Addis Ababa University College of Health Sciences

School of Public Health

INVESTIGATING INEQUALITIES AND ASSESSMENT OF THE DETERMINANT FACTORS IN POSTNATAL CARE SERVICE UTILIZATION IN ETHIOPIA:

Analyses of the 2016 Ethiopia Demographic and Health Survey Data

By

Asnakech Gizaw Meka (BSc)

A thesis to be Submitted to Addis Ababa University College of Health Science

Department of General Public Health

Addis Ababa Ethiopia

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ABBREVIATIONS AND ACRONYMS

ANC: Antenatal care

AOR: Adjusted Odds Ratio

CC: Concentration Curve

CI: Concentration Index

CMR: Child Mortality Rate

CS: Caesarian Section

D: difference

EDHS: Ethiopian Demographic Health Survey

FMHACA: Food, Medicine and Health Care Administration and Control Authority

FMoH: Federal Ministry of Health

GLM: Generalized Linear Model

MCH: Maternal and child health

MHS: Maternal Health Service

MMR: Maternal Mortality Rate

NMR: Neonatal Mortality Rate

OR: Odds Ratio

PAR: Population Attributable Risk

PNC: Postnatal Care

PSU: Primary Sampling Unit

R: Ratio

R: Adjusted Relative Risk Ratio

RII: Relative Inequality Index

RMNCH: Reproductive Mothers, Neonates and Child Health

SBA: Skilled Birth Attendance

SD: Standard Deviation

SDG: Sustainable Development Goal

SES: Socio-Economic Status

SSA: Sub-Saharan Africa

SVD: Spontaneous Vaginal Delivery

WHO: World Health Organization

ABSTRACT

Background: Postnatal care is an important care which is given to the mother and her child to prevent and reduce maternal and child mortality. Despite the importance of the care for the mother and her child, there are considerable disparities in postnatal care utilization across many geographical locations, maternal socioeconomic, and demographic factors in many Sub-Saharan Africa.

Objectives: To investigate inequalities and assess the determinant factors in postnatal care service utilization among reproductive women in Ethiopia using the 2016 Ethiopia demographic health survey data.

Methods: The study utilized data from the fourth round Ethiopia Demographic and Health Survey (EDHS). The dataset was accessed from EDHS website upon registering to the website. Education and wealth-related inequalities were assessed by concentration curve and concentration index. The measured inequality also decomposed into its contributing factors using Erregers method of analysis. In addition to this, population attributable risk, difference, and ratio were used to assess the inequality after running Binary logistic regression and multi-collinearities were checked by using variance inflation factor (VIF=1.5).

Result: PNC utilization within the first two days in Ethiopia in 2016 was only 16%. Complex summary measures suggest Maternal level of Education and wealth related inequalities in PNC were significantly high in 2016: with concentration indies of 0.166 and 0.2089 respectively. Simple summary measures also revealed wealth status, 4+ ANC visit, delivery by CS, use of internet and region were significantly predict inequalities in Postnatal care utilization.

Conclusion: There is a significant inequality in Postnatal care utilization in Ethiopia. Maternal wealth status, maternal level of Education, frequency of ANC visits, use of internet, Region and C-Section delivery are the dominant inequality contributors in the utilization of PNC services within those critical hours after birth.

Recommendation: Policy makers should focus on the implementation of the strategies to adequately address the observed inequalities in postnatal care utilization among women. Strategies should focus on the key population subgroups.

Keywords: Postnatal care, Inequality, Education, Concentration curve, concentration index and Ethiopia Demographic Health Survey.

1. INTRODUCTION

1.1 Background

Postnatal period is the time period from birth to the first 48 hours after birth and It is a period where most of the maternal and new-born deaths occur (1). Postnatal care is an important care which is given to the mother and her child and is critical to reduce the rates of maternal and child mortality; however, most women in several developing countries do not receive any postpartum care (2).

Despite the importance of the care for the mother and her child, there are considerable disparities in postnatal care utilization across many geographical locations, maternal socioeconomic, and demographic factors in many Sub-Saharan Africa(3).

Globally, Maternal mortality rate (MMR) has been shown to be reduced by 44% since 1990 from 385 per 100,000 live birth to 216 per 100,000 live birth in 2015 however, around 830 women die every day from pregnancy related causes in which 99% of these are from developing countries (4). This means that about one woman every two minutes and for every woman who dies, 20 to 30 encounter complication with a serious or long-lasting consequences (5) . In 2015 global neonatal mortality rate which means death of a child in the first 28 days of life, was 19 deaths per 1000live births (4, 6). In developing countries Maternal mortality is as high as 99% of the global MM from which the sub-Saharan African countries account for up to 66% (1, 7).

Ethiopia is the one from the six countries where over 50% of the total maternal mortality occurs worldwide. Ethiopia accounts MMR of 1061 (665–1639) in 1980, 968 (600–1507) in 1990, 937 (554–1537) in 2000, and 590(358–932) in 2008 respectively (8).

Postnatal care is one of the most important maternal health care services not only for prevention of impairment and disabilities but also reduction of maternal mortality (1). According to WHO recommendation at least three additional postnatal contacts after the first 24 hours of birth for all mothers and newborns, on day 3 (48–72 hours), between days 7–14 after birth, and six weeks after birth are needed (9). However, Countries with low and middle income level account for 99% of maternal death and also the same number of neonatal death due to home delivery and absence of PNC. Some 50% of maternal deaths and 40% of

neonatal deaths occur within the first 24 hours after birth, this period is also known as immediate postpartum period (10, 11)

Even though maternal health service initiatives and policies established by the government, mothers in developing countries only seek PNC in the events of maternal or childhood complications (12). PNC is one of the recommended strategies to overcome maternal and neonatal deaths during postpartum period since promoting antenatal care and skilled birth attendance is not enough (12). Many factors limit the utilization of maternal and child health services in developing countries. These factors include the availability, accessibility, and quality of services from the institutional factors as well as the characteristics of the users and communities in which the users' live (13).

According to WHO state of inequality report, Ethiopia is among the countries with the highest levels of within-country economic-related inequality in RMNCH coverage (14). Equitable maternal and child health services to improve the health of the women and children across their life course are one of the key priorities of Universal Health Coverage (15).

1.2 Statement of the problem

In Sub-Saharan Africa Access to maternal and reproductive health services is unequally distributed, due to this inequality, Nearly 4.7 million women, newborns and children die each year (5). Like most SSA Countries, Ethiopia is suffering from high maternal mortalities (16). In Ethiopia, the level of maternal mortality is among the highest from the world, every year about 25, 000 women die and 400,000 suffer from long term complications of pregnancy, delivery and child birth.(8, 16).

Maternal mortality reduction remains as a challenge because of the limited access to the lifesaving services (PNC) among the key population groups due to their low socioeconomic status in Ethiopia and other developing countries. The 2016 EDHS reported that 83% of women with live birth in the preceding two years did not receive a postnatal check-up within the first two days of delivery, this means that in Ethiopia the level of Postnatal Care coverage is extremely low which is only 17% within the first 48 hours of delivery (17). The risk of a woman dying from pregnancy related complications in the poorest countries can be as high as about 1 in 7, While in the richest countries it is about 1 in 30, 000 (18).

Sustainable Development Goal (SDG) is facing serious threats due to Inequity, unjust and avoidable inequalities which are persisting in maternal and reproductive health indicators and outcomes (5). Poorer groups within developing countries use less health care (19) because of this, 61% of maternal death and 58% of neonatal death occur during postpartum period in Ethiopia (20). One of the new and ambitious targets of SDG is reducing preventable global maternal mortalities at least to less than 70 per 100,000live births by 2030 (4, 6). To achieve the 2030 SDG eliminating the existing inequities in maternal health service utilization is crucial. Many studies were done around MHS inequalities, with some limitations on their methods such as limitation of variables and measures of inequality they use. This study aims to modify the limitations by using more variables and combination of measures of inequality to fulfil the gaps or the limitations of measurements found on the other studies.

1.3 Rationale of the study

Many studies were done around PNC utilization inequalities with some limitations on their methods such as: 1. They only use the complex summary measures of inequality to measure inequalities 2. They use the wagstaff method of analysis for estimation of concentration indies. This study is important in the context of current efforts to address poor maternal and child health outcomes in Ethiopia using the preferred Erregers method for concentration indies and concentration curve. To significantly help achieve the ambitious SDG 3.1, eliminating the existing inequality in the consumption of PNC plays a critical role. To this end, the information generated from this study is useful to launch equitable interventions, which in turn facilitate achievement of the 2030 SDGs. The study will also be assist in the identification of the state of inequalities in the utilization of PNC services, which will help to identify specific strategies to increase the utilization especially among the poorest subgroups. Reduced Inequalities in PNC services utilization in turn will result in reduced risk of maternal and neonatal Morbidity and Mortality.

2 LITERATURE REVIEW

2.1 Postnatal care service utilization

Postnatal care (PNC) is the care provided to women and newborn in the first six weeks after birth (9). Even though the health of mothers is mostly regarded as the health of the society, an estimated 287,000 maternal deaths occurred worldwide (21). Maternal mortality remains unacceptably high across much of the developing world especially Sub-Saharan Africa (SSA) and South Asia accounting for 87% of maternal deaths (21).

The utilization of maternal health services in Ethiopia is very low and is influenced by a number of socio-cultural, perceived benefits and accessibility-related factors (8). More than nine in ten mothers received no postnatal care at all and only 7% received postnatal care within the first two days after birth (21). These disparities in the health service utilization within and between regional countries with diverse socio-cultural and economic conditions such as Ethiopia is a frequent encounter. Inequalities in the service utilization are exhibited favoring women in developing regions, urban residents, most educated and the wealthy (22).

