Factors determining knowledge and preventive practices within the COVID-19 pandemic among pregnant women at public health facilities in Ethiopia: A multicenter cross-sectional study

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KEYWORDS
coronavirus, knowledge, pregnant women, preventive practice, Ethiopia

Received: 24 February 2023, **Revised:** 3 November 2023, **Accepted:** 15 December 2023
Public Health Toxicol. 2023;3(4):19
https://doi.org/10.18332/pht/177084

ABSTRACT

INTRODUCTION Due to fear of the coronavirus pandemic, which directly threatens both the mother's and unborn baby's health, pregnant women may have skipped out on their prenatal appointments at medical facilities. Our objective was to assess knowledge, preventive practice, and associated factors in regard to COVID-19, among pregnant women attending antenatal care (ANC) at public health facilities of the East Gojjam Zone, Ethiopia, in 2020.

METHODS Between 1 December and 30 December 2020, 847 pregnant women participated in a multicenter cross-sectional study. A pre-tested interviewer-administered questionnaire was used to collect the data, which were then input into Epi Data version 4.6 and analyzed using SPSS version 25. Bivariable and multivariable logistic regression models were used to investigate the relationships between knowledge, COVID-19 prevention practices, and predictor variables. Statistical significance was determined using an odds ratio with a 95 per cent confidence level and a p-value of 0.05.

RESULTS The study findings were that urban residence (AOR=1.91; 95% CI: 1.30–2.79), being a civil servant (AOR=2.29; 95% CI: 1.20–4.37), having secondary school education level (AOR=1.96; 95% CI: 1.14–3.40) or college and above (AOR= 2.97; 95% CI: 1.56–5.65), and favorable attitude (AOR=2.10; 95% CI: 1.51–2.91), were the factors of knowledge towards coronavirus infection. Urban residence (AOR=1.54; 95% CI: 1.07–2.22), being a civil servant (AOR=1.81; 95% CI: 1.02–3.20), a merchant (AOR=1.86; 95% CI: 1.16–2.99), or employed in the private sector (AOR=1.97; 95% CI: 1.07–3.64), and having medical problems (AOR=1.69; 95% CI: 1.07–2.65), adequate knowledge (AOR=1.67; 95% CI: 1.23–2.28) and favorable attitude (AOR=1.74; 95% CI: 1.26–2.42), were positively associated factors against the coronavirus pandemic.

CONCLUSIONS Attendees at ANC had a generally adequate level of awareness of pregnant women, but there was a poor application of COVID-19 prevention strategies. To break the chain of transmission, increased education and implementation of preventive measures will be necessary. Continuous health education for people with medical issues, those without formal education, housewives, and rural residents should be considered.

INTRODUCTION

The coronavirus-19 disease (COVID-19) due to the SARS-CoV-2 virus had a drastic impact on the world, including on pregnant women[1]. In Wuhan, China, the majority (64.6%) of the pregnant women were absent from their antenatal follow-up and did not use all the personal protective equipment as a preventive measure[2]. Even though the SARS-CoV2 affected all population groups, pregnant women are particularly vulnerable due to physiological changes and impaired cellular immunity during pregnancy, which

increased their risk of respiratory infection[3,4]. Pregnant women often faced preterm delivery due to COVID-19, and preventive measures were reported to be considered[5,6].

Restricting movements, physical distancing, routine screening, isolation of infected persons, sanitizers, hand hygiene, environmental monitoring, and appropriate use of personal protective equipment like face masks were recommended to mitigate the COVID-19 pandemic[7]. COVID-19 was reported to make pregnant women more susceptible to stress and depression, resulting in miscarriage, preterm birth, low birth weight, and potentially even fetal death[8]. When pregnant women became infected, they required more hospitalization, intensive care unit admission, and mechanical ventilation, which may have affected the mode of delivery, impacted breastfeeding uptake and increased the physical burden of the pregnancy, resulting in psychological-emotional challenges[9].

