

AN ANALYSIS OF THE RELATIONSHIP BETWEEN ANTENATAL CARE,  
SKILLED BIRTH ATTENDANCE AND THE SOCIO-ECONOMIC STATUS OF  
HOUSEHOLDS IN ZIMBABWE

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## **ABSTRACT**

Maternal mortality is a global concern and a consensus has been reached that the health of mothers and children is an important indicator of national health and the socio-economic development of countries. Monitoring progress in maternal mortality reduction relies on reproductive health indicators, including the proportion of births attended by a skilled health worker and antenatal care coverage. Besides playing an educative role on the importance of skilled birth attendance, the use of antenatal care in the prevention of maternal mortality continues to be debated. This study carried out an analysis of the relationship between antenatal care, skilled birth attendance and the socio-economic status of households in Zimbabwe. A structural equation modeling approach is used to correct for the problems of endogeneity in the use of antenatal care whilst taking into account the possible effects of a household's socio-economic status on the decision to go for antenatal care and to utilise skilled attendance at delivery. The findings point to a significant and positive effect of the number of antenatal consultations, quality of the antenatal care services and socio-economic status on skilled birth attendance. The results suggest that interventions should target both supply and demand sides of maternal health making sure that women are encouraged to go for more antenatal visits and that health facilities are able to provide high quality antenatal care services.



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### **Dedication**

I wish to dedicate this thesis to my beloved husband Anotida Tangawamira for all the love, care and support. To my parents Mr Nyashadzashe Koke and Mrs Monica Koke- thank you for believing in me; and to my brothers and sister, I am passing on the button to you.



### **Declarations**

I, Elisa Pride Tangawamira, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher education.

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**List of Acronyms**

ANC	Antenatal Care
CARMMA	Campaign on Accelerated Reduction of Maternal Mortality in Africa
GDP	Gross Domestic Product
HTF	Health Transition Fund
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
MoHCW	Ministry of Health and Child welfare
SBA	Skilled Birth Attendance
UNICEF	United Nations Children Fund
UN ZIMBABWE	United Nations in Zimbabwe
WHO	World Health Organisation
ZNS	Zimbabwe National Statistics



## **CHAPTER 1**

### **Introduction**

#### **1.1 Orientation of the study**

Maternal mortality continues to be a global concern with the goals of safe motherhood eluding many governments. The World Health Organisation reports that approximately 800 women die everyday from avertible causes related to pregnancy and childbirth (WHO, 2014). The health of mothers and children is an essential indicator of national health and the socio-economic development of countries. According to Pathak, Singh and Subramanian (2010), high maternal mortality lowers the ability of women to participate in economic activities and curtails a nation's macroeconomic benefits. The importance of the development-health relationship is reflected in two out of the eight Millenium Development Goals (MDGs) which focus on reducing infant and maternal mortality. Global technical agreements have been advanced to determine ways of improving maternal health in the poorest countries, however, achieving these improvements has remained a challenge.

Monitoring progress in maternal mortality reduction relies on reproductive health indicators, including the proportion of births attended to by a skilled health worker and antenatal care coverage (WHO, 2010). Slow progress towards the MDG for maternal health has led to calls for accelerated progress in scaling up skilled birth attendance (Koblinsky et al., 2006). The proportion of women receiving skilled birth attendance during delivery is used as a progress indicator for reducing maternal mortality, since direct measurement of maternal mortality is difficult (Campbell, 1999; de Bernis, Sherratt, AbouZahr, & Van Lerberghe, 2003; Nikiema, Kameli,



Capon, Sondo, & Martin-Prevel, 2010). For the majority of women in labor, access to a skilled birth attendant along with equipment, drugs and supplies is now advocated as the single most important factor in preventing maternal deaths (WHO, ICM, & FIGO, 2004). There is an ongoing debate on the use of antenatal care as a preventative measure for reducing maternal and infant mortality in developing countries. The main reason is that the uptake of maternal health care is typically dependent on socioeconomic and cultural factors. Carroli, Rooney and Villar (2001) argued that good quality evidence on antenatal care (ANC) in developing countries is scarce and that the interventions currently in progress have not been subjected to rigorous evaluation.

### **1.1.1 Skilled Birth Attendance**

Adegoke and van den Brook (2009) define skilled birth attendance (SBA) as the process by which a woman is given adequate care during labour, delivery and the early postpartum period. This requires a skilled birth attendant or skilled personnel to attend the delivery and an enabling environment, which includes adequate supplies and equipment, transport and effective communication systems. Skilled delivery care is considered to be crucial within the health care system for saving the lives of mothers and new-borns and it is an important indicator for monitoring MDG 5.

The majority of maternal deaths occur during labor, delivery, and the immediate postpartum period (Wanjira, Mwangi, Mathenge, Mbugua, & Ng'ang'a, 2011). As most maternal deaths occur due to obstetric complications, most of these deaths could be prevented if women had access to high-quality maternal health care,



including antenatal care, skilled assistance at delivery, and postnatal care (Chou et al., 2010, Pembe et al., 2010). A skilled health professional can administer interventions to prevent and manage life-threatening complications, such as heavy bleeding, or refer the patient to a higher level of care when needed (WHO, 2013). By increasing the use of skilled birth attendance at delivery, antenatal care can have an indirect influence on the survival of mothers and children (Adjiwanou & LeGrand, 2013).

#### **1.1.2 Antenatal Care**

WHO (2013) defines antenatal care as the process of recording medical history, assessment of individual needs, advice and guidance on pregnancy and delivery, screening tests, education on self-care during pregnancy, identification of conditions detrimental to health during pregnancy, first-line management and referral if necessary. It is more effective in preventing adverse pregnancy outcomes when sought early in the pregnancy and continued through to delivery. Under normal circumstances, WHO recommends that a woman without complications should have at least four ANC visits. Women with complications, special needs, or conditions beyond the scope of basic care may require additional visits (Zimbabwe National Statistics, 2012).

Antenatal care (ANC) from a skilled provider is important to monitor the pregnancy, detect malformation problems and reduce the risks for mother and child during pregnancy and at delivery. ANC visits constitute one of the few times women in many resource-poor settings seek care for their own health and represent an



important opportunity to help women best prepare for birth, as well as inform them about pregnancy-related complications, and the advantages of skilled birth attendance (Carroli et al., 2001). Beyond these roles of detecting malformation problems and other risk factors, de Bernis et al. (2003) agree that in areas where skilled birth attendance remains uncommon, this educational role of ANC is far from negligible in importance, as the timely use of qualified personnel reduces the risk of death for both the mother and new-born.

### **1.1.3 Socio-economic status of households**

According to Gabrysch and Campbell (2009), the socio-economic status of households refers to the relationship between financial capability of a family and the costs of antenatal care, a facility delivery and also includes transport costs. Previous studies have highlighted the differences in the utilization of maternal health care in developed and developing countries. The gap in the risk of maternal deaths between developed and developing countries is said to be a result of different socio-economic differences between the two (UNICEF, 2008). While the socio-economic status can directly affect whether a woman can reach a facility for delivery, the anticipation of high costs affects whether the decision to utilise skilled birth attendance or go for antenatal visits is made in the first place.

### **1.1.4 Methodological challenges**

Despite the promising results, findings from most of the previous studies on the relation between antenatal care and skilled birth attendance have several limitations. Some studies only use the number of antenatal visits to study the relationship but



neglect to investigate the impact of the quality of care on possible skilled attendance use nor the relationship linking the frequency of visits to the quality of the services (Bloom, Lippeveld, & Wypij, 1999). Another problem is the failure by some of these studies to take into account possible endogeneity biases (Rockers, Wilson, Mbaruku, & Krook, 2009). It is possible that the decisions to seek antenatal care and skilled attendance at delivery are related. Concern over health problems may affect both the demand for antenatal care and the likelihood of a skilled delivery or the association may be partly explained by circumstantial factors that affect both phenomena simultaneously. All this acts to bias the estimated impact of ANC on SBA in single equation models.

## **1.2 Statement of the problem**

In an effort to reduce the country's high maternal and child mortality rates, the Ministry of Health and Child Welfare (MoHCW) in Zimbabwe advocated for the increased availability and utilisation of focused antenatal care including prevention of mother- to- child transmission of Human Immunodeficiency Virus (HIV). In response to the antenatal care and skilled birth attendance message, the Government of Zimbabwe in partnership with UNICEF and international donors, launched the Health Transition Fund (HTF) and scrapped all maternal healthcare fees. This led to nearly all women (94%) attending at least one ANC visit (Zimbabwe National Statistics, 2012). Despite the increase in ANC uptake and its educational role on pregnancy and delivery, the number of women utilising skilled birth attendance reduced over time and the maternal mortality rates increased. United Nations in



Zimbabwe (2013) estimated that the government of Zimbabwe was losing at least 1.23% of Gross Domestic Product (GDP) annually due to maternal complications. Given that costs are being incurred providing free maternal care and the targets of lowering maternal mortality rates are not being achieved, there is a need to undertake a study that analyses the relationship between antenatal care, skilled birth attendance, and socio-economic status of households in Zimbabwe. This relationship affects the country's potential in achieving MDG number 5 of reducing maternal mortality by three quarters by 2015.

Recurrent topics of study in developing countries have been on the determinants of maternal and child health whilst the effect of antenatal care on women's decision to utilise skilled birth attendance has received less attention by researchers. A variety of studies have been carried out in different countries to investigate factors that influence maternal healthcare utilisation. Gabrysch and Campbell (2009) reviewed literature on the determinants of delivery service use and found that most of the studies focused on how socioeconomic, demographic and cultural factors influenced utilisation. Other studies that have been of interest are on ANC's impact on maternal and child health outcomes like birth weight. In Zimbabwe studies have not critically focused on the role of ANC in predicting SBA but also mostly on the determinants of maternal health care.

### **1.3 Objectives of the study**

This study sought to find out if utilising antenatal care services ultimately led to increased skilled birth attendance and if the socio-economic status of households



affected the uptake of utilising both antenatal care and skilled birth attendance in Zimbabwe by correcting for endogeneity biases using structural equations.

#### **1.4 Hypotheses of the study**

The research hypotheses of the study are as follows:

- $H_0$ : There is no significant relationship between the socio-economic status of households, antenatal visits and the utilisation of skilled birth attendance.
- $H_1$ : There is a significant relationship between the socio-economic status of households, antenatal care and the utilisation of skilled birth attendance.

#### **1.5 Significance of the study**

The study will help to widen the scope of knowledge on the role of antenatal care in predicting the utilisation of skilled birth attendance and the role the household socio-economic status plays in this relationship. The findings from this research will impart knowledge that will assist healthcare policy makers in the formulation and implementation of sustainable strategies to improve maternal health care outcomes in Zimbabwe and achievement of the Millennium Development Goal on maternal health.

#### **1.6 Limitations of the study**

Large scale surveys like the Zimbabwe Demographic and Health Survey (ZDHS) on which this analysis is based are expensive and as a consequence, they are only



conducted periodically. Although the 2010- 11 ZDHS is the most recent at the time of writing, the information provided might not reflect the current situation and practices. Surveys rely on a self-report method of data collection. Inaccuracies can come up as a result of intentional deception, poor memory, or misunderstanding of questions. The study is affected by omitted variables as well. The ZDHS does not contain all data on the supply side of the health care utilisation such as cost of services, distance to health institutions and quality of service offered by the skilled personnel.

### **1.7. Organization of the Study**

The study is organized in the following manner: Chapter Two gives the background of the maternal health situation in the world, sub- Saharan Africa and in Zimbabwe. In Chapter Three, the key theories and postulates on the relationship between skilled birth attendance, antenatal care and the socio-economic status of households are reviewed. This is followed by a review of previous empirical work related to this study.

Chapter Four presents the methodology which explains how the models were formulated and how probit analysis is done. In Chapter Five, descriptive statistics and the results of the statistical analysis are presented and discussed. Chapter Six is a summary of the findings of the study.



## **CHAPTER 2**

### **BACKGROUND TO MATERNAL HEALTH SITUATION IN ZIMBABWE**

#### **2.1 Introduction**

This chapter gives an overview of the global maternal health situation and then narrows the synopsis down to less developed countries and sub Saharan Africa in particular. After this, the study presents the Zimbabwean situation and then relates the importance of maternal health in economic development. Finally, it highlights the efforts made by the Zimbabwean government towards improving maternal health.

#### **2.2 An overall picture of maternal health situation**

WHO (2014) estimated that about 800 women died from pregnancy or childbirth related complications around the world every day. A shocking 99% of all maternal deaths have been estimated to occur in the developing world with African countries, accounting for 40% of the global pregnancy related mortality (Unies, 2010). Maternal mortality includes all deaths that occur to women during pregnancy, during birth, and up to 2 months after birth or the end of the pregnancy. Two indicators were set to monitor the progress toward improving maternal health. The first one is the maternal mortality ratio (MMR), or the number of maternal deaths per 100,000 live births. The second is the proportion of births attended to by skilled health personnel.

Between 1990 and 2013, the global maternal mortality ratio declined by 2.6% per year which is below the recommended 5.5% required to achieve MDG5. In 2013, an estimated 289,000 maternal deaths, which could have been prevented, occurred globally causing a decline in maternal mortality ratio (MMR) of 45% from the 1990



levels. While substantial reductions in maternal deaths have been achieved in all regions of the world, Sub-Saharan Africa still remains with very high rates even though the maternal death rate had dropped by 41 per cent in 20 years (WHO, 2010). In general, the 1990 rate of 850 deaths per 100,000 live births declined to a regional average of 500 deaths per 100,000 live births in 2010 (Unies, 2010). However, this rate was still high compared to the WHO standard which considers a maternal mortality ratio (MMR) of less than 300 deaths per 100,000 live births to be low. Thus, most sub-Saharan African countries including Zimbabwe are not on track for meeting the targets pertaining to maternal health.

