








# BMJ Open Multilevel analysis of quality of antenatal care and associated factors among pregnant women in Ethiopia: a community based cross-sectional study

Wubshet Debebe Negash <sup>1</sup>, Samrawit Mihret Fetene <sup>1</sup>,  
 Ever Siyoum Shewarega <sup>2</sup>, Elsa Awoke Fentie <sup>2</sup>,  
 Desale Bihonegn Asmamaw <sup>2</sup>, Rediet Eristu Teklu,<sup>3</sup> Fantu Mamo Aragaw,<sup>3</sup>  
 Daniel Gashaneh Belay <sup>3,4</sup>, Tewodros Getaneh Alemu <sup>5</sup>,  
 Habitu Birhan Eshetu<sup>6</sup>

**To cite:** Negash WD, Fetene SM, Shewarega ES, *et al*. Multilevel analysis of quality of antenatal care and associated factors among pregnant women in Ethiopia: a community based cross-sectional study. *BMJ Open* 2022;**12**:e063426. doi:10.1136/bmjopen-2022-063426

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-063426>).

Received 01 April 2022  
 Accepted 19 July 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

## Correspondence to

Dr Wubshet Debebe Negash;  
 wubshetdn@gmail.com

## ABSTRACT

**Objective** To determine the magnitude of quality of antenatal care and associated factors among pregnant women in Ethiopia.

**Design** A community-based cross-sectional study.

**Setting** Ethiopia.

**Participants** A total of 4757 weighted sample of pregnant women from 18 January 2016 to 27 June 2016, were included for this analysis.

**Outcome** Quality of antenatal care (ANC).

**Methods** Our analysis was based on secondary data using the 2016 Ethiopian Demographic and Health Survey. The quality of ANC was measured when all six essential components, such as blood pressure measurements, blood tests, urine tests, nutrition counselling, birth preparation advice during pregnancy and information on potential complications, were provided. Stata V.14 software was used for analysis. A multilevel mixed-effect logistic regression analysis was fitted. Adjusted OR (AOR) with 95% CIs was used to show the strength and direction of the association. Statistical significance was declared at a p value less than 0.05.

**Results** The magnitude of quality of ANC in Ethiopia was 22.48% (95% CI: 21.31% to 23.69%). Educational status; primary (AOR=1.34; 95% CI: 1.06 to 1.68) and secondary (AOR=2.46; 95% CI: 1.76 to 3.45), middle (AOR=1.31; 95% CI: 1.01 to 1.72) and rich (AOR=2.08; 95% CI: 1.59 to 2.72) wealth status, being married (AOR=2.34; 95% CI: 1.08 to 5.10) and four or more ANC (AOR=2.01; 95% CI: 1.67 to 2.40) were statistically significant associated factors of quality ANC in Ethiopia.

**Conclusions** This study found that nearly only one in five pregnant women received quality ANC during pregnancy. To improve the quality of ANC in Ethiopia, Ministry of Health and health facilities are needed to increase financial support strategies that enable pregnant women from poor households to use health services and enhance pregnant women's understanding of the significance of quality of ANC through health education. Additionally, Community health workers should also be placed on supporting unmarried pregnant women to have quality ANC.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study uses nationally representative data and large sample size.
- ⇒ This study also used a multilevel-modelling technique to identify a more valid result that considers the survey data's hierarchical nature.
- ⇒ The study has limitations due to the cross-sectional nature of the data, it does not show a temporal relationship between independent variables and the outcome variable.
- ⇒ There could be recall bias, since we used the most recent live birth in the past 5 years before the survey.
- ⇒ Due to the use of secondary data, we used only six essential components of antenatal care (ANC) to determine the magnitude of quality of ANC.

## INTRODUCTION

Women and teens receive care from health professionals during pregnancy to ensure that both mothers and babies experience the most favourable outcomes. Aside from offering health education, screening, diagnosis and disease prevention, antenatal care (ANC) can save lives.<sup>1 2</sup> Focused ANC primarily helps women to maintain normal pregnancies by detecting pre-existing conditions, preventing complications that may arise during childbirth.<sup>3 4</sup> ANC is the main method for improving maternal health outcomes through early detection of pregnancy risks, and complications.<sup>4</sup> Access to care also includes nutrition, vaccinations, medical tests and therapies.<sup>5</sup> Moreover, women's access to comprehensive maternal healthcare, from conception to delivery and afterward, it is possible to minimise their risk of death.<sup>1 6</sup>

Understanding and applying different perspectives does not hinder success in achieving quality in healthcare as long as

the key principles and concepts of quality are identified and applied.<sup>7</sup> A measure of quality of care is the extent to which people and societies are provided with health services that are consistent with evidence-based professional knowledge and that result in the desired health outcomes.<sup>8</sup>

There was a 38% drop in maternal mortality worldwide between 2000 and 2017.<sup>9</sup> But according to the WHO estimates, approximately 295 000 women died after pregnancy or childbirth since 2017, with 94% of these deaths occurring in low income and lower middle-income countries.<sup>9</sup> The maternal mortality rate in sub-Saharan Africa is also the highest in the world, with 546 maternal deaths per 100 000 live births.<sup>1</sup> In Ethiopia, approximately 14 000 maternal deaths occurred in 2017, resulting in an overall maternal mortality rate of 401 deaths per 100 000 live births.<sup>9</sup> In developing nations, the rate of maternal and neonatal death continues to rise despite improved access to ANC. This shows that even when coverage is high, negative health outcomes are still prevalent.<sup>10</sup>

