THE INFLUENCE OF FEMALE EDUCATION ON MATERNAL HEALTH CARE UTILIZATION IN ZAMBIA: A MULTILEVEL ANALYSIS

By

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DECLARATION

I, **Sambo Jairos Kepson**, declare that this dissertation:

(a) Represents my own work;

(b) Has not previously been submitted for a degree at this or any other University;

(c) Does not incorporate any published work or material from another dissertation.

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APPROVAL

This dissertation of **Sambo Jairos Kepson** has been approved as fulfillment of the requirement for the award of the degree of Master of Arts in Economics by the University of Zambia.

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ABSTRACT

Introduction: In most developing countries female education is considered the single most important predictor of maternal health seeking behavior. The study seeks to analyze the role of female education by establishing whether quantitative evidence provides the same conclusions and additional neighborhood influences on maternal health seeking behavior. The study examined female education association with maternal health seeking behavior, its differences in impact and whether it is consistent across different antenatal and delivery-care services.

Methods: Using the 2013-2014 Zambia Demographic and Health Survey (ZDHS) data, we specified multilevel models, to assess factors associated with (1) tetanus toxoid (TT) inoculation (2) the choice of skilled birth-attendants (3) choice of skilled provider during antenatal care and (4) frequency of prenatal visits.

Results: The average prenatal visits for pregnant women was 3.8. Almost 83 percent of women in the sample were immunized with tetanus toxoid, 93 percent had used some form of formal antenatal care, and 73 percent had used formal delivery assistance for the most recent child. At individual level, female education, partner's education, household wealth, birth history are positively associated with utilization of all health services whereas household size is negatively associated. Women with secondary education had 2 times and 16 percentage point's greater log-odds of being assisted by a skilled provider than women with no education for assisted deliveries and prenatal care respectively. There exist differences in impacts of individual-level female education and community-level education on maternal health-seeking behaviors with secondary level of education consistently being more pronounced across all health services with an exception of TT use. The proportion of educated women in the community, is positively associated with TT use and showing expected positive association on the other three maternal health services, though not significant. Community education had a 1.4 times greater log-odds effect on TT use. At community level, region and place of residence are positively associated with the use of all maternal health services. However, the results show that both individual and community level factors have a much stronger effect in the rural sample.

*Conclusion***:** The results suggest simultaneous targeting of health policy at both individual and community-levels. Efforts by the government should be targeted to provide universal secondary education in rural and hard-to-reach communities coupled with reducing provincial and regional disparities in the provision of maternal health services.

DEDICATION

To my late parents, wife, daughter, family and friends for their continued support

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LIST OF ACRONYMS

ANOVA	-	Analysis of Variance
AGC	-	Adaptive Gaussian Quadrature
AIC	-	Akaike Information Criteria
BIC	-	Bayesian Information Criteria
CHW	-	Community Health Worker
CSO	-	Central Statistical Office
EA	-	Enumeration Areas
FML	-	Full and Maximum Likelihood
HIV	-	Human Immunodeficiency Virus
ICC	-	Intra Class Correlations
LR	-	Likelihood Ratios
ML	-	Maximum Likelihood
MLA	-	Multilevel Analysis
REML	-	Restricted Maximum Likelihood
SEA	-	Standard Enumeration Areas
TBA	-	Traditional Birth Attendants
TT	-	Tetanus toxoid
VIF	-	Variance Inflation Factors
WHO	-	World Health Organization
ZDHS	-	Zambia Demographic Health Survey

CHAPTER ONE

INTRODUCTION

1.0 Overview of the Study

The use of maternal health services is important in preventing infant and maternal mortality. In Zambia, most women have at least one antenatal visit during pregnancy but the skilled deliveries are still low. According to the Zambia Demographic Health Survey (ZDHS) 2013-2014, about 96 percent of women consulted a skilled health provider at least once for antenatal care for the most recent birth with urban areas having a higher coverage at 99 percent and rural areas lower at 94 percent. A higher proportion of women in urban areas (89 percent) further reported being assisted by skilled providers during delivery compared to rural areas (52 percent). Despite the high use of antenatal services, maternal mortality and under-five mortality rates are still as high as 398 death per 100, 000 live births, and 75 deaths per 1,000 live births, respectively (CSO, 2014).

The use of maternal health care services across different education levels is well documented in Zambia. The recent ZDHS, contends that about 99 percent of women with more than secondary education received antenatal care from skilled providers than women with no education (91 percent). With regards to tetanus toxoid injections, the percent of women whose last birth was protected against tetanus is 77 percent, 80 percent, 85 percent and 92 percent for women with no education, primary, secondary and more than secondary education respectively. Furthermore, assisted deliveries are related with the level of education acquired by a woman (CSO, 2014). For example, the percentage of women who were assisted during delivery by a skilled provider is 46 percent, 57 percent, 82 percent and 96 percent for women with no education, primary, secondary and more than secondary

education respectively. This evidence is similar to other studies conducted in Zambia (Stekelenburg et al., 2004; Hazemba and Siziya, 2011 and Nakambale et al., 2014).

Earlier scholarly works conducted in Zambia confirm that women with higher education are more likely to deliver in a health facility and hence assisted during delivery (Stekelenburg et al., 2004; Hazemba and Siziya, 2011 and Nakambale et al., 2014). While the focus of these studies conducted in Zambia has been to understand unclear reasons why women fail to utilize health care services, I extend the debate by explicitly unravelling why female education is important coupled with its failure to predict utilization arising from neighborhood effects across several utilization outcomes in Zambia. Elsewhere, most previous research in this area have focused on the effects of schooling per see (Caldwell, 1979), Elo, 1992 and Bbaale and Guloba, 2014, assess differences in impacts of various schooling category, interactive effect of education and residence (Raghupathy, 1996) and the educational links to socioeconomic situation (Desai and Alva, 1998; Elo, 1992). However, it is still not clear if the influence of neighborhood effects or community context matters for health care services. This study bridges this gap in knowledge. Others like Behrman and Wolfe, 1987 and Elo, 1992 argue that the effects of schooling may be overstated due to woman childhood background were health related skills and habits are acquired. This is a more reason why the researcher picks one major component related to the hierarchical nature of the data used and place of residence a woman resides to get the true effect of maternal education. Elo, 1992, Raghupathy, 1996 and Desai and Alva, 1998 made major strides in this area of study by looking at the interactive effects of maternal education and urban residence using fixed effects models. However, the proportion of educated women in these community was not studied.

