ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

THE NUMBER OF ANTENATAL CARE VISIT AND ITS DETERMINANT FACTORS USING THE 2016 EDHS DATA: APPLICATION OF COUNT REGRESSION MODELS

By

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October, 2021

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A THESIS SUBMITTED TO CENTER FOR POPULATION STUDIES, COLLEGE OF DEVELOPMENTAL STUDY, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN POPULATION STUDIES (REPRODUCTIVE HEALTH)

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This is to certify that Tigist Tefera has completed the requirements for the MSc degree in Addis Ababa University's College of Development Studies. Under my supervision, examiners evaluated and approved a thesis titled " **The number of antenatal care visit and its determinant factors using the 2016 EDHS Data: Application of Count Regression Models**" Before this date, no part of the thesis had been submitted for the award of any degree or diploma. The Institutional Review Board (IRB) of Addis Ababa University's College of Development Studies granted ethical approval.

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Advisor:	_____	_____	_____

_____

Chief of Department or Graduate Program Coordinator

DECLARATION

I hereby declare that the thesis entitled "The number of antenatal care visit and its determinant factors using the 2016 EDHS Data: Application of Count Regression Models" is my original work and has not been submitted before for the award of any academic degree or diploma. I also declare that no chapter of this thesis in the whole or part combined in this thesis from any previous work done by others or myself.

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LISTS OF ABBREVIATIONS

ANC Antenatal Care

ANOVA Analysis Of Variance

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

EPHI Ethiopian Public Health Institution

EPMM Ending Preventable Maternal Mortality

HEW Health Extension Worker

HIV Human Immunodeficiency Virus

HO Health Officer

ICF International Classification of Functioning

IPTP Intermittent Preventive Treatment for malaria during Pregnancy

IR Individual Record

IRR Incidence Rate Ratio

MM Maternal Mortality

MMR Maternal Mortality Ratio

NGO Non-governmental Organization

SDG Sustainable Development Goal

SNNPR Southern Nations, Nationalities, and Peoples' Region

SSA Sub Saharan Africa

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

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ABSTRACT

***Background**: 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.*

***Objective:** To assess the frequency of antenatal care visits and the factors affecting it using the 2016 EDHS Data through the application of count regression models*

***Methods:** The research was carried out in Ethiopia using data from the 2016 Ethiopia Demographic Health Survey. A weighted sample of 7575 women who gave birth in the last five years before the survey was included in the final analysis. The data was exported to STATASE 14 (64-bit) software was used for 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. Finally, the IRR was used to report the relationship between the frequency of ANC and explanatory variables, along with its 95 percent confidence interval.*

***Result:** (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 (+35 years, IRR = 1.13; 95% CI: 1.01-1.26), residence (rural, IRR = 0.91; 95% CI: 0.83-0.99), maternal education (primary, IRR = 1.05; 95% CI: 1.00-1.09, and secondary, IRR = 1.08; 95% CI: 1.01-1.15), wealth quintile (richer, IRR = 1.13; 95% CI: 1.06-1.21, and richest, IRR = 1.17; 95% CI: 1.08-1.28), place of ANC service (public, IRR = 1.28; 95% CI: 1.06-1.56, and private, IRR = 1.32; 95% CI: 1.05-1.66), and ANC providers (nurse/midwife/HO, IRR = 0.86; 95% CI: 0.79-0.94, HEW, IRR = 0.87; 95% CI: 0.78-0.97), and first ANC visit (>3 months, IRR = 0.71; 95% CI: 0.68-0.74) were significantly associated with level of antenatal care visits.*

***Conclusion:** Frequency of antenatal care visits is low in Ethiopia. Maternal age, residence, maternal educational status, wealth quintile, place of ANC service, and type of ANC providers were significantly associated with the level of antenatal care visits.*

Keywords: Number of antenatal care visits, count regression model, EDHS

CHAPTER ONE: INTRODUCTION

1.1. Background

Antenatal care (ANC) is care provided during pregnancy to help ensure that mothers have a healthy pregnancy and childbirth, as well as that their newborns are healthy (Kinzie, Gomez, and Chase, 2004). Moreover, antenatal care (ANC) provided by skilled health professionals maintains and improves a mother's health during pregnancy by identifying and managing pregnancy-related complications (Gupta, et.al, 2014). 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) 2020 (UNICEF).

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 (UNICEF, 2020). Additionally, antenatal care attendances were related to a rise in facility-based deliveries and the use of postnatal services (Gupta, et.al, 2014). 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 (Gupta, etal, 2014).

According to a recent World Health Organization (WHO) recommendation, a minimum of eight antenatal care contacts are required to reduce prenatal mortality and improve women's experiences of care, one contact in the first trimester, two contacts in the second trimester, and five contacts in the third trimester are required (Tunçalp, Bucagu, and Peas-Rosas, 2018). Routine antenatal nutrition, maternal and fetal assessment, preventive measures, interventions for the management of common physiologic symptoms in pregnancy, and health system-level interventions to improve the utilization and quality of ANC should all be included in the contacts (WHO, 2018). Increased antenatal care contact helps pregnant women get the most out of their antenatal content/items (Haile, Habte, and Bogale, 2020; Edward, 2011; Islam, and Masud, 2018).

1.2. Statement of the problem

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 complications. 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 (WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division., 2015). Maternal mortality was the second leading cause of death for women of reproductive age in 2016, and the leading cause among women aged 15–29 years. Almost all maternal deaths (95%) occurred in low- and lower-middle-income countries, with Africa accounting for nearly two-thirds (65%). Maternal mortality is the number of women who die during pregnancy, childbirth or within 42 days after delivery. In low-income countries, one woman in every 41 died from maternal causes in 2015. Maternal mortality can be reduced by improving access to modern contraception and ensuring that women receive high-quality care. In 2018, an estimated 12.8 million adolescent girls aged 15–19 years gave birth. Eclampsia, systemic infections, and complications during childbirth are more common in adolescent girls. Low-income countries have the highest rates of adolescent birth (97 births per 1000) (World health statistics, 2019).