2.2 Inequalities in PNC by Socio-demographic factors

2.2.1 Education

Education was found to have significant impact on the use of maternal health care services. This implies that improving women's education has a positive impact on utilization of maternal health services this fact is proved by different studies at different time period, for instance a study revealed that Educated women are more likely to have higher autonomy and develop self-confidence and capability to decide on their own health (23). According to the findings of the study in Nepal, Educated mothers are more likely to use PNC than mothers with no education (AOR 4.623; 95% CI (2.880-.421)) (10), as the educational status of the mother increases non-utilization status decreases (24). Similarly, a mother with more than primary education had significantly greater chance of seeking PNC from a trained provider (OR = 2.1, 95% CI: 0.93-4.9, $p < 0.10$) (13) (25). Paternal level of education has also a positive impact on PNC utilization that mothers with higher educated partner are more likely to attend PNC services (AOR 1.736; 95% CI (1.099-2.742)). In contrast, another study revealed that, when a father had greater than primary schooling, a mother will have 66% less likely to seek PNC services ($p < 0.10$) (13).

2.2.2 Economic status

In many studies, Low economic status is found as a major determinant of inequities in MHS utilization (7). This may be due to women may lack money to cover payments for transportation and the service or other expenses to bring families and admit at a health facility (7). Mothers from middle (AOR 1.638, 95% CI (1.60-2.129)) and rich (AOR 3.182, 95% CI (2.171-4.665)) families are more likely to use postnatal care when compared to mothers from poor families (10). The same study from Ethiopia reveals women from the middle and richest households (AOR = 2.4, 95% CI = 1.73.5) were more likely to utilize postnatal care services than women from the poorest households (26). Poorer women are unlikely to access PNC service utilization within 48 hours of birth than the richer women (adjusted probability 0.30, and 0.57 respectively). comparing this with the choice of birth places, accessibility of PNC in the government facility is more likely to the poorer women, whereas, the rich tend to utilize private facilities for PNC (12).

2.2.3 Occupational status of the mother and father

A study shows that government employed women are more likely to utilize PNC services compared to traders (1, 21). The higher tendency of PNC utilization by employed mothers might be due to mothers who are involved in paid employment are more likely to be economically independent and consequently have access to services, and utilize the services when they need or as recommended by their health workers (1). A similar result was revealed at a study conducted in Nepal (10). There are evidences which show that having a paid job empowers mothers to utilize maternal health services. In contrast, different studies conducted in Ethiopia didn't reveal an association between occupation and PNC utilization, but one study reveals that, among all regions the majority of mothers availing antenatal services are housewives (27). In contrast, a study done in Mizan Tepi shows that, With regard to influence of mother's occupation on postnatal care services, mothers who were housewives are less likely to attend postnatal care services compared to those who are merchants (20). This study also is in contrast with the study done in Nepal that shows housewives are 7.25 times (95% CI = 2.94–18.18) more likely to utilize PNC service than women whose occupation is farming (28).

2.2.4 Age of the Mother

A study done in Nepal shows that, the proportion of women attending postnatal care and immediate postnatal care services decreases with the increasing age of the women (29). Similarly, other study also shows that younger (aged less than 20years) and middle aged mothers (aged 20-34years) are more likely to seek pregnancy-related services from skilled attendants compared to mothers aged 34 and above years in Uganda (30) and also other study stated that, mothers who are in the age group of 25 and above at birth of the child (RR=0.76, CI=0.62-0.94) are less likely to utilize PNC than the mothers whose age group is 15-24 years (25) In contrast, some studies show that Adolescents have lower MHS utilization when compared to older women with the same background characteristics (31).

Inequalities by type of residence

The other major determinant of inequalities of MHS utilization in the previous studies is Residence (urban and rural). There is also a high disparity in service utilization between urban and rural areas for instance a study shows that, women who resided in the urban areas are more likely to utilize PNC than women resided in the rural areas (AOR = 3.7; 95%CI: 1.1, 13.2) (7, 20). Utilization of health care services by the rural population (9.5 percent), which is very low compared to 14 percent in urban areas, is lower than the national average (FMoH, 2014) (30).

2.3 Inequalities in utilization of PNC service by Knowledge of danger signs of Postpartum

Evidences showed knowledge of the mother can determine the utilization of PNC after delivery. for example, mothers who are aware of maternal complications that can occur during postpartum period 2.7times more likely to use postnatal care services than mothers who are not aware of maternal complications that can occur during postpartum period (AOR:2.72, 95%CI: 1.71 - 4.34) (21). Similar studies done in Ethiopia revealed that Awareness about postpartum danger signs are directly associated with PNC service utilization (1, 32). The mother's Postnatal care service utilization increase with the increased level of awareness of PNC danger signs of the mother 2.54 times (95% CI: 1.133–5.904, p-value<0.002) (25). Those mothers who faced birth related complication while giving birth also are 2.58times more likely to seek postnatal care services utilization than mothers who did not face any complication while giving birth (AOR: 2.58, 95% CI: 1.56, 4.28)(21).

2.4 Inequalities in utilization of postnatal care service by place of birth

Women who gave birth at home are limited in the use of postnatal care service. According to a study done in Ethiopia, there is a significant association between place of birth and utilization of postnatal care, women who gave birth at health facility are 0.65 times more likely to utilize PNC than women who deliver at home [AOR = 0.65, 95% CI (0.58, 0.94)](32) and also another study shows that, women who gave birth at health institutions were nearly three times (AOR=2.7, 95% CI: 1.1, 7.0) more likely to attend postnatal care services as compared to women who delivered at home (20). There are also similar studies done in India and Zambia revealed that postnatal care utilization is much higher in women who have facility births compared to women who have home birth. This implies that there is a higher disparity in postnatal care utilization in case of home birth compared to facility Birth (12, 21, 33). This study is similar with the study done in Ethiopia, Halaba kulito Town (1), and also done in Zambia (34). In the opposite of this, a study done in Tanzania reveals that, there is no association between place of birth and utilization of postnatal care, women who gave birth in the health facility were less likely to utilize PNC when compared to women who gave birth at home [for 1 PNC, aRRR = 0.41; 95 % CI 0.28–0.61; for at least 2 PNC, aRRR = 0.42, 95 % CI 0.26–0.67] (35).

2.5 Inequalities in utilization of postnatal care service by Media exposure

In the rural areas of Pakistan women who are exposed to mass media had 2.24 (p = .025, 95% [CI] ¼ [1.18, 4.51]) times more likely to use postpartum care than women who are not exposed to mass media (36). In Bangladesh, 53% (n = 10) of women who had some exposure to mass media used postpartum care compared with 4% (n = 14) who had no exposure to any mass media (37). Similarly another study shows that women who have mass media exposure at least twice a week are more likely to utilize MHS than those who have less exposure (7). This implies that exposure to any kind of Mass Media improves the utilization of Postnatal care among women. In contrast, a study reveals that there is no association between mass media exposure specifically listening radio and watching television programs with the utilization of postnatal care (26).

2.6 Inequalities in utilization of postnatal care service by Access and distance of health facility

Lack of access to health care services in rural areas due to inaccessibility of health facilities and professionals, lack of transportation services, and less access to infrastructures and services play a key role in maternal health (PNC) service inequality (12). Women who travel for two or more hours to get a health service are less likely to utilize PNC service than women who travelled less for the service (AOR=0.458; 95% CI: 0.231- 0.908) and also women who can had an access to transportation are more likely (AOR=2.655; 95% CI:1.322, 5.330) to attend PNC service than women who had no access to transportation (38).

2.7 Inequalities in utilization of postnatal care service by Information/advice from professionals

A study done in Ethiopia shows that mothers who got information/advise about early postnatal care services from health professionals were 5 times more likely to utilize early postnatal care than mothers who didn't get information/advice (AOR=5.049; 95% CI: 2.074, 12.289) (38). Information/advice given by the health providers have an influence on the mothers who gave birth at the health facility to utilize PNC. Accordingly, those women who got counseling and advice about postnatal care utilization had over thirty-two times [(AOR=32.6, 95% CI (14.7-72.3)] more likely to utilize postnatal care than those women who didn't get any advice from the health care providers during discharge (15, 18). The odds of having postnatal care visit for those women who were counseled about Postpartum danger signs by the health care providers during discharge were two times more likely to have PNC visit than those who didn't get information about the danger signs seen during postpartum period (AOR (1.95, 95% CI (1.05-3.64) (18).