In low- and middle-income countries, COVID-19 negatively affected maternal and newborn health by decreasing the number of pregnant women attending prenatal care and institutional delivery[10]. Increased knowledge of pregnant women aids in reducing their negative attitude and increases the preventive measures taken against COVID-19[11]. Knowledge regarding the pandemic was a determining factor for pregnant women to achieve an ideal pregnancy during the COVID-19 pandemic[12]. Adherence to COVID-19 preventive measures among pregnant women is insufficient; hence, studies are recommended to create awareness about COVID-19 through the media and health education[13,14].

Therefore, the study aimed to assess the knowledge, preventive practice, and associated factors in regard to COVID-19, among pregnant mothers attending antenatal care at public health facilities in East Gojjam Zone, Ethiopia.

METHODS

Study setting, design, and period

A cross-sectional study was conducted from 1 to 30 December 2020, in the East Gojjam Zone public health facilities in the Amhara regional state, Ethiopia. With population projection from the 2007 census, East Gojjam Zone has a total population of 2153937, of whom 1087221 are women. East Gojjam Zone is divided into 19 districts and 468 kebeles.

The study's sample size was determined by using a single population proportion formula based on the following assumptions. Considering a design effect of 2 and 10% non-response rate, the final sample size was 847.

A multistage sampling technique was used. The study area had 103 health centers, eight primary hospitals, and one general and comprehensive specialized hospital. First, stratification was done based on the level of the health facility. Then, one-third of each type of health facility was taken by simple random sampling technique using a lottery method. Then, the proportional allocation for each health facility was done to allocate the sample size based on the case flow seen in the last month's registration report. Finally, each study participant was selected using a systematic sampling technique for every 2nd pregnant woman after randomly selecting the 1st sample from 1 and 2.

Measurements and operational definitions

The dependent variables were knowledge and preventive practice regarding the COVID-19 pandemic. Knowledge and preventive practice were assessed by asking pregnant women 28 and 9 'yes' or 'no' item questions, respectively. One point was given for the correct response, while zero was given for the incorrect response. The knowledge assessment questions consisted of the transmission, risk perception, preventive measures, and the signs and symptoms of COVID-19. Better knowledge among pregnant women was considered when pregnant women scored greater than or equal to the mean values of knowledge-related questions within our study sample. Pregnant women who scored greater than or equal to the mean values of practice-related questions were categorized as having better preventive practices for COVID-19.

Data collection tools and procedures

An interviewer-administered questionnaire was used to collect data from study participants. The questionnaire was adapted from a literature review[15-18] with modification and contextualized into the local setting. The questionnaires collected information on sociodemographic characteristics, the obstetric and reproductive history of the study participants, and knowledge and practice assessment questions regarding COVID-19. Under the supervision of MSc midwives, BSc midwives collected the study's data.

Data quality control

The questionnaire was written in English, then translated into the study participants' native tongue, Amharic, and finally back into English. Before data collection, the supervisors and data collectors received training. A pre-test was conducted on 5% of the estimated sample size at Finote Selam General Hospital to evaluate the suitability of phrasing, clarity of the questions, and responder attitude to the questions and interviewer. The questionnaire was reviewed and confirmed for completion.

Data processing and analysis

The collected data were rechecked, coded, and entered into a computer using Epi Data version 4.6. and exported to SPSS version 25.0 for analysis. Descriptive statistics were computed to determine frequencies and percentages to describe the study population regarding sociodemographic and other relevant variables. Bivariable logistic regression was used to check variables associated with the dependent variable. Then, those variables with a p-value ≤0.25 were fitted to multivariable logistic regression adjusted for covariates. A p-value <0.05 with a 95% confidence level

was used to declare a significant association of independent variables with the dependent variable. The Hosmer-Lemeshow goodness of fit test checked the model fitness.

