

# The Usage of Antenatal Care Visit and Its Determinant Factors Using 2016 EDHS Data: Application of Count Regression Models

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**Abstract:** Antenatal care gives women and their families the information and advice they need to have a healthy pregnancy, have safe childbirth, and recover postpartum. ANC is an important intervention for lowering maternal and newborn mortality. There have been some studies done on determinants that affect the number of the minimum recommended antenatal care visits attendance, and it would be interesting to see the number of antenatal care visits and its determinant factor among pregnant women in Ethiopia from the 2016 Ethiopia Demographic Health Survey. The data was exported to STATASE 14 (64-bit) software was used for analysis and a weighted sample of 7575 women who gave birth in the last five years before the survey was included in the final analysis. A multivariable Negative Binomial regression analysis approach was carried out to identify the number of ANC visits and the determinants that affect the number of ANC visits, because the response variable was over dispersed. The aim of this study to assess the use of antenatal care visits and the factors affecting it using the 2016 EDHS Data through the application of count regression models. Finally, the IRR was used to report the relationship between the frequency of ANC and explanatory variables, along with its 95 percent confidence interval. According to the analysis (62.79%) of mothers had at least one antenatal care visit, (37.21%) had no antenatal care visit and only 31.88% attended four or more ANC visits during their pregnancy in Ethiopia. Maternal age, residence, maternal education, wealth quintile, place of ANC, ANC providers, and first ANC visit were significantly associated with level of antenatal care visits. Generally, frequency of antenatal care visits is low in Ethiopia. Its recommended to all concerned bodies should focus on their program on the number of ANC visits in all Ethiopia to improve both maternal and child health.

**Keywords:** Number of Antenatal Care Visits, Count Regression Model, EDHS

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## 1. Introduction

Antenatal care (ANC) is provided during pregnancy to help ensure that mothers have a healthy pregnancy and childbirth, as well as that their newborns are healthy [18]. Moreover, antenatal care (ANC) provided by skilled health professionals maintains and improves mother's health during pregnancy by identifying and managing pregnancy-related complications [11]. Antenatal care (ANC) includes essential and routine interventions for better pregnancy management.

It includes identifying and managing obstetric complications like preeclampsia, intermittent preventive treatment for malaria during pregnancy (IPTp), and identifying and managing infections like HIV, syphilis, and other sexually transmitted infections (STIs) [30].

The goal of ANC is to organize mothers for birth and parenthood by preventing, detecting, alleviating, and managing any complications which will arise from the pregnancy itself, pre-existing conditions that worsen during pregnancy, or effects of unhealthy lifestyles [30].

Additionally, antenatal care attendances were related to arise in facility-based deliveries and use of postnatal services [11]. Generally, antenatal care provides women and their families with appropriate information and advice for a healthy pregnancy, safe childbirth, and postnatal recovery. It helped including look after the newborn, promotion of early exclusive breastfeeding, and assistance with choosing future pregnancies to enhance pregnancy outcomes. ANC attendance is additionally considered a crucial intervention for reducing maternal and newborn mortality [11].

Over the past 25 years (1990-2015), the global maternal mortality ratio (MMR) declined by 44% which is far from the decline targeted (75%) to be achieved by 2015 worldwide. Approximately 303,000 maternal deaths are attributed to pregnancy and childbirth-related complication. Developing countries accounted for around 99% of the global maternal deaths with 239 per 100,000 MMR in 2015. Sub-Saharan Africa, including Ethiopia, accounted for about 201,000 maternal deaths in 2015 [32].

The Sustainable Development Goal (SDG) 3.1 states that a discount in international MMRs to much less than 70 per 100,000 stay births and a country-level reduction in MMRs to much less than one hundred forty per 100,000 stay births is to be carried out by means of 2030 [32]. However, greater than 800 reproductive ages female die each day from issues for the duration of pregnancy and child birth. Globally, MMR lowered by using 2.9% per year between 2000 and 2017, which is less than half of the 6.4 percent annually needed to gain the SDG maternal loss of life reduction. Number of women and girls who died every year from pregnancy and child birth issues diminished to 295,000 in 2017 worldwide. Sub-Saharan Africa on my own accounted for about 196 000 of maternal deaths from the estimated world maternal deaths in 2017 as a result of problems throughout and after pregnancy and child birth. According to the 2016 EDHS, the maternal mortality ratio in Ethiopia was estimated at 412 deaths per 100,000 live births. Most of these complications happen during being pregnant and most of them are preventable or treatable [6, 34].

Another study conducted in Ethiopia identified maternal mortality ratio 472, 446, 422, 401 deaths per 100,000 live births reported in 2014, 2015, 2016 and 2017 respectively due to pregnancy-related cause [34]. Recent study in different area of Ethiopia shown maternal deaths were due to direct obstetric causes was still considerable (86% in a Pastoralist Area of Borena Zone, Oromia Region and 318 maternal deaths per 100,000 live births in southeast Ethiopia) [16, 19]. Similarly, a study done in eastern Ethiopia revealed Pregnancy-related mortality was estimated to be 543 per 100,000 live births. Only 26% of those who died as a result of pregnancy-related causes attended at least one antenatal care service. Postpartum hemorrhage and hypertensive disorders of pregnancy were the leading causes of maternal death [27].

