

# Utilization of Eight Antenatal Care Contacts among Healthcare Providers in Central Gondar Zone, Northwest Ethiopia: A Cross-Sectional Study

Zelege Agerie Mengistie (MSc)<sup>1</sup>

<sup>1</sup> Lecturer, Department of Midwifery, Teda Health Science College, Ethiopia

ARTICLE INFO	ABSTRACT
Article type: Original article	<b>Background &amp; Aim:</b> Ensuring optimal maternal outcomes depends on adequate antenatal care. The World Health Organization recommends eight antenatal care contacts, but there is little evidence on their uptake. This study assesses the utilization and determinants of eight antenatal care contacts among health care providers in the Central Gondar Zone.
Article History: Received: 10-Dec-2022 Accepted: 02-May-2023	<b>Methods:</b> A multicenter cross-sectional study was conducted from May to June, 2022 involving 421 health care providers in public health facilities who were randomly selected. Data were collected through face-to-face interviews and observations with a structured questionnaire. Epi-data version 4.6 and SPSS 23 facilitated data entry and analysis. Bivariable and multivariable logistic regressions were performed, reporting adjusted odds ratios (AOR) with a 95% confidence interval (CI).
Key words: Adequate Antenatal Care Contacts Healthcare Providers Public Health Facilities	<b>Results:</b> Of the 421 healthcare providers, only 20.9% used eight contacts for antenatal care. Significant determinants included workplace (AOR=8.29; 95% CI: 1.47-15.4), understanding the importance of eight contacts in antenatal care (AOR=7.9; 95% CI: 3.70-16.89), knowledge of eight antenatal care contacts (AOR=2.90; 95% CI: 1.63-5.12), and the ability to distinguish between eight and four antenatal care visits (AOR=9.00; 95% CI: 3.70-21.91). <b>Conclusion:</b> The utilization of eight antenatal care contacts remains suboptimal. Strategic interventions to address the identified barriers are essential to improve service utilization in line with recommended guidelines.

► Please cite this paper as:

Agerie Mengistie Z. Utilization of Eight Antenatal Care Contacts among Healthcare Providers in Central Gondar Zone, Northwest Ethiopia: A Cross-Sectional Study. Journal of Midwifery and Reproductive Health. 2024; 12(3): 4309-4318. DOI: 10.22038/JMRH.2023.67799.1988

## Introduction

Each year, more than half of all deaths among women in resource limited settings are caused by problems related to pregnancy (1). The majority of deaths can be prevented through skilled birth attendance and sufficient antenatal care contacts (eight or more). This is according to a global appeal for immediate action prompted by the Maternal Mortality Report (2). It is a forum for the delivery of vital services to reduce complications in maternal and newborn care by providing comprehensive care (4). According to some studies (5-6), when offered

high-quality care and regular attendance, enough Antenatal Care can lower maternal mortality by 20%. Due to this, ANC-trained healthcare providers are very important to reduce maternal complications during pregnancy (7-8). This is because it is more important for early detection and management of complications than four focus antenatal care (9-10).

Worldwide, 65% of pregnant women receive at least eight prenatal contacts from trained prenatal care providers health workers (11).

\* Corresponding author; Zelege Agerie Mengistie, Lecturer, Department Midwifery department in Teda health science college, Ethiopia. Tel: 251975126560; Email: [ageriemengistie@gmail.com](mailto:ageriemengistie@gmail.com)



Copyright © 2023 Mashhad University of Medical Sciences. This work is licensed under a Creative Commons Attribution Noncommercial 4.0 International License <mailto:https://creativecommons.org/licenses/by/3.0/>

About nearly half (48%) of pregnant women received at least eight antenatal visits in South Asia (12). Results from a cross-national survey done in Africa showed that only 13.0% of ANC contacts had eight or more contacts (13). Evidence indicates that 66% of all maternal deaths worldwide occurred in sub-Saharan African nations (14).

The Ethiopian Federal Ministry of Health set a target to reduce maternal mortality to 250 per 100,000 live births by 2020, we are currently stacked with a 412 maternal mortality ratio (15). Facing this significant challenge, the Ethiopian Federal Ministry has launched an initiative in 2021 to implement the WHO's 2016 guideline (16). This recommendation is an enhanced model with a minimum of eight ANC contacts that emphasize contact information, scheduling, and services (17). Despite the development of at least eight ANC contact guidelines, pregnancy-related preventable morbidity and mortality remain alarmingly high (18). In addition to this, the implementation of a new eight or more ANC contacts approach and the associated maternal mortality is not clearly determined (19). The latest WHO recommendation that the number of contacts for a woman be increased from four to eight raises questions about its adoption and execution (17).