Elsewhere, it has been shown that access to and the use of quality maternal health care services remain crucial to improving maternal-child survival (Guloba and Bbaale, 2014; Gage 2007; Stekelenburg et al., 2004; Hazemba and Siziya, 2011 and Nakambale et al., 2014). In Zambia maternal health service use is influenced by mother's age, place of residence, province and mother's education (Stekelenburg et al., 2004; Hazemba and Siziya, 2011 and Nakambale et al., 2014; CSO, 2014).

It is well established in literature that better educated women are more likely seek services of skilled attendants than the less educated women and that at community level, educated women act as role models by helping others to understand the importance of health services through socialization (Flosta et al., 2005; Gage, 2007; Guloba and Bbaale, 2014; Ononokpono et al., 2014). However, there are high dropout rates among girls at secondary level in Zambia, which has prompted the policy makers to institute measures aimed at enhancing girls' retention rates in schools. These measures include the re-entry policy, which allows girls who drop out of school due to pregnancy to return to school after giving birth (Mutombu and Muenda, 2010).

Undoubtedly, recent descriptive evidence suggests that education is an important predictor of maternal health service utilization in Zambia (CS0, 2014). Does quantitative evidence provide the same conclusions considering the community context in which a woman lives? What is the education level for females which is necessary for utilization? and Are there any differences in impact of various education levels on use of maternal health services?, are some of the questions we attempt to answer. Against this backdrop, we use the most recent Zambia Demographic Health Survey (ZDHS) data to examine the association of female education as a predictor of maternal health seeking behavior, its differences in

impact and whether it is consistent across different antenatal and delivery-care service using a multilevel approach.

1.1 Background of the Study

Over the last two decades, child and maternal mortalities in Zambia have remained very high (Table 1). Both child mortality and maternal mortality rates have been declining at an unacceptably-low-rate. In such a case, educating a woman and having communities with educated women could help reduce mortalities. However, such interventions seem unattainable in a country faced with a double burden of higher poverty (about 60 percent of the population is poor) and low overall life expectancy of 52.2 years coupled with a high HIV rate of over 13 percent. The problem is further exacerbated by lower literacy and higher drop-out rates especially among rural girls. While the ratio of girls to boys in secondary school is eleven to ten, the majority of girls drop out of school later, thereby reducing number of girls in tertiary institutions to 8 girls for every 10 boys (CSO, 2014). This certainly, is crippling government's effort of educating women from both rural and urban areas and this may have trickledown effect on health outcomes and intergenerational poverty in the long run.

Table 1: Selected Health and Socio-Economic Indicators

	Years			
Indicators	**1991/2**	**2001/2**	**2006/7**	**2013/14**
Incidence of Poverty (%)	70	68	64	60
Life Expectancy at Birth (Years)	46.9	43	41	52.5
Maternal Mortality Ratio Per 100 000 Live Birth	20.1	729	449	398
Child Mortality Ratio Per 1000 Live Birth	120	164	119	75
Fully Immunized Children under one Year (%) ¥	73	76	78	84.9
Literacy Rates (%)	na	na	74.4	81.1
Ratio of Girls to Boy in Secondary Education	na	na	0.92	1.1
Ratio of Girls to Boy in Tertiary Education	na	na	0.92	0.8

Source: (Ministry of Health – Zambia, Cutesy of Chansa Collins and Author)
¥ Immunized against Measles
na Not available

In Southern Africa, Zambia has higher maternal and child mortalities compared to its neighbors such as Namibia and Botswana with under-five mortality rates of 45 deaths per 1,000 live births and 44 deaths per 1,000 live births respectively (World Bank, 2016). This has prompted the Government of the Republic of Zambia to promote extensively policies that are not only geared to promoting maternal health care utilization but also reducing child and maternal mortalities. These child and maternal policies help health care providers to diagnose pregnancy-related problems and in preventing child delivery complications which may result from expectant mothers (Guloba and Bbaale, 2014; WHO, 2006 and Van Lerberghe and De Brouwere, 2001).

Antenatal care services are also important in helping mothers to diagnose diseases, checking if there are any possibilities of multiple births and delivery complications which if known early enough by skilled service providers can be dealt with. Furthermore, to prevent infant deaths, mothers need to be given a tetanus toxoid injection during their pregnancy. A tetanus toxoid injection prevents neonatal tetanus in pregnant women. In

addition, the need for proper medical attention and hygienic conditions during delivery cannot be underscored. Delivery care not only reduces the risk of complications and infections but also helps to curb death or serious illness of the mother and the infant (WHO, 2006; Van Lerberghe and De Brouwere, 2001).

1.2 Statement of the Problem

In an effort to improve maternal and child health in Zambia, policies linked to female's education become paramount. This knowledge is particularly important as it informs policy makers on factors that affect maternal health care utilization in which female education is considered the single most important predictor (Caldwell, 1979).

In Zambia, female education is pertinent in advance maternal health care demand in three ways: generating evidence-based and targeted-health policies which are more effective, understanding of the level education which is necessary for enhancing women health seeking behaviour, and for the reduction of maternal and child mortalities in the long run. At community level, improving access and quality to female education is an essential building-block for increasing the number of trained health workers (UN, 2007). However, there are some challenges in achieving this.

The problem is compounded by high illiteracy in primary schools, high drop-outs at secondary level but also in the design of policies. However, with collective efficacy among women in the community, government policies are more likely to be effective. Will female education be significant when we consider community context or neighborhood in which a woman lives?

Since the data collected in the ZDHS is inherent hierarchical in nature, as a results of being collected using a multistage random sampling approach, multi-level analysis is more appropriate to use in this study. Our study adds new knowledge by using multilevel approach which has several advantages compared conventional logistic models. This approach avoids the problem of the assumption of independence which is more prevalent in common statistical models and tests. The lack of independence causes an underestimate of standard errors giving spurious significant results.

In literature, there is evidence of the factors associated with maternal health seeking behavior for developing countries, but there is limited evidence in Zambia. We attempt to establish the extent and nature of the association of mother's education on maternal health-seeking behaviors by considering the context in which a woman resides. We extend the analysis by Guloba and Bbaale (2014) on female education and maternal health care utilization by using a multi-level analysis approach to capture neighborhood effects. In this regard, the main contribution towards literature is that this study will also assess the association of female education at both individual and community-level on the use of antenatal and child delivery health services.

1.3 General Objective

The general objective of the study is to examine the factors that influence the use of maternal health care services in Zambia, in particular the use of antenatal and delivery-care services using the multilevel analysis, considering the neighborhood in which a woman lives.