The health of both the mother and the baby depends on proper care during pregnancy and delivery. To reduce

maternal and neonatal morbidity and mortality, skilled care during pregnancy, childbirth, and the postpartum period are critical. However, according to the EDHS (2000, 2005, 2011, 2016), 10 percent, 12 percent, 19 percent, and 32 percent of women who gave birth in the five years before the survey received antenatal care from a skilled provider and made four or more antenatal care visits during their pregnancy [3- 6].

A recent recommendation put forward by the World Health Organization (WHO) states that; a minimum of eight antenatal care contacts is needed. One contact in the first trimester, two contacts in the second trimester and five contacts in the third trimester is needed to reduce prenatal mortality and improve women's experience of care [29]. The contacts should include information on routine antenatal nutrition, maternal and fetal assessment, preventive measures, interventions for management of common physiologic symptoms in pregnancy, and health system-level interventions to improve the utilization and quality of ANC [33]. An increase antenatal care contact helps to maximize the utilization of antenatal content /items of pregnant women [7, 12, 15].

According to the 2016 EDHS, pregnant women who received at least one antenatal care visit was 62%, while only 32% of mothers attended four and more antenatal care visits respectively. On the other hand, the 2016 EDHS report showed that 37% had no antenatal care visits [6, 8]. A study in South West Shoa Zone, Ethiopia shows that 45.5% of pregnant women attended at least four ANC visits due to different kinds of determinant factors. These were wealth index quintile, age, knowledge of the required number of ANC visits and maternal health attitude score maintained statistically significant associations with attending ANC [31]. Another study conducted in SNNPR (Arba Minch Zuria District revealed that only 25.5% mothers attended four and more antenatal care visits due to the determinant factors like; time of first antenatal visit, ANC provider, family planning utilization before recent birth, planned for pregnancy, and perceived required time to reach health facilities [12].

Several studies identify determinant factors that affect utilization, level, component and timing of antenatal care in developing countries including Ethiopia, but some studies were done concerning determinant factors that affect the frequency/number of the minimum recommended antenatal care visits attendance. These identified determinant factors include; time of first antenatal visit, ANC provider, family planning utilization before recent birth, planned pregnancy, perceived required time to reach health facilities, parity, administrative division, place of residence, mothers' and fathers' educational level, media exposure, wealth quintile, place of receiving ANC, mistimed and unwanted pregnancy were found to be predictors that either positively or negatively affect the minimum recommended antenatal care visits attendance [12, 15, 21].

According to the Anderson and Newman model of social behavior used to conceptualize this research, personal

access to and use of health services are considered a function of three characteristics. These are predisposing factors (social and cultural characteristics that existed before people needed health services, including social structure, health beliefs, and demographics) and contributing/ enabling factors (the logistical aspects of receiving care, such as individuals / family, community, etc.). And demand/ need factors (the most direct reason for the use of health services comes from the purpose and health problems that generate the demand for health services) (Anderson's, 2003). Therefore, these three factors can directly affect the frequency of prenatal care visits. Adequate ANC attendance is significantly determined by the provider's explanations on pregnancy-related issues and place of ANC service [11, 14].

Generally, minimum recommended antenatal care visits attendance is accepted to be an important factor for preventing adverse outcome of pregnancy and under attending the minimum recommended antenatal care visits affect both the maternal and child health. But, when I reviewed the literature on antenatal care service most of the study done in Ethiopia focused on the utilization, quality, 0 and 4+ visits, and factors that associated with them. And also they were focused on socio-demographic, economic, the distance of health service. Aware about the level of number of antenatal care visits and identified the determinants affecting the number of visit attendance is important in Ethiopia.

For that reason the current study focused to assess the frequency of antenatal care and factors that affect the number of antenatal care visits in Ethiopia using count regression models. While I addressed the socio-demographic, economic, health system (distance, types of provider, and place of ANC service) and then came up with constructive recommendations to remedy the problems identified.

## 2. Methods and Materials

### 2.1. Study Area and Data Source

Ethiopia covers an area of 1,100,000 square kilometers and is located between 3° to 15° north latitude and 33° to 48° east longitude and also divided into nine regional states based on ethnic and political autonomy (Afar, Amhara, Benishangur, Gumuz, Gambella, Harari, Oromia, Somalia, Southern State, National and People's Region (SNNP and Tigray) and two administrative city management, namely Addis Ababa and Dire Dawa. According to the revised world population viewed for 2019, the country's total population is 109,224,559, with 54,635,339 men and 54,589,220 women. In the country, different ethnic groups live harmoniously, and people speak a variety of languages. Additionally, there are both government and non-government health institutions

(hospitals, health centers, and clinics). This study was based on secondary data analysis from 2016 Ethiopian Demographic and Health Survey, which was collected cross-sectionally between January 18, 2016, and June 27, 2016. Data were obtained from the DHS website (<https://dhsprogram.com/Data/terms-of-use.cfm>) after contacting them via email through personal accounts and clarifying the reason for the request.

### 2.2. Study Population and Sampling Procedure

All pregnant women who gave birth in the five years preceding the survey included in the study population in Ethiopia. The study participants were extracted from the individual record (IR) file. In the interviewed households, 16,583 eligible women for interviews were identified, of which 15,683 completed the interview and a weighted sample of 7,575 was eligible for current analysis. From January 18, 2016, until January 18, 2016, Ethiopian population statistics (2016) 2016 were implemented by the Central Statistics Agency (CSA). The EDHS 2016 sample was in layers and selected in two stages. Each region was in layers to urban and rural areas and a sampling layer of 21 was obtained. Enumeration areas (EAS) samples were selected independently in two stages in each layer. Initially, the enumeration area used a method of probability proportional to the size of the EA to unify the enumeration and rural areas of urban areas and rural areas using a method of probability based on the independent selection in each sampling layer.