Despite the good intervention to increase the coverage of ANC, coverage alone cannot be a guarantee to achieve the Sustainable Development Goal. Quality of ANC service is an influencing factor for the health of the mother and the survival of newborn care.<sup>11 12</sup> In addition to this, quality of healthcare services for individuals and population increases the likelihood of desired health outcomes.<sup>8</sup>

The Ethiopian government had tried to improve the maternal healthcare services through giving priority in its political agenda.<sup>13</sup> The government aimed to reduce the maternal mortality below 267 deaths per 100 000 live births.<sup>14</sup> To achieve this goal the country implemented different interventions such as ANC, skilled birth services and postnatal care. Additionally, expansion of health centres and hospitals with adequate medical equipment, health extension programmes, supporting facilities like private wing and non-governmental organisations are still working to improve the maternal health.<sup>13 14</sup>

While Ethiopia has made the aforementioned interventions to reduce pregnancy-related complications, maternal death rates due to these complications remained high.<sup>13 15 16</sup> Even though multiple studies were conducted in Ethiopia, none of them were representative for the country and are related with factors and coverage of ANC,<sup>12 17–19</sup> rather than quality of ANC. Hence, it is essential to have a clear understanding of this issue in order to implement interventions which would improve the quality of ANC. Therefore the aim of this study was to determine the magnitude of quality of ANC and associated factors among pregnant women in Ethiopia.

## METHODS

### Study settings and data source

A cross-sectional study of Ethiopian Demographic and Health Survey (EDHS) data were used for this study. The survey was conducted by the Central Statistical Agency in

collaboration with the Federal Ministry of Health and the Ethiopian Public Health Institute. EDHS was a national representative sample conducted from 18 January 2016 to 27 June 2016. There are 9 regional states in Ethiopia (Tigray, Afar, Amhara, Oromia, Benishangul, Gambela, South Nation Nationalities and People Region, Harari and Somali), and 2 administrative cities (Addis Ababa and Dire-Dawa), 611 Districts and 15 000 Kebeles.

We used the women's recode (Individual Recode (IR) file) data set and extracted the dependent and independent variables. The data set is freely available and possible to download from the link: <https://dhsprogram.com/data/available-datasets.cfm>. The Demographic and Health Survey (DHS) employs a two-stage stratified sampling technique, which makes the data nationally representative.<sup>20</sup> A total weighted sample of 4757 pregnant women aged 15–49 years were included in the study. Pregnant women who had not received ANC visits during their recent pregnancy and who did have not all the six components of ANC services were excluded in this study.

The healthcare system in Ethiopia is structured in a three-tier system: primary, secondary and tertiary levels of care. The primary level of care including primary hospitals, health centres and health posts, the secondary level of care is delivered by general hospitals and the tertiary level of healthcare is given by specialised hospitals.<sup>21</sup>

### Variables of the study

#### Dependent variable

The outcome variable was quality of ANC. The outcome variable is binary, and it is coded as 1 if they had received all the six essential ANC components and 0 otherwise. These components were measurement of blood pressure, blood test, urine test, informed on possible complication, counselling on nutrition and advice on birth preparedness plan ever in their ANC visit.<sup>22</sup> Each component has a binary response (1=yes and 0=no). The construction of the outcome variable was guided by the WHO ANC guidelines.<sup>23</sup>

#### Independent variables

Different independent variables were considered in this study to determine factors associated with quality of ANC (table 1).

### Data processing and analysis

Stata V.14 statistical software was used for data analysis. All frequency distributions were weighted (v005/1000000) throughout the analysis to ensure that the DHS sample was a representative sample and to obtain reliable estimates and SEs before data analysis.

The first step was a graphical representation of the quality of ANC among pregnant women.

Out of 15 683 total eligible households, 7193 were pregnant in the preceding 5 years. Of this, 2500 pregnant women were excluded because of they had no ANC. Lastly, 4693 pregnant women in the preceding 5 years had complete data on quality of ANC and were included

**Table 1** List of variables for the assessment of quality of ANC among pregnant women in Ethiopia

Variables	Description
Age of the women	15–24, 25–34 and 35–49.
Resident	Rural, urban.
Women education level	No formal education, primary education and secondary and higher education.
Women occupation	Not employed, employed.
Partner education level	No formal education, primary education and secondary education and higher.
Wealth index	As a result of high variability of observation from the original DHS classification of households into five categories using principal component analysis, the wealth index scores were re-categorise into three categories (poor, medium and rich) by merging poorest with poorer and richest with richer for the ease of interpretation of principal component analysis.
Timing of first ANC in months	≤3, >3.
Number of ANC visits	<4, ≥4.
Birth order	1, 1–4 and ≥5.
Marital status	Married, unmarried.
Region	Small peripheral (Somali, Afar, Gambela, Benshangul Gumuz).
Distance to the nearest health facility	Large central (Tigray, Amhara, Oromia, South Nation Nationalities). Metropolitan (Addis Ababa, Dire Dawa, Harar). Big problem, not big problem.
Community-level education and community-level poverty	Hence, we generate the community-level variables by aggregating the individual-level factors at cluster level and categorising them as high and low based on the national median value since these were not normally distributed. Community-level education was generated by the proportion of households in the educated categories obtained from the highest educational level. Categorised as low if the proportion of women were educated below 50% and high if the proportion is ≥50%. <sup>61</sup> Community-level poverty was aggregated by the proportion of households in the poorest and poorer quantile. Aggregated as low if the proportion from a given community is <50% and high if the proportion is ≥50%. <sup>61</sup>

ANC, antenatal care ; DHS, Demographic and Health Survey .

in the analysis. Overall, a total weighted sample of 4757 pregnant women were included in this study.