RESULTS

Sociodemographic and obstetric characteristics of study participants

Out of 847 sampled pregnant women, 806 responded to the questionnaires, resulting in a response rate of 95.2%. Among the participants, 285 (35.4%) were aged 25–29 years, and the mean age was 27.6 ± 6.1 years. The majority, 763 (94.6%) of the study participants were married. More than half, 426 (52.9%) of the study participants were urban residents. About 42.6% of study participants did not have any formal education. Nearly half (329; 40.8%) of the study participants reported that their monthly income worsened in the past three months before the study (Supplementary Table 1). In all, 501 (62.2%) and 327 (40.6%) study participants were multigravidas and nulliparous, respectively. About 70 (8.7%) of the participants had a history of abortion (Table 1).

Knowledge of study participants towards COVID-19 pandemic

Every study participant (100%) had heard of COVID-19, and about four-fifths (81.6%) knew it was a viral disease; and 90.3% of the participants said that COVID-19 could not be transmitted during breastfeeding. Headache (38.3%), fever (67%) and cough (68.6%) were the three most frequently mentioned COVID-19 symptoms by the participants (Table 2).

Table 1. Obstetrics-related characteristics of pregnant women attending ANC at East Gojjam Zone, Northwest Ethiopia public health facilities, 2020 (N=806)

Characteristics	n	%
Gravidity		
Primigravida	305	37.8
Multigravida	501	62.2
Gestational age (weeks)		
<37	739	91.7
≥37	67	8.3
Parity		
Nulliparous	327	40.6
Primipara	170	21.1
Multipara	309	38.3
Number of children		
<3	552	68.5
≥3	254	31.5
History of abortion		
Yes	736	91.3
No	70	8.7

Preventive measures of pregnant women against COVID-19

Of 806 pregnant women who reported COVID-19 preventive measures, 514 (63.8%) washed their hands using soap and water, 410 (50.1%) wore a face mask when they were in public, 156 (19.4%) maintained social distancing, and 361 (44.8%) did not participate in public meetings. Also, 354 (43.9%) (95% CI: 40.5–47.3) pregnant women reported good preventive practices for COVID-19 (Table 3).

Factors associated with knowledge of pregnant women

Pregnant women residing in urban settings had 1.9 times better knowledge of COVID-19 than those living in rural areas (AOR=1.9; 95% CI: 1.3–2.8). The odds of having good

Table 2. COVID-19 knowledge of pregnant women attending ANC at public health facilities of East Gojjam Zone, Northwest Ethiopia, 2020 (N=806)

Knowledge on COVID-19	Response	n	%
Ever heard about COVID-19	Yes	806	100
	No	0	0
COVID-19 is a viral disease	Yes	658	81.6
	No	148	18.4
Knowledge of transmission of COVID-19			
Coughing /sneezing	Yes	490	60.8
	No	316	39.2
Direct contact with COVID-19 patient	Yes	470	58.3
	No	336	41.7
Eating contaminated meat/ food items	Yes	249	30.9
	No	557	69.1
Mother to the fetus during pregnancy	Yes	142	17.6
	No	664	82.4
During breastfeeding	Yes	78	9.7
	No	728	90.3
A person with COVID-19 can transmit it to others without developing symptoms	Yes	171	21.2
	No	635	78.8
Incubation period 2–14 days	Yes	243	30.1
	No	563	69.9
Knowledge of risk perception of COVID-19			
Pregnant women are at higher risk than others if infected with COVID-19	Yes	282	31.5
	No	524	68.5