### 2.3. Study Design and Sample Size Determination

A cross sectional study design was employed using the Ethiopian Demography and Health Surveys (EDHS) 2016. The data set from the Ethiopia Demographic and Health Survey (EDHS, 2016) used for this analysis. The study population included women and pregnant women between the ages of 15 and 49 in the first 5 years of the survey in the study area. This study extracted all Ethiopian women at the time of the interview and used data from the last life of the women with complete variable information. Among them, 15,683 women completed the interview and a weighted sample of 7,575 eligible pregnant women will be included in the final analysis of this study.

### 2.4. Variables of the Study

Dependent variable: The number of antenatal care visit is the dependent variable in this study its originally coded (m14) in EDHS, while it was recorded (nanc) to suitable the current analysis.

Independent variables: It is explanatory variables which can affect directly the frequency of antenatal care visit attendance of mothers throughout their pregnancy time.

**Table 1.** Independent variables and it's coding in EDHS, while recoding to fit the current study.

S. N	Independent variables	Coding in EDHS	Recoding and category
1	Maternal age	V012	age_cat; 15-19yrs=1, 20-34yrs=2 and +35yrs=3
2	Marital status	V501	mar; in union=1, not in union=0
3	Educational status	V106	No difference; 0=no education, 1=primary, 2=secondary, and 3=higher
4	Occupation status	V714	No difference; 0=no, 1=yes
5	House hold wealth status	V190	No difference; 1=poorest, 2=poorer, 3=middle, 4=richer, 5=richest
6	Residence	V025	No difference; 1=urban, 2=rural
7	Region	V024	No difference; Tigray=1, Affar=2, Amahara=3, Oromiya=4, Somalia=5, Benishangul Gumuz=6, SNNPR=7, Gambela=8, Harari=9, Addis Ababa=10, Dire Dawa=11
8	Place of ANC service	M57A	panc2; 1=Home, 2=Public, 3=Private, 4=NGO
9	ANC provider	M2A-N	anc_pro2; 1=Doctor, 2=Nurse/midwife/HO, 3=HEW, and 4=TBA/other
10	Parity	V201	Par; 0=1-2, 1=3-4, 2=5+
11	Type of pregnancy	M10	Typr; 1=wanted, 2=unwanted
12	Timing of first ANC	M13	Tanc; 0=<3 months, 1=>3 months
13	Distance of health service	V467D	No difference; 1=big problem, 2=not a big problem

No difference\*: the 2016 EDHS variable's code does not need to be recoded for this study because it is the same as before.

Socio-demographic and economic characteristic of individual (age of mother, marital status, occupation, educational status, household wealth status), region, residence, distance of health service, place of ANC service, parity, timing of first ANC, types of pregnancy, region, ANC provider are the determinant variable that influences the number of antenatal care visits. Few of these exposure variables were used as they were originally coded in EDHS, while most of them were recorded to fit the current analysis.

### 2.5. Methods of Data Analysis

STATASE 14 (64-bit) software was used for analysis after the data had been cleaned, checked for completeness, and exported. The data was analyzed using univariate statistical methods (frequency distribution). The frequency distribution was used to describe the characteristics of the overall sample respondents (mothers) across a set of background characteristics. Simple summary statistics (as mean for count variables such as frequency of ANC visits) were obtained in bivariate analysis for each category of the selected explanatory variables to examine the unadjusted but statistically significant relationship between dependent variables and selected independent variables.

The Pearson Chi-square goodness of fit statistics of Poisson regression analysis was used to determine whether or not there was over-dispersion. The mentioned goodness of statistics represents over-dispersion in the data set if the observed value of the Pearson Chi-square statistic divided by the degrees of freedom is greater than one. In this study multicollinearity was not done because all independent variables were categorical. A p-value <0.05 was considered statistically significant. The count regression models like Poisson or Negative Binomial were employed to determine the factors that influence the number of antenatal care visits throughout their pregnancy period. Poisson distribution with a log link is the natural selection for the count outcome [20]. However, the most serious limitation of Poisson regression is that it assumes that the variance of the distribution of the count response variable is equal to its mean which is usually termed as equal dispersion property. There are assumptions

on the Poisson regression model to use when the observations are independent and count, the mean and the variance of the response variable are equal and the logarithm of the response variable is linear with the predictors. The change in the log of the response variables is linear with a change in the explanatory variable and the variance of the response variable is greater than the mean or over dispersion, because of over dispersion I used in other count regression models of Negative Binomial regression. Finally, the association between the frequency of ANC and explanatory variables was reported with IRR and its 95% CI.

## 3. Result

### 3.1. Socio-demographic, History of Maternal Health Service Utilization and Obstetric History Characteristics of Mothers

A total number of 7575 women who had a live birth in the last 5 years preceding the survey interviewed in 2016 EDHS, As shown in Table 2, 5278 (69.72%) women age between 20-34 years attended 2.49 ANC visit averagely, while 1958 (25.82%) women aged 35 year and more had average ANC 2.03. 7009 (92.49%) women were married and they were attended antenatal care visit 2.37 in average. Out of the sampled 6611 (87.23%) were rural residents, 963 (12.77%) urban residents and average ANC visit 2.09 and 4.31 respectively.