By 2030, the Sustainable Development Goal (SDG) 3.1 needs to call for a reduction in international MMRs to less than 70 per 100,000 live births, as well as a reduction in MMRs at the country level to less than 140 per 100,000 live births (EPMM; UN General Assembly, 2015). Achieving SDG 3.1 will require 91% coverage of one antenatal care visit, 78% of four antenatal visits, 81% of in-facility delivery, and 87% of skilled birth attendance (GBD 2015 Maternal Mortality Collaborators, 2016). Nevertheless, above 800 women of reproductive age die every day because of complications during pregnancy and childbirth. MMR declined by 2.9 percent per year on average between 2000 and 2017, which is below half of the 6.4 percent annual reduction mandatory to meet the SDG maternal loss of life reduction target. In 2017, the number of women and girls who died every year due to pregnancy and childbirth complications decreased to 295,000. Maternal deaths in Sub-Saharan Africa accounted for about 196 000 of the estimated global maternal deaths in the same year as a result of problems during and after pregnancy and childbirth. The maternal mortality rate in Ethiopia, according to the 2016 EDHS, was estimated to be 412 deaths per 100,000 live births. The

majority of these issues arise during pregnancy, and the majority of them are preventable or treatable (WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division., 2019; CSA and ICF, 2017). In Ethiopia, in 1990, there were 16,740 maternal deaths, compared to 15,234 maternal deaths in 2013. Ethiopia's Maternal Mortality Ratio (MMR) was still high during the study period, according to this finding (Gzacwu, et al, 2017).

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 causes (WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division, 2019). A recent study in a 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) (Sara, et al, 2019; Lindtjørn, et al, 2017). 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 (Tesfay, et.al, 2018; Yiftu and Asres, 2014).

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 (CSA and ORC Macro, 2001; CSA and ORC Macro, 2006; CSA and ICF International, 2012; CSA and ICF, 2017). Women can obtain essential offerings for their health and the health of their future children by maintaining regular contact with a health professional throughout their pregnancy (UNICEF, 2020). Evidence-based interventions that are likely to affect maternal, fetal, and neonatal health and survival are many possibilities for high ANC coverage and repeated contact between mothers and health care providers (WHO, Lincetto, et.al.) Furthermore, the number of ANC visits and the quality of care received during these visits are important factors in increasing health facility delivery. Women who receive antenatal care follow-up visits become more aware of birth preparedness and complication readiness

(Fekadu, et.al, 2019; Limenih, Belay & Tassew, 2019; Obago & Irene, 2013). Under-attending the minimum required from the WHO recommendation of antenatal care follow-up may result in poor outcomes of pregnancy like; placental abruption, intrauterine infections, preterm birth, low birth weight, and even intrauterine fetal death and neonatal death (Raatikainen, Heiskanen & Heinonen, 2007). However, present evidence from developing countries including Ethiopia indicates that few women attended four and more antenatal care visits throughout their pregnancy due to different factors (Ousman. et.al, 2019). The recent Ethiopia Mini Demographic Health Survey (EMDHS) in 2019 results also shown women who gave birth in the five years preceding the survey received antenatal care visits at least once and had four or more ANC visits for their last pregnancy indicated progress when compared to the other four EDHS, but a mother who had four or more ANC visits before the 5 years preceding the survey fell below 50% till (EPHI and ICF, 2019). Similarly, antenatal care use in Ethiopia was reported by 33.81 percent of women who had no ANC visits and 36.78 percent of women who had at least four ANC visits for their most recent pregnancy, respectively (Tegegne. et al. 2019). In general, antenatal care service in Ethiopia was low due to different factors that affect ANC visits (Setegn, et al, 2021; Lielt, et al, 2021).

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 (Haile, Habte and Bogale, 2020; Islam and Masud, 2018; Ochako and Gichuhi, 2016). Therefore, it is widely accepted that attending the minimum recommended antenatal care visits is an important factor in preventing a negative pregnancy outcome, and that failing to attend the minimum recommended antenatal care visits has an impact on both maternal and child health. As a result, the goal of this study is to determine the number of women who received antenatal care and the factors that influence it among Ethiopian women who gave birth before the age of five, 2016 EDHS.

1.3. Research questions

The following lookup questions were developed to assist researchers in their investigation of the number of antenatal care visits and their determinant factors among mothers who give live birth before the age of five years in Ethiopia's 2016 EDHS survey.

1. What was the level of frequency of antenatal care visits in the last five years preceding the survey in Ethiopia?
2. What are the determinant factors that influence the number of antenatal care visits in Ethiopia?
3. Is there a variation in the number of antenatal care visits among regions of the country?

1.4. Objectives of the study

1.4.1. General objective

To assess the frequency of antenatal care and factors that affect the number of antenatal care visits in Ethiopia using count regression models.

1.4.2. Specific objective

The specific objectives of this study are to:

- Assess frequency of antenatal care visits in the last five years preceding the survey in Ethiopia.
- Identify the determining factors that influence the number of antenatal care services in Ethiopia.
- Determine the variations in the number of antenatal care services between regions of Ethiopia.

1.5. Significance of the study

Pregnancy-related complications are mostly preventable if attended with a skilled health attendant and mothers comply with the recommended number of ANC visit accordingly. ANC service provides all the necessary information about pregnancy diagnosis and treatment of the complication. But in our country, there is a gap in the number of antenatal care visits.

Only a few studies are available on these problems which are done in developing countries including Ethiopia. Thus, more studies are deemed necessary to know the degree of determinant factors that affect the number of antenatal care visits in Ethiopia. Therefore, the present study was providing additional information about the number of antenatal care visits and the level of its determinant factors in the country. Moreover, this study will provide important suggestions for the Ethiopian Ministry of Health, ANC provider health professionals at the health facility, and policymakers at different levels who are concerned about the implementation of WHO minimum recommended of ANC contact. Furthermore, the study may be used as the baseline for researchers who will study the related issue in the future.

1.6. Scope of the study

This study's main focus is on the number of antenatal visits and the factors that influence pregnant women's willingness to follow the WHO's antenatal care contact recommendation in Ethiopia. The frequency of antenatal care visits was the focus of this study, despite the fact that antenatal care services can cover a wide range of parameters. The current study only looked at pregnant women in the reproductive age group (15-49) five years prior to the survey, using data from the 2016 EDHS.

