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Socio-Economic and Demographic Determinates Of Maternal Health Care Utilization Services in Ethiopia

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This is to certify that the thesis prepared by Haymanot Zeleke, entitled: Socio-Economic and Demographic Determinates of Maternal Health Care Utilization Services in Ethiopia and summited in partial fulfillment of the requirements for the Degree of Master of Science in statistics complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

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Maternal mortality in Ethiopia is one of the highest in the world. One explanation for poor health outcomes among women and children is the non use of modern health care services by a sizable proportion of women in Ethiopia. The main objective of this study is to analyze factors associated with the utilization of health care services, which influence the use of maternal health care services in Ethiopia. The data for this study were taken from the 2011 Ethiopian Demographic and Health Survey which is a nationally representative survey of women in the 15-49 years age groups. Then logistic regression technique was used to estimate parameters. Separate models were also used for ANC, delivery care and PNC. In addition to this a bivarite analysis was done to estimate the probability of use of the maternal health care services. In the logistic regression model place of residence, occupation of husband, education level of mother's and husband, region and exposure to mass media were found to be strong indicators of utilization of health care service. Mother's work status was not significantly related with delivery care and PNC. Mother's age and birth order were found insignificant factors for ANC and religion and mother's age were found insignificant related to PNC.

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Acronyms

ANC Antenatal Care

CSA Central Statistics Authority

DHS Demographic and Health Survey

OR Odds Ratio

PNC Postnatal Care

SNNPR South Nations Nationalities and Peoples Region

SPSS Statistical Package for Social Science

UNFPA United Nations Population Fund

UNICF United Nation Children's Fund

WHO World Health Organization

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CHAPTER ONE

1. INTRODUCTION

1.1BACKGROUND OF THE STUDY

According to the World Health organization (WHO, 2008) maternal health refers to the health of women during pregnancy, childbirth and the postpartum period. While motherhood is often a positive and fulfilling experience, for too many women it is associated with suffering, ill-health and even death. The major direct causes of maternal morbidity and mortality include hemorrhage, infection, high blood pressure, unsafe abortion, and obstructed labor.

Maternal health has emerged as global priority because of a great gap in the status of mother's well being between the rich and the poor countries. In rich nations, where women have access to basic health care, giving birth is a positive and fulfilling experience. (WHO, 2008)

The child bearing functions of women, especially in developing countries, have been granted as a normal or routine process. Yet these valued and precious parts of life are among the most hazardous experiences that women often engage in without being aware of the risks or dangers that they are in (WHO, 2005).

Women's access to health care is a complex one - as it is both the outcome of women's status in the society, including society's response to their health needs, and a determinant of women's health and productivity and, ultimately, of their status (Chatterjee, 1990).

The world now faces a global economic slowdown and a food security crisis: the economic slowdown will diminish the incomes of the poor; the food crisis will raise the number of hungry people in the world and push millions people into poverty. The poor are not only those lowest incomes but also those who are the most deprived of health, education and other aspects of human well-being. Most maternal deaths do occur in poor countries and it is well known that poor countries are also the ones with highest maternal death (Van Lerberghe and De Brouwere 2001).

The World Health Organization (WHO) estimates that 580,000 women of reproductive age die each year from complications arising from pregnancy, and high proportion of these deaths occur in Sub-Saharan African. The ratio of maternal mortality in the region is one of the highest in the world, reaching level of 686 per 100,000 live births (World Bank, 1994a). Women play a principal role in the rearing of children and the management of family affairs, and their loss from maternity-related causes is a significant social and personal tragedy.

Poor maternal health remains a major reproductive health concern in most parts of the less developed world, including Sub-Saharan Africa. Compared with achievements in the reduction of fertility and infant mortality in the last few decades, relatively less progress has been made in the area of maternal health (Magadi et al., 2003). Insufficient maternal health care is largely responsible for the appalling annual toll of maternal deaths that are preventable. Maternal mortality ratios are still unacceptably high in developing countries, particularly in Sub-Saharan Africa.

In Ethiopia, the levels of maternal and infant mortality and morbidity are among the highest in the world. The maternal mortality rate in 2006 was 673 per 100,000 live births, and the infant mortality rate was 113 per 1,000 (CSA and ORC Macro, 2006). One explanation for poor health outcomes among women and children is the nonuse of modern health care services by a sizable proportion of women in Ethiopia. Several studies in the 1990s have shown that about 25 percent of Ethiopian women received antenatal care and less than 10 percent received professionally assisted delivery care (Mengistu and James, 1996; Mesganaw et al., 1990).

The Millennium Summit in 2000 like previous several international conferences also identified maternal health as an urgent priority. The fifth Millennium Development Goal (MDG) is to improve maternal health and this is to be achieved by reducing maternal mortality ratio by three-quarters between 1990 and 2015. An assessment of inequalities in access to maternal health care in Ghana, Kenya, Nigeria, Uganda and Zambia will give an indication of the progress made towards attainment of goal 5 (WHO,2005).

Approximately 80 percent of the maternal deaths globally occur due to haemorrhage, sepsis, unsafe induced abortion, hypertensive disorder of pregnancy, and obstructed labour (WHO 2005). The emphasis on two out of eight critical United Nations Millennium Development Goals, that is, reducing under five mortality by two-thirds between 1990 and 2015; and reducing maternal mortality ratio by three quarters between 1990 and 2015 epitomise the relevance of these indicators in global efforts towards human development (WHO 2004).

Around 80% of causes of maternal death are direct causes like haemorrhage, infection, obstructed labour, unsafe abortion and high blood pressure. Severe bleeding usually occurring after the mother gave birth is the single most feared complication claiming the life of most mothers. There are also some health conditions that may have developed before or during pregnancy which may lead indirectly to the death of a mother, some of these conditions include malaria, anaemia, hepatitis, heart diseases and HIV/AIDS (WHO1999).

An estimated 358,000 maternal deaths occurred worldwide in 2008, a 34% decline from the levels of 1990. Despite this decline, developing countries continued to account for 99% (355,000) of the deaths. Sub-Saharan Africa and South Asia accounted for 87% (313,000) of global maternal deaths. Eleven countries including Afghanistan, Bangladesh, the Democratic Republic of Congo, Ethiopia, India, Indonesia, Kenya, Nigeria, Pakistan, Sudan, and the United Republic of Tanzania, comprised 65% of all maternal deaths in 2008 (WHO 2010).

In Ethiopia, the levels of maternal and infant mortality and morbidity are among the highest in the world. The maternal mortality rate in 2000 was 816 per 100,000 live births, and the infant mortality rate was 113 per 1,000 (CSA and ORC Macro, 2001). One explanation for poor health outcomes among women and children is the nonuse of modern health care services by a sizable proportion of women in Ethiopia. Previous studies have clearly demonstrated that the utilization of available maternal health services is very low in the country. Several studies in the 1990s have shown that about 25 percent of Ethiopian women received antenatal care and less than 10 percent received professionally assisted delivery care (Mengistu and James, 1996; Mesganaw et al., 1990).

Despite low utilization of health care services, there is considerable variation across different demographic and socio-economic variables. The explanation of this diversity may be complex. Utilization of maternal health care services is affected by a multitude of factors. This study was an attempt to understand the factors that determine women's utilization of health care services.

1.2. STATEMANT OF THE PROBLEM

Maternal mortality in Ethiopia is one of the highest in the world. According to the 2005 Demographic and Health Survey the maternal mortality rate was 673/100,000. Far more many women also suffer from complications of pregnancy and delivery and maternal health care service utilization is far below the acceptable level. An effort has been made in this study to assess the effect of socio-demographic factors on utilization of maternal health care services based on the data are obtained from the Ethiopian Demographic and Health Survey conducted in 2011.

In general, maternal health care utilization has a significant impact on poverty, homelessness and affects family cohesion.

We will attempt to find the answers of the following questions:

- From several socioeconomic and demographic factors given, what are the majors determining factors affecting maternal health care utilization in Ethiopia?
- How important are the socio-economic and demographic factors in influencing program and policy in maternal health care?

1.3. OBJECTIVE OF THE STUDY

GENERAL OBJECTIVE

The general objective of this study is to identify factors associated with the utilization of health care services, which influence the use of maternal health care services in Ethiopia.

SPECIFIC OBJECTIVES

- To examine the relationship of social, economic and demographic factors with the utilization of maternal health care services.
- To analyze the dominant factors that influences the utilization of maternal health care services.
- To compare each factor that influences maternal healthcare service utilization among ANC service, delivery care service and PNC service.

1.4. SIGNIFICANCE OF THE STUDY

The study could be information in order to understand the current status of utilization of maternal health care services in Ethiopia and to elucidate the various factors influencing the use of these services in the country. This study intended to create awareness for governmental and non-governmental organizations to take intervention measures and set appropriate plans to improve the existing low utilization of maternal health care service.

1.5. SCOPE AND LIMITATION OF THE STUDY

A major limitation of the 2011 EDHS is that it does not cover all important possible predictors about the utilization of maternal health services, like distance to health facilities, transportation services, the price and quality of care and respondent's belief concerning health practices.

1.6. ORGANIZATION OF THE PAPER

The paper is organized as follows. The first chapter provides a brief background of the study, statement of the problem, objective, its significance and limitation of the study. The second chapter is a review of literature related to determinants of maternal health in Ethiopia and the rest of the world. The third chapter describes the source of data, variables of the study and the methodology used for analysis. The fourth chapter presents the statistical data analysis and discussion while the last chapter provides the conclusion and recommendations made.

CHAPTER TWO

2. LITRATURE REVIEW

2.1. Concepts and Definition of maternal health care in Ethiopia

Worldwide over half a million women die as a result of childbirth or complication due to pregnancy. Almost all or 99% of these deaths occur in developing countries. Asia and Africa alone take 95% of the share of the world's maternal death and the number is almost equally divided between Asia (253,000) and Africa (251,000). Four percent of the deaths occur in Latin America and the remaining one percent in the more developed regions of the world (AbouZahr, 2003)

The death of a mother devastates her family and the broader community. Mothers, as caretakers, educators, and providers, are often at the center of their communities. When a mother dies in childbirth, it puts the baby at risk of morbidity and mortality. (Jo Borghi et al, 2006).

Moreover, in many parts of Africa, women's decision-making power is extremely limited, particularly in matters of reproduction and sexuality. In this regard, decisions about maternal care are often made by husbands or other family members. (UNICF\FMOH, 1987-1998)

In 1987, the Safe Motherhood Conference, which was hosted by the World Health Organization (WHO), United Nations Population Fund (UNFPA), and World Bank, took place in Nairobi, Kenya, and paved the way for the Safe Motherhood Initiative. The conference called for a reduction in the maternal mortality ratio (MMR) by fifty percent by 2000. (Starrs, 2006)

The three maternal health care indicators employed to describe women's access to maternal health care services are type of antenatal care, delivery care and postnatal care.

Antenatal care is the care that a woman receives during pregnancy helps to ensure healthy outcomes for women and newborns (WHO, 2000). It is considered as one of the most important for the health of the mother and optimal development of the fetus as well as for preventing or minimizing the complication of pregnancy (UNICEF, 2004).

Prenatal care provides an opportunity to monitor and intervene in situations of anemia, malnutrition, infection, premature labor, preeclampsia, and other conditions that threaten the life of the mother and her unborn child. Prenatal care also provides the critically important function of educating the mother and family about how to access the health care system at the time of delivery, so that plans can be made for the mother to avail herself of skilled birth attendants and adequate delivery facilities when she needs them. Women are more likely to use a skilled birth attendant during childbirth if they have had at least one prenatal care visit.

Ideally ANC should consist of health education for pregnant women, early screening to identify those at high risk of developing complications and diagnosing problems if there are any. Whenever possible it is also important to intervene in order to prevent the development of complications. The diagnosis and treatment should not be limited to those conditions that developed during pregnancy but also for any pre-existing medical condition. These actions should lead to a decrease in the risk or severity of morbidity and mortality (Berg, 1995).

Place of delivery is the place of delivery is an important determinant for reducing the risk of infant and maternal death. Women were asked whether their babies born at home or at any health institution (public hospitals, private hospitals or other health care institutions). There are two aspects of the delivery services that are considered in this analysis-whether the delivery was at home or at a health care facility and whether a trained person was present to assist in the delivery. Social norms in rural areas are such that home delivery is preferred to institutional deliveries. This in itself is not a problem if hygienic and appropriate delivery practices are used either by traditional helpers or by a professionally trained person who makes home visits for helping with the delivery.

Postnatal care is healthcare provided following childbirth to both mother and infant. The postnatal period is the time from immediately after birth up to 42 days. It is important for mothers to receive care at this time as it has been recorded that more than 60% of maternal deaths take place during the postnatal period (Population Council, 2010; Gill et al, 2007). The death of a mother further exposes her newborn child to high risks of morbidity and mortality. Thus, receiving PNC can make the difference between life and death for both mother and child. In developing countries, the most common causes of maternal deaths during the postpartum period are hemorrhage, infections and hypertensive disorders (Gill et al, 2007).

Relevant studies in both developing and developed countries are reviewed with particularly emphasize on findings and methodological issue in developing countries. The framework covers all possible factors influencing maternal health care utilization and specifies the mechanism through they operate. Socio-economic variables, such as education, occupation of husband, women's work status and women's exposure to media

are considered. Aspects relating to demographic variables, such as age, place of residence and, are then discussed.

Despite the progress that has been made in Indonesia in recent decades to improve maternal health outcomes, maternal mortality still remain high. While many factors contribute to such maternal health outcomes, the lack of use of maternal health care services during pregnancy and delivery provided by well trained and well-equipped medical professionals is recognized as an important factor contributing to high maternal mortality in Indonesia, (Sari, 2009).