According to the last 5 years preceding the survey participated women residing in regional states of Ethiopia: Tigray 532 (7.08%) and average ANC visits 3.63, Afar 71 (0.94%) and average ANC visits 1.78, Amhara 1,630 (21.50%) and average ANC visits 2.51, Oromiya 3,127 (41.23%) and average ANC visits 1.77, Somali 268 (3.54%) and average ANC visits 1.29, Benishangul-Gumu 81 (1.06%) and average ANC visits 2.56, SNNPR 1,597 (21.09%) and average ANC visits 2.64, Gambela 21 (0.27%) and average ANC visits 2.86, Harari 17 (0.23%) and average ANC visits 2.96, Addis Ababa 198 (2.61%) and average ANC visits 6.39 and Dire Dawa 33 (0.44%) and average ANC visits 4.52.

In total, 4,780 (63.12%) women who gave birth in the last

5 years had no education and received ANC 1.89 in average, similarly 2,147 (28.32%) were attended primary school have received ANC visits 2.82 averagely. Whereas women were attended secondary and more than secondary school 419 (5.53%), 230 (3.02%) and attended ANC in average 4.15, 5.02 respectively. Regarding occupational status of the mother, majority 5,408 (71.38%) women had no occupation and attended ANC visit in average 2.22, while 2,167 (28.62%) had occupation and women have received 2.75 ANC visit averagely. Women with poorest wealth quintile 1,648 (21.76%) have received in average 1.75 ANC visits, whereas women with richest wealth quintile 1,262 (16.72%) and attended antenatal care visit 3.93 averagely.

Out of 2,620 (34.61%) mothers who gave birth within the last five years had 1-2 a live birth and received ANC in average 2.93. On the contrary, 2,961 (39.08%) women had 5 and more a live birth attended 1.86 ANC visits averagely. Most of the mothers within the last 5 years preceding participated in the survey received ANC in public health institutes 4,393 (92.67%) and had in average 3.74 ANC visits, while 213 (4.49%) women attended in privet institutions and received ANC visits 4.81 averagely. Regarding the type of ANC provider, around 3,239 (69.09%) and 1,146 (24.10%) women who gave birth in the last 5 years preceding have got ANC from Nurse /midwife/HO and HEW, in average 3.76 and 3.53 ANC visits respectively, Whereas 313 (6.58%)

women who have got ANC from doctor and received 5.01 visits averagely. Approximately 6,880 (90.84%) pregnant women who gave a live birth within the last 5 years preceding were wanted pregnancy and they have received ANC visits 2.44 in average. In contrast women who had unwanted pregnancy around 695 (9.16%) and they were attended ANC visits 1.73 averagely.

Majority of the women who were attended antenatal care visits 4,235 (89.59%) started their ANC after three months and received 3.59 times in average. Whereas 490 (10.41%) women who were started ANC visit before three months of their pregnancy time and also they have received in average 5.41 times. Regarding of distance from health service around 4,402 (58.06%) women were reported a big problem to reach health facilities and they were attended 1.93 averagely. In contrast women who no reported a big problem (no a big problem) about 3,173 (41.94%) and they have received in average 2.99 times. Two thousand eight hundred eighteen (37.21%) of the mothers who gave a live birth within the last five years preceding the survey had not received ANC visits during their last pregnancy, while 4757 (62.79%) of the mothers had received at least 1 time ANC visit. In total, 2415 (31.88%) of mothers had received 4 and more times ANC visits, whereas 5160 (68.12%) had visited less than 4 times during their last pregnancy (table 2).

**Table 2.** Average number of antenatal care visits according to Socio-demographic, history of maternal health service utilization and Obstetric history characteristics of mothers.

Variables	Number of Women (%)	Average ANC visit	Standard Deviation of ANC
Age			
15-19 yrs	339 (4.47)	2.50	2.22
20-34 yrs	5,278 (69.72)	2.49	2.34
35+ yrs	1,958 (25.82)	2.03	2.33
Marital status			
In union	7,009 (92.49)	2.37	2.32
Not in union	566 (7.51)	2.44	2.54
Residence			
Urban	963 (12.77)	4.31	2.74
Rural	6,611 (87.23)	2.09	2.13
Region			
Tigray	532 (7.08)	3.63	2.17
Afar	71 (0.94)	1.78	2.18
Amhara	1,630 (21.50)	2.51	2.31
Oromiya	3,127 (41.23)	1.77	2.01
Somali	268 (3.54)	1.29	1.81
Benishangul-Gumuz	81 (1.06)	2.56	1.99
SNNPR	1,597 (21.09)	2.64	2.19
Gambela	21 (0.27)	2.86	2.14
Harari	17 (0.23)	2.96	2.52
Addis Ababa	198 (2.61)	6.39	3.26
Dire Dawa	33 (0.44)	4.52	2.82
Educational status of the mother			
No education	4,780 (63.12)	1.89	2.12
Primary	2,147 (28.32)	2.82	2.30
Secondary	419 (5.53)	4.15	2.40
More than secondary	230 (3.02)	5.02	2.71

Table 2. Continued.