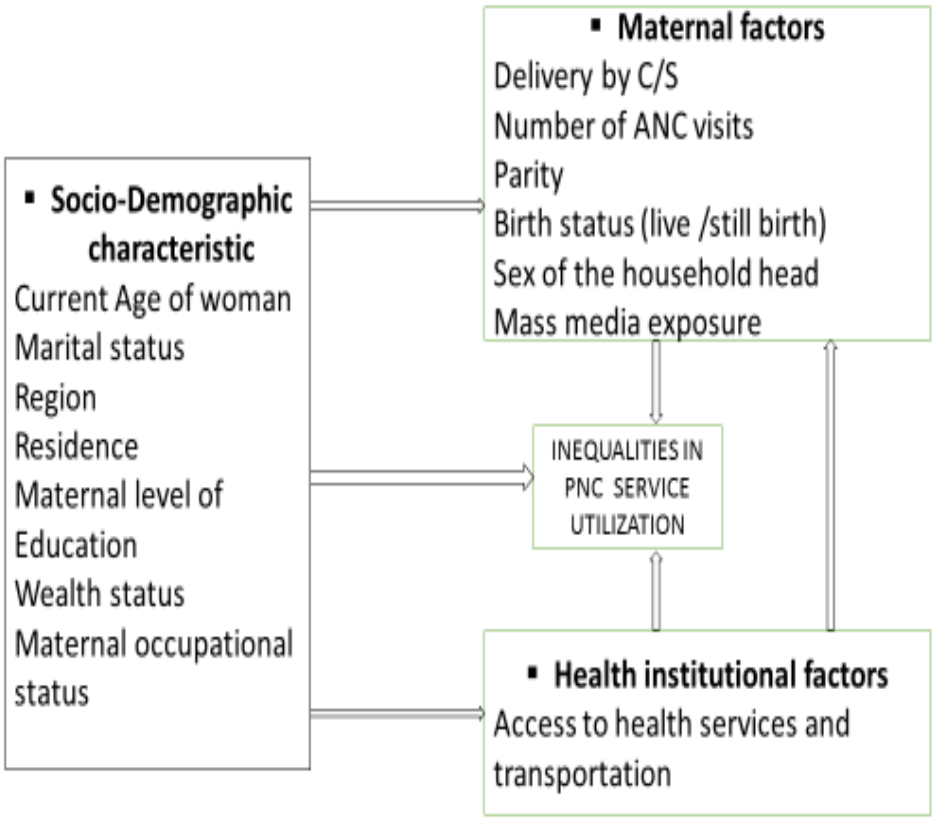
2.8 Inequalities in utilization of postnatal care service by exposure of ANC

According to a study, Mothers who had more frequent ANC visits are more likely to receive PNC services compared to women who had ANC visits less than two ANC, for 1 PNC visits, aRRR = 1.89, 95 % CI 1.23–2.90; for at least 2 PNC, aRRR = 1.65, 95 % CI 0.96–2.82, p = 0.068] (35). A study which was done in Ethiopia reveals that, Mothers who had three ANC visits are 4 times (AOR=4.29, 95% CI=1.59, 11.55) and who had four ANC visits are 9 times

(AOR=9.55, 95% CI =3.46, 26.36) more likely to utilize PNC services compared to mothers who had single ANC visit (1). Similarly, another study states that, Women who attend ANC follow up during their pregnancy are more likely to attend PNC than the women who have no ANC visit during their pregnancy (AOR=3.4; 95%CI= 2.8 - 4.1).

4. Conceptual framework

This conceptual framework is adopted from research literatures. There are several categories of independent variables: socio-demographic characteristics of mothers (age at recent birth, maternal level of education, current marital status, parity, place of residence, region, wealth quintile, maternal occupation); maternal factors (mass media exposure, number of ANC visits, birth order); institutional factors (accessibility of health services and transportation) and The dependent variable of the study is use of postnatal care within the first two days after delivery. Analysis of direct association between each independent variables and the dependent variable will be done.



• Figure 1. Conceptual framework for Postnatal care service utilization among reproductive women in Ethiopia adopted from research literatures.

4. Research questions

What is the status of inequality in postnatal care service utilization among reproductive women in Ethiopia?

What is the individual contribution of commonly studied determinant factors to the socio-economic inequality in uptake of postnatal care service in Ethiopia?

4.1. Research hypothesis

There is inequality in the uptake of postnatal care service utilization.

5. OBJECTIVES

5.1 General objective

To investigate inequalities and assess the determinant factors in postnatal care service utilization among reproductive women in Ethiopia using the 2016 Ethiopia demographic health survey data.

5.2 Specific objectives

To estimate the inequalities in postnatal care service utilization

To determine contribution of each determinant for the observed education and wealth status driven inequality in the uptake of postnatal care (PNC) service utilization.

6. METHODOLOGY

6.1 Study setting

Ethiopia makes up the horn of East Africa and is known to be the cradle of mankind and lately being promoted as the “Land of Origins. It shares borders with Eritrea to the north and northeast, Djibouti and Somalia to the east, Sudan and South Sudan to the west, and Kenya to the south, with over 102 million inhabitants. Ethiopia is the most populous landlocked country in the world and the second-most populous nation on the African continent. It occupies a total area of 1,100,000 square kilometers (420,000 sq. mi), and its capital and largest city is Addis Ababa. Ethiopia is the home for various ethnic groups and cultural diversity, with its population speaks more than 80 different languages. Nine regions and two City Administrations make up the country's federal administration. Economically, agricultural activities hold responsible for lion's share of the country's Gross Domestic Product, with 38.8% share (39).

6.2 study population

All Women with a live birth in the last two years preceding the survey in 2016.

6.3 Sampling procedure

EDHS was used the 2007 population and housing census conducted by CSA as a sampling frame for 2016 survey which was conducted by CSA. A total of 18,008 households were selected, of which 17076 were occupied. From the occupied households 16650 were successfully interviewed. From the interviewed households 16583 eligible women were identified for individual interviews. The interviews were completed with 15683 women yielding a response rate of 95%. After all the sample for this study was drawn from all live births within the last two years 4246 from 15683 women prior to the survey(17, 40).

Demographic and health surveys are considered as providing an important source of monitoring population health indicators and vital statistics in middle and low-income countries and known by its design, which are highly comparable among different settings and over time.

6.4 VARIABLES OF THE STUDY

6.4.1 Outcome Variables

The outcome variable in this study was postnatal care service utilization. Postnatal care is the care given to a mother and her child starting from the delivery of placenta up to six weeks (42 days) after delivery. It was coded as "yes" if the mother received PNC within the first two days after delivery; otherwise, it was coded as "no".

6.4.2 Explanatory Variables

The explanatory variables that were used in this study were women's occupation (not currently working or currently working), residence (urban or rural), level of education of the woman, woman's current age categorized in to three and (< 20years coded as 1, 20-34 coded as 2 and 35-49 coded as 3), current marital status, region, type of Residence, and wealth index. Wealth index is computed from a wide range of asset-based household characteristics such as car, television and radio refrigerator. Principal Component Analysis statistical procedure was used to produce wealth index. We used the wealth index variable already created by the EDHS. Educational status of the woman is categorized into four groups as (no education coded as 0, primary coded as 1, secondary coded as 2 and higher coded as 3). Marital status also categorized as- never married coded as 0, married coded as 1, divorced coded as 2, widowed coded as 3 and separated coded as 4 categories. Region of the mother is also grouped in to, Tigray coded as 1, Afar as 2, Amhara as 3, Oromiya as 4, Somalia as 5, Benshangul-Gumuz as 6, SNNP as 7, Gambela as 8, Harari as 9, Addis Ababa as10, and Dire-Dawa as 11.

From the maternal factors variables like: mass media exposure (magazine, radio, Tv), frequency of ANC visits, and birth order, use of internet; from the institutional factors: accessibility of health services and transportation.

6.5 Data analysis

6.5.1 Measurement of inequality

Analysis of inequalities was done using SPSS version 25, STATA version 14 and R version 3.5.3. A composite variable "wealth index" was used from the datasets for measuring the Living standard which is the most appropriate measure of socioeconomic inequalities than the direct measures of living standard (income, consumption)(41). Household information which is collected on the durable assets ownership: (radio, television, car, refrigerator, motor cycle and bicycle), the housing characteristics: number of rooms for sleeping and building material (wall, roof and flor) and access to utilities and infrastructure: supply of electricity, source of drinking water, sanitation facilities) were used to construct Wealth index(17).

Health Inequalities are different from health inequities which can be explained as observable differences of health between subgroups within the population. Health inequalities can be measured and monitored and they can serve as an indirect indicator of health inequity which is the normative concept (42, 43). There are complex and simple summary measures of inequality, in which some them are slope(D&R) some are complex (PAR & CI), some are absolute (PAR & D) and some are relative (CI & R). in this study measurement of inequalities was done by employing both the complex (concentration index, and the related concentration curve, and Population Attributable Risk (PAR)) and simple summary measures (Difference and Ratio)(43).

Concentration indices (CI): are the relative measures of inequality that indicate the extent to which the utilization of a health indicator (postnatal care utilization in this study) is concentrated among the disadvantaged or the advantaged(43).

The values of concentration index are calculated from relative concentration curve. Concentration curve graphs cumulative proportion of populations under investigation in x-axis, puts in order from the less advantaged to the most advantaged and cumulative percentage of health outcome or variable under caption (postnatal care utilization for this study) in the y-axis(44). Relative concentration index (CI) is assumed as twice the area between the plotted concentration curve and the 45degree line (line of equality). When there is no any disparity (if there is no inequality) in the health outcome variable of interest, then CI is just zero. If the concentration curve lies below the line of equality (the diagonal line), then CI becomes positive and health variable being studied is more concentrated among the most

advantaged subgroups. CI is negative when the curve lies above the diagonal line and indicates pro-poor dominancy of the variable of interest. Availability of different variants of concentration indices has made it very possible to widely apply the indices in most health care variables. Measurement property of a variable and a researcher's reply to inequality should be in the center stage during choice of the proper variant of concentration index (45, 46).

For variables with bounded upper limits, computation of inequality is cumbersome (45) and standard concentration index could not be used unless 'relative invariance' principle is given superior preference over other criteria (47). Types of variant of CI that used in a study are largely normative decision and we preferred standard concentration index which exhibits relative invariance criterion. Generalized Linear Model (GLM) with binomial function specified was fitted to predict log odds of PNC utilization. Regression coefficients were estimated for all explanatory variables that was go into the model. The overall concentration index of predicted PNC utilization was computed. Concentration index for predicted outcome is defined by the following formula:

$$CI = \frac{\sum_k (\beta k\, xk)\, ck}{\mu}$$

The formula explains that the predicted health outcome (PNC Utilization in this study) is a result of summation of contributions made by all explanatory variables under investigation (k variables). Determinants contribute to the overall CI through a combination of their concentration index (ck), regression coefficient (βk), mean (xk), and mean of health outcome (μ) which was predicted by these determinants. Weight variable already available in the DHS dataset was used for analyses. The 'decomp' package was used to do both concentration indices and decomposition analysis. 'Survey' package was used to create 'survey design object' to account for stratification and two-stage clustering pursued in the DHS methodology.

