ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

TRENDS IN INEQUALITIES IN THE UTILIZATION OF ANTENATAL CARE (ANC) SERVICES AND ITS ASSOCIATED FACTORS AMONG WOMEN AGED 15-49 YEARS IN OROMIA REGION, ETHIOPIA

BY: ENDALE TADESSE (B.A, LLB, MSc.)

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES ADDIS ABABA UNIVERSITY SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIRMENTS FOR THE MASTERS DEGREE OF PUBLIC HEALTH

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Title: Trends in inequalities in the utilization of antenatal care (ANC) services and its associated factors among women aged 15-49 years in the Oromia region, Ethiopia

Approval by the Examining Board

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Declaration

I, the undersigned, declare that this is my original work and has not been presented in this or any other University and all sources of materials used for the thesis have been fully acknowledged.

Name of principal investigator: _____

Signature: _____

Date: _____

DEDICATION

This thesis work is heavily indebted to my lovely wife, Miss **Birhane Tola and My daughter Sifen Endale, my Sons Eba Endale and Yona Endale** who are the essence of love, source of inspiration, engine of courage, a cause for my passionate commitment for emancipating my potential and secret for all of my achievements through all aspects of my life.

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ACRONYMS AND ABRIVATIONS

ANC+1…….Antental care visits 1+
ANC+4…… Antental care visit 4 or more
ANC……. Antenatal Care
CC……. Concentration Curve
CI……... Confidence Interval
CIX……. Concentration Index
CSA……Central Statistical Agency
DHS……Demographic and Health Survey
EDHS……. Ethiopian Demographic and Health Survey
ENRHS……Ethiopian National Reproductive Health Strategy
EPHI……Ethiopian Public Health Institute
GLM…… Generalized Linear Models
HEP……. Health Extension Programme
HEW…… Health Extension workers
HSDP……Health Sector Development Programme
HSTP……... Health Sector Transformation Plan
MD……MDs/ Difference in Means
MDGs.....Millennium Development Goals
MOH……... Ministry of Health
NGOs……. Non-Governmental Organizations
PP……... Percentage Points
RD……. Rate Difference
RII……...Relative Index of Inequality
RMNCH…… Reproductive, maternal, newborn, and child health
RR……. Rate Ratio
SDGs……. Sustainable Development Goal
SII……. Slope Index of Inequality
SNNP…….Southern Nations, Nationalities, and People's region
UANC……Utilization of Antenatal Care Service
UHC……Universal Health Coverage
UN……. United Nations
UNDP……United Nations Development Programme
UNFPA……. United Nations Population Fund
UNICEF……United Nations Children's Fund
USAID……...United States Agency for International Development
WHO…….World Health Organization

ABSTRACT

Background: Although there is a significant improvement in maternal health service in recent years, inequalities in the utilization of ANC service remain to be a challenge in Oromia region. In this study, we aim to provide a comprehensive analysis to examine the trends in inequalities in the utilization of ANC service and its associated factors among women aged 15-49 years in Oromia region between 2000 -2016 EDHS.

Methods: Women in the most recent birth data from regional representative surveys in Oromia region in the four consecutive EDHS rounds was used. Trends in inequalities of ANC service utilization were measured using a combination of RD, RR, CIX, SII, and RII,and is subsequently decomposed into contributing factors. Multivariable logistic regression analyses using GLM approach were carried out to identify the factors of ANC utilization. A p-value of < 0.05 and 95% CI was reported as a measure of magnitude of significance. Data analysis was done using STATA version 14 and Microsoft Excel© 2016.

Result: Over 16 year period, the percentage of women who revieved ANC1+ and ANC+4 visits increased significantly from 27.3%, 10.2% in 2000 to 51%, 22.2% in 2016 EDHS respectively. Although ANC services showed an upward trend from 2000-2016, there was very low utilization of ANC services influenced by socio-demographic and economic factors in the region. Trends in RD and RR of any ANC use were analyzed. The overall CIX for any ANC services utilization among women significantly an increased trend from 0.79 in 2000 to 0.99 in 2016 EDHS. By contrasts, an estimate of CIX indicates declined significantly for wealth status from 0.279 in 2000 to 0.133 in 2016, education level from 0.247 in 2000 to 0.134 in 2016, and disparity of urban-rual areas decresed from -0.204 in 2000 to -0.062 in 2016) respectively. The RR &RII of any ANC services utilization with socioeconomic status was significantly decreased while the RR of wealth status &SII by educational level among women were slightly increased significantly between 2000-2016. Wealth status & women's education were the most significant contributors to inequality in ANC visits. Inequalities in use of ANC favoured advantageous women over their counterparts. The findings of the present study shows that these disparities continue to persist in the region.

Conclusion: The findings show that utilization of any ANC services is very low. The findings of the study show that there was inequality in any ANC service utilization in Oromia region. The socio-economic factors such as residence, level of education , and economic status were the determinants of inequality. There is a need to increase the availability, accessibility and affordability of health services to all women, especially for the disadvantaged, uneducated and those who live in hard-to reach rural areas in the study area. Finally, the regional government should scale up of strategies that are pro-poor to increase ANC service provision in underserved areas are crucial.

1. INTRODUCTION

1.1 Background

Maternal health care services are important for the wellbeing of mothers and their children. Antenatal Care(ANC) is a routine care provided to pregnant women from conception to the start of labor. It is one of the three most essential cares given to women during pregnancy and a key indicator of the Sustainable Development Goals (SDGs), target 3.1 - reducing the global maternal mortality ratio in 2030 (1,2).

Despite the progress made in many countries in increasing the availability of maternal health care, the majority of women across Africa remain without full in access to this care(2). The greatest inequality in ANC use was observed in Africa (9.4% in Somalia and 99.9% in Libya) between 2012 and 2015 (3). Recent estimates suggested that the target to reduce Maternal Mortality Ratio to less than 70 maternal deaths per 100,000 live births by 2030 requires a coverage of 91% for any ANC visit, and 78% for at least four ANC visits(4). About 88–98% of all maternal deaths could be avoided by proper care during pregnancy and labour (5). ANC service provides a unique opportunity for screening and diagnosis, health promotion, and disease prevention among pregnant women, and their families and communities(6).

Global, national policies and programs concerning utilization of ANC services are varied. As demand for maternal health services increases, government health programs are turning to user fees to help alleviate pressure on constrained budgets (7). Some studies reported that in countries where policies guaranteed “free” maternity services, many women still had to pay for services out-of-pocket. Mostly, in Africa countries like Ghana and Tazania, fees have had a negative effect on utilization of ANC services. However, suspension of user fees led to an increase in attendance at ANC clinics in South Africa(7–10). In Ethiopia, public health facilities are supposed to provide free maternity services by policy since 2005; but in reality, mothers paid an average of 126 Ethiopian Birr to get ANC services from public health facilities excluding health posts(11). Despite the presence of free (or subsidized) maternal health services for women in some African countries, women still bear some direct out of pocket medical costs (i.e. Laboratory testing) and non-medical costs (i.e. transportation), posing financial barriers to the use of ANC services(12).

According to WHO, under normal circumstances a woman should have at least ANC+4 visits for uncomplicated pregnancies while the newest guidelines from the WHO recommend that women attend ANC+8 visits(13). Worldwide, 85% of pregnant women attend at least one ANC visit with a skilled health professional, and 62% attend at least ANC+ visits in the period 2010-2016. However, the coverage ANC+1 visits has been registered 77% in developing countries and only 49% in sub-Saharan Africa countries between 2010–2015(14,15). Studies have shown that large inequalities exist in ANC use by wealth index, women’s education level and place of residence in developing

countries. Inequalities in maternal health care are of concern to all developing countries and present one of the biggest possible challenges to governmental policies in many sub Saharan African countries. (3,16).

Despite strong international efforts to expand maternal health care services for women; especially in Sub- Saharan Africa, countries like Ethiopia still have low utilization of ANC services(17,18). In Ethiopia, women who had received any ANCvisits from a skilled provider increased from 27% in 2000 to 62% in 2016. Likewise, the percentage of women who had four or more ANC visits increased from 10% in 2000 to 32% in 2016 respectively (19–22). In Oromia region, the prevalence of women making any ANC service from a skilled provider has increased from 27% in 2000 to 50.7% in 2016. In the same year the percentage of pregnant women who get ANC+4 visits increased from 10.8% in 2000 to 22.2% in 2016 (19,20,23). The national ANC coverage for the period 2013-2016 was 64.1% and three out of the 11 regions had their ANC coverage below the national average. Clearly, regions such as Afar, Somali, and Oromia have suffered from considerably low coverage of maternal health services(24).

While recognizing a positive trend in ANC services, Oromia is still underperforming when it comes to maternal health care services(25).Other studies (26–28) have shown that utilization of ANC service among women aged 15-49 years in the study area is very low. Consequently, this low utilization of ANC services, high infant mortality and maternal mortality are a common public health problem among women reproductive aged (15-49) years in the region(28,29).

The major factors contributing for the low use of ANC services in the region includes women's level of education, place of residence, household size, inaccessibility of health services, lack of time due to women's work load, long waiting time, poor quality of ANC services and women's autonomy, religion, household income, and marital status of women (30–33). Over the past decades, Ethiopia has made great efforts to strengthen its health system and improve the health of women. Despite these encouraging achievements, maternal health services were struck with unfair distribution of ANC service within and across regions, and across population subgroups based on variety of socioeconomic and demographic variables. In addition, the impressive gains in health sector in recent years are unevenly distributed, and aggregated indicators, hide, striking inequalities across the population subgroups (34,35).

For this reason, the Ethiopian government has designed a new plan, the Health Sector Transformation Plan (HSTP) 2015/16–2019/20 to improve health by addressing inequalities (36). Inequalities in the main socioeconomic stratifies such as poorest versus richest, less educated versus most educated and urban-rural residences are major determinant factors to the overall inequalities in the utilization of ANC services in the country in general and in Oromia region too. The persistent of

inequality among its population, particularly between the richest and the poorest, remains the major health sector challenge. In the perspective of achieving UHC in a country as diverse as Ethiopia, having large social inequalities combined with economic growth, it is clear that inequalities must be measured and trends need to be understood(37).

To our knowledge, there is paucity research on trends of inequalities in the utilization of ANC services and its associated factors over time in the region. Therefore, the purpose of this study is to examine trends of inequalities in the utilization of ANC services and its associated factors in Oromia region during 2000,2005,2011 & 2016. This study aimed to provide necessary information for decision-makers at different levels to assess trends in inequalities in the utilization of ANC services across socioeconomic and place of residence over time. Ultimately, this information will be used to target regional programs to the disadvantaged and marginalized groups of women aged 15-49 years in the region. The study will serve as a benchmark for further studies in the area.

1.2 Statement of the Problem

ANC is an important intervention to slash the already high maternal mortality rate and child death, which is a key strategy to improve maternal and infant health. Different studies have found that poor ANC service has been associated with adverse pregnancy(38,39).Globally, developing countries still face a challenge of poorly implemented ANC programs with irregular clinical visits and long waiting times & poor feedback to the women(40). Significant and persistence health difference among and within countries, regions, economic groups, and exist in individual ability to access adequate or quality health care. In this regard, the disparities and lack of ANC utilization is commonly associated with premature deaths, neonatal and maternal mortality and morbidity(41,42).

Studies suggest that a large number of people are still being ‘left behind’ in African countries in terms of access to needed health care services. The SDGs are based on an understanding of the need to move towards more equitable health systems that provide the highest possible quality of care(43). Ethiopia has adapted the current global development agenda (SDGs) which has 17 goals, with Goal 3 focusing on health (ensure healthy lives and promote well-being for all at all ages). The country needs to move towards UHC and right the inequities between urban and rural, among regions and socioeconomic status by implementing targeted interventions, which should again be comprehensive, multisectoral and targeted(44). This requires targeted models of service delivery, increased health financing and enhanced socioeconomic status in marginalized populations lagging behind the national averages during the era of MDGs. Strategies that are directed at the areas with greatest need, including most marginalized and disadvantaged populations, should be identified and implemented(45).

Inequalities in maternal health have been widely acknowledged, both across countries and within countries. Thus, inequality in access to, and utilization of ANC services remains a significant public health importance in many developing countries, including Ethiopia(46,47). Improvement in ANC service has been used as a strategy to reduce maternal and child mortality in many developing countries. Studies have shown on socioeconomic inequalities in utilization of ANC services has increased in some developing countries, particularly high in many countries in Africa compared to other region. In most cases, the poor are disproportionately affected by these inequalities in utilization of any ANC services (48,49).

In Ethiopia, only 62 % of women aged 15-49 with a live birth received ANC+1 visit from a skilled provider for their most recent birth in 2016(19). This value is much more below the average rates of least developed & Sub-Saharan Africa countries i.e., 74% and 76%, respectively(47).Similarly, the ANC coverage with at least four visits are only 32%, which is also below the average rates for least developed countries & Sub-Saharan Africa which is 44% and 47% respectively(14,19).On the otherhand, in Oromia region the ANC coverage with at least one visits has increased from 27% in 2000 to 50.7% in 2016 and ANC coversge with atleast four visits increased from 10.8% in 2000 to 22.2% in 2016 (19,20,23). However, the ANC coverage has shown an increment over the past 16 years, it is still most of the women did not attend minimum number of visit recommended by WHO services in Oromia region (50,51). Overall, ANC visits still the current problem in Ethiopia (19,20).

In Ethiopia, as in other low-income countries, there are high rates of maternal and newborn death, and the utilization of ANC service is low. Child and underfive mortality rate in Oromia are declining, but remains high. Consequently, there was a serious issues with access to and availability of basic maternal and child health, and nutritional services, among others. The high mortality rate in Ethiopia is reflective of the low utilization of maternal healthcare services(25,52) Several studies have shown that utilization of any ANC service is not equally accessible across the different socioeconomic groups. Socio-demographic, economic and rural environmental conditions of the women are considered as important determinants for the utilization of ANC services(53–55). Inaddition, women's empowerment seems to play a part in influencing the utilisation of ANC services (56,57). There is a regional disparity of trends in the utilization of ANC service between regional states of Ethiopia. A disparity in health services utilization within and between regional states of country with different socio-cultural and economic conditions is common in Ethiopia and in Oromia, too(26,28,58). The growing inequality in access to health care and in health outcomes is an issue of concern as countries endeavor like Ethiopia to improve maternal health care services. Inequalities in maternal health services utilization constitute a major challenge in Ethiopia(34,58,59). Studies have reported that any ANC services have wider gaps between the richest and poorest; the

most and least educated; and urban- rural places of residence in Oromia region affect the pregnancy outcome (28,58,60).

Research on health inequalities in Oromia is limited. Most studies on health inequalities in Oromia region have focused on a general reproductive health(61), and none have assessed the trends in inequalities on a single indictor(i.e on any ANC Visits).Previous studies covered small geographical areas on the utilization of ANC service associated factors at regional level, Oromia(33,62).Therefore, study aimed to provide necessary information for decision-makers at different levels to assess trends in inequalities of ANC service across socioeconomic and places of residence over time and identifying determinant factors for any ANC services in the region. A better understanding of the determinants of inequalities in maternity care services may help to tackle these disparities and offering insights to policy makers about potential public health strategies towards a more integrated and accessible any ANC services for pregnant women aged 15-49 years in the region.

1.3 Rationale and Significance

Until today no systematic study has been done focusing on inequalities in the utilization of ANC services. Therefore, the present rational of study aims to clearly assess inequalities in utilization of ANC service. It can assist strategic framework of the region in targeting public health efforts to reduce disparities among reproductive women in the utilization of ANC service in the region. Therefore, narrowing the gaps of health service inequalities helps countries/regions to track progress towards SDG 3 and other health-related goals, and ensure that disadvantaged populations are not left behind(63). Inequality in accessing ANC services in Oromia has not been studied using regional representative data and analysing inequality trends over time. The significance of the study relates to its social change implications in improving maternal health. The result of this study may also help the local government and NGOs in understanding the potential determinants & to plan a new strategy to come up with a solution and enactment of different maternal health care related services and promoting ANC services among reproductive women aged 15-49 years.

Additionally, the outcomes of this study help policy-makers, planners, programmers and partners in the health sector to formulate appropriate planning and interventions to monitor inequalities in the utilization of maternal care services. In addition, the possible beneficiaries of the results of this study are the society in over-all and women and children in particular as the interventions made on ANC services improve the utilization of these services.

2. LITERATURE REVIEW

2.1 Global Overview of Maternal Health Care Services

Maternal health has become a global concern because the lives of millions of women in reproductive age can be saved through maternal health care services. Efforts designed to improve the health of women of reproductive age in developing countries are commonly insufficient and ineffective (64–66). The provision of special care for women's health during pregnancy through the public health services was a relatively late development in modern obstetrics. Prenatal care, also known as antenatal care, first became a concern of public health in the late 1930s in Great Britain and quickly spread to other industrial countries. (67). During the second half of 20th century, international awareness grew of the dimension the tragedy of maternal mortality and UANC expand to developing countries(16,68,69).