The sub-Saharan Africa region alone accounted for 62% (179,000) of global maternal deaths which is higher than that of other regions. This suggests that the African health system is failing to cope with maternal mortality. In spite of this, Africa spends one per cent of total global health expenditure while sub-Saharan Africa (excluding South Africa) spends only 0.3 percent (WHO, 2006). This underlines the need for greater efficiency.

### **2.3 The maternal health situation in Zimbabwe**

In 2010, Zimbabwe was ranked among the 40 countries in the world with high MMR of over 960 maternal deaths per 100,000 live births as shown in Table 2.1. Estimates obtained from models developed by the WHO/UNICEF/UNFPA/World Bank, (2012), showed that the MMR increased during the last two decades from 450 deaths per 100,000 live births in 1990 to about 690 deaths in 2005. The 2010/11 Zimbabwe Demographic Health Survey (ZDHS) reported that the maternal mortality ratio



(MMR) in Zimbabwe stood at 960 deaths per 100,000 live births having increased from 612 deaths per 100,000 live births recorded in the 2005/06 ZDHS. Both measures show that these ratios are unacceptably high and that MDG 5 remains an unattainable dream by 2015 for Zimbabwe.

**Table 2.1: Maternal mortality Ratio in Zimbabwe, 1990 - 2010**

Year	Deaths/100 000 live births	
	WHO/UNICEF/UNFPA/World Bank	DHS
1990	450	...
1995	540	283
2000	640	695
2005	690	612
2010	570	960
2015 MDG Target	112.5	

*Source: United Nations in Zimbabwe 2013*

The country made remarkable progress during the first decade (1980-1990) of independence in improving access to health services. The implementation of the Primary Health Care program enabled access to basic health care services to about 85 per cent of the population resulting in a 20% decline in mortality rate (United Nations in Zimbabwe, 2013).

Zimbabwe had a health infrastructure and system that compared favourably to other African countries partly as a result of a legacy of health system development before independence in the 1960s and 1970s, when the Zimbabwean model was hailed as the most efficient and comprehensive in sub-Saharan Africa (Kevany, et al., 2012). Unfortunately the country failed to sustain this progress and had not made any progress from the 1990 MDGs base year maternal mortality levels.



The situation deteriorated in 2009, when the country abandoned its hyper-inflated currency and adopted several foreign currencies, mainly the US dollar as legal tender. By 2013 maternal mortality ratio was 960 deaths per 100,000 live births. According to a UN report of 2013, Zimbabwe's fight to lower maternal mortality rates was failing due to growing socioeconomic inequalities, AIDS, and lack of access to emergency obstetric care (United Nations in Zimbabwe, 2013).

In addition, the household's wealth status could have had an influence on the uptake of both antenatal care and skilled birth attendance (Pathak et al., 2010). Table 2.2 shows that there are vast differences in the wealth/ household socio-economic statuses between the rural and urban population in Zimbabwe.

**Table 2.2: The distribution of wealth among Zimbabwean citizens**

Wealth Index					
	Lowest	2nd	Middle	4 <sup>th</sup>	Highest
Urban	0%	1%	8%	37%	54%
Rural	29%	28%	25%	13%	5%

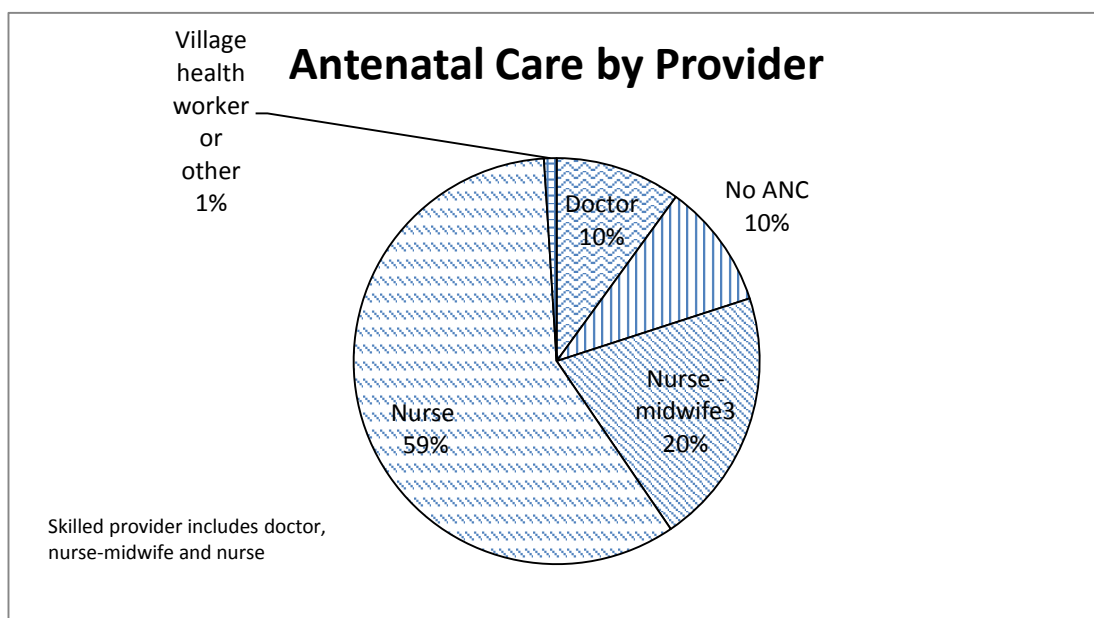
*Source 2010-11 ZDHS Summary Statistics*

Most households with high socio-economic status are in the urban areas, while those with low socio-economic status are more often in the rural areas. For this study household socio-economic status was measured using the wealth index. The wealth index in the ZDHS was constructed using household asset data, including ownership of consumer items ranging from a television to a bicycle or car, as well as dwelling characteristics such as source of drinking water, sanitation facilities, and type of flooring material. Households were ranked from lowest to highest scores separated into quintiles, each representing 20% of the population. Households in the highest



quintile were classified as having higher socioeconomic status than the remaining 80% of households in the country.

Figure 2.1 from the 2010- 2011 ZDHS shows that the greater majority (ninety percent) of women received ANC from a skilled provider (doctor, nurse-midwife, or nurse) during their last pregnancy. This figure is slightly lower than that recorded in the 2005-06 ZDHS (94 percent) and the 1999 ZDHS (93 percent).



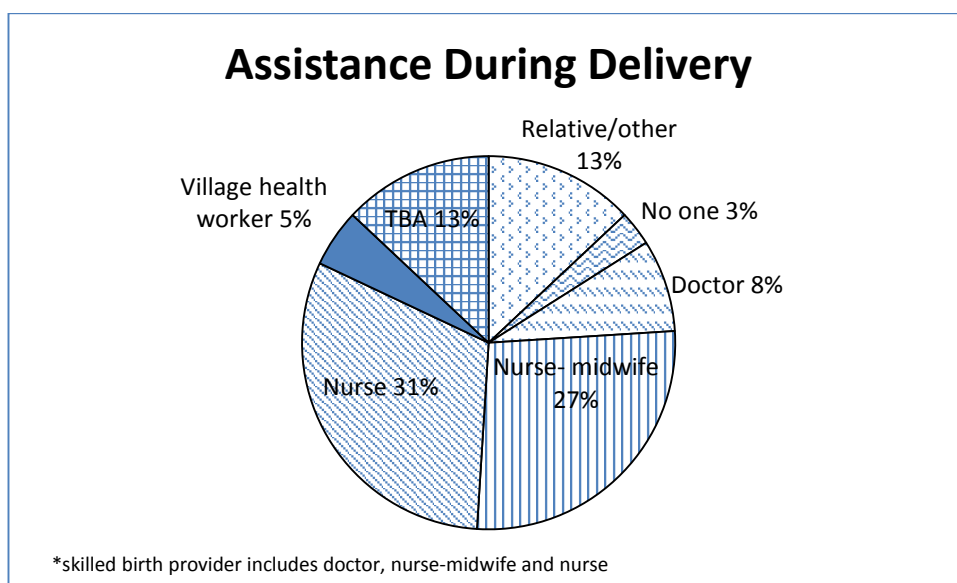
Source 2010-11 ZDHS Summary Statistics

**Figure 2.1: Percentage distribution of women with a live birth in Zimbabwe**

Skilled Birth attendance/ obstetric care from a skilled provider (doctor, nurse-midwife, or nurse) during delivery is recognized as a critical element in the reduction of maternal and neonatal mortality. Births delivered at home are usually more likely to be delivered without assistance from a skilled provider, whereas births delivered at a health facility are more likely to be delivered by a trained health professional.



According to figure 2.2, only 66 percent of the women utilised skilled birth attendance at delivery. Overall, the percentage of live births delivered by a skilled provider observed in the 2010-11 ZDHS (66 percent) represented a slight reduction from the figures reported in the 2005-06 ZDHS (69 percent) and the 1999 ZDHS (73 percent).

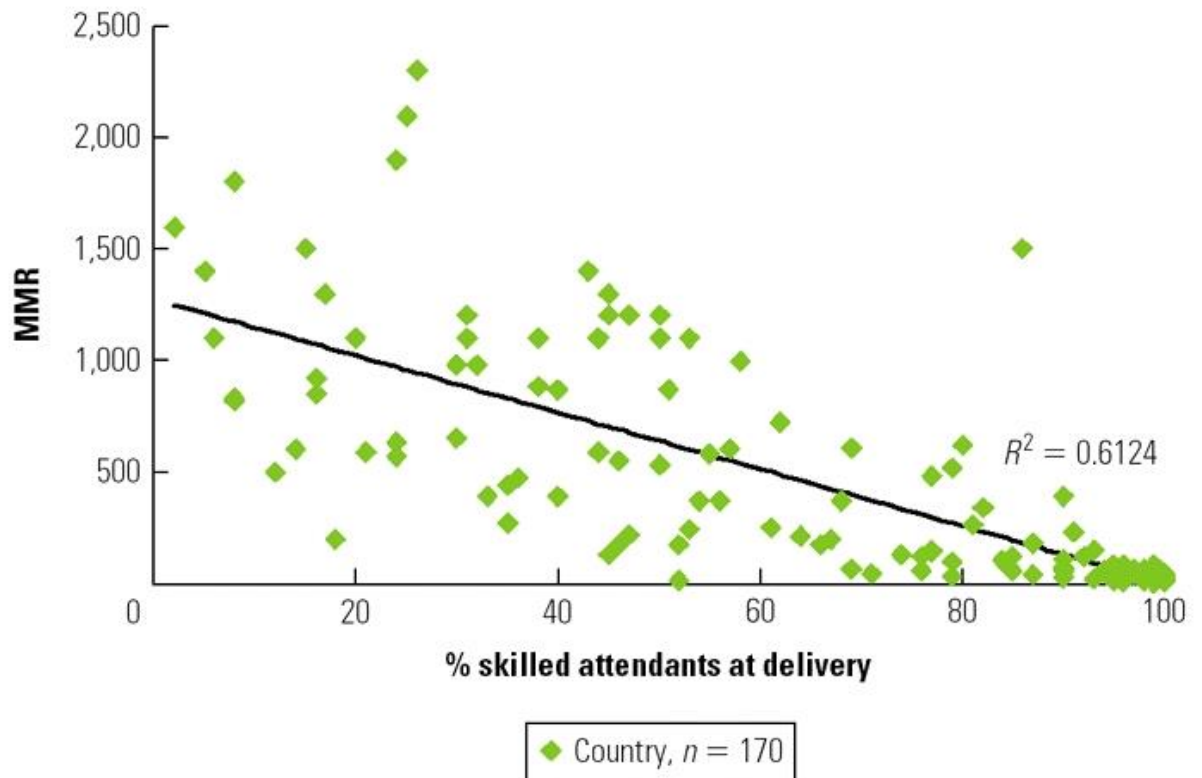


Source 2010-11 ZDHS Summary Statistics

**Figure 2.2: Percentage distribution of births in Zimbabwe**

Figure 2.3 shows that the higher the proportion of deliveries with a skilled attendant in a country, the lower the country's MMR. Furthermore, most of the Sub-Saharan Africa countries (not labeled) are above the regression line. Lack of or poorly functioning health management information systems with an effective feedback loop as well as weak supervision were further challenges influencing the quality of maternal services and MMRs.





Relation between Skilled Attendant at Delivery and MMR for All Countries, Estimates developed by WHO, UNICEF, and UNFPA 2001.

**Figure 2.3: Relation between Skilled Attendant at Delivery and MMR**

### 2.3 Maternal health in the development context

Maternal mortality is an important measure of women's health and indicative of the performance of health care systems (AbouZahr & Wardlaw, 2001; Pathak et al., 2010). The health of a mother impacts the family and even the entire community. Ability and access to necessary healthcare largely determines health outcomes for the mother and her baby. In addition, the health care services that a mother receives during pregnancy, childbirth, and the immediate postnatal period are important for the survival and wellbeing of both the mother and the infant thus, reducing maternal mortality increases the chances of survival as well as the potential to become effectively involved in the economic development process.



The World Bank (1999) explains that maternal health initiatives are sound investments that yield high social and economic returns at low cost. Through the Safe Motherhood Initiative, they outline the following:

- i. Investments in safe motherhood not only improve a woman's health and the well-being of her family, but also increase the labour supply, productive capacity, and economic well-being of societies;
- ii. The burden on women associated with numerous pregnancies, poor maternal health, pregnancy complications, and caring for sick children drains women's productive energy, jeopardizes their income-earning capacity, and adds to their poverty;
- iii. Unwanted or mistimed pregnancies can interfere with women's social and economic activities and cause emotional and economic hardship not only to women but also to their families; and
- iv. Children whose mothers die or are disabled in child-bearing have vastly lessened prospects of leading a productive life.