In the package, primary sampling unit (PSU) as cluster, household as secondary sampling unit and strata as stratifying variable were specified to create survey design object which was later called in the GLM to estimate regression coefficients, predicted concentration index of outcome variable and both concentration index and percentage contributions of all explanatory variables selected in the analysis. 'Strata' variable was created by combining

residence and region variables together. Cut-off point to declaring statistical significance was p-value = 0.05.

Since concentration index(CI) was computed for only ordered dimensions of inequality, the calculation of CI was confined to the two commonly used Socio Economic Status (SES) variables: education and wealth index(43).

The population attributable risk (PAR): is a complex summary measure of inequality that shows the potential for the improvement of the health indicator at the level of national average that could be achieved if all subgroups had the same level of health as a reference subgroup. For the calculation of PAR, the selection of the reference subgroup depends on the type of the health indicator (favorable vs adverse) and the characteristics of the dimension of inequality for which PAR is calculated.

For type of residence, urban is selected as the refers sub group without considering the health indicator type.

For dimensions of inequality with more than two subgroups that have a natural ordering, such as education the most advantaged subgroup regardless of the health indicator type.

For sex and dimensions of inequality with more than two subgroups that have no natural ordering, such as subnational region highest estimate subgroup is selected as the reference subgroup.

In this study Since PNC utilization is favorable health indicator, PAR is calculated as the difference between the reference subgroup and the national average of PNC utilization;

$$PAR = yref - \mu.$$

Where $yref$ is the reference subgroup and μ is national average

If there is no improvement that could be achieved, PAR takes zero and also takes a positive value for favorable health indicators whereas negative value for adverse health indicators. The higher the value of PAR indicates the higher inequality.

Simple summary measures namely ratio and difference were also used to make a pair-wise comparison between two sub-groups, which help to assess the inequality between two groups.

Ratio

Ratio is a simple summary measure of inequality that shows the relative inequality between two subgroups without considering their population share.

R is calculated as the ratio of two subgroups.

$$R = ymax / ymin$$

Where ymax refers to the most advantaged where as ymin refers to the most disadvantaged subgroups.

The selection of ymax and ymin depends on the type of the health indicator and the characteristic of the dimension of inequality.

For place of residence, ymax refers to urban if the health indicator is favorable, rural if it is adverse.

For sex, female is selected as ymax in case of favorable health indicator otherwise male is selected as ymax depending on the type of health indicatori.

For dimensions of inequality with more than two subgroups that have a natural ordering, such as education ymax = most advantaged subgroup in case of favorable health indicators, whereas in case of adverse health indicator type ymax is the most disadvantaged subgroup.

In cases of dimensions of inequality with more than two subgroups that have no natural ordering, such as subnational region, R is calculated as highest estimate divided by the lowest estimate without considering the type of health indicator.

If there is no inequality R takes the value 1 and R takes only positive value. The further the value of R the higher is the inequality.

Difference

Difference (D) is simple summary measure which shows an absolute measure of inequality. D is calculated as the difference between two subgroups. For dimensions with more than two subgroups with a natural ordering such as education, $ymax$ refers to the most advantaged subgroup and $ymin$ refers to the most disadvantaged subgroup for favorable health outcome indicator, whereas ymax refers to most disadvantaged subgroup and ymin refers to the most advantaged subgroup in the case of adverse health outcome indicators.

$$D = ymax - ymin$$

D takes zero if there is no inequality, and greater absolute values implies, higher level of inequalities. Positive values show the presence of higher coverage among the most

advantaged subgroup, whereas the negative value indicates coverage of PNC utilization is more concentrated among the most disadvantaged subgroup for favorable health outcome indicators, where the reverse is for adverse health outcome indicators.

Disaggregation of the data by the following different dimensions of inequality was carried out: wealth index, educational status of the woman, place of residence, region, current age of the woman, marital status and her occupation, birth order/parity. The broken-down of the PNC use by various dimensions of inequality could show us inequality in the use of the service.

6.6 Data Quality

All electronic data files for the 2016 EDHS were transferred via IFSS to the CSA central office in Addis Ababa, where they were stored on a password-protected computer. The data processing operation included secondary editing, which required resolution of computer-identified inconsistencies and coding of open ended questions; it also required generating a file for the list of children for whom a vaccination card was not seen by the interviewers and whose vaccination records had to be checked at health facilities. The data were processed by two individuals who took part in the main fieldwork training; they were supervised by two senior staff from CSA. Data editing was accomplished using CSPro software. During the duration of fieldwork, tables were generated to check various data quality parameters and specific feedback was given to the teams to improve performance. Secondary editing and data processing were initiated in January 2016 and completed in August 2016 (17).

6.7 Data Source and Ethical Issues

The dataset was accessed from the 2016 EDHS website upon registering to the website. The 2016 EDHS is the fourth Demographic Health survey conducted in Ethiopia (17). The sampling frame used for the 2016 EDHS was the frame of the 2007 Ethiopian population and housing census (PHC) (17). DHSs were nationally representative household surveys which have been undertaken at 5-yearly intervals in more than 60 countries, with a strong focus on indicators of MCH, reproductive health, fertility, nutrition, mortality, and self-reported health behaviors among adults and contain data on household characteristics than income or expenditure (48). All EDHSs were conducted using a similar approach in sample design, sample selection, and survey methodology (each round survey methodology is stated in the respective reports) and they are ethically approved.

Definition of terms

Post-natal care:

Refers to the care provided to the mother and her baby starting from the time of delivery up to the end of 48 hours (two days) after delivery(18).

Utilization of services:

Use of post-natal service such as counseling on the physiological processes of recovery after birth, immunizing the infant, family planning and other services by women till six months after the delivery of the baby(9, 18).

Inequality in PNC:

It is an avoidable disparity in the use of PNC across sub-population(43).

Wealth index:

It is a composite measure of a household's cumulative living standard (17).

Results

Demographic and socio-economic characteristics of the respondents

About 15,683 women of reproductive age group who were taken from the nine regions and two administrative states, (Addis Ababa city administration and Dire Dawa city council) were included in the 2016 EDHS. Out of them, 12,201 (77.8%) resided in the rural part of the country. The proportion of the respondents residing in the rural areas was ranged from 28% in Dire Dawa to 87% in SNNP Region. Majority of the respondents were from the Oromia region and were followed by the Amhara and SNNP Regions. About 46.3% of the women comprise those in the middle age group (20-34) and the mean age was 27.9 (SD ±9.2). Majority of the women were Married, not formally educated, and not currently working. During the survey year, about 29.8% of the respondents had six or more births which implies higher fertility. When we see the proportion of the women by their religion, Orthodox Christian participants (43.5%) were more than those of Muslim (31.4%) and others (25.1%) in the study population. Majority (66.6%) of the women also have no exposure of mass media. The uptake of PNC among women in Ethiopia in 2016 is described by the table below.

Table 1: Uptake of women's PNC service by their demographic and socio-economic characteristics in Ethiopia by survey year 2016

Characteristics	**Category**	**Percentage of PNC utilization within the first 2days after birth**
		N (%)
Age	<20	554 (1.5)
	20-34	2846 (11.5)
	35-49	845 (2.8)
Marital status	Never married	31 (0.3)
	Married	3994 (14.8)
	Living together	48.9 (0.1)
	Widowed	30.6 (0.1)
	Divorced	85 (0.4)
	Separated	56.2 (0.2)
Parity	1	869 (4.1)
	2-3	1305 (5.8)
	4-5	931 (3.3)
	6+	1142 (2.6)
Frequency of ANC visit	No visits	1492 (1.1)
	One visit	203 (0.3)

	2-3 visit	1132 (4.2)
	4+ visits	1419 (10.1)
Residence	Urban	513 (5.4)
	Rural	373 (10.4)
Region	Tigray	309 (3.2)
	Afar	42 (0.1)
	Amhara	778 (3.3)
	Oromia	1893 (3.8)
	Somali	177 (0.5)
	Benishangul	44 (0.1)
	SNNP	855 (3.0)
	Gambela	10 (0.0)
	Harari	10 (0.1)
	Addis Ababa	108 (1.4)
	Dire Dawa	19 (0.1)
Maternal educational status	No education	2566 (6.0)
	Primary	1302 (6.1)
	Secondary	259 (2.1)
	Higher	118 (1.5)
Maternal occupational status	Not currently working	3204 (10.6)
	Currently working	1041 (5.2)
Wealth status	Poorest	994 (1.6)
	Poorer	926 (2.3)
	Middle	881 (2.6)
	Richer	788 (2.6)
	Richest	657 (6.6)
Mass media exposure	No	5418 (9.4)
	Yes	2171 (6.4)

Table 2: Uptake of PNC service utilization among the women by current age of their child in the year 2016 survey

Current age of the child	PNC utilization within first 2days
	N (%)
0-6 month	1426 (5.7)
7-12 month	1118 (4.5)
1-2 years	1702 (5.6)
Sum total	4246 (15.8)