Although there are controversies across the world with regard to making any ANC visits conventional or focused type, several developing countries adopted the new ANC model as a standard. In 2002, WHO recommended that pregnant women make at least four ANC visits(69,70): in 2016 this recommendation was modified to at least eight visits with the first ANC visit to be undertaken before the 12th week of pregnancy. While there has been marked progress in the uptake of at least one ANC visit in Ethiopia there has been the suboptimal attendance of the recommended visits(13,19,20).

2.2 Trends in the Utilization of Antenatal Care Service

In terms of global coverage, ANC is a success story. Studies have documented that trends and coverage of ANC+1 visits are rising across the world, but still the pace of progress is more slowly(71). Globally, the proportion of women attending at least once ANC visits have increased from 64 % to 81 % over the last 15 years(72). In developed countries, nearly all women (98%) receive ANC service. In less developed countries, 50% of the women are deprived of ANC services. The WHO recommended at least four ANC visits was not achieved for almost half of the pregnant women worldwide, the failure was more common in less developed countries(73,74).

In 2014, 83 % of pregnant women in the developing regions had at least one ANC visit by skilled health care provider, which was an improvement of 19 % points from 64% since 1990. Likewise, coverage of at least one ANC visit increased from 50 - 89 % in Northern Africa and from 68 to 80 % in sub-Saharan African countries between 1990 &2014 (75). But, the highest coverage of at least one ANC visit in the Americas and European regions have achieved 86% and 80%, respectively in the same periods(76,77). In low- and middle-income countries, UANC service has increased since the introduction in 2002 of the WHO ANC model, known as focused ANC (FANC). However,

globally,47% pregnant women do not attend at least four ANC contacts during the period of 2007-2014, therefore the need to increase uptake in ANC contacts is vital(13,78).

Globally, while 86 % of pregnant women access ANC with some skilled health personnel at least once, only two in three (65 %) receive at least four ANC visits. Regions with the highest rates of maternal mortality, such as sub-Saharan Africa and South Asia, even fewer women received at least four antenatal visits (52 % and 49 %, respectively). The lowest levels of ANC services are observed in sub-Saharan Africa and South Asia (14). ANC service trends indicated that slower progress in sub-Saharan Africa than in other regions, with an increase in coverage of at least one ANC visit only 4% during the past decade (14).

A trend analysis of the EDHS (2000, 2005, 2011&2016) has shown that there was a significant increase women who had at least one ANC service from 27.2% in 2000 to 62 % in 2016 increment by 61.4 % in Ethiopia for the last 16 years. Similarly, the proportion of women who received the recommended four or more ANC visits increased from 10% in 2000 to 32% in 2016(19–22). Notably, in Oromia region trends in the utilization of ANC for at least one ANC visit has also increased from 27 % in 2000 to 50.7 % in 2016 increment by 49.7 %. Likewise, the four or more ANC visits increased from 10.8% in 2000 to 22.2% in 2016 in the region(19,20).

Even though there is considerable progress in the utilization of maternal health service in the region, ANC service utilization is below the average coverage rate of the national level, and the disparities of ANC utilization and its factors for this low utilization of ANC services in the region were not well examined(19,32). However, previous studies covered small geographical areas on the utilization of ANC service were unable to identify inequalities of utilization ANC services and its associated factors at regional level. A similar study was previously conducted in the region (61). This study, like ours, examined disparity using the EDHS, but focused on an overall of reproductive health and maternal health services components(family planning, ANC services, place of delivery and postental care) in the region. Unlike our study(61), examined how systematic injustice in the uptake of maternal health services was also observed based on place of residence, education levels, and household wealth status in the region. Mostly, our study exceptional others previous studies(33,61,62) focused on examing trends in inequalities only on ANC sevices and its associated factors for four consecutive pooled EDHS in region.Therefore, this study tried to assess trends in inequalities in the utilization of ANC services and its associated factors in the biggest region of Ethiopia, Oromia.

2.3 Trends in inequalities of Antenatal Care Service

Health inequalities exist in social gradient, which refer to a gradual, or a linear decreed related to decreasing social position. The debate on absolute versus relative measures of inequality suggested

controversial when it relates to the issue of whether inequalities are increasing or declining over time. In some cases, the results have been supposed inconsistent because an absolute measure indicated increased inequalities and a relative measure indicated decreased inequalities or vice versa(79). Although the health status in most countries of the world has significantly improved over the past few decades, substantial inequalities in health outcomes among nations, socioeconomic groups and individuals have remained(80). While other studies have shown in most countries, health inequalities have been decreasing. However, health inequalities have been grown in a small but substantial proportion of countries, and in many of these countries, a decline in health status and health-service coverage among poor populations is part of the cause(81).

Evidence shows that economic-related inequalities in health and utilization of health services remain prevalent in developing countries. A recent study using population-based survey data in 35 low and middle-income countries indicated that pro-wealth inequalities are common in coverage of any ANC service and these inequalities have increased in many countries(82).Inequality in the use of ANC services persistently favoured better-off women, but there was a gradual progress towards equitable utilisation. This inequality was generally the lowest for the services provided in communities or primary health care (e.g. ANC). However, a recent study demonstrated that wealth-related inequality in ANC+1 visits increased between 2011 and 2014 in Asian countries. Few studies further examined inequality in maternal health care utilization disaggregated at urban-rural level. These studies suggested that the decline in inequality was more pronounced in the urban area than in the rural area, thus widening the urban-rural gap in inequality of maternal health care service use(83).

A study used data from Bangladesh DHS to examine the trends in socioeconomic inequalities in the utilization of the ANC, wealthier and more educated women, as well as those living in urban areas, are the major users of maternity care in Bangladesh (84). However, study in Indonesian has shown the changes in inequality of ANC 4+ utilization across economic status and education level from 2002 to 2012. The coverage of ANC 4+ has increased substantially as inequalities declined. The general downward trend for SII by the economic status of women was seen. A reduction of SII for ANC 4+ was observed across economic status, although the value slightly increased between 2002 and 2007. The absolute inequalities in ANC 4+ across education level also declined over time. A slight decrease of SII was observed from 2002 to 2007, but the trend was reduced sharply between 2007 and 2012. A similar downward trend was observed for wealth-related inequality merely between the last two periods of the survey(85).

Previous research conducted in different Sub-Saharan countries shows that poorer women continue to have fewer ANC visits compared to their more affluent counterparts. Majority of these implicated women tend to be poorly educated and unemployed(86). Other studies have shown that maternal

health interventions more used by mothers with formal education, those living in urban areas and richer parts of the women in Ethiopia. As for the urban- rural inequality, Ethiopia made a considerable reduction in relative disparities in ANC use between the 2000 and 2011surveys, a 55% reduction in the value of the relative differences. While relative and absolute urban-rural inequalities in the utilization of ANC increased in Madagascar over time, the relative ratio of urban (RRur) and relative difference of urban (RDur) suggest a decline in geographical differences in ANC services. In contrast, geographical differences in the absolute utilization of ANC service in Cameroon increased (87). Study in Ghana has, observed in inequalities in attending ANC+1 visits in relation to urban and education, whilst wealth inequalities in ANC visits increased over the periods between 2003 to 2008(88).

2.4 Factors Associated with Utilization of ANC Services

A review of the literature suggests that in developing countries, the use of modern health care such as maternal health services can be influenced by the socio-demographic characteristics of women, the cultural context, health system and the accessibility of these services. These factors can influence the ANC use of pregnant women either positively or negatively(53). A study on maternal health care across sub-Saharan Africa found that low level of education, rural residence, poor provision of services and low household income were all associated with poor ANC attendance(89).

2.5.1 Socio- Demographic Factors

A number of socio-demographic characteristics of the individual affect the underlying tendency to seek care (90). In this regard, good examples are maternal age at delivery, household size, marital status and birth order, which have been examined as determinants of maternal health care use repeatedly. For instance, studies showed that utilization of ANC services in Ghana and in Kenya UANC reduced the age of the expectant mothers'. On the contrary, other studies confirmed that older women were more likely to use ANC services than their younger counterparts were. The reason may be due to the fact that older women might have gathered immense knowledge on the need of ANC services, which may positively influence their use of ANC services(53,91).

By women's age in sub-Saharan Africa and in South/Southeast Asia, however, variations in ANC service by age are more apparent. In more than half of the countries mothers aged 20-34 years are most likely to report four or more visits(92). Birth order is also another predictor for the UANC. There is gradual decrease in seeking the care with increasing birth order of women. Study has shown that in Jordan women who have 1-2 children are more likely to receive adequate ANC services compared those with more than 6 children (93). With the increase in the number of children that women had, the probability of receiving adequate ANC visits decreased. One study, however, showed no statistically significant association between number of children with ANC use(94).

Different studies assessed the effect of marital status on using ANC service once in the course of pregnancy. These studies showed that married women were more likely to use ANC service than the never married/currently unmarried. Married women were 40% more likely to receive ANC from a health professionals than unmarried women(95,96).

Household size is another important predisposing factor believed to influence the UANC service. It is widely acknowledged that women with large family sizes tend to underutilise maternal healthcare services due to excessive demand of their money, time, and other resources. The situation becomes worse in developing countries like Ghana when women, aside child bearing roles, spend a lot of time to fetch water and firewood, prepare daily meals, and keep the house in order(53).Place of residence has been found to influence the utilization of maternal health care services. Rural women were less likely to use ANC compared with urban women. There was a significant association between rural residence and decreased chances of using adequate ANC compared with urban (94,97,98).In contrast, study has examined that the urban-poor may become worse off than their rural counterparts and urban non-poor in the use of ANC especially in a society with high medical facility. This is due to increasing rural-urban migration of women of reproductive age could have a major influence on the pattern of ANC use in the urban area of Nigeria (99). Other studies have, however highlighted poor maternal health outcomes associated with urban poverty, especially in the poor slum settlements associated with major urban centres(100).

2.5.2 Economic Factors

Socio-economic factors include the socio-economic status (or household income) and occupational status of pregnant women and their partners. Among the socio- economic factors, the level of education of mother determines the utilization level of ANC service. The association between maternal education and use of health services in Ghana demonstrates a strong link between mothers' formal education and women's health knowledge in accessing healthcare services and have found a positive and significant association between education and maternal healthcare use(53). Similarly, in Nepal women with more than primary level education were more likely to use ANC than those with no education (101). Other study has shown that lack of knowledge about healthy pregnancy and the importance of ANC services during pregnancy have been reported as the hindering factors for low number of access to ANC services(56). However, in Kenya characterized by high rate of female literacy and better economic situation than many countries, a very high maternal mortality has been reported(102).

On the other hand, occupational status of women is among the most common factors affecting the utilization of ANC services. There is an association between maternal occupation and access to maternal health service in in Nigeria and Ghana(103).Employed women more frequently receive

prenatal care, compared to housewives or/and unemployed. Overall, timing and frequency of prenatal care visits are significantly associated with the occupational status of pregnant women. In contrast, a study in India showed that ANC service is more common among housewives, compared with employed women(104).

The other predicator for maternal health service is wealth index. Wealth index signifies the economic status of the individual/family. Study finding has reported that wealthier mothers have more chance of attending a first visit and additional visits than poorer mothers. For instance, wealth is expected to have a positive relationship with ANC since the use of the service is associated with the cost of consultation and the purchase of recommended medication alongside other indirect costs such as transportation cost(105,106). Other studies showed that use of ANC use is positively associated with level of household wealth. In all countries, use of four or more ANC visits is highest among women from the richest households. For instance, in Bangladesh, India, Nepal and Pakistan, women in the richest wealth quintile are at least 6 times more likely than women are in the poorest quintile to report four or more visits. While in many Sub-Saharan African countries, there is little difference in use of ANC service among the bottom 60 % of households by wealth status, while only in the top two wealth quintiles is there substantially higher use. This pattern is observed in Burkina Faso, Chad, Ethiopia, Kenya, Madagascar, Mali, Niger and Uganda. (92).

2.5.3 Enabling Cultural and Religious Factors

Several studies have revealed that the relationship between ANC service and women's culture, values, norms, religious beliefs, and language barriers(94,107,108). The studies have showed that black African women's use of ANC services was associated with certain cultural beliefs and practices. Lack of cultural competency and sensitivity of health services, as well as non-cultural factors such as lack of reproductive knowledge and how to negotiate the health system, led to women's dissatisfaction with ANC service(109). The cultural perspective on the use of ANC services suggests that medical need is determined not only by the presence of physical disease but also by cultural perception of illness (110). Significant factors in the use of ANC service in one country or culture may not be significant in another. For example, use of reproductive health services is mediated by cultural influences that shape the way individuals perceive their bodies, their health and available healthcare services. In South Asian culture, for example, the use of preventive services such as routine ANC service is unfamiliar as healthcare services are perceived as curative only. Similarly, in Kenya women in some cultures may not use ANC service because of the perception that the modern health sector is intended for curative services only(111,112).

Religious beliefs and practices are other factors identified in the empirical literature as having significant influence on the utilization of maternal health services. In a Zimbabwean study, found

that women belonging to some religious groups; John Morange Apostolic, Christ Church and Mugodhi were more likely to refrain from the use of ANC service(113).There is a significant difference in uptake of UANC by religion which is especially common in Indian that has a great role in influencing an individual's choice regarding healthcare services utilization(91,114).Another study done in Ibadan, Nigeria revealed that women who were Muslims or other religions were more than 2 times likely to attend ANC clinic than women who were Christians(40). A study has conducted in Ethiopia has showed there was a significant variation in the uptake of ANC service by religion. Those women who followed Orthodox, Muslim and Protestant religions exhibited comparable and higher use of ANC service (24.8- 28.3%), than those women who followed traditional beliefs (11.3%)(95).

2.5.4 Access to Health Services Factors

The accessibility of health services is often cited as a critical determinant of health care choice in the developing world where an increase in distance to the health facility is associated with less use(115). A woman's decision to seek ANC service is not simply a matter of personal preference; the accessibility of services that either facilitate or impede utilization also has an important influence. As outlined by the WHO, access to ANC services consists of several elements, including distance and/or time to a facility, the physical availability of services, cultural and social factors that may impede access, economic and other costs associated with use of services, and the quality of the services offered(116).

A study conducted in Bangladesh on exploring maternal health care seeking behavior of married women indicated that accessibility due to long distance to health facility and cost of health services influenced pregnant women not to utilize ANC services (110). Similar study has shown that in Kano State, Northern Nigeria distance to health facilities is a known barrier in health utilization, about 22.2% of urban as against 79.6% of rural could not asses maternal health services because of distance to health facilities(110).

A study conducted in Haiti indicated that the availability of a health centre within 5 km significantly increased the probability of receiving ANC service in a timely manner and of attending for care on four or more occasions(117–119). By contrary, in Matebe land North province, Zimbabwe, 63% of the clients who were within 10 km of health facilities (2 hrs walk) considered that they had adequate access to ANC service(119). The distance effect on health care utilization has been common in sub-Saharan African countries. On the other hand, getting money for treatment is a big problem among reroductive women range from 30.4% in Nigeria to 66.4% in Zambia. The disparity is more noticeable in Nigeria where twice as many rural women have difficulty in getting money for treatment(120).

A study done in Ethiopia has also showed that distance from home to health facility and absence or shortage of transportation are among major factors for not attending ANC services. According to the study, more than 56% of the mothers attending ANC services did not use transportation to come to health facilities. With respect to the average time taken on foot from home to facility, 20% of the participants reported it takes more than half an hour to reach the health facility(47).

2.5.5 Health System and Policy Factors

Studies have been recognized that maternal health services are also depending on the functioning of the entire health system. The health systems factors that shape the use and effectiveness of existing services or technical inputs are less well understood. Others have identified how health sector reforms such as decentralization, privatization, and sector-wide approaches to health financing might possibly improve or hinder maternal or reproductive health provision(121). The most common health system barriers identified in the review include insufficient health infrastructure especially in rural areas, limited birth choices, facilities that close too early absence of female health provider, lack of privacy at healthcare facilities(122). Health systems play significant roles in shaping how specific inputs can work to improve maternal outcomes (123).

Poor quality of service for pregnant women is another major concern in both government and private health systems. In Malawi, for example, a recent study found that only 13% of clinics had 24-hour midwifery care, which represents a major hazard for maternal (124). In many countries, the poor would be in worse shape than the better off with respect to health outcomes and health system outputs, but the complexity and persistence of inequalities was much greater than they anticipated. Inequalities were also present in health system outputs across all forms of services, even those provided by the public sector without cost recovery (125,126). Health system-based costs arising from maternity user fees, and emergency referrals presented barriers for women especially from poor circumstances from visiting health facilities. A study in Ghana showed that limited and unequal distribution of skilled maternity care services was an important health system barrier(122). In Ethiopia, public health facilities are supposed to provide free maternity services by policy since 2005; but in reality, mothers paid an average of 126 Ethiopian Birr to get ANC services from public health facilities excluding health posts (11).