The interesting finding in this study is that in the multivariate analysis, women's working status and husband's occupation do not have a significant impact on the probability of women obtaining antenatal care and modern delivery care, although these variable, particularly husband's occupation is positively and strongly associated with the dependent variables (Sari, 2009).

According to Chimankar, D.A and Sahoo (2011) the place of residence, educational level of women, exposure to mass media, birth order and wealth index are significant predictors in explaining the use of maternal health care services. Controlling the effect of other variables, the predictive power of women's educational level, wealth index have been positively associated with antenatal care and also delivery care. Although, the utilization of any antenatal care (both partial and full) is high in Uttarakhand, the use of full ANC is still rather low. Though women use antenatal care, many of them do not get professional care at delivery .Only one-third of women deliver in medical institutions.

The major obstacles of the institutional delivery are traditional attitudes and cultural beliefs (that is, feeling not necessary) surrounding pregnancy and childbirth.

The level of utilization of maternal health care services was found to be highest in Tamil Nadu, followed by Andhra Pradesh and Karnataka. Part of the interstate differences in utilization is likely to be due to differences in availability and accessibility among the three south Indian states. It is argued that the differential in access to health care facilities between rural-urban areas is an important factor for lower utilization of maternal health care services, particularly for institutional delivery and delivery assistance by health personnel in the rural areas of the three states. Results from this study indicate that health workers might play a pivotal role in providing antenatal care in the rural areas (K. Navaneetham and A. Dharmalingam October 2000)

Postnatal checkups soon after the delivery are particularly important to reduce the maternal and neonatal deaths. To assess the extent of postnatal care checkups, respondents were asked for the last birth in the five years preceding the survey whether they received a health check after the delivery. It is found that only 37 percent of women have received postnatal checkups within the 42 days of the birth. Births to urban mothers are almost twice as likely to be followed by a postnatal checkup (60 percent) as births to rural mothers (30 percent). The utilization of postnatal care services substantially increases with the increase of the educational level of women. Exposure to mass media and wealth index of the household have a positive bearing on the postnatal care. Utilization of antenatal and delivery care services has positive impact on the use of postnatal care (Chimankar and Sahoo, 2011).

Educational level, employment, family wealth index (FWI) and place of residence were found to be strong predictors of utilization of Maternal Healthcare Services (MHCS) in the northern region of Nigeria. On the other hand, mother's age, educational level, FWI, place of residence and religion were found to strongly predict utilization in the southern region, (Hauwa Suleiman Adamu, 2011).

Another important factor in the utilization of maternity care services, especially in Africa, is the cultural background of the woman (Leslie and Gupta, 1989). The cultural perspective on the use of maternal health services suggests that medical need is determined not only by the presence of physical disease but also by cultural perception of illness. In most African rural communities, maternal health services coexist with indigenous health care services; therefore, women must choose between the options (Addai, 2000).

Moreover, in many parts of Africa, women's decision making power is extremely limited, particularly in matters of reproduction and sexuality. In this regard, decisions about maternal care are often made by husbands or other family members (WHO, 1998). Availability of women's time is also important. In developing countries, women spend more time on their multiple responsibilities for care of children, collecting water or fuel, cooking, cleaning, growing food, and trade than on their own health (World Bank, 1994a).

The service and social environments are typically very different in urban and rural areas. Strong urban-rural differentials in utilization of maternity care services are therefore expected (Bell et al., 2003). With regard to work status, one study made in four Indian states found that working mothers are less likely to deliver in a medical institution than

non-working mothers (Sugathan et al., 2001). A study in Ethiopia, however, found that mothers' work status does not significantly relate to utilization of maternal health care services (Mekonnen and Asnakech, 2002).

The utilization of maternal health care services is inadequate in Ethiopia, as clearly depicted by the major maternal health care indicators (antenatal, delivery, and postnatal care services). The situation is worst in the rural areas, where more than 80percent of the population resides. According to Yared and Asnaketch (2002) the most important factors influencing the use of maternal health services in Ethiopia are demographic and socio cultural in nature. However, this does not detract from the relevance of service-related factors, especially in the rural areas. The demographic and socio cultural factors identified in this study include maternal education, marital status, place of residence, parity, and religion, which are similar to those documented in many settings throughout Africa and other developing countries.

Both bivariate and multivariate analyses demonstrate the difference in the utilization of health care services and women's demographic and socio - economic characteristics. Except mothers' age at birth, work status and religion, all variables entered into the model appeared to be acceptable at 5 percent level of significance. Socio-economic variables such as education, region, residence, wealth index and household decision were implicated most strongly in women's utilization of health care services, as seen in the strong positive relationship between utilization of health care services and women's education as well as household decision autonomy (Ethiopian Society of Population Studies, 2008)

Delivery and postnatal care are still far from commonplace among pregnant women in Ethiopia. The 2005 EDHS data show that most deliveries still occur at home and are assisted by medically unskilled birth attendants. Among all live births in the five years preceding the survey, almost 95 percent took place outside a health facility. Only one out of twenty births occurred at a health facility. As is the case in antenatal care services, there existed marked variation both in utilization of delivery and postnatal care services as a function of women's background characteristics. The data show that younger women are more likely than older women to seek both delivery and postnatal care services; most of the time they seek the services for the first birth than other higher birth orders. The proportion of births delivered at health facilities in urban areas is by far higher than rural areas (42.6 percent and 2.4 percent, respectively). The comparable percentages for postnatal care are 35.5 percent and 3.5 percent. Urban children are more likely to be born at health institution than rural children. Births at home are substantially higher among women who live in Tigray, Afar, Amhara, Oromia, Benishangul Gumuz and SNNP regions. On the other hand, relatively large proportions of women give birth in health institutions in Gambella (16.1 percent), Harari (31.8 percent), Addis Ababa (78.4 percent) and Dire Dawa (26.3 percent) (Ethiopian Society of Population Studies 2008).

Different socio demographic variables were found to be strongly related with the utilization of ANC and delivery services. The most significant ones include educational status of the mother, wealth index, place of residence, birth order, religion and husband´s educational status. In addition to the above mentioned factors use of antenatal care services was found to be a very strong predictor of use of assistance during delivery, (Eyerusalem Dagne, 2010).

About 84% of the women with a secondary or higher education used the service as compared to women with no education (22%). This difference was also seen in the distribution of use by wealth index 65% of women in the richest wealth index category used the service while only 11 % of those in the poorest category used the service. Working mothers and mothers who were head of the household had a relatively higher percentage of use of antenatal care services when compared to those who were not working and who were not the head of the household. Most women (40%) used antenatal care service for the first child than the later ones, (Eyerusalem Dagne, 2010).

Utilization of these services was very low among rural women as compared to those living in urban areas. In the logistic regression model educational status of the mother, household wealth, place of residence, birth order of the child and educational and occupational status of the husband were found to be strong indicators of utilization in the total sample of women. Antenatal care use was found to be a strong indicator of use of assistance during delivery. The effect of this indicator variables vary according to place of residence. In the urban women household wealth, sex of household head and occupation of the husband had no effect on both antenatal care and use of assistance during delivery. Birth order and sex of household head were not significantly related with antenatal care use in the rural women and education of the mother was not found to be significantly related with use of delivery assistance in the rural sample, (Eyerusalem Dagne, 2010).

It is well recognized that mother's education has a positive impact on health care utilization. In a study in Peru using DHS data, Elo (1992) using logistic regression model found quantitatively important and statistically significant effect of mother's education on

the use of prenatal care and delivery assistance. It is argued that better educated women are more aware of health problems, know more about the availability of health care services, and use this information more effectively to maintain or achieve good health status.

The strong influence of mother's education on the utilization of health care services is consistent with findings from other studies. Mother's education may also act as a proxy variable of a number of background variables representing women's higher socioeconomic status, thus enabling her to seek proper medical care whenever she perceives it necessary. Research in developing countries has consistently shown maternal schooling to be strongly and positively associated with utilization of maternal healthcare services (Elo, 1992; Kamal, 2009). The higher a women's level of education the more likely she is to utilize maternal healthcare services. In addition, Kamal (2009) using regression model showed that husband's education is another factor which affects utilization of maternal health care services. Husband's education is found to have a significant positive association with maternity care service utilization. The pattern of service utilization by husband's education was found to be almost on par with what was observed for women's education. Although husband's education appeared to be a significant factor where the seeking of assistance from skilled birth attendances is concerned, it was not as strong a factor as women's education. This is because the husband's education is strongly associated with the wife's education. Nevertheless, women whose husbands had at least secondary education were 50 % more likely to use the service compared to women whose husbands had no education. Husband's education

level, like the seeking of assistance from skilled birth attendances, also appeared less pronounced as a factor influencing the use of medically-equipped places.

The proportion of antenatal care, institutional delivery and skilled birth attendant utilization were very low. Economical, health facility related and socio-cultural factors were the most frequently identified contributors to the low maternal health care utilization. More effort should be given to educate mothers, to improve men involvement and religious leaders, to strengthen community participation, to increase political commitment and to boost accessibility to maternal health care services. Emphasis should also be given to capacity building for skilled birth attendants and HEWs. TBAs are still highly accepted by communities and therefore TBAs´ role should be reassessed and motivated (Yalem Tsegay Assfaw, 2010)

According to Hayelom (2008) there was a significant association ($P<0.05$) between antenatal care utilization and socio-demographic variables such as schooling, high parity, income, age and marital status. It was also observed that non-attendance was higher for those with unplanned pregnancy, low knowledge of unhealthy pregnancy and those whose husband or partner's attitude to ANC attendance were negative

Place of residence is an important factor affecting maternal healthcare services utilization. A study done based on the 2000 Ethiopian DHS demonstrated that 27% of mothers who gave birth in the five years before the survey received ANC from health professional and further analysis showed that urban women showed higher use of ANC than the rural counterparts, 83% of women in Addis to 22% women in the rural regions (Yared and Asnaketch, 2002).

Bivariant and multivariate analysis showed significant association between ANC attendance and maternal age, occupation, wanted pregnancies, illness experience and perceived susceptibility to dangerous health problems related to pregnancy and childbirth (Melkamu, 2005).

A systematic review which assessed the inequalities in maternal health service utilization using 30 papers from 23 countries including Ethiopia showed that pattern of use of the maternal health services was different among countries and even within countries. Urban and wealthy women were more likely to receive assistance of health professional than rural and poor women. Wealthier women were likely to seek early ANC than poor women (Say and Raine, 2007). For many, lack of transportation and/or considerations of the cost of transportation are mitigating factors to healthcare seeking. For others, the low quality of services and anticipation of poor behavior from health staff may be the mitigating factor/s. In general rural women are less likely to give birth in health facility than their urban counterparts (Babalola and Fatusi, 2009).

2.2. Determinants of maternal healthcare

There are a number of social, economic and demographic factors or common variables that determine the chance that a woman could get maternal health service. A number of variables from social, economic and demographic theories that determine maternal health service are:

- Social factors
  - Women's education
  - Husband educations

- Exposure to media

- Economic factors
  - Women's work status
  - Husband occupation
- Demographic factors
  - Age of mother's
  - Place of residence
  - Birth order
  - Religion
  - Region

Chapter three

3. Data and Methodology

3.1. Data

The dataset used in this study has been taken from the Ethiopia Demographic and Health Survey (EDHS) conducted by the central Statistics Agency (CSA) in 2011. Census sample frame and was designed to obtain and provide information on the basic indicators of the health and demographic variables of interest for the following domains: Ethiopia as a whole, urban and rural areas of Ethiopia (each as a separate domain), and all geographic areas (nine regions namely: Tigray, Affar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples (SNNP), Gambela and Harari regional states and two city administrations: Addis Ababa and Dire Dawa). The response variables of this study were ANC, delivery care and PNC in Ethiopia and some of the common predictors that are expected to influence the maternal health care utilization in Ethiopia were recorded are women's education, husband education, exposure to mass media, women's work status, husband occupation, women's age, birth order, religion, place of residence and region.

The principal objective of the 2011 EDHS was to provide current and reliable data on fertility and family planning behavior, child mortality, adult and maternal mortality, children's nutritional status, use of maternal and child health services, knowledge of HIV/AIDS, and prevalence of HIV/AIDS and anemia.

In many DHS surveys eligible individuals include women of reproductive age (15-49) and men age 15-59, or in some cases 15-54.The 2007 Population and Housing Census, conducted by the CSA, provided the sampling frame from which the 2011 EDHS sample

was drawn. The 2011 EDHS sample was selected using a stratified, two-stage cluster design; enumeration areas (EAs) were the sampling units for the first stage. The sample included 624 EAs, 187 in urban areas and 437 in rural areas. Households comprised the second stage of sampling. A complete listing of households was carried out in each of the 624 selected EAs from September 2010 through January 2011. A representative sample of 17,817 households was selected for the 2011 EDHS, of which 17,018 were covered during data collection. Of these, 16,702 were successfully interviewed, yielding a household response rate of 98 percent

In the interviewed households 17,385 eligible women were identified for individual interview; complete interviews were conducted for 16,515, yielding a response rate of 95 percent. Similarly, a total of 15,908 eligible men were identified for interview; completed interviews were conducted for 14,110, yielding a response rate of 89 percent. In general, response rates were higher in rural areas than urban areas, for both women and men.

The main focus is a number of specific questions asked of women about their most recent pregnancy and live birth in the five years preceding the survey. Women were asked 1) whether they were checked by a trained health professional, that is, doctor, nurse, or midwife, at least once during pregnancy, i.e., antenatal care (ANC); 2) whether they were attended by a trained health professional during their delivery, i.e., professionally assisted delivery (PAD); and 3) for those mothers who delivered outside a health facility, whether they received a medical checkup from a health professional within 42 days after delivery, i.e., postnatal care (PNC).