For any program or approach on maternal health and safe motherhood to succeed, it must have the support of the highest level of national authority. Such support enables the allocation of adequate financial and human resources; improves the infrastructure and communications; and puts in place effective and implementable standards, policies, and protocols (Rogo, Oucho & Mwalali, 2006). Most countries in Sub-Saharan Africa have not addressed policy issues, even where the policies have been shown to have significant effects on maternal mortality.



#### **2.4 Efforts by the Zimbabwean Government towards achieving MDG 5**

In a move to revitalise the country's ailing health system, the Government of Zimbabwe, in partnership with UNICEF and international donors, launched the Health Transition Fund (HTF) in order to reduce the country's high maternal and child mortality rates. The Ministry of Health and Child Welfare (MoHCW), advocated for the increased availability and utilisation of focused antenatal care including Prevention of Mother to Child Transmission (UN Zimbabwe, 2013). For that purpose, the Ministry together with the United Nations Development Fund through the HTF provided hospitals and clinics with monthly cash allowances for them to provide free ANC services to pregnant women.

Through the HTF and the adoption of the Campaign on Accelerated Reduction of Maternal Mortality in Africa (CARMMA), the government of Zimbabwe is highly committed to improving maternal health in the country.



## **CHAPTER 3**

### **LITERATURE REVIEW**

#### **3.1 Introduction**

This chapter reviews the literature concerning maternal health which gives an insight into the possible relationship between antenatal care, skilled birth attendance and the socio-economic status of households. It begins with a brief background on the general thoughts about the relationship between antenatal care and skilled birth attendance and their role in reducing maternal mortality. The chapter then goes on to give theoretical postulates about the relationships and the importance of each factor and provides an empirical literature review. Finally the chapter draws some insights from all the literature to help in the formulation of the research methodology.

#### **3.2 Background**

The importance of antenatal care (ANC) for the prevention of maternal and infant mortality in developing countries is controversial (Alexander & Kotelchuck, 2001). Carroli, Rooney, and Villar (2001) concluded that good-quality evidence on ANC's effectiveness is sparse. World Health Organization (1997) attributed the failure of antenatal care in improving maternal outcomes to difficulty in predicting birth complications during pregnancy, lack of communication between antenatal and delivery care personnel and poor quality of antenatal services.

Bloom, Wypij, and Gupta (2001); Pathak et al. (2010) and Obago (2013) argued that the use of skilled personnel at birth reduces the risk of death for the mother and the



new-born. Thus, if ANC encourages women to deliver using skilled attendants, there will be a direct influence on the survival of mothers and children. Jewell and Rous (2009) believed that this influence may be indirect such as increased birth weight.

The few studies which have examined this association, (Elo, 1992; Govindasamy & Ramesh, 1997; Magadi et al., 1999; Navaneetham & Dharmalingam, 2000; Mekonnen & Mekonnen, 2002; Abouzahr & Wardlaw, 2003; Stephenson et al., 2006; Sarma & Rempel, 2007) have revealed a positive effect of the frequency of antenatal care visits and of the content/ quality of the services received. Bloom, Lippeveld and Wypij (1999), Adjiwanou and LeGrand (2013) and Obago (2013) have shown that an increase in antenatal care (ANC) predicts an increase in skilled birth attendance (SBA) which is a progress indicator for reducing maternal mortality.

In a study based on data from India, Pathak et al. (2010) suggested that the socio-economic status of women and households was a major contributory factor to the relationship between the number of ANC visits and skilled birth attendance.

### **3.3 Theoretical Postulates**

Theoretical postulates are ideas that arise from theory linking the possible relationships between the variables investigated in this study. This section discusses how the use of a service (in 3.3.1), augmenting the socio-economic status of households (in 3.3.2) and how sociocultural factors (in 3.3.3) may influence the use of maternal health services.



### **3.3.1. The use of a service creates externalities that enhance the future use of other services.**

Adjiwanou and LeGrand (2013) argued that the use of ANC services creates externalities that enhance the future use of skilled birth attendance through its educative role. Ahmed and Mosley (2002); Pallikadavath, Foss and Stones (2004) examined the use of antenatal care and skilled birth attendance independently and they recognized that the decision of women to utilise the latter was more likely to be joint or subject to non-measurable factors.

Adjiwanou and Legrand (2013) explored the three pathways which may explain the relationship between antenatal care and skilled birth attendance. According to the authors, this association may be through the quality of services provided and the information given to women during the antenatal care visits. If the quality of services provided is high, then women can be taught how best to take care of their pregnancies and warned of possible birth complications, leading them to do the very best for their unborn children. The ANC visits may help improve women's familiarity with medical personnel and thus decreasing the 'psychological costs' related to their seeking skilled service. Antenatal care may also help in creating or strengthening habits to make use of skilled attendance at birth as also suggested by Barber (2006).

The existing literature has concluded that the use of antenatal care services during pregnancy serves dual functions. First, antenatal care provides a precautionary service that monitors signs of pregnancy complications, detects and treats pre-existing and concurrent problems which helps pregnant women in reducing risk. Secondly, the ANC visits could be considered the entry point for women into the



health care systems (Dixit, Dwivedi, & Ram, 2013). Women who make ANC visits are exposed to the health facilities and there is an opportunity to encourage them to seek subsequent health care for themselves and their newly-born children.

Another argument put forward is that a mother who uses prenatal care may also utilize subsequent health care services, not because of the role of prenatal care but as a consequence of the mother's inborn attitudes, beliefs and motivations. Many researchers demonstrated that a woman's beliefs, about the risk and effectiveness of health care affected the likelihood that she delivered her baby in an institution (Sugathan, Mishra, & Retherfort, 2001; Lee, 2005; Mishra & Retherfort, 2006). Literature thus negates the positive impact of ANC visit on institutional delivery. Some authors argue that bias arise in a cross sectional studies as data are truncated since some attributes are only observed when the woman visits a health centre for antenatal care (Holland, 1986).

In addition, the number of consultations which is commonly used as an indicator for antenatal care, does not differentiate women in terms of variations in the quality or range of services received (Bloom et al., 1999) or of their specific motivations, such as perceiving pregnancy complications that underlie their frequency of visits (Ram & Singh, 2005). Bloom et al., (1999) defined a compound indicator relating the frequency of ANC care to its content, in which women in the highest quartile were on average four times more likely to deliver using skilled birth attendance than women in the lowest quartile.

Analysing the influence of antenatal care on birth weight, Joyce (1994) showed that women who received adequate care were different from other women with regard to



certain unobservable factors which, if not taken into account, caused the effects of antenatal care to be underestimated. Consequently, women were likely to differ in terms of unobservable factors associated not only with the use of ANC care, but also with the quality of services received and their likelihood to use skilled personnel for delivery (Nikiema et al., 2009; Rockers et al., 2009). With composite indicators, however, it is not possible to tell whether skilled birth attendance is due to the frequency rather than to the quality of antenatal care (Barber, 2006; Rockers et al., 2009). Rani, Bonu, and Harvey (2008) argued that it might not be possible to relate frequency of care visits to the quality of the services.

However, there are several reasons to believe that the decisions to seek antenatal care and skilled birth attendance at delivery are interrelated. First, various characteristics of women or their households such as education attainment or income can explain why women may choose both types of care. For instance, Nikiema et al. (2009) argued that women who wished to give birth with the help of skilled attendants were also those who made the most use of ANC services. A key problem with previous studies on the relation between antenatal care and SBA has thus been their failure to take into account possible endogeneity biases. In this case, unless one is able to include all the characteristics influencing the use of both of these services, there will be a simultaneity bias in the projected effect of antenatal care on skilled birth attendance (Joyce, 1994; Cramer, 1995).

Concern over possible health problems may also affect both the demand for antenatal care and the likelihood of skilled birth attendance making the estimated impact of ANC on SBA in single equation models biased (Jewell & Rous, 2009). Thus, women



experiencing complications or worried about health problems may seek both antenatal care and skilled attendance at birth more frequently than other women (Bloom et al., 2001). However, expecting complications may, at times, have the opposite effect: discouraging women from seeking formal care at delivery through fear of a caesarean section or to circumvent the direct and indirect costs of interrupting their normal activities (Carter, 2010). Thus, the direction of the bias cannot be known in advance, as it will depend on the dominant effect.

### **3.3.2 Augmenting the socio-economic status of households changes the demand for maternal health services.**

Improving a household's socio-economic status can lead to increased demand for maternal services which otherwise would not have been affordable for very poor households. A study by Nguyen et al. (2012) showed that the Bangladesh pilot voucher program improved the utilization of formal maternal health services and reduced the financial burden of care. The program provided poor women with cash incentives and free access to antenatal, delivery, and postnatal care, as well as cash incentives for providers to offer these services. They found that the vouchers were effective in targeting the economically disadvantaged to improve the use of priority health services and that combining demand and supply-side incentives was important in health intervention programs.

Sloanb, Chowdhuryc, Schmidtd, Hossaind, and Wanga (2004) reviewed demand barriers present in low and middle income countries and evidence on the effectiveness of interventions to overcome these obstacles. They found evidence



which suggested that demand-side barriers may be as important as supply factors in deterring patients from obtaining healthcare. These obstacles were likely to be more important for the poor and other vulnerable groups, where the costs of access, lack of information and cultural barriers impeded them from benefiting from public spending. Demand barriers were also shown to be essential in richer countries, particularly among vulnerable groups. An increased focus on obtaining robust evidence on effective interventions yielded high returns on maternal health reduction.

### **3.3.3 Sociocultural factors that influence the uptake of ANC and SBA directly or indirectly.**

Socioeconomic and cultural factors in the determinants of maternal health services include education, religion, polygamy, exposure to the media, place of residence and autonomy in decision making (Muchabaiwa, Mazambani, Chigusiwa, Bindu, & Mudavanhu, 2012). Commonly held beliefs and norms that could be religious or cultural, shape the way individuals perceive their own health and the health services available. Religious and cultural beliefs have been found to be sources of exclusion from maternal healthcare utilisation in India and Africa (Stephenson et al., 2006). Although most studies have ignored polygamy, it is a customary practice that is associated with traditionalists. Stephenson et al. (2006) found that women in polygamous unions were less likely to report for delivery at a health institution.

In some instances maternal healthcare utilization is constrained by women's lack of decision making power, the low value placed on women's health and the negative or judgmental attitudes of family members (WHO, 1997). Women with more autonomy



in decision making, which is determined by the society and culture, have been found to be more likely to use maternal healthcare (Stephenson et al., 2006). On access to the media, Stephenson et al. (2006) found that women who were exposed to reproductive knowledge were more likely to utilise health facilities for delivery in Malawi, Kenya and Tanzania whilst no effect was found for Ghana, Ivory Coast and Burkina Faso. This implies that the impact of access to the media on maternal healthcare utilization is country specific.

Costs and proximity to a healthcare facility are health facility related characteristics which also influence maternal healthcare utilisation. From economic theory, price is negatively related to demand. Although healthcare in Zimbabwe is subsidized, there are registration fees that are demanded especially at municipal clinics. In addition to that, healthcare is characterised by implicit costs like time and transportation. Sarma and Rempel (2007) found distance to a healthcare facility negatively related to utilisation, especially for distances of more than ten kilometers.

Educated women were considered to be better able to: (a) break away from tradition to utilize modern means of safeguarding their own health and that of their children (Caldwell & Caldwell, 1988); (b) utilize what is available in the community to their advantage (Caldwell, & Caldwell, 1988; Barrera, 1990) and (c) make independent decisions regarding their own and their children's health leading to greater utilization of modern health facilities (Caldwell 1979; Caldwell 1986).

Other factors such as ageing and ill-timed pregnancies can influence ANC and SBA. From theory, ageing leads to rising depreciation in health stock (Grossman, 2000). This implies increasing marginal cost of health investment. The demand for health



capital is thus expected to fall with ageing. However, the demand for healthcare inputs for health stock may rise due to the inelastic nature of the demand curve for health with respect to the price. Empirical evidence has various findings. Age can be negatively related to skilled healthcare utilisation be it ANC or SBA. This is because it captures past maternal experience and if there were no complications in previous pregnancies, a woman can choose not to seek either ANC or SBA (Sarma & Rempel, 2007). Gabrysch and Campbell (2009) found ample evidence that higher maternal age, education and household wealth and lower parity increased use as did urban residence.

In the case of ill-timed or unwanted pregnancies this negative relationship however could be due to diminishing marginal willingness to invest in the additional children's health (Magadi et al., 1999). There are cases however, where younger women have been observed to utilise less maternal healthcare because of lack of experience or ignorance (Magadi et al. 1999), and also where older women utilise more healthcare which is attributed to the experience hypothesis which says that maternal age reflects the woman's accumulated knowledge of healthcare services and the value she places on modern facilities (Elo, 1992; Grossman, 2000).

Facility use in the previous delivery and antenatal care use are also highly predictive of health facility use for the index delivery, though this may be due to confounding by service availability and other factors. Obstetric complications also increase use but are rarely studied. Quality of care is judged to be essential in qualitative studies but is not easily measured in surveys, or without linking facility records with women. Distance to health facilities decreases use, but is also difficult to determine.



Challenges in comparing results between studies include differences in methods, context-specificity and the substantial overlap between complex variables.

### **3.4 Empirical Review**

Obago (2013) examined the role of antenatal care in predicting use of health facilities for delivery among women in Kenya using a logistic regression equation. The study found that both the number of ANC visits and the quality of these visits (based on number of services received) were positive predictors of health facility delivery. Women who received a higher quality of antenatal care (based on an index derived from the number of ANC services received) were from two to four times more likely to deliver in a health facility compared with women who received only one service. Similarly, women with four or more ANC visits were two and a half times more likely than women with no ANC visits to deliver in a health facility. The effect of antenatal care on use of a health facility for delivery illustrated the role that ANC can play in informing women of the importance of delivering at a health facility. It follows therefore that women who obtain skilled care during pregnancy were also more likely to seek skilled attendance for delivery.