Studies on women in nations other than Ethiopia have found that characteristics such as maternal age, the number of children still living, pregnant women's level of education, site of residence, occupation, religion, socioeconomic status, and obstetric history were strongly related to the use of ANC services (20-22). Similarly, a recent study found that in low- and middle-income countries, late ANC booking, media exposure, and husbands' behavior were the most important factors influencing the use of health services (23-25).

Addressing utilization of eight or more ANCs through contact with skilled health professionals is very important to reduce maternal-child perinatal mortality and morbidity. It is also an entry point to the health system and an opportunity to monitor and preserve the well-being of pregnant women and their children (26). To my knowledge, however, this research is the first of its kind to look at the

prevalence and potential obstacles to the uptake of eight or more ANC contacts in Ethiopia, specifically in the study area, following the launch of the WHO recommendation for eight or more ANC contacts with qualified healthcare providers. Therefore, the purpose of this study was to identify the utilization of appropriate ANC offered by public health institutions in the Central Gondar Zone, Northwest Ethiopia, as well as its determinants.

## Materials and Methods

A multicenter cross-sectional study design was conducted in the Central Gondar Zone, Amhara Region state of Ethiopia, from May to June, 2022 among healthcare providers in 70 antenatal clinics. According to the 2020 population project, there were 15783 healthcare providers in the Central Gondar Zone, with 1,448,174 men and 1,477,385 women (27). The Central Gondar Zone has 135 health centers, 496 health posts, 175 clinics, seven government hospitals, three private hospitals, and other facilities listed in the zonal health department report (28).

The assumptions for the single population proportion formula were used to generate the sample size for this investigation. A prevalence of at least eight ANCs contacts utilization was 3.6% CI of 95%, (29), 5% degree of precision, and 10% non-response rate yielded by  $n = \frac{z^2 \cdot p \cdot (1-p)}{d^2}$  formula, the final sample size was 422 study participants.

All health care providers who worked at public health facilities that existed in the Central Gondar Zone at the time of data collection were the source population. All randomly selected healthcare providers who worked at public health facilities in the Central Gondar Zone were the study sample, while healthcare providers who were sick and annually left during data collection or left involuntarily were left out of the study. The lists of healthcare providers were obtained from each health center and hospital and the sampling frame was designed by numbering the list of healthcare providers. From 142 public health facilities, 70 public health facilities ((65 health centers and 5 hospitals) were selected using simple random sampling. The total sample size was distributed to each selected hospital and health center proportionally based on the previous one-month ANC service performances. Hospital and

Health center proportionally. . Finally, participants were recruited into the study using a simple random sampling technique and study participants were selected in every 3rd interval. A structured questionnaire based on the Ethiopian Ministry of Obstetric Management Protocol guidelines and published papers (19, 30, 31) were contextualized for the study setting. The surveys were written in English, translated into the regional tongue (Amharic), and then, for uniformity, back into English. Research tool contains three parts: socio-demographic characteristics, knowledge-related characteristics about the recommended eight or more ANC contacts, and the likelihood of eight or more ANC contact utilization.

An interview schedule and observational checklist were used to collect data in order to get relevant results. 12 Bachelor of Science (BSc) in Midwifery who teaches at universities and colleges were recruited as data collectors and two MSc in clinical midwifery as supervisors. The researcher trained the data collectors and supervisors over the course of two days about ethical issues, the content of tool, and how to collect data. To ensure the validity of the measuring instrument, the questionnaires were pre-tested on 5% of the final sample size. Changes were made based on input from the pre-test, such as adjusting the sequence of questions, editing ambiguous questions, and removing less crucial questions. Every day the obtained data were verified, and any missing data were quickly collected by returning to the medical facilities. Prior to statistical analysis, data cleaning and a double check of the entered data were performed using 10% of the sample size to control data entry mistakes.

Utilization of a minimum eight of ANC contacts was measured by asking healthcare providers whether they used adequate ANC contacts during pregnancy follow-up, and the response was either yes or no.

Data collected included socio-demographic data (age, marital status, educational level, occupation, and monthly income), availability of eight ANC contact guidelines, training about use of eight or more ANC contacts, knowledge about eight or more ANC contacts, duration of experience and workplace.