3.2. Variables of the study

The dependent and independent variables that were considered to affect the status of

Maternal healthcare were selected based on experiences from the available similar studies and the available data on the subject.

3.2.1 The response variable

The response variables of this study are maternal health care service in Ethiopia. Three dependent variables were created from questions included in the maternal health component of the DHS questionnaire on ANC, delivery care and PNC that occurred within five years of the survey.

3.2.2. Explanatory Variables/Factors

Based on the reviewed literature, some of the common predictors that are expected to influence the maternal health care in Ethiopia were recorded as given below for the purpose of the analysis.

TABLE3.1: Demographic and Socioeconomic Variables

variables	description	Category's/values
Place of residence	This is a dichotomous variable (urban and rural) according to where the woman was living at the time of the survey.	0= Rural 1= Urban
Region	This variable classified as: Tigray, Affar, Amhara, Oromiya, Somali, SNNP,	1=Tigray 2=Affar 3=Amhara

	Benishangul-Gumuz, Gambela, Affar, Addis Ababa Harari, and Dire Dawa	4=Oromiya 5=Somali 6=Ben-Gumuz 7= SNNP 8 = Gambela 9 =Harari 10= Addis Ababa, 11= Dire Dawa
Religion	Classification of this variable was developed according to previous literature as: Coptic orthodox, protestant, and Muslim and others like traditional religion.	0=Orthodox 1=catholic 2=Muslim 3=Protestant 4=Traditional
Women's age	This variable refers to age of the woman at the time of the survey	0=15-19 1=20-34 2=35-49
Birth order	This refers to the rank of the child at birth	0=1 1=2-4 2=5
Women's work status	In the survey this was defined as if the woman has been working in any field	0=no 1=yes

	other than household work in the seven days before the survey	
Husband's occupation	Occupation of husband or partners	0= Not Working 1= Agricultural Employee 2=Non-Agricultural Employee
Women's education	Educational status refers to the highest educational level the woman attained	0=no 1=primary 2=secondary and above education
Husband,s education	Educational status refers to the highest educational level the husband attained	0=no 1=primary 2=secondary and above education
Exposure to media	Exposure to any Mass Media	0=Not at All 1= Less a Weak 2=At Least Once a Week

3.3. The Methodology

The statistical methods that have been used in this study are descriptive statistics, bivariate and multivariate analyses. For the multivariate analysis, the response category was collapsed to create a dichotomous variable on the basis of whether or not the woman had received maternal health care. Since the interest is in identifying women at risk

because they did not receive care, the outcome variables were coded as 1 if the women received ANC and as 0 if she did not receive ANC. The same coding procedure was applied for delivery care and PNC. The data has been analyzed by using the statistical packages SPSS 16.0. In analyzing data, both bivarite and multivariable analyses were employed. Logistic regression was used for the multivariate analysis.

3.3.1 Bivariate statistical analysis

Bivariate analysis is one of the simplest forms of the quantitative (statistical) analysis. It involves the analysis of two variables (often denoted as X, Y), for the purpose of determining the empirical relationship between them. In order to see if the variables are related to one another, it is common to measure how those two variables simultaneously change together. As its name suggests, bivariate analysis involves looking at how two variables or questions relate to each other. This is done by tabulating them in a two way format known as a **crosstab**. In the bivarite analysis, chi-square test were applied to examine the association between each of the independent variables and maternal health care. The chi-square test in bivarite analysis does not consider confounding effects. Therefore, logistic regression is used in the analysis with the mothers who attend maternal health care service (antenatal care, delivery care and postnatal care) as the response variable

3.3.2. Logistic Regression Analysis

There are several multivariate analysis methods that can be used to examine the relationship between several independent variables and a dependent variable. In the present study we are using the logistic regression analysis because the outcome of variable is dichotomized into two categories. The outcome variable Y_i is coded as 1 if

maternal health care is provided and 0 if not provided. This model allows one to predict the log odds of outcomes of a dependent variable from a set of variables that may be continuous, discrete, categorical, or a mix of any of these. Hosmer and Lemeshow (2000) have described logistic regression focusing on its theoretical and applied aspect.

In such a case, binary logistic regression is a useful way of describing the relationship between one or more independent variables and a binary outcome variable that has only two possible values. Indeed, a generalized linear model is used for binary logistic regression.

This study considers only those women who had at least one live birth in the five years preceding the survey. If women had more than one live birth in the past five years, only the type of care received for the most recent live birth is considered.

3.3.2.1. Model

Let Y be an nx1 vector of response variable with $y_i = 1$ if the getting maternal health care service and $y_i = 0$ if not getting the service, X is an n x (k+1) design matrix of explanatory variables, β is a (k+1) x 1 vector of parameters.

Let the conditional probability that the outcome is present (probability of success) be given by:

$$\Pi(x) = P(Y=1/X=x) = 1-P(Y=0/x)$$

$$= \frac{\exp(\beta o+\beta_1 X_1+\beta_2 X_2+\cdots\beta_k X_k)}{1+\exp(\beta o+\beta_1 X_1+\beta_2 X_2+\cdots\beta_k X_k} = \frac{\exp(X'\beta)}{1+\exp(X'\beta)}$$

In the terminology of logistic regression analysis the odds of a success is defined to be the ratio of the probability of a success to the probability of a failure.

The odds are simply the ratio of the probabilities for the two possible outcomes. We obtain the odds of success by using the above equation

odds $(Y=1)=\frac{\pi}{1-\pi}=\exp(X'\beta)$

In logistic regression analysis, it is assumed that the explanatory variables affect the response through a suitable transformation of the probability of the success. This transformation is a suitable link function of π, and is called the logit-link, which is defined as:

$\text{logit}(\pi)=\log\left(\frac{\pi}{1-\pi}\right)=\log(\exp(\beta_0+\beta_1X_1+\ldots+\beta_kX_K))=\log(\exp(X'\beta)$

$\text{logit}(\pi)=\eta(x)=\beta_0+\beta_1X_1+\ldots+\beta_kX_K=X'\beta$

Where the observation y_i are dependent Bernoulli random variable, $\beta = (\beta_0, \beta_1, \beta_2 \ldots \beta_k)$ are the model parameters and $X'= (X_0, X_1 \ldots X_k)$ with $X_0 =1$, are explanatory variables. The Logits (log odds) are the β coefficients (the slope values) of the regression equation. Logistic regression calculates changes in the log odds of the dependent, not changes in the dependent value as OLS regression does. For a dichotomous variable the odds of membership of the target group are equal to the probability of membership in the target group divided by the probability of membership in the other group. Odds value can range from 0 to infinity and tell you how much more likely it is that an observation is a member of the target group rather than a member of the other group. Another important concept is the odds ratio (OR). It is calculated by using the ratio of the odds from two rows. The odds ratio is equal to $\exp(\beta)$, or sometimes written e^{β}. So, if we take the exponent constant and raise it to the power of β, we get the odds ratio Hosmer and Lemeshow (2000).

3.3.2.2. Parameter Estimation

The most commonly used method of estimating the parameters of a logistic regression model is the method of Maximum Likelihood (ML) instead of Ordinary Least Squares (OLS) method. Mainly for this reason the ML method based on Newton-Raphson iteratively reweighted least square algorithm becomes more popular with researchers (Ryan, 1997). When more than one observation occurs at a fixed x_i value, it is sufficient to n_i record the number of observations n and the number of successes. We then let y_i refer to this success count rather than to an individual binary response. Then $\{Y_1,\ldots, Y_N\}$ are independent binomials with $E(Y_i)=n_i\pi(X_i)$, where $n_1+\ldots+n_N=N$. Their joint probability mass function is proportional to the product of N binomial functions,

$f_i(y_i)=\pi(x_i)^{yi}\,[1-\pi(x_i)]^{ni-yi}$

The principle of maximum likelihood states that we use as our estimate of β the value which maximizes the likelihood function. However, it is easier mathematically to work with the log likelihood function,

$$L(\beta) = \sum_j(\sum_i(Y_iX_{ij})\beta_j)-\sum_i n_i\log[1+\exp(\sum_k \beta_k X_{ik})]$$

To find the value of β that maximizes L(β) we differentiate L(β)with respect β_j, and set the resulting expressions equal to zero. The solution for the maximum likelihood estimates is obtained by a method called Newton Raphson iteration which is known as iteratively Reweighted Least Square (IRLS) algorithm

$$\frac{\partial L(\beta)}{\partial \beta j}= \sum_i Y_iX_{ij} -\sum_i n_iX_{ij}\frac{\exp(\sum_k \beta_k X_{ik})}{1+\exp(\sum_k \beta_k X_{ik})}=0$$

From the above equation an updated estimate of $\beta_0,\ldots \beta_p$ is obtained

3.3.2.3. Model Evaluation

A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the intercept -only model (also called the null model). An intercept -only model serves as a good baseline because it contains no predictors. Consequently, all explanatory variables are added to the model. There are several steps involved in assessing the appropriateness, adequacy and usefulness of the model. First, the overall goodness of fit of the model is tested. Second, the importance of each of the explanatory variables is assessed by carrying out statistical tests of the significance of the coefficients.

3.3.2.3.1 Likelihood ratio test

The Likelihood Ratio (LR) test is performed by estimating two models and comparing the fit of one model to the fit of the other. Removing predictor variables from a model will almost always make the model fit less well (i.e., a model will have a lower log likelihood), but it is necessary to test whether the observed difference in model fit is statistically significant. The likelihood ratio test does this by comparing the log likelihoods of the two models, if this difference is statistically significant, then the less restrictive model (the one with more variables) is said to fit the data significantly better than the more restrictive model. If one has the log likelihoods from the models, the likelihood ratio test is fairly easy to calculate. The likelihood ratio test is performed to test the overall significance of all coefficients in the model on the basis of test statistic:

$$G=[(-2lnLo)-(-2L1)]$$

Where, L_0 is the likelihood of the null model and L_1 is the likelihood of the saturated model. The statistic G is distributed chi-squared with degrees of freedom equal to the

difference in the number of degrees of freedom between the two models and plays the same role in logistic regression as the numerator of the partial F-test does in linear regression(Hosmer and Lemeshow, 2000).

3.3.2.3.2. The Hosmer-Lemeshow Goodness-of-Fit test

The test statistic for this test procedure is formulated under the null hypotheses that the model fits the data, and the alternative is that the model does not fit the data. The test statistic is constructed by grouping the data set into roughly 10 groups. The groups are formed by ordering the existing data by the level of their predicted probabilities. So the data are first ordered from least likely to have the event to most likely for the event. Then roughly equal sized groups are formed. The observed and expected numbers of events are computed for each group. The test statistic is

$$\hat{C}=\sum_{K=1}^{g}\frac{(O_k-E_k)^2}{v_k}$$

Where, O_k and E_k are the observed and expected number of events in the k^{th} group, and v_k is a variance correction factor for the k^{th} group. If the observed number of events differs from what is expected by the model, the statistic $\hat{C}$ will be large and there will be evidence against the null hypothesis. This statistic has an approximate chi-squared distribution with (g – 2) degrees of freedom (Hosmer and Lemeshow, 2000).

3.3.2.3.3. Statistical Tests of Individual Parameters

The statistical significance of individual regression coefficients is tested using the Wald and Score chi-square statistic. The Wald test is based on the behavior of the log-likelihood function at the ML estimate, having chi -squared form. The standard error of the estimate $\hat{\beta}$, depends on the curvature of the log-likelihood function at the point where

it is maximized, with greater curvature giving smaller SE values. For a dichotomous dependent variable, the Wald statistic is:

$$W=\left[\frac{\widehat{\beta}}{SE(\widehat{\beta})}\right]^2$$

In order to test for the significance of the model parameters we need to know the distribution of the estimates. Under certain regularity conditions the maximum likelihood estimates have an asymptotic multivariate normal distribution with expected value equal to the true parameters. A test procedure that uses this general result is the Wald test, which can be used to test for the significance of individual as well as several parameters at a time. The test procedure is as follows.

The Wald statistic is a test which is commonly used to test the significance of the individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in logistic regression that a particular logit (effect) coefficient is zero i.e. H_0: $\beta_i=0$ against $\beta_i\neq0$.The Wald test statistic for this hypothesis is

$$Z=\frac{\hat{\beta}_j}{\sqrt{V\hat{a}r(\hat{\beta}_j)}}$$

This statistic has approximately a standard normal distribution in large samples. Equivalently, the square of this statistic has an approximate chi-squared distribution with one degrees of freedom and this is the usual formulation of this statistical procedure. In addition this test statistic can be used to construct a confidence interval for β_j. An approximate $100(1-\alpha)$ % confidence interval for the true parameter β_j is

$$\hat{\beta}_j \pm Z_{\alpha/2}\sqrt{V\hat{a}r(\hat{\beta}_j)}$$

Where, $Z_{\alpha/2}$ is the normal critical value for a two-sided test. Confidence intervals for effects in the logit scale can be translated into confidence intervals for odds ratios by exponentiation of the boundaries (Hosmer and Lemeshow, 2000).

3.3.2.4. Model Diagnostics

Regression model building is often an iterative and interactive process. The first model we try may prove to be inadequate. Regression diagnostics are used to detect problems with the model and suggest improvements.

There are three ways that an observation can be considered as unusual, namely outlier, influence and leverage. In logistic regression, observations whose values deviate from the expected range and produce extremely large residuals and may indicate a sample peculiarity are called outliers. These outliers can unduly influence the results of the analysis and lead to incorrect inferences. An observation is said to be influential if removing the observation substantially changes the estimate of coefficients. Influence can be thought of as the product of leverage and outliers. To identify if an observation is outlier or influential, the following rules of thumbs were employed in this study (Hosmer and Lemeshow, 2000).