Continued

Table 2. Continued

Knowledge on COVID-19	Response	n	%
Patients with co-morbidities disease are at higher risk than others if infected with COVID-19	Yes	435	54.0
	No	371	46.0
Children individuals are at higher risk than others if infected with COVID-19	Yes	254	21.2
	No	552	78.8
Older people are at higher risk than others if infected with COVID-19	Yes	400	49.6
	No	406	50.4
Knowledge of signs and symptoms of COVID-19			
Fever	Yes	540	67.0
	No	266	33.0
Cough	Yes	553	68.6
	No	253	31.4
Headache	Yes	309	38.3
	No	497	61.7
Sore throat	Yes	149	18.5
	No	657	81.5
Runny nose	Yes	160	19.9
	No	646	80.1
Difficulty breathing	Yes	283	35.1
	No	523	64.9
Diarrhea	Yes	66	8.2
	No	740	91.8
Knowledge of preventive measures			
Frequent hand washing with water and soap/alcohol-based hand sanitizer	Yes	502	62.3
	No	304	37.7
Avoid unnecessary travel	Yes	471	58.4
	No	335	41.6
Avoid close contact with an infected person	Yes	574	71.2
	No	232	28.8
Avoid touching your eye, nose, or mouth with unwashed hands	Yes	508	63.0
	No	298	37.0
Wear a mask in public	Yes	517	64.1
	No	289	35.9
Avoid crowded places	Yes	483	59.9
	No	323	40.1
Cure of COVID-19	Yes	137	17.0
	No	669	83.0
Vaccine of COVID-19	Yes	237	29.4
	No	569	70.6

knowledge of COVID-19 among pregnant women who were civil servants were 2.3 times more likely than pregnant women of other occupations (AOR=2.3; 95% CI: 1.2–4.4). Based on education level, the odds of having good knowledge of COVID-19 among pregnant women who had an education level of secondary school or college and above, were 2.0 (AOR=2.0; 95% CI: 1.1–3.4) and 3 (AOR= 3.0; 95% CI: 1.6–5.7) times more likely compared to those who had no formal education, respectively. Women with a favorable attitude towards preventative measures were 2.1 (AOR=2.1; 95% CI: 1.5–2.9) times more likely than those with an unfavorable attitude to have good knowledge of the COVID-19 pandemic (Table 4).

Associated factors of COVID-19 preventive practices

Pregnant urban residents were 1.5 (AOR=1.5; 95% CI: 1.1–2.2) times more likely than non-urban residents to apply better COVID-19 pandemic prevention practices. The odds of having good prevention practices among pregnant women who were civil servants (AOR=1.8; 95% CI: 1.0–3.2), merchants (AOR=1.9; 95% CI: 1.2–3.0), and other occupations (AOR=2.0; 95% CI: 1.1–3.6) where higher than those of pregnant women who were housewives. Pregnant women who had medical problems were 1.7 (AOR=1.7; 95% CI: 1.1–2.7) times more likely than their counterparts to

Table 3. Practice of COVID-19 preventive measures among pregnant women attending ANC at public health facilities of East Gojjam Zone, Northwest Ethiopia, 2020 (N=806)

Measures adopted	Response	n	%
Wash hands with soap and water/ hand rub with sanitizers	Yes	514	63.8
	No	292	36.2
Wear a face mask in public	Yes	410	50.1
	No	396	49.1
Avoid touching your eyes, nose, and mouth with unwashed hands	Yes	309	38.3
	No	497	61.7
Avoiding handshaking with others	Yes	408	50.6
	No	398	49.4
Covering mouth and nose during coughing or sneezing	Yes	410	50.9
	No	396	49.1
Stay at home during the transmission period	Yes	277	34.4
	No	529	65.6
Throw the tissue in the trash	Yes	403	50.0
	No	403	50.0
Maintain at least a 2 m distance from others	Yes	156	19.4
	No	650	80.6
Do not participate in public meetings	Yes	361	44.8
	No	445	55.2

Table 4. Multivariable logistic regression analysis of the factors associated with the knowledge related to COVID-19 of pregnant women attending ANC at public health facilities of East Gojjam Zone, Northwest Ethiopia, 2020 (N=806)

