1  
2  
3 171 The respondent was classified as having “**Inadequate Knowledge**” when he/she answered  
4  
5 172 correctly below 50% of COVID-19 related knowledge questions. Whereas, the respondent was  
6  
7 173 classified as having “**Adequate Knowledge**” when he/she answered correctly 50% and above of  
8  
9 174 COVID-19 related knowledge questions.  
10  
11  
12

### 13 175 **Data quality assurance**

14  
15  
16 176 Pre-test was conducted on 5% of the total sample size in Kalu district, and the amendment was done  
17  
18 177 according to the finding. Training on the objectives of the study was given to data collectors and supervisors  
19  
20 178 before the day of the data collection. Regular supervision, control as well as support of data collectors by  
21  
22 179 the supervisors were made daily, and each completed questionnaire was checked and the necessary  
23  
24 180 feedback was offered to interviewers. The collected data were properly handled, reviewed and checked for  
25  
26 181 completeness and consistency by the supervisors and before the analysis was completed each day.  
27  
28

### 29 182 **Data processing and analysis**

30  
31 183 The collected data were coded, edited, entered Epi-Info version 7.2 and analyzed using the  
32  
33 184 Statistical Package for the Social Sciences (SPSS) version 20. Internal consistency of the knowledge  
34  
35 185 measures was tested using a reliability test where the Cronbach alpha coefficient aided in  
36  
37 186 determining the reliability of the variables. The results showed that the Cronbach alpha for  
38  
39 187 knowledge questions was 0.801. The result added credibility where, according to Griethuijsen, the  
40  
41 188 range of Cronbach alpha from 0.6 to 0.7 is considered adequate and reliable.<sup>21</sup> It is proved that the  
42  
43 189 items used to measure knowledge on COVID-19 are therefore acceptable. Descriptive summary  
44  
45 190 statistics such as mean  $\pm$  SD, median  $\pm$  IQR, frequencies and proportions were presented as  
46  
47 191 appropriate. Since the cross-sectional survey was conducted for a single outcome variable and  
48  
49 192 multiple response variables, a binary logistic regression analysis was done and all independent  
50  
51 193 variables at  $p < 0.20$  were taken to a multivariable logistic regression analysis<sup>22</sup> to identify  
52  
53  
54  
55  
56  
57  
58  
59  
60

194 associated factors with outcome variables. The statistical significance of the variables at the final  
 195 model was declared at  $p < 0.05$  and 95% confidence level for the adjusted odds ratio. The Hosmer  
 196 and Lemeshow statistics and the deviance coefficient were used to check the goodness of the fit of  
 197 the model.

## 198 RESULTS

### 199 Socio-demographic characteristics of participants

200 A total of 828 participants were involved with a response rate of 98%. Among the study participants,  
 201 541 (65.3%) are from Dessie city, and the rest are from Kombolcha city. Among the participants, 511  
 202 (61.7%) were females; 423 (51.1%) were Muslim followed by 385 (46.5%) Orthodox Tewahido religions'  
 203 followers. The mean (Standard Deviation) age of the study participants was 39 ( $\pm 14$ ) years. From all  
 204 participants, 672 (81.2%) were living in urban settings; 576 (69.6%) were married, 167 (20.2) were single  
 205 headed participants; 218 (26.4%) had no formal education. Regarding their occupational status, 246  
 206 (29.7%) were housewives followed by 176 (21.3%) government employees (Table 2).

207 **Table 2.** Socio-demographic characteristics of participants in Dessie and Kombolcha city  
 208 Administrations, northeast 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</b>			39 ( $\pm 14$ )
18-35	422	51.0	
36-64	341	41.2	
$\geq 65$	65	7.9	
<b>Religion</b>			
Orthodox Tewahedo	385	46.5	
Muslim	423	51.1	
Catholic	8	1.0	
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	30.0
<b>Main occupation</b>		
House wife	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

209

### 210 Household level and Media related characteristics

211 The median ( $\pm$ interquartile range) for family size of the participants was 4.42 ( $\pm$ 1.8). The median  
 212 ( $\pm$ IQR) income of the participants was 3,000 ( $\pm$ 2500) ETB. Of the participants, 29 (3.5%) use their  
 213 water from a spring water source (any type: protected or unprotected). Among them, 584 (70.5%)  
 214 had lack adequacy of water (<20L/C/D) and, 789 (95.3%) access their source of water within less  
 215 than 30 minutes (1km round trip). About 720 (87%) had a functional TV in the household, 78  
 216 (94.3%) had a cell phone (Table 3).