Variables	Number of Women (%)	Average ANC	Standard Deviation of ANC
Occupational status			
No	5,408 (71.38)	2.22	2.27
Yes	2,167 (28.62)	2.75	2.45
Wealth quintile			
Poorest	1,648 (21.76)	1.57	1.97
Poorer	1,654 (21.79)	1.95	2.02
Middle	1,585 (20.93)	2.19	2.12
Richer	1,426 (18.80)	2.61	2.26
Richest	1,262 (16.72)	3.93	2.71
Parity			
1-2	2,620 (34.61)	2.93	2.39
3-4	1,994 (26.32)	2.39	2.47
5+	2,961 (39.08)	1.86	2.07
place of ANC service			
Home	74 (1.55)	2.76	1.44
Public	4,393 (92.67)	3.74	1.73
Private	213 (4.49)	4.81	3.11
NGO	61 (1.28)	4.41	2.20
ANC provider			
Doctor	313 (6.58)	5.01	3.19
Nurse /midwife/HO	3,239 (69.09)	3.76	1.71
HEW	1,146 (24.10)	3.53	1.56
TBA/other	58 (1.22)	3.07	1.16
Type of pregnancy			
Wanted	6,880 (90.84)	2.44	2.34
Unwanted	695 (9.16)	1.73	2.18
Timing of first antenatal care			
<3 months	490 (10.41)	5.41	2.57
> months	4,235 (89.59)	3.59	1.64
Distance of health service			
Big problem	4,402 (58.06)	1.93	2.12
No a big problem	3,173 (41.94)	2.99	2.48
Total	7575 (100)	2.37	2.34

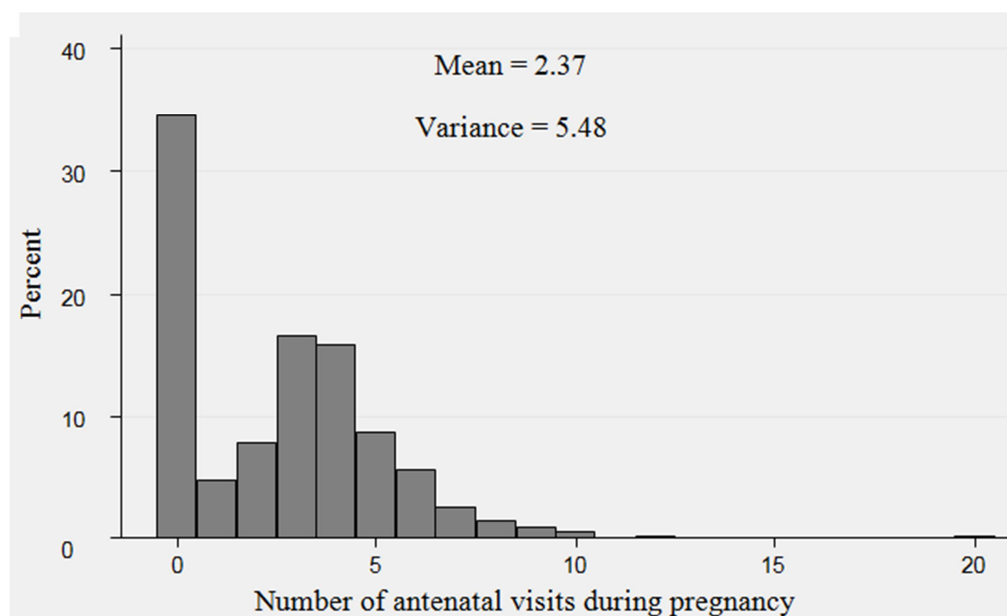


Figure 1. Number of antenatal care visits during pregnancy according to 2016 EDHS.

The above figure shows most of the mother who were given a live birth within the last 5 years before the survey they did not received ANC visit (37.21%), whereas 4.42%,

8.02%, 18.48%, 15.76%, 8.02%, 4.2%, 1.84% women who attended ANC visits 1, 2, 3, 4, 5, 6 and 7 times respectively.

### 3.2. Frequency of ANC Visits by the Regions of Ethiopia

Table 3 below shows the variation in frequency of ANC visits within and between the regions of Ethiopia. Among the regions, percentage of mothers who had at least one ANC visits is highest in Addis Ababa, 96.8%, followed by Tigray, 90.3%, and Dire Dawa, 87.4%. Percentage of mothers who

had four or more ANC visits is also highest in Addis Ababa, 89.1% and lowest in Somali region, 11.8%. More than half, 56.2% of the mothers from Somali region had never received any ANC service, being the highest from all the regions. Oromia, and Afar regions has also higher percentage of mothers who had never received any ANC services, 48.7%, and 48.6%, respectively.

*Table 3. Variations of antenatal care visits between regions of Ethiopia, EDHS 2016.*

Region	Number of ANC				Total
	0 ANC (%)	1-3 ANC (%)	4-7 ANC (%)	>=8 ANC (%)	
Tigray	52 (9.7%)	177 (33.2%)	290 (54.6%)	13 (2.5%)	532 (100%)
Afar	34 (48.6%)	22 (30.8%)	13 (18.7%)	1 (1.9%)	71 (100%)
Amhara	528 (32.4%)	588 (36.1%)	482 (29.6%)	31 (1.9%)	1630 (100%)
Oromia	1522 (48.7%)	912 (29.2%)	672 (21.5%)	20 (0.6%)	3127 (100%)
Somali	150 (56.2%)	86 (32.0%)	30 (11.1%)	2 (0.7%)	268 (100%)
Benishangul-Gumuz	25 (30.8%)	22 (27.2%)	34 (41.5%)	1 (0.6%)	81 (100%)
SNNPR*	486 (30.4%)	500 (31.3%)	586 (36.7%)	25 (1.6%)	1597 (100%)
Gambela	6 (27.4%)	6 (29.2%)	9 (42.5%)	1 (0.9%)	21 (100%)
Harari	4 (23.8%)	7 (41.2%)	5 (28.4%)	1 (6.7%)	17 (100%)
Adis Ababa	6 (3.2%)	15 (7.7%)	117 (59.2%)	59 (29.9%)	198 (100%)
Dire Dawa	4 (12.6%)	7 (21.4%)	19 (57.6%)	3 (8.4%)	33 (100%)
Total	2818 (37.2%)	2342 (30.9%)	2258 (29.8%)	157 (2.1%)	7575 (100%)