Residuals: Residual analysis for logistic regression is complicated by the fact that the errors are not normally distributed. Residuals in a logit model can be defined as the difference between Yi (0 or 1) and the predicted probability for Y_i. For a particular covariate pattern the Pearson residual is defined as

$$e_i = \frac{Y_i - n_i \hat{\pi}_i}{\sqrt{\widehat{var}(Y_i)}}$$

Where $\hat{\pi}_i$ is the estimated probability for i^{th} covariate

$$\widehat{var}(y_i) = n_i\hat{\pi}_i\,(1-\hat{\pi}_i)$$

This divides the raw residual $(y_i-\hat{\mu}_i)$ by the estimated binomial standard deviation of y_i. The Pearson statistic for testing the model fit satisfies

$$X^2=\sum_{i=1}^{N} e_i^2$$

The standardized residual divides $(y_i-n_i\hat{\pi}_i)$ by standard error of y_i, and given as:

$$\text{Standardized residual}=\frac{Y_i-n_i\hat{\pi}_i}{\sqrt{[n_i\hat{\pi}_i(1-\hat{\pi}_i)(1-n_i)]}}$$

The deviance residual for the i^{th} observation is defined as

$$\pm\sqrt{2\left[y_i\log\frac{Y_i}{n_i\hat{\pi}_i}+(n_i-y_i)\log\frac{n_i-Y_i}{n_i-n_i\hat{\pi}_i}\right]}$$

Standardized, deviance and Pearson residuals are obtained using SPSS. Observations with values larger than 3 in absolute value are considered as outliers (Agresti, 2007).

Leverage Values (Hat Diag): An observation with an extreme value on a predictor variable is called a point with high leverage. Leverage is a measure of how far an independent variable deviates from its mean. In fact, the leverage indicates the geometric extremeness of an observation in the multi-dimensional covariate space. These leverage points can have an unusually large effect on the estimate of logistic regression coefficients (Cook, 1977).Measure of how far an observation is from the others in terms of the levels of the independent variables (not the dependent variable). Observations

where cook's distance are larger than one are considered to be potentially highly influential (Belsley et al., 1980).

DFBETAS: Measure of how much an observation has affected the estimate of regression coefficient (there is one DFBETA for each regression coefficient, including the intercept). It can be used to assess the effect of an individual observation on each estimated parameter of the fitted model. The influential observations for the individual regression coefficients are identified by DFBETASj(i), j = 0, 1, 2, . . . , p and calculated as

$$DFBETAS_{j(i)}=\frac{\widehat{\beta}_j-\beta_{j(i)}}{s_i\sqrt{c_{jj}}}$$

Where c_{jj} is the (j + 1) diagonal element from $(X'VX)^{-1}$. $DFBETAS_{j(i)}$ measures the change in β_j in multiples of its standard error. Values larger than $2/\sqrt{n}$ in absolute value are considered influential is suggested by Belsley et al (1980).

Cook's D: Measure of aggregate impact of each observation on the group of regression coefficients, as well as the group of fitted values. Cook's distance D is proposed to measure the effect of excluding any specific observation on the set of parameter estimates. In logistic regression, a case is identified as influential if its Cook's distance is greater than 1.0 (Hosmer-Lemeshow, 2000).

Chapter four

4. Statistical data analysis and discussion

The data analysis had been carried out using SPSS16. Descriptive statistics has also been presented to describe the data. Bivariate analysis has been done by taking each independent variables and calculating the proportion of use of antenatal care, delivery care and postnatal care. Since the outcome of each dependent variable is dichotomous therefore logistic regression analysis has been used to estimate the effect of the indicator variables on the outcome variables. Three logistic regression models have been fitted

4.1 Descriptive statistical analysis

The major demographic and socioeconomic background characteristics of the respondents with each type of maternal health care (i.e. antenatal care, delivery care and postnatal care) are presented in Table 4.1 below

Table 4.1.Descriptive statistics of ANC, delivery care and PNC services usage status of mothers

Explanatory variable	**Maternal health care**											
	Antenatal care				Delivery care				Postnatal care			
	No	Yes	Total	% of ANC user	No	Yes	Total	% of delivery care at health facility	No	Yes	Total	% of PNC user
Place of residence												
Rural	3793	2212	6005	36.84	5628	377	6005	6.28	5631	374	6005	6.23
urban	288	1145	1433	79.9	530	903	1433	63.01	801	632	1433	44.10

Region												
Tigray	275	512	787	65.06	687	100	787	12.71	664	123	787	15.63
Affar	497	197	694	28.39	651	43	694	6.19	639	55	694	7.93
Amhara	557	361	918	39.32	837	81	918	8.82	857	61	918	6.65
Oromiya	639	428	1067	40.11	964	103	1067	9.65	995	72	1067	6.75
Somalyi	397	136	533	25.52	486	47	533	8.82	489	44	533	8.25
Benisshangul-Guumuz	404	248	652	38.04	542	110	652	16.87	586	66	652	10.12
SNNP	615	410	1025	40	958	67	1025	6.54	960	65	1025	6.34
Gambela	316	251	567	44.27	457	110	567	19.40	472	95	567	16.75
Harari	177	250	427	58.55	267	160	427	37.47	286	141	427	33.02
Addis Ababa	17	310	327	94.80	53	274	327	83.79	152	175	327	53.52
Dirre Dawa	187	254	441	57.59	256	185	441	41.95	332	109	441	24.72
Religion												
Orthodox	1140	1478	2618	56.45	1980	638	2618	24.37	2118	500	2618	19.1
Catholic	41	36	77	46.75	64	13	77	16.88	70	7	77	9.09
Protestant	847	570	1417	40.23	1240	177	1417	12.49	1266	151	1417	10.66
Muslim	1983	1258	3241	38.82	2798	443	3241	13.67	2895	346	3241	10.68
Other	70	15	85	17.65	76	9	85	10.59	83	2	85	2.35
Mother's age												
15-19	219	168	387	43.41	328	59	387	15.25	339	48	387	12.40
20-34	2740	2437	5177	47.07	4164	1013	5177	19.57	4415	762	5177	14.72
35-49	1122	752	1874	40.13	1666	208	1874	11.1	1678	196	1874	10.46
Birth order												
1	728	882	1610	54.78	1096	514	1610	31.93	1231	379	1610	23.54
2-4	1771	1546	3317	46.61	2732	585	3317	17.64	2869	448	3317	13.51
5^{+}	1582	929	2511	36.99	2330	181	2511	7.21	2332	179	2511	7.13
Mother's work status												
Not employed	2983	2121	5104	41.55	4375	729	5104	14.28	4503	601	5104	11.78
Employed	1098	1236	2334	52.95	1783	551	2334	23.61	1929	405	2334	17.35
Husband occupation												
Did not work	93	51	144	35.42	118	26	144	22.03	126	18	144	12.5

Agricultural employee	3368	1859	5227	35.57	4922	305	5227	5.83	4940	287	5227	5.49
Nonagricultural employee	620	1447	2067	70.00	1118	949	2067	45.91	1366	701	2067	33.91
Mothers education level												
No education	3253	1730	4983	34.72	4579	404	4983	8.12	4639	344	4983	6.90
Primary	799	1199	1998	60.01	1487	511	1998	25.57	1619	379	1998	18.97
2nd and above	29	428	457	93.65	92	365	457	79.87	174	283	457	61.93
Husband education level												
No education	2565	1227	3792	32.36	3555	237	3792	6.25	3562	230	3792	6.07
primary	1289	1421	2710	52.4	2199	511	2710	18.86	2344	366	2710	13.51
2nd and above	227	709	936	75.75	404	532	936	56.84	526	410	936	43.80
Exposure to mass media												
Not at all	2360	1030	3390	30.38	3169	221	3390	6.52	3209	181	3390	5.34
Less than once a week	838	639	1477	43.26	1331	146	1477	9.88	1344	133	1477	9.00
At least once a week	883	1688	2571	65.65	1658	913	2571	35.51	1879	692	2571	26.92

From the above table provides information about the distribution of demographic and socioeconomic factors with each type of maternal health care service. The table exhibits that out of 7,438 mothers 6,005 live in the rural area of Ethiopia and the remaining live in the urban area of the country. The table also exhibits that only, 36.84%, 6.28% and 6.23% of the mothers got antenatal care, delivered at hospital and got postnatal care respectively who live rural area. The mothers who lived in the urban area of the country were advantageous, because 79.9%, 63.01% and 44.1% of them used antenatal care, delivery at hospital and used postnatal care. When we come to the proportion of maternal health care service according to region, the highest proportion is found in Addis Ababa i.e. 94.8%, 83.79% and 53.52% of the mothers got antenatal care, delivery at hospital and got postnatal care respectively. Whereas the lowest proportion of getting ANC and delivery care were in the region Affar and for PNC was in SNNP.

The educational level of mothers' and husbands' also makes variation in the use of maternal health care service, because 93.65% of mothers having secondary and above educational level used antenatal care services and only 34.72% of the mothers were without education used ANC services. The same is true for the other two types of maternal health care services. Only 6.25% of the mothers whose husband had no education got less delivery care in comparison to 56.84% mothers whose husbands had secondary and above educations. The findings on the other two types of maternal health care services are similar.

The proportion of maternal health care service exhibited by the above table also shows differences in all categories. 52.95% of the mothers who had work got antenatal care while 41.55% of the unemployed mothers got antenatal care. Similarly 14.28% of the mothers who had no work delivered at hospital while 23.61% of the mothers who had worked delivered at hospital. 11.78% of the mothers having no work and 17.35% of mother's having work got postnatal care, respectively. Similarly the proportion of maternal health care service differs with the occupation of husband. A smaller percentage of getting maternal health care service was observed for mothers whose husbands have no work. The percentage of the mother's getting antenatal care, delivered at hospital and postnatal care were 35.42%, 22.03% and 12.5% respectively. In case of having non-agricultural employee, the percentage of mothers getting antenatal care, delivered at hospital and postnatal care were 70%, 45.91% and 33.91%, respectively. At the same time the percentage of mothers, whose husbands were employed in agricultural, only got antenatal care, delivered at hospital and postnatal care were 35.57%, 5.83% and 5.49%, respectively. The proportion of mothers who got maternal health care increased steadily

as their exposure to the mass media increase For example after getting exposure from the media within one week the percentage of mothers getting antenatal care increase as 30%, 43.26% and 65.65% respectively. The same finding also appears to other two types.

Utilization of ANC services is found to be relatively higher for young mothers in comparison to adolescent mothers i.e. 43.41% and 40% respectively. It was also observed that utilization of delivery care services and postnatal care service is relatively higher in adolescent mothers i.e. 19.57% and 14.72% respectively than older mothers i.e. 11.1% and 10.46% respectively. The proportion of mother's, which got maternal health care service declined as birth order is increased. Hence the mother's who get antenatal care for the first birth, two to four and five and higher birth is 54.78%, 46.61% and 36.99%, respectively. Similarly the proportion of mothers who got delivery care and postnatal care also declined as the birth order is increased. The percentage of getting delivery care is 31.93%, 17.64% and 7.21% with respect to the birth order, respectivcly and percentage of getting postnatal care is 23.54%, 13.51% and 7.3% with respect to birth order respectively.

For the last explanatory variable i.e. religion the proportion of getting maternal health care service is as 17.65%, 10.59% and 2.35% of ANC, delivery care and PNC, respectively in comparison to other religion. The proportion of getting ANC, delivery care and PNC for orthodox religion is 56.45%, 24.37% and 19.1%, respectively. The remaining three religions have approximately the same proportion in each type of maternal health care service.

4.2. Bivariate statistical analysis

With bivariate analysis, we are testing hypotheses of "association" and causality. In its simplest form, association simply refers to the extent to which it becomes easier to know/predict a value for the dependent variable if we know a case's value on the independent variable. A measure of association helps us to understand this relationship. These measures of association relate to how much better this prediction becomes with knowledge of the independent variable or how well an independent variable relates to the dependent variable.

Table 4.2.Test of Significance of Individual Predictors for Logistic Regression Using Score Test

	ANC			Delivery care			PNC		
Independent variable	**Score Chi-Square**	**DF.**	**Sig.**	**Score Chi-Square**	**DF.**	**Sig.**	**Score Chi-Square**	**DF.**	**Sig.**
Place of residence	8.665	1	.000	2.614	1	.000	1.419	1	.000
Region	7.198	10	.000	1.599	10	.000	8.032	10	.000
Religion	2.276	4	.000	1.263	2	.000	1.124	4	.000
Mother's age	27.29	2	.000	70.356	2	.000	21.789	2	.000
Birth order	1.306	2	.000	4.214	2	.000	2.259	2	.000
Mother's work status	84.06	1	.000	97.74	1	.000	42.593	1	.000
Husband's occupation	7.151	2	.000	1.670	2	.000	1.023	2	.000
Mother's education level	8.313	2	.000	1.647	2	.000	1.153	2	.000
Husband's education level	6.626	2	.000	1.357	2	.000	9.141	2	.000
Exposure to mass media	7.372	2	.000	9.320	2	.000	6.142	2	.000

From table 4.2 chi-square analysis is done for 10 variables and all of them are statistically significant at 10% (since, $p<0.05$) significance level for all the three maternal

health care's i.e. there were associations between response and each independent variable. All 10 explanatory variables i.e. place of residence, region, religion, mother's age, birth order, mother's work status, husband occupation; mother education level, husband education level and exposure to mass media have association to each type of maternal health care (ANC services, delivery care services and PNC services).