In the past two decades, the government of Ethiopia has invested heavily in health system strengthening guided by its pro-poor policies and strategies resulting in significant gains in improving the health status of Ethiopians in general and maternal health services too. However, these improvements of maternal health services at national or regional levels are overweighed by inequalities in service utilization(127,128).

2.5.6 Health Knowledge Factors

Health knowledge is a vital element to enable women to be aware of their health status during their pregnancies. A mother with little or no knowledge on the likely risks they are bound to experience during pregnancy is more likely not to seek care. Therefore, the lack of knowledge about the seriousness of complications, danger signs in pregnancy or where to receive services poses great risks to mothers(129). The odds of utilizing ANC were more than three times for those with better knowledge of danger signs of pregnancy than those with poor knowledge. The studies have revealed that sufficient knowledge of the benefits of ANC services and the complications associated with pregnancy plays an important role in the utilization of ANC service was higher than among women lacking such knowledge (107,130,131).

A study conducted in diverse part of the world has exposed that level of knowledge regarding ANC in mothers is significant for utilizing ANC service. The knowledge level of expectant mother also varies in deferent component of the globe(132). A study performed in Bangladesh where 75.5 % of the respondents showed some knowledge about antenatal care, 60% of the respondents should not know about the danger sign of pregnancy, and 66.7 % replied that ever heard about ANC and know about the impact of not following ANC service(133).

A study in Ethiopia, found that many women were not aware of the risks of pregnancy, pregnancy danger signs or when to begin ANC service. Most women prefer to wait three or four months before confirming their pregnancy and sharing the news with others. Many of these women only attended ANC because they felt sick or were persuaded by family members. These factors delay mothers' first ANC visit which often means they will attend less than the recommended four times ANC visit(47). More than three in every ten women indicated lack of knowledge about the service as a reason for ANC non-attendance (134). Unlike to these findings a study has conducted on Knowledge towards ANC service utilization among women in Fiche Town, North Shewa Zone, Oromia region the majority 313 (90.7%) of women respondents had good knowledge regarding ANC services (135).

2.6 Conceptual Framework

Our review was conducted under the guiding framework of Anderson's behavioral model of health services utilization, which has been widely used as a conceptual framework for understanding access to and utilization of health services(136). According to the model, such utilization is dependent on the interaction between individual traits, population characteristics, and the surrounding environmen. Andersen proposes that the relevant factors can be grouped into five main categories:Extenal environment, health care system, an individual's predisposition to use medical services; enabling or impeding circumstances (such as infrastructure); and the need for health care(137). The more distal factors are entered first, followed by more proximal factors to assess their associations with at least

one or more ANC visits. In the first iteration, the external environment factor variables, i.e. year of surveys, region and types of residence are entered simultaneously. Study identified the place of residence as a significant determinant for healthcare access and utilisation of married women(138).In the second iteration, health car system factors are entered along with the factors associated with external environment. A similar approach are used for predisposing, enabling, and need factors at both the individual and contextual level.

Predisposing characteristics are related to demographic elements and social structure; age, birth order, household size, education, wealth status, occupation, and maternal status. Enabling elements consist of community factors that affect the availability and accessibility of health care, religion & culture and personal factors such as knowing how to take advantage of what is offered. Need factors, conceptualized as either need perceived by the individual or need evaluated by professionals, are the most direct and important factors impacting health service utilization and are thus considered to be more immediate and powerful predictors of service use than predisposing or enabling factors(137). The variables representing these factors not all possible independent variables in each component were included in the study presented in the **figure 1**.

The researcher was mostly focused on limited independent variables like predisposing factors (age of women, place of residence, women education, household size, birth order, employment status and marital status), and enabling factors (accessibility to health facility; availability; affordability, religion and culture). The need factors include knowledge in the sign of pregnancy, perceived birth outcome and maternal health information. Most conceptual models view health care-seeking behaviour because of rational individual choice. Bourdieu's view has been also used to theorize inequalities in health and illness. In the analysis below, we gain ourselves of this model to examine trends of ANC service utilization, inequalities in health services,and associated factors for utilization of ANC services were products of accumulated dispositions(110).

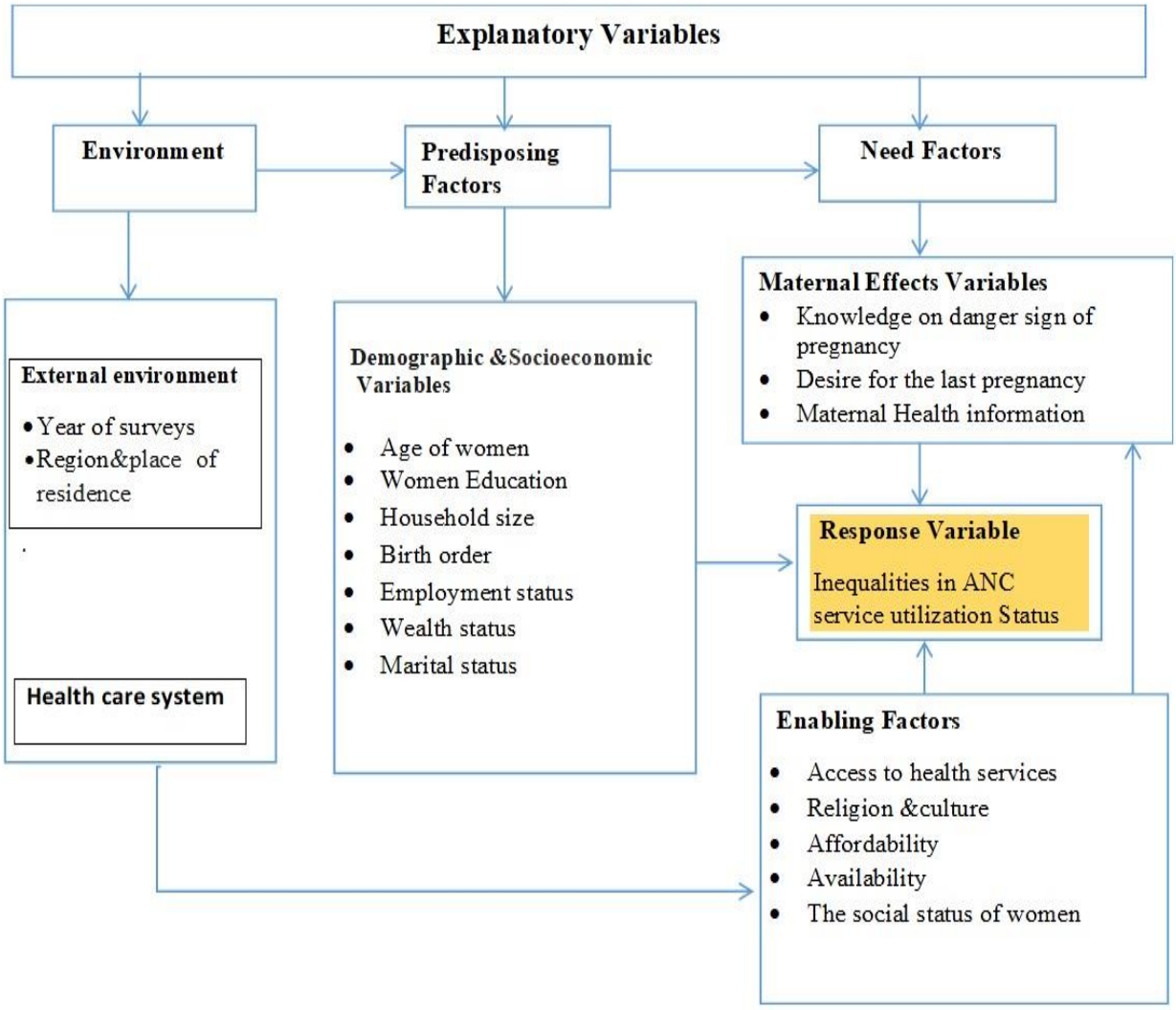


Figure 1: A conceptual framework for inequalities in ANC services utilization status in Oromia, developed by researcher adopted the Anderson Model and Related Literature.

3. OBJECTIVES

3.1 General Objective

The general objective of the study was to assess trends in inequalities in the utilization of ANC services and its associated factors among women aged 15-49 in Oromia region using four rounds of EDHS

3.2 Specific objectives:

The specific objectives of the study were;

- To assess trends in ANC services utlization among women aged 15-49 years
- To assess trends in inequalities in ANC services by place of residence, wealth status and maternal education.
- To identify factors contributed to observed inequality in ANC Services by using the four rounds of EDHS data set in Oromia region.

4. METHODOLOGY

4.1 Study Area and Setting

This study was conducted in Oromia National Regional State in Ethiopia with the largest population and surface area. Oromia is comprised of 21 zonal administrations and 19 town administrations. It has the total area of 363,375 $km^{2,}$ and it shared more than 34.5% of the total area of the country. According to 2007 population and housing census projections, the total population of the region was 39,710,045 in 2020. In 2020, there were 107 hospitals (95 public and 12 private hospitals), 1,404 health centers, and 7,090 health posts(139).

While recognizing a positive trend, Oromia is still underperforming when it comes to maternal and child health outcomes. Child mortality in Oromia is declining, but remains high. Neonatal mortality, particularly, showed very little decline between 2005 and 2016. Newborn mortality rates are still high; there is low utilization of maternal, newborn and child health (MNCH) services along the continuum of care; the quality of MNCH services is poor; and there is inequity in service utilization and reduction of neonatal, infant and under-five mortality within the region(25,140).

The 2016 DHS showed that half (51.1%) of Oromia women have no education. This percentage is twice as high as Oromia men with no education (26.1%).Only 17% of female residents of rural Oromia (85%) were literate with all of its implication for way of life, health, child bearing and rearing, maternal and child nutrition, and disease prevention(141).

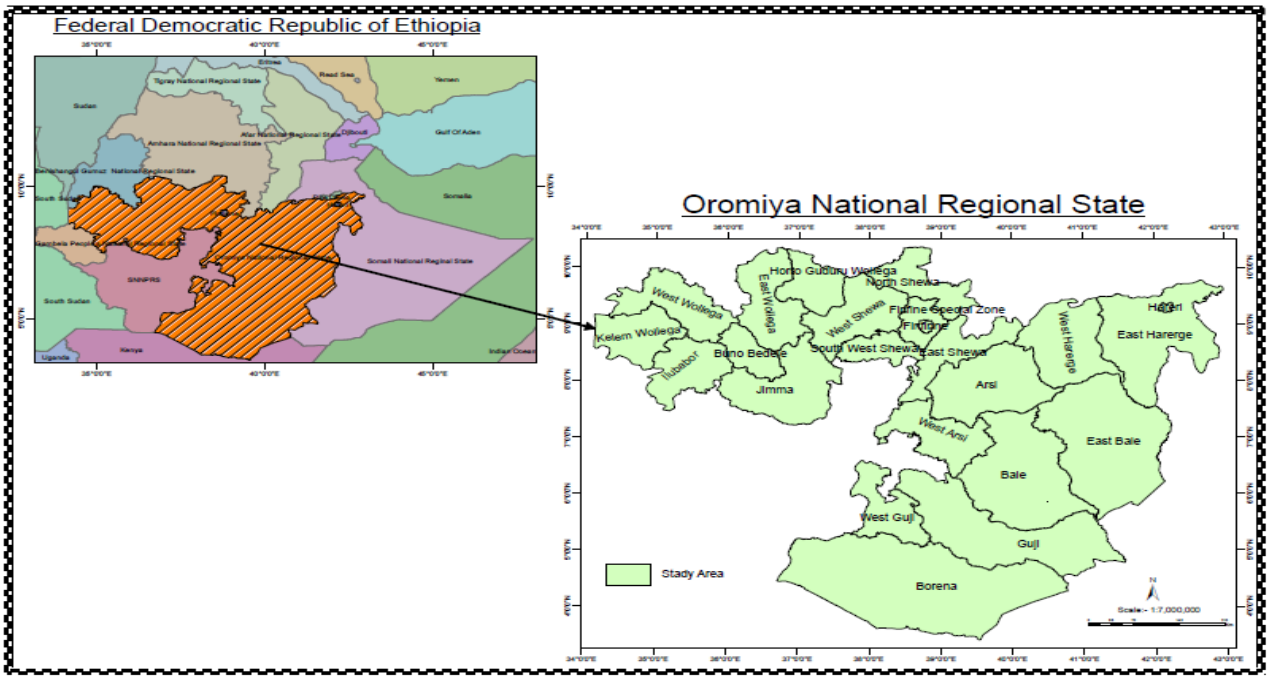


Figure 2:Location of the Study Area

4.2 Study Design and Study Period

In Ethiopia, there have been four DHS survey conducted by the Central Statistical Agency (CSA) and for 2000, 2005 and 2011 and 2016. This study analyzed data from the Oromia region cross-sectional survey, Ethiopia Demographic and Health Survey (EDHS) series, which is based on the regionally representative probability sample that covered the entire region. This study was used the four rounds of EDHS series to analyze trend and assess inequalities in utlization of ANC services in the region among all women reproductive age group (15-49 years). And the data analysis was conducted in the period of December 2018 to May 2019. All women age 15-49 years who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed.

4.3 Source of Population

The source population for this study was all women who are in the reproductive age group aged (15-49 years) who have had a birth in the last 5 years prior the survey date, in Oromia National Regional State.

4.4 Study Population

The study population of Oromia National regional State were women aged 15 - 49 years who gave at least one birth in the last 5 years preceding the surveys((2000-2016)

4.5 Selection Criteria of Subjects

All women in the age group of 15-49 years of age who have given at least one birth at the time of survey data conducted were included.

4.6 Sample Size Determination and Procedure

The two-stage stratified cluster sampling with the region and residence as strata has been used in all of the four surveys, 2000-2016 EDHS. A sample of Enumeration areas (EA's) was selected using a two stage stratified sampling strategy, where each region is stratified into urban and rural area. In 2000 and 2005 EDHS, sampling was based on the Census Enumeration Areas (CEAs) of the 1994 Population and Housing Census of Oromia region sample frame. Likewise, 2011 and 2016 sampling have been based on the census, Enumeration Areas (CEAS) of the 2007 Population and Housing Census of the region. Sampling frame for selection of households in the second stage was derived from household listing operation carried out in all the selected primary sampling units (PSUs).

The study was based on a total weighted of a representative probability sample of 12,0277 women in the reproductive age group (15 – 49) years in four series rounds of EDHS. A representative sample of 6,739 eligible women of the reproductive age group(15-49 years) were selected for four EDHS series data in the region. Finally, we determine our analysis was restricted to the most recent

birth. The sample for specific sudy was drawn from recent births with the last five years which is 1,329, 1,206, 640 and 1,030 women aged 15-49 years in 2000, 2005, 2011 and 2016, respectively.

4.7 Data Collection Procedure and Source of Data

Study instruments(tool) used in each DHS were a set of standardized questionnaires. These questionnaires were adapted from model survey instruments developed for the MEASURE DHS project to reflect the population and health issues relevant to Oromia region. In the EDHS, sampled women were asked to provide information on ANC (e.g. number of ANC visits) during pregnancy for the last recent birth in the five years preceding the survey. Based on these data, two indicators are calculated to measure the extent of ANCcoverage. One is the proportion of women who received any ANC visits for the most recent birth in the five years preceding the survey. Given the WHO recommendation of a minimum of ANC4+ visits, we also calculate the proportion of women who had four or more ANC visits during pregnancy for the most recent birth. Data on any ANC visits (2000-2016) used for this study are openly available from EDHS series data-base, and downloaded from DHS website at: http://www.measuredhs.com in a stata format after a consent on the purpose of use of the data was submitted and permission was granted.

4.8 Operational Definitions

- **Antental care (at least one visit by skiled provider)-**is percentage of women aged 15-49 with a live birth in a given time period that received ANC provided by a skileed health personnel at least once during pregnancy.
- **Four or more ANC visits-** A woman had received from health care professionals four or more times ANC services during her pregnancy.
- **Any Antental care services**-is a women attended at least one or more ANC contact from health care professinals during pregnancy.
- **Antental care Coverage- is** a women attending any ANC and at least four ANC contacts from a formal health care provider during pregnancy**.**
- **Prenatalcare**;synonymus with ANC.
- **Utilisation** -is described using the number of visits to the ANC service clinic made by a pregnant women from the first visit until the end of pregnancy.
- **Maternal healthcare**- Antenatal care clinics and facility delivery services provided to pregnant women in a healthcare facility.
- **Skilled provider/Health care professinals-** are includes doctor, nurse, and midwife for 2000, 2005, and 2011 EDHS surveys. The 2016 EDHS skilled provider/ health care professinals definition includes doctor, nurse, midwife, health officer, and health extension worker.
- **Population base-** Women who have had one or more births in the 5 years preceding the survey.

- **Inequality in ANC Service-** is a variations and disparities in maternal health care services(i.e ANC visits) of indivioduals and social groups.

4.11 Variables of the Study

4.11.1 Response Variable

The response variable of this study was the inequality in the utilization of ANC service by the number of ANC visits made by a pregnant women (i.e. count from 1,2,3…n). In the present study, number of ANC visits taken by the women aged 15-49 years preceeding to 5 years from four series consecutive EDHS. Each woman who had given recent birth in the last five years preceding the survey were asked about the number of visits they had to ANC healthcare facility.