1.7. Organization of the study

The significance, scope, and organization of the study are all included in chapter one, as well as a general introduction and background of the study, a statement of the problem, research questions, the study's objective, general and specific objectives, and the study's significance, scope, and organization of the study. In chapter two, the author's works on the concept of ANC by frequency of antenatal care, socio-demographic determinant factors, mothers' obstetric history, history of maternal health service utilization, and conceptual framework were reviewed in light of the study's goal. Study area and data source, Study population and Sampling procedure, Study design and sample size determination, inclusion and exclusion criteria, Variables of the study (Dependent and independent variables), Operational definition, methods of data analysis, and ethical clearance are all covered in Chapter three. The fourth chapter discusses the results by socio-demographic, maternal health service utilization history, and obstetric history characteristics of mothers, as well as the frequency of antenatal care visits by Ethiopian regions, determinants of antenatal care visit frequency, discussion, and the study's strengths and limitations. The final chapter, Chapter 5, summarizes the main points and makes recommendations for developing effective methods for determining the frequency of antenatal care and the factors that influence the number of antenatal care visits in Ethiopia.

CHAPTER TWO: REVIEW OF LITERATURE

2.1. Frequency of antenatal care

ANC provided through health professionals for pregnant women continues and safeguards women's health during being pregnant and improves effects via identifying and managing pregnancy-related problems (Gupta, et.al, 2014). All pregnant women need to have a minimum of four antenatal care visits for prevention in the absence of any complications. It helps in the early detection and management of complications (WHO, Maternal Health and Safe Motherhood Programme, 1996). A new recommendation of ANC visit proposed by the WHO states that; a minimum of eight antenatal care contacts is needed. one contact in the first trimester (up to 12 weeks), two contacts in the second trimester (Contact 2: 20 weeks, Contact 3: 26 weeks), and five contacts in the third trimester (Contact 4: 30 weeks, Contact 5: 34 weeks, Contact 6: 36 weeks, Contact 7: 38 weeks, and Contact 8: 40 weeks) to reduce prenatal mortality and improve women's experience of care (Tunçalp, Bucagu, and Peñas-Rosas, 2018).

Around 86 percent of pregnant women in the world receive antenatal care from trained health personnel at least once, but only two out of three (65 percent) receive at least four visits. Around half of them in Sub-Saharan Africa and South Asia (52 percent and 48 percent, respectively) received at least four antenatal visits (UNICEF, 2019).

The study conducted in Bangladesh has shown 79% had at least one ANC visit and 31.3% of pregnant women received at least four ANC visits, while only 6% received the updated WHO recommendation of at least eight ANC visits. On the other hand, about21% of the mothers did not receive any ANC visits in Bangladesh. The average number of visits among urban mothers was 3.7, while for rural mothers it was 2.4. On average mothers in both urban and rural received around 3 visits **(**Islam and Masud, 2018). A population-based study done in Nepal revealed that 50% of pregnant women attended the recommended minimum of four or more antenatal care visits and around 85% had at least one visit during their last pregnancy, while 15% of pregnant women had not attended antenatal care at all (Joshi, et.al, 2014).

Another study conducted in Rwanda showed that about 46% of pregnant women received the recommended four or more ANC visits during pregnancy and 34%of mothers had three or fewer antenatal care visits from this 13.3% had two or fewer visits **(**Rurangirwa, et.al, 2017).

Similarly, a study was done in Empowered Action Group (EAG) states of India revealed that 46.09% of women had 1-3 antenatal visits, and 28.25% pregnant mothers had no antenatal visits. Only 25.65% of mothers had 4 or more ANC visits during their last pregnancy (Gupta and Talukdar, 2017). A study on determinants of prenatal care use revealed that 78.5% in Asia and 88.5% in Latin America of pregnant women used prenatal care. Among those who sought any prenatal care, the average number of visits varies from 4.2 in Sub-Saharan Africa to 5.6 in Latin America (Guliani, Sepehri & Serieux, 2014).

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 (CSA and ICF, 2017; EPHI and ICF, 2019). 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 (Wilunda, et.al, 2015).

Another study conducted in SNNPR Arba Minch Zuria District revealed that only 25.5% of 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 (Haile, Habte and Bogale, 2020). In Southwestern Ethiopia, 8.1% of the child-bearing mothers did not receive ANC visits. The number of child-bearing mothers who attended 4 visits was 36.7%. The number of child-bearing mothers who attended ANC below 4 visits was 33.4%, attendance of four and more visits was 66.6% and 91.9% of pregnant women had at least 1 ANC visit (Terefe & Gelaw, 2019).

2.2. Socio-demographic determinant factors

Different socio-demographic factors affect the utilization of ANC services. The study conducted in India, Empowered Action Group (EAG) states indicated that pregnant women who are in the older age group had less frequent antenatal care visits than mothers who were in the younger age group (20-24 and 25-29) (Gupta and Talukdar, 2017).

The study done on factors associated with four or more antenatal care visits and its decline identified that; women less than twenty years at the time of delivery had a significantly higher odds ratio of four and more ANC visits as compared to women in the 20–34 year age group (Gupta, et al, 2014). Similarly, a study was done in Kenya identified younger women (15–24 years) were more likely to receive ANC as compared to older women (35–49 years) (Ochako and Gichuhi, 2016).Another study has shown that women in the 20–34 years age group in Cambodia (1.58), Nepal (1.54), and Uganda (1.62) were more likely to have at least one ANC visit compared to women who were less than 20 years old. While in Cambodia (1.43), Cameroon(1.57), and Peru(2.48), women aged 20–34 were more likely to have four or more visits compared to women who were less than 20 years old (Saad-Haddad, et.al, 2016).

In Bangladesh mothers aged 20-34 years old at the time of the beginning of the child have been more in all likelihood to have eight or extra ANC visits and a higher mean of the frequency of ANC visits than their youthful (aged <20 years) and older (aged 35 and above) counterparts (Islam and Masud, 2018). Also, every other find out about performed indicates that teenage mothers have been less likely to have fewer antenatal care visits (Guliani, Sepehri & Serieux, 2014). The study carried out in Rwanda published that the risk of bad utilization of ANC offerings used to be almost twice as high in the older age group as in contrast to women aged 30 years or less (Rurangirwa, et al, 2017).

The number of ANC visits is significantly higher for child-bearing mothers who are less than 20 years old at the time of pregnancy (Terefe & Gelaw, 2019). Maternal age was identified to be a factor in the utilization of ANC services in the Hadiya zone study. As a result, mothers aged 25-29 years were less likely to use ANC services than those aged 35 and older (Abosse, Woldie & Ololo, 2010). According to an Ethiopian study, women aged 20 to 34 had more ANC visits than younger women (Ousman, et.al, 2019).