4.3. Binary logistic statistical analysis

In this section binary logistic regression is applied to assess the relation between each type of maternal health care services i.e. antenatal care, delivery care and postnatal care services with demographic and socioeconomic variables. The SPSS version 16.0 was used to perform binary logistic regression by making the mothers who have not got maternal health care as a reference category.

The magnitude (odds ratio or e^{β}) of the effect of a specific explanatory variable indicate that an average of one unit change on a specific explanatory variable effects on the change of the odds of the event occurrence by a factor of odds ratio, holding other explanatory variables constant

4.3.1 Binary logistic analysis of antenatal care

Dependent Variable Encoding

Original Value	Internal Value
No antenatal care visits	0
Yes	1

Table 4.3 Intercept-only model of ANC

		β	S.E.	Wald	df	Sig.	Exp(β)
Step 0	Constant	-.195	.023	70.249	1	.000	.823

In Table 4.3 the intercept-only model or null model has ln(odds) = -0.195. If we exponentiate both sides of this equation we find that our predicted odds [Exp(-0.195) = 0.823] That is, the predicted odd of using ANC is 0.823.

Table 4.4 Omnibus Tests of Model Coefficients of ANC

		Chi-square	df	Sig.
Step 1	Step	1914.316	28	.000
	Block	1914.316	28	.000
	Model	1914.316	28	.000

A Table 4.4 shows that the omnibus test is highly significant so we can conclude that adding the predictors will increase our precision in prediction of whether or not mothers got ANC services.

Table 4.5. Hosmer-Lemeshow Test of ANC

Step	Chi-square	DF	Sig.
1	6.277	8	.616

Contingency Table for Hosmer- Lemeshow Test of ANC

		Number of antenatal care visits during pregnancy = No antenatal care visits		Number of antenatal care visits during pregnancy = Yes		
		Observed	Expected	Observed	Expected	Total
Step 1	1	632	629.676	109	111.324	741
	2	578	575.044	161	163.956	739
	3	537	549.416	207	194.584	744
	4	497	516.478	246	226.522	743
	5	486	477.971	262	270.029	748
	6	441	431.394	303	312.606	744
	7	372	374.472	368	365.528	740
	8	313	301.326	431	442.674	744
	9	183	177.388	561	566.612	744
	10	42	47.834	709	703.166	751

Table 4.5 shows that the value of chi-square is non-significance; so we cannot reject the null hypothesis. It means that there is no difference between the observed and expected frequencies which indicates that the model adequately fits the data.

Table4. 6. variables in the equation of ANC

		$\hat{\beta}$	S.E.	Wald	df	Sig.	Exp($\hat{\beta}$)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Mother age			2.836	2	.242			
	15-19	-.220	.139	2.492	1	.114	.803	.611	1.055
	20-34	-.008	.069	.013	1	.908	.992	.867	1.136
	Region			207.545	10	.000*			

Tigray	.836	.162	26.728	1	.000*	2.308	1.681	3.168
Affar	-.696	.147	22.373	1	.000*	.499	.374	.665
Amhara	-.028	.152	.034	1	.854	.972	.722	1.309
Oromiya	-.365	.138	7.043	1	.008*	.694	.530	.909
Somali	-1.060	.157	45.833	1	.000*	.346	.255	.471
Benishangul-Gumuz	-.151	.146	1.073	1	.300	.860	.645	1.145
SNNP	-.060	.154	.153	1	.696	.942	.697	1.273
Gambela	.029	.170	.028	1	.866	1.029	.738	1.435
Harari	-.145	.160	.820	1	.365	.865	.632	1.184
Addis Ababa	1.126	.287	15.412	1	.000*	3.083	1.757	5.407
Rural	-.818	.101	65.320	1	.000*	.441	.362	.538
Mother edu.			91.396	2	.000*			
No education	-1.630	.218	55.728	1	.000*	.196	.128	.301
primary	-1.138	.215	28.092	1	.000*	.321	.210	.488
religion			26.665	4	.000*			
orthodox	1.005	.309	10.576	1	.001*	2.733	1.491	5.008
catholic	.870	.388	5.027	1	.025*	2.388	1.116	5.109
porotistant	.675	.304	4.930	1	.026*	1.964	1.082	3.562
muslim	1.106	.308	12.858	1	.000*	3.021	1.651	5.528
Birth order			.380	2	.827			
1	.051	.084	.368	1	.544	1.052	.892	1.241
2-4	.014	.067	.043	1	.835	1.014	.889	1.156
Husband edu.			42.457	2	.000*			
No education	-.463	.115	16.068	1	.000*	.630	.502	.789
Primary	-.079	.110	.519	1	.471	.924	.745	1.146
Non empl. motr	-.171	.059	8.291	1	.004*	.843	.750	.947
Media			103.607	2	.000*			
Not at all	-.672	.067	100.503	1	.000*	.511	.448	.582
< than 1 a week	-.292	.076	14.878	1	.000*	.747	.644	.866

	Husb occ			36.287	2	.000*			
	did not work	-.656	.201	10.644	1	.001*	.519	.350	.769
	agricultural employee	-.450	.080	31.787	1	.000*	.638	.545	.746
	Constant	2.117	.388	29.845	1	.000*	8.310		

a. Variable(s) entered on step 1: Mage, Region, Residance, Mel, religion, bor, Hel, Workstat, media, Hocc.

Interpretation of the coefficients from Table 4.6

Table 4.6 exhibits that the mother's age and birth order are not significant while the other explanatory variable have significant effect on antenatal health care.

Women who live in rural areas of the country were 56% less likely to use ANC services (OR= 0.441, 95% CI: 0.362-0.538) than women who reside in urban areas of the country while controlling for other variables in the model.

A statistically significant difference was seen by education level of mothers even after controlling for the other variables. Women who had no education were about 80% less likely to use ANC service than women who had secondary and above (OR=0.196, 95% CI: 0.128-0.301) controlling for all the other variables in the model. Women who had primary education were about 68% less likely to use ANC service than women who had secondary and above (OR=0.32, 95% CI: 0.210-0.488)) controlling for all the other variables in the model.

Women whose husband had no education were about 37% less likely to use ANC services than women whose husband had secondary and above (OR=0.630, 95% CI: 0.502-0.789) controlling for all the other variables in the model.

Women who had no any exposure to mass media were about 49% less likely use ANC services than women who have exposure at least once a week (OR 0.511, 95% CI:

0.448-0.882) controlling for other variables in the model. Similarly women who had exposure for less than once a week were about 25% less likely to use ANC services than women who have exposure to media for at least once a week (OR 0.747, 95% CI: 0.644-0.866) controlling for other variables in the model.

Women who had no work about 16% less likely to use ANC service than women who had work (OR=0.843, 95% CI: 0.750-0.947) controlling for all the other variables in the model.

Women whose husband had no work and agricultural worker were about 48% and 36% less likely to use ANC services than women whose husband had non agricultural worker (OR=0.519, 95% CI: 0.350-0.769) and (OR=0.638, 95%CI: 0.545-0.746), respectively controlling for all the other variables in the model.

Protestant women were 96.4% more likely to use ANC services than women that are followers of religion other than orthodox, catholic and muslim (OR=1.964, 95% CI: 1.082-3.562) controlling for all the other variables in the model. Women followers of religion orthodox, catholic and muslim were 2.733, 2.388 and 3.02 times more likely to use ANC service than women that are followers of religion other than protestant (OR=2.733, 95% CI: 1.491-5.008), (OR=2.388, 95% CI: 1.116-5.109), and (OR=3.02, 95% CI: 1.651-5.528), respectively controlling for all the other variables in the model.

The region is also a significant variable on the use of health facility for ANC. Women's living in Tigray and Addis Ababa region were 2.308 and 3.083 times more likely to use ANC services than women in Dire Dawa (OR=2.308, CI: 1.681-3.168) and (OR=3.083, 95% CI: 1.757-5.407), respectively controlling for all the other variables in the model.

Women in Affar, Oromiya and Somalia were 50%, 31% and 65% less likely to use ANC services than women in Dire Dawa (OR=0.499, CI: 0.374-0.655), (OR=0.694, CI: 0.530-0.909) and (OR=0.346, CI: 0.255-0.471), respectively controlling for all the other variables in the model

4.3.2 Binary logistic analysis of delivery care

Table 4.7. Intercept-only model of delivery care

		β	S.E.	Wald	df	Sig.	Exp(β)
Step 0	Constant	-1.571	.031	2.615E3	1	.000	.208

In Table 4.7 the intercept-only model or null model has ln(odds) = -1.571 If we exponentiate both sides of this equation we find that our predicted odds [Exp(-1.571)=0.208]. That is, the predicted odd of using delivery care is 0.208.

Table 4.8. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	3012.486	28	.000
	Block	3012.486	28	.000
	Model	3012.486	28	.000

Table 4.8 shows that the omnibus test is highly significant (p-value is 0.00) so we can conclude that adding the predictors will increase our precision in prediction maternal health care of delivery care.

Table 4.9. Hosmer-Lemeshow Test of delivery care

Step	Chi-square	df	Sig.
1	9.202	8	.326

Contingency Table for Hosmer and Lemeshow Test

		Place of delivery = no		Place of delivery = yes		
		Observed	Expected	Observed	Expected	Total
Step 1	1	735	736.430	9	7.570	744
	2	725	728.358	16	12.642	741
	3	725	727.523	20	17.477	745
	4	725	721.551	20	23.449	745
	5	698	700.044	34	31.956	732
	6	700	700.139	44	43.861	744
	7	674	680.342	71	64.658	745
	8	650	628.229	95	116.771	745
	9	408	422.768	338	323.232	746
	10	118	112.616	633	638.384	751

Table 4.9 exhibit the non-significance of the chi-square value (p-value is 0.326) so, we cannot reject the null hypothesis (the model is a good fit) that there is no difference between the observed and expected frequencies which indicates that the model adequately fits the data.

Table 4.10 Variables in the Equation of delivery care

		$\hat{\beta}$	S.E.	Wald	df	Sig.	Exp($\hat{\beta}$)	95.0% C.I.for EXP(β)	
								Lower	Upper
Step 1[a]	Mother age			6.382	2	.041*			
	15-19	-.462	.219	4.448	1	.035*	.630	.410	.968
	20-34	.022	.119	.035	1	.851	1.023	.810	1.291

Region			262.807	10	.000*			
Tigray	-1.629	.221	54.458	1	.000*	.196	.127	.302
Affar	-2.152	.239	80.865	1	.000*	.116	.073	.186
Amhara	-1.407	.219	41.103	1	.000*	.245	.159	.376
Oromiya	-1.604	.202	63.315	1	.000*	.201	.135	.299
Somali	-1.812	.229	62.746	1	.000*	.163	.104	.256
Benishangul-Gumuz	-.255	.196	1.699	1	.192	.775	.528	1.137
SNNP	-1.912	.237	65.147	1	.000*	.148	.093	.235
Gambela	-.746	.229	10.616	1	.001*	.474	.303	.743
Harari	-.435	.203	4.588	1	.032*	.647	.435	.964
Addis Ababa	-.245	.227	1.164	1	.281	.783	.502	1.221
Rural	-1.763	.117	228.295	1	.000*	.171	.136	.216
Mother edu.			43.934	2	.000*			
No education	-1.187	.180	43.585	1	.000*	.305	.215	.434
primary	-.839	.164	26.044	1	.000*	.432	.313	.596
religion			14.910	4	.005*			
orthodox	-.481	.398	1.460	1	.227	.618	.284	1.349
catholic	-.454	.538	.712	1	.399	.635	.221	1.824
porotistant	-.787	.395	3.961	1	.047*	.455	.210	.988
muslim	-.874	.398	4.811	1	.028*	.417	.191	.911
Birth order			51.370	2	.000*			
1	.807	.133	36.856	1	.000*	2.242	1.728	2.910
2-4	.132	.119	1.218	1	.270	1.141	.903	1.442
Husband edu.			36.925	2	.000*			

	No education	-.860	.143	35.959	1	.000*	.423	.320	.561
	Primary	-.421	.123	11.759	1	.001*	.657	.516	.835
	Non empl. motr	-.093	.090	1.069	1	.301	.911	.764	1.087
	Media			42.081	2	.000*			
	Not at all	-.678	.114	35.551	1	.000*	.508	.406	.635
	< than 1 a week	-.587	.125	21.997	1	.000*	.556	.435	.710
	Husb occ			33.006	2	.000*			
	did not work	-.345	.259	1.767	1	.184	.708	.426	1.178
	agricultural employee	-.672	.117	32.920	1	.000*	.511	.406	.643
	Constant	3.364	.459	53.648	1	.000*	28.902		

a. Variable(s) entered on step 1: Mage, Region, Residance, Mel, religion, bor, Hel, Workstat, media, Hocc.

Interpretation of the coefficient from Table 4.10

The above table show that mother's work status have not significant on utilization of delivery care while the others variables have significant effect. Let us see the effect of each variable on delivery care.

The age of mothers have not significant effect on ANC but not in delivery care. women who have age less than 15-19 years were 37% less likely to use delivery care services than mothers whose age at birth is 35 to 49 (OR=0.630, 95% CI: 0.410-0.968) controlling for all the other variables in the model.

Women who live in rural areas of the country were 83% less likely to use delivery care services (OR=0.171, 95% CI: 0.136-0.216) than women who reside in urban areas of the country while controlling for other variables in the model.

womens who live in region Tigray, Affar, Amhara, Oromiya, Somali, SNNP, Gambela, and Harari were 80%,88%, 76%, 80%, 84%, 85%, 53% and 35%less likely to use delivery care services than women in Dire Dawa (OR=0.196, 95% CI: 0.127-0.302), (OR=0.116, 95% CI: 0.073-0.186), (OR=0.245, 95% CI: 0.159-0.376), (OR=0.201, 95% CI: 0.135-0.299), (OR=0.163, 95% CI: 0.104-0.256), (OR=0.148, 95% CI: 0.093-0.235), (OR=0.474, 95% CI: 0.303-0.743) and (OR=0.647,95% CI:0.435-0.964), respectively controlling for all other variables in the model.