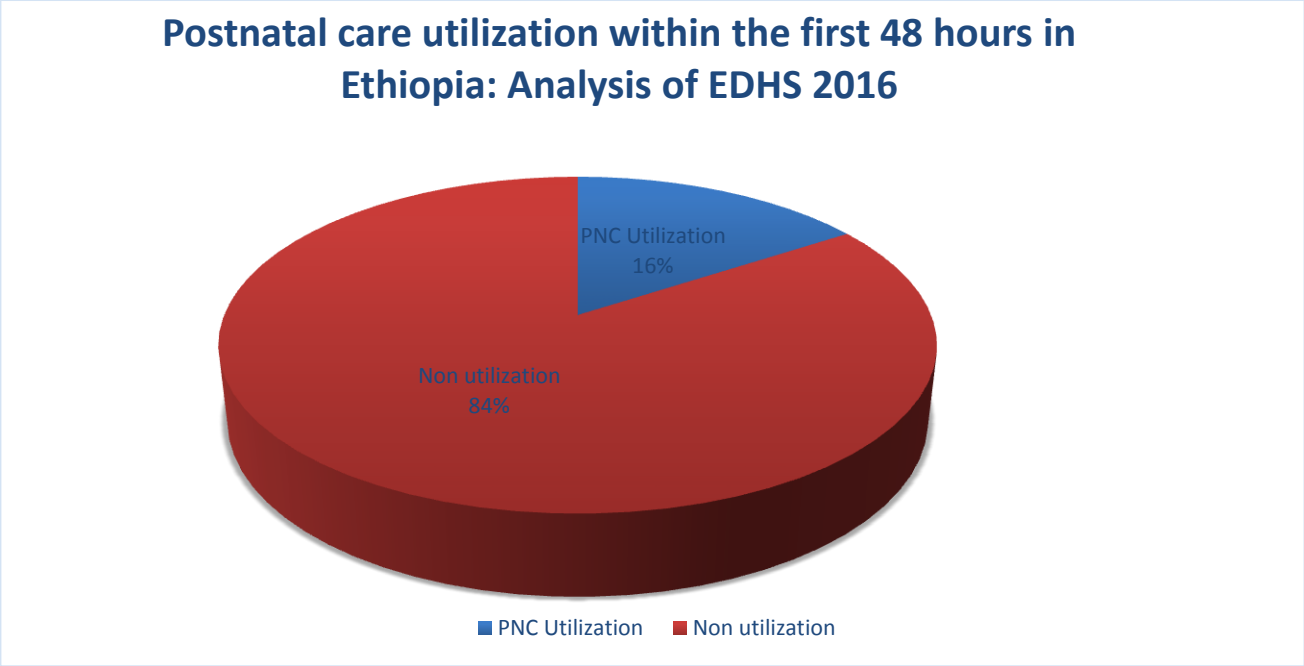


Figure 1: Utilization of postnatal care within the first two days after delivery by the women of reproductive age groups in Ethiopia in 2016 EDHS.

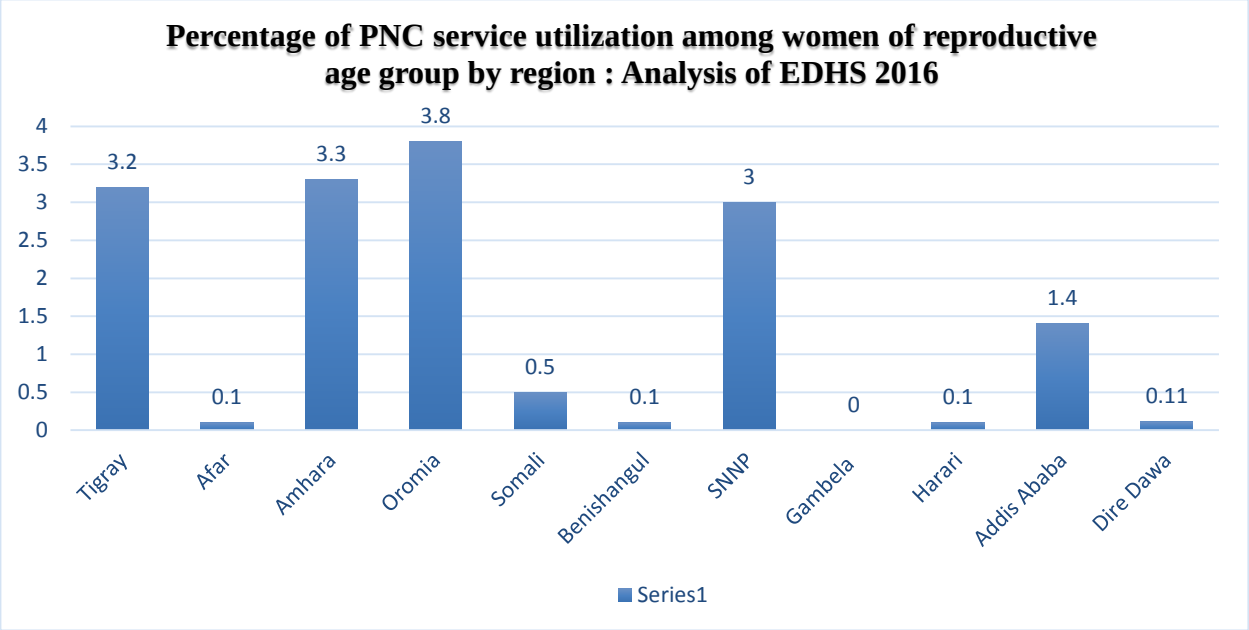


Figure 2: Postnatal care utilization among women of reproductive age group in Ethiopia in 2016

The table below shows the concentration indies of PNC service utilization by the two common socioeconomic factors

Table 3: Concentration indices of the main variables of socioeconomic status

Index:	**No. of obs.**	**Index value**	**Standard error**	**p-value**
Erreygers N CI for wealth status	4027	0.20893864	0.01925007	0.0000
Erreygers N CI for Educational status	4027	0.166113	0.01880161	0.0000

Concentration indies for educational and wealth status of the women

Inequalities for the one of the critical indicators of maternal health care services were measured by using the two complex summary measures: concentration index(CI), concentration curve (C) and population attributable Risk. The concentration index of inequality shows a positive value which indicates that utilization of PNC is concentrated

among the most Advantaged subgroups. The better the women's socioeconomic status was the higher PNC services were utilized. The concentration index of inequality in the analysis proved that the existence of the inequality in the utilization of PNC. For the indicator of maternal health service (PNC utilization), the concentration index was (0.209) with a statistical significance of p-value (0.0000), which implies that women among the better-off groups were more advantageous in the uptake of Postnatal care service utilization than the women among the most disadvantaged subgroups.

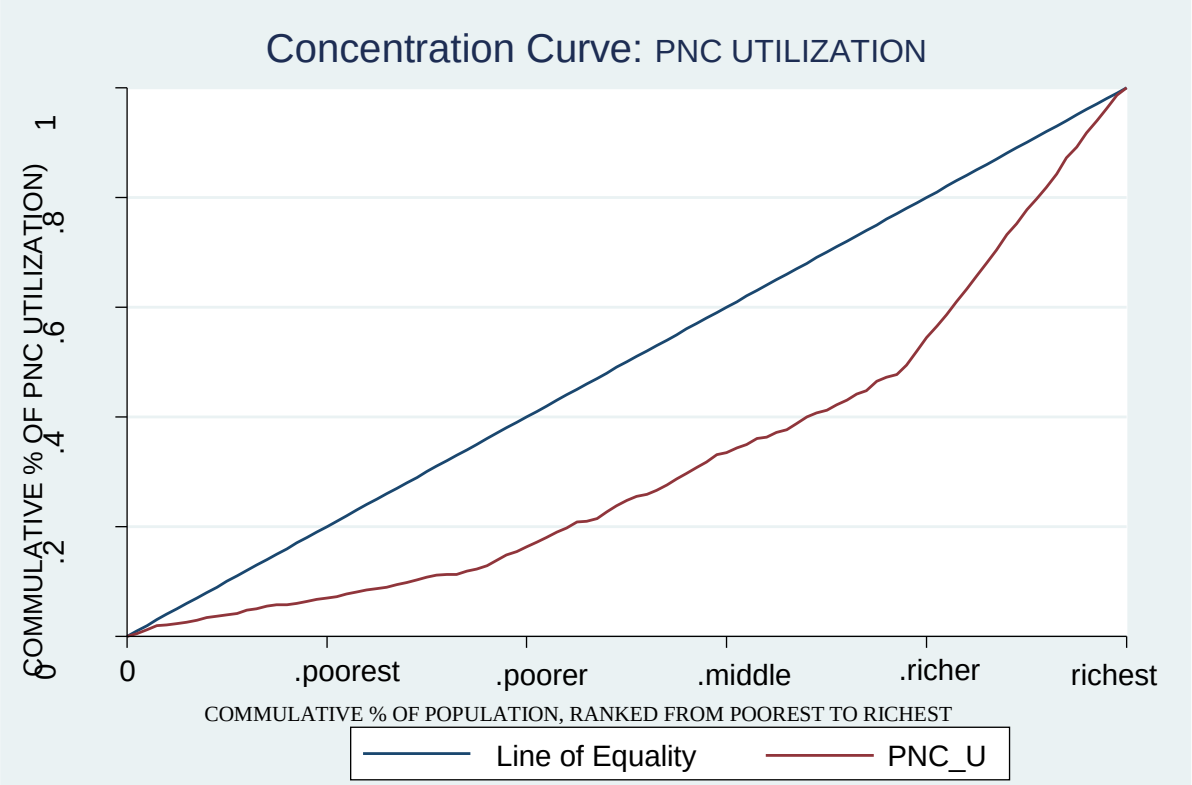


Fig 3: PNC service utilization among women of reproductive age group in Ethiopia

The figure above shows the concentration curve for Postnatal care service utilization variable

The concentration curve lies below the line of equality indicating that, postnatal care service utilization was concentrated among the better-off women than the most disadvantaged women**.**

The education based concentration index for PNC utilization was (0.166) with a statistical significance of p-value (0.0000) which implies that educated women were more advantageous in utilizing postnatal care services compared to their non-educated counterparts.