The collected data were coded and entered into Epi-data software version 4.6 before being exported to the SPSS version 23 statistical package for analysis after being checked for completeness and consistency. Descriptive statistics were done to quantify the use of at least eight ANC contacts and other characteristics. Variables with a p-value of less than 0.25 in bivariable logistic regression were selected as candidates for multivariable logistic regression. Finally, multivariable logistic regressions were used to assess the relative impact of explanatory variables on outcome variables. Adjusted Odds Ratio (AOR) and its 95% Confidence Interval (CI) were used to determine the level of association. A significance level of 0.05 was used to declare the significance of statistical tests.

The reliability of the questionnaire was assessed through an interview and direct observation using validated and pretested structured questionnaires. This required conducting the survey with participants in a medical facility located in the research area. A reliability test was done and Cronbach's alpha (reliability coefficient) equal to 0.78 was found showing an acceptable level of consistency. A standard error and variance inflation factor were used to examine the linear correlation between the independent variables in order to check for multi-collinearity. The multivariable analysis (VIF=0.7) additionally examined variables having a variance inflation factor (VIF) of one to ten and a standard error of >2. Using the cut point P-value > 0.05, the Hosmer-Lemeshow goodness of fit test was employed to assess the model's fitness.

Ethical clearance was obtained from the ethical review committee of Real Dream Health Sciences College with ethical letter protocol number: RDC/201/01/2021. The Central Gondar Zone Health Bureau and the relevant HCFs granted permission. The objectives and the benefits of the study were explained for the study subjects. Written consent was obtained from each participant. The right of the participants to withdraw from the study whenever they want to do so was respected. Anonymous questioner was used to protect the identity and confidentiality of the information obtains from individual participants.

Participants who could read and write gave their written consent, while those who could not gave their verbal or oral consent.

## Results

### Socio-demographic characteristics

A total of 421 healthcare professionals participated in this survey, yielding a response rate of 99.05%, according to the findings from (Table 1). The participants' ages ranged from 32.8 to 1.17 years on average, with 128 (30.3%) between the ages of 25 and 34. Among the total participants, 209 (49.6%) were orthodox Christians and 255 (60.6%) were married. According to the educational background, of the total participants, 126 (29.9%) had diploma midwives.

**Table 1.** Socio-demographic characteristics of health providers at a public health facility, Central Gondar Zone, Ethiopia, 2022 (N = 421)

Variables	Frequency (%)
<b>Maternal Age</b>	
≤24	110 (26.1)
25-34	128 (30.5)
35-44	110 (26.1)
≥45	73 (17.3)
<b>Gender</b>	
Male	154 (36.3)
Female	267 (63.7)
<b>Marital status</b>	
Single	78 (18.5)
Married	255 (60.6)
Divorced	72 (17.1)
Windowed	16 (3.8)
<b>Religion</b>	
Orthodox	209 (49.6)
Muslim	96 (22.3)
Catholic	60 (14.3)
Protestant	56 (13.8)
<b>Education</b>	
Diploma	126 (29.9)
BSc	120 (28.6)
Master	86 (20.4)
Doctor	89 (21.1)
<b>Profession</b>	
Midwife	266 (63.2)
Medical doctor	109 (25.9)
Others	46 (10.9)
<b>Work experience</b>	
≥8 years	160 (38.0)
5-7years	95 (22.6)
2-4 years	63 (15.0)
≤2 year	103 (24.4)

Variables	Frequency (%)
<b>Place work</b>	
Health center	234 (55.6)
Primary hospital	110 (26.1)
Specialized hospital	77 (18.3)
<b>Family income</b>	
≤7000	65 (15.4)
7001-11250	66 (15.7)
≥11251	290 (68.9)
<b>Access to information about new 8 antenatal contacts</b>	
Yes	102 (24.2)
No	319 (75.8)

About 266 (63.2%) of healthcare providers were midwife professionals. More than half of healthcare providers 234 (55.6%) were from health center facilities. According to access to health information, 319(75.8%) of the study participants didn't get information about their new eight or more antenatal contacts. Furthermore, regarding family income status, 290 (68.9%) participants, earned a monthly equal to or greater than 11251 Ethiopian birr.

### Knowledge on adequate ANC contact utilization

Among study participants, only 98 (23.3%) of them had knowledge about the WHO's 2016 recommended eight or more ANC contacts, while most healthcare providers i.e. 313 (74.7%) did not understand the difference between eight or more and four ANC (Table 2).