A statistically significant difference was seen by education level of mothers even after controlling for the other variables. Women who had no education were about 70% less likely to use delivery care services than women who had secondary and above (OR=0.305, 95% CI: 0.215-0.434) controlling for all the other variables in the model. Women who had primary education were about 57% less likely to use delivery care services than women who had secondary and above (OR=0.432, 95% CI: 0.313-0.596) controlling for all the other variables in the model.

Similarly Women whose husband had no education were about 58% and 34% less likely to use delivery care services than women whose husband had secondary and above (OR=0.423, 95% CI:0.320-0.561) and (OR=0.657, 95% CI: 0.516-0.835) controlling for all the other variables in the model.

Women at their first birth were 2.242 times more likely to use delivery care services than women at their fifth birth (OR=2.242, 95% CI: 1.728-2.910) controlling for all the other variables in the model.

The chances of getting delivery care also vary according to occupation of husband. Women whose husband had agricultural worker were about 49% less likely to use delivery care services than women whose husband had non agricultural worker (OR=0.511, 95% CI: 0.406-0.635) controlling for all the other variables in the model.

Women who followers of religions protestant and muslim were 55% and 58%, less likely to use delivery care as compared to women that are followers of religion other than orthodox and catholic (OR=0.455, 95% CI: 0.210-0.988) and (OR=0.417, 95% CI: 0.191-0.911), respectively controlling for all the other variables in the model.

The last explanatory variable that had a great association and has significant effect on delivery care is exposure to mass media. Women who had no any exposure to mass media were about 49% less likely use delivery care services than women who have exposure at least once a week (OR=0.508, 95% CI: 0.406-0.635) controlling for other variables in the model. Similarly women who had exposure for less than once a week were about 44% less likely to use delivery care services than women who have exposure to media for at least once a week (OR=0.556, 95% CI: 0.435-0.7) controlling for other variables in the model.

4.3.3 Binary logistic analysis of postnatal care

Table 4.11. Intercept-only model of postnatal care

		β	S.E.	Wald	df	Sig.	Exp(β)
Step 0	Constant	-1.855	.034	2.994E3	1	.000	.156

In Table 4.11 the intercept-only model or null model has ln(odds) =-1.855. If we exponentiate both sides of this equation we find that our predicted odds [Exp(-1.855)=0.156]. That is, the predicted odd of using PNC is 0.156.

Table 4.12 Omnibus Tests of Model Coefficients of postnatal care

		Chi-square	df	Sig.
Step 1	Step	1649.167	28	.000
	Block	1649.167	28	.000
	Model	1649.167	28	.000

Table 4.12 omnibus tests is significant because the significant value is less than 0.05 so we can conclude that adding the predictors to the model will increase precision in prediction maternal health care of postnatal care.

Table 4.13 Hosmer-Lemeshow Test of postnatal care

Step	Chi-square	Df	Sig.
1	10.256	8	.248

Contingency Table for Hosmer and Lemeshow Test

		Respondent's check up after delivery = No		Respondent's check up after delivery = Yes		
		Observed	Expected	Observed	Expected	Total
Step 1	1	727	723.035	10	13.965	737
	2	720	725.529	24	18.471	744
	3	704	706.624	26	23.376	730
	4	707	702.672	25	29.328	732
	5	713	707.711	31	36.289	744
	6	695	698.723	49	45.277	744
	7	689	687.165	61	62.835	750
	8	655	646.077	88	96.923	743
	9	510	533.452	234	210.548	744
	10	312	301.012	458	468.988	770

Table 4.13 shows the non-significance of the chi-square value (p-value is 0.326 i.e. greater than 0.05), so we can not reject the null hypothesis (the model is a good fit). It is no difference between the observed and expected frequencies which indicates that the model adequately fits the data.

Table 4.14Variables in the Equation of post natal care

								95.0% C.I.for EXP(β)	
		$\hat{\beta}$	S.E.	Wald	df	Sig.	Exp($\hat{\beta}$)	Lower	Upper
Step 1[a]	Mother age			4.572	2	.102			
	15-19	-.408	.212	3.691	1	.055	.665	.438	1.008
	20-34	-.189	.110	2.972	1	.085	.827	.667	1.026
	Region			111.248	10	.000*			

Tigray	.004	.198	.000	1	.985	1.004	.681	1.479
Affar	-.526	.209	6.331	1	.012*	.591	.392	.890
Amhara	-.625	.214	8.546	1	.003*	.535	.352	.814
Oromiya	-.864	.199	18.887	1	.000*	.421	.285	.622
Somali	-.636	.220	8.328	1	.004*	.530	.344	.815
Benishangul-Gumuz	.086	.205	.177	1	.674	1.090	.729	1.629
SNNP	-.704	.223	9.973	1	.002*	.495	.319	.766
Gambela	.244	.220	1.231	1	.267	1.276	.829	1.964
Harari	.534	.188	8.099	1	.004*	1.706	1.181	2.465
Addis Ababa	-.094	.187	.252	1	.616	.910	.631	1.313
Rural	-1.125	.119	89.131	1	.000*	.325	.257	.410
Mother edu.			31.382	2	.000*			
No education	-.862	.154	31.354	1	.000*	.423	.313	.571
primary	-.590	.135	19.103	1	.000*	.554	.425	.722
religion			6.687	4	.153			
orthodox	1.092	.741	2.171	1	.141	2.980	.697	12.738
catholic	.516	.853	.367	1	.545	1.676	.315	8.910
porotistant	.946	.738	1.644	1	.200	2.576	.606	10.947
muslim	.865	.742	1.360	1	.243	2.376	.555	10.172
Birth order			15.890	2	.000*			
1	.393	.129	9.302	1	.002*	1.481	1.151	1.906
2-4	.023	.115	.040	1	.841	1.023	.817	1.281
Husband edu.			23.096	2	.000*			
No education	-.617	.135	20.784	1	.000*	.539	.414	.703
Primary	-.463	.112	17.016	1	.000*	.630	.505	.784
Non empl. motr	.000	.086	.000	1	.994	.999	.845	1.182
Media			40.540	2	.000*			
Not at all	-.722	.114	40.013	1	.000*	.486	.388	.607

	< than 1 a week	-.380	.119	10.223	1	.001*	.684	.542	.863
	Husb occ			32.036	2	.000*			
	did not work	-.473	.278	2.901	1	.088	.623	.362	1.074
	agricultural employee	-.654	.117	31.419	1	.000*	.520	.414	.654
	Constant	-.006	.764	.000	1	.994	.994		

a. Variable(s) entered on step 1: Mage, Region, Residance, Mel, religion, bor, Hel, Workstat, media, Hocc.

Interpretation of logistic regression analysis of PNC

Table 4.14 shows that mothers age, religion and mothers work status have not significant effect on postnatal care services while mother's education levels, husband education level, exposure to mass media, birth order, occupation of husband, region and place of residence have significant effect.

Women who live in rural areas of the country were 67% less likely to use PNC services (OR=0.325, 95% CI: 0.257-0.410) than women who reside in urban areas of the country while controlling for other variables in the model.

Women in region Affar, Amhara, Oromiya, Somali and SNNP were 41%, 46%, 58%, 47% and 50% less likely to use PNC services than women in Dire Dawa (OR=0.591, 95% CI: 0.392-0.890), (OR=0.535,95% CI: 0.352-0.814), (OR=0.421, 95% CI:0.285-0.622), (OR=0.530, 95% CI: 0.344-0.815) and (OR=0.495, 95% CI: 0.319-0.766) controlling for other variables in the model. Women live in Harari are 70.6% more likely to use PNC services than women live in Dire Dawa (OR=1.706, 95% CI: 1.181-2.465) controlling for other variables in the model.

Similarly to the above two model both mothers and husband education levels had also significant effect on PNC services. Women who had no education were about 58% less likely to use PNC services than women who had secondary and above (OR=0.423, 95% CI: 0.313-0.571) controlling for all the other variables in the model. Women whose husband had no education were about 46% less likely to use PNC services than women whose husband had secondary and above (OR=0.539, 95% CI: 0.414-0.703) controlling for all the other variables in the model.

Women at their first birth and 2-4 birth were 48.1% and 2.3% more likely to use PNC services than women at five and more birth (OR=1.481, 95% CI: 1.151-1.906) and (OR=1.023, 95% CI: 0.817-1.281), respectively controlling for all the other variables in the model.

The occupation of husbands also had significant effect on PNC services. Women whose husband had agricultural worker were about 48% less likely to use delivery care service than women whose husband had non agricultural worker (OR=0.520, 95% CI: 0.414-0.654) controlling for all the other variables in the model

Women who had no any exposure to mass media were about 61% less likely use PNC services than women who have exposure at least once a week (0R=0.486, 95% CI: 0.388-0.607) controlling for other variables in the model. Similarly women who had exposure for less than once a week were about 32% less likely to use PNC services than women who have exposure to media for at least once a week (OR=0.684, 95% CI: 0.542-0.863) controlling for other variables in the model.

4.4. Logistic regression diagnostics result

The first fitted model for the data may be inadequate. Regression diagnostics are used to detect problems with the model and suggest improvements. It would be reasonable to use diagnostics to check if the model is adequate or not. The adequacy of the fitted model was checked for possible presence and treatment of outliers and influential values. The diagnostic test results for detection of outliers and influential values are presented in the Appendix A and B. Appendix B 1, 2 and 3 shows for antenatal care the residuals like Studentized, deviance, Pearson and standardized residuals are all less than 3 in absolute value. The Residuals less than 3 in absolute value show the absence of an outlier observation. In appendix A Table1 the DFBETAs for model parameters (including the constant term), Cook's influence statistic and Leverage Values (Hat Diag) were less than 0.0232, 1 and 1 respectively. DFBETAs less than 0.0232imply an observation has no effect on the estimate of a regression coefficient while a Cook's distance less than unity showed each observation had no impact on the group of regression coefficients. A value of the leverage statistic less than one shows that no observation is far apart from the others in terms of the levels of the independent variables (not the dependent variable). Thus, from the above goodness of fit tests and diagnostic checking, we can say that our model is adequate.

The diagnostic test results for detection of outliers and influential cases are included in the Appendix B 4-9 and on Appendix Table 1. A check of the standardized residuals for the two maternal healthcare services (i.e. delivery care and PNC) presented in Appendix B 4-9 reveals that all have values less than absolute value of 3 indicating the absence of outliers in the model implying the models are adequate. Another method of detecting

outliers is leverage value. The greater the value of leverage i.e. leverage greater than one the more potential that observation has for influencing the model fit. From the two scatter plots of leverage values for the two maternal healthcare services models, the leverage values are less than one indicating the absence of outlying observation. In addition, Cook's distance is proposed to measure the effect of excluding any specific observation on the set of parameter estimates. Cook's distance greater than one identifies cases that might be influential (Cook, 1977). Since Cook's distance are all less than one, means that there are no influential cases having an effect on the model. Finally, from the result presented in Appendix A Table 1, there are no high values of DFBETAS because all values less than 0.0232, which means that there are no influential observations for the individual regression coefficients. Thus, from the above goodness of fit tests and diagnostic checking, we can say that both of our models are adequate.

4.5 Discussion

This study found evidence that some of the demographic and socioeconomic variables considered have significant influence on each maternal health care (antenatal care, deliver care and postnatal care). Place of residence, exposure to any mass media, husband/partners occupation, educational level of mother's educational, level of husband, mother's work status, religion and region were identified as important determinants of antenatal care. Place of residence, exposure to any mass media, husband/partners occupation, educational level of mother's, educational level of husband, mother's age, birth order, religion and region are important explanatory variables for delivery care. The important explanatory variables for postnatal care are place of residence, exposure to any

mass media, husband/partners occupation, mother's educational level, husband education level, birth order and region.

Mother's place of residence was found to be significantly related to ANC use, delivery care and PNC use in the total sample. The result of this study also shows that mothers who live in urban areas of Ethiopia were more likely to use maternal healthcare services than mothers who live in rural area. A study by Navaneetham and Dharmalingam (2000) found that the differential in access to health care facilities between rural-urban areas is an important factor for lower utilization of maternal health care services, particularly for institutional delivery and delivery assistance by health personnel in the rural areas of the three states. Another local study, urban women showed higher use of ANC than the rural counterparts, 83% of women in Addis to 22% women in the rural regions (Yared and Asnaketch, 2002).

Regions also have significant relation to use of maternal health care (ANC, delivery care and PNC). In 2005 EDHS births at home are substantially higher among women who live in Tigray, Afar, Amhara, Oromia, Benishangul Gumuz and SNNP regions. On the other hand, relatively large proportions of women give birth in health institutions in Gambella (16.1 percent), Harari (31.8 percent), Addis Ababa (78.4 percent) and Dire Dawa (26.3 percent).

In this study, mother's and husband's education was an important predictive factor for usage of ANC, delivery care and PNC services. It is also likely that educated mothers will tend to seek out higher quality services. In the literature, there is strong consistency in the relationship between mother's education and utilization of maternal healthcare services. Navaneetham and Dharmalingam (2000) also found women's literacy is an

important predictor for the use of maternal health care services in all three states. Illiterate women were less likely to use maternal health care services for delivery assistance and place of delivery compared to literate women in all the three states in India. Kamal (2009) using regression model showed that husband's education is another factor which affects utilization of maternal health care services. Husband's education is found to have a significant positive association with maternity care service utilization. The pattern of service utilization by husband's education was found to be almost on par with what was observed for women's education.