\*: SNNPR: Southern Nations, Nationalities, And People's Region

### 3.3. Determinants of Frequency of Antenatal Care Visits

The number of ANC visits was determined using a multivariable generalized linear regression analysis with a Negative Binomial log link and a complex sampling design. Age, residence, educational status of the mothers, wealth quintile, places of ANC service, ANC provider, and timing of first ANC visit were identified as significant determinants of the number of ANC visits, according to the regression analysis.

Mothers with the age of 35 years and above compared to those mothers in the age range of 15-19 are expected to have a rate of 1.13 times greater number of ANC visits while holding the other variables in the model constant (IRR=1.13; 95% CI: 1.01-1.26). Mothers living in rural areas compared to mothers in urban residents are expected to have a rate of 0.91 times fewer number of ANC visits while holding the other variables in the model constant (IRR=0.91; 95% CI: 0.83-0.99). Mothers with primary school education (IRR=1.05; 95% CI: 1.00-1.09) and mothers with secondary school education (IRR=1.08; 95% CI: 1.01-1.15) are expected to have a rate of 1.05 and 1.08 times greater ANC visits, respectively compared to mothers with no education while holding the other variables in the model constant. When compared to the mothers from the poorest households, mothers from middle-class households are expected to have a rate of 1.07 times (IRR=1.07; 95% CI: 1.01-1.14), mothers from richer households 1.13 times (IRR=1.13; 95% CI: 1.06-1.21), and mothers from the richest households 1.17 times (IRR=1.17; 95% CI: 1.08-1.28) greater ANC visits while

holding the other variables in the model constant.

Mothers who received ANC services from public health institutions compared to those mothers who received ANC services at home are expected to have a rate of 1.28 times greater number of ANC Visits while holding the other variables in the model constant (IRR=1.28; 95% CI: 1.06-1.56). Similarly, mothers who received ANC services from private health institutions compared to mothers who received ANC services at home are expected to have a rate of 1.32 times greater number of ANC Visits while holding the other variables in the model constant (IRR=1.32; 95% CI: 1.05-1.66). When compared to mothers who obtained ANC services from doctors, mothers who obtained ANC services from nurses, midwives, and health officers are expected to have a rate of 0.86 times lesser number of ANC Visits while holding the other variables in the model constant (IRR=0.86; 95% CI: 0.79-0.94). Similarly, mothers who obtained ANC services from health extension workers (IRR=0.87; 95% CI: 0.78-0.97) and mothers who obtained ANC services from traditional birth attendants and others (IRR=0.79; 95% CI: 0.68-0.92) compared to mothers who obtained ANC services from doctors are expected to have a rate of 0.87 and 0.79 times lesser number of ANC Visits, respectively while holding the other variables in the model constant. Mothers who had their first ANC visit after the third month of pregnancy compared to those mothers who had their first ANC visit before the third month of pregnancy are expected to have a rate of 0.71 times lesser number of ANC Visits while holding the other variables in the model constant (IRR=0.71; 95% CI: 0.68-0.74) (Table 4).

**Table 4.** Results of the multivariable generalized linear regression analysis with Negative Binomial log link to identify the determinants of number of ANC visits, EDHS 2016.

Variables	Average ANC	IRR (95% CI)	P-value
Age in years			
15-19	2.50	1	
20-34	2.49	1.07 (0.96-1.19)	0.198
35+	2.03	1.13 (1.01-1.26)	0.027*
Residence			
Urban	4.31	1	
Rural	2.09	0.91 (0.83-0.99)	0.032*
Educational status			
No education	1.89	1	
Primary	2.82	1.05 (1.00-1.09)	0.041*
Secondary	4.15	1.08 (1.01-1.15)	0.029*
Higher	5.02	1.08 (0.98-1.21)	0.135
Occupational status			
No	2.22	1	0.628
Yes	2.75	1.01 (0.97-1.05)	
Wealth quintile			
Poorest	1.57	1	
Poorer	1.95	1.03 (0.98-1.09)	0.268
Middle	2.19	1.07 (1.01-1.14)	0.033*
Richer	2.61	1.13 (1.06-1.21)	<0.001*
Richest	3.93	1.17 (1.08-1.28)	<0.001*
Parity			
1-2	2.93	1	
3-4	2.39	1.04 (0.99-1.09)	0.131
5+	1.86	0.99 (0.94-1.04)	0.650
Place of ANC service			
Home	2.76	1	
Public	3.74	1.28 (1.06-1.56)	0.012*
Private	4.81	1.32 (1.05-1.66)	0.016*
NGO	4.41	1.21 (0.95-1.54)	0.131
ANC provider			
Doctor	5.01	1	
Nurse/midwife/HO	3.76	0.86 (0.79-0.94)	0.001*
HEW	3.53	0.87 (0.78-0.97)	0.013*
TBA/other	3.07	0.79 (0.68-0.92)	0.002*
Type of pregnancy			
Wanted	2.44	1	
Unwanted	1.73	1.02 (0.96-1.08)	0.539
Timing of first ANC visit			
<3 months	5.41	1	
>3 months	3.59	0.71 (0.68-0.74)	<0.001*
Distance of health service			
Big problem	1.93	1	
Not a big problem	2.99	1.02 (0.98-1.06)	0.246

\*: Significant difference, IRR: Adjusted Incidence Rate Ratio, CI: Confidence Interval.