4.11.2 Explanatory Variables

We selected the explanatory variables based on literature review on the inequalities of ANC services utlization in the region. However, we used only those variables which were available in the 2000,2005,2011 and 2016 EDHS. The explanatory variables were used in this study were categorized into demographic and socio-economic factors. The following explanatory variables were used in this study: mother's age (15–19, 20–34 and 35–49), Place of residence (urban-rural), maternal education (No- education, primary, secondary+), current marital status (currently not union, currently union), Birth order (1, 2-5 and 6+), Household size (1-2, 3-4 and 5+) employment status, (employed, not employed), wealth status(Poor, Middle and rich), religion (Orthodox, Protestant, Muslim, traditional/others), distance to health facility as problem (yes or partially) and getting money for treatment as a problem (yes or partially).

4.12 Measures

We measured inequality of ANC services utilization using three equality stratifiers namely, economic status, educational status and place of residence. Economic status was approximated by wealth index computed based on household assets and characteristics of the household. In DHS, wealth index is computed using Principal Component Analysis (PCA)(142). Since wealth index variable was not available in the 2000 EDHS data, we constructed the Wealth Index variable using the PCA as a measure of socioeconomic status used in DHS reports of many countries (143). The variables included in the PCA were durable assets ownership: radio, car, refrigerator, television, motorcycle, and bicycle; housing characteristics: number of rooms for sleeping and building material (wall, floor and roof); and access to utilities and infrastructure: electricity supply, source of drinking water, and sanitation facility.

The generated wealth score was divided into three wealth terciles: poor, middle and rich. For this study, "poor" and "rich" are understood by absolute inequality SII, relative inequality RII, the CIX, and decomposition method as relative terms, with poor referring to the lowest rank of wealth terciles

and rich referring the highest rank of wealth terciles. Educational status of the mother was categorized as no education, primary, secondary and above education. Place of residence was classified as urban and rural areas.

4.13 Data processing and Analysis

Extracted data were checked for data quality. Prior to analyzing, data disaggregation was conducted. Disaggregated data easily show the level of health inequality in each subgroup of a given dimension/strata of inequality in Oromia. Ratio, difference SII,RII and CIX inequality measures were applied to assess and visualize differences of ANC service utilization in a given dimensions,

The data were analysed using univariate, bivariate and multivariable statistical methods. One-way ANOVA(with Bonferroni correction for multiple comparsions) was performed to determine whether there were any significant differences among the mean number of ANC visits. Then, we computed multivariable logistic regression analyses to evaluate the independent effects of each predictor variable on the outcome variable((i.e. the number of ANC visits) by controlling for confounding factors. Multivariable logistic regression model with adjustment for clustering and sampling weights were used to investigate factors on ANC Visits. Those explanatory variables with P-value< 0.02 in bi-variable logistic regression model entered in the multivariable logistic regression model to measure the effect of each variable after adjusting for the effect of other variables.Variables with P-value < 0.05 considered as statistically significant.

Absence of multicollinearity among explanatory variables was checked by variance inflation factors (VIF) and tolerance. Variance inflation factors (VIFs) for each covariate were between '1.04 to 1.258', indicating no multicollinearity; since the values are < 5.0.Variable whose variance inflation factor (VIF) greater than 10 were not entered to multivariable analysis(144). The statistical software packages STAT version 14.0 and Microsoft Excel © were used for statistical analyses of this study. To adjust for data representation in our analysis, we used the ***svyset command*** in Stata in order to account for clustering, sample weight and stratification. This technique also uses sample weights to adjust the estimates for the effects of oversampling and under sampling in smaller enumeration areas(145). Therefore, we used the **svy** prefix command for all analyses in this study. We considered an alpha (α) level of 0.05 as statistically significant

4.14 . Inequality and Decomposition Analysis

The inequality was assessed using six measures of inequality: Difference (D) and Rate ratio(RR), Slope of Index of Inequality(SII), Relative Index of Inequality(RII), and Concentration index (CIX), and Concentration Curves (CCs). While Difference and Ratio are simple measures, the other four are complex measures(146). Unlike simple measures, complex measures account for the number of categories in a variable. When a population shift is likely to occur, especially when trend analysis is

integral to the study, complex measures are likely to reflect the true change in equality over time(146). While simple measures are easy for interpretation and understanding. Therefore, an inequality study combining simple and complex, as well as relative and absolute, measures provides a more comprehensive analysis(147). For education, economic status, and residence, the Difference was calculated as ANC visits in the rich group minus and the poor group, secondary or above education group minus no education group, and urban minus rural populations, respectively.

Difference is a measure of absolute inequality that measures level of health intervention coverage in most-advantaged subgroup is subtracted from health intervention coverage in the most-disadvantaged subgroup or vice versa. While ratio is a measure of relative inequality that measures level of health intervention in the most-advantaged subgroup is divided from health intervention coverage in the most-disadvantaged subgroup or vice versa(127,148). No inequality existed if Difference(D) was zero and Ratio was one. R takes only positive values.

The RII and the SII are the two major measures used for comparisons, and quantify the socioeconomic gradient in relative and absolute terms, respectively, thus providing complementary information(149). The SII expresses the absolute percentage point difference in ANC visits coverage between the predicted highest socioeconomic rank(most-advantaged) and lowest rank(most disadvantaged)(in wealth terciles and education level), assuming a linear relationship between socialeconomic rank and ANC visits coverage (148,149). A zero value for SII indicated an absence of inequality while positive values suggested higher prevalence of ANC service utilization in the advantaged subgroups. SII with a negative sign indicates a downward slope with most disadvantaged subgroup(146,150). The RII expresses the ratio of the predicted outcomes between the two extremes of the social rank, assuming a log-linear relation (149). RII = 1 indicates equality, whereas any value of RII below or above 1 indicates inequality. RII takes only positive values(150).

We show that absolute and relative measures of inequality are not inconsistent when assessing trends, but are actually complementary(147). When analysing inequality trends, absolute and relative inequality must be studied jointly because there is a clear interacting pattern of reduction or increase in inequality that sometimes produces apparently contradictory changes in absolute and relative inequality. The best scenario in terms of trend of inequality is when relative and absolute inequalities decreased in the utilization of health services(147).

The annualized changes of the SII and RII were calculated to adjust for the interval of time trend between the earliest and most recent surveys (151). With the use of linear regression and logit models, changes in SII and RII were estimated with 95%CIs, taking the earliest survey time as the reference group (2000) EDHS. Changes in the SII were measured by the annual absolute change,

expressed by dividing the difference between the SII in the earliest (2000) and the most recent surveys (2016) by the number of years between the two period surveys.

As measures for health inequality, the CIX and the related concentration curve express the inequality in health status the full range of socioeconomic status(152). The value of CIX ranges from − 1 to + 1 with a value of 0 indicating perfect equality and positive values indicating health service utilization concentrated among rich and negative values indicating service utilization concentrated among poor(61,153). On the other hand, concentration curve graphically depicts the degree of health inequality. If the outcome variable is equally distributed in the social groups then the concentration curve will be a 45 degree line (line of equality) from the origin, and the CIX=0. If the outcome variable is higher amongst the disadvantaged, the concentration curve lies above the line of equality, and the CIX is defined as a value between 0 and -1 (154). Conversely, if the indicator is concentrated in the advantaged, the concentration curve lies below the line of equality, and the CIX is a value between 0 and 1. The farther the curve is under the line of equality, the more concentrated the maternal health services utilization variable is among the poor(24). We can also calculated the corrected CIX for the binary health indicator proposed by Erreygers(155). The Erreygers's CIX which modifies and improves traditional index. It provides more accurate estimation for binary-dependent variables(155). Erreygers revised CIX for health as follows:

$$E(h) = \frac{4\mu}{bn-an}.C(h)$$

where b_n and a_n represent the maximum and minimum of the health variable 'h', μ is the mean of the health variable in the population and C(h) represents the concentration index.

To further explore which factors contribute to inequalities, the concentration index can be decomposed by relating health outcomes to their potential socioeconomic determinants(154). Hereby, we can investigate underlying inequalities that may explain the variation in health coverage. Regression model–based decomposition method was then used to decompose the concentration index to estimate the contribution of a set of socioeconomic factors to the inequalities in ANC service utilization(154).The absolute contribution indicates the extent of inequality from each explanatory variable. A negative value of absolute contribution indicates that the predictor contributes to pro-poor inequality and vice versa. The CIX was computed using the ***STATA conindex command*** (156). Changes in the determinants' shares between 2000 and 2016 reveal the role played by their CIX and elasticities. A large absolute value indicates a large contribution. As the difference in the inequality of ANC service is assessed in terms of inequality in 2000 minus inequality in 2016, a positive sign for any determinant indicates that the determinant has contributed

to the decline in inequality, while a negative sign indicates the counteracted the decline in the inequality(157).

4.15 Data Quality and Management

The Ethiopia DHS questionnaire were based on model survey instruments developed for the international MEASURE *DHS+* project. Since these questionnaires are standard, they were developed in English language. The English language questionnaires were translated in to five languages(Amarigna, Oromigna, Tigrigna, Somaligna, and Afarigna) then back translated to original English version. Before the start of fieldwork, the questionnaires were pretested in all local languages(19–22). To assure data quality the EDHS asked the women to report duration of pregnancy, time and number of ANC visits, and problems in accessing health care. For the analysis of trend and inequality in ANC services the four round series of EDHS data (2000, 2005, 2011 and 2016) with the particular focus on the number of any ANC visits and the individual record file were used. The completeness and accuracy of data were checked by running the frequency.

4.16 Ethical consideration

This is a secondary data analysiss requiring no direct data collection from human subjects. However, request to access datasets from measure DHS website was made, and the websites had allowed the same before analysis was made. So secondary data analysis of EDHS surveys is used after the permission of download from the official website of the DHS program www.measuredhs.com web portal of ICF Macro and CSA.

4.17 Dissemination of the Results

After completion, the final result document will be submitted through soft and hard copy to Addis Ababa University School of public health where the study was conducted, and after presentation the final result will be communicated to policy, programs and decision makers who are working on maternal and child health issues at each level and submitted to Oromia Health Bureau and finally to be published in an international peer reviewed journal.

5. RESULTS

5.1 Background Characteristics of Respondents

The data for this study were obtained over four consecutive survey periods of 2000,2005,2011 and 2016 EDHS. In this study, the analytical samples did not include any missing or `don't know' responses. For this descriptive analysis we used only 2000 and 2016 EDHS. The average age of the sample was 29.5 years (SD±7.4) in 2000 and 29.1years (SD±6.9) in 2016. About 71 % of the respondents were in the 20-34 age group, slightly less than a quarter were 35 years old or above, while only 6% were in the 15-19 age group in 2016.

The majority (94%) of the women were resident in rural areas while only 6% lived in urban areas in 2016. In terms of education attainment, 82% of women reported no formal education in 2000, which was reduced to 65% in 2016. More than a quarter of mothers (30%) have primary education and only 5% have secondary &above education in 2016. The percentage of illiterate mothers decreased from 82.9% in 2000 to 65% in 2016, and mothers with secondary and above education level increased from 4.4 % in 2000 to 5.2% in 2016(Table 1).

When we see the proportion of the women by their religion, Muslim participants (59%) were more than those of Protestant (20%) and Orthodox Christian (18%) in the study population. The Wealth index distributions showed that a larger proportion (45.1%) of these women were in the middle wealth terciles while 41.6% and 13.3% were in the poor and rich terciles in 2016 respectively.

Seventy percent of women were unemployed and only 30% employed in the study population. Nighty-four percent of the women were currently in union compared to only 6% who have never been currently not in union in 2016. During the survey year, about 74.7% had more than five members in their household while only 25.3% had less than five members in 2016.

Women have problems in accessing and getting money to pay health services in the study area. The women who reported that the distance to health facilities was a major barrier were less likely to utilise ANC services compared to those women who reported that the distance to a health facility was no a hiderance.On the otherhand, women may not have to pay health services was a major barrier less likely to utilise ANC services compared to those women to pay health services was no a problem (Table 1).

Table 1: Demographic and Socioeconomic Characterstics of Respondents in Oromia in the 2000& 2016 EDHS Series

Background Characteristics	Survey Years	
	2000	**2016**
	N(%)	N(%)
Ages		
15-19	77(5.9)	57(5.5)
20-34	900(68)	730(70.9)
35-49	352(26,1)	243(23.6)
Place of Residence		
Urban	98(10.3)	62(6)
Rural	1231(89.7)	968(94)
Women Education		
No education	1102(82.9)	666(64.7)
Primary	169(12.7)	310(30.1)
Secondary & above	58(4.4)	54(5.2)
Household Size		
1-2	26(2)	9(0.8)
3-4	323(24.4)	252(24.5)
5+	980(73.6)	769(74.7)
Birth Order		
1	214(16.4)	175(17)
2-5	666(50.3)	544(52.8)
6+	449(33.3)	311(30.2)
Religion		
Orthodox	456(34.7)	186(18.2)
Protestant	160(12.2)	202(19.8)
Muslims	620(47.1)	605(59.2)
Traditional/Other	93(6)	29(2.8)
Current Marital status		
Currently not in union	113(8.6)	66(6.4)
Currently in union	1216(91.4)	964(93.6)
Employment status		
Not-Employed	675(51.9)	725(70.4)
Employed	653(48,1)	305929.6)
Wealth Status		
Poor	727(56)	429(41.6)
Middle	243(18.4)	464(45.1)
Rich	292(25.6)	137(13.3)
Distance to Health Facility is a problem		
Yes	na	774(75)
Partially	na	256(25)
Getting Money need for treatment is a problem	na	
Yes	na	747(72.5)
Partially	na	283(27.5)

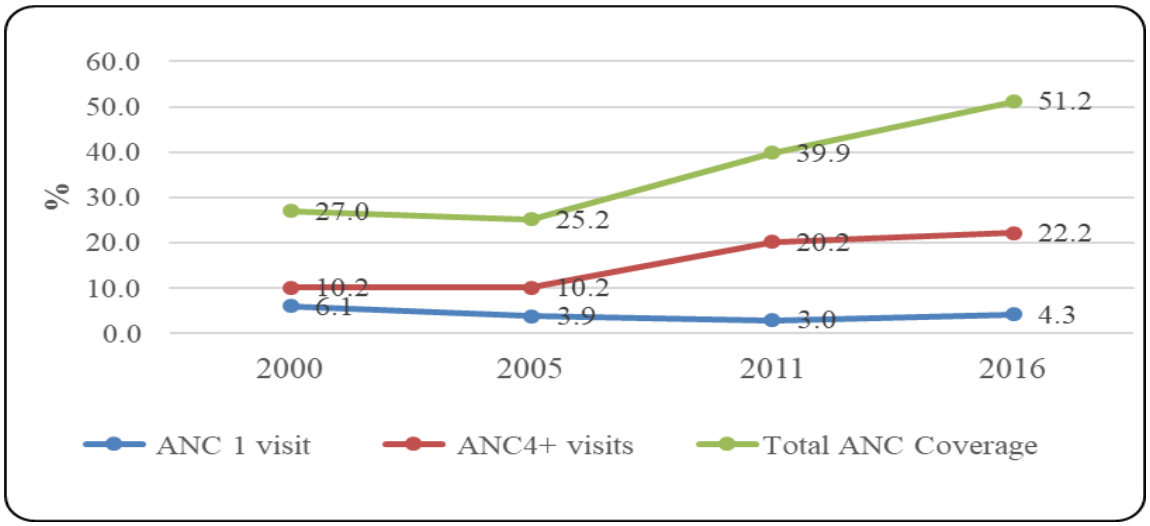
na=not applicable

5.1 Trends in Prevalence of Utilization of Antental Care Service

Figure 3 presents trends in the utilization of ANC services among women in Oromia region from 2000- 2016 EDHS.The ANC services trend coverage by skilled provider increased steadily from 27.3% (95% CI: 21.5–32.5%) in 2000 to 51% (95% CI: 45.5–56.5%) in 2016. However, the coverage of of ANC services considerably by 7.7% reducation from 2000 to 2005 and then declined below the earlier level. The trend analysis reveals a positive trend in ANC service coverage increasing by102.4% from 2005 to 2016 in the region. Generally, the use of ANC increased over time. The utilisation of ANC4+ visits was relatively less though there was a rising trend observed over the years in the region. The proportion of reproductive women aged 15-49 years who received recommended ANC4+ visits increased from 10.2% (95% CI: 9.5–10.4%) in 2000 to 22.2% in 2016 (95% CI: 19–23%). From the year 2000 to 2005, the progress was stagnant over the years in the utilisation of ANC4+ visits, while between the years 2005 and 2016 there was increased by 117.6%. The prevalence of women of making ANC+4 visits was increased during the same period, however, that of women aged 15-49 years who received ANC 1 visits was decreasing from 6.1% in 2000 to 4.3 % in 2016.