The second step was a bivariate analysis that calculated the proportion of quality of ANC across the independent variables with their p values. All the variables having a p value less than 0.2 in bivariable were used for multivariable analysis. For the multivariable analysis, adjusted ORs with 95% CIs and a p value of less than 0.05 were used to identify associated factors of quality of ANC. In the final step of the analysis, a multilevel logistic regression analysis comprising fixed effects and random effects was done.

The results of the fixed effects of the model were presented as adjusted OR (AOR) while the random effects were assessed with intraclass correlation coefficient (ICC). Four models were fitted; null model (model 0) which shows the variations in the quality of ANC in the absence of any independent variables. Model I an adjusted for the individual-level variables, Model II adjusted for the community-level variables and model III adjusted for both individual and community-level variables. Simultaneously, model fitness was done using the deviance (−2 log likelihood). Variance inflation factor was used to check for multicollinearity among independent variables and it was found no multicollinearity (mean value for the final model=1.5).

### Ethical approval

Not applicable/no human participants included. Consent to participants is not applicable since the data are secondary and is available in the public domain. All the methods were conducted according to the Helsinki declarations. More details regarding DHS ethical standards and data are available online at: <http://www.dhsprogram.com>.

### Patient and public involvement statement

Pregnant women were included in this study by providing valuable information. Nevertheless, they have never been involved in the study design, protocol, data collection tools and reporting disseminating the finding.

## RESULTS

### Socio-demographic and maternal characteristics of the women

A total of 4757 weighted sample women who gave birth in the preceding 5 years were included for the final analysis. The mean age of the women was 28 years with an IQR of (IQR: 38–24). Most (42.83%) of the women were from the rich wealth status. Most (92.89%) of the women were married and half (50.76%) had four or more ANC. The majority (81.7%) of the women were rural residents. Most (90.35%) of the women were from large central regions. Majority (70%) of the women were from communities with high proportion of education (table 2).

### MAGNITUDE OF QUALITY OF ANC AMONG ANC ATTENDANTS

The magnitude of quality of ANC in Ethiopia was 22.48% (95% CI: 21.31% to 23.69%). Of the six essential components of ANC, blood pressure was the most (75.29%) service given for ANC booked women. Of the study participants 264 (5.55%) had not get any of the six components of ANC (table 3).

### Factors associated with quality of ANC

The null model in the random effects, showed that a significant statistical differences in the odds of quality of ANC with a community variance of 1.35. Moreover, the ICC in the null model revealed that the 29.15% of the

**Table 2** Sociodemographic-related characteristics of women in Ethiopia, 2016 (n=4757)

Variables	Categories	Frequency (n)	Percentage (%)	Weighted % of quality of ANC
Age of women	15–24	1232	25.9	19.99
	25–34	2487	52.29	23
	≥35	1038	21.81	24.18
Household wealth index	Poor	1727	36	13.71
	Middle	993	20.87	17.64
	Rich	2037	42.83	32.26
Educational status of the women	No formal education	2569	54.01	17.07
	Primary	1574	33.1	22.54
	Secondary and higher	614	12.9	44.95
Occupation	Employed	2210	46.46	24.1
	Not employed	2547	53.54	21.07
Current marital status	Unmarried	338	7.11	21.67
	Married	4419	92.89	22.54
Number of ANC	<4	2342	49.24	14.79
	≥4	2415	50.76	29.93
Timing of first ANC in months	≤3	1541	32.29	29.55
	>3	3216	67.61	19.09
Birth order	1	1119	23.52	25.88
	2–4	2083	43.79	22.7
	≥5	1555	32.69	19.72
Distance to the health facility	Big problem	2397	50.39	18.5
	Not big problem	2360	49.61	24.17
Residence	Urban	870	18.29	39.42
	Rural	3887	81.71	18.68
Region	Small peripheral	225	4.72	16.28
	Large central	4298	90.35	21.56
	Metropolitan	234	4.92	45.31
Community-level education	High	3369	70.83	17.7
	Low	1388	29.17	24.44
Community-level poverty	High	2316	48.68	16.54
	Low	2441	51.32	28.11

ANC, antenatal care .

total variability of quality of ANC accounted for differences between clusters. Additionally, the median OR revealed that there was heterogeneity on quality of ANC among different clusters. Accordingly the odds of quality of ANC was 3.02 times higher among women of higher cluster of quality of ANC than women within lower cluster of quality of ANC. With regard to model comparison, the third model was selected as a final model since it has the lowest (4085.68) deviance. In the final model, after adjusting for the individual and community-level variables, education of the women, number of ANC, wealth index and current marital status were significantly associated factors with quality of ANC.

Accordingly, the odds of quality of ANC was 1.34 (AOR=1.34; 95% CI: 1.06 to 1.68) times and 2.46

(AOR=2.46; 95% CI: 1.76 to 3.45) times higher among women who had completed primary and secondary education, respectively, as compared with women who had no formal education.

Women in the rich and middle wealth status were 1.31 (AOR=1.31; 95% CI: 1.01 to 1.72) times and 2.08 (AOR=2.08; 95% CI: 1.59 to 2.72) times higher quality of ANC than women of poor wealth status.