1.4 Study Objectives

Specifically the study seeks:

1. To examine the association of mother's education with maternal health-seeking behavior
2. To examine the differences in impact of mother's education on maternal health seeking behavior
3. To establish whether the association of maternal education with maternal health seeking behavior is consistent across different types of maternal health services.

1.5 Research Hypotheses

1. Mother's education is a significant predictor of maternal health care utilization.
2. There are differences in the influence of mother's education levels on maternal health seeking behavior.
3. The mother's education relationship to utilization is inconsistent across different types of health services.

1.6 Significance of the Study

The Government of the Republic of Zambia embarked on health reforms in the early 1990s in a quest to influence maternal health seeking behavior and ultimately health outcomes among expectant mothers. This study links female education to maternal health seeking behavior among women. The knowledge of the correlation of female education on health seeking behavior is particularly important for generating evidence-based and targeted policies which are more effective. Additionally, an understanding of the level of education at which significant results or variations in results are registered is

necessary for enhancing women health seeking behavior. An increase in maternal health care utilization is expected to result in a reduction in maternal and child mortalities in the long run.

1.7 Theoretical Framework

We model maternal health care utilization in this study using Grossman's, (1972) theory of demand for health and health care services. This model is an extension of Becker's human capital model were individuals invest in their health stock for the purposes of productive capacities (Zweifel et al., 2009). Seeking antenatal and delivery services is referred to as the demand for health care. The Grossman model assumes that for a utility maximizing individual, he/she derive their utility from consumption goods (X) and from health goods (H). The utility function is represented as:

$$U = U(X, H) \tag{1}$$

This model has additional assumptions. Health stock which is accumulated overtime can be enhanced through medical treatments (M) and preventive efforts (t^I), in this case going to a health facility to receive a TT inoculation and antenatal services. Seeking antenatal and delivery care services on the other hand is a form of consumption of medical treatment services described by Grossman as (M) with an objective of maintaining good health (H). Antenatal care and delivery services also represents a form of consumption called preventive efforts (t^I) aimed also at restoring health, (H). Therefore, a rational expectant mother invests in H through M and t^I and hence health stock investment function is:

$$H = H(M, t^I) \tag{2}$$

Improvements in health stock is necessary for its intrinsic value but more so it's needed by an individual to earn more income in the labor market which would result in purchasing more goods to consume thereby increasing overall utility. This is true as health stock is considered a capital good (Zweifel et al. 2009). In order to maximize life time utility, rational individuals will demand an optimal stock of health since an individual can influence their stock of health.

To model the demand for health and health care services (antenatal and delivery care services), Grossman employed dynamic optimization technics. This represents a life time utility maximization problem faced by an individual.

We adopt a simple version of the Grossman model discussed in Zweifel et al., (2009) and apply it to the analysis of demand for antenatal and delivery care services in Zambia. We consider an individual with a two planning horizon time period, period 0 and 1. In each time period, an individual (woman) may experience an amount of time of ill-health because of her condition of being pregnant and for ensuring the baby grows health in the womb (t^s). This could be lowered by accumulation of a larger stock of health (H). Assuming also that the woman derives utility from consumption goods (X) and that sick time results into disutility, the utility function becomes:

$$U = U[t^s(H_O), X_O] + \beta U[t^s(H_1), X_1] \tag{3}$$

Where β is a subjective discounting factor.

Additionally, the Grossman model assumes that an individual is a producer of her own health and therefore movements in her health stock overtime represents an important constraint in our optimization problem. Further, health stock depreciates at a rate of δ overtime due to aging and pregnancy related illnesses and conditions. The individual can make investments in health stock I through utilization of antenatal and delivery health services or committing time through preventive efforts t^I. A woman could spent some time in preventive efforts through going for immunization of TT atleast twice and to ANC atleast four times.

The health stock in the next period (H_1) depends on the stock of health today but adjusted for depreciation and investments in the current period given by:

$$H_1 = H_0(1-\delta) + I(M_O, t^I) \tag{4}$$

Lastly, we have the budget constraint which is based on the assumption that women's expenditure is associated with seeking antenatal care services (pM)[1], expenditure on consumption goods (cX) which are financed by wage income (W) and initial endowment of wealth (A_O). In this model we also assume that, women invest in health only in period 1. The budget constraint facing a woman is thus:

$$A_O + w_o[1-t^s(H_O)-t^I) + \frac{w_1[1-t^s{}_1(H_1)}{R} = pM + cX_O + \frac{CX_1}{R} \tag{5}$$

Where R is the discount factor.

[1] These could be transport costs, costs of books and drugs though most of services are offered free of charge.

The individual faces a dynamic utility maximization problem over her life time subject to health stock and budget constraints. The problem is solved using a Lagrangian set up below:

$$L(H_1, t^I, M, X_O, X_1) = U[t^s(H_O), X_O] + \beta U[t^s(H_1), X_1] + U[H_O(1-\delta) + I(M, t^I) - H_1] + \lambda[A_O + w_0(1 - t^s(H_O) - t^I) + \frac{w_1(1 - t_1^s(H_1))}{R} - pM - cX_O - \frac{cX_1}{R}] \quad (6)$$

Using the solutions to this problem, we adopt a generic structural demand function for medical care specified in log form with the variable education explicitly shown on how it affects utilization as follows[2]:

$$InM = const. + \ln H_1 - (1 - \alpha_M)\ln p + (1 - \alpha_M)\ln w_o - \alpha_E E \quad (7)$$

Where the variables are specified as:

$M =$ Antenatal and delivery services utilized

$H_1 =$ Individual health stock in period one

$w_o =$ Wage rate in period zero

$p =$ Price of health care services

$E =$ Individual and the proportion of educated women in the community.

In this study, education of the woman is a variable of interest entering the model both at individual and community level. As noted by Zweifel et al., (2009), education of a woman

[2] For detailed explanations on how this model is derived, see Zweifel et al., 2009.

increases the productivity of medical services, hence less medical services are necessary to maintain a given stock of health capital.

We now estimate our optimized value using a logistic multi-level model and linear regression multi-level model presented in Chapter 3.

1.8 Definitions of Key Terms

1. **Community Level Education** - refers to the proportion of the educated women in the community. In this case, the community is defined as the Standard Enumeration Area (SEA) that is commonly used by the Central Statistical Office.

2. **Formal Antenatal Care** - refers to being assisted during antenatal care by some skilled health provider which include: a doctor, clinical officer, nurse and midwife. This concept is borrowed from Raghupathy, (1996).

3. **Formal Delivery Assistance** - refers to being assisted during delivery by some skilled health provider which include: a doctor, clinical officer, nurse and midwife. This concept is borrowed from Raghupathy, (1996).