### Utilization of adequate antenatal care contacts among healthcare providers

The prevalence of the use of updated WHO eight or more ANC contact guidelines among healthcare providers was 20.9% (95%CI: 16.6–24.9), while most of the 333 (79.5%) of these healthcare providers were providing prenatal care using outdated versions of the WHO guidelines (four ANC visits). Among these, nearly half (42.0%) of the healthcare providers didn't know the rationale for the new version of antenatal management guidelines (more details presented in (Table 3).

### Factors influencing the use of appropriate prenatal care providers

This study identified some important factors that are associated with the utilization of the optimal ANC contacts in the Central Gondar

Zone. In the bivariate analysis, eight variables were related to the outcome and the result of the multiple regression analysis showed that only four variables were independently related to the outcome.

Based on the results, healthcare providers who work in specialized hospitals were 8.29 times more likely to practice adequate antenatal care contacts when compared with healthcare providers who work in health centers (AOR=8.29; 95%CI:0.47–1.54).

**Table 2 .** Frequency distributions of health care providers' knowledge on adequate antenatal care contacts in the Central Gondar Zone, Northwest Ethiopia, and 2022 (N = 421)

Obstetric Characteristics	Frequency (%)
<b>Know eight ANC contacts</b>	
Yes	98 (23.3)
No	323 (76.7)
<b>Know when it launched in the country start</b>	
Six years	102 (24.2)
Four years	60 (4.3)
Two years	33 (7.8)
I don't know	226 (53.7)
<b>Need to come for at least eight ANC contacts throughout her pregnancy</b>	
Yes	115 (27.3)
No	211 (47.7)
Can't say	105 (25.0)
<b>Know difference between eight ANC contacts and four ANC visits</b>	
Yes	108 (25.3)
No	313 (74.7)
<b>Difference (N=108)</b>	
More in number contact	35 (32.4)
Early detect and treat	27 (25.0)
Hepatitis B Surface Antigen	14 (12.9)
Ultrasound scan before 24 weeks	11 (10.2)
Screening for active TB	11 (10.2)
Indirect coomb's test	10 (9.3)
<b>Think eight ANC is necessary for women during becoming pregnant?</b>	
Yes	117 (27.8)
No	304 (72.2)

Furthermore, healthcare providers who had knowledge about adequate antenatal care contact guidelines were almost eight times more

likely to utilize eight or more ANC contacts when compared with healthcare providers who didn't have this knowledge (AOR = 7.9; 95% CI: 3.70–16.89). Furthermore, healthcare providers who knew the difference between eight ANC contacts and four ANC visits were nearly three times more likely to know the new adequate antenatal care contacts approach when compared to those who didn't (AOR = 2.90; 95% CI: 1.63–5.18).

**Table 3.** Utilization of adequate antenatal care contacts among health care providers in Central Gondar Zone, Ethiopia, 2022 (N = 421)

Category	Frequency (%)
<b>Use eight antenatal contacts in this facility</b>	
Yes	88 (20.5)
No	333 (79.5)
<b>Why did not used eight ANC contact? (n=339)</b>	
I don't know the rational	
Fear of increased workload for ANC	140 (42.0)
No dissemination of the new guidelines	77 (23.1)
Late initiation of ANC	20 (6.0)
Lack of training about adequate ANC Other	16 (3.1)
<b>As health care providers what is your recommended</b>	
Better to continues 4 ANC visits health avail the guidelines	120 (26.4)
Give training about eight ANC contact	90 (24.7)
Providers adhered to new approaches Community mobilize about 8 ANC contact	81 (22.3)
Others	62 (15.0)
	44 (8.6)
	24 (3.0)

Finally, healthcare providers who knew the importance of adequate antenatal care contacts during pregnancy were nine times more likely to practice the optimal eight or more ANC contacts in the health facility than healthcare providers who didn't know the importance of adequate antenatal care contacts (AOR = 9.00; 95% CI: 3.70–21.91) (Table 4).