Married women were 2.34 times more likely to have the quality of ANC than women who had not married (AOR=2.34; 95% CI: 1.08 to 5.10).

The odds of quality of ANC increased by 2.01 times among women who had four or more ANC as compared with their counter parts (AOR=2.01; 95% CI: 1.67 to 2.40) (table 4).



**Table 3** Magnitude of quality of ANC among ANC attendants, Ethiopia, 2016

ANC components	Categories	Frequency	Percentage
Blood pressure	Yes	3582	75.29
	No	1175	24.71
Blood test	Yes	3454	72.6
	No	1303	27.4
Urine test	Yes	3147	66.16
	No	1610	33.84
Told about pregnancy complications	Yes	2142	45.02
	No	2615	54.98
Nutritional counselling	Yes	3150	66.21
	No	1607	33.79
Told about birth preparedness plan	Yes	2662	55.96
	No	2095	45.04
Overall ANC quality	Yes	1069	24.48
	No	3688	77.52
Number of components	0	264	5.55
	1	369	7.76
	2	468	9.84
	3	803	16.87
	4	911	19.15
	5	873	18.35
	6	1069	22.48

ANC, antenatal care .

## DISCUSSION

According to the WHO guideline recommendation, all pregnant women needed to receive all essential components (advice on birth preparedness plan, blood pressure measurement, blood test, counsel on nutrition, urine test, information on possible complications) of ANC.<sup>23</sup> The study attempted to assess the magnitude and associated factors of the quality of ANC among pregnant women in Ethiopia. The findings of our study will help policymakers and health facilities to develop tailored intervention strategies by considering the level of quality of ANC services and the factors associated with it.

According to this study, only one in five pregnant women received quality ANC. The quality of ANC was significantly associated with education, wealth status, marital status and the number of ANC visits.

The finding is higher than a study conducted in East Africa 11.16%.<sup>24</sup> This discrepancy could be due to the previous study incorporating different countries, which significantly varied across countries. That may be because of inequalities in access to ANC services and the views of populations about the importance of ANC.<sup>25</sup> Moreover, in some of the East African countries, there is ongoing conflict and persistent political instability that played an important role in hindering the quality of the ANC; the scholars revealed that lack of safety played a major role in reducing the ANC, especially in remote areas.<sup>26 27</sup>

However, this study is also lower than the studies conducted in Ambo, Ethiopia 89%<sup>28</sup>; Jimma, South West Ethiopia 48.3%<sup>29</sup>; Bahir Dar, Ethiopia 52.3%<sup>30</sup>; Nepal 43%<sup>31</sup>; urban slum Aligarh, India 66%<sup>32</sup>; Malaysia 50%<sup>33</sup>; and Builsa district, Ghana 85%.<sup>34</sup> The possible explanation could be that most of the indicated studies are facility based with small sample sizes. The way they operationalised the dependent variable (quality of ANC) could also be the reason for the discrepancy, because the current study assessed the quality of ANC only by using six essential components of ANC, whereas the former studies assessed the outcome variable slightly different from the current study. For instance, studies done in Ambo, Ethiopia; Jimma, South West Ethiopia; and Bahir Dar, Ethiopia, quality of care assessed based on the point of view of the provider, manager and the clients.<sup>28-30</sup> Additionally, the discrepancy between this finding and that of studies conducted outside of Ethiopia could be due to socio-demographic and cultural differences.

Pregnant women with a higher level of education had higher odds of quality of ANC compared with those without formal education. The findings of this study are in agreement with those of studies conducted in Southern Ethiopia,<sup>35</sup> Tanzania<sup>36</sup> and East Africa.<sup>24</sup> The possible reason for this might be that pregnant women with higher levels of education are more likely to find information from mass media to become aware of the importance

**Table 4** Multilevel analysis of factors associated with quality of ANC in Ethiopia, 2016 (n=4757)

Variables	Categories	Model 2		Model 3		Model 4	
		AOR (95% CI)	Null model	AOR (95% CI)	Null model	AOR (95% CI)	Null model
Age	15–24	1		1		1	
	25–34	1.10 (0.86 to 1.42)		1.10 (0.86 to 1.42)		1.05 (0.81 to 1.35)	
	35 and above	1.23 (0.87 to 1.72)		1.23 (0.87 to 1.72)		1.14 (0.81 to 1.61)	
Women educational status	No education	1		1		1	
	Primary	1.36 (1.09 to 1.71)		1.36 (1.09 to 1.71)		1.34 (1.06 to 1.68)*	
	Secondary and higher	2.63 (1.89 to 3.67)		2.63 (1.89 to 3.67)		2.46 (1.76 to 3.45)*	
Occupation of women	Employed	1.07 (0.89 to 1.28)		1.07 (0.89 to 1.28)		1.07 (0.89 to 1.28)	
	Not employed	1		1		1	
Wealth index	Poor	1		1		1	
	Middle	1.33 (1.03 to 1.73)		1.33 (1.03 to 1.73)		1.31 (1.01 to 1.72)*	
	Rich	2.27 (1.78 to 2.90)		2.27 (1.78 to 2.90)		2.08 (1.59 to 2.72)*	
Current marital status	Unmarried	1		1		1	
	Married	2.28 (1.04 to 4.95)		2.28 (1.04 to 4.95)		2.34 (1.08 to 5.10)*	
Husband education	No formal education	1		1		1	
	Primary	0.73 (0.59 to 0.91)		0.73 (0.59 to 0.91)		0.72 (0.61 to 1.01)	
	Secondary and higher	1.21 (0.90 to 1.63)		1.21 (0.90 to 1.63)		1.16 (0.86 to 1.57)	
Number of ANC	<4	1		1		1	
	≥4	2.05 (1.72 to 2.45)		2.05 (1.72 to 2.45)		2.01 (1.67 to 2.40)*	
	1	1		1		1	
Birth order	2–4	1.09 (0.85 to 1.39)		1.09 (0.85 to 1.39)		1.11 (0.86 to 1.42)	
	≥5	1.29 (0.92 to 1.81)		1.29 (0.92 to 1.81)		1.37 (0.97 to 1.92)	
	Rural	1		1		1	
Residence	Urban	2.45 (1.62 to 3.69)		2.45 (1.62 to 3.69)		1.38 (0.89 to 2.16)	
	Small peripheral	1		1		1	
Regions	Large central	1.59 (0.97 to 2.57)		1.59 (0.97 to 2.57)		1.48 (0.89 to 2.46)	
	Metropolitan	2.33 (1.26 to 4.31)		2.33 (1.26 to 4.31)		1.81 (0.94 to 3.47)	
Community-level education	Low	1		1		1	
	High	1.21 (0.86 to 1.68)		1.21 (0.86 to 1.68)		0.99 (0.69 to 1.42)	
Community-level poverty	Low	1.52 (1.09 to 2.09)		1.52 (1.09 to 2.09)		1.03 (0.72 to 1.46)	
	High	1		1		1	