217 Table 3. Household level and media related characteristics of participants in Dessie and  
 218 Kombolcha city Administration, northeast Ethiopia, 2020

HH and media characteristics	Frequency	Percentage	Median ( $\pm$ IQR)
Family size			
1-3	251	30.3	4.42( $\pm$ 1.8)
4-6	476	57.5	
>6	101	12.2	
Monthly Income at household level			3000( $\pm$ 2500)

Type of water sources			
	Piped water in dwelling	136	16.4
	Piped water at yard	585	70.7
	Communal "Bono"	78	9.4
	Spring (any type: protected or unprotected)	29	3.5
Amount of water in Litter/Capita/Day			13.15(12.00)
	No access (<20L/C/D)	584	70.5
	Basic access (>=20L/C/D)	244	29.5
Time to take water in minutes			2.00(+2.00)
	<=30 minutes (1 km round trip)	789	95.3
	>30 minutes (>1 km round trip)	39	4.7
Functional TV in the household			
	No	108	13.0
	Yes	720	87.0
Functional radio in the household			
	No	347	41.9
	Yes	481	58.1
Functional cell phone in the household			
	No	47	5.7
	Yes	781	94.3

219

## 220 **Factors associated with the Knowledge of participants towards prevention of the COVID-** 221 **19 pandemic**

222 In the bivariate logistic regression (first model), seventeen independent variables were entered. In  
 223 the multivariable logistic regression (second model), only seven variables were significantly  
 224 associated with inadequate knowledge of participants towards the prevention of the COVID-19  
 225 pandemic. Variables associated with inadequate knowledge towards COVID-19 prevention were  
 226 sex, age, residence, educational level, information from health care workers, mass media and social  
 227 media.

228 Female participants were 41% more likely to have inadequate knowledge towards COVID-19 as  
 229 compared to their counterparts (AOR=1.41, 95% CI; 1.03, 1.92). Participants whose age group  
 230 >=65 years were 2.72 times more likely to have inadequate knowledge of COVID-19 as compared  
 231 to the age groups of 18-35 years (AOR= 2.27, 95% CI; 1.45, 5.11). People who live in rural areas

1  
2  
3 232 are 2.70 times more likely to have inadequate knowledge as compared to urban dwellers. The  
4  
5 233 participants who were unable to read and write were 60% times more likely to have inadequate  
6  
7 234 knowledge compared to those who were attending high level education (AOR=1.60, 95% CI; 1.02,  
8  
9 235 2.51). Participants who did not receive information from health care workers towards COVID-19  
10  
11 236 were 95% times more likely to have inadequate knowledge as compared to those who received  
12  
13 237 information from health care workers (AOR=1.95, 95% CI; 1.35, 2.82). Among the participants  
14  
15 238 who were not receiving information about COVID-19 from mass media, they were 2.6 times more  
16  
17 239 likely to have inadequate knowledge compared to those who received information from mass  
18  
19 240 media (AOR=2.57, 95% CI; 1.58, 4.19]. In addition, participants who were not receiving  
20  
21 241 information from social media were 2.13 times more likely to have inadequate knowledge about  
22  
23 242 COVID-19 as compared to those who received it from social media (AOR= 2.13, 95% CI; 1.33,  
24  
25 243 3.42) (Table 4).