## 4. Discussion

Antenatal care is used to assess the effectiveness of maternal care utilization. When administered early in the pregnancy and continued through delivery, it leads to early detection of pregnancy problems and prevents adverse pregnancy outcomes. This study was conducted to assess the number of antenatal care visits and its determinant factors in Ethiopia. The finding of this study shown that 37.21%, 62.79%, and 31.88% of the mothers who gave a live birth within the last five years preceding the survey had not received ANC visits, received at least 1 time ANC visit, and received 4 and more times ANC visits during their last pregnancy respectively. It showed progress when compared

to the 2011 data, which showed that 57 percent of women had not received an ANC visit in the five years preceding the survey, 43 percent had received at least one ANC visit, and 19 percent had received four or more ANC visits during their pregnancy [5]. This improvement may be because of health promotion and awareness-raising activities, as well as an increase in the number of health institutions and health care providers with a variety of their professions all over Ethiopia. The current study is lower than the study conducted in Bangladesh (79%), Nepal (85%), and southwest Ethiopia (91.9%) of women make at least 1 ANC visit; moreover, 50% in Nepal, 46% in Rwanda, 45.5% in southwest shoa zone Ethiopia, and 66.6% in southwestern Ethiopia of women had four or more ANC visits, inversely in this study found women who did not receive ANC visits high as compared to



the study conducted in Bangladesh, Nepal, Empower Action Group (EAG) state of India, and southwestern Ethiopia (21%, 15%, 28.25%, and 8.1%) respectively [10, 15, 17, 24, 26, 31]. It discrepancy may be due to differences in socio-demographic characteristics of the respondents, gap of time the research conducted, accessibility of infrastructure, and level of awareness about antenatal care. And also might be the availability of health posts within the cluster level, access of waiting for pregnant women after 36 weeks gestational age of her pregnancy in health facility its increase health seek behavior of mothers and number of NGO which are doing on maternal and child health focus on rural part of Ethiopia that's a higher percentage of 4 or more ANC visits in southwest shoa zone and southwestern Ethiopia.

A study conducted in Bangladesh, Latin America, and Sub-Saharan Africa showed that the women who received ANC visit averagely 3, 5.6, and 4.2 respectively, which is high as compared to the current study women who received 2.37 averages ANC the last 5 years preceding the survey [15, 9]. In the current study, maternal age was related to the frequency of antenatal care visits during pregnancy. The frequency of ANC visits was higher among pregnant mothers over the age of 20 than among women under the age of 20. This finding is supported by research conducted in Cambodia, Nepal, Uganda, Cameroon, Peru, and Bangladesh, as well as 32 low-income countries in Asia, Sub-Saharan Africa, and Latin America and Ethiopia [1, 9, 15, 23, 25]. This may be due to old mothers experience the healthy or unhealthy pregnancy outcome how to important for her and her family, a shortage of clear understanding about how important ANC is to the community and pregnant adolescent girls to motivate them to look for ANC services, lack of reproductive health education programs, and also it may need extra investigation to decide why younger age pregnant mothers had a lower frequency of ANC. Furthermore, it's possible that the current study's regression analysis was limited to negative binomial regression or did not include other count regression models. But the studies were done in Tanzania, Kenya, Rwanda, and Keffa, Sheka and Bench Maji zone of SNNPR Ethiopia revealed pregnant mothers in the younger age had a higher frequency of ANC visits than old aged pregnant mothers [11, 21, 24, 26]. It might be due to Younger mothers are more likely to be educated, alerted, and impressed to seek appropriate antenatal care, despite the sample size representativeness and research conducted time gap.

The current study indicated that women who had primary and secondary educational attainment were 5 and 8 percent more likely to use ANC services as compared with those who had no education respectively. Maternal educational status had a significant effect on the number of antenatal care visits in developing countries. This result is supported by most of the studies related to ANC service conducted somewhere [2, 9, 11, 13, 21, 25, 28]. This could be because educated mothers were more concerned with the outcome of their pregnancy and pregnancy complications, and they were close to seeking health care services. And also the studies were done in Asia, women with secondary education had an

average of 6 visits, compared to those with no education (3.2) [9]. Similarly, in this study women who had average ANC visits 1.89, and 4.15 women with no education, and secondary education respectively this was lower than the result displayed in Asia. It may be due to different socio-demographic characteristics of the mother and educational curriculum system variation towards girls.

According to the findings of this study, mothers' residence had a significant association with the frequency of antenatal care visits. The study conducted in Sub-Saharan Africa and southwestern Ethiopia supported this finding [22, 26]. This is maybe in urban areas, health facilities with skilled professions are more accessible, and various health promotion programs using various types of mass media benefit urban residents by explaining the close relationship between urban residence and the use of maternal health services. Furthermore, rural women are more vulnerable to traditional practices that are disadvantageous to modern health care, as well as a shortage of all necessary skilled professionals in health care facilities.