Dixit et al. (2013), in trying to capture the effect of antenatal care visits on institutional delivery in India, discovered that women who did not make any ANC visits were socioeconomically and demographically different from the women who had visited health centre for ANC. Therefore, in this situation a simple comparison of the outcome variable between group of women who made and those who did not make any ANC visits would yield biased estimates of the impact of antenatal care



visits and this result would not explicitly be adjusted for endogeneity bias. Employing the propensity score matching estimation approach they found women who made one to two ANC visits had 6.6 percent higher chance to deliver in an institution compared to women who made no visit. In addition, if a woman visited a health centre at least three times, her chances were 31 percent higher to deliver in an institution.

In their study on the factors influencing choice of delivery site in Uganda Amooti-Kaguna and Nuwaha (2000) found that, access to maternity services, social influence from the spouse, other relatives, traditional birth attendants and health workers; self-efficacy; habit (previous experience) and the concept of normal versus abnormal pregnancy were considered as important. They however found that attendance of antenatal care discouraged skilled birth attendance at delivery if the mothers were told that the pregnancy was normal.

The likelihood of delivering in a medical institution was found to be influenced not only by use of antenatal-care services but also by such potentially confounding factors as mother's age, education, exposure to mass media, household standard of living, and access to health services, Sugathan, Mishra and Retherford (2001) statistically controlled these factors (i.e., held constant) when they estimated the effects of antenatal care on institutional delivery. They used a logistic regression to analyse data based on India's first and second National Family Health Surveys (NFHS-1 and NFHS-2).

The analysis indicated that, among rural mothers in Andhra Pradesh, Gujarat, Bihar, and Rajasthan who gave birth during the 3-year periods before NFHS-1 and NFHS-2,



the odds of giving birth in a medical institution were two to five times higher for mothers who received at least one antenatal check-up than for mothers who did not receive any antenatal check-up, after a number of potentially confounding variables are controlled by holding them constant. Contrary to expectation, availability of a hospital within 5 km of the village did not have a statistically significant effect on the odds of giving birth in a medical institution in most cases, after other potentially confounding variables were controlled.

Among the other predictor variables considered, mother's education had a strong positive effect on the odds of institutional delivery in each of the four states in both surveys. Mother's age also had a strong positive effect, but child's birth order had a strong negative effect in most cases. Together, the opposite effects of mother's age and child's birth order indicated that women who delayed childbearing were more likely to deliver in a medical institution. The effects of religion were mixed. In some cases, the odds of institutional delivery were higher for Muslims than for Hindus, but in other cases the direction of the effect was reversed. The odds of institutional delivery were lower for scheduled-caste and scheduled-tribe mothers than for other mothers. They were also lower for working mothers than for nonworking mothers. The odds for institutional delivery were higher for mothers who were regularly exposed to the electronic mass media than mothers who were not regularly exposed and higher for mothers in households with a high standard of living than for mothers in households with a low standard of living (Sugathan et al., 2001).

Adjiwanou and Legrand (2013) used a structural equation modeling approach to estimate the effects of antenatal care on skilled birth attendance in the rural areas of



four countries: Ghana, Kenya, Uganda and Tanzania. By correcting for endogeneity, they found that the simple probit (or logit) models tended to underestimate the direct effect of antenatal care on skilled birth attendance.

Pervin et al. (2012) estimated the association of ANC with facility delivery and perinatal mortality in Bangladesh using a population based approach of prospectively collected data from 2005 to 2009. The reason was that most existing studies were limited to cross-sectional surveys with long recall periods, and generally did not include population-based samples, they used a before and after study design to determine the role of ANC services on reduction of perinatal mortality between the periods before (2005 – 2006) and after (2008–2009) implementation of the Maternal Neonatal and Child Health program in that country. They found that antenatal care visits were associated with increased facility-based delivery in the private and government service areas. In the private service area, the adjusted odds of perinatal mortality was about 2-times higher among women who received  $\leq 1$  ANC compared to women who received  $\geq 3$  ANC visits. The study also found that the ongoing ANC activities in government service areas had little impact on improving mortality rates even though ANC visits are found to increase the use of increased facility based delivery. This different result was attributed to interventions within the private ANC package more focused such that the linkage between community- and facility-based services was established, and quality of services offered by health care providers was maintained through regular monitoring and training activities. Their study therefore showed that different types of ANC providers yielded different results.



### **3.5 Insights from the literature review**

The literature contains methodological limitations in explaining the relationship between antenatal care and skilled birth attendance. Some of the studies make no attempt to remove the selection bias present in the data set to rectify the causal estimation of the ANC visit which leads to woman's decision to use skilled birth attendance. In general it has been found that women who go for antenatal care sessions end up utilising skilled birth attendance but the odds ratios were different for each country owing to the number of visits and quality of the antenatal care received. In some countries the number of visits did not matter. Some of the possible difficulties in assessing the actual effect of ANC visits included unavailability of experimental observations or longitudinal data. It has also come to light that antenatal care could discourage seeking skilled birth attendance if the pregnancy is perceived as normal.

This study recognises the need to study this relationship between the socio-economic status of households, ANC and SBA in Zimbabwe as this will be specific to the country unlike most studies which are region specific. To my knowledge this relationship has not been studied in Zimbabwe and most focus has been on the determinants of maternal health. The study adopts the Structural Equation Model (SEM) used by Adjiwanou and LeGrand (2013). Although Adjiwanou and Legrand's study is a multi- country study, this study will only be for Zimbabwe.



## **CHAPTER 4**

### **METHODOLOGY**

#### **4.1 Introduction**

This chapter discusses the methodology of the study. The chapter outlines the analytical framework used in this study which helps to bring an understanding of how the models in chapter 5 are estimated and how the coefficients are interpreted.

#### **4.2 Analytical Framework**

The fact that the response variable of interest, utilization of skilled birth attendance, is binary mandates use of an appropriate technique such as the logistic distribution, yielding the logit model or the standard normal distribution, yielding the probit model. In this quantitative study, probit analysis is used to assess the relationship between skilled birth attendance, antenatal care and the socio-economic status of households.

The analysis is carried out using three different probit models. The first is a probit model which does not take into account possible endogeneity biases. The second is a recursive bivariate probit model which corrects for the possible biases of the number of antenatal care visits. Finally, the third model consists of a simultaneous system of equations in which the quality of antenatal care, the number of ANC visits, the socio-economic status of households and skilled birth attendance are influenced by an exogenous set of variables. The system is structured so as to correct for possible endogeneity biases. Results from the third model are then compared with those from the other two as these have been used in most studies.



#### 4.2.1 Probit and Logit analysis

Probit or logit models can be used to analyse the relationship between a discrete dependent random variable  $Y$  and one or more independent random variables,  $X$ . The discrete dependent random variable denotes a choice, or category, from a set of mutually exclusive choices or categories. The independent random variables are presumed to affect the choice or category of the choice maker, and represent a priori beliefs about the causal or associative elements important in the choice process. Ordered logit or probit models can be applied to take advantage of the additional information provided by the ordinal over the nominal scale. The independent random variables,  $X$ , could be continuous and/or discrete.

For a binary outcome dependent variable, one can interpret the population regression as the probability of success or  $Y = 1$  given  $X$ . According to Söderbom (2009), binary response models are of the form:

$$P(y = 1 | x) = G(x'\beta) \equiv p(x) \quad (4.1)$$

Where  $y$  is the observed response variable,  $x$  is a vector containing the observed explanatory variables,  $P$  and  $p$  denote probability,  $\beta$  is a coefficient of the observed explanatory variables and  $G$  is the standard normal cumulative distribution function (cdf) and it is a function of the index,  $x'\beta$ . Equation (4.1) is called an index model because it restricts the way in which the response probability,  $p(x)$ , depends on  $x$  where  $x'\beta = \beta_1 + \beta_2 x_2 + \dots + \beta_K x_K$ . The binary indicator  $y$  is set to unity in the case of success and zero otherwise.  $x$  is of dimension  $1 \times K$ ,  $\beta$  is a  $K \times 1$  vector and the first element of  $x$  is unity. It is assumed that the range of  $G$  is:  $0 < G(z) < 1$  for all values



of  $z$  in the real number space. The function  $G$  maps the index onto the response probability. Index models where  $G$  is a cdf can be derived from an underlying latent variable model:

$$y_i^* = x_i' \beta + \varepsilon_i, \quad \varepsilon_i \sim N[0,1] \quad (4.2)$$

$$y_i = 1 \text{ if } y_i^* > 0, \text{ otherwise } y_i = 0 \quad (4.3)$$

$y_i$  is the target recorded as 1 whenever  $y_i^*$  is positive. It is assumed that the error term,  $\varepsilon$  is a continuously distributed variable independent of  $x$  and that the distribution of  $\varepsilon$  is symmetric about zero with a variance of 1. The primary goal is to explain the effects of  $x_i$  on the response probability  $P(y=1|x)$ .

For the logit model:

$$G(x' \beta) = \Lambda(x' \beta) = \frac{e^{x' \beta}}{1 + e^{x' \beta}} \quad (4.4)$$

where  $\Lambda(\cdot)$  is used to indicate the logistic cumulative distribution function, (cdf). The predicted probabilities lie between 0 and 1.

The probit model:

$$G(x' \beta) = \Phi(x' \beta) = \int_{-\infty}^{x' \beta} \phi(v) dv \quad (4.5)$$

where  $\Phi$  is the cumulative distribution function of the standard normal distribution and  $\phi(\cdot)$  is the standard normal density. The predicted probabilities also lie between 0 and 1.



#### 4.2.2 Assumptions and estimation techniques

The basic assumptions for the probit or logit models are as follows:

- i. The observations on the dependent variable  $y$  are assumed to have been randomly sampled from the population of interest (even for stratified samples or choice-based samples).
- ii.  $y$  is endogenous whereas the  $x$ 's are exogenous.
- iii. There is uncertainty in the relation between  $y$  and the  $x$ 's, as reflected by a scattering of observations around the functional relationship.

The distribution of error terms must be assessed to determine if a selected model is appropriate. Estimation of binary choice models is usually based on the method of maximum likelihood and not least squares. Each observation is treated as a single draw from a Bernoulli distribution (binomial with one draw). For  $N$  independent, identically distributed observations following the equation (4.1), the log likelihood function is maximised.

The density of  $y_i$  given  $x_i$  can be written as the joint probability of independent events:

$$g(y | x_i; \beta) = [G(x_i' \beta)]^y [1 - G(x_i' \beta)]^{1-y} \quad y = 0, 1 \quad (4.6)$$

The log-likelihood for observing  $i$  is a function of the  $K \times 1$  vector of parameters and the data  $(x_i, y_i)$  is given by :

$$\ell_i(\beta) = y_i \log[G(x_i' \beta)] + (1 - y_i) \log[1 - G(x_i' \beta)] \quad (4.7)$$



Restricting  $G(\cdot)$  to be strictly between zero and one ensures that  $\ell_i(\beta)$  is well defined for all values of  $\beta$ . The log likelihood for a sample size of  $N$  is:

$$\mathbf{L}(\beta) = \sum_{i=1}^N \ell_i(\beta) \quad (4.8)$$

and the MLE of  $\beta$ , maximizes this log likelihood.

#### 4.2.3 Interpretation of coefficients

The coefficients of the analyses are interpreted as follows:

An increase in  $x$  increases/decreases the likelihood that  $y = 1$  (makes that outcome more/less likely). Interpretation is for the sign of the coefficient but not the magnitude. The magnitude cannot be interpreted using the coefficient because different models have different scales of coefficients. It is common to report the marginal effects after reporting the coefficients when estimating probit and logit models (Katchova, 2013). The marginal effects reflect the change in the probability of  $y = 1$  given a 1 unit change in an independent variable  $x$ .

Traditionally, logit model was used more often as it was easier to compute but in economics, the assumption of a standard normal distribution is more realistic (Söderbom, 2009). Following previous research, this study uses the probit model because the logistic distribution tends to give larger probabilities to  $y = 1$  when  $x'\beta$  is extremely small (and smaller probabilities to  $y = 1$  when  $x'\beta$  is very large) than the normal distribution (Greene, 2012).



### 4.3 Empirical models

The following section describes the models used for the study starting with the simple probit, followed by the recursive biprobit. These two models then build up to main model which consists of a system of recursive simultaneous equations.

#### 4.3.1 Model 1: Simple probit model

To assess the relationship between skilled birth attendance, antenatal care and the socioeconomic status of households, a simple probit model can be used. The probit model is the special case of the equation  $P(y = 1 | x) = \Phi(x'\beta) \equiv p(x)$  with:

$$\Phi(z) \equiv \int_{-\infty}^z \phi(v) dv \quad (4.9)$$

$$\text{where } \phi(z) = 2(\pi)^{-1/2} \exp(-z^2/2) \quad (4.10)$$

$\phi$  is the standard normal density.  $\Phi(z)$  is the distribution function of the standard normal distribution.  $\Phi$  is a function with values that strictly lie between zero and one: i.e.  $0 < \Phi(z) < 1$ , for all real numbers  $z$ . This choice of  $\Phi$  ensures that the probability of success (utilising skilled birth attendance) is strictly between zero and one for all values of the parameters and the explanatory variables. The function  $\Phi$  is monotonically increasing in the index  $z$  such that:

$$\Pr(y = 1 | x) \rightarrow 1 \text{ as } x\beta \rightarrow \infty \quad (4.11)$$

$$\Pr(y = 1 | x) \rightarrow 0 \text{ as } x\beta \rightarrow -\infty \quad (4.12)$$



Hence  $\Phi$  is non-linear function, making the use of ordinary least squares inappropriate. The probit function increases in  $x\beta$ . It increases relatively quickly around  $x\beta = 0$ , while the effect on  $\Phi$  at extreme values of  $x\beta$  tends to zero or 1. The latter result makes the partial effects of changes in explanatory variables to not be constant.