**Table 4.** Factors associated with the Utilization of adequate antenatal care contacts by healthcare providers in Central Gondar Zone, Ethiopia, 2022 (N = 421)

Variables	Utilization of adequate ANC contacts		COR(95%CI)	AOR(95% CI)	P-value
	Yes	No			
<b>Age groups</b>					
≤24	87	23	0.60(0.53,1.84)	0.42(.16,1.14)	0.08
25-34	101	27	0.59(0.41,1.45)	0.56(0.24,1.34)	0.19
35-44	82	28	0.46(0.74,3.74)	0.51(0.22,1.22)	0.13
≥45	63	10	Rf	Rf	
<b>Religion</b>					
Orthodox	168	41	1.49(0.77,2.90)	1.35(0.62,2.94)	0.45
Muslim	46	10	1.67(0.89,4.08)	2.01(0.70,5.78)	0.20
Catholic	75	21	1.30(0.61,2.75)	1.08(0.43,2.71)	0.88
Protestant	44	16	Rf	Rf	
<b>work experience</b>					
≥7 years	123	37	1.12(0.63,2.20)	0.96(0.49,1.85)	0.89
5-6years	80	15	1.80(0.89,3.66)	2.08(0.89,4.78)	0.09
2-4 years	53	10	1.79(0.80,4.02)	1.86(0.71,4.87)	0.20
≤2 year	77	26	Rf	Rf	
<b>Workplace</b>					
Health center	169	65	Rf	Rf	0.85
Primary hospital	90	20	1.73(0.99,1.25)	1.62(0.49,1.52)	0.13
Specialized hospital	74	3	9.49(2.89,31.16)	8.29(1.47,1.54)	0.001
<b>Know adequate ANC contacts</b>					
Yes	40	58	3.95(2.38,6.56)	7.9(3.70,16.89)**	0.000
No	48	275	Rf	Rf	
<b>Know when it was launched in the country</b>					
Six years ago	23	79	1.08(0.64,3.31)	0.87(0.42,1.81)	0.71
Four years ago	10	50	0.35(0.42,2.81)	0.84(0.34,2.07)	0.71
Two years ago	7	26	0.99(0.36,0.38)	0.80(0.28,2.35)	0.69
I don't know	48	178	Rf	Rf	
<b>Know the difference between eight or more ANC contacts and four ANC visit</b>					
Yes	38	70	2.86(1.74,4.70)	2.90(1.63,5.18)*	0.000
No	50	263	Rf	Rf	
<b>Know the importance of adequate ANC contacts</b>					
Yes	105	12	2.92(1.52,5.59)	9.00(3.70,21.91)	0.000
No	228	76	Rf	Rf	

Note\*shows significant at p <0.05, \*\* statically significant at p<0.000, Hosmer- Lemes how goodness of fit test P 0.363, RF=Reference

## Discussion

The 2016 WHO ANC guidelines recommend that all pregnant women should have eight or more ANC contacts with skilled healthcare professionals to reduce maternal-child morbidity and mortality (32). Because it has more important components to early assess maternal, child, and fetal conditions than the former four antenatal visits (17). The World Health Organization's recommended antenatal care contact has yet to be institutionalized in Ethiopia (33). This study stands on the

frontlines to determine adequate antenatal care contact coverage and the factors that influence ANC contacts among healthcare providers after launched new guidelines. Hence, determining the prevalence and hindering factors of adequate antenatal care contacts utilization among healthcare providers is very crucial for improving the maternal healthcare system. My study revealed that 20.9% (95% CI: 16.6-24.9) of healthcare providers only used the latest WHO recommendation for adequate ANC contacts. This shows that compliance with the use of the updated ANC guidelines is low,

probably because it has not been adopted as a national policy. Compared to a prior study using Jordanian population-based data, this one revealed a lower prevalence, which is the coverage of adequate ANC contacts (74.0%), followed by Ghana (41.9% to 43.0%) and Albania (30.0%) (13). Similarly, the study from the Demographic and Health Survey in Liberia was 26.6% (28).

This discrepancy may be due to the information used was gathered recently, after the endorsement by Ethiopian Ministry of Health to practice adequate ANC contact guidelines and the findings cannot be credited to the implementation or non-implementation of the guidelines. Since the Ethiopia Ministry of Health recommendations were released in 2021 (19). It could be that before 2021, healthcare providers had eight or more ANC contacts if the women had high-risk pregnancies that needed a healthcare professional to keep a careful eye on them, but the new guideline (34) recommended that all pregnant women should be followed by a minimum of eight or more contacts with skilled healthcare providers.

On the other hand, the prevalence was found to be similar to the two population-based studies done in Nigeria (17.4% to 20%) (35, 36). Unfortunately, those studies utilized data collected after the endorsement of the adequate ANC contact guidelines. Therefore, approach for new adequate ANC contact is not more implemented in the study area.