## 244 **DISCUSSION**

245 This finding showed that the proportion of inadequate knowledge towards COVID-19 prevention  
246 was 54.11% (95% CI: 50.6, 57.6), which is higher than studies conducted in Debre Birhan  
247 University, Ethiopia (26.2%),<sup>23</sup> Syrians (40%),<sup>24</sup> Iran (39.2%),<sup>25</sup> Bangladesh (51.7%),<sup>26</sup> Saudi  
248 Arabia (18.4%),<sup>27</sup> across the world (20.1%),<sup>28</sup> Malaysia (19.5%),<sup>29</sup> India (13.3%),<sup>30</sup> three Middle  
249 Eastern countries (Jordan, Saudi Arabia and Kuwait) (33.9%)<sup>11</sup> and Sudan (9.4%).<sup>31</sup> The  
250 differences in level of knowledge have been subjected to variation in the cut-values. In addition,  
251 the discrepancies might be due to differences in the reach of community awareness creation  
252 through mass media and social media.

253 In this study, the odds of inadequate knowledge towards COVID-19 were 1.4 times higher among  
254 female participants compared to male participants. This finding is similar to studies conducted in



1  
2  
3 255 Iran,<sup>25</sup> Bangladesh,<sup>32,33</sup> Sudan.<sup>31</sup> In Ethiopia, most of home-based activities such as food  
4  
5 256 preparation and food serving, child feeding, cloth hygiene, and home-based sanitation are left for  
6  
7 257 females. Therefore, females may not get access to media because of their busy time taking care of  
8  
9 258 the family members. Consequently, they are prone to inadequate knowledge of COVID-19  
10  
11 259 compared to males.  
12  
13  
14

15 260 The study indicated that older adults (i.e. 65 and above years of age) had 3-folds greater odds of  
16  
17 261 inadequate knowledge towards COVID 19 compared to adults. This finding is similar to studies  
18  
19 262 conducted at Debre Birhan University, Ethiopia,<sup>23</sup> Iran,<sup>25</sup> Bangladesh, <sup>26,33</sup> medical college in  
20  
21 263 Uttarakhand, India.<sup>30</sup> In most of the cases, older adults are not accessible to modern technologies  
22  
23 264 in Ethiopia. Hence, they will have inadequate knowledge towards COVID-19 compared to adults  
24  
25 265 due to the shortage of information.  
26  
27  
28

29 266 The odds of inadequate knowledge were 2.7 times higher among participants who were residing  
30  
31 267 in rural areas compared to those who were living in urban dwellers. This finding is similar to  
32  
33 268 studies conducted in Bangladesh, <sup>32,34</sup> Sudan.<sup>31</sup> In Ethiopia, most of the people are living in rural  
34  
35 269 areas which is hard to reach for awareness creation using mass media or social media (telegram,  
36  
37 270 Facebook, WhatsUp and Instagram). Thus, people in rural settings had inadequate knowledge of  
38  
39 271 COVID-19 prevention and control measures compared to urban populations who are easily  
40  
41 272 accessible to different sources of media to acquire information regarding COVID-19.  
42  
43  
44  
45

46 273 Moreover, participants who were unable to read and write were 1.6 times more likely to have  
47  
48 274 inadequate knowledge of COVID-19 compared to those who attended tertiary level educations.  
49  
50 275 This finding is similar to studies conducted in Syrians,<sup>24</sup> Iran,<sup>25</sup> rural residents in China,<sup>35</sup> Sudan,<sup>31</sup>  
51  
52 276 Bangladesh,<sup>32</sup> Nepal.<sup>36</sup> In Ethiopia, most of the unable to read and write segment of the population  
53  
54 277 are found in rural areas. Those unable to read and write people are not accessible to media which  
55  
56  
57  
58  
59  
60

1  
2  
3 278 are the ultimate source of information to acquire basic knowledge regarding prevention and control  
4  
5 279 modalities of COVID-19 infections. Thus, participants who were unable to read and write are less  
6  
7  
8 280 knowledgeable about COVID-19 compared to tertiary educated participants.  
9