#### 4.3.1.1 Probit regression analysis

Basically, probit regression analysis consists of three main steps. The first step is to estimate the probit coefficients using Maximum Likelihood Estimation (MLE). As mentioned in the analytical framework, the absolute scale of the coefficients in a probit model gives a distorted picture of the response of the dependent variable to a change in one of the stimuli because the model is actually of a probability.  $\beta_i$  measures the change in the z-score for a unit change in  $x_i$ , not the change in  $\Pr(y = 1|x_i)$ .

To make the model useful, the predicted probability of success can be calculated using the probit coefficients. This is done by estimating the marginal effects of the explanatory variables on the probability of observing a certain outcome. This is the second step in probit regression analysis. The calculation of marginal effects depends on whether the explanatory variable in question is binary or continuous. In addition, the explanatory variables that appear in the equations can have direct or indirect effects on dependent variable expectations. The marginal effect of a change in a variable is the sum of these effects. This can be done using the delta method.



As documented by Greene (1998), in order to compute marginal effects in a binary choice model, one must scale the coefficients. In the above simple binary probit model, we would have

$$E[y_1 | x_1] = \Phi(\beta'x_1) = \text{Prob}[y_1 = 1] \quad (4.13)$$

so that, for a continuous variable,  $z_i$

$$\partial E[y_1 | x_1] / \partial z_i = \partial \Phi(\beta'x_1) / \partial z_i = \phi(\beta'x_i) \times \beta_z \quad (4.14)$$

where  $\phi(\cdot)$  is the density function of the standard normal distribution and  $\beta_z$  is the derivative of the coefficient with respect to the variable  $z$ . If  $z_i$  is a binary variable, then the appropriate way to measure the marginal effect is to use the difference expression:

$$E[y_1 | x_{1z} = 1] - E[y_1 | x_{1z} \dots = 0] \quad (4.15)$$

Both the sign and the magnitude of the marginal effects can be interpreted. The interpretation that an increase in  $x$  increases (decreases) the probability that  $y = 1$  by the marginal effect expressed as a percent. For dummy independent variables, the marginal effect is expressed in comparison to the base category ( $x = 0$ ). For continuous independent variables, the marginal effect is expressed for a one-unit change in  $x$ .

After the computations above, the next step is to measure how well the model fits using the Likelihood Ratio (LR) Chi-Square, the Wald test or the Huber- White procedures. The LR statistic is used to test the null hypothesis that all of the regression coefficients are simultaneously equal to zero. Alternatively, when



assessing the contribution of individual predictors in a given model, one may examine the significance of the coefficients using the Wald test statistic. The Wald test statistic is the ratio of the square of the probit coefficient to the square of the standard error of the coefficient and is asymptotically distributed as a chi-square distribution.

$$W_j = \frac{\beta_j^2}{SE_{\beta_j}^2}$$

The Huber White procedure can also be used to estimate consistent standard errors and thus significance levels, in the context of statistical dependence between individuals living in the same sample area.

#### 4.3.2 Model 2: The recursive biprobit model

When one of the covariates, is likely to be jointly determined with the dependant variable, it requires a simultaneous equations methodology. The recursive biprobit model takes into account possible endogeneity and estimates simultaneously the determinants of both antenatal care and skilled birth attendance. The model appears in Maddala (1983, p. 123). To evaluate the effect of a binary endogenous regressor, number of antenatal care visits,  $y_2$ , on a binary skilled birth attendance outcome,  $y_1$ , let the skilled birth outcome be determined by an index model:

$$y_1^* = x_1' \beta_1 + \gamma_2 + \varepsilon_1 \quad y_1 = \begin{cases} 1 & \text{if } y_1^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (4.16)$$



$$y_2^* = x_2' \beta_2 + \varepsilon_2 \quad y_2 = \begin{cases} 1 & \text{if } y_2^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (4.17)$$

$$(\varepsilon_1 \varepsilon_2 | x_1, x_2) \sim N \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right] \quad (4.18)$$

where  $y_1$  is the skilled birth attendance outcome that takes the value one if a woman utilised skilled birth attendance and zero otherwise.  $y_2$  represents the number of antenatal care visits and takes the value one if a woman attended four or more antenatal care visits and zero otherwise. The errors  $\varepsilon_1$  and  $\varepsilon_2$  are bivariate normally distributed with zero means and variance covariance matrix,  $\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$ , where  $\rho$  is tetrachoric correlation coefficient. The data matrix  $x_1$  consists of all explanatory variables of the first ( $y_1$ ) equation and the data matrix  $x_2$  consists of a set of explanatory variables on the right hand side of the second ( $y_2$ ) equation including the relevant instruments for estimating  $y_2$ .  $\beta_1$ ,  $\beta_2$  and  $\gamma$  are the parameters to be estimated.

According to Greene (2008) in the recursive bivariate probit model specification, the joint probability of two independent events is equal to the product of the independent events. The parameters  $\beta_1$ ,  $\beta_2$ ,  $\gamma$  and  $\rho$  (in equations 4.16 – 4.18) may be estimated by maximum likelihood. The probability terms that enter the log-likelihood are as follows:



$$P(y_1 = 1, y_2 = 1) = \Phi_2(x_1'\beta_1 + \gamma, x_2'\beta_2, \rho) \quad (4.19)$$

$$P(y_1 = 1, y_2 = 0) = \Phi_2(x_1'\beta_1, -x_2'\beta_2, -\rho) \quad (4.20)$$

$$P(y_1 = 0, y_2 = 1) = \Phi_2[-(x_1'\beta_1 + \gamma), x_2'\beta_2, -\rho] \quad (4.21)$$

$$P(y_1 = 0, y_2 = 0) = \Phi_2(-x_1'\beta_1 - x_2'\beta_2, \rho) \quad (4.22)$$

where  $\Phi_2(\cdot)$  denotes the cumulative distribution function of the bivariate normal distribution. Note that the symmetry of the normal distribution implies that

$$\Phi(-\beta_2' x_2) = 1 - \Phi(\beta_2' x_2).$$

If  $\varepsilon_1$  is correlated with  $y_2$ , a standard univariate model such as a probit model gives inconsistent estimates. Therefore in the recursive case, there is need for further assumptions to consistently estimate the endogenous effect,  $\gamma$ . One identification strategy is to look for an appropriate instrument for  $y_2$  which in this case are included in the  $x_2$  control variables. Suppose that  $y_2$  is an indicator variable denoting number of antenatal care visits, which is determined by a variable,  $x_2' = [x_{2k} \ x_{2j}]$  where  $x_{2k}$  are the instruments for estimating  $y_2$  and  $x_{2j}$  are the remaining control variables, which only influences the decision to have skilled birth attendance through its influence on  $y_2$  such that:

$$y_2^* = \beta_{2k}' x_{2k} + \beta_{2j}' x_{2j} + \varepsilon_2 \quad (4.23)$$

The simultaneity in this model can be ignored unlike in the linear regression model, because in this instance, it is the log-likelihood that is being maximised, whereas in the linear regression case, there is manipulation of certain sample moments that do



not converge to the necessary population parameters in the presence of simultaneity. Inference on the causal effect of  $y_2$  on  $y_1$  requires both  $\rho$  and  $\gamma$  to be identified. Therefore, this study tests for the exogeneity ( $H_0 : \rho = 0$ ) along the lines suggested by Monfardini and Radice (2007).

The approach for computing marginal effects in the bivariate probit model is essentially the same as for the simple probit although the computations are more involved. The conditional mean function of the model is

$$\begin{aligned}
 E[y_1 | x_1, x_2] &= E[y_2] E[y_1 | x_1, x_2, y_2] \\
 &= \text{Prob}[y_2 = 1] E[y_1 | x_1, x_2, y_2 = 1] + \text{Prob}[y_2 = 0] E[y_1 | x_1, x_2, y_2 = 0] \\
 &= \Phi(\beta'_2 x_2) \Phi(\beta'_1 x_1 + \gamma) + \Phi(-\beta'_2 x_2) \Phi(\beta'_1 x_1)
 \end{aligned} \tag{4.24}$$

For  $y_2$ ,

$$E[y_2 | x_2] = \Phi(\beta'_2 x_2) \tag{4.25}$$

For a continuous variable,  $z$ , which might appear in  $x_1$  and/or  $x_2$ :

$$\begin{aligned}
 \partial E[y_1 | x_1, x_2] / \partial z &= [\Phi(\beta'_2 x_2) \phi(\beta'_1 x_1 + \gamma) + \Phi(-\beta'_2 x_2) \phi(\beta'_1 x_1)] \beta_{1z} + [\phi(\beta'_2 x_2) \\
 &\quad \Phi(\beta'_1 x_1 + \gamma) + \phi(-\beta'_2 x_2) \Phi(\beta'_1 x_1)] \beta_{2z}
 \end{aligned} \tag{4.26}$$

where  $\beta_{1z}$  and  $\beta_{2z}$  are the derivatives of  $\beta'_1 z$  and  $\beta'_2 z$  with respect to  $z$ . Either of these may be zero. The first expression in the square brackets and multiplied by  $\beta_{1z}$  is the direct effect and the second expression multiplied by  $\beta_{2z}$  is the indirect effect. To



obtain the marginal effect of a binary variable, the difference in the expected value given the different probabilities is used.

For a binary variable,  $q$ , which might appear in  $x_1$  and/or  $x_2$ :

$$\begin{aligned} E[y_1 | x_1, x_2, q = 1] - E[y_1 | x_1, x_2, q = 0] &= [\Phi(\beta'_2 x_2) \Phi(\beta'_1 x_1 + \gamma) + \Phi(-\beta'_2 x_2) \\ &\Phi(\beta'_1 x_1)] | q = 1 - [\Phi(\beta'_2 x_2) \Phi(\beta'_1 x_1 + \gamma) + \Phi(-\beta'_2 x_2) \Phi(\beta'_1 x_1)] | q = 0 \end{aligned} \quad (4.27)$$

For the endogenous binary variable,  $y_2$  in equation 4.17:

$$E[y_1 | x_1, x_2, y_2 = 1] - E[y_1 | x_1, x_2, y_2 = 0] = \Phi(\beta'_1 x_1 + \gamma) - \Phi(\beta'_1 x_1) \quad (4.28)$$

Goodness of fit procedures for the recursive biprobit model are carried out using the Wald test of exogeneity for the exclusion variable. The null hypothesis is that debut of antenatal care is a weak instrument for the estimation of the recursive biprobit model. The null is rejected if the minimum eigenvalue statistic exceeds its critical value.

In a single equation specification, there is the assumption of error in variation in explanatory variables hence one cannot use the skilled birth attendance equation on its own. This can be resolved by putting simultaneous equations in a recursive bivariate model. However, the problem with this is that in the recursive bivariate the errors are still not linked and endogeneity may still be a problem. The next best alternative is to use a simultaneous equation specification that is recursive as it produces more robust standard errors for inference purposes.



### 4.3.3 Model 3: Structural equations modelling

In the third model, a recursive system of simultaneous equations is used to assess the effects of the content of antenatal care and the socio-economic status and at the same time controlling for endogeneity biases. In the model specification, one uses prior theory and previous works in statistics to detail a series of relevant simultaneous equations. The simultaneous equation models contain random variables and structural parameters to be estimated.

Following Kaplan (2009), the general matrix representation of simultaneous equation models is written as:

$$y = \beta y + \Gamma x + \zeta \quad (4.29)$$

where  $y$  denotes the vector of endogenous variables with dimension  $p \times 1$ . The exogenous variables are denoted with the  $q \times 1$  vector,  $x$ .  $\beta$  and  $\Gamma$  consist of unknown parameters to be estimated as well as known values which arise from a *priori* economic knowledge. Disturbances, or errors in the equations, are represented with  $\zeta$ , a  $p \times 1$  vector. There is one disturbance per endogenous variable, hence similar dimensions.  $\Gamma$  is a coefficient that describes the effects of exogenous variables on the endogenous variables. The dimension of  $\Gamma$  is  $p \times q$ . Beta coefficients ( $\beta$ ) with dimensions  $p \times p$  describe the effects of endogenous variables on other endogenous variables.

Using prior theoretical postulates identified in the literature review chapter and empirical findings on the relationship between antenatal care and skilled birth attendance, and also the findings from Pathak et al. (2010) which suggest that the



socio-economic status of women is a contributory factor to the relationship between the number of ANC visits and skilled birth attendance, this study comes up with the following model:

$$\begin{aligned}
 y_1 &= z\delta_1 + u_1 \\
 y_2 &= \gamma_{21}y_1 + z\delta_2 + u_2 \\
 y_3 &= \gamma_{31}y_1 + \gamma_{32}y_2 + z\delta_3 + u_3 \\
 y_4 &= \gamma_{41}y_1 + \gamma_{42}y_2 + \gamma_{43}y_3 + z\delta_4 + u_4
 \end{aligned} \tag{4.30}$$

where  $y_1$  represents the wealth equation,  $y_2$ , the number of antenatal care visits  $y_3$  the quality of antenatal care equation, and  $y_4$ , the skilled birth attendance equation.  $z$  is the vector of exogenous variables,  $\mu_i$  is the error term, whilst  $\delta_i, \gamma_{ij}$  are the parameters to be estimated. The joint determination of the variables in this model is recursive. The first equation ( $y_1$ ) is completely determined by the exogenous factors. Then, given the first, the second becomes determined, and so on. All the endogenous variables ( $y_1, y_2, y_3$ , and  $y_4$ ) appear in the last equation. The endogenous variables  $y_1, y_2$  and  $y_3$  are the dependent variables of other equations in the system.  $(\mu_1, \mu_2, \mu_3, \mu_4)$  follows a multinomial normal distribution  $N(0,0,0,0,\Sigma)$  where  $\Sigma$  is the variance covariance matrix of error terms.