Te results related to the use of skilled ANC1 visits provide some differences when compared to those related to the use of ANC+4 visits. Overall, improvements were observed for ANC service coverage in the region between 2000 and 2016EDHS.

Figure 3: Coverage and Trends of Antental care visits (EDHS 2000- 2016)



5.2 Trends in Inequalities in the Utilization of Antental Care Services

We disaggregated the trends in ANC services use by selected background characteristics: wealth status of women, place of residence (urban or rural) and mother's education to see change over time.

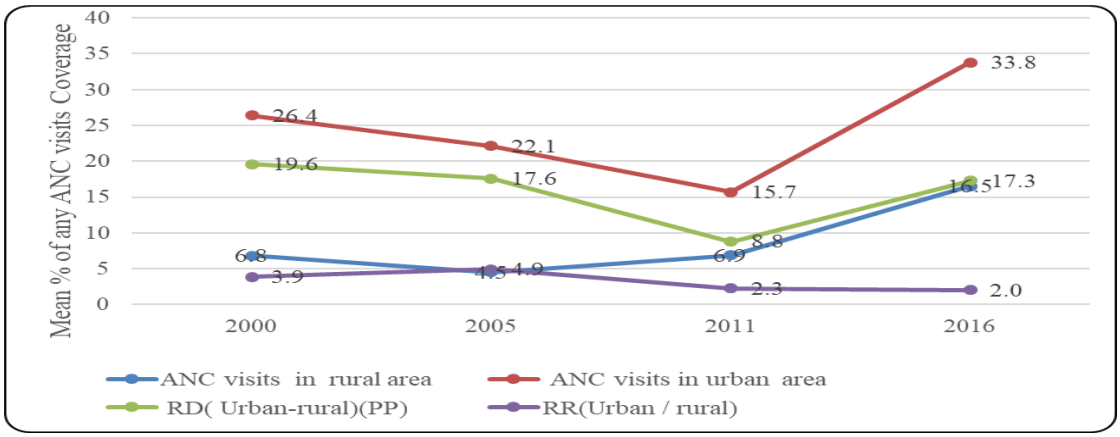
We examined whether the changes in absolute gaps between different groups were significant. We tested if these differences between groups at the earlier survey (i.e. 2000) were significantly different to that of the differences at the latest survey (i.e. 2016) available to the indicator.

5.2.1 Absolute and Relative Inequalities

Figure 4 shown an absolute and relative inequality in any ANC service utilization between urban - rural areas over study periods. For the most recent data (2016EDHS), the receipt of ANC was significantly higher at 33.8 mean percentage in urban area compared to 16.5 mean percentage in the rural. The disparity RR value decreased significantly from 3.9 in 2000 to 2.0 in 2016.

The urban areas were higher in ANC service utilization in all EDHSs, but any ANC service was increased much more in rural areas from 6.8 in 2000 to 16.5 mean percentage in 2016 as compared to urban areas from 26.4 to 33 mean percentage. Recent data showed that urban women were nearly 2 times more likely to access any ANC services than their rural counterparts. Similarly, the urban – rural RD decreased from 19.6 percentage points(PP) in 2000 to 17.3 PP in 2016. The urban–rural RD showed that women in urban areas utilized more ANC service compared to rural women counterparts.

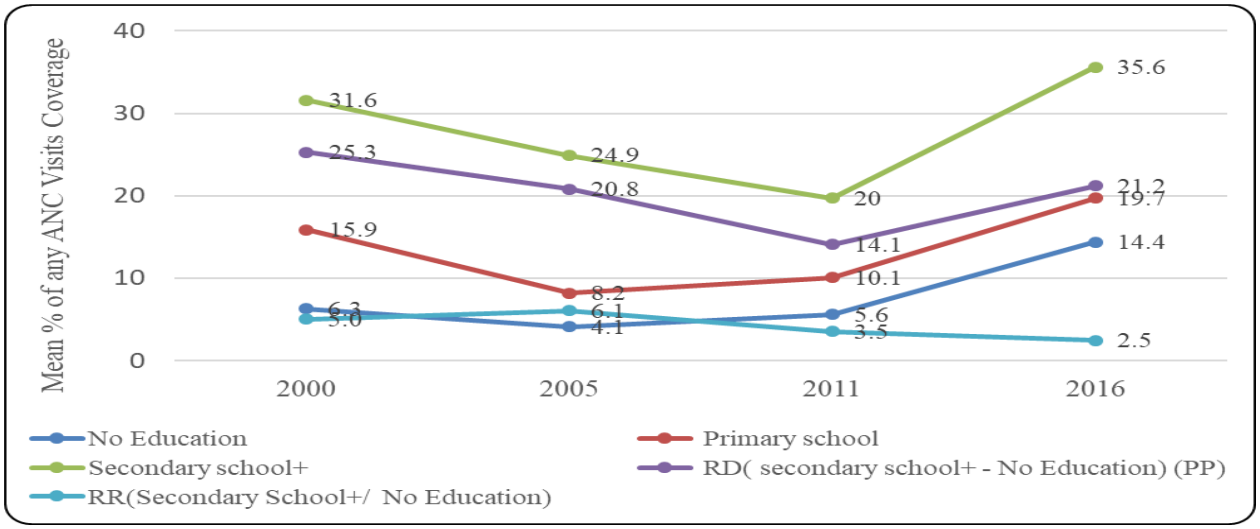
Figure 4:Trends in Mean percentage of any Antental care visits in Place of Residence-based Inequality(EDHS 2000-2016)



The result revealed considerable differences in the utilization of any ANC service among women with no formal education (increased from 6.3% in 2000 to 14.4% in 2016) and women who completed secondary &above education (increased from 31.6% in 2000 to 35.6% in 2016) (Figure5). A reduction was observed in the utilization of ANC service in comparison women with no education and those with secondary+ education with a difference of 25.3 PP in 2000(p=0.001) decreasing to 21.2PP in 20016. Similarly, there was modest declining trend over the years form (RR=5.0) in 2000 to (RR=2.5) in 2016. The relative advantage women of who completed secondary and above education

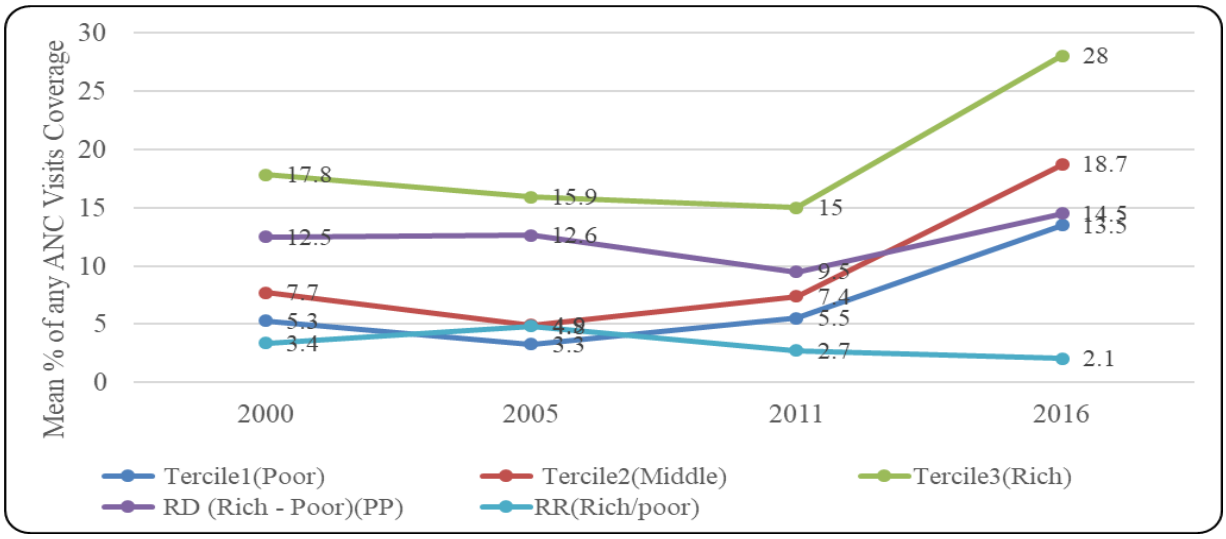
level were 2.5 times more likely to have utilized any ANC service compared to women with no education in 2016.

Figure 5: Trends in Mean percentage of any Antental care Visits in Educationa- based Inequality(EDHS 2000-2016)



In figure 6, RD on the utilization of ANC services across different wealth status of women shows a slight increase with RD from 12.3 PP in 2000 to 14.5 PP in 2016. Any ANC service utlization among women were a wide gap by wealth terciles. In contrast to the RD results, the poor-rich ratio inequality for the use of ANC service is high with a reduction from 3.40 in 2000 to 2.10 in 2016 EDHS. Women from the rich wealth terciles were 2 times more likely to have any ANC services utilization than the poor in 2016EDHS.

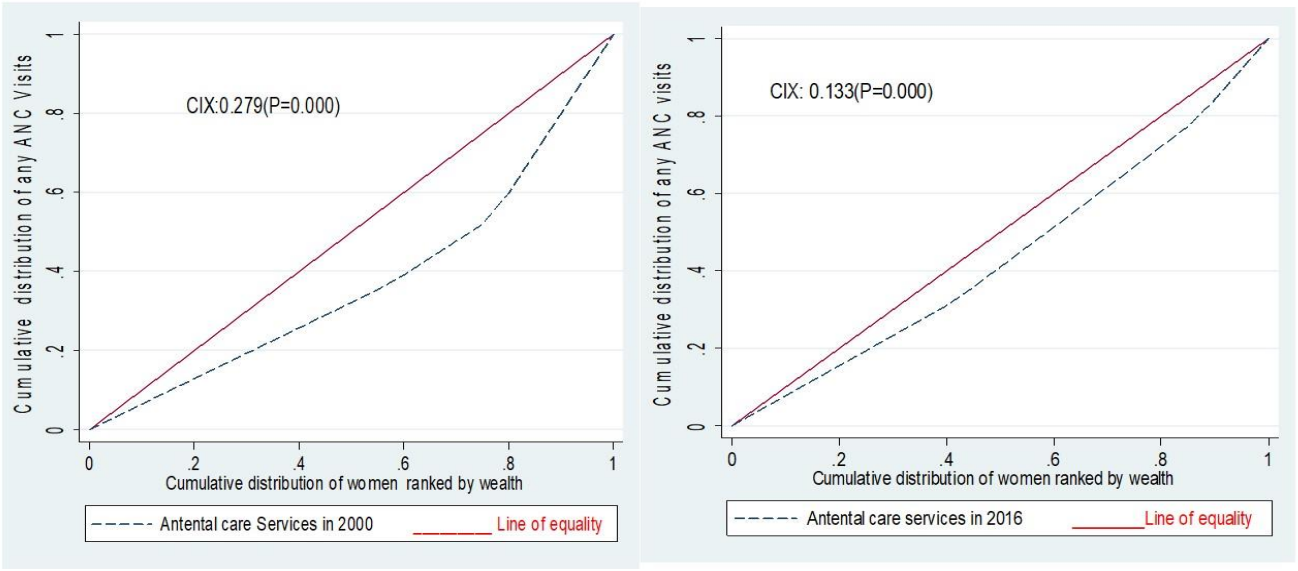
Figure 6: Trends in Mean percentage of any ANC Visits Wealth Status-based Inequality(EDHS 200-2016)



5.2.2 The Concentration Index and Curves for Wealth-based Inequality in Antental care services

The results indicated that the CIX for wealth-based inequality across the two survey years (2000 and 2016) were 0.27942643 and 0.133811117, respectively. The CIX was positive and any ANC services was significantly concentrated among the rich subpopulation group (p= 0.000 and p= 0.000) respectively. The CIX of wealth terciles declined from about 0.2794 in (2000) to 0.1338 in the (2016) surveys. On the otherhand, the concentration curve lies below the equality line,indicating ANC service utlization was concentrated among the rich for the survey year (2011, 2016). The curve for 2016 lies closest to the line of equality while the curve for 2000 lies furthest from the line of equality (Figure 7).

Figure 7: Concentration Curve for Utilization of any ANC services by Wealth Status,2000&2016

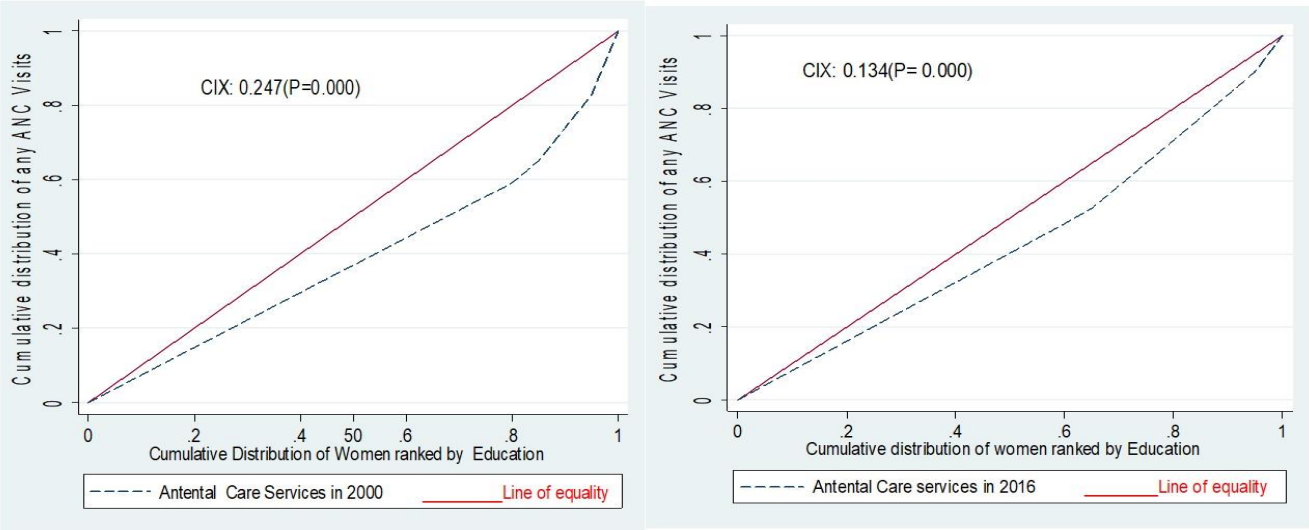


5.2.3 The Concentration Index and Curves for Level of Education -based Inequality in Antental care services

Level of maternal education was one of the contributors for the difference in any ANC services utilization across the population. The concentration index for the level of maternal education over the two early and recent surveys was (0.24792162, and 0.13441614), respectively. The CIX was positive for 2000 and 2016 survey year which indicates that any ANC visits was concentrated among the mother who attend the highest level of education. The trend of the CIX for level of education was declined from 0.24792(2000) to 0.13441 in (2016) survey year respectively. The inequality gap between those with no education with a secondary school and above level of education is gradually closing, the concentration index also shows a significant drop in 2016. Figure 8 describes the concentration curve for any ANC service is close to the line of equality which

suggests that, there is narrow inequality and the distribution of any ANC Visits was close to diagonal line of equality.

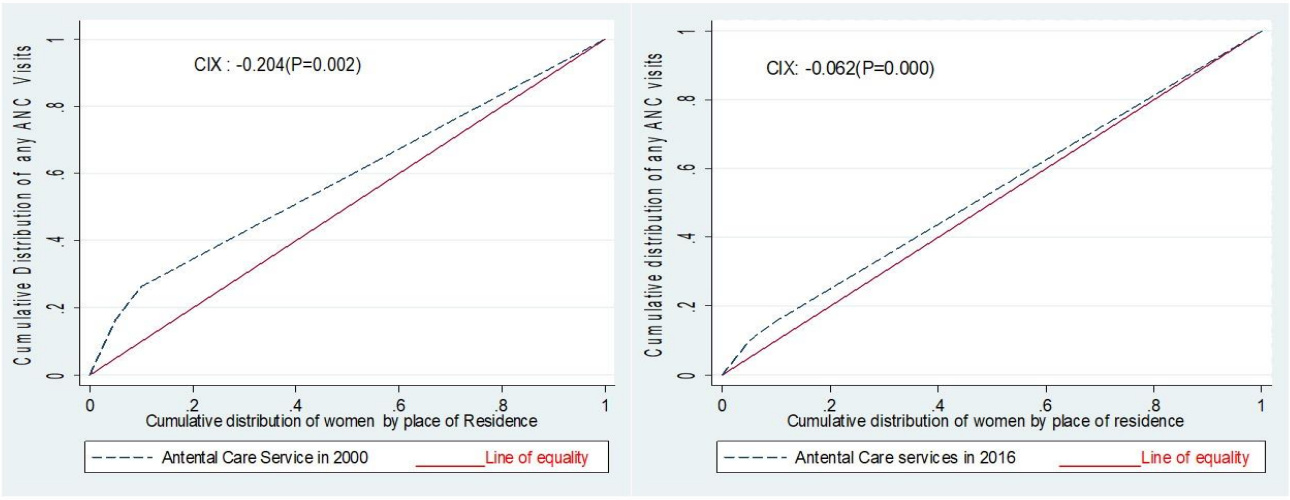
Figure8: Concentration Curve for Utilization of any ANC services by Level of Education,2000&2016



5.2.4 The Concentration Index and Curves for Place of Residence -based Inequality in Antental care services

Place of residence is one of the equities stratifiers used in this analysis. The CIX for any ANC services in rural areas was concentrated towards the pro-rural residence at -0.2041(P=0.002) in 2000. The CIX in urban -rural areas decreased from -0.2041 (P=0.002) to -0.0615 (P=0.000) between 2000-2016 surveys respectively. The negative values of CIX indicate that inequalities of any ANC visits were concentrated among rural women than the counterparts. Figure 9 also illustrated in 2000 & 2016, the concentration curve was above the line of equality, which indicates a high concentration of any ANC service utilization in pro-rural area.