Individual level factors at the healthcare provider's study include: knowledge of the importance of adequate ANC contact for pregnant women, knowledge of adequate ANC contact, healthcare providers' ability to differentiate between eight ANC contacts and four ANC visits, and eight antenatal contacts during becoming pregnant were statistically significant associations with the utilization of WHO recommended ANC contacts in the Central Gondar zone of Ethiopia.

The odds of adequate ANC contact were higher among healthcare providers who worked at hospitals compared to healthcare providers who worked at health centers. Similarly, a study in Cote d'Ivoire discovered that eight or more ANC visits during pregnancy were strongly correlated with schooling (37). Healthcare

providers are increasingly using the recommended ANC guideline and as a result, they are more aware of how the new guideline can reduce maternal child mortality (38). Healthcare providers who knew the importance of eight or more ANC contacts for pregnancy were 2.9 times more likely to utilize an adequate ANC contact compared to healthcare providers who didn't know about the new adequate ANC contact. The results of this investigation were found to be congruent with those of a study in Bangladesh that had similar conclusions with encounters with eight or more ANC contacts (31). This might be due to early initiations helping the women get early counseling about ANC visit schedules and establish a client-provider relationship. This, in turn, helps them to complete at least eight ANC contacts. Based on the available information, my analysis revealed that the odds of the frequency of adequate ANC contact services were also found to be higher among healthcare providers who had knowledge of adequate ANC contact compared to counterparts. This may be due to the fact that healthcare providers who had information about the new adequate ANC contacts were endorsed to practice modern ANC guidelines. This may be due to the fact that healthcare providers who had access to information about the new adequate ANC contact were endorsed to practice eight or more ANC guidelines. The positive impact of healthcare providers' knowledge on the frequency of ANC visits was consistent with the study's findings (39).

Furthermore, among healthcare providers who were able to differentiate between eight ANC contacts and four ANC visits of guidelines during becoming pregnant, they were nine times more likely to practice the new adequate ANC contact than their counterparts. Scholars recommended that healthcare providers be trained to recognize the significance of the WHO's updated guidelines and to provide culturally appropriate support to reduce pregnancy complications (40, 41). If healthcare providers are aware of the new WHO-recommended ANC contact guideline, it will have a significant impact on the utilization of adequate ANC contact. To further enhance adequate ANC contact, the mass media campaign on the benefits of having a sufficient number of ANC connections should be

strengthened. Evidence showed that accessing healthcare providers' good knowledge of the optimal benefits of adequate ANC contacts during the period of pregnancy was associated with capacity building for the use of modern healthcare services and eliminating inequality in access to updated ANC guidelines (42, 43).

The study highlighted certain significant potential limitations that should be taken into account when interpreting the findings. First off, the study's cross-sectional design precluded proving cause-and-effect connections. Second, recollection bias and social desirability may be included.

### Conclusion

In this study, it was found that achieving the WHO-recommended minimum of eight ANC contacts is still not institutionalized in all public health facilities and can be influenced by a variety of factors. Solving relevant factors for the non-utilization of the recommended adequate ANC contact is mandatory. In addition to this, increasing the awareness of healthcare providers should be a major domain to increase the utilization of adequate ANC contact. Furthermore, there is a need for further addressing hindering factors for the WHO-recommended guidelines' implementation.

### Acknowledgements

The author is grateful to the Real Dream Health Sciences College Ethical Review Committee for their approval. Also, he express his gratitude to the study participants and data collectors for their invaluable assistance during data collecting.

### Conflicts of interest

Authors declared no conflicts of interest.

### Funding

None.

### Ethical approval

Ethical clearance was obtained from the ethical review committee of Real Dream Health Sciences College with ethical letter protocol number: RDC/201/01/2021. The Central Gondar Zone Health Bureau and the relevant HCFs granted permission. Participants who could read and write gave their written consent,

while those who couldn't gave their verbal or oral consent.

### Authors' contribution

AZMZ: Designed the tests and developed with the ideas; performed the data analysis and interpretation; wrote the paper, tools, and authored the paper. AZM performed quality assessment.