The finding showed that in the current study pregnant women in the middle, richer, and richest households were more likely to have frequent ANC visits compare to those in the poorest household. This result is similar to the studies conducted in other countries including Ethiopia [9, 13, 25, 28, 31]. This is maybe because of the easy to afford the transportation and health service fee the pregnant mothers who got the service they want, and most of the time mothers from the above-mentioned wealth quintile having access to get an education and different mass media system.

In this finding, the place of antenatal care service was highly associated with the frequency of antenatal care visits. It may be the variety of skilled professions present in health service, presence of differences between places of ANC service in terms of respectful treatment from health care provider's, quality of care, and satisfaction of pregnant mothers from care provisions and it also needs further research, particularly satisfaction of pregnant mothers about health care service between public, private, and NGO health institutions. Similarly, a skilled health care provider had a significant association with the number of antenatal care services. The current study result showed that mothers who obtained ANC services from skilled health profession had more ANC visits as compared to traditional birth attendance. The finding supported by the studies conducted in Northern Jordan, which reported that women who often received dignified and respectful treatment from health care providers, received enough information and counseling on ANC, and provider's explanations on pregnancy-related issues were more likely to attend the targeted care as recommended compared to the counterparts, also agreed with a study conducted in Arba Minch [12, 14]. This is maybe skilled providers have Caring, Respectful and Compassionate behavior.

Another association was found in this study between pregnant mothers' right time to start their first ANC and frequency of ANC service. Mothers who received their first ANC visit after the third month of pregnancy received fewer

ANC visits than mothers who received their first ANC visit before the third month of pregnancy (IRR=0.71; 95% CI: 0.68-0.74). This finding is similar to a study conducted in other countries, including Ethiopia, which found that mothers who started their first ANC visit early (before three months) were more likely to attend ANC services frequently than their counterparts [2, 11, 12, 25]. The reason for this could be that mothers who started their first ANC visit early had enough time to contact a health facility with a skilled professional health provider and gain knowledge about ANC services.

## 5. Conclusion and Recommendation

### 5.1. Conclusion

In general, the number of antenatal care visits between women who gave birth within the last five years preceding the survey was low in Ethiopia, while on average 2.37 ANC visits were attended to mothers in their last pregnancy before the survey. As well as the number of mothers who had not received antenatal care services was high (37.21%) and low (31.88%) minimum recommendation of ANC services used. Since the country's implementation, it has been far from the minimum recommended antenatal care visit by the World Health Organization. According to variation in the frequency of ANC visits within and between the regions of Ethiopia was high, when in Addis Ababa, Dire Dawa, and Tigray region the highest percentage of mothers were attended antenatal care service. Whereas Somali, Oromia, and Afar region the lowest percentage of mothers were attended, inversely a higher percentage of mothers who had never received any ANC service in those regions. This study showed that maternal age, residence, maternal educational status, wealth quintile, place of ANC service, type of ANC providers and timing of first ANC were significantly associated with the level of antenatal care visits.

### 5.2. Recommendation

Polymakers and planner and Minister of Health:

Should focus on their program on the number of ANC visits in all Ethiopia, specifically rural part and the region of Somalia, Oromia, and Afar to improve both maternal and child health.

For timing of first ANC visit, type of ANC provider, place of ANC service, and wealth quintile should be given priority. But, maternal educational status and maternal age should not be ignored.

Reproductive health program should develop with detailed and brief instruction and structure that routine educations have to be given to a reproductive age group and community to enhance maternal and child health.

Should be available a skilled health professional (Doctor) who was trained especially on maternal and child health in all health centers.

Researcher

Should do further study on the frequency of ANC visit

including the remaining factors in a details way.

Additional studies with other count regression models should be conducted to assess the association between the number of ANC visits and determinant factors.

Frequency of ANC visit difference between women who were received from the doctor and other skilled health profession and also women who received ANC in public and private clinic reason should be researched out.

## List of Abbreviations

ANC: Antenatal Care  
ANOVA: Analysis Of Variance  
IRR: Incidence Rate Ratio  
ARR: Annual Rate of Reduction  
CI: Confidence Interval  
CSA: Central Statistical Agency  
DHS: Demographic Health Survey  
EA: Enumeration Area  
EAG: Empowered Action group  
EDHS: Ethiopian Demographic Health Survey  
HEW: Health Extension Worker  
HIV: Human Immunodeficiency Virus  
HO: Health Officer  
IPTP: Intermittent Preventive Treatment for malaria during Pregnancy  
IR: Individual Record  
MMR: Maternal Mortality Ratio  
NGO: Non-governmental Organization  
SNNPR: Southern Nations, Nationalities, and Peoples' Region  
STI: Sexual Transmitted Infection  
TBA: Traditional Birth Attendance  
WHO: World Health Organization  
UNFPA: United Nations Fund for Population Activities  
UNICEF: United Nations International Children's Emergency Fund  
UN: United Nation  
USAID: United States Agency for International Development

## Declarations

### Ethics Approval and Consent to Participate

The study was conducted after ethical clearance is obtained from the Ethical Review committee at Addis Ababa University Center for Population Studies of Collage of Development studies.

### Consent for Publication

Not applicable.

### Availability of Data and Material

The data obtained by submitting the study protocol through registering online on the website <https://dhsprogram.com/Data/terms-of-use.cfm>. Thus,

administrative permissions were required to access the raw data from this organization. Public access to the database is open upon permission.

### Competing Interests

The authors declare that they have no competing interests.

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