In this system of equations wealth determines the number of antenatal care visits a woman makes in the sense that if she cannot afford to go due to financial constraints she ends up making less visits. If a woman comes from a higher wealth quintile household she can afford to pay for more maternal health care visits (Pathak et al., 2010). The quality of care that a woman receives is based on an index derived from the number of ANC visits. If a woman goes for more antenatal care visits she is more



likely to receive more ANC services and hence a higher quality than a woman who schedules less visits (Obago, 2013). By increasing the number antenatal care services received, a woman can increase knowledge on importance of facility delivery, be properly monitored for complications which can arise and supplements for taking care of herself and the unborn baby, all which increase the probability of facility use at delivery.

The first equation in the system ( $y_1$ ) is clearly identified and can be estimated by OLS. Without some exclusion restrictions none of the remaining equations is identified, but each becomes identified if we assume that the structural errors are pairwise uncorrelated. This assumption means the variance covariance matrix,  $\Sigma$ , is a diagonal matrix, the right-hand-side variables in the  $y_1$  equation are each uncorrelated with  $u_1$ . Starting with the fourth equation  $y_4$  is a linear function of  $z$  and  $u_4$ , then in the third equation,  $y_4$  is uncorrelated with  $u_3$  under the above assumption. But  $y_3$  is a linear function of  $z$ ,  $u_4$  and  $u_3$  and so  $y_3$  and  $y_4$  are both uncorrelated with  $u_2$  in the second equation and so on. It follows that each equation in the system is consistently estimated by ordinary least squares. OLS equation by equation is not necessarily the most efficient estimator in fully recursive systems, even though  $\Sigma$  is a diagonal matrix.

If it can be assumed that  $\Sigma$  is diagonal, maximum likelihood estimators become a series of successive single-equation least squares estimators. Since the matrix  $\beta$  containing the coefficients of the endogenous variables on the right hand side of the system in equation 4.31 is assumed to be triangular, there must be an equation with



only one unlagged endogenous variable. The wealth variable (with unit coefficient) is to be regressed on all the predetermined variables in that equation. The next equation has one new endogenous variable (number of ANC visits) where this variable is regressed on the preceding wealth variable and all the predetermined variables in that equation. In the next equation, another new endogenous variable is introduced (quality of antenatal care). It is regressed on the two preceding endogenous variables and all the predetermined variables in that equation. In the final equation, skilled birth attendance is regressed on the three endogenous variables and all the predetermined variables in that equation.

The Stata command ‘cmp’ fits seemingly unrelated regressions models of this nature. Its estimator is also consistent for recursive systems in which the endogenous variables appear on the right-hand side as observed. If all the equations are structural, then estimation is full-information maximum likelihood. If only the final stage or stages are structural, then estimation is done using the limited-information maximum likelihood method (Roodman, 2011).

#### **4.4 Different models estimated**

The following section gives a description of the specific probit and recursive biprobit models as well as the simultaneous equation models used in this study. The previous section described the general models.



#### 4.4.1 Model 1: Probit Model

The first model is the probit version in which skilled birth attendance depends on the number of antenatal care visits, the quality of antenatal care, wealth and other exogenous variables. The equation is specified as:

$$SBA_{1i} = 1(ANC_{1i}\pi_1 + Q\_ANC_{1i}\delta_1 + Weal_{1i}\varphi_1 + X_{1i}\beta_1 + \varepsilon_{1i} \geq 0) \quad (4.31)$$

where  $SBA_{1i}$  is skilled birth attendance,  $ANC_{1i}$  is the number of antenatal visits made,  $Q\_ANC_{1i}$  is the quality/ range of antenatal care services received and  $Weal_{1i}$  represents the socio-economic status of the household measured by the wealth index.  $X_{1i}$  is a vector of covariates including socio- cultural factors, economic factors, perceived benefits and contextual variables.  $\pi_1$ ,  $\delta_1$ ,  $\varphi_1$  and  $\beta_1$  are the regression coefficients used in the final calculation of probabilities.  $\varepsilon_{1i}$  is the disturbance or error term representing all those factors that affect SBA but are not taken into account explicitly in the equation. The subscripts 1 refer to the coefficients and variables in the skilled birth attendance equation.

In the equation, the probability of a woman utilising skilled birth attendance, ( $SBA_{1i}$ ), is given by an indicator function  $1(ANC_{1i}, Q\_ANC_{1i}, Weal_{1i}$  and  $X_{1i})$  which takes the value 1 if a woman utilised skilled birth attendance and 0 otherwise. Skilled birth attendance is assumed if delivery took place in presence of qualified personnel: a doctor, nurse/midwife or a nurse.

#### 4.4.2 Model 2: Recursive Biprobit

The second model is the recursive biprobit in which the first equation is similar to that in model 1. It however contains a second equation in which the number of visits



is a function of the debut of antenatal care as well as the exogenous variables from model 1. The model is specified below:

$$SBA_{1i} = 1(ANC_{1i}\pi_1 + Q\_ANC_{1i}\delta_1 + Weal_{1i}\varphi_1 + X_{1i}\beta_1 + \varepsilon_{1i} \geq 0) \quad (4.31)$$

$$ANC_{2i} = 1(\beta_{21}ANC\_debut_{2i} + X_{2i}\beta_2 + \varepsilon_{2i}) \quad (4.32)$$

where  $ANC\_debut$  is the debut of antenatal care visits.  $\beta_2$  is the regression coefficient used in the final calculation of probabilities.  $\varepsilon_{2i}$  is the disturbance or error term representing all those factors that affect  $ANC$  but are not taken into account explicitly in the equation. The subscripts 2 refer to the coefficients and variables in the antenatal care equation. The rest of the variables are as explained in model 1.

The recursive bivariate probit model is an adaptation from the model by Maddala 1983 in which one of the binary dependent variables (the number of antenatal visits) is an endogenous regressor in the other equation (skilled birth attendance equation). This enables one to test the assumption that ANC care may be endogenous and corrects for possible resulting biases by estimating simultaneously the above two equations:

The debut of antenatal care visits is the shift factor for the number of antenatal care visits. The error terms  $\varepsilon_{1i}$  and  $\varepsilon_{2i}$  follow a multinomial normal distribution  $N(0,0,\Sigma)$  where  $\Sigma$  is the variance-covariance matrix of error terms. The number of services received ( $ANC_{2i}$ ) is a categorical variable set to 0 if a woman did not attend antenatal care sessions, 1 if the woman made between 1 and 3 visits, and is set to 2 if the woman made four or more antenatal consultations following the WHO recommendation.



Estimating the system of equations in this model requires imposing the exclusion rule for identification (Maddala, 1983). In order to do that, an instrumental variable is required. The instrument must have the following two properties:

- The instrument must be relevant in that it is correlated with the number of antenatal visits.
- The instrument must be exogenous in that it is not correlated with  $\varepsilon$  (not affected by skilled birth attendance).

Dong, Hennessy and Jensen (2009), argued that the relationship between  $x$  and  $y$  can be estimated without the exclusion criteria. However, it is always desirable to have at least one, especially when a possibility of misspecification exists. The study uses debut of antenatal care as an exclusion variable. The reason is that the debut of antenatal care affects the number of antenatal visits in that the later the care begins, the fewer the number of visits that will generally occur during the nine months of pregnancy (Carter, 2010). This variable is not expected to always have a direct influence on the decision to seek skilled attendance for delivery. Several authors point out that women in rural areas of Africa are often unaware of the benefits of an early debut of antenatal care (Myer & Harrison, 2003).

In Model 3, the main model of analysis for this study, additional exclusion variables are needed to identify the determinants of skilled birth attendance relative to the content of care and the socio-economic status of households. The variables provider of ANC care and/or the location of this care are selected as shift factors for the content of care. These two variables are likely to influence the content of care without having any direct influence on skilled birth attendance.



#### 4.4.3 Model 3: System of Equations (Structural equation models)

The third model is a full system of simultaneous equations in which skilled birth attendance, number of antenatal care visits, quality of antenatal care visits and wealth are endogenous variables. the model is specified as follows:

$$SBA_{1i} = 1(ANC_{1i}\pi_1 + Q\_ANC_{1i}\delta_1 + Weal_{1i}\phi_1 + X_{1i}\beta_1 + \varepsilon_{1i} \geq 0) \quad (4.31)$$

$$ANC_{2i} = 1(\beta_{21}ANC\_debut_{2i} + X_{2i}\beta_2 + \varepsilon_{2i}) \quad (4.32)$$

$$\left. \begin{aligned} Q\_ANC_{3i} &= 1si(ANC_{3i}\gamma_3 + Z_{3i}\theta_3 + X_{3i}\beta_3 + \varepsilon_{3i}) < \alpha_{1s} \\ Q\_ANC_{3i} &= 2si(\alpha_1 \leq ANC_{3i}\gamma_3 + Z_{3i}\theta_3 + X_{3i}\beta_3 + \varepsilon_{3i}) < \alpha_{2s} \\ Q\_ANC_{3i} &= 3si(ANC_{3i}\gamma_3 + Z_{3i}\theta_3 + X_{3i}\beta_3 + \varepsilon_{3i}) > \alpha_{2s} \end{aligned} \right\} \quad (4.33)$$

$$\left. \begin{aligned} Weal_{4i} &= 1w(wemploy_{4i}\omega_4 + spemploy\omega_4 + X_{4i}\beta_4 + \varepsilon_{4i}) < \alpha_{1w} \\ Weal_{4i} &= 2w(\alpha_1 \leq wemploy_{4i}\omega_4 + spemploy\omega_4 + X_{4i}\beta_4 + \varepsilon_{4i}) < \alpha_{2w} \\ Weal_{4i} &= 3w(\alpha_2 \leq wemploy_{4i}\omega_4 + spemploy\omega_4 + X_{4i}\beta_4 + \varepsilon_{4i}) < \alpha_{3w} \\ Weal_{4i} &= 4w(wemploy_{4i}\omega_4 + spemploy\omega_4 + X_{4i}\beta_4 + \varepsilon_{4i}) \geq \alpha_{3w} \end{aligned} \right\} \quad (4.34)$$

$(\varepsilon_{1i}, \varepsilon_{2i}, \varepsilon_{3i}, \varepsilon_{4i})$  follows a multinomial normal distribution  $N(0,0,0,0,\Sigma)$ ,

$$\Sigma = \begin{bmatrix} \text{var}(\varepsilon_{1i}) & & & \\ \text{corr}(\varepsilon_{1i}, \varepsilon_{2i}) & \text{var}(\varepsilon_{2i}) & & \\ \text{corr}(\varepsilon_{1i}, \varepsilon_{3i}) & \text{corr}(\varepsilon_{2i}, \varepsilon_{3i}) & \text{var}(\varepsilon_{3i}) & \\ \text{corr}(\varepsilon_{1i}, \varepsilon_{4i}) & \text{corr}(\varepsilon_{2i}, \varepsilon_{4i}) & \text{corr}(\varepsilon_{3i}, \varepsilon_{4i}) & \text{var}(\varepsilon_{4i}) \end{bmatrix}$$

where  $Z_i$  represents the ANC provider and/or ANC location and *wemploy* is the woman's employment status and *spemploy* is the spouse's employment status.  $\gamma_3, \theta_3, \beta_3, \omega_4$  and  $\beta_4$  are the regression coefficients used in the final calculation of probabilities. *si* and *w* represent the indicator functions.  $\alpha_{is}$  and  $\alpha_{iw}$  represent the probabilities.  $\varepsilon_{3i}$  is the disturbance or error term representing all those factors that affect the quality of ANC but are not taken into account explicitly in equation (4.33).



The disturbance or error term  $\varepsilon_{4it}$ , represents all those factors that affect the household wealth respectively, but are not taken into account explicitly in equation (4.34). The subscripts 3 refer to the coefficients and variables in the quality of antenatal care equation whilst the subscripts 4 refer to the coefficients and variables in the wealth equation. The rest of the variables are as explained in models 1 and 2. The woman's employment status and her spouse's employment status are identified as the shift factors for the wealth status of households.

#### **4.5 Data**

The study uses data from the Zimbabwe Demographic and Health Survey (ZDHS) conducted by the Zimbabwe National Statistics Agency (ZIMSTAT) from late September 2010 through March 2011. The 2010-11 ZDHS is a follow-up to the 1988, 1994, 1999, and 2005-06 Zimbabwe Demographic Health Surveys and provides updated estimates of basic demographic and health indicators. This large dataset gives an advantage of low variance associated with estimating using large samples. The birth records dataset from the survey is the one used for this study as it contains information on maternal healthcare utilisation. The ZDHS data set is publicly accessible and has passed all ethical reviews and which are carefully designed to ensure the complete confidentiality of respondents. Information from the individual and household questionnaires will be used for analysis.

The study uses in its sample the most recent births which took place during the five years prior to the survey. In the 2010-11 ZDHS, women who gave birth in the five years preceding the survey were asked whether they had received antenatal care for



their last live birth. If the respondent had received ANC for her last birth, she was then asked a series of questions about the care she received, such as the type of provider, number of visits made, stage of pregnancy at the time of the first visit, and services and information provided during the visit. For women with two or more live births during the five-year period preceding the survey, data refer to the most recent birth. A national sample of 9171 women was interviewed during the survey and data referring to the most recent birth has 4427 observations.

The research design is quantitative, analysing cross-sectional data from the publicly available 2010-11 Zimbabwe Demographic Health Survey (ZDHS). Data are analysed using Stata statistical software. In most countries skilled birth attendance for women follows a pattern similar to the use of health facilities, mainly because these facilities are where skilled personnel are found. This study assumes that delivering in a health facility implies utilisation of skilled birth attendance because that is where trained personnel such as the nurses; midwives and doctors are normally found. The socio-economic status of the women's households is captured using the levels of household wealth reported in the survey.