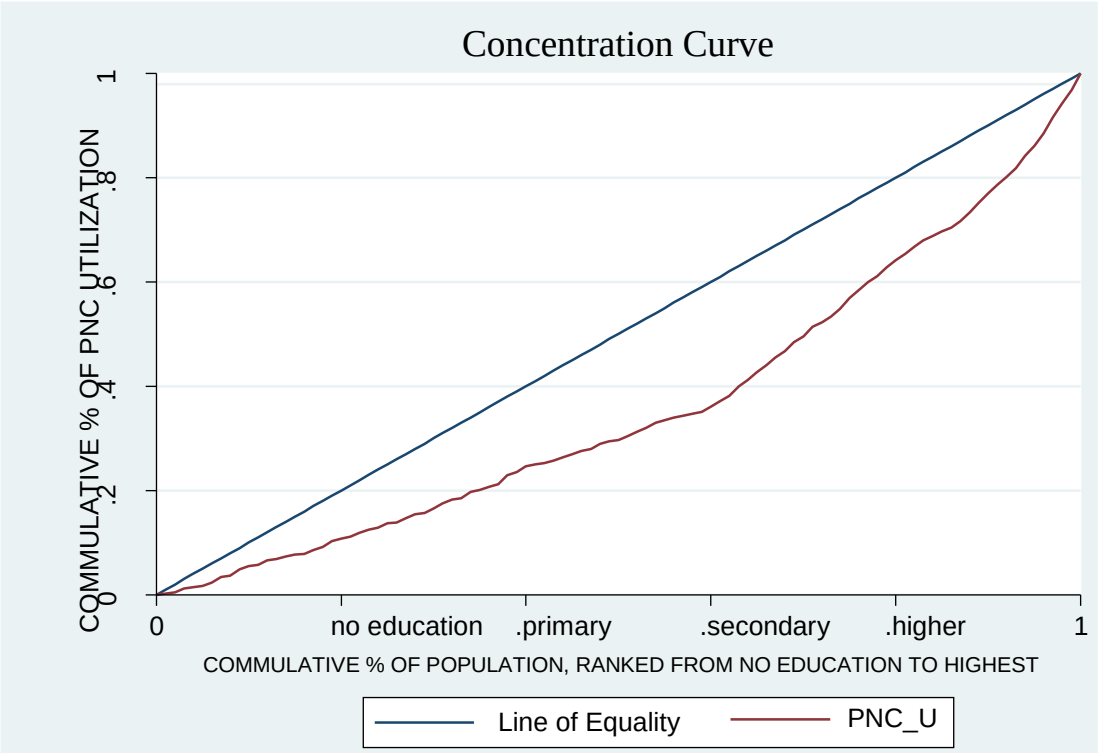


Fig 4: PNC service utilization among women of reproductive age group in Ethiopia

The figure shows concentration curve for Postnatal care service utilization. The concentration curve lies below the line of equality indicating that, postnatal care service utilization was concentrated among the higher educated women than the non-educated women.

Population Attributable Risk (PAR)

The analysis of PAR shows the potential for the improvement of the PNC utilization at the national level if all women could utilize the service regarding their socioeconomic status. The employed PAR reveals, women who had a follow up of ANC during their pregnancy were more likely to utilize PNC services after birth. If all Women with no ANC visit had at least one ANC visit, the national average of PNC service utilization was improved by 3.8% with (0.026, 0.036) CI. And also the proportion of PNC utilization at the national level was increased by 10.2% CI (0.086, 0.118) if all women had at least two to three ANC visits. In addition to this result, if all women could have the same level of ANC follow up (4+vists) as recommended by WHO, the average PNC service utilization coverage at the national level was improved by 22.7% with the confidence interval of (0.18, 0.27).

Women among the worse-off group were less pronounced (10.8%) in utilizing PNC when Compared to the better-off women 12.2%, if all women among the worse-off group, could access the service like the better-off women the proportion of the national average PNC service utilization was improved at least by 1.4% with a 95% CI of (0.0047, 0.0224). If the accessibility of internet coverage among the women in Ethiopia was improved and all women had the access to use internet at least within the last 12 months, the average national coverage of PNC utilization was improved by 12% with (0.021, 0.223) CI. In addition to this the average national coverage of PNC service utilization was improved by 20% with (0.022, 0.373) CI if all women were used internet before the last 12 months. In fact, most of the mothers didn't have the hobby to use, internet access is one of the necessities to get health information in the mother's life.

Regarding to mode of delivery, about 59% of the women who gave birth by C-Section were more likely to utilize PNC services than the women who didn't gave birth by CS or gave birth by SVD. If all women gave birth by C-Section, the average national coverage of PNC service utilization within the first two days was increased by 47% with a CI of (0.326, 0.592).

The existence of area based inequality in PNC utilization also found in our study. For instance, the proportion of the women's PNC utilization living in Oromia region was 16.3%, whereas in Gambela region it was 12.0%, if all women had the accessibility of PNC services and could utilize it, just like Oromia region, the average national coverage of PNC service utilization was increased by 4.3% than the women in Gambela with confidence limit of (0.0214, 0.0642). The result of PAR in terms of each determinant factors are more described by the table below.

Table 4: Estimation of population attributable risk of PNC utilization in Ethiopia in 2016

	Coefficient	**Standard error**	**|z| p-value**	**95% CI**
Wealth status				
Ref. most adv	0.014	0.005	0.003	0.005, 0.022
Education				
Ref. most adv	0.022	0.014	0.108	-0.005, 0.048
Region				
Ref. higher estimates	0.043	0.011	0.000	0.021, 0.064
Residence				

Ref. urban	-0.046	0.048	0.340	-0.141, 0.049
Occupation				
Ref.currentlyworking	0.051	0.017	0.759	-0.027, 0,038
Current age				
Ref. <20	0.008	0.016	0.614	-0.023, 0.039
Marital status				
Ref. married	-0.004	0.011	0.683	-0.025, 0.016
Caesarian birth				
Ref. no	0.482	0.126	0.000	0.235, 0.729
head of Household				
ref. female	0.007	0.020	0.739	-0.033, 0.046
Birth status				
Ref. live birth	-0.054	0.045	0.234	-0.142, 0.035
Use of internet				
Ref. int. users	0.075	0.036	0.037	0.005, 0.146
Parity				
Ref. BO 1	0.007	0.009	0.446	-0.011, 0.024
Accessibility of service& transport				
Ref. no prob	0.010	0.024	0.691	-0.038, 0.057

Determinants of postnatal care utilization using simple summary measures

The multivariable logistic regression model revealed that, region, use of internet, wealth status and frequency of ANC visits of the women during their pregnancy were significantly associated with the utilization of Postnatal care.

After the model was fitted, we employed the absolute and relative measures to measure inequalities in utilization of Postnatal care services by the selected determinant factors. we used formula for ratio (R=ymax/ymin) and difference (D = ymax - ymin) by using the adjrr command in Stata(49).

The Adjusted Ratio of PNC service utilization among women using internet before the last 12 months was 52.8% times lower (aR = 0.5277 & 95% CI (0.3704, 0.7519)) than the PNC

services utilization of those women who never used internet and this was statistically significant. The utilization of PNC services among those women who were using internet before the last 12 months were 20.6% (aD = -0.2061 & 95% CI (-0.4200, 0.0078) percentage points lower than the women who were never used internet.

Regarding to the women's region, those women living in Oromia were 68% points more likely (aR = 1.6820 & 95% CI (1.2720, 2.2241)) to utilize PNC services than the women in gambela region. In terms of the absolute difference; in Gambela region, women were 8.2% (aD = 0.0822 & 95% CI (0.0365, 0.1279)) percentage points less often to utilize PNC within the first 48hrs than the women living in Oromia region.

Women who had 4+ ANC visits during their pregnancy had 70% points higher utilization rate of PNC services (aR = 4.7011 & 95% CI (3.1149, 7.0948)) than the women who had no ANC visits. Those women who had no ANC visits were 19.8% (aD = 0.1978 & 95% CI (0.1547, 0.2408) percentage points lower utilization rate of the service than the women with 4+ ANC visit.

Women among the most advantaged subgroups were 57% times more likely to utilize PNC services within the first two days after delivery (aR = 1.5655 95% CI (1.0402, 2.3560)) than the women among the most disadvantaged subgroups. Those women among the disadvantaged subgroups were 6.9% (D = 0.0690, 95% CI (0.0074, 0.1306)) percentage points less often to utilize PNC services within the first two days after birth than the advantaged groups.

Women who deliver by C-Section were at least 4 times more likely to utilize PNC services (aR = 4.0848, 95% CI (2.8533, 5.8478) than the women who hadn't birth by C-Section. Utilization of PNC services among women who gave birth by C-Section was 44.8% (aD = -0.4479 & 95% CI (-0.6456, -0.2502) percentage points higher than the utilization of PNC among women who gave birth spontaneously (SVD). The table below shows the estimated value of the selected variables. The table below describes the results of summary measures: Ratio and difference.