10  
11 281 The study revealed that the odds of inadequate knowledge were twofold times higher among  
12  
13 282 participants who were not receiving information regarding COVID-19 from health care workers  
14  
15 283 compared to those who were receiving from health care workers. Moreover, the odds of inadequate  
16  
17 284 knowledge were 2.5 times higher among participants who were not receiving information  
18  
19 285 regarding COVID-19 from mass media (TV/Radio) compared to their counterparts. Furthermore,  
20  
21 286 the odds of inadequate knowledge were 2 times higher among participants who were not receiving  
22  
23 287 information regarding COVID-19 from social media compared to those who were receiving it from  
24  
25 288 social media. This finding is similar to a study conducted in eight referral hospitals, Ethiopia.<sup>37</sup>  
26  
27  
28  
29 289 The community may get information regarding the COVID-19 pandemic from different sources.  
30  
31 290 These sources include health care workers, mass media (TV, radio, newspapers, and magazines),  
32  
33 291 social media (telegram, Facebook, WhatsApp, Instagram, tweeters), and religious leaders. Thus,  
34  
35 292 community members who are not accessible to these sources are less knowledgeable about  
36  
37  
38 293 COVID-19 compared to those who are accessible to the listed sources of information.  
39  
40

41 294 The findings may have implications in the prevention campaign/program of the new corona virus  
42  
43 295 pandemic, particularly in the study settings. This study helps other researchers as a baseline  
44  
45 296 information for community-level studies. This finding may enforce the local as well as national  
46  
47 297 Anti-COVID-19 programmers to revise their campaign plans to strengthen the efforts against the  
48  
49 298 COVID-19 pandemic. This study extracted community level information regarding participants'  
50  
51 299 knowledge about COVID-19 prevention from the hotspot areas of COVID-19. However, this study  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 300 is limited due to its cross-sectional design/behavior which could not show a cause and effect  
4  
5 301 relationship.

## 8 302 **CONCLUSIONS**

10 303 In this study, more than half of the study participants had inadequate knowledge about COVID-19  
11  
12 304 prevention among residents of Dessie and Kombolcha city administrations, northeast Ethiopia.  
13  
14 305 Findings from this study showed that sex, age, residence, educational level, information seeking  
15  
16 306 from health care workers, mass media and social media were significantly associated with  
17  
18 307 inadequate knowledge.

20  
21  
22 308 This study recommends revising the COVID-19 prevention plan to increase community awareness  
23  
24 309 towards the COVID-19 pandemic. Strengthening the community to consider health care workers  
25  
26 310 and mass media as a source of COVID-19 related information might be encouraged. House to  
27  
28 311 house awareness creation might be important to address older adults who are more vulnerable to  
29  
30 312 the pandemic. Females' empowerment in formal education shall be strengthened to increase their  
31  
32 313 awareness and exposure to the latest information. The city administrations shall focus on their rural  
33  
34 314 residents to access and have an appropriate information towards COVID-19 prevention.

## 39 315 **List of abbreviations**

40  
41  
42 316 AOR: adjusted odds ratio; CI: confidence interval; COVID-19: Coronavirus disease 2019; IQR:  
43  
44 317 interquartile range; L/C/D: liter per capita per day; OR: odds ratio; SD: standard deviation

## 47 318 **Declarations**

### 50 319 **Ethics approval and consent to participate**

51  
52 320 Ethical clearance was obtained from Ethical Review Committee [**Reference number:**  
53  
54 321 **CMHS/311/036/12**] of College of Medicine and Health Sciences, Wollo University. Permission

1  
2  
3 322 letter was obtained from Dessie and Kombolcha town administrations health department and  
4  
5 323 offices, then from kebele administrations involved in the study. Informed verbal consent was  
6  
7  
8 324 obtained from each study participant. The information gathered from the participants was used for  
9  
10 325 research purpose and confidentiality kept. Participation in the study was on a voluntary basis and  
11  
12 326 participants who were unwilling to participate in the study and those who wish to quit from the  
13  
14  
15 327 study at any point in time informed to do so without any restriction.

### 17 328 **Consent for publication**

18  
19 329 Not applicable.

### 22 330 **Data availability**

23  
24 331 All data relevant to the study are included in the article or uploaded as supplementary information.