Continued

Table 4 Continued

Variables	Categories	Null model	Model 2	Model 3	Model 4
			AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Random effect					
Variance		1.35	1.05	1.06	1.03
ICC (%)		29.15	24.34	24.39	23.71
MOR		3.02	2.64	2.66	2.62
PCV	Re	Re	22.22	21.48	23.7
Model comparison					
Deviance (-2 log likelihood)		4655.62	4093.76	4563.94	4085.68
Mean VIF		—	1.45	1.2	1.5
*P value<0.05.					
ANC, antenatal care ; AOR, adjusted OR; ICC, Intraclass correlation coefficient; MOR, median OR; PCV, proportional change in variance; VIF, variance inflation factor.					

of ANC and adhere to follow-up schedules.<sup>37</sup> Moreover, they can understand healthcare providers' instructions, education and counselling due to better communication skills that facilitate interactions with health workers.<sup>38</sup>

The likelihood of quality of ANC among pregnant women from households in the middle and rich wealth status was higher than that of pregnant women from poor wealth status households. This finding is supported by studies done in Nepal,<sup>39</sup> Kenya<sup>40</sup> and East Africa.<sup>24</sup> Providing healthcare, whether from governmental or non-governmental facilities, with person-centred services (take into account the preferences of pregnant women and respond to their needs accordingly) may be able to improve the quality of ANC for pregnant women from the richest households.<sup>41 42</sup> Moreover, the economic differences in accessing maternal or reproductive healthcare, along with other factors, such as media exposure and travel time to the health facility, are also determining factors in the quality of ANC.<sup>43 44</sup> Thus, ANC information may be more readily available to rich women from the mass media. Additionally, the cost of travelling to distant health facilities contributes indirectly to the cost of ANC which can be easily afforded by pregnant women from the rich households as compared with their counterparts.<sup>45</sup> Furthermore, income could also influence the health seeking behaviour of the mother in which women in poor households may be subjected to specific worries and feel inadequate for seeking healthcare, this can directly affect the quality of ANC.<sup>46 47</sup>

The study also showed that married pregnant women were higher odds of quality of ANC compared with their counterparts. This is consistent with previous studies conducted in Ethiopia.<sup>48-50</sup> In comparison to unmarried women, pregnant married women may experience higher quality ANC as a result of better psychological (advise to seek ANC visit for better pregnancy outcome) and economic support from their husbands, the desirability and plannedness of their pregnancy, and the community's acceptance and support of their pregnancy status.<sup>51</sup> However, those women who are pregnant outside of wedlock are often afraid to go out and socialise in the community due to community stigmatisation and marginalisation.<sup>52</sup> This situation makes them less likely to go to ANC visits which in turn affects the quality of ANC.<sup>48 51</sup>

Furthermore, pregnant women who had received at least four ANC visits had the quality of ANC compared with mothers who had received below four ANC visits. This finding agreed with the report from Southern Ethiopia,<sup>18</sup> and Rwanda.<sup>53</sup> It might be that women who visit four or more ANC have a greater chance of getting extensive health education sessions, have improved rapport with ANC providers and are more likely to get and recognise quality of ANC and report it positively.<sup>54 55</sup> Furthermore, the frequent contact between the ANC provider and the pregnant woman also promotes a sense of trust and confidence in the services as well as enhances the familiarity of the pregnant woman with the health system.<sup>56</sup> This ensures that women to freely share information with skilled providers and that further ANC components can be served as a result.<sup>53 57</sup>

Elsewhere studies in Ghana<sup>58</sup> and Ethiopia<sup>18 59</sup> revealed that women who had resided in rural areas were less likely to have quality ANC. This might be because the health infrastructures in the rural area are less developed and there are fewer trained health workers. Studies in Nigeria,<sup>60</sup> and Kenya,<sup>40</sup> also revealed that as the age of women become older they get quality ANC than adolescent and young aged women. It might be because older women understand the importance of ANC visits, and they can benefit from repeated health education and counselling, thus enhancing their understanding of ANC benefits. However, in this study, some socio-demographic characteristics such as residence and age were not statistically significant. This difference might be differences in the approach used in collecting and analysing data. For instance, the current study uses EDHS data and multilevel approaches of analysis.