Religion is found be significantly related with use of ANC services and assistance during delivery but not with use of PNC. It was observed that women who follow traditional beliefs had lower chance of receiving antenatal care service when compare with those who follower of Orthodox/catholic Christianity, protestant and muslim. This finding is similar with other studies in Ethiopia by Eyerusalem (2010) who showed that Religion is found be significantly related with use of antenatal care services but not with use of assistance during delivery. It was observed that women who follow traditional beliefs had a 50% lower chance of receiving antenatal care service when compare with those who follow orthodox/catholic Christianity.

Work status of the mother was found to be specifically associated with utilization of ANC in this study. Experiences and roles as economic providers might empower women through increased control over income which, in turn, may increase their power in decision making about health care and their ability to access and pay for the services that they need when they are pregnant. This result was not significant for assistance during

delivery care and PNC. Mekonnen and Asnakech, (2002), found that mothers' work status does not significantly relate to utilization of maternal health care services.

Husband occupation was found to be specifically associated with utilization of ANC, delivery care and PNC services in this study. The results showed that husband occupation as non-agricultural employer was is positively associated with utilization of ANC, delivery care and PNC services from health professionals. This finding is similar to a result Sari (2009) for Indonesia women's working status and husband's occupation do not have a significant impact on the probability of women obtaining antenatal care and modern delivery care, although these variable, particularly husband's occupation is positively and strongly associated with the dependent variables. Similar study in Ethiopia also found that occupational status of the husband was found to be strong indicators of utilization in the total sample of women (Eyerusalem, 2010).

According to this study age of a mother was not found to be significantly related to both use of ANC and PNC. This finding was similar to that from 2005 EDHS. However, mother's age was significantly associated to the use of delivery care. It was seen that there was a slightly higher likelihood of use of delivery care services for women in the age group 35-49 as compared to those who were less than 20 years.

Birth order of the child showed significant association with use of delivery care services and use PNC. Use of these maternal health services was shown to decrease with increase in birth order. The decrease in odds was especially more consistent in the use of assistance during delivery. This finding was similar to the study by Chimankar and Sahoo in (2011).

The other important finding of this study was the strong association between exposure to mass media and maternal health care (ANC, delivery care and PNC). As the chance of getting media increased the use of maternal health care also increased. According to Sari (2009) the more frequently the women were exposed to mass media, the greater was their use of antenatal care, health facilities as the place of deliveries and skilled birth attendants during birth.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study attempted to answer important issues on the status of use of maternal health care services in Ethiopia. Maternal health care service utilization was found to be very low and it was seen that utilization of this services was unequally distributed. The distribution varied depending on place of residence and among the different strata of socioeconomic and education groups. Education of the mothers was a very strong predictor showing the importance of women's education in order to reduce maternal mortality and even more to improve survival of their children.

Those mothers living in the rural area, those with less exposure to media and uneducated mothers and husbands were at a greater disadvantage. Husband's educational status and mother's education had a significant and positive effect on the utilization of maternal healthcare services. Exposed to media increase the maternal health care services also increase in each type (ANC, delivery care and PNC).

The occupation status of husband, had a significant impact on the utilization of maternal health care services; mothers whose husbands work in non agriculture works were more likely to use the health service.

5.2 Recommendations

As there is variation and differences in use of maternal health care across place of residence it is recommended that the government try to balance the maternal health care services by including support services to rural and urban areas fairly.

Increasing exposure to media information increases awareness and knowledge about maternal health and attitudes toward risk prevention by using the maternal health care services. Therefore, it is recommended that more should be done to improve the media.

Great attention should be given to the most vulnerable group of women in the country who are living in rural areas and had no or litter education.

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Appendix A:

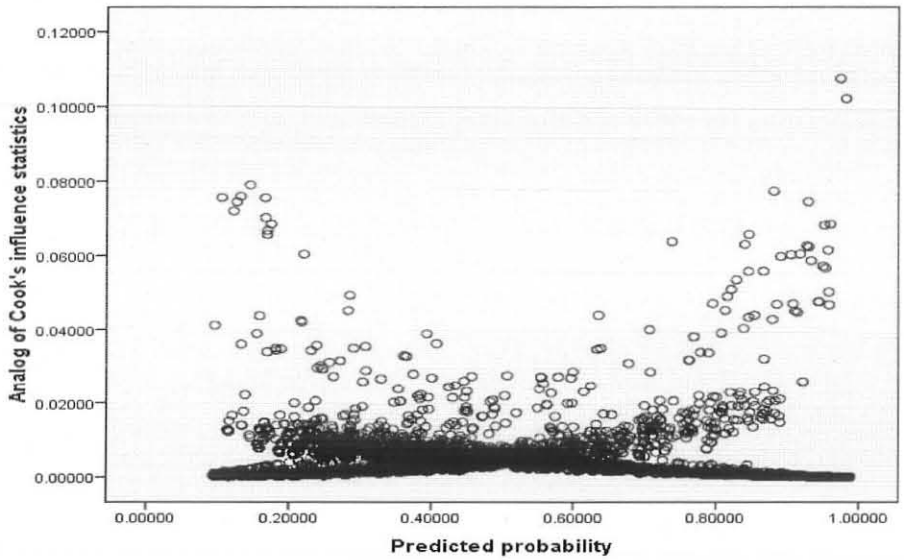
Table 4.15 Result of Diagnostic Tests for Outliers and Influential Value for Standard logistic regression.

		ANC		Delivery care		PNC	
	N	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
DFBETA for constant	7438	-.05743	.02050	-.10511	.01782	-.09314	.01694
DFBETA for Mage(1)	7438	-.01341	.01238	-.02888	.01524	-.02576	.02245
DFBETA for Mage(2)	7438	-.00371	.00399	-.01255	.01225	-.01043	.00915
DFBETA for Region(1)	7438	-.01505	.01533	-.02180	.02084	-.01922	.01762
DFBETA for Region(2)	7438	-.00959	.01152	-.02696	.01928	-.02012	.02246
DFBETA for Region(3)	7438	-.01183	.01450	-.01929	.02040	-.01995	.02307
DFBETA for Region(4)	7438	-.00939	.01274	-.01875	.02014	-.02027	.02109
DFBETA for Region(5)	7438	-.01106	.01172	-.02754	.02316	-.02036	.02081
DFBETA for Region(6)	7438	-.00968	.01238	-.02023	.02193	-.02120	.02079
DFBETA for Region(7)	7438	-.01052	.01540	-.02639	.01600	-.02013	.02188
DFBETA for Region(8)	7438	-.01246	.01517	-.02555	.02279	-.02704	.02250
DFBETA for Region(9)	7438	-.01175	.01274	-.01862	.02150	-.01949	.01555
DFBETA for Region(10)	7438	-.06340	.01975	-.02481	.02127	-.01557	.01786
DFBETA for Residance(1)	7438	-.00727	.00817	-.01002	.01114	-.01279	.01130
DFBETA for Mel(1)	7438	-.01376	.02123	-.02437	.02204	-.01815	.01179
DFBETA for Mel(2)	7438	-.01366	.02058	-.02203	.02089	-.01531	.01056
DFBETA for religion(1)	7438	-.07891	.01760	-.13029	.02064	-.52437	.01395
DFBETA for religion(2)	7438	-.07961	.02105	-.13172	.02039	-.52416	.01427
DFBETA for religion(3)	7438	-.07946	.02112	-.13148	.02089	-.52426	.09437
DFBETA for religion(4)	7438	-.07974	.02281	-.13282	.02303	-.52384	.09371
DFBETA for bor(1)	7438	-.00411	.00561	-.01125	.01332	-.01055	.01363
DFBETA for bor(2)	7438	-.00262	.00365	-.01032	.01146	-.00964	.01033
DFBETA for Hel(1)	7438	-.00930	.00988	-.01527	.01159	-.01503	.01114
DFBETA for Hel(2)	7438	-.00916	.00956	-.01310	.01080	-.01078	.00679
DFBETA for Workstat(1)	7438	-.00276	.00242	-.00656	.00482	-.00613	.00367
DFBETA for media(1)	7438	-.00312	.00254	-.01135	.01044	-.01069	.01130

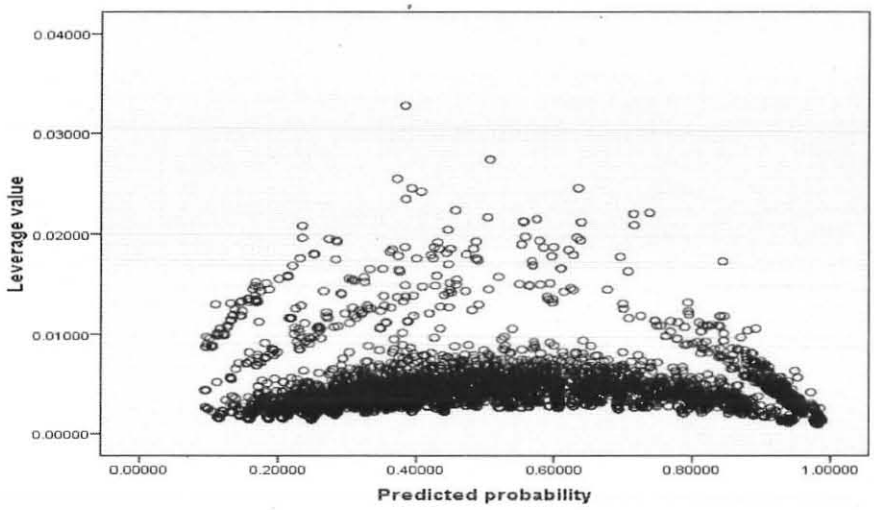
DFBETA for media(2)	7438	-.00444	.00297	-.01021	.01191	-.00772	.01006
DFBETA for Hocc(1)	7438	-.03336	.02269	-.05148	.02059	-.03073	.02898
DFBETA for Hocc(2)	7438	-.00741	.00457	-.01362	.00972	-.01059	.00992
Valid N (listwise)	7438						

APPENDIX B: Scatter Plots for Diagnostic Checking for Standard Logistic Model

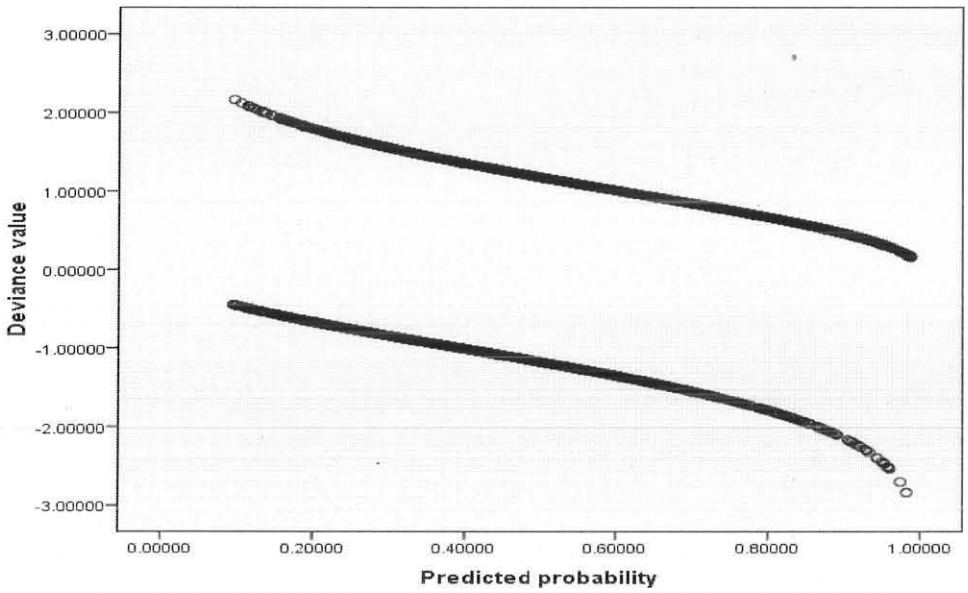
1. Scatter Plots for Diagnostic Checking for ANC



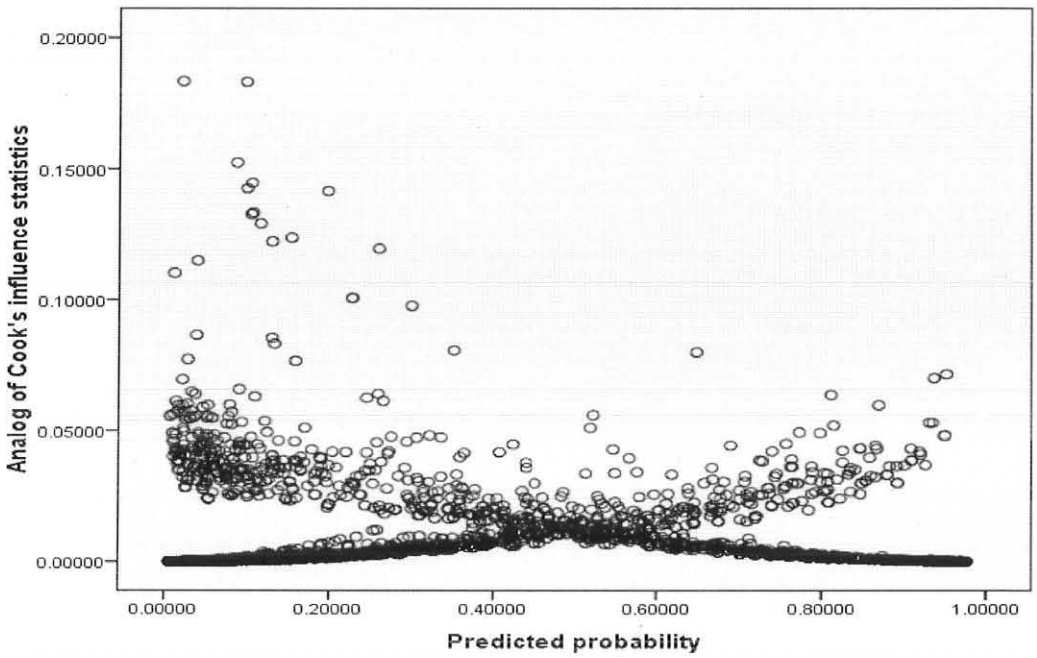
2. Scatter Plots for Diagnostic Checking for ANC