Table 5: Measurement of inequalities in PNC service utilization by the maternal background

Determinant factors	Estimated value	95% CI
Wealth status		
Ratio		
richest/poorest	1.5655	1.0402, 2.3560
Difference		
Richest-poorest	0.0690	0.0074, 0.1306
Use of Internet		
Ratio		
Non users/users	0.5277	0.3704, 0.7519
Difference		
users- non users	-0.2061	-0.4200, 0.0078
Freq. of ANC visit		
Ratio		
4+ ANC visits/no ANC	4.7011	3.1149, 7.0948
Difference		
4+ ANC visits-no ANC	0.1978	0.1547, 0.2408
Region		
Ratios		
Highest/lowest	1.3550	1.1469, 1.6009
Difference		
Highest-lowest	0.0428	0.0211, 0.0644
C-Section		
Ratio		
SVD/C-section	4.0848	2.8533, 5.8478
Difference		
SVD-C-section	-0.4479	-0.6456, -0.2502
Parity		
Ratio		
BON1/BON6+	0.8731	0.6015, 1.2672
Difference		
BON1-BON6+	-0.0216	-0.0817, 0.0386

Age		
Ratio		
35-49/(<20)	1.1128	0.7111, 1.7414
Difference		
35-49 – (<20)	0.0168	-0.0531, 0.0867
Residence		
Ratio		
Urban /rural	0.7939	0.5367, 1.1743
Difference		
Urban – rural	-0.0390	-0.1096, 0.0316
Education		
Ratio		
Higher /lower	1.4895	0.9427, 2.3535
Difference		
Higher –lower	0.0806	-0.0360, 0.1971
Head of the household		
Ratio		
Femal/male	1.0438	0.8068, 1.3504
Difference		
Femal-male	0.0069	-0.0351, 0.0488
Accessibility of the service		
Ratio		
No problem/big problem	0.8838	0.4789, 1.6311
Difference		
No problem-big problem	-0.0209	-0.1314, 0.0897
Occupation		
Ratio		
Working/not working	1.0325	0.8433, 1.2642
Difference		
Working-not working	0.0051	-0.0274, 0.0375
Birth status		
Ratio		

Live birth/stillbirth	0.7454	0.4869, 1.1412
Difference		
Live birth-stillbirth	-0.0534	-0.1412, 0.0344
Marital status		
Ratio		
Married/never married	1.1473	0.5946, 2.2140
Difference		
Married-never married	0.0203	-0.0710, 0.1117

Decomposition of the concentration indices

The decomposition analysis shows how far health inequalities can be explained by wealth related inequalities rather than non-wealth related inequalities and as how each determinant factors contribute to the socioeconomic related inequalities of PNC service utilization in Ethiopia using the recent EDHS data. In this study we decomposed the selected variables to explore the contribution of each variable in the observed inequalities found. The predominant contributor of inequalities in PNC service utilization (within the first two days) inequalities were wealth status which contributes positively (40%), followed by 4+ visits of ANC (30%), C-S delivery (9%), being in Region (Somali 3.6%). In addition to this, use of internet in the last 12 months (1.6%) was out of the major contributors of inequality which was statistically significant. Table 6 shows the results of decomposition analysis of the PNC utilization.

Table 6: Decomposition of Postnatal care service utilization concentration indices: Ethiopia 2016

Variables	**Contribution%**	**Concentration index**	**95% confidence interval**	
			Lower boundary	**Upper boundary**
Wealth	40.4	0.28	0.26	0.29
Education	7.6	0.33		
Rural residence				
(ref) urban	1.6	-0.10	0.30	0.36
Region (ref Tigray)				

Afar	1.3	-0.44	-0.98	0.09
Amhara	-1.3	0.03	-0.01	0.06
Oromo	0.35	-0.00	-0.03	0.024
Somalia	3.7	-0.45	-0.63	-0.28
Benishangul	0.6	-0.18	-0.62	0.27
SNNP	0.83	-0.01	-0.05	0.02
Gambela	0.05	-0.06	-2.51	2.39
Harari	-0.07	0.27	-1.52	2.07
Addis Ababa	-5.4	0.83	0.81	0.85
Dire-dawa	-0.26	0.22	-0.94	1.38
head of hh (ref.Male)				
Female	0.0023	0.01	-0.06	0.07
Reading magazine (ref. not at all)				
< Once a week	-2.34	0.48	0.41	0.55
At least once a week	-1.144	0.49	0.35	0.63
Listening to radio (ref. not at all)				
< Once a week	1.5	0.19	0.14	0.23
At least once a week	6.4	0.42	0.38	0.46
Watching Tv (ref. not at all)				
< Once a week	1.27	0.24	0.18	0.29
At least once a week	4.2	0.78	0.76	0.81
Use of internet (ref. never use)				
Within last12 month	1.67 0.15	0.72 0.53	0.62 0.38	0.82 0.68

Before last 12 month				
Delivery by CS (Ref. No)	9.0	0.54	0.44	0.64
Freq. of ANC visit (ref. No ANC)				
1	-0.86	-0.14	-0.23	-0.04
2-3	0.62	0.01	-0.02	0.04
4+	30.4	0.23	0.20	0.26
Marital status (ref. never married)				
Married	-0.38	0.08	-0.10	0.25
Divorced	0.23	-0.26	-0.53	0.02
Widowed	0.19	-0.06	-0.22	0.10
Separated	0.18	-0.09	-0.25	0.07
Not currently working	0.81	0.13	0.095	0.17
Party (ref. one birth)				
2-3	0.7	0.05	0.017	0.08
4-5	-1.58	-0.07	-0.11	-0.04
6+	-1.06	-0.08	-0.11	-0.06
Current age (ref. <20yrs)				
20-34	0.47	0.03	0.017	0.04
35-49	-0.07	-0.03	-0.06	0.008

Discussion

This study aimed to investigate inequalities and determine the contribution of the common determinant factors to the observed inequality in PNC service utilization within the first 48 hours after birth. To do so, we employed both complex and simple summary measures of inequality using the fourth round of the EDHS data. The present study found that the use of PNC services was disproportionately highly concentrated among the economically better-off and highly educated women. In terms of place of residence, use of PNC was dominated the rural women, the highest and the lowest PNC utilization was observed in Oromia and gambela region respectively. We also decomposed the socioeconomic inequalities to obtain the individual influence of the commonly known factors on the inequality with at least four ANC visit, caesarian birth, use of internet, and region of the women had a significant influence.

According to the complex measures, the estimated concentration indies for PNC utilization were positive for both socioeconomic factors wealth and education this means, the concentration of PNC services is highly concentrated among the better-offs and highly educated women. This implies that there is unfair distribution of PNC services between the most advantaged and disadvantaged women favoring the most advantaged group and this result is in line with other study in Ethiopia(7). This inequality may be due to the reason that highly educated and better off women have high probability to be informed about postnatal care services, postpartum danger signs and may also have the demand to access the care(50-52). Furthermore, based on the other complex measure of inequality PAR, wealth status, caesarian birth, use of internet and women's region are the dominant contributors of inequality in PNC service utilization.

The employed simple summary measures ratio and difference also show a similar result as the above complex summary measures. Compared to the women with no ANC visit, the women with at least four ANC visits as recommended by WHO were more pronounced in utilizing PNC services (53). This may be due to the adequate counseling during their ANC attendance and may also be they were more educated(50, 51). The higher utilization found among the ANC users implies that, as the number of ANC visits increased to at least four visit potentially the awareness of the mother on early detection and treatment and also prevention of maternal complications created during each visits of ANC also be highly promoted (52).

The simple summary measures also reveal, women who have caesarian birth are more advantageous in accessing PNC services than the women who have birth by spontaneous vaginal delivery(21). This may be due to the reason that the women with caesarian birth stay in the facility for a prolonged period of time after the procedure, this condition facilitates the interaction between the mother and the health provider so that the mother will have a better opportunity to have the appropriate PNC services on the exact time. The findings this study is in contrast with a study done in postnatal care utilization in India(12).

Regarding to area based inequality, utilization of PNC services in Oromia is higher when compared to utilization of PNC among those women in gambela region. The observed area based inequality in the uptake of PNC services were favoring Oromia region than the other regions. This may be due to the Problem in the accessibility of the service and health providers or the services such as laboratory, delivery procedure were costly, and also in some areas the big problem is transportation.

To give some explanation about the Positive and negative CI= the Positive CI contribute in the inequalities in PNC services by widening the observed inequalities and the negative CI contribute in inequalities by shrinking the gap of the inequalities. The result of decomposition analysis during the survey year reveals that wealth status is an important positive contributor to the concentration indies of the PNC utilization. This means wealth inequality makes the utilization more concentrated among the better off women. furthermore, inequality in 4+ ANC visits, Caesarian birth, use of internet and region also important positive contributing factors to the concentration index of PNC utilization among all variables in the logistic regression. These positive contributors make the concentration indies among the better off women. This implies that, access to internet, caesarian birth and at least four ANC visits make PNC utilization concentrated among the better-off women within the critical hours. This may be due to the reason that, the worse off women may not have the money to access the service, stay in the facility and transportation or may be due to the women are not educated(7). It is essential to understand that reducing wealth inequalities in the absence of other interventions cannot be an effective tool to reduce inequality in the utilization of PNC services. It is need to overcome other determinants, such as education, ANC follow up, use of internet. The observed wealth related inequality in PNC utilization favoring the most advantaged women

over the study period indicates that there was inadequate implementation of the existing strategies to address inequalities(41).

Strength and limitation

Strength of the study

We used the most recent and nationally representative data source. The data were collected by highly qualified and trained interviewers using a standardized data collection procedure.

We used mix of simple and complex summary measures were used to improve quality of the evidence

Limitation

The study suffered some limitations Since the information were obtained through the mother's recall in the EDHS data, there might be a recall bias

The study ignores to investigate the inequalities in new borne PNC checks and also the contribution of paternal factors to the observed inequalities in maternal PNC utilization.

The decomposition only provides the statistical explanation and the results may not necessarily be a good guide to policy makers.

Wealth index cannot show the current wealth status of the household for instance, if the household destroyed accidentally or have a chance of lottery that can change its status, the current wealth status of the household will be changed.

Conclusion

There is a significant pro-rich and pro-educated inequality in Postnatal care utilization in Ethiopia. Maternal wealth status, level of Education, frequency of ANC visits, use of internet, Region and C-Section delivery were significantly contributing a large share in the wealth based inequalities in PNC services utilization within those critical hours after birth.

Recommendation

For the Government and stakeholders- should monitor the implementation of the strategies in the utilization of PNC services and encourage women's education to have better level to promote their awareness on PNC utilization to prevent and treat postpartum complications. In addition to this, ANC follow up should be strengthen as recommended by WHO to make them well-informed about PNC services especially for the most disadvantaged groups.