It is conclusive that we need to do more to improve the quality of ANC. More than three-fourths of mothers actually did not receive quality ANC, and less than a quarter received it with all six essential components (such as, blood pressure measurements, blood tests, urine tests, nutrition counselling, birth preparation advice during pregnancy and information on potential complications) of ANC. This means that thousands of mothers are only receiving some of the components of ANC to maintain a healthy pregnancy. Therefore, the Ministry of Health, health facility professionals and community health workers have an important role in raising consciousness of this matter to counteract the problem.

The main strengths of this study were the use of nationally representative data, with a large sample size and the availability of individual and community-level factors. This study also used a multilevel-modelling technique to identify a more valid result that considers the survey data's hierarchical nature. Despite these strengths, it has limitations due to the cross-sectional nature of the EDHS data. It does not show a temporal relationship between independent variables and the outcome variable. There could be recall bias since we used the most recent live birth in the past 5 years before the survey for the calculation of the quality of ANC. Additionally, due to the use of secondary data, we used only six essential components of ANC to determine the magnitude of quality of ANC. The DHS omitted to provide data regarding screening and treatment of disorders such as HIV, abnormal fetal lie, diabetes, tuberculosis and malaria, as well as the provision of preventive interventions, such as tetanus immunisation and insecticide-treated bed nets which would be relevant if they were incorporated in the construction of quality of ANC. If the aforementioned components were included the estimate might become low.

## Conclusion

This study found that nearly only one in five pregnant women received quality ANC during pregnancy. Level of education, wealth index, marital status and number of ANC visits were factors associated with the quality of ANC visits. It would be useful to increase financial support

strategies that enable pregnant women from poor households to use health services and enhance pregnant women's understanding of the significance of quality of ANC through health education targeting women with no education. Emphasis should also be placed on supporting unmarried pregnant women to have quality ANC. Ministry of Health, health facility's professional and community health workers have an important task in raising consciousness of this matter.

## Author affiliations

<sup>1</sup>Department of Health Systems and Policy, University of Gondar, Gondar, Ethiopia

<sup>2</sup>Department of Reproductive Health, Institute of Public Health, University of Gondar, Gondar, Ethiopia

<sup>3</sup>Department of Epidemiology and Biostatistics, University of Gondar, Gondar, Ethiopia

<sup>4</sup>Department of Human Anatomy, University of Gondar, Gondar, Ethiopia

<sup>5</sup>Department of Pediatrics and Child Health Nursing, University of Gondar, Gondar, Ethiopia

<sup>6</sup>Department of Health Education and Behavioral Sciences, University of Gondar, Gondar, Ethiopia

**Acknowledgements** Our thanks forwarded to the Demographic and Health Survey (DHS) programmes, for the permission to use all the relevant DHS data for this study.

**Contributors** All authors contributed to the preparation of the manuscript. WDN, SMF, DGB and EAF conceived the idea. WDN extracted the data, conducted analysis and wrote the original draft of the manuscript. ESS, DBA, RET, FMA, TGA and HB critically edited, revised and reviewed the manuscript. DGB assisted in the data analysis and interpretation. All of the authors read and approved the final manuscript. WDN act as the guarantor.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

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

**Patient consent for publication** Consent obtained directly from patient(s).

**Ethics approval** Not applicable.

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

**Data availability statement** Data are available upon reasonable request. The data used for this study will be available with a reasonable request from the corresponding author.

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

## ORCID iDs

Wubshet Debebe Negash <http://orcid.org/0000-0001-9720-7558>

Samrawit Mihret Fetene <http://orcid.org/0000-0002-6312-0267>

Ever Siyoum Shewarega <http://orcid.org/0000-0001-8146-6344>

Elsa Awoke Fentie <http://orcid.org/0000-0003-2485-3764>

Desale Bihonegn Asmamaw <http://orcid.org/0000-0001-7302-2575>

Daniel Gashaneh Belay <http://orcid.org/0000-0002-5724-6234>

Tewodros Getaneh Alemu <http://orcid.org/0000-0002-7829-0648>

## 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* 2019.
- 2 Organization WH. *The who application of ICD-10 to deaths during the perinatal period: ICD-PM*, 2016.