Women who had secondary and post-secondary education had on average, 6 and 7.3 visits respectively when compared with those with no education (3.2) in Asia. Moreover, an Indian study showed that mothers with a higher level of education had more antenatal care visits (Guliani, Sepehri & Serieux, 2014; Gupta and Talukdar, 2017). In addition, Kenya's women with secondary or higher education were more likely to go to 4 or more ANC visits compared to those with primary education (Ochako and Gichuhi, 2016). A Study in Ghana showed women whose partners were educated up to the middle, junior secondary or junior high school levels were more likely to have attended ANC at least four times relative to those whose partners were uneducated (Sakeah, et al, 2017). Mothers who had no schooling and primary educational level were less likely to use ANC services compared to mothers who had a secondary and higher level of education (Mekonnen, et al, 2019).

Mothers with a primary educational level were more likely to attend ANC than women who are unable to read and write. Moreover, women who had higher education had more visits than illiterate women in 2005 and 2011 EDHS. However, the effect of education on the number of ANC visits was not relevant in 2016 EDHS. A similar association was also noted related to the partner's education level (Abosse, Woldie & Ololo, 2010). In low-income countries, educational status had a significant impact on the number of antenatal care visits. This finding was also supported by research conducted in Tanzania, Uganda, Senegal, Peru, Nepal, Cameron, Cambodia, Bangladesh, Vietnam, and Ethiopia (Guliani, Sepehri, & Serieux, 2014; Gupta, et al, 2014; Ha, et al, 2015; Atuhaire and Mugisha, 2020; Saad-Haddad, et al, 2016; Tessema, and Animut, 2020).

Kenyan women who were employed were more likely to go for more ANC visits compared to their counterparts who were never working (Ochako and Gichuhi, 2016). According to the 2011 and 2016 EDHS, mothers who were employed were more likely to use four and more ANC services compared to mothers with no employment **(**Mekonnen, et.al, 2019). Similarly, occupational status had a significant association with the frequency of antenatal care visits as revealed by the study done in Vietnam, Uganda (Ha, et.al, 2015; Atuhaire and Mugisha, 2020). A study on determinants of prenatal use in Asia revealed that, pregnant women from the richest wealth quintile had2.3 times more visits than those from the poorest wealth quintile (Guliani, Sepehri & Serieux, 2014). Considering household wealth in Kenya, those

from high-wealth households were more likely to go for 4 or more ANC visits than those from poor households (Ochako and Gichuhi, 2016).

The frequency of antenatal care visits was found to be significant among women with higher socioeconomic status as shown in the study conducted in low-income countries, Bangladesh, Cambodia, Cameroon, Nepal, Peru, Vietnam (Guliani, Sepehri & Serieux, 2014; Saad-Haddad, et.al, 2016; Ha, et.al, 2015). The study conducted in South West Shoa Zone Ethiopia showed that women in the highest wealth quintile had a three-and-a-half-fold increase in the odds of attending ANC compared to those in the lowest wealth quintile (Wilunda, et al, 2015). In addition, marital status, and planned pregnancy had significance on the number of antenatal care visits in Asia, Sub- Saharan Africa, and Latin America (Guliani, Sepehri & Serieux, 2014).

In Tanzania, women who get permission to antenatal care service seek, distance to health facilities, money, and accompanying attendants had a lower odds ratio of four and more ANC (Gupta, et al, 2014). The study conducted in Rwanda identified that women from households with a large number of people and women who are family heads were at higher risk of poor utilization of ANC services. They usually had two visits or less during the entire pregnancy. Also, single women, divorced, widowed, or separated made fewer ANC visits (Rurangirwa, et al, 2017).

A cross-sectional survey in Vietnam stated that ethnicity, knowledge on ANC visits, and financial support from the husband, were significantly associated with ANC visits (Ha, et.al, 2015). The study conducted in Uganda showed that marital status, family size, the intrinsic reason for ANC (getting a card), culture, and maternal age affect ANC visits utilization (Atuhaire and Mugisha, 2020). In Kenya, a study showed that women with unplanned pregnancies are less likely to have four or more prenatal visits than women who plan to become pregnant. Also, compared to currently married women, single women are less likely to participate in prenatal care. Compared with women in rural areas, women in urban areas are more likely to have four or more prenatal visits (Ochako and Gichuhi, 2016). A study on patterns of use and determinants of prenatal care (Bangladesh, Cambodia, Cameroon, Nepal, Peru, Senegal, and Uganda) showed that residents have a significant influence on care visits prenatal (Saad Haddad, et al, 2016).

Another study in rural Ghana found that cohabiting women and unmarried women (single, divorced, or widowed) were less likely than married women to have attended ANC at least four times. Women with national health insurance were more likely than those without insurance to have attended ANC at least four times (Sakeah, et al, 2017). Based on a systematic review on the determinant of antenatal care utilization in sub- Saharan Africa identified factors that affect ANC utilization in SSA. Women with unmarried, uninsured, rural dwellers**,** those living far from health facilities and unsupported by their husbands/ partners are less likely to use ANC services **(**Okedo-Alex, et al, 2019). A study on determinants of ANC Visit utilization of south western Ethiopia revealed that mothers in the urban region are 3.518 times more likely to visit the rural area. Mothers who do not volunteer are 0.815 times less likely to visit than those who volunteer. Mothers who come from a distance of ≥5 km are 0.931 times less likely to visit than those mothers who come from nearby (Terefe & Gelaw, 2019).

Pregnant women who plan to become pregnant and consider the time required to reach the health center are identified as important predictors of ANC frequency. Compared with mothers with an unplanned pregnancy, mothers who received enough ANC (four or more visits) were 2.6 time higher among mothers who planned to conceive. Compared with mothers who reported that it took more than 30 minutes, mothers who reported that it took less than 30 minutes to reach a medical facility were 3.3 times more likely to attend four or more antenatal visits (Haier, Habte**,** and Bogale, 2020 year).

A cross-sectional study in South West Shoa Zone, Ethiopia identified that knowledge of the required number of ANC visits and maternal health attitude score maintained had a statistically significant association with attending ANC. According to the result, knowledge of the required number of ANC visits had the strongest associations with ANC attendance. Those who knew the recommended number of ANC visits had almost a threefold increase in the odds of attending ANC compared to those who did not know. The odds of attending ANC reduced with increasing age. Women with a good attitude towards maternal health were about twice more likely to attend ANC compared to those with a poor attitude (Wilunda, et al, 2015).