4. Right Education Mix – refers to the level of education at which significant results or variations in results are registered.

The rest of the paper is organized as follows: Chapter 2 gives a detailed review of related literature from both Zambia and elsewhere. Chapter 3 presents the Methodology while Chapter 4 has Study findings, followed by the discussion of the findings in Chapter 5 and conclusions, policy recommendations and the areas for research in Chapter 6.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this section we present evidence on factors associated with prenatal care and child-delivery services use, the level of education that is optimal for health seeking behavior of expectant mothers and what the differences in effect of primary, secondary and higher education levels are across different antenatal and delivery health care services.

2.1 Use of Antenatal and Delivery-care Services

Maternal health care utilization has been studied over the last three decade since the pioneer works of Caldwell (1979). Some areas of interest include a focus on the use of antenatal and delivery-care services (Guloba and Bbaale, 2014; Raghupathy, 1996; Elo, 1992) and use and access to health facilities (Gabrysch, 2011; Gabrysch and Campbell, 2009; Gage, 2007). The use of antenatal and delivery-care services given or provided has generally been fairly high in developing countries with an exception of a few. Raghupathy, (1996) in a study from Thailand finds that almost 69 percent of the women in the sample had been immunized with a tetanus toxoid inoculation, with 89 percent of expectant mothers being assisted by skilled providers during prenatal care, and 77 percent had used skilled delivery assistance for their latest child. The average prenatal number of visits is around 3.6-3.8 which is slightly lower than that recommended by World Health Organization (WHO). Guloba and Bbaala, (2014) found that the average number of antenatal visits in Uganda was 3.7. This evidence is supported by several authors (Elo,

1992; Gage, 2007; Gabrysch and Campbell, 2009; Gabrysch, 2011; Guloba and Bbaale, 2014).

2.2 Factors Affecting Prenatal Care and Child Delivery Services

A vast amount of literature exists documenting the determinants of antenatal care and child-delivery health services in developing countries. Elsewhere, these factors have been classified as individual, household and community level factors. At community and household level, significant factors that have been identified include; proportion of educated women in the community, proportion of households poor, ethnicity diversity, place of residence, region of residence, distance from health facility to the nearest cluster, female education, partner's education, wealth status, occupation of the husband, intergenerational education, caste, household sizes and many more (Gabrysch et al., 2011; Boco, 2010; Gabrysch and Campbell, 2009). However, at individual level, female education, mother's age or age cohort, household size, birth order, past birth history, mother's level of employment, childhood environment, maternal autonomy, religion and media exposure are significant factors affecting maternal health seeking-behavior (Elo, 1992; Gage 2007; Ononokpono et al., 2014; and Guloba and Bbaale, 2014).

Over the last three decades since the pioneer works of Caldwell (1979), female education has been viewed as a single most important predictor of mother's health seeking behavior. At community, household and individual levels, there are three possible consequences of female education on maternal seeking behavior. The level of female education increases self-awareness and acceptance of modern practices among pregnant women, provides a greater capability in manipulating the real world and securing health services coupled with

a change in traditional balance of family relationships which shifts power from kin groups and allows mothers to assume great responsibility for their own health and children (Guloba and Bbaale, 2014). In general, education has had positive significant effect on maternal health behaviors (Gage, 2007; Alderman et al., 2003; Cleland and Van Ginneken, (1988). A higher proportion of educated women in a given neighborhood help other less educated women to understand and comprehend health services in addition to being role models in such societies (Gage, 2007). However, much of these studies did not take into the nature of the data used (i.e. the data is generally hierarchical in nature). In other word, the effects of community context has been ignored. Furthermore, the contribution that collective efficacy brings in the communities which is at the center of this paper has only been scratched.

Literature also highlights other factors which are important predictors of maternal health care utilization. At individual and household level, it has been argued that wealthy households are generally more likely to seek modern health care services (Guloba and Bbaale, 2014). Literature also asserts that older women are more likely to seek health care services compared to the younger ones. Women who are older face higher risks than the younger ones during pregnancy. However, household size tends to reduce maternal health care utilization. This is because women coming from large families tend to have several demands on their time coupled with resource constraints. A large share of their incomes are spent on consumption or buying other goods other than health goods (Chakraborty et al., 2003). Elsewhere, Guloba and Bbaale, (2014) and Chakraborty et al., (2003) support the findings of the effect household size has on maternal health seeking behaviors.

Ononokpono et al., 2014 and Boco, (2010), find that at community level, high proportions of educated women are more likely to have better access to shared knowledge and health facilities. This explains the importance of having social cohesion in communities. My study adds to the body of knowledge, by unveiling the effect of collective efficacy which maternal education brings in the community which earlier studies have ignored in Zambia and elsewhere. At community level, improving access and quality to female education is an essential building-block for increasing the number of trained health workers (UN, 2007). On the other hand, regional differences with regards to urban or rural settings and provinces also have significant effects on seeking modern health care services. Ethnically diverse communities in African countries tend to have poor health outcomes (Ononokpono et al., 2014). This relationship can be explained to by problems of collective action faced by many heterogeneous communities in Africa (Platas, 2013; Ononokpono et al., 2014). In Zambia, provinces like Lusaka and Copperbelt have diversified ethnic groups, religious and cultural groups coming from various parts of the country. The differences in culture may be a source of diverse views on national issues of economic development such as health care.

2.3 Optimal Level of Female Education and Differences in Impact of Primary and Secondary Education

In literature, there is mixed evidence of the optimal level of female education needed to influence maternal health care seeking behaviors effectively. Optimal level of education refers to the level of education at which significant results or variations in results are registered. Evidence elsewhere suggests that at individual level, secondary education is the most consistent predictor of maternal health seeking behavior (Elo, (1992);

Raghupathy, (1996); Guloba and Bbaale, (2014)). Primary level education on average seems to have a much smaller effect. Raghupathy, (1996) and Guloba and Bbaale, (2014) find that educational differentials in delivery assistance and prenatal visits respectively, start to emerge only after secondary school and that positive effects of education occur at all levels of education (primary, secondary, tertiary or higher) for prenatal care. Guloba and Bbaale, (2014) contend that in fact what matters the most under antenatal care is how accessible and available the medical personnel is to expectant mothers. However, even though the authors find that education associations are positive on tetanus toxoid (TT) use (for both primary and secondary), higher educational levels attenuates negative effects. This is mainly attributed to the fact that antenatal care visits can be intensive which tends to conflict with work schedules for those women who are more educated. Elo, (1992) contend that secondary and higher levels of education have strong effects on maternal seeking behavior in particular on prenatal and delivery assistance utilization.