### 27 332 **Competing interests**

28  
29 333 No competing interests for any authors.

### 33 334 **Patient and public involvement**

34  
35 335 Patients and/or the public were not involved in the design, or conduct, or reporting, or  
36  
37 336 dissemination plans of this research.

### 40 337 **Funding**

41  
42 338 Data collection was sponsored by Dessie Health Science College (grant number 151/09/12). The  
43  
44 339 funder had no role in the study design, data collection and analysis, decision to publish or  
45  
46 340 preparation of the manuscript.

### 49 341 **Contributors**

50  
51 342 Conception and design of the study: AMK. Conduct of the study: AMK, GGB, AMM, KAY, and  
52  
53 343 AWT. Analysis and interpretation of data: AMK, GGB and AMM. Drafting the manuscript and  
54  
55  
56  
57  
58  
59  
60

344 revising it critically: AMK, GGB, AMM, KAY, and AWT. All authors have given final approval  
 345 for the manuscript to be published.

### 346 **Acknowledgements**

347 The authors are very grateful to Institutional Review Board (IRB) of College of Medicine and  
 348 Health Sciences, Wollo University for the approval of the ethical clearance. We would like to  
 349 thank the health departments of the two city administrations for their cooperation. We also thank  
 350 all individuals participated in this study for their cooperation in taking part in this study.

### 351 **REFERENCES**

- 352 1 Velavan, T. P. & Meyer, C. G. The COVID-19 epidemic. *Tropical medicine & international health* **25**,  
 353 278 (2020).
- 354 2 World Health Organization. *WHO Coronavirus Disease (COVID-19) Dashboard*,  
 355 <<https://covid19.who.int/>> (2020).
- 356 3 Organization, W. H. & organization, W. h. (2020).
- 357 4 Zegarra-Valdivia, J., Vilca, B. N. C. & Guerrero, R. J. A. Knowledge, perception and attitudes in Regard  
 358 to COVID-19 Pandemic in Peruvian Population. (2020).
- 359 5 Tavakoli, A., Vahdat, K. & Keshavarz, M. Novel coronavirus disease 2019 (COVID-19): an emerging  
 360 infectious disease in the 21st century. *ISMJ* **22**, 432-450 (2020).
- 361 6 Chukwuorji, J. C. & Iorfa, S. K. Commentary on the coronavirus pandemic: Nigeria. *Psychological*  
 362 *Trauma: Theory, Research, Practice, and Policy* **12**, S188 (2020).
- 363 7 Olusola, A., Olusola, B., Onafeso, O., Ajiola, F. & Adelabu, S. Early geography of the coronavirus  
 364 disease outbreak in Nigeria. *GeoJournal*, 1-15 (2020).
- 365 8 Ethiopia Embassy UK. (2020).
- 366 9 Haque, T. *et al.* Knowledge, attitude and practices (KAP) towards COVID-19 and assessment of risks  
 367 of infection by SARS-CoV-2 among the Bangladeshi population: An online cross sectional survey.  
 368 (2020).
- 369 10 Adhikari, S. P. *et al.* Epidemiology, causes, clinical manifestation and diagnosis, prevention and  
 370 control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review.  
 371 *Infectious diseases of poverty* **9**, 1-12 (2020).
- 372 11 Naser, A. Y. *et al.* Knowledge and practices towards COVID-19 during its outbreak: a multinational  
 373 cross-sectional study. *medRxiv* (2020).
- 374 12 Deribe, K. *COVID-19 in Ethiopia: status and responses*, <<https://rstmh.org/news-blog/news/covid-19-in-ethiopia-status-and-responses>> (2020).
- 375 13 Abdelhafiz, A. S. *et al.* Knowledge, perceptions, and attitude of egyptians towards the novel  
 376 coronavirus disease (COVID-19). *Journal of Community Health*, 1-10 (2020).
- 377 14 Austrian, K. *et al.* COVID-19 related knowledge, attitudes, practices and needs of households in  
 378 informal settlements in Nairobi, Kenya. (2020).
- 379