Figure 9:Concentration Curve for Utilization of any ANC Services by Place of Residence, 2000 &2016



While the CCs provide a clear pictorial view of the levels and nature of inequality in any ANC visits variable, it does not provide the magnitude of inequality. The concentration index is a more refined measure of health inequality which shows the distribution of use across all the socioeconomic groups. To address this, we compute and report the Erreygers concentration indices in table 2**.** As mentioned earlier, the positive sign of the CIX suggests that socioeconomic inequality favored the privileged (or was concentrated against the poor). For ANC services (measured by number of ANC visits), the CIX was 0.79 in 2000, 0.75 in 2005, 0.96 in 2011 and 0.99 in 2016, respectively. The disaggregated socioeconomic inequalities in the use of any ANC visits increased as revealed by concentration indices from 0.79 in 2000 to 0.99 in 2016 EDHS.

Table 2: Erreygers Concentration Indices for any ANC services Utilization in Oromia, 2000-2016

Index	Survey Year	CIX	SE(CIX)	Difference CIX (2016)-CI(2000)
Erreygers normalized CIX	2000	0.79*	1.018	0.99-0.79= 0.20
	2005	0.75*	2.695	
	2011	0.96*	1.169	
	2016	0.99*	7.444	

Notes: CIX= Concentration Index SE= Standard Error CIX= Confidence Interval *P<0.001

Figures 10 and 11 shows the trends in absolute(SII) and relative (RII)socioeconomic inequalities for ANC service utilization. The absolute inequalities by educational level of any ANC services were present in each survey period and appeared to widen over time. The trends in absolute difference in the utilization of any ANC service by educational attainment were significantly increased from SII of 0.46 (95%CI: 0.33;0.58) in 2000 to 0.47 (95%CI 0.35;.60) in 2016(p=0.001). Similarly, the trends for inequalities in recipt of any ANC services by educational attainment were increased at pace of 1.4% per annual with 14% of changes in ANC visits could explained by the linear regression model in the region. In contrast, the RII (95% CI) for education was decreased from 5.97 (95% CI: 2.95; 8.99) in 2000 to 2.76 (95% CI; 1.85; 3.66) in 2016 (p=0.001). Likewise, the trend inequality result also revealed that the receipt of any ANC services by educational level among women were decreased by 1.1% per annum with 99% of changes in ANC visits.

The trends for absolute inequalities in any ANC service between the rich-poor were significantly decreasing gradually from SII of 0.37(95%CI:0.23;0.50) in 2000 to 0.36(95% CI:0.21;0.50) in 2016(p=0.001). Likewise, RII also shown decreased from RII by 4.23(95%CI:1.96;6.51) in 2000 to 2.09 (95% CI: 1.36;2.81)in 2016((p=0.001) respectively. The trends in relative inequality in receive of any ANC services between the rich-poor wealth terciles decreased by 0.65% per annum with 90% of changes in ANC visits. Both absolute and relative socioeconomic-related inequalities in ANC services were observed using all complex measures (SII and RII) favouring the advantaged women in the study area. The gap between the rich

and the poor as well as secondary+ versus no formal level of education are still becoming larger over time between 2000 to 2016 EDHS. The results of SII &RII shows that there was 47% absolute and 76% relative increase in the ANC service utilization when we move from the no formal education to secondary and above level of education in 2016 EDHS. Similarly, the SII and RII shows that there was a 36% absolute and 109% relative increase in any ANC service utilization when we move from the poor - rich women in 2016EDHS. The findings of the study shown values of SII and RII were higher for maternal educational status compared to wealth terciles for all EDHS surveys indicating that there is a larger inequality by maternal education status than by household wealth status in the region.

Figure 10:Trends in SII for the use of ANC services by Wealth Status and Level of Education, 2000-2016

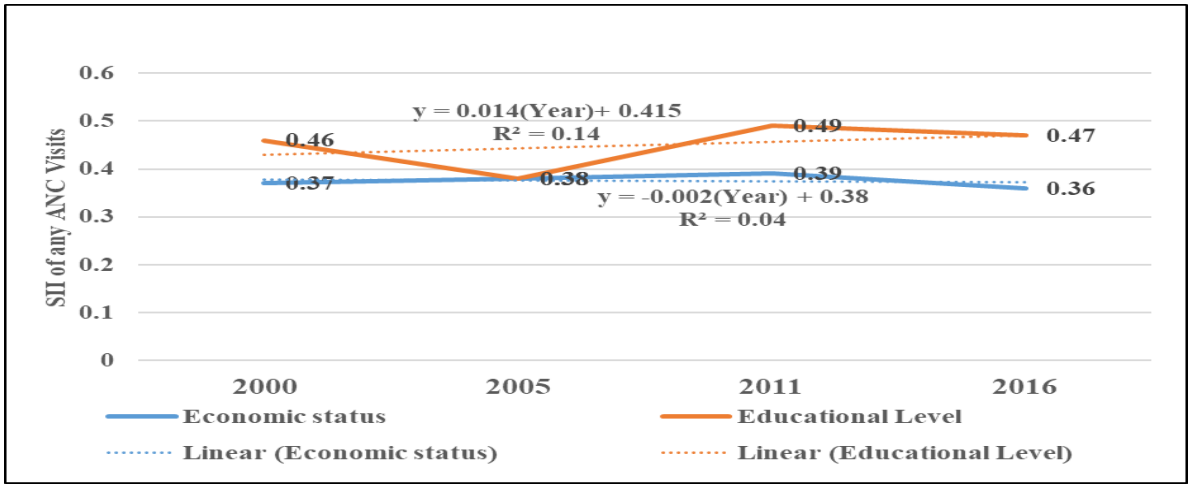
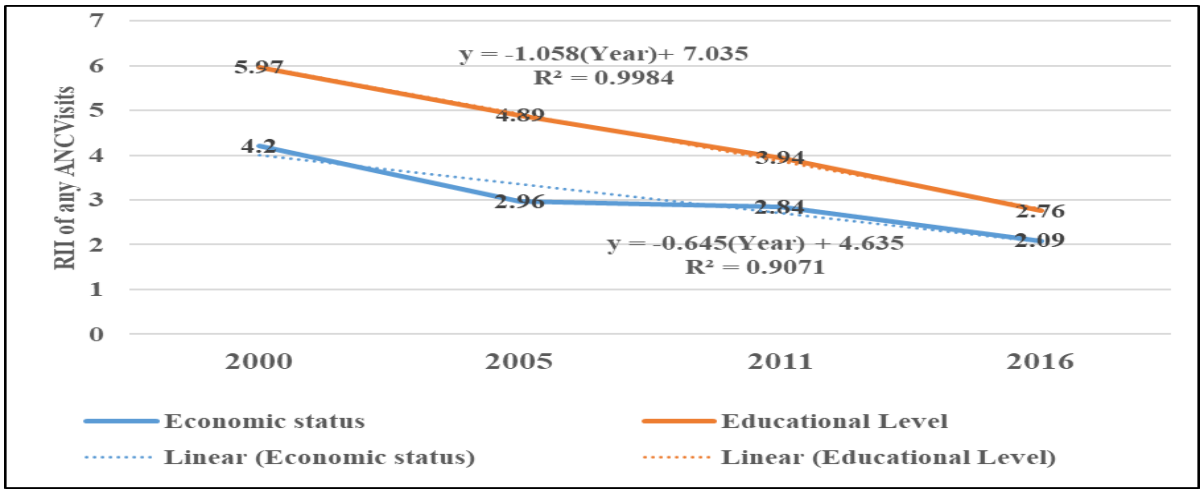


Figure 11:Trends in RII for the use of ANC services by Wealth and Level of Education ,2000-2016



5.3 Decomposition of the Concentration Index

Table 3 present result from the decomposition analysis of the contribution of the selected sociodemographic and economic inequality on overall concentration index in any ANC visits. For brevity, we only present the results for the decomposition analysis for the 2000 and 2016 survey

periods. The decomposition results revealed that the largest contributor to wealth-based inequality were rich wealth index (43%), middle (23.3%, p=0.550) and poor (19.26%, P=0.029) terciles, while the middle wealth tercile was the positive contribution for inequality which indicates there was no significant effect of wealth on the inequality of any ANC services in 2000 and 2016 EDHS. Wealth index had a larger contribution by increasing inequalities in any ANC visists in all years although the contribution declined from 84% in 2000 to 43% in 2016. Nonetheles dispite the decrease, the contribution of wealth status to inequality for any ANC services utilization is still large(>40%).

Mather's education was the second contributor by increasing the levels of inequalities in any ANC services over time, the contribution decreased from 48% in 2000to 38% in 2016. The mother's education across the survey is a significant contributing factor to inequality, whereby this is approximately primary (19.51% , P=0.000) and secondary and above level was (18.67%, P=0.109) for any ANC visits in 2016EDHS. The results shown that women employment status is another important factor accounting for a sizeable share of the observed inequalities in any ANC services across the study surveys. Specifically, women employment status explains approximately 39% and 26% of the observed inequalities in the receipt of ANC care in 2000 and 2016,respectively. However, women employment status has a significant contribution (0.36%, P=0.001) for inequalities of any ANC services in 2000 EDHS. From the table, it can be observed that most of the inequality in the utilisation of any ANC services can be explained by wealth status and mother's education contributed to inequality in any ANC service utilisation, and positive sign indicates pro-rich inequality over the time of 2000 and 2016 EDHS.

The mother's traditional/ others religion and place of residence (i.e rural area) were a negative contribution determinants to inequality, whereby this is approximately -39.73%, P=0.038 and -68%, P=0.018 for ANC visits, respectively in 2000. Similarly, the results shows the mother's age was the negative contribution(-27%) to inequality for any ANC visits, which indicates pro-poor inequality in 2016 EDHS.The value of the absolute contribution indicates the extent of inequality contributed by the explanatory variable. The decomposition residual regression errors of inequalities in any ANC service utilization were found as in 2000(21), 2005(-0.9), 2011(-2.3), and in 2016(0.5).

Table 3: Decomposing Concentration Index of Inequality in Any ANC Visits in Oromia, 2000-2016 EDHS

Explanatory Variables	Survey Years															
	2000				**2005**				**2011**				**2016**			
	Elast	CIX	Abs.Co	Percent Con(%)	Elast	CIX	Abs.Co	Percent Con(%)	Elast	CIX	Abs.Co	Percent Con(%)	Elast	CIX	Abs. Co	Percent Con(%)
Age				-18%				10%				168%				-27%
20-34	-0.11	0.81	-0.09	-10.96	0.12	0.02	0.00	0.38	0.62	0.96	0.60	62.69	-0.18	0.99	-0.18	-18.17
35-49	-0.08	0.71	-0.05	-6.76	0.11	0.70	0.07	9.96	1.05	0.96	1.01	105.65	-0.44	0.20	-0.09	-8.92
Place of Residence				-68%				3%				5%				-30%
Rural	-0.39	0.17	-0.54	-68.12	0.22	0.10	0.02	2.95	0.45	0.12	0.05	5.34	-0.30	1.00	-0.30	-30.20
Education Level				48%				131%				91%				38%
Primary	0.39	0.98	0.38	48.37	0.34	0.91	0.31	41.32	0.50	0.99	0.50	51.93	0.21	0.94	0.19	19.51
Secondary+	0.73	0.88	0.64	81.15	0.79	0.86	0.67	89.69	0.55	0.68	0.37	38.73	0.54	0.35	0.19	18.67
Employment status				39%				6%				10%				26%
Employed	0.36	0.86	0.31	38.80	0.05	0.80	0.04	5.74	0.10	0.99	0.10	10.00	0.28	0.93	0.26	25.94
Wealth status				84%				139%				75%				43%
Middle	0.06	0.69	0.04	5.21	0.32	0.76	0.24	32.01	0.36	0.96	0.34	35.76	0.24	0.99	0.23	23.31
Rich	0.63	0.99	0.63	79.00	0.80	0.99	0.80	106.70	0.45	0.84	0.37	39.01	0.24	0.81	0.19	19.26
Birth order				-46%				-10%				-19%				-13%
2-5	-0.13	0.84	-0.11	-13.39	-0.044	0.77	-0.03	-4.51	-0.09	0.98	-0.08	-8.67	-0.17	1.00	-0.16	-16.50
6+	-0.39	0.66	-0.26	-32.82	-0.06	0.69	-0.04	-5.79	-0.72	0.14	-0.10	-10.52	-0.16	-0.20	0.03	3.27
Religion				-41%				-37%				22%				-11%
Protestant	-0.13	0.76	-0.10	-12.75	0.04	-0.83	-0.03	-4.41	0.01	0.98	0.01	1.23	-0.13	1.00	-0.13	-12.70
Muslims	0.12	0.76	0.09	11.23	-0.25	0.64	-0.16	-21.00	-0.19	0.89	-0.17	-17.58	0.01	1.00	0.00	0.50
Traditional/Others	-0.69	0.46	-0.32	-39.73	-0.13	0.66	-0.09	-11.57	0.40	0.92	0.37	38.39	0.24	0.04	0.01	0.96
Total observed			0.63	80			1.62	214.5			3.24	338			0.49	48.83
Residual			0.16	20.5			-0.86	-114.5			-2.28	-238			0.51	51.17
Total			**0.79**	**100**			**0.75**	**100**			**0.96**	**100.00**			**1.00**	**100.00**

Notes: *P <0.05 CI=Confidence interval Elast=Elasticity Abs.Co=Absolute Contribution
Percent Con (%)= Percent Contribution CIX = Concentration Index

5.4 Association of Socio-Economic and Demographic Variables and the Utilization of ANC Services

Table 4 represents unadjusted effects of several factors for any ANC visits using bivariate setup, where the p-values were obtained using ANOVA. The results of one-way ANOVA for studying the association of explanatory variables such as place of residence, educational level, religion, employment status of mother, birth order and wealth status were found to have significantly associated ($p<0.05$) with the mean number of ANC visits taken over two survey periods of 2000 &2016. On the other hand, the variables age of mothers, household size, distance to health facilities and getting money for treatment were significantly associated ($p<0.05$) with the mean number of ANC visits taken only in the 2016 survey. While marital status of women was not significantly associated ($p>0.05$) with the mean number of ANC visits taken during 2000 and 20016 surveys in the study area.

Women living in urban area were significantly different in utilization of any ANC visits ($p=0.011$) in comparison to women living in rural areas. Women living in urban area have 26.4 % more utilized any ANC visits as compared to women living in rural areas in 2000. Similarly, the result showed that the mean number of ANC visits was higher significantly in urban areas 3.9 (34 %) than rural areas 1.7 (17%) respectively in 2016. The mean number of ANC visits among secondary or above educational level women living in Oromia region was 3.16 (31.6%) while the mean was 1.6 (15.9%) for those who completed primary school and 0.6 (6.3%) never been in formal education in 2000 respectively. Likewise, the mean number of ANC visits among secondary& above education, women was 3.6 (36%) while the mean was 2.1 (22%) for those who completed primary school and 1.4 (15%) never been in formal education in 2016 respectively. The highest mean number of ANC visits during pregnancy were observed among secondary & above education, women with the increasing in education level, increased in mean number of ANC visits during the two periods.

Again, women's employment status was significantly associated with the mean number of ANC visits at 2.2 (22%) while the mean was 1.8 (16%) for those among not employed women in 2016 EDHS respectively. On the other hand, the results depict that the mean number of ANC visits who were followers of Orthodox religious women was 2.8 (27.8%) while the mean was 1.7 (17%) for those who followers of Muslim religious women and 1.67 (16.7%) &1.55 (15.5%) for those followers of Protestant and traditional/Others religious women in 2016. The mean number of ANC visits among in the rich terciles women living in Oromia region was 1.78(17.8%) while the mean was 0.73(7.3%) for those in the middle terciles and 0.53(5.3%) for those who was poor terciles in 2000 respectively.

Similarly, the mean number of ANC visits among in the rich terciles women was 2.8(28%) while the mean was 1.86(18.7%) for those in the middle terciles and 1.34(13.5 %) for those who was poor terciles women in 2016 respectively (Table 4).