Raghupathy, (1996), also finds that female education does not provide uniform impact across different health services. These results are consistent with those by Guloba and Bbaale, (2014); Gage, (2007); Elo, (1992); Cleland and Ginneken, (1988); Behrman and Wolfe, (1987). These differences are also more pronounced in rural samples than urban samples. Cleland and Ginneken, (1988) associates these effects to economic advantages of a community which are directly and strongly associated with female education. Since economic status and female education are related, causality may be overstated.

Economists have questioned the effects of female education and other factors on maternal seeking behavior. This debate is borne out of the fact that female education is a proxy for social economic status of a family and geographic areas of residence (Gage, 2007; Elo,

1992; Desai and Alva, 1998; Behrman and Wolfe, 1987). Female education is strongly associated with a mother's childhood background and their childhood place of residence. Previous studies have addressed this by controlling for social economic strata and or economically developed areas, husband education and access to social amenities (Guloba and Bbaale, 2014; Gage, 2007; Desai and Alva, 2005; Elo, 1992; Behrman and Wolfe, 1997). Other authors exclude variables such as social status, economic advantages attached to place of residence and exposure to the media that are correlated with maternal education (Guloba and Bbaale, 2014).

Most literature finds significant correlation of female education on maternal health care utilization, though they vary in outcomes (heath seeking behavior) under study and possible approaches and methodology to modelling the outcomes under study. While the focus on these studies conducted in Zambia and elsewhere has been to understand unclear reasons why women fail to utilize health services, I extend the debate by examining why education is important and why it is not significantly associated with utilization of maternal health service outcomes in Zambia. The study uses a multilevel approach to study collective efficacy in the communities.

CHAPTER THREE

METHODOLOGY

3.0 Empirical Strategy

Typically, because of the inherent hierarchical nature of the Zambia Demographic Health Survey (ZDHS), in which data is collected using a multistage random sampling approach, multi-level analysis is more appropriate to use in this study (Rabe-Hesketh and Skrondal, 2008; Boco, 2010 and Worku et al., 2013). Common statistical models and tests on the other hand, tend to suffer from the assumption of independence. However, people in the same clusters are usually similar but different in distinct clusters. The lack of independence causes an underestimate of standard errors giving spurious significant results. Hence the need for multilevel modelling to take into account the hierarchical structure of the data, clustering at different levels coupled with simultaneous analysis of community and individual level factors (Gage, 2007).

Current multilevel models use Full and Restricted Maximum Likelihood (FML and REML) which have several advantages over the Analysis of Variance (ANOVA) estimations for estimating the variance component. Since mothers are nested within households and households within clusters by the inherent nature of multistage cluster sampling survey, another complication arises. The assumption of independence among individuals within the same cluster and the assumption of equal variances across clusters are violated in the case of nested data. Moreover maternal utilization patterns of health services are affected by characteristics at different levels namely individual and community levels (Worku et al., 2013).

This study uses a two-level binary logistic regression model, by examining the effects of the number of individual and community variables. In our analysis, we characterize women and households at individual level (or first level) and characterize cluster or community level as the second level. We aggregated household level to women level since on average a household had 2.3 women. This number was too small to justify a household as a separate level or unit of analysis. We present for each of the three dependent variables two models as: (1) Intercept-only model, an empty model that contains no covariates. This model decomposed the total variance into individual and community components. In other words, the community level variance was estimated in order to justify the applicability of multilevel regression analysis. Community-level variance was statistically significant (p-value < 0.0000) for all models; it showed that some of the total variance in all utilization outcomes can be explained by community-level factors thus Multilevel analysis (MLA) was performed to adequately consider the community-level factors affecting utilization outcomes, (2) Full model that include individual and cluster variables. In this study, we ran four separate models for each dependent variable. The successful inclusion of variables from null, to individual, community and full model helped to determine if the full model was a better model of choice.

Suppose there is a binary response Y_{ij} which depends on the individual-level explanatory variable X_{ij} and the area-level explanatory variable Z_j and the deviation from the intercept and the slope due to cluster (second level) effect are represented by u_{0j} and u_{1j}, we represent the two models as: The intercept-only model;

$$LOGIT(p_{ij}) = y_{00} + u_{0j} \tag{8}$$

With the full model;

$$LOGIT(p_{ij}) = y_{00} + y_{01}Z_j + y_{10}X_{ij} + u_{0j} + u_{1j}X_{ij}. \quad (9)$$

The intercept y_{00} and the slopes y_{01} and y_{10} are fixed effects, whereas u_{oj} and u_{1j} are random effects of second level (level 2). The intra-class correlations (*Rho*) were calculated for all the four models.[3] This means that for the two-level logistic random intercept model with an intercept and a variance of σ^2_{u0}, *Rho* is given by $\eta = \frac{\sigma^2_{u0}}{\sigma^2_{u0} + \frac{\pi}{3}}$ (Rabe-Hesketh and Skrondal, 2008; Albright and Marinova, 2010 and Worku et al., 2013).

To model the effect of female education on frequency of antenatal visits, we used *xtmixed* available in Stata. For the rest of the logit models and ordered probit, *meqrlogit* and *meoprobit* were used respectively. To further validate on our findings, an ordered probit model was performed on TT inoculation use. The results for this model are presented in appendix B. We estimated the maximum likelihood by integrating the random effects for each model using the Adaptive Gaussian Quadrature, AGQ (Gutierrez, 2007); while the significance of the random effects were evaluated using the likelihood ratio (LR) statistics (Ononokpono et al., 2014). Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were used to test for the goodness of fit of the models.

3.1 Other Methods of Modelling Maternal Health Seeking Behavior

The diversity in modelling maternal health seeking behavior highlights a myriad of robust models available for analysis. Common to most of these studies is the use of logistic and

[3] For some numerical exposition of Rho, see Worku et al., (2013).

probit multilevel models to capture binary outcomes in utilization of health care services (Albright and Marinova, 2008; Gutierrez, 2007). The ordered probit is also particularly important in modelling ordered choices such as TT use (Green, 2012). Guloba and Bbaale, (2014) have shown that both logistic and ordered probit models provide both similar and consistent findings. This study will examine the relationship of individual and community level factors that influence maternal health care utilization using multi-level analysis for the categorical and non-categorical outcomes. The method takes into the hierarchical nature of data thereby avoiding underestimating standard errors which may give spurious significant results.