A preliminary analysis is done examining means, standard deviations and checking the data distributions. This is followed by limited dependant variable regression analyses.

#### **4.6 Variables**

The following are the variables used in the study.

There are four dependant variables namely skilled birth attendance, number of antenatal care visits, quality of antenatal care and the socioeconomic status of



households. Skilled birth attendance is a dichotomous variable taking the value 1 if a woman delivered in a health facility and 0, otherwise. The number of ANC visits variable was extracted from the survey as reported. It is an ordered variable coded 0 if no ANC visits were made, 1 if the number of ANC visits made was between 1 and 3 and the variable was coded 2 if at least four ANC visits were made.

The quality of antenatal care variable is defined by the content of services provided to women. The content of services includes information on complications and recourse and other services received such as measuring weight and height of the woman, taking blood pressure, urine sample, blood sample and giving anti-tetanic injections. The quality of antenatal care depending on the number of ANC services received is grouped into five categories and takes values 0 if women received very low (1-2 services), 1 if the woman received low (3-4 services), 2 if the woman received medium (5-6 services), 3 high (7-8 services), and 4 very high (>9 services) quality.

The socio-economic status of the women's households (Weal) is captured using the levels of household wealth as reported in the survey. This variable is coded 0 if the household is in the poorest range, 1 if household is considered to be poor, 2 if household is considered to be in the middle range and 3 if the household is considered to be from the rich range and 5 if in the richest range. Quality of antenatal care and socio-economic status of households are ordered dependant variables.

The independent variables used in this study are based on the conceptual framework developed by Gabrysch and Campbell (2009). The socio-cultural factors include the woman's age at pregnancy, if woman lives with a partner or not, the number of living



children before the index child, the previous birth interval, the woman's and spouse's level of education attained and religion. The religion variable shows the different religious affiliations the women belong to. The variable is coded 0 the woman is not affiliated to any religious sect, 1 if she is traditional, 2 if apostolic, 3 if catholic, 4 if protestant and 5 if Muslim.

The perceived benefits/needs from antenatal care include the debut of antenatal care visits, the antenatal care provider, the venue of the antenatal care provider and the pregnancy wanted variables. The debut of antenatal care shows when a woman started going for antenatal care it is coded zero if the woman did not go for antenatal care, 1 if first ANC visit occurred in first trimester and 2 if the first ANC visit occurred after first trimester.

The antenatal provider variable tells us who provided the antenatal services to the women. It is coded 0 if the woman did not have any ANC services, 1 if she had ANC services provided by someone other than WHO recognized providers, 2 if she had ANC from a trained nurse or nurse-midwife and 3 if a doctor provided the services. The antenatal care venue is the place where the antenatal care was provided coded 0 if any other venue was used, 1 if public sector was used or 2 if the woman got her ANC services from the private sector. The pregnancy wanted variable shows how the news of the pregnancy was received. It ranges from 0 if the pregnancy was wanted then, 1 if it was wanted later and 2 if the pregnancy was wanted no more.

The economic accessibility category includes the woman's and spouse's work status variables. The employment status variable shows which sector the woman or her spouse is employed in. If unemployed, the status is coded 0, 1 if working in sales or



services, 2 if working in agriculture and 3 if working in skilled manual field. Place of residence shows where a woman is residing. It is coded zero if living in the urban area and 1 if a woman resides in the rural area.

Using the models defined in this chapter, the estimation results are presented in Chapter 5.



## CHAPTER FIVE

### RESULTS AND DISCUSSION

#### 5.1 Introduction

This chapter presents the results from the models presented in chapter 4. A preliminary analysis is done examining means, standard deviations and the data distributions are checked. This is followed by limited dependant variable regression estimations and a discussion of the results.

#### 5.2 Preliminary analysis

Before regression analysis is done it is important to check the correlation between the explanatory variables. Table 5.1 shows the correlations between the explanatory variables used in the study. Significant correlation between the variables implies the matrix will not be invertible and all algorithms of regression analysis break down. In the presence of collinear variables one of them should be removed.

Table 5.1: Correlations between variables

	num_antev	deb_antev	qual_antev	age	partnr	nchild	bir_int	relig	educ	sp_educ	antepr	ante_ven	pregw	wemploy	spemploy	weal	place_res
num_antev	1																
deb_antev	0.2726	1															
qual_antev	0.15	0.08	1														
age	0.0475	0.0498	0.0008	1													
partnr	-0.0292	-0.003	-0.0081	0.0197	1												
nchild	-0.0362	-0.0094	-0.0475	0.705	0.0632	1											
bir_int	-0.1208	-0.0728	-0.0625	-0.0714	0.0354	0.2583	1										
relig	0.0644	0.0259	0.0612	0.0401	-0.0685	-0.0854	-0.0494	1									
educ	0.0634	0.0285	0.1615	-0.1095	-0.073	-0.281	-0.0543	0.2113	1								
sp_educ	0.0633	0.0088	0.1043	-0.1083	-0.0682	-0.2128	-0.0562	0.1423	0.3442	1							
antepr	-0.0729	-0.1284	-0.035	-0.0439	0.002	0.0392	0.0408	-0.0549	-0.1117	-0.0667	1						
ante_ven	0.0604	0.1228	0.0209	0.0456	0.0114	-0.053	-0.0465	0.0725	0.0825	0.074	-0.3686	1					
pregw	-0.0364	-0.0159	-0.0512	0.1691	0.0059	0.2324	0.1363	0.0018	-0.0726	-0.0255	0.0127	0.0141	1				
wemploy	0.0079	0.0065	0.0043	0.0527	0.0078	0.0284	-0.0401	0.0076	0.0329	0.0288	-0.0434	0.0648	0.0387	1			
spemploy	0.0497	0.0236	0.0931	-0.0223	-0.163	-0.1077	-0.0536	0.1495	0.2163	0.1878	-0.0521	0.0913	-0.0164	0.0697	1		
weal	0.0752	0.0514	0.1514	-0.031	0.0034	-0.2202	-0.109	0.2103	0.3612	0.315	-0.1282	0.1677	-0.0025	0.0821	0.3342	1	
place_res	-0.046	-0.0271	-0.0963	0.0238	-0.0329	0.1877	0.0906	-0.2113	-0.3009	-0.2479	0.1683	-0.1592	-0.006	-0.0276	-0.2668	-0.6422	1



In table 5.1 above num\_antev is the number of antenatal visits a woman had. deb\_antev is the debut of antenatal care. qual\_ante is the quality of ANC services. age is the age at pregnancy. partnr is the partner variable. nchild represents the number of living children before the index child. relig is religion. educ is the woman's education. sp\_educ is the spouse's education. antepro is the antenatal provider. ante\_ven is the antenatal care venue. pregw is pregnancy wanted. wemploy is woman employment. spemploy is spouse's employment. weal is wealth and place res is the place of residence.

Descriptive statistics of variables presented in table 5.2 show the results in comparison to the reference group for each category in the population. For example, 66% of the women had skilled birth attendance at delivery compared to the reference group i.e. women who did not deliver in health facilities. The content of antenatal care variable was measured from information on complication and recourse, women weight and height measured blood pressure, urine and blood sample taken and anti-tetanic injection received. For the previous birth interval variable, if the woman only had one birth, they were put in the category "only one child".

Table 5.2: Descriptive statistics of variables used in the analysis

Variable name	Mean	Std. Dev
<b>DEPENDANT VARIABLES</b>		
skilled birth attendance (no)		
yes	0.65431	0.47563
number of anc visits (none)		
1-3	0.24908	0.43253
at least four	0.65913	0.47406
content of care (very low)		



low	0.13877	0.34575
medium	0.35930	0.47986
high	0.36188	0.48061
very high	0.08847	0.28402
wealth quintile (poorest)		
poor	0.19871	0.39904
middle	0.19140	0.39341
rich	0.19560	0.39667
richest	0.16697	0.37296
INDEPENDENT VARIABLES		
Sociocultural factors		
woman age at preg (15-19)		
20-29y	0.28228	0.45012
30-39y	0.37969	0.48532
40-45y	0.31776	0.46562
living with partner (no)		
yes	0.77218	0.41944
number of living chn before index (0)		
1 or 2	0.38093	0.48563
3 or 4	0.30479	0.46033
5 or more	0.22496	0.41757
previous birth interval (only 1 child)		
<24 mnths	0.28149	0.44974
24-36 mnths	0.03166	0.17510
36 months or more	0.00052	0.02275
religion(none)		
traditional	0.01069	0.10286
apostolic	0.43117	0.49525
catholic	0.07075	0.25642
protestant	0.40454	0.49082
muslim	0.00462	0.06782
woman education (none)		
primary	0.41449	0.49265
secondary or more	0.53193	0.49899
spouse's education (none)		
primary	0.30561	0.46068



secondary or more	0.65081	0.47673
Perceived benefit/ need		
anc begins in first trimester (none)		
first trimester	0.41807	0.49330
after first trimester	0.58093	0.49347
anc provider (none)		
other	0.00205	0.04521
trained	0.80819	0.39377
doctor	0.09966	0.29958
anc venue (others)		
public sector	0.87247	0.33361
private sector	0.12528	0.33108
pregnancy wanted (then)		
later	0.24636	0.43093
wanted no more	0.06910	0.25365
Economic accessibility		
woman employment (unemployed)		
sales or services	0.20502	0.40373
agriculture	0.12644	0.33236
other	0.11841	0.32311
spouse employment (unemployed)		
sales or services	0.21061	0.40775
agriculture	0.20633	0.40468
other	0.41510	0.49275
place of residence (urban)		
rural		
	0.72058	0.44873

Bracketed items refer to base categories. For each variable, statistics shown are in relation to a base category for that variable.

Of the women who went for antenatal care, only 66 percent had four or more visits with only 42 percent having begun the visits in the first trimester. The greater majority of the women in the population (25 percent) come from the poorest whilst 17 percent of the women come from rich and very rich households. The greater



proportion of women in the analysis was from the rural areas and only 28 percent were from urban areas. 14 percent had low quality antenatal care and only 9 percent had very high antenatal care.

### 5.3 Limited dependant variable regression analyses.

Table 5.3 presents the coefficients and significance levels from the three models for the effect of the number of antenatal care visits, the quality of antenatal care and the socio-economic status of households (represented by the variable wealth) on skilled birth attendance.

Table 5.3: Coefficients and marginal effects of ANC care and wealth status on SBA

model and description	number of anc visits	quality of anc	wealth	LR chi2(.)	Prob> chi2	rho for ANC and SBA	wald test of rho=0
probit	0.0597*** (0.0164)	0.0471*** (0.0075)	0.0549*** (0.0072)	629.63	0		
recursive biprobit	0.3046* (0.1460)	0.1557*** (0.0287)	0.1904*** (0.0072)	1332.55	0	-0.07192	0.4786
structural equation model (4 eqn's)	0.0639** (0.0230)	0.0502*** (0.0101)	0.0467*** (0.0097)	2820.08	0		

Significance at \*p<.05, \*\*p<.01, \*\*\*p<.001 . Note: marginal effects show the discrete change from the base level. All the standard errors calculated using the delta method, standard errors in brackets

The probit model has a likelihood ratio chi-square of 629.63 and a p-value less than 0.01 compared with 1332.55 for the recursive biprobit model with a p-value less than 0.01 and 2820.08 for the structural equation model (SEM). This tells us that all the coefficient estimates in the models are statistically significant. The recursive biprobit model includes a test of the null hypothesis of exogeneity which has a p-value of 0.4786, greater than 0.10. Thus, the null hypothesis that the (debut of antenatal care is a weak instrument for the estimation of model 2) is not rejected at the 0.10 level.



To tackle the problem of clustering associated with cross sectional data; this model used robust standard errors.

All three models reveal a positive effect of the number of visits, the quality of antenatal care and the socio- economic status on skilled birth attendance. Compared to having less than four ANC visits, attending four or more antenatal care sessions increases the predicted probability of utilising skilled birth attendance by 0.06 for the probit model, 0.09 for the recursive biprobit and 0.064 for the structural equations model. Having very high compared to very low quality ANC increases the predicted probability of utilising skilled birth attendance by 0.04706 for the probit, 0.04707 for the recursive biprobit and by 0.0639 for the SEM. Compared to the poorest household, coming from very rich households increases the predicted probability of utilising skilled birth attendance by 0.0549 for the probit model, 0.0553 for the recursive biprobit and 0.0467 for the structural equations model.

The fact that the estimated coefficients for the effect of antenatal care are greater in the recursive biprobit than the probit model suggests that the probit model underestimates the impact of antenatal care on the decision to seek skilled birth attendance. The direction is however not consistent after including the content of care and the households' socio-economic status variables.

#### **5.4 Results and discussion of the Structural Equation Model results**

The results in table 5.4 show that given the age of a woman, the probability of transitioning to a higher wealth level and that of having more ANC visits first decreases and then increases. Possible reasons could be that at a lower age level, a woman is living with her parents and she is better off. As she grows older she may



leave her parents and her wealth status initially deteriorates because she is no longer being subsidised by the parents. This is shown by a 0.009 decline in the probability of migrating to a poor socio-economic status as compared to the poorest base level and also a 0.052 decline in the probability of having 0-3 antenatal care visits compared to not going for ANC at all.

As the woman grows older she may begin to be involved in projects which generate wealth and compared to the base levels, her probability of transitioning to a higher wealth quintile and going for 4 or more ANC visits increases. Her probability of migrating to the middle bracket increases by 0.011, that of transitioning to the highest socio-economic status increases by 0.035 and the probability of her attending four or more ANC visits increases by 0.052. This phenomenon is supported the life cycle hypothesis theory in macroeconomic theory where individuals make consumption decisions based both on the resources available to them over their lifetime and on their current stage of life. Since the socio-economic status of households is significant in predicting skilled birth attendance, government could have targeted subsidies for young girls who get pregnant to enable them to go for ANC visits or to deliver at health facilities. An increase in age is however not significant at the 0.05 level to explain the quality of care or skilled birth attendance in this model.