### References

1. Organization WH. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva. World Health Organization; Available at: <https://apps.who.int/iris/handle/10665/327595>. 2019.
2. Dahab R, Sakellariou D. Barriers to Accessing Maternal Care in Low Income Countries in Africa: A Systematic Review. *International Journal of Environmental Research and Public Health*. 2020; 17(12).
3. Dahab R SD. Barriers to Accessing Maternal Care in Low Income Countries in Africa: A Systematic Review. *International Journal of Environmental Research and Public Health*. 2020; 17: 4292.
4. Odusina EK, Ahinkorah BO, Ameyaw EK, Seidu A-A, Budu E, Zegeye B, et al. Noncompliance with the WHO's Recommended Eight Antenatal Care Visits among Pregnant Women in Sub-Saharan Africa: A Multilevel Analysis. *BioMed Research International*. 2021; 2021.
5. Prual A, Toure A, Huguet D, Laurent Y. The quality of risk factor screening during antenatal consultations in Niger. *Health Policy and Planning*. 2000; 15(1): 11-16.
6. Testa J OC, Prual A, De Bernis L, Kone B. Determinants of risk factors associated with severe maternal morbidity: application during antenatal consultations. *Reproductive Biology and Endocrinology*. 2002; 31: 44-50.
7. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience: World Health Organization; 2016. View Article. 2020.
8. Indicators K. Mini demographic and health survey. EPHI and ICF. 2019 Jul.
9. Geneva WHO. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. [Internet]. [Cited 5 March 2020] Available on: <https://www.who.int/publications/i/item/9789241549912>. 2016: 152 p.



10. Vogel JP, HN, Souza JP, Gülmezoglu AM, Dowswell T, Carroli G, Baaqeel HS, Lumbiganon P, Piaggio G and Oladapo OT. Antenatal care packages with reduced visits and perinatal mortality: a secondary analysis of the WHO Antenatal Care Trial. *Reproductive Health*. 2013; 10(1): 19.
11. World Health Organization. Progress on household drinking water, sanitation and hygiene 2000-2017: special focus on inequalities. World Health Organization; 2019.
12. Kuhnt J VS. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. *BMJ Open*. 2017; 7: e017122.
13. Ekholuenetale M. Prevalence of eight or more antenatal care contacts: findings from multi-country nationally representative data. *Global Pediatric Health*. 2021; 8: 2333794X2111045822.
14. World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division: executive summary. World Health Organization; 2019.
15. Corsi DJ, Neuman M, Finlay JE, Subramanian SV. Demographic and health surveys: a profile. *International journal of epidemiology*. 2012; 41(6): 1602-1613.
16. Abdelhakm EM, Said AR. Developing nursing management protocol for maternity nurses regarding emergency obstetric care. *American Journal of Nursing Science*. 2017; 6(5): 418-425.
17. Johnson FA, Frempong-Ainguah F, Matthews Z, Harfoot AJ, Nyarko P, Baschieri A, et al. Evaluating the impact of the community-based health planning and services initiative on uptake of skilled birth care in Ghana. *PloS One*. 2015; 10(3): e0120556.
18. Csa IJ. Central statistical agency (CSA)[Ethiopia] and ICF. Ethiopia demographic and health survey, Addis Ababa, Ethiopia and Calverton, Maryland, USA. 2016; 1(1).
19. Yasin C, Geleto A, Berhane Y. Referral linkage among public health facilities in Ethiopia: a qualitative explanatory study of facilitators and barriers for emergency obstetric referral in Addis Ababa city administration. *Midwifery*. 2019; 79: 102528.
20. Shiferaw K, Mengistie B, Gobena T, Dheresa M, Seme A. Extent of Received Antenatal Care Components in Ethiopia: A Community-Based Panel Study. *International Journal of Women's Health*. 2021; 13: 803-813.
21. Othman S, Almahbashi T, Alabed AAA. Factors Affecting Utilization of Antenatal Care Services in Sana'a City, Yemen. *Malaysian Journal of Public Health Medicine*. 2017; 17(3): 1-14.
22. Worku D, Teshome D, Tiruneh C, Teshome A, Berihun G, Berhanu L, et al. Antenatal care dropout and associated factors among mothers delivering in public health facilities of Dire Dawa Town, Eastern Ethiopia. *BMC Pregnancy and Childbirth*. 2021; 21(1): 1-8.
23. Ahinkorah BO, Ameyaw EK, Seidu A-A, Oduosina EK, Keetile M, Yaya S. Examining barriers to healthcare access and utilization of antenatal care services: evidence from demographic health surveys in sub-Saharan Africa. *BMC Health Services Research*. 2021; 21(1): 1-16.
24. Boerleider AW, Wiegers TA, Manniën J, Francke AL, Devillé WL. Factors affecting the use of prenatal care by non-western women in industrialized western countries: a systematic review. *BMC Pregnancy and Childbirth*. 2013; 13(1): 1-11.
25. Nations U. Children's Fund antenatal pdf [Internet]. Available at: <https://www.unicef.org/media/files/antenatalpdf>. 2020.
26. Majrooh MA, Hasnain S, Akram J, Siddiqui A, Memon ZA. Coverage and quality of antenatal care provided at primary health care facilities in the Punjab province of Pakistan. *Plos One*. 2014; 9(11): e113390.
27. Mekuria W. The link between agricultural production and population dynamics in Ethiopia: a review. *Advances in plants & Agriculture Research*. 2018; 8(4): 348-353.
28. Ekholuenetale M, Nzoputam CI, Barrow A. Effects of socioeconomic factors and booking time on the WHO recommended eight antenatal care contacts in Liberia. *PLOS Global Public Health*. 2022; 2(2): e0000136.
29. Woldeamanuel B, Belachew T. Risk factors associated with frequency of antenatal visits, number of items of antenatal care contents received and timing of first antenatal care visits in Ethiopia: multilevel mixed-effects analysis.
30. Ekholuenetale M NC, Barrow A, Onikan A. Women's enlightenment and early antenatal care initiation are determining factors for the use of eight or more antenatal visits in Benin: further analysis of the demographic and health survey. *Journal of The Egyptian Public Health Association*. 2020; 95(1): 13.
31. Islam MM, Masud MS. Determinants of frequency and contents of antenatal care visits in Bangladesh: Assessing the extent of