3.2 Data Sources

The study used the 2013-2014 Zambia Demographic and Health Survey data, a nationally representative survey that interviewed 16,411 women aged 15-49 years (CSO, 2014). A two-stage stratified cluster sampling was employed taking into account rural-urban categorizations. In stage one, 722 clusters were selected using the proportion to size sampling with 305 and 415 Enumerating Areas (EAs) from urban and rural areas respectively. An average of 25 households were interviewed after careful listing of households. The total national representative sample of 18, 052 households were interviewed. Women aged 15-49 and men aged 15-59 were interviewed using household, individual women and men questionnaires. The survey covers a broad range of topics including socio-economic demographics and sexual reproductive health of women. We used the sample of 5442 women who had a child within five years prior to the survey for the most recent pregnancy.

Three carefully designed questionnaires were used namely: (1) household, (2) individual women and (3) individual men questionnaires. The household questionnaire captured a broad range of information ranging from; demographic characteristics, housing types and sanitation to mention but a few. The women individual questionnaire had a broad range of topics such as; background information, media exposure, reproductive history, knowledge sources on family planning, fertility preferences, immunization, child and maternal mortality, breastfeeding practices and nutrition status and utilization of delivery and antenatal care services. In the men's questionnaire, information on reproductive health, nutritional status, and utilization of health services was not included.

3.3 Variables Used in the Study

3.3.1 Dependent Variables

Antenatal health care utilization: It has been argued that the use of antenatal health care services assists health care providers to prevent and diagnose diseases, any possibilities of multiple births such as twins and triplets and delivery complications that may arise from expectant mothers. In the ZDHS survey, women aged 15-49 were asked a question as to whether they had antenatal care during pregnancy from: (1) doctor, (2) clinical officer, (3) nurse or midwife, (4) traditional birth attendants (TBA), (5) community health worker (CHW), (6) others and (7) none of these health workers. A binary-dummy variable was generated taking a value of one if during antenatal care a woman was attended by a skilled provider (i.e. either by a doctor, clinical officer, nurse and or midwife), then zero otherwise. We further generated another dummy variable on ANC use, 1 if a mother had gone for ANC atleast four times and 0 otherwise. The results are presented in the appendix.

Use of Skilled Assistants in Delivery: To reduce the risks of maternal and infant deaths during delivery, assistance by skilled personnel such as doctors, clinical officers and nurses and or midwives becomes paramount. A question was asked in the ZDHS survey as to who assisted an expectant woman during her last pregnancy prior to the survey. The child delivery attendants' dichotomous variable in the original data set was coded as: (1) doctor, (2) clinical officer, (3) nurse and or midwives, (4) traditional birth attendants (TBA), (5) community health worker (CHW), (6) others and (7) none of these health workers. A dummy variable taking a value of one if a woman was assisted during delivery by a skilled provider (i.e. either a doctor, clinical officer, nurse and or midwife), then zero otherwise was later generated.

Tetanus toxoid utilization: A tetanus toxoid inoculation is given to an expectant woman to prevent a baby and or mother from getting neonatal tetanus and tetanus respectively. Eligible women were asked whether they had received the TT inoculation during their pregnancy prior to the survey. A binary response of (1) yes and (2) no is available in the original data set. A dummy variable was generated for TT uptake i.e. one if TT inoculation was given to a woman during their pregnancy and then zero otherwise. Further, women were asked the number of times they received the TT injection. An alternative analysis on this dependent variable was provided using the ordered probit as choices are ordered for the number of TT inoculations given, (1) received TT at least twice; (2) received TT once and (3) no TT injection received by an expectant woman. The ordered probit is used to model ordered choices such as TT use (Greene, 2012). Guloba and Bbaale, (2014) have shown that both logistic and ordered probit provide both similar and consistent findings.

Number of antenatal visits made by a mother: Since WHO (2006) recommends at least (4) antenatal care visits, we also estimated factors influencing the frequency of antenatal visits. We separately used mixed-effect linear regression models to capture the effect of female education on antenatal visits.

3.3.2 Independent Variables

Female education: In the 2013-2014 ZDHS, educational attainments by expectant women were categorized as: (0) none, (1) primary school education, (3) secondary school education and (4) higher level of education. The categories for partner's education are similar to those of female education. In addition to obtaining the general associations of education on maternal health seeking behavior, in this study, the correlations of specific education levels and its differences in impact on maternal health care utilization were captured. We need to note that maternal health seeking behavior is not only predicted by female education but also by other factors. For this reason, we included additional variables as controls.

Individual level factors: These are characteristics influencing maternal health care seeking behavior at individual or mother level. They included; age cohorts for women categorized in seven categories; (1) 15-19, (2) 20-24, (3) 25-29, (4) 30-34, (5) 35-39, (6) 40-44 and (7) 45-49 and age-range 15-19 was a base category, social status (was not included), birth order with categories one, two, three and four, household size entered in the model as a continuous variable and mother's birth history was categorized as one, two, three and four with one being the base category. A dummy for religious affiliation was also introduced in our models as maternal choices tend to be influenced by household

member's behavior in cultural and religious affiliation. The dummy was decomposed into (1) Catholic, (2) Protestant, (3) Muslim and (4) others, with Catholic Church affiliation category as base outcome.

Household level factors: At household level, wealth status of a household is the single-most direct predictor of maternal health care utilization. The 2013-2014 ZDHS uses a single *wealth index* constructed using combined information on household physical assets such as ownership of consumer items, types of dwellings, source of water and availability of electricity using the principal component analysis (see for example, Filmer and Pritchett, 2001 and Languatuo, 2008). The sample was split into quintiles i.e. (1) poorest, (2) poorer, (3) middle class, (4) richer, and (5) richest households. The wealth index (w_j) entered our models as a dichotomous variable with five categories. The husband's characteristics influence maternal health choices and we control for the husband's level of education in this study as well.