- 3 Preparer TBP. Global health technical briefs. In: *Focused antenatal care: a better, cheaper, faster, evidence-based approach*, 2005.
- 4 Sserwanja Q, Nabbuye R, Kawuki J. Dimensions of women empowerment on access to antenatal care in Uganda: a further analysis of the Uganda demographic health survey 2016. *Int J Health Plann Manage* 2022;37:1736–53.
- 5 UNICEF. Healthy mothers, healthy babies—UNICEF data, 2019. Available: <https://data.unicef.org/resources/healthymothers-healthybabies/>.
- 6 Kinney MV, Kerber KJ, Black RE, et al. Sub-Saharan Africa's mothers, newborns, and children: where and why do they die? *PLoS Med* 2010;7:e1000294.
- 7 Buttell P, Hendler R, Daley J. Quality in healthcare: concepts and practice. *The business of healthcare* 2008;3:61–94.
- 8 Organization WH. *Delivering quality health services: A global imperative*. OECD Publishing, 2018.
- 9 Hailemariam A, Gebreselassie T, Teller C. Session. In: *The lagging demographic and health transitions in rural Ethiopia: socio-economic, agro ecological and health service factors affecting fertility, mortality and nutrition trends*. 104, 2007.
- 10 Hogan MC, Foreman KJ, Naghavi M, et al. Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards millennium development goal 5. *The Lancet* 2010;375:1609–23.
- 11 Tafere TE, Afework MF, Yalew AW. Does antenatal care service quality influence essential newborn care (ENC) practices? in Bahir Dar City administration, North West Ethiopia: a prospective follow up study. *Ital J Pediatr* 2018;44:1–8.
- 12 Muchie KF. Quality of antenatal care services and completion of four or more antenatal care visits in Ethiopia: a finding based on a demographic and health survey. *BMC Pregnancy Childbirth* 2017;17:1–7.
- 13 Van Lith LM, Yahner M, Bakamjian L. Women's growing desire to limit births in sub-Saharan Africa: meeting the challenge. *Global Health: Science and Practice* 2013;1:97–107.
- 14 . Health sector transformation plan HSTP 2015/16–2019/20 (2008–2012 EFY); 2015.
- 15 Legesse T, Abdulahi M, Dirar A. Trends and causes of maternal mortality in Jimma university specialized Hospital, Southwest Ethiopia: a matched case-control study. *Int J Womens Health* 2017;9:307–13.
- 16 Westoff CF, Koffman D. *DHS analytical studies*. In: *Birth spacing and limiting connections*. 21, 2010.
- 17 Ejigu Tafere T, Afework MF, Yalew AW. Antenatal care service quality increases the odds of utilizing institutional delivery in Bahir Dar City administration, North Western Ethiopia: a prospective follow up study. *PLoS One* 2018;13:e0192428.
- 18 Tadesse Berehe T, Modibia LM. Assessment of quality of antenatal care services and its determinant factors in public health facilities of Hossana town, Hadiya zone, southern Ethiopia: a longitudinal study. *Adv Public Health* 2020;20:1–11.
- 19 Fesseha Get al. Perceived quality of antenatal care service by pregnant women in public and private health facilities in northern Ethiopia. *American Journal of Health Research* 2014;2:146–51.
- 20 Csa I. Central statistical agency(CSA)[Ethiopia] and ICFEthiopia demographic and health survey2016Addis Ababa, Ethiopia and Calverton, Maryland, USA.
- 21 MOH E. October 2010. In: *Federal Democratic Republic of Ethiopia Ministry of health sector development program IV October 2010 contents*, 2014.
- 22 Arsenault C, Jordan K, Lee D, et al. Equity in antenatal care quality: an analysis of 91 national household surveys. *Lancet Glob Health* 2018;6:e1186–95.
- 23 Organization WH. *Who recommendations on antenatal care for a positive pregnancy experience*. World Health Organization, 2016.
- 24 Raru TB, Mamo Ayana G, Bahiru N, et al. Quality of antenatal care and associated factors among pregnant women in East Africa using demographic and health surveys: a multilevel analysis. *Womens Health* 2022;18:174550652210767.
- 25 Tessema ZT, Minyihun A. Utilization and determinants of antenatal care visits in East African countries: a multicountry analysis of demographic and health surveys. *Adv Public Health* 2021;2021:1–9.
- 26 Ziegler BR, Kansanga M, Sano Y, et al. Antenatal care utilization in the fragile and conflict-affected context of the Democratic Republic of the Congo. *Soc Sci Med* 2020;262:113253.
- 27 Chukwuma A, Wong KLM, Ekhatör-Mobayode UE. Disrupted service delivery? the impact of conflict on antenatal care quality in Kenya. *Front Glob Womens Health* 2021;2:9.
- 28 Nemera Yabo A, Yabo AN, Gebremicheal MA, Chaka EE. Assessment of quality of antenatal care (Anc) service provision among pregnant women in Ambo town public health institution, Ambo, Ethiopia, 2013. *AJNS* 2015;4:57–62.
- 29 Abate TM, Salgado WB, Bayou NB, Abeba A. Evaluation of the quality of antenatal care (Anc) service at higher 2 health center in Jimma, South West Ethiopia. *OAlib* 2015;02:1–9.
- 30 Ejigu T, Woldie M, Kifle Y. Quality of antenatal care services at public health facilities of Bahir-Dar special zone, Northwest Ethiopia. *BMC Health Serv Res* 2013;13:1–8.
- 31 Bastola DKY P, Gautam H. Quality of antenatal care services in selected health facilities of Kaski district. *Nepal*. 2018.
- 32 Mehnaz S, Abedi A, Fazli S, Ansari M, et al. Quality of care: predictor for utilization of ANC services in slums of Aligarh. *Int J Med Sci Public Health* 2016;5:1869.
- 33 Yeoh PL, Hornetz K, Dahlui M. Antenatal care utilisation and content between low-risk and high-risk pregnant women. *PLoS One* 2016;11:e0152167.
- 34 Duysburgh E, Williams A, Williams J, Loukanova S, et al. *Quality of antenatal and childbirth care in northern Ghana*. , 2014: 121, 117–26.
- 35 Shudura E, Yoseph A, Tamiso A. Utilization and predictors of maternal health care services among women of reproductive age in Hawassa university health and demographic surveillance system site, South Ethiopia: a cross-sectional study. *Adv Public Health* 2020;2020:1–10.
- 36 Rwabilimbo AG, Ahmed KY, Page A, et al. Trends and factors associated with the utilisation of antenatal care services during the millennium development goals era in Tanzania. *Tropical Medicine and Health* 2020;48:1–16.
- 37 Babalola S, level Women's education. Women's education level, antenatal visits and the quality of skilled antenatal care: a study of three African countries. *J Health Care Poor Underserved* 2014;25:161–79.
- 38 Leng C. *Communication between the healthcare provider and people of low Ses*, 2019.
- 39 Joshi C, Torvaldsen S, Hodgson R, et al. 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 Childbirth* 2014;14:1–11.
- 40 Afulani PA, Buback L, Essandoh F, et al. Quality of antenatal care and associated factors in a rural County in Kenya: an assessment of service provision and experience dimensions. *BMC Health Serv Res* 2019;19:1–16.
- 41 de Masi S, Bucagu M, Tunçalp Özge, et al. Integrated person-centered health care for all women during pregnancy: implementing World Health organization recommendations on antenatal care for a positive pregnancy experience. *Glob Health Sci Pract* 2017;5:197–201.
- 42 Steele V, Patterson K, Berrang-Ford L, et al. Antenatal care research in East Africa during the millennium development goals initiative: a scoping review. *Matern Child Health J* 2022;26:469–80.
- 43 Sanogo N'doh Ashken, Yaya S, status W. Wealth status, health insurance, and maternal health care utilization in Africa: evidence from Gabon. *Biomed Res Int* 2020;2020:4036830.
- 44 Ahmed S, Creanga AA, Gillespie DG, et al. Economic status, education and empowerment: implications for maternal health service utilization in developing countries. *PLoS One* 2010;5:e11190.
- 45 Tsegaye B, Ayalew M. Prevalence and factors associated with antenatal care utilization in Ethiopia: an evidence from demographic health survey 2016. *BMC Pregnancy Childbirth* 2020;20:1–9.
- 46 Rahman M, Haque SE, Mostofa MG, et al. Wealth inequality and utilization of reproductive health services in the Republic of Vanuatu: insights from the multiple indicator cluster survey, 2007. *Int J Equity Health* 2011;10:58–10.
- 47 Fekadu E, Yigzaw G, Gelaye KA, et al. Prevalence of domestic violence and associated factors among pregnant women attending antenatal care service at University of Gondar referral Hospital, Northwest Ethiopia. *BMC Womens Health* 2018;18:1–8.
- 48 Fenta SM, Ayenew GM, Getahun BE. Magnitude of antenatal care service uptake and associated factors among pregnant women: analysis of the 2016 Ethiopia demographic and health survey. *BMJ Open* 2021;11:e043904.
- 49 Belay A, Astatkie T, Abebaw S, et al. Prevalence and factors affecting the utilization of antenatal care in rural areas of southwestern Ethiopia. *BMC Pregnancy Childbirth* 2022;22:1–8.
- 50 Tsegay Y, Gebrehiwot T, Goicolea I, et al. Determinants of antenatal and delivery care utilization in Tigray region, Ethiopia: a cross-sectional study. *Int J Equity Health* 2013;12:1–10.
- 51 Wulandari RD, Laksono AD, Nantabah ZK. Effect of marital status on completeness of antenatal care visits among childbearing age women in rural Indonesia. *Medico-legal Update* 2020;20:2253–8.
- 52 Hanlon C, Whitley R, Wondimagegn D, et al. Between life and death: exploring the sociocultural context of antenatal mental distress in rural Ethiopia. *Arch Womens Ment Health* 2010;13:385–93.