- 1  
2  
3 380 15 CSA (Ethiopia). *Population Projections for Ethiopia - Central Statistical Agency*,  
4 381 <[http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037)  
5 382 [2007-2037?download=936:population-projection-2007-2037](http://www.csa.gov.et/census-report/population-projections/category/368-population-projection-2007-2037?download=936:population-projection-2007-2037)> (2019).  
6 383  
7 383 16 Tadesse Tamrat. *Kombolcha city*, <<https://en.wikipedia.org/wiki/Kombolcha>> (2019).  
8 384 17 Hayat, K. *et al.* View of Pakistani Residents toward Coronavirus Disease (COVID-19) during a Rapid  
9 385 Outbreak: A Rapid Online Survey. *Int J Environ Res Public Health* **17**, 3347,  
10 386 doi:10.3390/ijerph17103347 (2020).  
11 387 18 Kebede, Y., Yitayih, Y., Birhanu, Z., Mekonen, S. & Ambelu, A. Knowledge, perceptions and  
12 388 preventive practices towards COVID-19 early in the outbreak among Jimma university medical  
13 389 center visitors, Southwest Ethiopia. *PLoS One* **15**, e0233744-e0233744,  
14 390 doi:10.1371/journal.pone.0233744 (2020).  
15 391 19 Organization, W. H. Critical preparedness, readiness and response actions for COVID-19: interim  
16 392 guidance, 7 March 2020. (World Health Organization, 2020).  
17 393 20 Zhong, B.-L. *et al.* Knowledge, attitudes, and practices towards COVID-19 among Chinese residents  
18 394 during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey.  
19 395 *International journal of biological sciences* **16**, 1745 (2020).  
20 396 21 Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H. & Mohamad, E. Public knowledge, attitudes and  
21 397 practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One* **15**, e0233668-e0233668,  
22 398 doi:10.1371/journal.pone.0233668 (2020).  
23 399 22 Hidalgo, B. & Goodman, M. Multivariate or multivariable regression? *American journal of public*  
24 400 *health* **103**, 39-40 (2013).  
25 401 23 Aynalem, Y. A., Akalu, T. Y., Gebresellassie, B., Sharew, N. T. & Shiferaw, W. S. Assessment of  
26 402 undergraduate student knowledge, practices, and attitude towards COVID-19 in Debre Berhan  
27 403 University, Ethiopia.  
28 404 24 Al Ahdab, S. Knowledge, Attitudes and Practices (KAP) towards pandemic COVID-19 among Syrians.  
29 405 (2020).  
30 406 25 Erfani, A., Shahriarirad, R., Ranjbar, K., Mirahmadizadeh, A. & Moghadami, M. Knowledge, attitude  
31 407 and practice toward the novel coronavirus (COVID-19) outbreak: A population-based survey in Iran.  
32 408 *Bull World Health Organ, E-pub* **30** (2020).  
33 409 26 Byanaku, A. & Ibrahim, M. Knowledge, attitudes, and practices (KAP) towards COVID-19: A quick  
34 410 online cross-sectional survey among Tanzanian residents. *medRxiv* (2020).  
35 411 27 Al-Hanawi, M. *et al.* Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the  
36 412 Kingdom of Saudi Arabia: A Cross-Sectional Study. *Front. Public health* **8**, 217 (2020).  
37 413 28 Ali, M. *et al.* Knowledge, attitude, practice and fear of COVID-19: A cross-cultural study. *medRxiv*  
38 414 (2020).  
39 415 29 Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H. & Mohamad, E. Public knowledge, attitudes and  
40 416 practices towards COVID-19: A cross-sectional study in Malaysia. *Plos one* **15**, e0233668 (2020).  
41 417 30 Maheshwari, S., Gupta, P. K., Sinha, R. & Rawat, P. Knowledge, attitude, and practice towards  
42 418 coronavirus disease 2019 (COVID-19) among medical students: A cross-sectional study. *Journal of*  
43 419 *Acute Disease* **9**, 100 (2020).  
44 420 31 Mohamed, A. *et al.* Knowledge, attitude and practice of the Sudanese people towards COVID-19: An  
45 421 online survey. (2020).  
46 422 32 Karim, A. *et al.* Knowledge and attitude towards COVID-19 in Bangladesh: Population-level  
47 423 estimation and a comparison. *Nature* **5**, 536-544 (2020).  
48 424 33 Paul, A. *et al.* Knowledge, Attitude and Practice Towards Novel Corona Virus among Bangladeshi  
49 425 People: Implications for mitigation measures. *medRxiv* (2020).