Compared with mothers who contacted magazines or TV and radio at least once a week, mothers who never read, never watch TV, and never listen to radio were less likely to visit the ANC four or more times. In addition, in all four surveys (Mekonnen, et al, 2019), the couple's employment status, wealth status, and place of residence had a significant impact on receiving four or more ANC visits. A study of the spatial distribution and determinants of the optimal ANC visits in Ethiopia found that people's residence, religious beliefs, distance from health institutions, regional and community literacy levels are significantly related to the best ANC visits (Tessema & Animut, 2020).

In Ethiopia, Islamic women and women in the rural areas had fewer ANC visits than Christian women, and women in the urban areas respectively across the EDHS survey. In addition, mass media and women empowerment were also found to be important determinants for ANC use (Ousman, et al, 2019). In Hadiya, Women whose husbands have a positive attitude towards ANC were more likely to utilize ANC than women whose husbands had a negative attitude towards ANC. It was also found out that mothers who are residing within a nearer walking distance (less than an hour) from a health facility were about 4 times more likely to utilize antenatal care than those residing farther (greater than 2 hours) (Abosse, Woldie & Ololo, 2010)**.**

2.3. Obstetric history of mothers

An obstetric history involves asking approximately a woman's current and past pregnancies. It incorporates gestational age, gravidity (the number of pregnancies a lady has had), equality (the entire number of times a lady has given birth to a child with a gestational age of 24 weeks or more), and pregnancy complications.

A cross-sectional study in Northern Jordan identified that women who wanted to get pregnant were 1.82 times more likely than those who had an unwanted pregnancy to attend ANC adequately. Women who had three or more previous pregnancy-related illnesses were 2.14 times more likely than those who had a normal pregnancy to attend ANC adequately (Hijazi, et al, 2018). A study in Asia, Sub-Saharan Africa, and Latin America discovered that women with a high number of children and unintended pregnancies are less likely to have fewer visits. Moreover, birth order had significant effects on the attendance of antenatal care visits

(Guliani, Sepehri & Serieux, 2014). Another study in Uganda revealed that parity had a significant effect on antenatal care visits and utilization (Atuhaire & Mugisha, 2020).

When compared to one parity women, higher parity women were less likely to go for more ANC visits. According to a study conducted in Kenya, women with a birth interval of fewer than 37 months were less likely to have more ANC visits than those with a preceding birth interval of at least 37 months (Ochako & Gichuhi, 2016). In Ethiopia, a study showed that women with four or more last deliveries had fewer visits than primiparous women (Ousman, et al, 2019).

Family size was found to be a strong factor in antenatal care utilization. Mothers who live in a household having less than three children were eight times more likely to utilize ANC than those living in a household size greater than five. The number of delivery experiences and parity were also found to be determinants of ANC service utilization, when the order of birth decreases utilization of ANC becomes less likely. Moreover, women whose pregnancies were planned and wanted were more likely to utilize ANC service than those who had unplanned and unwanted pregnancies. Mothers who considered pregnancy as a risky event were more likely to seek ANC than those considering it risk-free (Abosse, Woldie&Ololo, 2010).

2.4. History of maternal health service utilization

Another factor affecting ANC utilization is having a skilled health care provider. A study in Northern Jordan revealed that women who often received dignified and respectful treatment from health care providers were 5.54 times more likely to utilize ANC adequately compared to those who rarely had positive communication with providers. Additionally, women who received enough information and counseling on ANC were 7.34 times more likely to attend the targeted care as recommended compared to those who obtained little information. Adequate ANC attendance is significantly determined by the provider's explanations on pregnancy-related issues (Hijazi, et al, 2018).

In Tanzania, the study identified that timing of first ANC and quality of care are significant to women who attended four and more antenatal care visits (Gupta, et.al, 2014). The study on determinants of antenatal care visits and their impact on the choice of birthplace in Uganda showed that late ANC attendance, history of obstetric care, perceived costs, and quality of care had a significant effect on ANC utilization (Atuhaire and Mugisha, 2020). Women who

had an initial visit in the second or third trimester were less likely to have four or more visits compared to women who had their initial visit on the first trimester in the seven countdown countries (Bangladesh, Cambodia, Cameroon, Nepal, Peru, Senegal, and Uganda) (Saad-Haddad, et al, 2016). Mothers who were not satisfied with the service are 0.246 times less likely to visit ANC than those mothers who were satisfied during their visit. Mothers who had better knowledge were 0.841 times less likely to visit than those mothers who had poor knowledge about the danger sign during pregnancy (Terefe & Gelaw, 2019).

The study in Arba Minch showed that the time of first antenatal visit, ANC provider, and family planning utilization before recent birth were identified as significant predictors of frequency of the ANC. In other words, mothers who started their first ANC visit early (before three months) were 3.8 times more likely to attend at least four and more ANC than their counterparts. Mothers who had obtained ANC services from a skilled provider had 1.8 times higher odds of receiving four or more ANC visits than the mothers who had obtained ANC services from unskilled health personnel. Mothers who used pre-pregnancy contraceptives were four times more likely to attend ANC visits at least four and more compared to mothers who had not used contraception before recent birth (Haile, Habte & Bogale, 2020).

Women who used contraceptives and did not want to have more children in the future were more likely to attend four or more ANC visits than women who had not used contraceptives and wanted to have more children in the future in all rounds of the EDHS (Mekonnen, et al, 2019). Women who started ANC after 12 weeks of gestation are less likely to have adequate ANC visits than those who start before 12 weeks of gestation. Women living in a community where ANC utilization is high are 2.67 times more likely to have optimal ANC visits than women residing in a community with a low proportion of ANC utilization (Tessema & Animut, 2020).

Generally, minimum recommended antenatal care visits attendance is accepted to be an important factor for preventing the adverse outcome of the pregnancy, and failed to attending the minimum recommended antenatal care visits affects both the maternal and child health. But, when I reviewed the literature on antenatal care service most of the studies done in Ethiopia focused on the utilization, quality, 0 and 4+ visits, and factors associated with them. And also they were focused on socio-demographic, economic, the distance of health service.

So, this study was conducted on the factors that affect the frequency of antenatal care visits. 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.

2.5. Conceptual framework

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). Therefore, these three factors can directly affect the frequency of prenatal care visits.