- compliance with the WHO recommendations. *PloS One*. 2018; 13(9): e0204752.
32. WHO. Maternal mortality. Fact sheet; Geneva. Available at: <http://www.who.int/en/news-room/fact-sheets/detail/maternal-mortality>, Accessed 7 July 2018). 2018.
33. Indicators K. Mini demographic and health survey. EPHI and ICF. 2019 Jul.
34. World Health Organization. WHO recommendation on antenatal care contact schedules. The WHO Reproductive Health Library, March. 2018:1-7.
35. Fagbamigbe AF, Olaseinde O, Setlhare V. Sub-national analysis and determinants of numbers of antenatal care contacts in Nigeria: assessing the compliance with the WHO recommended standard guidelines. *BMC Pregnancy and Childbirth*. 2021; 21(1): 1-19.
36. Ekholuenetale M, Benebo FO, Idebolo AF. Individual-, household-, and community-level factors associated with eight or more antenatal care contacts in Nigeria: Evidence from Demographic and Health Survey. *Plos One*. 2020; 15(9): e0239855.
37. Kourouma KR, Agbre-Yacé ML, Doukouré D, Tano-Kamelan A, Coulibaly-Koné AS, N'dia AF, et al. Feasibility of the eight or more contacts of the WHO new antenatal care model in Cote d'Ivoire: an antenatal care providers' perspective. *African Journal of Reproductive Health*. 2021; 25(5): 150-160.
38. Knoema. Ghana maternal mortality ratio, 1960–2020 - knoema.com. Available at: <https://knoemacom/atlas/Ghana/Maternal-mortality-ratio>. 2021.
39. Joshi C TS, Hodgson R, Hayen A. Factors associated with the use and quality of antenatal care in Nepal: a population-based study using the demographic and health survey data. *BMC Pregnancy and Childbirth*. 2014; 14: 94.
40. Zanconato G, Msolomba R, Guarenti L, Franchi M. Antenatal care in developing countries: the need for a tailored model. *In Seminars in Fetal and neonatal Medicine*. 2006; 11(1); 15-20.
41. Roberts J SD, Marshak HH, Manda-Taylor L, Gleason P and Mataya R. The patient-provider relationship and antenatal care uptake at two referral hospitals in Malawi: A qualitative study. *Malawi Medical Journal*. 2015; 27(4): 145-150.
42. Kieny MP BH, Dovlo D, et al. Strengthening health systems for universal health coverage and sustainable development. *Bull World Health Organ*. 2017; 95: 537-539.
43. Chol C NJ, Agho KE, Cumming RG. Women's autonomy and utilisation of maternal healthcare services in 31 Sub-Saharan African countries: results from the demographic and health surveys, 2010– 2016. *BMJ Open*. 2019; 9: e023128.