Table 5.4 Marginal effects of SEM for the number of visits and for wealth

	# anc visits =1		# anc visits =2		wealth = 1		wealth = 2		wealth = 3		wealth = 4	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
<b>age at pregnancy</b>	-0.0516**	0.0163	0.0516**	0.0163	-0.0089***	0.0015	0.0109***	0.0018	0.0179***	0.0028	0.0347***	0.0052
<b>Partner</b>	0.0244	0.0171	-0.0244	0.0171	-0.0017	0.0015	0.0021	0.0018	0.0034	0.003	0.0066	0.0058
<b>number of children</b>	0.0185	0.0144	-0.0185	0.0144	0.0082***	0.0014	-0.0100***	0.0015	-0.0164***	0.0024	-0.0318***	0.0045
<b>birth interval</b>	0.0629***	0.015	-0.0629***	0.015	0.0008	0.0012	-0.001	0.0015	-0.0016	0.0024	-0.0031	0.0047
<b>Religion</b>	-0.0108	0.0062	0.0108	0.0062	-0.0024***	0.0006	0.0030***	0.0007	0.0049***	0.0011	0.0094***	0.0021
<b>Education</b>	-0.0288	0.0194	0.0288	0.0194	-0.0135***	0.0018	0.0165***	0.0019	0.0270***	0.0029	0.0523***	0.0054
<b>spouse's education</b>	...	...	...	...	-0.0152***	0.002	0.0186***	0.002	0.0306***	0.0031	0.0591***	0.0058
<b>pregnancy wanted</b>	0.0171	0.0121	-0.0171	0.0121	-0.0018	0.0011	0.0022	0.0014	0.0036	0.0022	0.0069	0.0043
<b>women employment</b>	...	...	...	...	-0.0033***	0.0007	0.0040***	0.0008	0.0065***	0.0013	0.0126***	0.0024
<b>spouse's employment</b>	0.0058	0.0068	-0.0058	0.0068	-0.0029***	0.0006	0.0036***	0.0007	0.0058***	0.0012	0.0113***	0.0022
<b>place of residence</b>	-0.0107	0.0564	0.0107	0.0564	0.0709***	0.0057	-0.0868***	0.0076	-0.1424***	0.0044	-0.2753***	0.005
<b>debut of anc</b>	0.3790***	0.0142	-0.3790***	0.0142								
<b>Wealth</b>	-0.0158	0.0289	0.0158	0.0289								
<b>anc venue</b>	...	...	...	...								
<b>number of anc visits</b>	...	...	...	...								
<b>quality of anc</b>	...	...	...	...								

Significance at \*\*p&lt;.01, \*\*\*p&lt;.001. Note: dy/dx for factor levels is the discrete change from the base level. (...variable not included in equation)



Table 5.5 Marginal effects of SEM for having skilled birth attendance and for quality of antenatal care

	skilled birth		quality of anc=1		quality of anc=2		quality of anc=3		quality of anc=4	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
<b>age at pregnancy</b>	0.03314	0.0196	0.0115	0.0068	0.0084	0.005	-0.0156	0.0092	-0.011	0.0066
<b>Partner</b>	...	...	0.0082	0.0073	0.006	0.0053	-0.0111	0.0099	-0.0079	0.007
<b>number of children</b>	-0.06008***	0.0186	-0.0198***	0.006	-0.0145***	0.0044	0.0269***	0.008	0.0189***	0.0059
<b>birth interval</b>	-0.00936	0.0264	0.0074	0.0071	0.0054	0.0052	-0.01	0.0096	-0.007	0.0067
<b>Religion</b>	...	...	...	...	...	...	...	...	...	...
<b>Education</b>	0.090293***	0.0222	-0.0316***	0.0082	-0.0231***	0.0061	0.0428***	0.0111	0.0302***	0.0075
<b>spouse's education</b>	...	...	...	...	...	...	...	...	...	...
<b>pregnancy wanted</b>	-0.0107	0.0155	0.0124*	0.0054	0.0090*	0.004	-0.0167*	0.0073	-0.0118*	0.0052
<b>women employment</b>	-0.02085*	0.0095	0.0029	0.0032	0.0021	0.0023	-0.0039	0.0043	-0.0028	0.0031
<b>spouse's employment</b>	...	...	...	...	...	...	...	...	...	...
<b>place of residence</b>	-0.14245***	0.0277	-0.0121	0.0197	-0.0089	0.0143	0.0164	0.0266	0.0116	0.019
<b>debut of anc</b>	...	...	...	...	...	...	...	...	...	...
<b>Wealth</b>	0.046717***	0.0097	-0.0193*	0.0097	-0.0141*	0.007	0.0261*	0.0129	0.0184	0.0095
<b>anc venue</b>	...	...	-0.0211*	0.0094	-0.0155*	0.0069	0.0286*	0.0127	0.0202*	0.009
<b>number of anc visits</b>	0.063902**	0.0230	-0.0685***	0.0145	-0.0501***	0.0107	0.0928***	0.0193	0.0654***	0.015
<b>quality of anc</b>	0.050158***	0.0102	...	...	...	...	...	...	...	...

Significance at \*p<.05, \*\*p<.01, \*\*\*p<.001. Note: dy/dx for factor levels is the discrete change from the base level. (...variable not included in equation)



In table 5.4, the number of living children that a woman has first increases then decreases the probability of transitioning to a higher wealth level or socio-economic status. With fewer children, the probability of transitioning from the poorest wealth quintile to a poor wealth quintile increases by 0.008. This can be attributed to the fact with fewer children; demand on the household resources is low. As the number of children increases demand on the household resources is increased and the probability of migrating to a higher wealth status begins to decrease. The probability of migrating to the highest wealth level compared to the base level decreases by 0.032 as the number of children increases.

Having more children compared to not having any living children before the index child leads to a 0.06 decline in the probability of having skilled birth attendance at delivery. In support of these results, Navaneetham and Dharmalingam (2000) find that high value is often placed on the first pregnancy as it is known to be more difficult than others and the woman has no previous experience and this could explain why first time mothers deliver in hospitals compared to their counterparts. Gabrysch and Campbell (2009) also explain that women with more children or a higher parity can draw on their maternal experiences and may not feel the need to receive professional care if their previous deliveries were not complicated. Free tubal ligation can be used as an incentive for women with higher parity who give birth in hospitals.

Compared to the poorest wealth status, the woman's and the spouses' level of education first decreases the probability of migrating to a higher wealth. This may be



explained by the fact that as the education level is very low, both the woman and her partner are unlikely to find well-paying jobs and the probability to migrate to a higher wealth level may be decreased as resources can be diverted to attaining a higher education level. As the level of education increases they both can have more access to and control over financial resources. In table 5.5, the level of education is associated with a 0.09 increase in the probability of delivering in a health facility. Consistent with findings from Gabrysch and Campbell (2009) theoretical review, almost all the studies in this field find a strong effect of education on skilled birth attendance.

Whether or not the pregnancy was wanted can have an impact on the quality of care as shown in table 5.5. If the pregnancy was wanted, the woman is more likely to get more ANC services but if the pregnancy is wanted no more, she is less likely to increase the quality of antenatal care services especially if they come with an additional cost.

The woman and her spouse's employment status increases ability to migrate to a higher wealth level as shown in table 5.4. With more earnings they can afford to provide for their family's needs and transition to a higher wealth status is made easier with affordability. However, the woman's employment status decreases the probability of skilled birth attendance as shown in table 5.5. If work is poverty induced this can reduce skilled attendance use because of the opportunity costs associated with a facility delivery not only to the woman but also to the person who escorts her to the hospital for delivery.



The results in table 5.4 show that staying in a rural area compared to staying in urban areas decreases the woman's probability to transcend to a higher socio-economic status. Compared to staying in urban areas, the predicted probability of utilising skilled birth attendance decreases by 0.14 if a woman is staying in the rural areas as shown in table 5.5. The findings of this study are consistent with those of most researchers (Obago, 2013; Bloom et al., 2001) who also find that women in rural areas are less likely to deliver in hospital facilities compared to their counterparts in urban areas. Juan, Bladimir and Wilman (2013) explain these findings in the sense that the place of residence is normally associated with physical inaccessibility to hospitals and employment opportunities. The rural areas generally get worse services and infrastructure, more poverty and more traditional beliefs which may lessen facility use.

The debut/ beginning of antenatal care has an impact on the number of antenatal care visits that a woman makes. If she starts going for antenatal care in the first trimester her probability of having more visits increases but if she starts her visits after the first trimester her chances of making four or more visits are lowered as shown by the decline in the probability.

### **5.5 Results showing summary of the relationship between SBA, ANC and socio-economic status**

This study aimed at doing an analysis of the relationship between SBA, ANC and the socio-economic status of households after accounting for endogeneity and possible simultaneity in the variables. Household wealth increases the probability of a woman getting higher quality antenatal care. At low levels of wealth (poor and poorest) the



probability of migrating from very low to low quality ANC is probably reduced (-0.07) because these women are marginalised by the providers due to their socio-economic status. As the household wealth status improves, the probability of a women receiving medium quality ANC (compared to very low quality ANC) decreases but by a lesser extent. If the woman comes from an even higher socio-economic status her probability of getting high quality ANC increases by 0.03 and her probability of getting the highest quality ANC increases by 0.02. This shows that women who come from rich or very rich households get more services. The slight decreases in the probability between high and very high quality could be because more services may not be available in the clinics or hospitals despite the socio-economic status the woman comes from.

Ultimately, the number of visits increased the probability of getting higher quality antenatal care services. The study found that both the number of ANC visits and the quality of these visits are positive predictors of health facility delivery/ skilled birth attendance. Quality of antenatal care led to a 0.05 increase in the probability of delivering in a health facility and the number of ANC visits improved the probability of a skilled birth delivery by 0.06. The study results also demonstrate a significant positive association between wealth and skilled birth attendance with household wealth status increasing the probability of a woman's decision to have skilled attendance at delivery by 0.05. These results imply that the socio-economic status of the household does matter in the decision to ultimately use both antenatal care and skilled attendance since the SBA equation is derived from the antenatal care equations. This positive association between antenatal care and skilled birth attendance and also the positive association between wealth and skilled birth



attendance is consistent with most of the studies (Bloom et al., 2001; Obago, 2013, Adjiwanou and LeGrand, 2013 and Trujilo et al., 2013) which investigate this relationship.



## **CHAPTER 6**

### **CONCLUSIONS AND POLICY IMPLICATIONS**

#### **6.1 Conclusions**

This study carried out an analysis of the relationship between skilled birth attendance, antenatal care and the socio-economic status of households in Zimbabwe using data from the 2011-12 Zimbabwe Demographic and Health Survey. Structural equation modelling was used to analyse the relationship after taking into account possible endogeneity biases between antenatal care and skilled assistance at delivery. This model also took into account possible simultaneity between the three variables. The variable used to represent skilled birth attendance is the number of women who delivered in a hospital or clinic.

From the results, the system of simultaneous equations reveals a positive effect of the number of visits, the quality of antenatal care and the socio- economic status on skilled birth attendance. Hence the null hypothesis that there is no significant relationship between the socio-economic status of households, antenatal visits and the utilisation of skilled birth attendance is rejected in favour of the alternative. The study also finds that the level of education increases the probability of skilled birth attendance but that the number of children (parity), the woman's employment status and living in the rural areas decreases the probability of utilising skilled care at delivery.

#### **6.2 Policy Implications**

The results suggest that interventions should target both supply and demand sides. The demand side makes sure that women are encouraged to go for more antenatal visits and the supply side ensures health facilities are able to provide high quality



antenatal care services. All these factors consequently lead to the reduction of maternal mortality through the skilled birth channel. Government can promote maternal health in the community using community based health workers. Once the health workers identify a pregnant woman they should encourage her to register her pregnancy at a clinic or hospital. That alone increases the number of antenatal visits which increase skilled birth attendance and consequently leads to reduced maternal mortality. Improved maternal health implies women are more able to contribute to the economic development of the nation as stated in the first chapter.

Increased medical coverage of deliveries, through additional skilled staff and service points, are basic requirements for improving delivery care. Reliable supply lines and staff retraining programs are also critical. The Zimbabwe MoHCW should emphasize increasing the level of schooling of mothers and establish health facilities in the poorest regions of the country. Government should urgently prioritise social services delivery in fulfilment of its human rights obligations enshrined in the new constitution and have health facilities within a 5 kilometre radius as per WHO stipulation. These facilities should offer exceptional services. Women in rural areas live far away from quality obstetric care, so improvements depend greatly on early recognition of complications, better provisions for emergency treatment, and improved logistics for rapid movement of complicated cases to district hospitals to ensure that the distance to access is reduced. If a woman moves from a rural to an urban area, it further increases their access to both antenatal professional care and institutional delivery. Skilled birth attendance is used as an indicator for maternal mortality as mentioned in the introductory chapter. From the statistics (only 66 percent of the women utilising



skilled birth attendance) derived from the survey used in this study and a maternal mortality ratio of 960 deaths per 100000 live births, maternal mortality must therefore be declared a national disaster deserving urgent national attention and deployment of sufficient human and financial resources to address it.

### **6.3 Area for Further Research**

A possible area for further study involves the use of all the demographic health surveys that have been done in Zimbabwe as a panel analysis. The benefit of a panel analysis is that the study will be able to detect developments or changes in the characteristics of the target population because the panel extends beyond a single moment in time (which was only five years in this case). As a result, the panel analysis can establish sequences of events and shed better light on the relationships investigated in this cross sectional study.



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