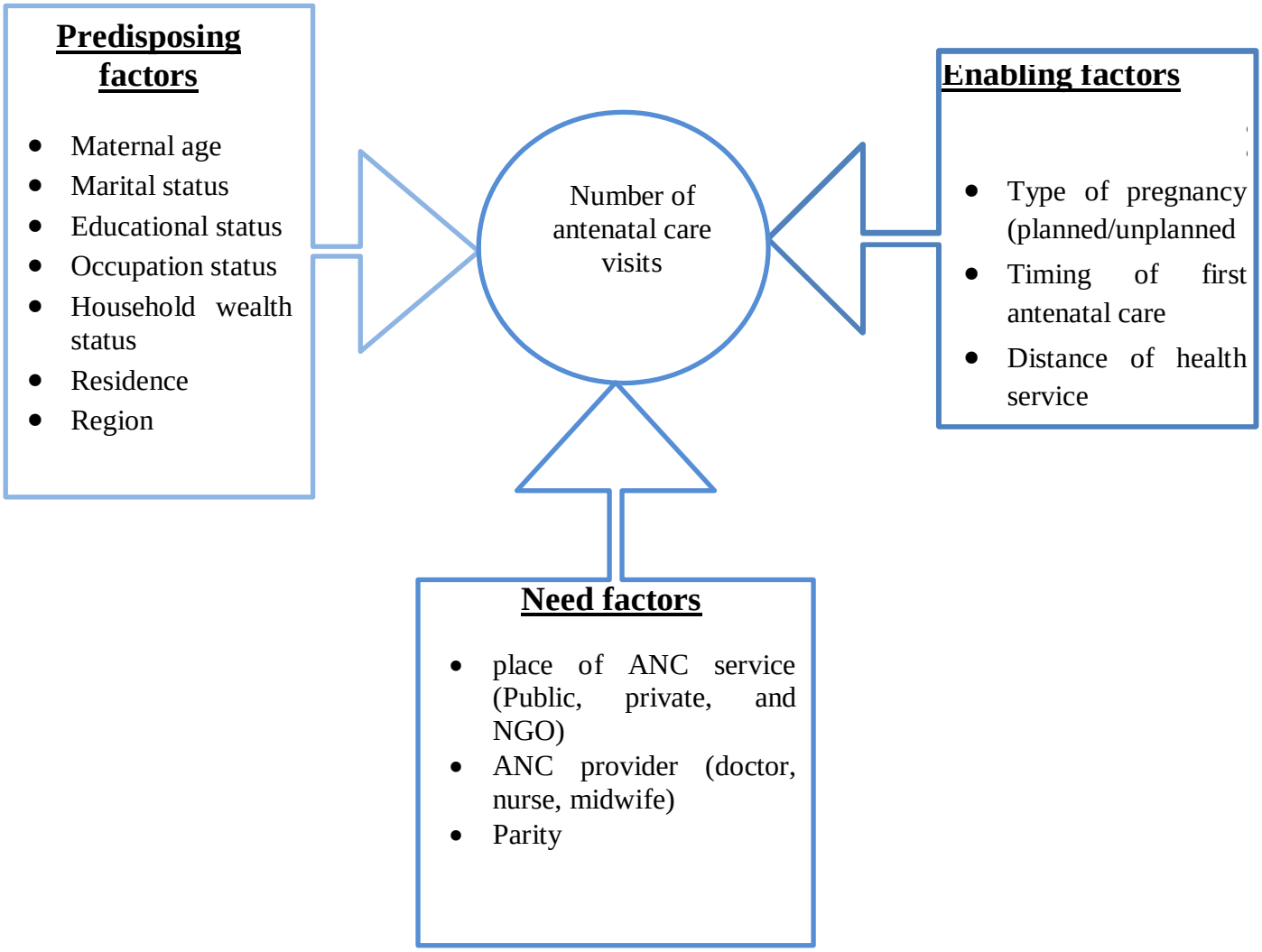

Figure1. Conceptual framework on frequency of ANC visits and its determinant factors in Ethiopia using 2016 EDHS (adopted from Anderson's (2003) model and modified from literature (Hijazi, et.al, 2018; Gupta, et.al, 2014).

CHAPTER THREE: METHODS OF THE STUDY

3.1. 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.

3.2. 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. 2016 EHDS has published a full report elsewhere that includes detailed information about data collection procedures, sampling, and questionnaires used in the surveys (CSA and ICF, 2017).

3.3. 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) was 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 was extract 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 was included in the final analysis of this study.

3.4. Inclusion and Exclusion criteria

3.4.1. Inclusion criteria

All reproductive age group women, who were pregnant five years preceding the survey and participated in the 2016 EDHS.

3.4.2. Exclusion criteria

Pregnant women five years preceding the survey who did not participate during the survey, reproductive age group women who were not pregnant within five years preceding the survey, and pregnant women who were not in the reproductive age group five years preceding the survey.

3.5. Variables of the study

3.5.1. Dependent variable

The number of antenatal care visits is the dependent variable in this study

3.5.2. Independent variables

It is the explanatory variable that can affect directly the frequency of antenatal care visit attendance of mothers throughout their pregnancy time.

Table1: Independent variables and their 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, BenishangulGumuz=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	Typpr; 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 the individual (age of mother, marital status, occupation, educational status, household wealth status), region, residence, the distance of health service, place of ANC service, parity, timing of first ANC, types of pregnancy, region, ANC provider is the determinant variable that influences the number of antenatal care visits.

3.6. Operational definition

Number of antenatal care visit: the occurrence of pregnant women attendance at health facility throughout their pregnancy.

3.7. 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 (McCullagh & Nelder, 1989). 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.

3.8. Ethical clearance

The study was carried out after receiving ethical approval from the Ethical Review Committee at Addis Ababa University's Center for Population Studies of the Collage of Development Studies and I got the data by registering online at https://dhsprogram.com/Data/terms-of-use.cfm after accepting the DHS agreement statement and submitting the study protocol.

CHAPTERE FOUR: RESULT

4.1. 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, table.2 as shown 5278 (69.72%) women age between 20-34 years and attended 2.49 ANC visits averagely, while 1958 (25.82%) women age were 35 years and more had average ANC 2.03. 7009 (92.49%) women were married and they were attended antenatal care visits 2.37 on average. Out of the sampled 6611 (87.23%) were rural residents, 963 (12.77%) urban residents and average ANC visits were 2.09 and 4.31 respectively.