Variables	Knowledge		OR (95%)	AOR (95%)	p
	Yes	No			
Residence					
Rural ®	139	241	1	1	
Urban	277	149	3.2 (2.4–4.3)	1.9 (1.3–2.8)	0.001*
Age (years)					
15–19	27	33	1.5 (0.8–2.7)	1.0 (0.5–2.4)	0.931
20–24	107	93	2.0 (1.3–3.2)	1.1 (0.6–2.0)	0. 819
25–29	161	122	2.3 (1.5–3.6)	1.3 (0.7–2.2)	0.341
30–34	73	57	2.3 (1.4–3.7)	1.5 (0.8–2.6)	0.192
≥35 ®	48	85	1	1	
Employment status					
Housewife ®	199	297	1	1	
Civil servant	127	24	7.9 (4.9–12.7)	2.3 (1.2–4.4)	0.012*
Merchant	55	48	1.7 (1.1–2.6)	1.0 (0.6–1.7)	0.910
Private sector	35	21	2.5 (1.4–4.4)	1.6 (0.8–3.1)	0.142
Education level					
No formal education ®	118	225	1	1	
Primary	76	94	1.5 (1.1–2.2)	1.1 (0.7–1.7)	0.764
Secondary	66	39	3.2 (2.1–5.1)	2.0 (1.1–3.4)	0.015*
College and higher	156	32	9.3 (6.0–14.5)	3.0 (1.6–5.7)	0.001*
Gravidity					
Primigravida	176	129	1.5 (1.1–2.0)	1.5 (0.7–3.2)	0.323
Multigravida ®	240	261	1	1	
Gestation age (weeks)					
<37	376	363	0.7 (0.5–0.9)	1.0 (0.5–1.9)	0.965
≥37 ®	41	26	1	1	
Parity					
Nulliparous	186	141	1.8 (1.3–2.5)	0.8 (0.3–1.7)	0.535
Primipara	99	71	1.9 (1.3–2.8)	1.2 (0.7–2.0)	0.456
Multipara ®	131	178	1	1	
Number of living children					
<3	233	319	3.5 (2.6–4.9)	3.6 (0.5–5.2)	0.426
≥3	183	71	1	1	
Attitude					
Favorable	254	158	2.3 (1.7–3.05)	2.1 (1.51–2.9)	0.000*
Unfavorable ®	162	232	1	1	

® Reference categories. AOR: adjusted odds ratio. *p<0.05 (significant).

Table 5. Multivariable logistic regression analysis on factors associated with implementing COVID–19 preventive measures among pregnant women attending ANC at public health facilities of East Gojjam Zone, Northwest Ethiopia, 2020 (N=806)

Variables	Measures adopted		OR (95%)	AOR (95%)	p
	Yes	No			
Residence					
Rural ®	260	120	1	1	
Urban	192	234	2.6 (2.0–3.5)	1.5 (1.1–2.2)	0.020*
Age (years)					
15–19	23	37	1.1 (0.6–1.2)	0.6 (0.3–1.3)	0.193
20–24	87	113	1.3 (0.8–2.0)	0.7 (0.4–1.3)	0.285
25–29	144	139	1.8 (1.2–2.7)	1.1 (0.6–1.8)	0.817
30–34	51	79	1.1 (0.7–1.8)	0.7 (0.4–1.2)	0.235
≥35 ®	49	84	1	1	
Employment status					
Housewife ®	169	327	1	1	
Civil servant	97	54	3.5 (2.4–5.1)	1.8 (1.0–3.2)	0.043*
Merchant	56	47	3.1 (1.50–3.5)	1.9 (1.2–3.0)	0.010*
Private sector	32	24	2.6 (1.5–4.52)	2.0 (1.1–3.6)	0.030*
Education level					
No formal education ®	108	235	1	1	
Primary	73	97	1.6 (1.1–2.4)	1.2 (0.8–1.8)	0.493
Secondary	52	53	2.1 (1.4–3.3)	1.2 (0.7–2.0)	0.525
Gravidity					
Primigravida	155	150	1.6 (1.2–2.1)	0.7 (0.3–1.4)	0.297
Multigravida ®	199	302	1	1	
Parity					
Nulliparous	170	157	1.8 (1.3–2.5)	2.1 (1.0–4.6)	0.560
Primipara	69	101	1.2 (0.8–1.7)	0.71 (0.5–1.2)	0.162
Multipara ®	115	194	1	1	
Medical problems					
Yes	53	49	1.5 (1.0–2.2)	1.7 (1.1–2.7)	0.024*
No ®	301	403	1	1	
Overall knowledge					
Adequate	230	186	2.7 (2.0–3.5)	1.7 (1.2–2.3)	0.001*
Inadequate ®	124	266	1	1	
Attitude					
Favorable	215	197	2.0 (1.5–2.7)	1.7 (1.3–2.4)	0.001*
Unfavorable ®	139	255	1	1	