- 426 34 Ferdous, M. Z., Islam, M. S., Sikder, M. T., Mosaddek, A. S. M. & Zegarra-Valdivia, J. Knowledge,  
 427 attitude, and practice regarding COVID-19 outbreak in Bangladeshi people: An online-based cross-  
 428 sectional study. *medRxiv* (2020).  
 429 35 Lihua, M. *et al.* Knowledge, beliefs/attitudes and practices of rural residents in the prevention and  
 430 control of COVID-19: An online questionnaire survey. (2020).  
 431 36 Paudel, S., Shrestha, P., Karmacharya, I. & Pathak, O. K. Knowledge, attitude, and practices (KAP)  
 432 towards COVID-19 among Nepalese residents during the COVID-19 outbreak: An online cross-  
 433 sectional study. (2020).  
 434 37 Jemal, B. *et al.* Knowledge, attitude and practice of healthcare workers towards COVID-19 and its  
 435 prevention in Ethiopia: a multicenter study. (2020).

436

437 Table 4. Bi-variable and multivariable logistic regression of knowledge towards COVID-19  
 438 pandemic among residents of Dessie and Kombolcha city administration, northeast Ethiopia, 2020  
 439 (n=828).

Variables	Knowledge level, n (%)		Crude odds ratio (COR)		Adjusted odds ratio (AOR)	
	Inadequate	Adequate	OR	95% CI	OR	95% CI
Sex						
Male	156(49.2)	161(50.8)	1		1	
Female	292(57.1)	219(42.9)	1.38	1.04, 1.82*	1.41	<b>1.03, 1.92*</b>
Age						
18-35	215(50.9)	207(49.1)	1		1	
36-64	185(54.3)	156(45.7)	1.14	0.86, 1.52	1.14	0.83, 1.57
>=65	48(73.8)	17(26.2)	2.72	1.51, 4.88*	2.72	<b>1.45, 5.11*</b>
Place of residence						
Urban	333(49.6)	339(50.4)	1		1	
Rural	115(73.7)	41(26.3)	2.86	1.94, 4.21*	2.69	<b>1.78, 4.07*</b>
Marital status						
Single	92(55.1)	75(44.9)	1		1	
Married	307(53.3)	269(46.7)	0.93	0.66, 1.32	-	-
Divorced	27(57.4)	20(42.6)	1.10	0.57, 2.12	-	-
Widowed	22(57.9)	16(42.1)	1.12	0.55, 2.29	-	-
Education level						
Unable to read and write	94(61.4)	59(38.6)	2.48	1.64, 3.75*	1.60	<b>1.02, 2.51*</b>
Able to read and write with informal education	46(70.8)	19(29.2)	3.77	2.09, 6.81*	2.29	<b>1.22, 4.30*</b>
Primary school (grade 1-8)	98(62.0)	60(38.0)	2.54	1.69, 3.83*	1.67	<b>1.08, 2.60*</b>
Secondary school (grade 9-12)	113(55.4)	91(44.6)	1.93	1.33, 2.82*	1.50	<b>1.01, 2.24*</b>
Above 12 grade (University/College/TVET)	97(39.1)	151(60.9)	1		1	
Main occupation						