According to in 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 on average, similarly, 2,147 (28.32%) were attending primary school has 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 on average 4.15, 5.02 respectively. Regarding the occupational status of the mother, the majority of 5,408 (71.38%) women had no occupation and attended ANC visits on average 2.22, while 2,167 (28.62%) had occupation and women have received 2.75 ANC visits averagely. Women with the poorest wealth quintile 1,648 (21.76%) have received on average 1.75 ANC visits, whereas women with the richest wealth quintile 1,262 (16.72%) and attended antenatal care visits 3.93 averagely.

Mothers who gave birth within the previous five years had 1-2 live births and received an average of 2.93 ANC out of 2,620 (34.61 %). On the other hand, 2,961 (39.08 %) of women who had five or more live births had an average of 1.86 ANC visits. The majority of the

mothers who participated in the survey received ANC in public health institutes, with 4,393 (92.67 %) receiving an average of 3.74 ANC visits, while 213 (4.49 %) received ANC in private institutions, with an average of 4.81 ANC visits. In terms of the type of ANC provider, 3,239 (69.09 %) and 1,146 (24.10 %) women who gave birth in the previous 5 years received ANC from a nurse/midwife/HO and a HEW, respectively, with an average of 3.76 and 3.53 ANC visits, whereas 313 (6.58 %) women received ANC from a doctor, with an average of 5.01 visits. Approximately 6,880 (90.84 %) pregnant women who had a live birth in the previous 5 years were wanted pregnancies, with an average of 2.44 ANC visits. Women who had unwanted pregnancies, on the other hand, were around 695 (9.16 %) and had 1.73 ANC visits on average.

The 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 on average. Whereas 490 (10.41%) women who were started ANC visit before three months of their pregnancy time and also have received in average 5.41 times. Regarding 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 3).

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	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

Continue table 1.

Variables	Number of Women (%)	Average ANC	Standard Deviation of ANC
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
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

Continue table.1

Variables	Number of Women (%)	Average ANC	Standard Deviation of ANC
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

Table 3. Number of ante natal care visits among women in the last five years in 2016EDHS.

Number of antenatal visits	Frequency	Percent	Cumulative Percent
0	2,818	37.21	37.21
1	335	4.42	41.62
2	607	8.02	49.64
3	1,400	18.48	68.12
4	1,194	15.76	83.88
5	607	8.02	91.90
6	318	4.20	96.10
7	139	1.84	97.94
8	57	0.75	98.69
9	45	0.60	99.28
10	26	0.34	99.62
11	5	0.07	99.69
12	8	0.11	99.80
13	3	0.04	99.84
14	2	0.02	99.86
15	3	0.04	99.90
16	1	0.01	99.91
20	7	0.09	100.00
Total	7,575	100.00	
Mean	2.37		
Variance	5.48		

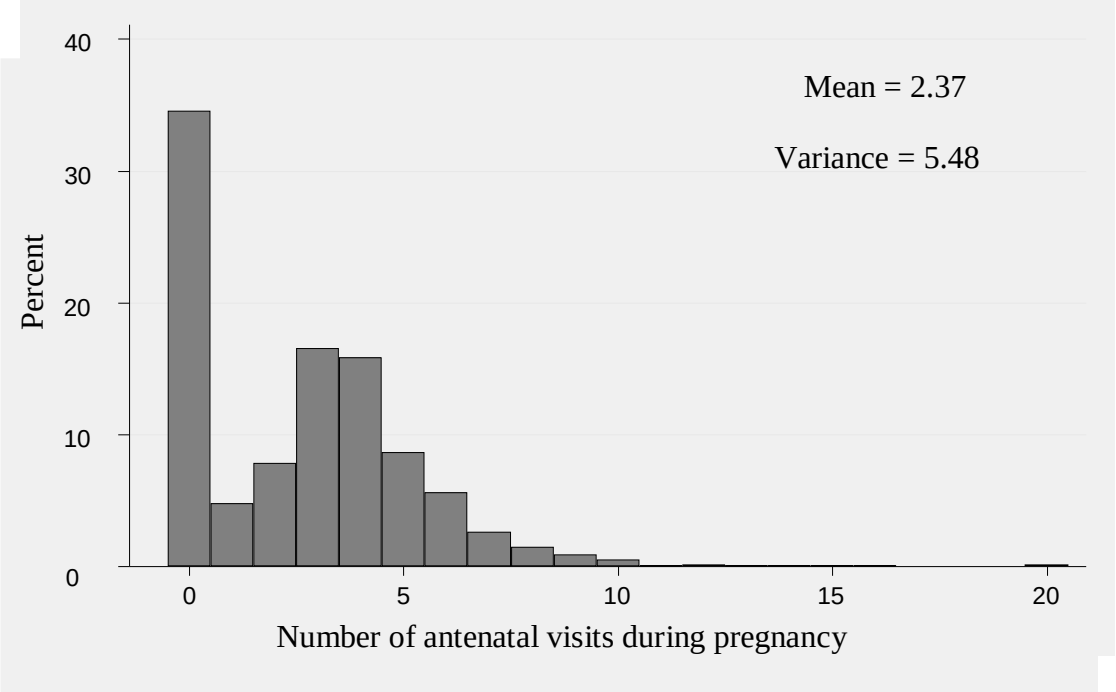

Figure 2. Number of antenatal care visits during pregnancy according to 2016 EDHS.

The above figure shows most of the mother who was given a live birth within the last 5 years before the survey they have 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.

4.2. Frequency of ANC visits by the regions of Ethiopia

Table 4 or graph 3 below shows the variation in the frequency of ANC visits within and between the regions of Ethiopia. Among the regions, the percentage of mothers who had at least one ANC visit is highest in Addis Ababa, 96.8%, followed by Tigray, 90.3%, and Dire Dawa, 87.4%. The percentage of mothers who had four or more ANC visits is also highest in Addis Ababa, 89.1%, and lowest in the Somali region, 11.8%. More than half, 56.2% of the mothers from the Somali region had never received any ANC service, being the highest of all the regions. Oromia, and Afar regions has also a higher percentage of mothers who had never received any ANC services, 48.7%, and 48.6%, respectively.

Table 4: Variations of antenatal care visits between the regions of Ethiopia, EDHS 2016.