® Reference categories. AOR: adjusted odds ratio. *p<0.05 (significant).

apply better preventive practices for COVID-19 . Pregnant women with better knowledge were 1.8 (AOR=1.8; 95% CI: 1.2–2.3) times more likely to have good preventive practices than those with inadequate knowledge of COVID-19 (Table 5).

DISCUSSION

In Ethiopia, the health sector's welfare of mothers, newborns, and children remains a top priority. Still, a significant proportion of women did not utilize maternity healthcare services during the COVID-19 pandemic. With this in mind,

we conducted a multicenter institution-based cross-sectional study to determine knowledge and preventive practice of the COVID-19 pandemic and associated factors among pregnant women attending ANC at public health facilities of East Gojjam Zone.

The proportion of pregnant women with adequate knowledge of COVID-19 was 51.6%. This result is in line with the study conducted in Gondar (55%)[19], Gurage (54.84%)[20], and India (50.5%)[21]. The mean scores reported in the current study were lower than those obtained in Wollega (75.4%)[22], Egypt (57.6%)[23], low-resource African setting (60.9%)[24], and in a defence hospital in India (75.3%)[25]. This discrepancy might be due to differences in sociodemographic characteristics (education level) of the study participants compared to other studies, as the majority of the participants in this study did not have any formal education, which directly affects the level of knowledge.

Conversely, our finding was higher than that of the studies in Debre Tabor (46.8%)[26], South Africa (43.5%)[27], and Iraq (28%)[28]. This discrepancy might be due to the difference in the study setting. The present study was facility-based compared to the study done in Debre Tabor[26]. When pregnant women go to health institutions, they get the opportunity to receive some information regarding the pandemic during their antenatal care follow-up. Furthermore, more than half of the study's participants were urban residents who could easily update themselves on COVID-19 through social media and mass media. Indeed, urban resident pregnant women were more likely to be knowledgeable about COVID-19 than their rural counterparts. This could be because urban residents have greater access to new information and update themselves through various media than rural residents. Studies from Wollega, Ethiopia[22] and India[25] support this finding.

Regarding occupation, pregnant women who were civil servants were 2.3 times more likely than housewives to be knowledgeable about the COVID-19 pandemic. The possible reason for this might be that pregnant women are employed, educated, and work in close collaboration with the government to reduce this pandemic's burden, thus increasing their knowledge. Studies conducted in Debre Tabor, Ethiopia[26] support this finding.

Participants who completed secondary school or college were 2.0 and 3.0 times, respectively, more knowledgeable about COVID-19 than those who did not attend formal education. The possible reason for this might be education is crucial and one of the most determinant factors in knowing and understanding adequately. Educated pregnant women can search, read, and follow social media, contributing to increased knowledge about the pandemic. The finding is supported by studies in Wollega[22] and India[25].

Pregnant women with a favorable attitude were 2.1 times more likely than those with an unfavorable attitude to be knowledgeable about the COVID-19 pandemic. The possible reason might be that the pregnant women's positive attitude made them eager to hear, read and know about the coronavirus.

In all, 43.9% of the pregnant women had good preventive practices for COVID-19. This is in line with the study conducted in Wollega (43.6%)[22]. But this finding is lower than studies from Debre Tabor (47.6%)[26], Gondar (47.4%)[19], Guraghe (76.2%)[20], South Africa (76%)[27], the defence hospital in India (92.7%)[25] and another study in India (69.8%)[21]. In low-income countries such as Ethiopia, a lack of knowledge and access to resources leads to poor pandemic prevention practices. Variations in pregnant women's social lives across countries may have contributed to the discrepancy.