***Community level factors*:** At community level, the proportion of women educated in the neighborhood, place of residence, region of residence, proportion of households poor and ethnicity diversity were included. The proportion of educated women in a cluster was computed by aggregating the number of women in the cluster (SEA) and generating a dummy coded as (1) for women in the cluster with education level greater than the mean, zero otherwise. A dummy variable to measure region of residence was generated with (1) urban, zero otherwise and rural category being the base. A dichotomous variable for place of residence included ten provinces with Lusaka province as a base province. An ethnolinguistic index was computed using a method developed by Alesina et al., (2003) to explain ethnicity diversity in the study. The ethnicity fractionalization index variable

(ELF) was computed as one minus Herfindahl Index of the ethno group shares, which reflects the probability that two randomly selected individuals from a population belong to different groups as applied in Alesina et al., (2003) paper to compute measures of fractionalization:

$$FRACT_j = 1 - \sum_{i=1}^{N} s_{ij}^2 \qquad (10)$$

Where s_{ij} is the share of the group $i(i = 1...N)$ in the province or cluster j. Using the ethnicity variable showing Zambia's diversified culture and tribes of about 55, we generate an ethnolinguistic variable. The variable was categorized as (1) highly diversified culture or tribes and zero (0) lowly diversified culture with the zero category being the base outcome. The cut-off point was based on the mean categorization – tribes whose index was just above the mean were classified as highly diversified and those below index as lowly diversified. A dummy variable was generated to capture poverty concentration in the community by using the wealth index's lower class categories poorest and poorer. Using these two lower categories, we generated a dummy variable with (1) category as being highly poor above the mean and zero otherwise.

CHAPTER FOUR

STUDY FINDINGS AND RESULTS

4.0 Descriptive Analysis

The average prenatal number of visits for pregnant women was 3.8. Almost 83 percent of women in the sample were immunized with tetanus toxoid, 93 percent had used some form of skilled antenatal care, and 73 percent had used skilled delivery assistance for their latest child. 56 percent (Table 2) of women in the sample with higher education received at least one tetanus toxoid (TT) injection compared to 47 percent of the counterparts who had no education. 54 percent of women whose husbands had a higher education received one tetanus toxoid injection compared to 50 percent of the counterparts whose partner's had no education. 28 percent of the women from the poorest households received at least two tetanus toxoid injections compared to 30 percent of the women in the richest category. Northern Province had the highest number of women receiving at least two TT injections compared to women in Southern province who received the lowest number of TT inoculations. About 88 percent of the women in urban areas received at least some TT injections compared to 79 percent of the counterparts in the rural areas. The results further revealed that 43 percent of women in the age-cohorts 45-49 had received no TT injection compared to 16 percent of the women in the age-cohorts 15-19. About four in ten (47 percent) women who live in communities with a low proportion of educated women and low ethnically diverse communities, received at least one TT inoculation.

Table 2: Average % of Women who Received Tetanus Toxoid Injections before Childbirth by Background and Community Characteristics

Characteristics	Observations	No TT injection	One TT injection	At least two TT injections
Female Education: No education	470	26	47	27
Primary	2585	21	49	30
Secondary	2108	13	54	33
Higher	281	18	56	26
Husband Education: No education	246	26	50	24
Primary	1585	24	48	28
Secondary	2213	15	52	33
Higher	474	18	54	28
Wealth: Poorest	957	23	46	31
Poorer	993	22	48	30
Middle	1276	19	52	29
Richer	1196	14	54	32
Richest	1026	14	56	30
Region: Central	441	24	43	33
Copperbelt	563	18	48	34
Eastern	688	20	52	28
Luapula	489	15	50	35
Lusaka	637	11	56	33
Muchinga	466	17	48	35
Northern	499	17	38	45
North western	523	23	56	21
Southern	625	22	58	20
Western	517	20	58	22
Location: Rural	2868	21	48	31
Urban	2580	11	56	32
Religion: Catholic	924	19	48	33
Protestants	4462	19	51	30
Muslims	19	15	47	38
Other	29	31	39	30
Age cohort: 15-19	737	16	50	34
20-24	1186	13	52	35
25-29	1156	12	54	34
30-34	1024	19	54	34
35-39	734	29	45	26
40-44	464	35	41	24
45-49	147	43	36	21
Exposure to radio: Not at all	2105	21	49	31

<once a week	595	20	48	32
Atleast once a week	983	18	53	29
Every day	1759	16	53	30
Ethnic diversity: Low	158	19	46.8	34.2
High	5290	16.2	52	31.8
Community households poor:				
Low	3001	12.6	55.3	32.2
High	2447	20.8	47.6	31.6
Community level education:				
Low	2019	19.4	48.9	31.7
High	3429	14.4	53.5	31.1
Total	5442	20	50	30

Source: Author's own Calculations - ZDHS 2013-2014

The majority of the women in the sample (whole sample), regardless of the level of education and other individual and community level characteristics were assisted by a nurse during antenatal care (Table 3). On average 5.5 percent of women with higher education were assisted by the doctor during antenatal care, compared to 0.8 percent of women with no education. It is worth noting that all the women with higher education received antenatal care compared to 5 percent of the counterparts with no education who did not receive antenatal care. 2.5 percent of women in the richest category were assisted by the doctor during antenatal compared to 0.7 percent of women in the poorest category. Lusaka Province had the highest number of women who were assisted by the doctor during antenatal care (2.9 percent), compared to Luapula province where no women were being assisted by a doctor during antenatal care.

Table 3: Average % of Women who Received Antenatal Care from a Health Care Provider by Background and Community Characteristics

Characteristics	Observations	Doctor	Clinical officer	Nurse	TBA	CHW	Others	None
Female Education: No education	468	0.8	1.6	86	3.3	1.8	1.5	5
Primary	2587	0.6	1.5	89	3.9	2.3	0.9	1.3
Secondary	2108	0.7	1	92	2.2	2.3	1.1	0.6
Higher	282	5.5	0.3	92	0.5	1.9	0.3	0
Husband Education: No education	246	0.8	1.4	86	3.5	1.8	1.2	5.1
Primary	1583	0.9	1.6	88	3.7	2.5	1.1	2
Secondary	2213	0.5	0.9	92	3.3	2.3	0.9	0.7
Higher	477	3	1.2	92	1.1	2	0.5	0.3
Wealth: Poorest	957	0.7	1.6	86	4.4	2.3	2.1	3
Poorer	991	0.4	1.7	88	5	2	1.4	1.6
Middle	1277	0.5	1	91	3	2.7	0.7	0.8
Richer	1198	0.8	1	94	2	1.7	0.3	0.9
Richest	1026	2.5	0.8	93	0.4	2.6	0.4	0.4
Region: Central	440	0.3	4.2	86.5	4.3	2.6	0.3	1.9
Copperbelt	562	1.6	0.4	85.1	6.6	4.7	0.1	1.5
Eastern	689	0.6	1.1	93.5	2.5	1.1	0.4	0.8
Luapula	489	0	0.4	91.2	6.2	0.8	0	1.5
Lusaka	640	2.9	0.4	95.4	0.6	0.2	0.1	0.4
Muchinga	465	0.1	0.8	89.5	4.3	0.7	2.1	1.5
Northern	499	0.8	1.7	88.8	3.2	2.2	0.9	2.3
North western	523	0.5	0.4	94.3	0.8	2.5	0	1.5
Southern	623	0.64	1.12	88.8	2.4	6.6	0	0.48
Western	519	1.6	1.9	86	0.1	0.9	7.5	2
Location: Rural	2867	0.6	1.6	88	4.1	2.9	1.6	1.3
Urban	2582	1.2	1	94.5	0.8	1.8	0.3	0.5
Religion: Catholic	924	1	0.9	90.4	3	2.2	0.8	1.8
Protestants	4463	0.8	1.3	90	3.2	2.3	1.1	1.3
Muslims	19	18.8	0	78.1	3.1	0	0	0
Other	29	0	1.6	80.7	1.6	0	3.2	12.9
Age cohort: 15-19	737	0.5	1.5	90.2	3.2	2.8	0.9	0.9
20-24	1185	0.6	1.6	90.1	3.3	2.3	1.2	1
25-29	1158	1	1.2	91	2.8	2.1	1.1	1.2
30-34	1024	1.1	1.2	90.9	2.5	1.8	0.9	1.8
35-39	737	0.9	1.4	88.3	4.1	2.6	1.2	1.4
40-44	462	1	0.4	88.6	4.1	2.9	0.2	2.8
45-49	146	0.5	1.2	88.6	4.4	0.5	2.2	2.7
Exposure to radio: Not at all	2105	0.6	1.3	89.5	3.5	2.5	0.8	1.8
<once a week	595	1.4	1.4	87.9	3.4	2.2	1.7	1.9