1							
2							
3	House wife	142(57.7)	104(42.3)	1.37	0.76, 2.44	0.73	0.38, 1.44
4	Merchant	84(50.0)	84(50.0)	1.00	0.55, 1.83	0.74	0.38, 1.44
5	Farmer	24(64.9)	13(35.1)	1.85	0.79, 4.34	0.67	0.25, 1.83
6	Government employee	83(47.2)	93(52.8)	0.89	0.49, 1.63	0.99	0.50, 1.95
7	NGO employee	31(49.2)	32(50.8)	0.97	0.47, 1.99	0.88	0.40, 1.92
8	Labourer	56(68.3)	26(31.7)	2.15	1.07, 4.34*	1.37	0.63, 2.96
9	Student	28(50.0)	28(50.0)	1		1	
10							
11	Family size						
12	1-3	137(54.6)	114(45.4)	1		1	
13	4-6	255(53.6)	221(46.4)	0.96	0.71, 1.31	-	-
14	>6	56(55.4)	45(44.6)	1.04	0.65, 1.65	-	-
15							
16	Type of water sources						
17	Piped water in dwelling	64(47.1)	72(52.9)	1		1	
18	Piped water at yard	307(52.5)	278(47.5)	1.24	0.86, 1.81	1.08	0.72, 1.62
19	Communal "Bono"	53(67.9)	25(32.1)	2.39	1.33, 4.27*	1.08	0.54, 2.17
20	Spring (any type: protected or	24(82.8	5(17.2)	5.40	1.95,	2.58	0.77, 8.67
21	unprotected)				14.99*		
22							
23	Amount of water in						
24	Litter/Capita/Day						
25	No access (<20L/C/D)	324(55.5)	260(44.5)	1.21	0.89, 1.63	-	-
26	Basic access (>=20L/C/D)	124(50.8)	120(49.2)	1		1	
27							
28	Time to take/fetch water in						
29	minutes						
30	<=30 minutes (1 km round	419(53.1)	370(46.9)	1		1	
31	trip)						
32	>30 minutes (>1 km round	29(74.4)	10(25.6)	2.56	1.23, 5.33*	0.69	0.25, 1.92
33	trip)						
34	Functional TV/radio in the						
35	household						
36	No	73(67.6)	35(32.4)	1.92	1.25, 2.95*	0.97	0.58, 1.62
37	Yes	375(52.1)	345(47.9)	1		1	
38							
39	Functional cell phone in the						
40	household						
41	No	31(66.0)	16(34.0)	1.69	0.91, 3.14*	0.96	0.47, 1.95
42	Yes	417(53.4)	364(46.6)	1		1	
43							
44	COVID-19 Information heard						
45	from family members						
46	No	376(53.1)	332(46.9)	0.76	0.51, 1.12*	0.80	0.50, 1.28
47	Yes	72(60.0)	48(40.0)	1		1	
48							
49	COVID-19 Information heard						
50	from health care workers						
51	No	355(57.5)	262(42.5)	1.72	1.25, 2.36*	1.95	<b>1.35, 2.82*</b>
52	Yes	93(44.1)	118(55.9)	1		1	
53							
54	COVID-19 Information heard						
55	from mass media (TV,...						
56	No	79(71.2)	32(28.8)	2.33	1.51, 3.60*	2.57	<b>1.58, 4.19*</b>
57							
58							
59							
60							



1							
2							
3	Yes	369(51.5)	348(48.35)	1		1	
4	COVID-19 Information heard						
5	from social mass (FB, ...						
6							
7	No	414(57.6)	305(42.4)	2.99	1.95, 4.61*	2.13	<b>1.33, 3.42*</b>
8	Yes	34(36.2)	75(68.8)	1		1	
9	COVID-19 Information heard						
10	from religious leader's						
11	No	428(55.8)	339(44.2)	2.59	1.49, 4.50*	1.16	0.60, 2.28
12	Yes	20(32.8)	41(67.2)	1		1	
13							
14	440	*for p<0.20 at bivariate analysis; *and bold for p<0.05 at multivariable analysis					
15							
16	441						
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

For peer review only

## Research checklist

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

	Item No	Recommendation	Page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2, 5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	1
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	n/a
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	n/a
		(c) Explain how missing data were addressed	9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-12
		(b) Indicate number of participants with missing data for each variable of interest	9-12
Outcome data	15*	Report numbers of outcome events or summary measures	12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted	12

		estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	2
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).