- 53 Sserwanja Q, Nuwabaine L, Gatasi G, *et al.* Factors associated with utilization of quality antenatal care: a secondary data analysis of Rwandan demographic health survey 2020. *BMC Health Serv Res* 2022;22:1–10.
- 54 Ewunetie AA, Munea AM, Meselu BT, *et al.* Delay on first antenatal care visit and its associated factors among pregnant women in public health facilities of Debre Markos town, North West Ethiopia. *BMC Pregnancy Childbirth* 2018;18:1–8.
- 55 Tamang TM. *Factors associated with completion of continuum of care for maternal health in Nepal*. Cape Town, South Africa: Paper presented at: IUSSP XXVIII International Population Conference, 2017.
- 56 Kare AP, Gujo AB, Yote NY. Quality of antenatal care and associated factors among pregnant women attending government hospitals in Sidama region, southern Ethiopia. *SAGE Open Med* 2021;9:20503121211058055:205031212110580.
- 57 Kassaw A, Debie A, Geberu DM. Quality of prenatal care and associated factors among pregnant women at public health facilities of Wogera district, Northwest Ethiopia. *J Pregnancy* 2020;2020:8
- 58 Andersen HM. "Villagers": differential treatment in a Ghanaian hospital. *Soc Sci Med* 2004;59:2003–12.
- 59 Shiferaw K, Mengistie B, Gobena T, *et al.* Extent of received antenatal care components in Ethiopia: a community-based panel study. *Int J Womens Health* 2021;13:803–13.
- 60 Fagbamigbe AF, Idemudia ES. Assessment of quality of antenatal care services in Nigeria: evidence from a population-based survey. *Reprod Health* 2015;12:1–9.
- 61 Liyew AM, Teshale AB. Individual and community level factors associated with anemia among lactating mothers in Ethiopia using data from Ethiopian demographic and health survey, 2016; a multilevel analysis. *BMC Public Health* 2020;20:1–11.