The mean scores reported in the present study were higher than the study conducted in Egypt (12.4%)[23], in a low-resource African setting (30.3%)[24], and Iraq (32.75%)[28]. The disparity could be attributed to a difference in the study period, as this study was conducted during the peak of COVID-19 in the country, causing pregnant women to be concerned about becoming infected and taking appropriate COVID-19 pandemic precautions. Furthermore, most study participants in the previous research studies were farmers and rural residents, which may result in poor prevention practices due to a lack of awareness about the severity of the COVID-19 pandemic. Pregnant women who reside in urban settings had better preventive practices for COVID-19 compared to their counterparts. This might be due to urban residents' pregnant women having better access to information, being more educated, and being able to search for COVID-19 prevention methods. Studies in Guraghe, Wollega, low-resource African settings, and India[20,22,24,25] supported this evidence.

Regarding occupation, pregnant women who were civil servants, merchants, and employed in the private sector were 1.8, 1.9, and 2.0 times more likely to practice COVID-19 prevention measures than housewives, respectively. This might be because pregnant housewives do not know what preventive measures need to be taken to avert the spread of COVID-19.

Pregnant women with medical problems were 1.7 times more likely to practice the prevention of COVID-19 when compared to their counterparts. The reason could be that pregnant women with medical problems may receive special attention and attempt to implement preventive measures against the COVID-19 pandemic.

Pregnant women who had adequate knowledge about COVID-19 practiced 1.7 times more preventive measures than pregnant women with inadequate knowledge. A possible explanation for this might be knowledge is a prerequisite for applying preventive measures for the COVID-19 pandemic. Studies in Ethiopia, South Africa, and India[19,21,27] supported this finding.

The study revealed that pregnant women with a favorable attitude were 1.7 times more likely to practice good prevention of COVID-19 methods compared to those without

medical problems. The reason might be that when pregnant women have a good feeling about COVID-19 prevention, they are more likely to implement the techniques of the global infection prevention strategies.

The COVID-19 pandemic might be the most intense and emotional experience in pregnant women's lives. Good knowledge and practice of pregnant women regarding COVID-19 contribute to filling the gap in preventive measures. One of the most critical segments in managing COVID-19 is focusing on vulnerable targeted groups like pregnant women by assessing their knowledge and preventive practices.

Strengths and limitations

The study covered many study locations and all types of health facilities, which helped to generalize the representativeness of the population. Despite this, the study has some limitations. The cross-sectional study design in this study cannot attribute a cause-effect relationship of the factors. Due to the parallel occurrence of the COVID-19 infection, the study had a low response rate. Additionally, interviewer bias might have been introduced.

CONCLUSIONS

The findings of this study show that adequate knowledge and preventive practices against the COVID-19 pandemic among pregnant women attending antenatal were 51.6% and 43.9%, respectively. This information can be used within the context of future respiratory pandemics. Intensified education and enforcement of preventive measures will be required to interrupt the transmission chain, since knowledge level may not always translate to actual practice of preventing a pandemic. Mass media program mobilization and health education should be considered for those who have medical problems, do not have any formal education, are housewives, and are rural residents in developing countries. Additional future qualitative and observational studies that include pregnant women attending private health institutions might be advisable.

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ACKNOWLEDGEMENTS
The authors would like to acknowledge the study participants, data collectors, supervisors, Debre Markos University Health Sciences College, East Gojjam Zone, and the regional health bureau.

CONFLICTS OF INTEREST
The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

FUNDING
There was no source of funding for this research.

ETHICAL APPROVAL AND INFORMED CONSENT
Ethical approval was obtained from the Ethical Review Committee for the College of Health Sciences at Debre Markos University with approval number: HSC/R/C/Ser/Co/214/11/13. Participants provided informed consent. A legally recognized representative of women aged under 18 years also provided written informed consent.

DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS
AA and KA conceptualized, designed, and wrote the proposal, trained data collectors and supervisors, conducted analysis, wrote results, and drafted and finalized the manuscript. Both authors read and approved the final manuscript.

PROVENANCE AND PEER REVIEW
Not commissioned; externally peer reviewed.