It shows that the mean number of ANC visits among women was 2.39(23.9) for the first birth, whereas it was 1.79(18%) for the second to fifth birth order and 1.35(13.5%) for the sixth birth or above respectively in 2016 EDHS. Furthermore, the highest mean number of ANC visits was 2.2(22%) observed for women aged between 15 -19 years at birth. The mean number of ANC visit among women aged 20-30 years at birth was 1.8(18%) and it was 1.5(15%) the lowest for women aged between 35-49 years at birth in the same year. The mean number of ANC visit among women having 3-4 children 2.08(20.8%) and women having 1-2 children (the reference group) 1.61(16.1%) in 2016.

Interestingly, the other two barriers cost of care and distance to health facility were not strongly significantly associated for the mean number of ANC visits as a big problem in the study area. Results indicated that the mean number of ANC visits among as distance to a health facility is a big problem for women living in Oromia region was 1.6 (16%) while the mean was 2.3 (23%) for those among distance to a health facility is not a big problem for those woman access to health service utilization in the region. Likewise, the mean number of ANC visits among as getting money need for treatment is a big problem for women was 1.6 (16.4%) while the mean was 2.1 (21%) for those among getting money need for treatment is not a big problem for woman access to health service in the region (Table 4).

Table 4: The Association between Socioeconomic & Demographic Variables and Number of ANC Visits in Oromia, 2000 and 2016EDHS

Explanatory Variables	**Survey Years**							
	2000				**2016**			
	N	**Mean±SD**	**F-Ratio/ P -value**	**Mean %**	**N**	**Mean±SD**	**F-Ratio/ P -value**	**Mean %**
Ages								
15-19	77	0.95±1.52	1.33	9.5	57	2.16±2.04	4.51	21.7
20-34	900	0.93±1.82	p=0.263^{NS}	9.3	730	1.83±1.97	p=0.011*	18.4
35-49	352	0.75±1.70		7.5	243	1.45±2.09		14.5
Total	1329	0.84+1.71		8.4	1030	1.76±2.01		17.7
Place of residence								
Urban	98	2.64±2.76	170	26.4	62	3.38±2.08	50.35	33.8
Rural	1231	0.68±1.50	p=0.001*	6.8	968	1.65±1.96	p=0.011*	16.5
Total	1,329	0.84±1.71		8.4	1,030	1.76±2.01		17.7
Women Education								
No education	1102	0.63±1.44	93.55	6.3	666	1.43±1.90	40.26	14.4
Primary	169	1.59±2.27	p=0.001*	15.9	310	2.16±1.98	p=0.001*	21.6
Secondary+	58	3.16±2.75		31.6	54	3.56±2.06		35.6
Total	1,329	0.84±1.71		8.4	1,030	1.76±2.01		17.7
Households Size								
1-2	26	1.00±1.99	0.26	1	9	1.61±2.02	15.97	16.1
3-4	323	0.83±1.65	p=0.768^{NS}	8.3	252	2.08±1.99	p=0.001*	20.8
5+	980	0.90±1.80		9	769	1.62±1.98		16.2
Total	1,329	0.84±1.71		8.4	1,030	1.76±2.01		17.7
Birth Order								
1	214	1.05±1.85	4.58	10.5	175	2.39±2.03	15.82	23.9
2-5	666	0.96±1.82	p=0.019*	9.6	544	1.79±2.01	p=0.001*	18.0
6+	449	0.68±1.63		6.8	311	1.35±1.89		13.5
Total	1,329	0.84±1.71		8.4	1,030	1.76±2.01		17.7
Religion								

	Continued-------(table 4)							
Orthodox	456	1.14±1.99	6.49	11.4	186	2.78±2.23	2.98	27.8
Protestant	160	0.84±1.78	p=0.001*	8.4	202	1.67±1.97	p=0.031*	16.8
Muslims	620	0.78±1.65		7.8	605	1.70±2.00		17.0
Traditional/Other	93	0.34±0.97		3.4	29	1.55±1,54		15.5
Total	1,329	0.84±1.71		8.4	1,022	1.51±2.23		15.2
Current Marital status								
Currently not in union	113	0.93±1.79	0.07	9.3	66	1.61±1.88	0.44	16.1
Currently in union	1216	0.88±1.77	p=0.794^{NS}	8.8	964	1.77±2.02	p=0.508^{NS}	17.8
Total	1,329	0.84±1.71		8.4	1,030	1.51±2.23		15.2
Employment status								
Not-Employed	675	0.76±1.70	6.81	7.6	725	1.57±1.94	23.51	15.8
Employed	653	1.02±1.84	p=0.009*	10.2	305	2.24±2.10	p=0.001*	22.4
Total	1,328	0.84±1.71		8.4	1,030	1.51±2.23		15.2
Wealth Status								
Poor	727	0.53±1.27	60.9	5.3	429	1.34±1.83	30.25	13.5
Middle	243	0.73±1.71	p=0.001*	7.3	464	1.86±1.98	p=0.001*	18.7
Rich	292	1.78±2.38		17.8	137	2.80±2.58		28.0
Total	1,262	0.84±1.71		8.4	1,030	1.76±2.01		17.7
Distance to Health Facility as a problem								
Yes	na	na	na		774	1.60±1.95	22.46	16.0
Partially	na	na	na		256	2.28±2.12	p=0.001*	22.8
Total					1,030	1.76±2.01		17.7
Getting Money need for treatment as a problem								
Yes	na	na	na		747	1.63±1.97	12.03	16.4
Partially	na	na	na		283	2.12±2.09	p=0.001*	21.3
Total					1,030	1.76±2.01		17.7

Note: na: not applicable NS-Non- significant * P<0.05 Mean%= Mean Percentage SD= Standard Deviation Minimum sore of ANC visits (2000-2016) =0

Maximum scores of ANC visits (2000&2016) =10 Maximum score of ANC visits (2005) =15 Maximum score of ANC visits (2011) =20

5.6 Multiple Comparisons Test with Unequal Variance

From the results so far, we know that there were statistically significant differences between the groups as entire. The table below, multiple comparisons, shows which groups were actually statistically different from one another. From the results the mean of ANC visits of the women of age < 19 does not differ significantly from that of age 20-34 but the others differ significantly as the p-value was P < 0.05. The rural residence of women's group was significantly differ from those among urban women group, with the MD of -1.96,95%, (CI=-2.257, -1.67), in 2000 and MD of -1,73, 95%) CI=-2,21, -1,25) on the mean number of ANC visits among women aged 15-49 years in 2016. This difference was shown statistically different between two groups (P=0.001).The pairwise mean comparison tests, there was a significant reduction in any ANC service utilization between urban versus rural areas by 1.9 and 1.7 in 2000 and 2016 respectively.

Results indicated primary education was significantly different from no formal education, women with the MD of 0.97, 95% (CI=0.642,1.285) in 2000 and MD of 0.72,95% (CI=0.410,1.039) on the mean number of any ANC visits in 2016. Likewise, the result was shown that a significant difference between the mean number of any ANC visits score of secondary & above compared to no formal education level of women's groups, with a MD being 2.53,95% CI= (2.05, 3.11), in 2000 &the MD of 2.12 95% (CI =1.49,2.75) in 2016. This difference was statistically different between two groups (P=0.001).

We also see from table5, the employment status of women was significantly different from not-employed women's group, with the MD of 0.254, 95%CI= (0.06,0.44), in 2000 and the MD of 0.66, 95% (CI=0.39,0.93) on the mean number of any ANC visits in 2016 EDHS. On the other hand, results indicated among rich wealth terciles group women were statistically differences from those poor wealth terciles women, with the MD of 1.25, 95%CI= (0.98,1.56), and the MD 1.45, 95%CI= (1.01,1.90) on the mean number of any ANC visits in 2000& 2016 respectively.

Our result also shows rich wealth terciles of women was significantly different as compared to the middle wealth terciles women's groups, with the MD of 1.05, 95%CI= (0.71,1.39), and 0.93, 95% (CI= 0.49,1.38) on the number of any ANC visits in 2000& 2016 respectively. Again, rich wealth terciles of women was significantly different as compared to middle wealth terciles women's groups, with the MD of 1.05, 95%CI= (0.71,1.39), and 0.93, 95% (CI= 0.49,1.37) on the number of any ANC visits in the same periods. This difference was statistically different between two groups (P=0.001). In contrast, there was no statistical difference(P>0.05) in the middle versus with the poor wealth tercies

of women, the MD of 0.2, 95%(CI= -0.10,0.50) in 2000 and 0.24,95%(CI= -0.00,0.48) in 20005 respectively. Again,from the p- value(0.001), the result shown that the mean visits of any ANC for the two group of middle versus the poor wealth terciles of women was significantly difference of 0.38,95%(CI= -0.04,0.81) in 2011 and with the MD of 0.52, 95%(CI= 0.21,0.83) in 2016 respectively.

In the 2000 survey, the muslims and traditional/Others religion were significantly different from Orthodox religion follower's women's groups, with the MD of -0.36, 95% CI= (-0.63, -0,08), -0.79,95%CI= (-1.34, -0.25) on the mean number of any ANC visits. It was also found that there exists highly significant association between religion and ANC visits. This MD was statistically different between two groups(P=0.001). In contrast, there was no statistical difference (P>0.05) among followers of religious women with the mean number of any ANC visits in 2016 EDHS. A post-hoc test reaveled signigicant differences bwtween distance to health facility as a big problem and partially among women in the utilization of any ANC services,with an average difference of 0.63(P=0.001) in 2005 and with an average difference of 0.68(P=0.001) in 2016 respectively. Like wise, the result showed a significant difference between getting money for treatement need as a big problem and partially among women in the utilization of any ANC services,with an average difference of 0.63(P=0.001) in 2005 and with an average difference of 0.68(P=0.001) in 2016 respectively.

Table 5: Mean Difference of Any ANC Visits Among women by Selected Demographic and Socioeconomic Variables ,2000-2016EDHS

Explanatory Variables		Survey Years			
		2000	**2005**	**2011**	**2016**
		MD (95%CI)	MD(95%CI)	MD(95%CI)	MD(95%CI)
Ages	20-34 vs 15-19	-	-	-	-0.3329(-0.968.0.304)
	35-49 vs 15-19	-	-	-	-0.715(-1.400,-0.030)*
	35-49 vs 20-34	-	-	-	-0.382(-0.735,-0.030)*
Place of Residence	Rural vs Urban	-1.960(-2.257,-1.67)***	-2.637(-3.00,-2.27)***	-1.755(-2.393,-1.114)***	-1.732(-2.211,-1.253)***
Women Education	Primary vs No Education	0.967(0.646,1.285)***	0.616(0.333,0.898)***	0.890(0.458,1.320)***	0.724(0.410,1.039)***
	Secondary+ vs No Education	2.536(2.051,3.117)***	3.118(2.555,3.679)***	2.813(1.800,3.824)***	2.125(1.495,2.756)***
	Secondary+ vs Primary	1.570(1.013,2.124)***	2.502(1.899,3.103)***	1.924(0.879,2.966)***	1.401(0.742,206)***
Household Size	3-4 vs1-2	-	-1.06(-1.160,0.947)	-	-2.529(-4.011,-1.046)***
	5+ vs1-2	-	-6. 42(1.677,0.392)	-	-2.993(-4.456,-1,529)**
	5+ vs 3-4	-	-536(-8616,-256)***	-	-0.463(-0.798,-0,129)**
Birth Order	2-5 vs 1	-0.090(0.233,-,1060)	-0.107(-1.160,0.947)	-0.361(-0.959,0.238)	-0.593(-0.994,-0.192)**
	6 vs 1	-0.372(-0.714,-0.020)*	-0.643(-1.677,0.392)	-0.846(-1.491,-0.199)**	-1.040(-1.476,-0.604)***
	6+ vs 2-5	0.282(-.0353,-0.030)**	-0.537(-0.816,-0.256)	-0.485(-0.947,-0.022)*	-0.440(-0.777,-0.115)*
Religion	Protestant vs Orthodox	-0.296(-0.708,0.118)	-0.349(-0.759,0.062)	-0.551(-1.213,0.111)	-0.500(-1.040,0.039)
	Muslims vs Orthodox	-0.356(-0.633,-0.08)***	-0.613(-0.919,-0,306)***	-0.863(-1.418,-0,307)***	-0.476(-0.915,-0.037)
	Muslims vs Protestant	-.061(-0.459,-0.388)	-0.265(-0.673,0.109)	-0.313(-0.880,0.255)	0.023(-0.406,0.453)
	Traditional/Others Orthodox	-0.797(-\1.342,-0.25)***	-0.759(-1,428,-0.089)**	-0.007(-1.638,1.626)	-0.626(-1.540,0288)
	Traditional/others Protestant	-0.502(-1.118, 0.114)	-0.411(-1.113,0.292)	0.545(-1.092,2.181)	-0.125(0.985,0.784)
	Traditional/others Muslims	-0.441(-0.979,0.093)	-0.147(-0.793,0.506)	0.857(-0.740,2,453)	-0.149(-1.003,0.704)
Employment status	Employed vs Not Employed	0.254(0.062, 0.443)**	0.294(0.071,0.514)***	0.571(0.221,0.918)***	0.664(0.395,0.933)****
Wealth Status	Middle vs poor	0.200(-0.102,0.501)	0.238(-0.005,0.481)	0.384(-0.044,0.811)***	0.521(0.214,0.829)***
	Rich vs poor	1.249(0.980,1.516)***	1.895(1.560,2.228)***	1.897(1.255,2.537)***	1.454(1.007,1.900)***
	Rich vs Middle	1.049(0.705,1.391)***	1.657(1.315,1.997)***	1.513(0.88,2.145)***	0.933(0.485,1.379)***
Distance to Health facility as a problem	Yes vs Partially	na	0.631(0.386,0.88)***	0.634(0.386,0.880)**	0.684(0.400,0.967)***

Notes: na. Not applicable The mean difference is significant; *P<0.05; **P<0.01 ***P<0.001

Sign-; indicates insignificant independent variables entering for multiple comparisons test to express differences between multiple group means

6. DISCUSSION

This paper provides a broad overview of examined trends in inequalities of ANC service utilisation in Oromia region.Findings showed that any ANC service utilization in Oromia region is still very low, although there was considerable increase from 27% in 2000 to 50.7% in 2016. The study shows that trends in the coverage of any ANC service among women, which was about 85% change during the last 16 years. While recognizing a positive trend, Oromia is still underperforming when it comes to maternal and child health outcomes(25). The proportion of women who attended any ANC +1 visit from a skilled health provider during their pregnancy was 50.7%, the second lowest rate at national level(62%) during 2016 EDHS(19,25). Such levels of ANC service coverage are low in the region even by Sub-Saharan standards and Asian countries(158).

Findings from both absolute (RD) and relative (RR) summary measures revealed inequality of any ANC services utilization among women by economic status, level of education and places of residence in Oromia region from 2000 to 2016 EDHS. The simple measures indicated the trends of absolute (RD) and relative (RR) inequality of ANC services among women based on socio-conomic status were significantly inconsistently between 2000 and 2016. However, the complex absolute measure (SII) showed an increasing trends of any ANC services inequalities in economic status between 2000 to 2005, followed by decreasing from 2011 to 2016 EDHS. While the complex relative measure (RII) indicated a significant decrease in any ANC services utilization differences based on economic status and level of education over 16 years of studied data in the region.

Findings from the analysis displayed, from both simple inequalities(RD and RR) and the complex inequalities(SII and RII) suggested consistent socio-economic inequalities in the utilization of measures of ANC service favoring wealthier and more educated women over time between 2000 & 2016 EDHS in the region. Oromia region is the biggest regional state of Ethiopia which, was achieved lowest coverage (50.7%) of any ANC services in the 2016 survey compared to Sub- Saharan African countries of regional states like in Nigeria and Ghana over time between 2000-2016(158–160). Although the aggregate of ANC coverage increased from 27% in 2000 to 50.7% in 2016, it remains quite low and approximately half of the population still do not receive ANC services to the required standards of care in the region. This finding is in line with study in Kenya (50.9% in 2014) (161), but inconsistent with local studies done in Ethiopiain: Debra Tabor (55.7% in 2015) (162),and Hadiya Zone (86.3% in 2001)(163). This finding is supported by another studies carried out in Ethiopia between 2000-2016 EDHS(158),regions such Afar(52%), Somalia(44.7%) and Oromia(52.1%) have suffered from considerably low coverage of maternal health service(i.e ANC)(24). In Harari and Somali, progress was slower, and Somali, Oromia, and Afar had the lowest

ANC coverage in 2016 EDHS(140). The observed difference might be due to socio-cultural and awareness difference, variation in socio-demographic characterstics, and the difference in study period.

Our findings of study also show that an upward trend in ANC4+ visits from 10.2% in 2005 to 22.2% in 2016 in the region. This finding is in line with conducting study in Nairobi(22%) (164) while inconsistent with studies in Ghana(87.3%)(160), Nepal (69%)(205) and Tanzania(166). Still, the utilization of ANC+4 visits recommends by WHO is very low in the region(14). This low proportion of ANC sevices utilization in the region might be due to the mothers' lack of awareness of the importance of ANC visits, financial problems, distance between mothers' home and health facility, and lack of transportation to health facility are among the challenges concerning ANC services(167). These findings suggest the need for interventions to improve the inadequate utilization of ANC service in the region; increasing pregnant women's utilization of ANC service is crucial as it also improves women's engagement with skilled delivery and contraceptive services (168,169).