	Number of ANC				
Region	**0 ANC (%)**	**1-3 ANC (%)**	**4-7 ANC (%)**	**>=8 ANC (%)**	**Total**
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-Gumz	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

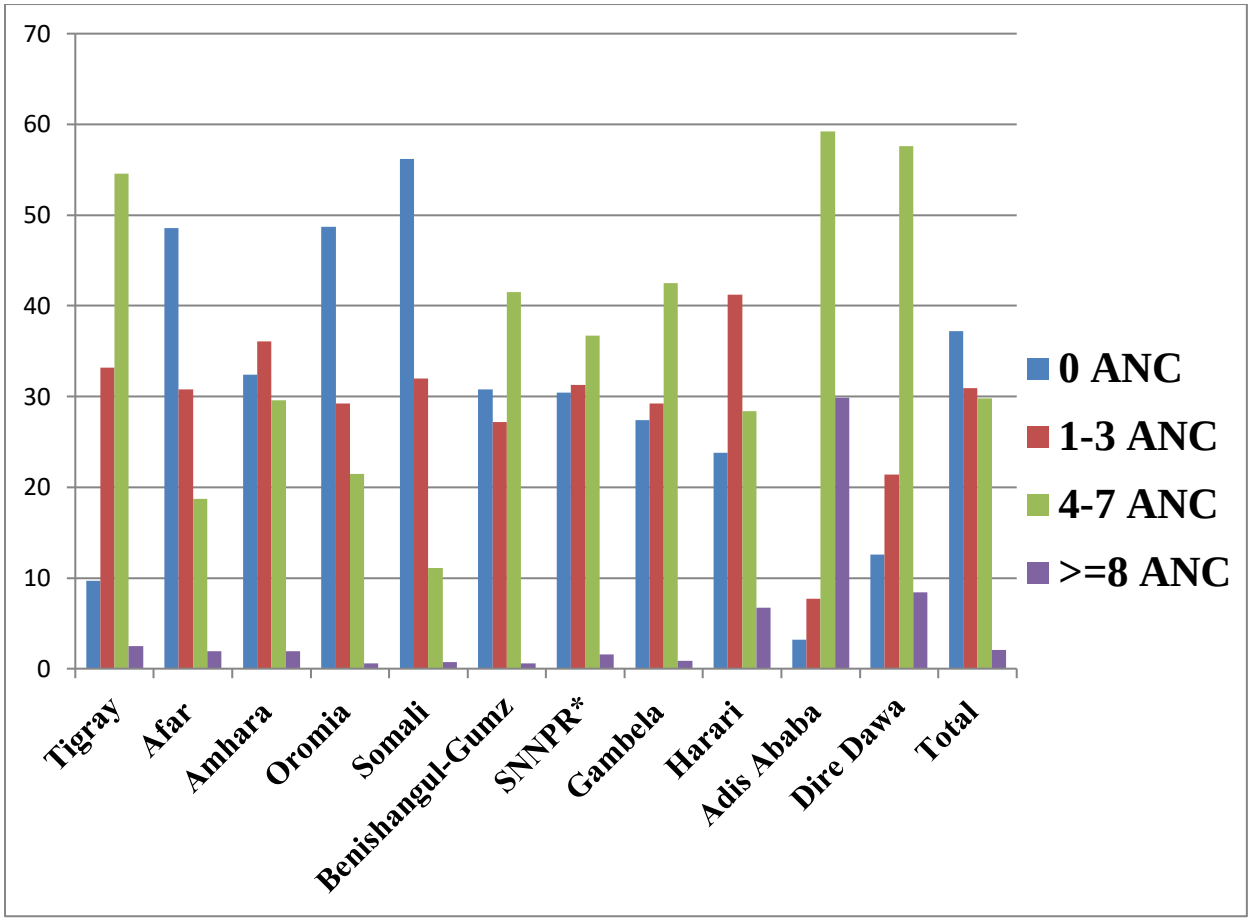

Figure 3. Graphical representation of antenatal care visits variations between the regions of Ethiopia, EDHS 2016.

4.3. Determinants of frequency of Antenatal care visits

The number of ANC visits was determined using a multivariable Negative Binomial log link and a complex sampling design analysis. 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 5).

Table 5: 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	
Yes	2.75	1.01 (0.97-1.05)	0.628
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

Table 4 (Continued)

Variables	Average ANC	IRR (95% CI)	P-value
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.

4.4. 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 (CSA and ICF International, 2012). 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 (Islam and Masud, 2018; Joshi, et.al, 2014; Rurangirwa, et.al, 2017; Gupta and Talukdar,2017; Wilunda, et.al, 2015; and Terefe & Gelaw, 2019). 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 average ANC the last 5 years preceding the survey (Islam and Masud, 2018, and Guliani, Sepehri & Serieux, 2014).

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 (Saad-Haddad, et.al, 2016; Islam and Masud, 2018; Guliani, Sepehri & Serieux, 2014; Abosse, Woldie & Ololo, 2010, and Ousman, et.al, 2019). 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 (Gupta, et al, 2014; Ochako and Gichuhi, 2016; Rurangirwa. et.al, 2017, and Terefe & Gelaw, 2019). 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 (Guliani, Sepehri & Serieux, 2014; Gupta, et.al, 2014; Ha, et.al, 2015; Ochako and Gichuhi, 2016; Atuhaire and Mugisha, 2020; Saad-Haddad, et al, 2016; Tessema and Animut, 2020). 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) (Guliani, Sepehri & Serieux, 2014). 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 (Okedo-Alex, et.al, 2019 and Terefe & Gelaw, 2019). . 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 (Guliani, Sepehri & Serieux, 2014; Ochako and Gichuhi, 2016; Saad-Haddad, et.al, 2016; Ha, et.al, 2015, and Wilunda, et.al, 2015). 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 (Hijazi, et.al, 2018 and Haile, Habte & Bogale, 2020). 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 (Gupta, et.al, 2014; Atuhaire and Mugisha, 2020; Saad-Haddad, et.al, 2016, and Haile, Habte & Bogale, 2020). 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.

4.5. Strength and Limitation of the study

4.5.1. Strength of the study

This study used a large sample size with nationally representative data of Ethiopia. A count statistical analysis was applied for this study that allows the effects of each determinant on the frequency of ANC services proficiently. Furthermore, the effects of health workers and places of health service factors were assessed.

4.5.2. Limitation of the study

No causal relationship was reported because of the Ethiopian demographic health survey based on cross-sectional data. Recall bias may affect the result due to the EDHS data collected depends on the respondent's remembrance in the last five years preceding the survey. This study has not assessed the effect of other determinant factors like partner status, contraceptive utilization, decision making, and level of awareness about ANC service.

CHAPTER FIVE: 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

Policymakers and planner and Minster 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.

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