For Researchers - it is advisable to conduct further study on inequalities in PNC utilization among the new borne babies and also the contribution of the paternal factors to the inequalities in PNC utilization to provide a guide for policy makers.

For Policy makers-the strategies on PNC utilization should focus on the key population subgroups such as: poorest, not educated, women around Gambella, and with no ANC follow up.

REFERENCES

1. Teshome A, j. D. Postnatal care utilization and associated factors among women of reproductive age Group in Halaba Kulito Town, Southern Ethiopia. BMC. 2018;76:9.
2. Integrative Review of Factors That Affect the Use of Postpartum care Services in Developing Countries [press release]. Elsevier2018.
3. Sanni Y, Olalekan U, Agbessi A, E M, B. G. Inequalities in maternal health care utilization in Benin: a population based cross-sectional study. BMC. 2018;18:9.
4. Tanvir H, H A, D M. Examining horizontal inequity and social determinants of inequality in facility delivery services in three South Asian countries. Journal of Social ScienceMed 2017(2047.2986).
5. UNFPA. The Maternal Health Thematic Fund towards Equality in Access, Quality of Care and Accountability. New Yorlk: ISGlobal Maternal Health Thematic Fund, 2017.
6. Clara Pones D, Andrew D , Ambar N , Anna L, M. C. Inequalities in women's and girls' health opportunities and outcomes. USA: Barcelona Institute for Global Health, 2016.
7. Emebet G, Alemayehu W, Fawole B. Inequities in maternal health services utilization in Ethiopia 2000–2016: magnitude, trends, and determinants BMC. 2018;15:119.
8. Alemayehu L, T. D. Maternal and Perinatal Health in Ethiopia Journal of Biotechnology and Biosafety 2015;3(2):191-6.
9. WHO. Recommendations on Maternal Health. Geneva: World Health Organization; 2017.
10. Vishnu K, Mandira A, Rajendra K, G. T. Factors associated with the utilisation of postnatal care services among the mothers of Nepal. BioMed Central. 2014;14:19.
11. Etienne V, Malgorzata M, Daniela Z, Igor K, V. M. Protocol for a systematic review on inequalities in postnatal care services utilization in low- and middle-income countries. BioMed Central. 2013;2(1):55.
12. Abhishek S, Sabu P, Udaya M, Saseendran P, J F, Z. M. Socio-Economic Inequalities in the Use of Postnatal Care in India. Plosoneorg. 2012;7(5).
13. Ruhul A, Nirali M, B. S. Socioeconomic factors differentiating maternal and child health-seeking behavior in rural Bangladesh. BioMed Central. 2010;9(1):9.
14. Health FDRoEMo. state of inequality In Ethiopian Health Sector A.A: Federal Ministry of Health, 2016/17.
15. Mohammed A , Wintana T, Tewodros M , N S. Prevalence and Determinants of Complete Postnatal Care Service Utilization in Northern Shoa, Ethiopia. Journal of pregnancy. 2018;2018:7.
16. Robel Y, Mitike M, Lynn S, G/mariam. A. Perinatal Mortality Magnitude, Determinants and Causes in West Gojam Addis Ababa, Ethiopia: AAU; 2016 [cited 2018 23 Aug].
17. International I. Ethiopia Demographic Health Survey. Calverton: Central statistical Agency and ICF, 2016.
18. Senait B, Yeshi A, G B. Prevalence of Postnatal Care Utilization and Associated Factors among Women Who Gave Birth and Attending Immunization Clinic in Selected Government Health Centers in Addis Ababa, Ethiopia. Jornal of Health, and Medicine and Nursing. 2016;26(2422 - 8419).
19. Tanja H, Carine R, Oona C, K. A. Huge poor–rich inequalities in maternity care: an international comparative study of maternity and child care in developing countries. Bulletin of World Health Organization. 2007.
20. Teklemariam Y, T. W. Postnatal Care Utilization and Its Determinants in Loma District, Southwest Ethiopia. Journal of women's Health and Gyneacology. 2018;5:103.

21. Miteku L, Zerfu E, D. B. Postnatal Care Service Utilization and Associated Factors among Women Who Gave Birth in the Last 12 Months prior to the Study in Debre Markos Town, Northwestern Ethiopia. International Journal of Reproductive Medicine. 2016;2016:7.
22. Frew B, Elias Y, W. M. Inequities in utilization of reproductive and maternal health service in Ethiopia. International Journal for Equity in Health. 2017;16:105.
23. Regassa N. Antenatal and postnatal care service utilization in southern Ethiopia; a population-based study. African Health Science. 2011;11(3):390-7.
24. Oluwaseyi D S, I. L. Determinants of postnatal care non-utilization among women in Nigeria BMC. 2016;9(21):11.
25. Paudel D , Baburao N, B. M. Determinants of postnatal maternity care service utilization in rural Belgaum of Karnataka, India: A community based cross-sectional study. international Journal of Medicine and Public health. 2014;4(1).
26. Shegaw M, Leslie S, Vincentas G. Determinants of Maternal Health Service Utilization in Ethiopia; analysis of 2011 Ethiopia Demographic Health surveys Data. BMC. 2014;14:161.
27. Neelima S, Satyendra P, Venkata U, Shankar D , S. R. Determinants of utilization of antenatal and postnatal care services in Telangana International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017;6(8):3352-61.
28. Sulochana Dhakal, Glyn N Chamal, al PPSe. Utilisation of postnatal care among rural women in Nepal. BMC. 2007;7(19):9.
29. Chiranjivi A, Rajesh K, Purnima T, Renuka O, Deepika G, Ashmita G. Proportion and factors affecting for post-natal care utilization in developing countries: A systematic review JMMIHS. 2016;2(0):15791.
30. Mugure N. utilization of post natal care services in kiambaa sub-county kiambu county. In: university ksojkph, editor. Kenya2015.
31. Banke-thomas O , Banke-thomas A, C. A. Factors influencing utilisation of maternal health services by adolescent mothers in Low-and middle-income countries. BioMed Central Pregnancy and child birth. 2017;17:65.
32. Banchalem A, Efrata T, B. F. Determinants of postnatal care utilization in urban community among women in Debre Birhan Town, Northern Shewa, Ethiopia. BMC. 2018;37:10.
33. Internation I. Ethiopia Demographic Health survey. Calverton: Central Statistical Agency and ICF International, 2011.
34. Choolwe J, Mosa M, Sitali M, Nildah L, M. C. Predictors of Antenatal Care, Skilled Birth Attendance, and Postnatal Care Utilization among the Remote and Poorest Rural Communities of Zambia. Original Research Article. 2017.
35. Almamy M. K, Christine E. C, L AM. Factors associated with compliance with the recommended frequency of postnatal care services in three rural districts of Tanzania. BMC. 2015;15.
36. Yenupini A, S. B. Integrative Review of Factors That Affect the Use of Postpartum Care Services in Developing Countries. Article in press. 2018;2(006).
37. Islam R, J. O. Determinats of antenatal and postnatal care visits among indigenous people in Bangladesh. PubMed. 2011;11(2).
38. Teklehaymanot N, Niguse D, A. T. Early Postnatal Care Service Utilization and Associated Factors among Mothers Who Gave Birth in the Last 12 Months in Aseko District, Arsi Zone, South East Ethiopia in 2016 Journal of Women's Health Care. 2017;6(1).
39. The World Factbook CIA. Ethiopia Addis Ababa, Ethiopia: Central Intelligency Agency; 2018 [cited 2018 Aug 2018]. Available from: "https://en.wikipedia.org/w/index.php?

40. International I. Demographic and Health Survey Sampling and Household Listing Manual. Calverton: Central Statistical Agency; 2012.
41. Markos M, Kannan N, Gobopamang L, B H. Socioeconomic inequalities in the uptake of maternal healthcare services in Ethiopia BMC. 2017;17:367.
42. WHO. Health Inequality Monitoring: with a special focus on low- and middle-income countries. 2013.
43. WHO. Health Equity Assessment Toolkit: TECHNICAL NOTES. 2016.
44. Owen O'Donnell; Stephen O'Neill; Tom Van Ourti aBW. Estimation of concentration indice. 2016. p. 27.
45. Wagstaff A. The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. Journal of Health Economics. 2005;14:429-32.
46. Wagstaff A, Paci P, E. vD. On the measurement of inequalities in health. Social Science and Medicine. PubMed. 1991;33:545-57.
47. Owen O'Donnell, Stephen O'Neill, Tom Van Ourti, Walsh. B. Estimation of concentration indices. 2016;16(1):112-38.
48. Constructing socio-economic status indices: how to use principal components analysis. [press release]. London: Oxford University Press in association with The London School of Hygiene and Tropical Medicine2006.
49. Edward C. Norton MMM, and Lowrence C. Klienman. Computing adjusted risk ratios and risk diff erences in Stata. Stata Journal. 2001;1.
50. Amane Tebure DA, and Elile Fantahun et al. Assessment of Postnatal care service utilization and Associated factors in Assella Town, Arsi zone, Oromia regional state, Ethiopia. Journal of reproductive health. 2018;6(1).
51. Mulatu Ayana H SSA, Molla Gedafaw B et al. Postnatal care service utilization and Associated factors among women in dembecha district northwest Ethiopia. Science journal of public health. 2015;3(5):7.
52. Suresh Mehata YRP, Maureen Dariang et al Trends and inequalities in use of Maternal health care services in Nepal. BioMed research international. 2017;2017: 11.
53. Wenjuan Wang SA, Shanxiao Wang, and Alfredo Fort. Levels and Trends in the use of Maternal health services in developing countries. USA: USAID, 2011.

ASSURANCE OF PRINCIPAL INVESTIGATOR

I, the undersigned MPH student declare that this thesis is my original work in fulfilment of requirement for masters of General Public Health.

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