There is a very high unmet health care need in rural Ethiopia and regional states of the country that needs to be addressed through rapid expansion of PHC services. Despite the fact that improved in the health service access and utilization in Ethiopia and regional state like Oromia region, still there were inequalities in any ANC service utilization(35,127). However, essentially the relative (RR) and absolute (RD) inequality gap in the utilization of any ANC services between urban and rural areas were decreased during 2000 to 2016 EDHS periods. This finding is in line with Sub-Saharan African countries; Ethiopia, Uganda and Zambia, but inconsistent in Madagascar and Cameron over the time between 2000& 2011 DHS(87). Inequality in health service access and utilization can be avoidable through tackling the socio-cultural and infrastructural barriers (170).

Our findings of study show RR in the utilization of ANC services inequality decreased significantly by 1.3(30%) between 2000 and 2016 EDHS.By contrast, RD in ANC use between women in the rich and poor terciles increased over time by 2 PP in the region. It means ANC coverage among the rich women was higher by 14.5 PP as compared to the poor in 2016 EDHS. A similar study in Sub-Saharan African countries Zimbabw(87), indicated that wealth-based absolute inequality in the utilization of any ANC service increased by 0.063 points during 2000-2011periods. In Ethiopia, while absolute wealth-based inequalities in the utilization of maternal health care increased between 2000-2011EDHS surveys, relative wealth-based inequalities in ANC use decreased over time(87). Our findings of study show that in spite of progress in any ANC service utilization regarding regional coverage by RMNCH interventions, sizeable inequalities between rich and poor persist in the region. This has huge implications in progress towards attaining SDG targets related to maternal health(3). This finding is in line with studies result in Madagascar and Uganda(87),but varying with study in

Pakistan(171). Still, more favored groups have better access and utilize services which demanding urgent actions to address the gaps stimulated by the socio-economic factors in the region(61).

The extent of absolute (RD) and relative (RR) maternal level of education related to inequalities in any ANC services utilization gaps significantly declined between 2000 & 2016 EDHS. Despite the fact narrowing the gap in educational attainment, still women with secondary or above education tended to have significantly higher use of maternal health services compared with those women no education in the region. For the most recent period (2016) the data show a much higher ANC coverage of 96% for women with secondary or above education compared to 54.5% for those with no education in Ethiopia(24). This finding is inline with other earlier studies done elsewhere in developing countries(35,87),while our finding is inconsistent to other study in Nigeria(172). Other study conducted in Pakistan(173), RR& RD on the coverage of ANC services across different maternal education level shows a slightly increase with RD 12·8 in 2007 and 13 PP in 2015 and with RR 1·15 in 2007 and 1.16 in 2015. This shows the central importance higher maternal education is known to have a synergistic effect with other enablers of ANC services utilization, as women with higher education may be more likely to live in urban areas, gain employment, possess more wealth, and have a better understanding of the benefits of attending ANC services (167).However, the 2016 EDHS(19) showed that half (51.1%) of Oromia women have no education opportunities. Hence, promoting female education and narrowing the equity gap is very crucial in the coming HSTP II , thereby contributing to the improved health status of women and their children in the region(174).

According to this findings, the pattern and trends in any ANC services show varied results over the study time between 2000-2016 EDHS. Notably, the mean percentage of of any ANC visits coverage by educational attainment, wealth status and places of residence among women was declined significantly in 2011EDHS in the region. This finding is potentially alarming one and the cause behind this negative trend requires further investigation. A possible explanation might be that women who received antental care once didn't seek further assistance owing to unsatisfactory service quality. Patience dissatisfaction in maternal healthcare service such as ANC is common in African settings, and has been shown have negative effects on subsequent healthcare visits(175,176).

The findings of this study also shows the aggregated CIX values of any ANC services across surveys inconsistently increased from 0.79 in 2000 to 0.99 in 2016 for which the CIX increased, indicating an increase in inequality. However, there was a slight decrease between 0.79 to 0.75 in 2000 and 2005, indicative of improvement in socioeconomic inequality for ANC services. Nevertheless, the CIX for ANC use still suffers from high level of socioeconomic related inequalities as revealed by a notably high CIX of 0.99 in 2016 EDHS. The presence of such inequalities implies inequities of the maternal healthcare utilization(88). This findings are inline with other studies in

Ghana (88), Bangladesh (177) and Nigeria(178),but it is contradictory to other studies in Vietnam(179)and India(180). By contrary, an estimate of CIX values of any ANC services indicates declined significantly for wealth status from 0.279 in 2000 to 0.133 in 2016, education level from 0.247 in 2000 to 0.134 in 2016 and place of residence decreased from -0.204 in 2000 to -0.062 in 2016) respectively in the region. Our findings is consistent with studies in vietnam(181), Zimbabwe(182), and Nigeria(183). The CIX values of any ANC services declined and remained positive except in urban-rural areas, indicating that higher utilisation of ANC services was favoured most advantaged group in terms of wealth status and educational level as well as pro–rural areas. Although the pro-rural and pro-poor policy will still be relevant going forward it is important to consider the socio-cultural appropriateness of the health service delivery strategies at regional/sub regional level in order to effectively close the inequality gaps(167).

Correspondingly,the utilization of ANC services appeared to be wealither and more educated with the concentration curves lying below line of equity and the CIX exceeding the value of 0, over time between 2000-2016 surveys. However, for any ANC services, the movement of the CIX and the curves illustrate approaching towards the line of equality in the 2016 survey. This finding is consistent with studies in Oromia,Ethiopia(24,184), and philippines(185),but our finding deviates from other studies in Bangladesh, Nepal and Zimbabwe(170) inequality in ANC visits, the distance from the line of equity to the line of concentration curve was greatest in Nepal (CI=−0.2859) relative to Bangladesh (CI=−0.1147), Ethiopia (CI=−0.1146) and Zimbabwe (CI=−0.0632) in 2010 to 2011. One possible explanation was indicated women from better-off economic status have benefitted from the ongoing health policies and programs to a greater extent than from pro-poor women. The reduction of out-of-pocket expenditures through enrollment on a health insurance scheme has been found to increase the utilization of maternal health services in particular(88). Removing user fees may increase utilization but will not eliminate inequality in utilization if the coverage of services is disproportionately spread to the disadvantage of less wealthy women(183).

Our finding indicate also that the concentration curves for place of residence was above the diagonal line, suggestive of pro-rural inequality in the uptake of any ANC services among reproductive women in the region over 16 years studied data.The CIX being negative for the ANC visit in this study is consistent with findings of other studies in Nigeria and Ghana(183) but our findings deviates from other study in Bangladesh (186).Our results of the concentration curve shows the closest to zero(line of equity), the disparity was narrowed between urban-rural areas in the utilization of ANC services between 2000-2016 periods. A negative Concentration indices and the curve lying above the diagonal line depicts the pro-rural pattern for any ANC services in the region.This could be due to the fact that

HEWs are the first contact to health care system in Ethiopia especially in rural areas, where 85% the population resides (187).

Our study findings also show that there was a trend in SII and RII for any ANC services utilization by wealth status among women decreased steadily significantly(P=0.001). Substantial changes trends in RII for any ANC services that consistently declined significantly(P=0.001) over time, both for wealth status and maternal level of education between 2000 and 2016EDHS. This means the socieconomic status inequalities in any ANC services narrowing over the years although still remain persistently inequitable among the women. Likewise, RII in any ANC service utilization declined over time by educational level from 5.97 in 2000 to 2.76 in 2016 EDHS. By contrast, SII in any ANC service utilization slightly increased over time by educational level from 0.46 in 2000 to 0.47 points in 2016 reflecting a rising of ANC services inequality by educational level in the region.

The findings of study show that from SII for wealth-based inequality in ANC service utilization was reversed result with other analyses of RD between 2000-2016 EDHS. Together these findings indicate that wealthier and more educated women are the main users of ANC services in the region. This finding is consistent with studies in Zimbabwe(188), Bangladesh(189) and Pakistan (173). The RII by wealth status and education level was declined as result of concentrated efforts of the government in collaboration with non-governmental organizations and the local community, to focus on hard-to-reach and disadvantaged populations(190).

Analysis of data from four EDHS surveys indicates that the most significant factors of inequality in any ANC use are wealth status and maternal education. Women from the poor wealth terciles and those with no formal education were the most disadvantaged group in terms of their use of any ANC services in the region. The link between maternal education and wealth and utilization of maternal health services has been well documented(191,192) and these findings further verify the association.This finding is consistent with the outcomes of studies elsewhere(120,193). On the other hand, our decomposition finding result show that wealth status, education, and women employment were a positive contribution to inequality of any ANC visits in 2016 EDHS. Wealth status accounted for the single largest share of the measured degree of economic related inequalities in ANC use over the time of 2000 and 2016EDHS. The decreasing of the trend inequalities significantly by 41% reflects the more rapid reduction in ANC visits prevalence in the rich wealth terciles compared to the poor wealth terciles. These findings substantiate the findings studies in Ethiopa and Zimbabwe(24,194). Poor mothers often receive maternal health services from public health facilities which many times do not provide full, reliable and high-quality care (195).This suggests that reducing financial barriers to use ANC services reduces the inequality gap. This may be explained by policy efforts in 2005 that sought to remove financial barriers for pregnant women to use maternal health

services (196). Women's education was found to be a second significant contributor to socioeconomic inequality in any ANC visits in the region. The women's attainment of secondary or above education level were significant contributer to the decline inequality with a total share of 81% in 2000 to 18.67 in 2016 declined by 62%.This finding is similar to studies conducted in Ghana(88), Malawi(197),and Ethiopa(198), which found that higher maternal education was associated with increased uptake of ANC services.

The findings of this study show that place of residence, wealth status, education level, birth order, religion and employment status of women were found to be significant factors associated with higher number of ANC visits whereas marital status of women was not significantly associated with the mean number of ANC visits taken during 2000 and 20016 surveys. Findings from the study show that urban areas is one of the factors positively associated for ANC service utilization in the study area. This finding is consistent studies in developing countries and elsewere(94,199). As in most sub-Saharan countries, urban women in Ethiopia tend to benefit from increased knowledge and access to maternal health services compared with their rural counterparts(91). As Ethiopia implements strategies to reduce maternal mortality, services are not adequately stretching to rural areas, partly due to lack of roads infrastructure, making distance a crucial factor that gauges the use of maternal health services(26). However, a study from India reported an absence of independent association between places of residence and ANC use(200).

According to this finding, wealth terciles goes up, ANC visits also increases among women. ANC service was more utilized by women of rich wealth terciles than women in poor wealth terciles. This finding is supported by findings of previous studies in sub-saharan African countries and local studies in Ethiopia(24,61,87,127,183). This suggests that financial barriers are significant influence on ANC visits in the region. This is the possibility of incidence of empowerment in the economic domain in Oromia was very low(18%) in 2016(140). On the otherhand, our findings study show that education level has a positive relationship with number of ANC visits among the reproductive women in the region. Evidence has shown that improved educational status has a vital impact on maternal health service utilization(60,96,166,170). In Oromia, reports have indicated that maternal literacy rate has increased over time from 21.7% in 2000 to 37.3% in 2016(141), and the imrprovements in maternal education was also demonstrated in our analyses. The present study show that women who attained at least primary education were more likely to attend ANC visits, and this association was even stronger for those who made for any ANC visits. This finding is similar to studies conducted in Ethiopia(91) Tazania(166), Bangladesi (201)and Nepal(199), which found that higher maternal education was associated with increased uptake of ANC services.

7. Study Limitations and Strengths

This study had the following limitations:

1. This study uses cross-sectional data from EDHS from 2000-20016. The cross- sectional nature of the survey does not indicate a cause-effect relationship wealth inequality, education and area of residence with usage of ANC services,

2. When disaggregated to the equity stratifiers, the sample size that we get from the EDHS survey becomes smaller which could affect the power of the study.

3. There is a possibility of recall error and under-reporting by the participants,

4. Although EDHS data were collected at four different time points, the outcome measures and the predictors were taken from different women in each survey. This makes it impossible to relate the changes in the utilization of the ANC services to the individual level,and

5. The study was a secondary data analysis and therefore the researcher had no influence on the variables collected and the quality of the primary data,

The study has strengths.

1. One of the strengths of this study is using publicly available data of EDHS series which is regionally representative and comparable, to see trend and magnitude of inequality and its contributing factor and good quality assurance procedures,
2. The presentation of inequality analyses using both simple and complex methodologies, based upon large, high-quality, regionally representative datasets with small percentages of missing observations,
3. Use of a combination of different methods for assessing inequalities, which leads to a better understanding of the current situation.

8. CONCLUSION AND RECOMMENDATIONS

8.1 Conclusions

Despite some progress utilization of any ANC services in the region during the past 16 years, the utilization of any ANC services is still far from satisfactory. The ANC service utilization rate in Oromian region is lower than the national figures available to date. ANC use is lowest among women who need it most. These are the poor, unemployed, uneducated women and women living in rural areas. Still, a large proportion of pregnant mothers do not have access to an adequate number of visits recommended by the WHO in the region.

The findings of the study showed that there was inequality in any ANC service utilization in the region. The socio-economic factors such as residence, educational status, and economic status were the determinants of inequalitiy. In the region, women who were educated, in the highest wealth terciles, and living in urban settings were taking advantage of health services compared to their counterparts.

We found fluctuating trends in inequalities in any ANC services among women in place of residence, wealth status and educational level indicating declining in time between 2000 &2011,but rising between 2011&2016 EDHS. The timing of rising trends corresponds with the introduction and intensification of the health extension program in the country afterwards in 2005(24). The findings of this study also indicated that relative inequality of socioeconomic and place of residence decreased over time. While the absolute inequality of wealth status among women in the utilization of any ANC services was an increasing trend from 2000- 2016 EDHS.

In the region, both the SII and RII suggested consistent socio-economic inequalities in the utilization of ANC service favoring wealthier and more educated women. Although our findings highlighted the importance of disparities in any ANC visits among women due to socio-economic status, there was narrowed in time between 2000& 2016 EDHS. The evidence that utilization of any ANC services is inequitable, to the disadvantage of the poor, also suggests that improving the utilization of ANC services in Oromia region goes beyond improving coverage of health service and requires better planning to ensure equitable provision of maternal health services in the region. Addressing socio-economic inequalities and increasing job opportunities for women remain key priority areas to improve the uptake of ANC services in the region.

Results of decomposition inequality during 2000-2016 highlight the majior sources of inequality to which economic status contributes the largest, with 43%, followed by the women's education level (38%), employment status (26%), and marital status(24%) in 2016EDHS. The findings in this study suggest a focus on vulnerable segments of the population to improve access to maternal health care and consequently narrowed inequalities(194).

The efforts toward improving the coverage maternal health interventions should consider equity in the distribution of services. If health is considered as the right of citizens, equity related targets should be given due attention. Several approaches had been used to tackle inequality in access and utilization of maternal health services. Financial protection programs (eg, cash transfer and maternal vouchers schemes) an approach had been successful in improving maternal health services access and utilization in different countries(61,202). Education can be considered as the strongest parameter to address the low coverage of ANC services. If the regional government could implement and support higher education for girls more effectively, women would be more conscious about proper and timely utilization of health care services both for themselves and for their children(203). In a country like Ethiopia in general and Oromia region too, where women's autonomy is very low, along with the rigid cultural traditions and family norms, access to education among married adolescents could be promoted by working effectively with the existing community structure(25).

8.2 Recommendations

On the basis of the discussions of the major findings made above and the conclusions drawn, the researcher forwards the following recommendations;

Policy Makers

- The National and regional governments removed user fee charges in the public health sector during ANC services for pregnant women particularly for economically disadvantaged women. It would be important to look at the effect of free maternity services on the inequality in ANC visits,and
- National and regional governments policies should target women in rural areas, uneducated and economically deprived wome so that the number of any ANC visits can be increased.

Accessibility of Services

- Development of infrastructure that will reduce access costs of distance and transport to health facilities among the rural community, having good communication channels need to prioritize to improve ANC service utilization,
- Encouraging mothers' education can have a considerable influence on reducing inequalities of service utilization across subgroups. Improving female education starting from the childhood, particularly in rural areas can help in improving the health equality across the nation. This study also suggests that besides improving women's academic education and economic status, women should be motivated to change their attitude to seek medical care during their pregnancy.

Researchers

- The health inequality study requires larger data to adequately assess inequality and it is recommended if the next surveys have a better sample size that allows to conduct inequality study for population sub-groups.
- Further research would be needed in order to identify the factors of disparities of ANC service utilization in more depth because of the vastness and cultural heterogeneity of the region.

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Declaration

I the undersigned declare that this is my original work and has not been presented in this or any other University and all source of materials used for the thesis have been fully acknowledged.

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