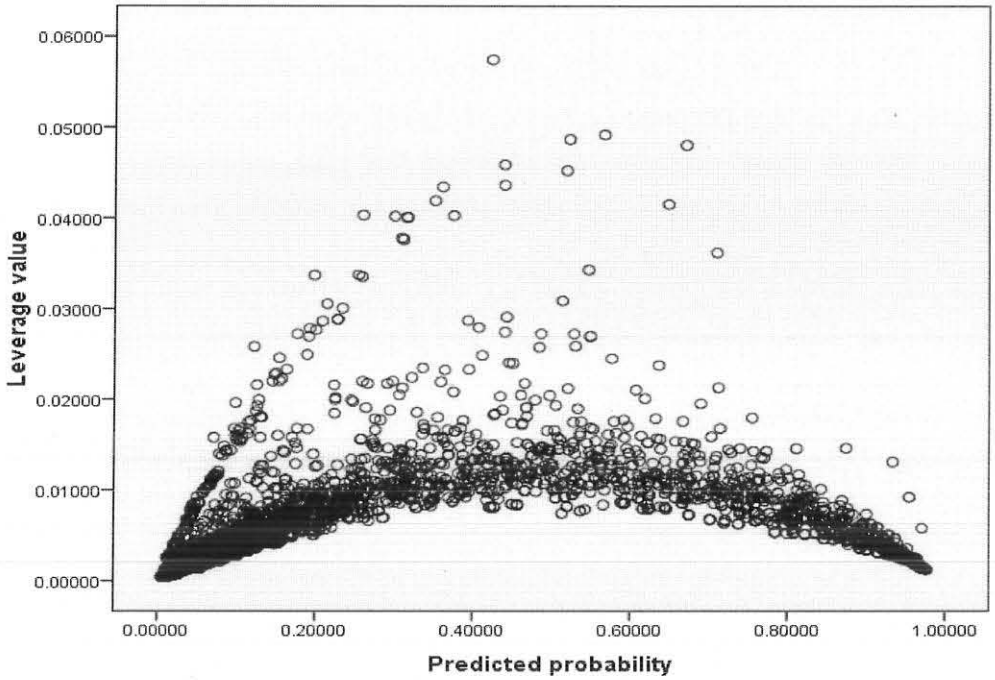
3. Scatter Plots for Diagnostic Checking for ANC



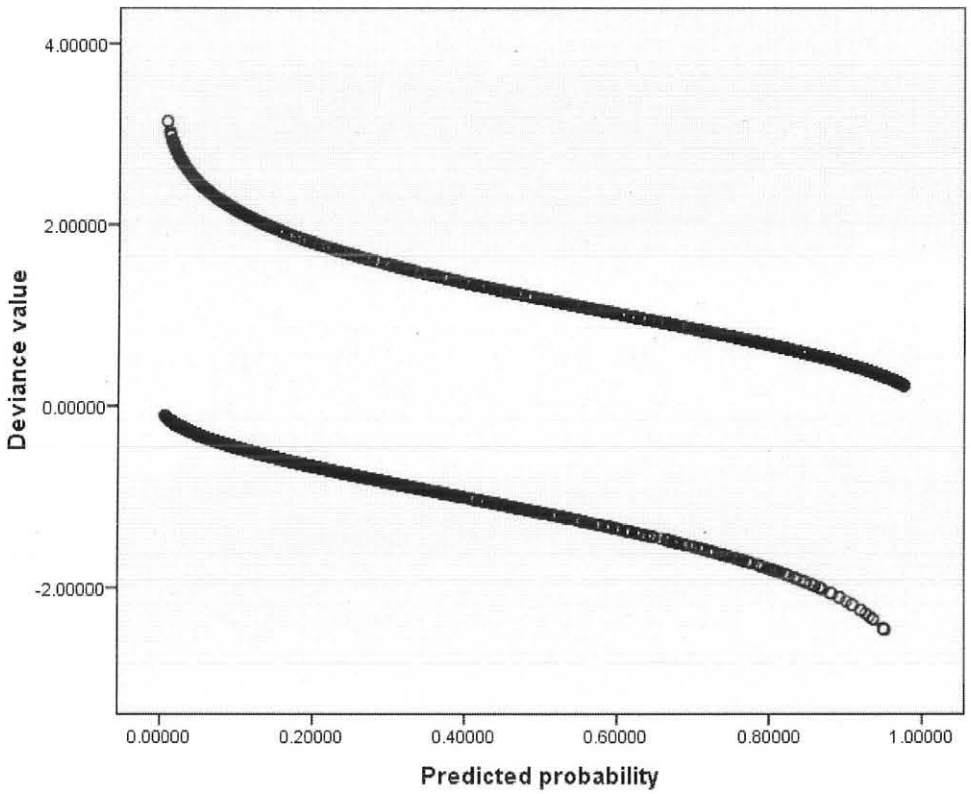
4. Scatter Plots for Diagnostic Checking for delivery care



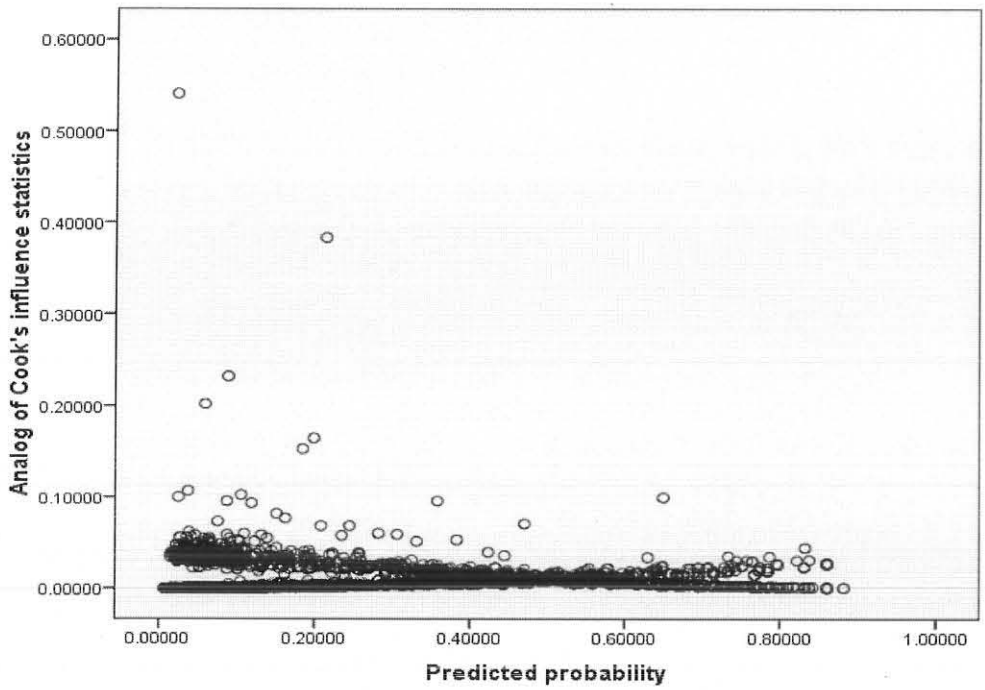
5. Scatter Plots for Diagnostic Checking for delivery care



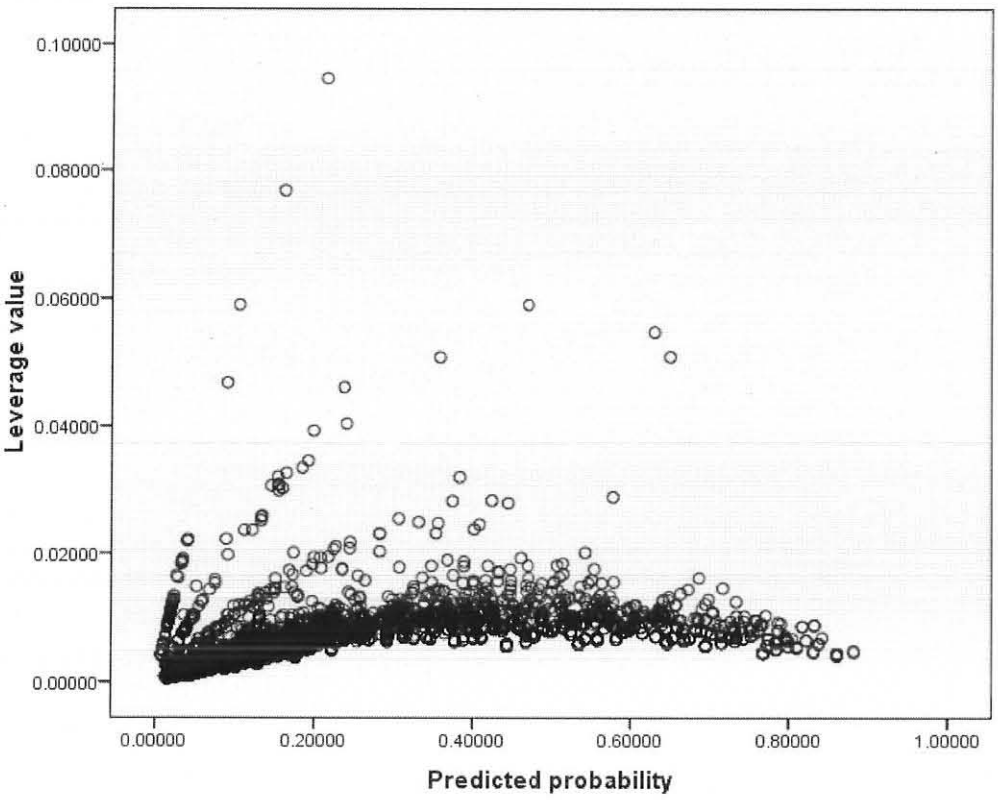
6. Scatter Plots for Diagnostic Checking for delivery care



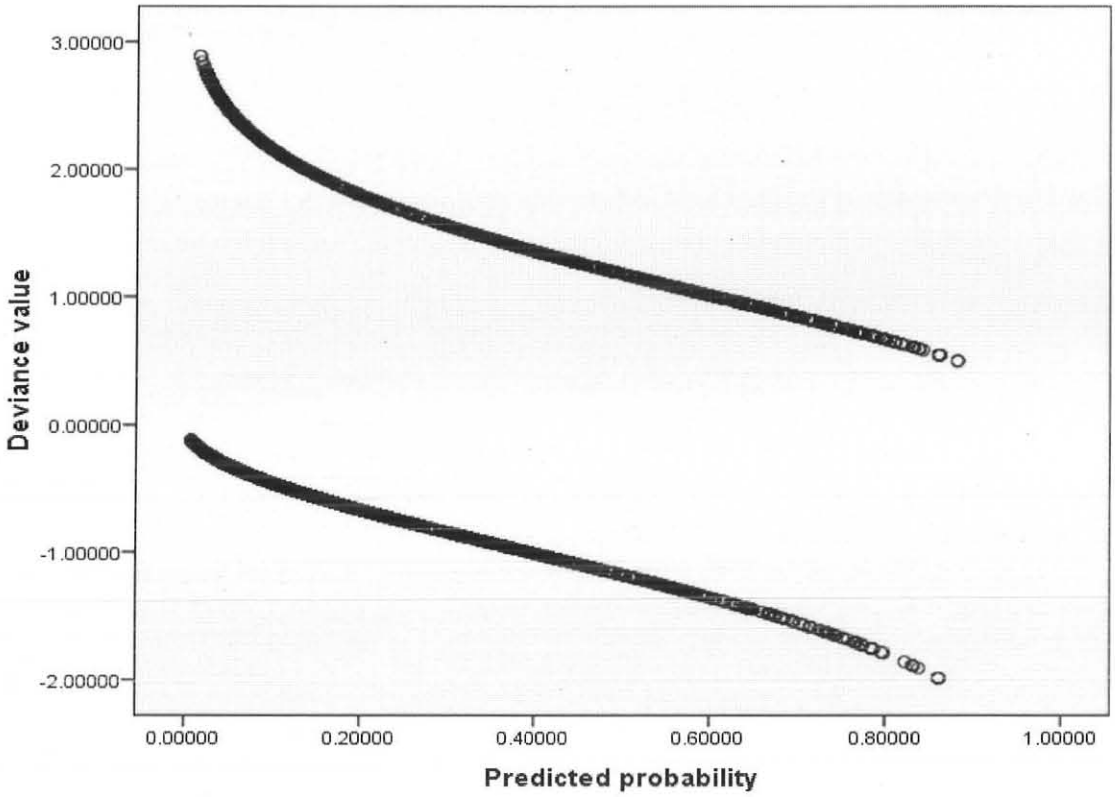
7. Scatter Plots for Diagnostic Checking for PNC



8. Scatter Plots for Diagnostic Checking for PNC



9. Scatter Plots for Diagnostic Checking for PNC



DECLARATION

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

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Signature: ----------

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Date of submission: June, 2013

This thesis has been submitted for examination with my approval as a University advisor.

MK. Sharma (Prof.) M K Sharma

Advisor's Name Signature