Atleast once a week	982	1.1	1.3	90.1	3.3	2.4	0.7	1.2
Every day	1761	0.9	1.1	91.5	2.6	1.9	1.2	0.8
Ethnic diversity: Low	158	1.3	0	90.5	4.4	2.5	1.3	0
High	5291	0.9	1.3	91	2.5	2.4	1	0.9
Community households poor: Low	3002	1.2	0.9	93.2	1.5	2.4	0.3	0.5
High	2447	0.5	1.8	88.3	3.9	2.3	1.9	1.4
Community level education: Low	2018	0.6	1.8	89.9	2.5	1.9	1.7	1.4
High	3431	1.1	1	91.6	2.6	2.6	0.6	0.6
Total	5449	1.5	1.2	89.4	3.1	2.1	1.1	1.8

Source: Author's own Calculation
ZDHS 2013-2014

About 96 percent of women in Lusaka province were assisted by a nurse, and 0.6 percent women were assisted by the traditional birth attendants (TBA). Lusaka and Western Province had the lowest proportion of women who were assisted by the traditional birth attendants (TBA) with Copperbelt and Luapula Provinces having the highest proportion of women being assisted by TBAs. About 97 percent of the women in urban areas were assisted by a skilled provider (Doctor, Clinical officer and Nurse/Midwife) during antenatal care, compared to 90 percent of the counterparts in the rural areas. About nine in ten (92 percent) women who lived in communities with a low proportion of educated women and low ethnically diverse communities were assisted by the skilled provider during antenatal care. On the other hand, about nine in ten (93 percent) of the women lived who in communities with a high proportion of educated women and high ethnically diverse communities were assisted by the skilled provider during antenatal care.

Table 4 revealed that 6.4 percent of women with higher education were assisted by a doctor during childbirth, compared to only 0.7 percent of their counterparts with no education. 89 percent of the women with higher education were assisted by a nurse during childbirth, compared to only 43 percent of the counterparts with no education. About 5

percent of women whose partners had higher education were assisted by a doctor during childbirth, compared to only 1.4 percent of their counterparts with no education. 87 percent of the women whose partner's had higher education were assisted by a nurse during childbirth, compared to only 50 percent of the counterparts with no education. Compared to Central province, with 45 percent of women being assisted during childbirth by a nurse, Lusaka province had about 79 percent of women assisted during childbirth by a nurse. About 88 percent of the women in urban areas were assisted by a skilled provider (Doctor, Clinical officer and Nurse/Midwife) during childbirth, compared to only 60 percent of the counterparts in the rural areas. About three in five (62 percent) of the women who live in communities with a low proportion of educated women and low ethnically diverse communities were assisted by the nurse during childbirth. Further, about eight in ten of women lived in communities with low proportions of poor households.

Table 4: Average % of Women who were Assisted during Childbirth by Background and Community-level Characteristics

Characteristics	Observations	Doctor	Clinical officer	Nurse	TBA	CHW	Others	None
Female Education: No education	470	0.7	0.7	44.3	21	23.6	2	7.5
Primary	2588	1.5	0.7	55.2	20.1	17.6	1	4
Secondary	2109	2.9	0.7	77.4	8.3	8.8	1	1
Higher	282	6.4	0.6	89	1.5	1.5	0.6	0.4
Husband Education: No education	246	1.4	0.8	50	21.6	20.5	0.6	5.2
Primary	1587	1.6	0.6	49.5	21.4	20.4	1.5	5
Secondary	2213	1.9	0.7	69	13.6	11.7	0.9	2.4
Higher	476	5	0.8	87.2	3.5	2.3	0.8	0.4
Wealth: Poorest	958	1.1	0.6	44.3	24.4	24	1.4	4.6
Poorer	993	1	0.7	52	22	18	1.4	4.6
Middle	1276	1.9	0.8	62	15.5	15.2	1	3
Richer	1199	2	0.7	79.4	7.1	8	1	1.7
Richest	1027	5.3	0.5	88	2	3.2	0.3	0.7
Region: Central	442	1.6	1.6	45	16	25.7	1.1	9.4
Copperbelt	563	3	0.2	69	17	7.8	1.2	2.2
Eastern	689	1.8	0.7	66.5	18.3	10	0.4	2.6
Luapula	489	1	0.2	63	24	8.9	0.1	2.3
Lusaka	638	5.3	0.4	79	7	6.1	0.6	2
Muchinga	466	1.1	1.1	59	13	18	1.8	6
Northern	498	1.6	1	50.1	24.1	21	0.5	1.9
North western	523	0.8	0.1	71	16.2	9.5	0.6	1.7
Southern	626	2	0.9	55	16	21	1.2	4.4
Western	519	2.4	0.7	60.2	3.7	26.6	4.4	2
Location: Rural	2580	1.6	0.8	57.2	19.5	16	1.7	3.3
Urban	2873	3.8	0.6	84	3.8	5.6	0.7	1.6
Religion: Catholic	925	2	0.9	64	17	12.3	0.5	3.5
Protestants	4466	1.9	0.6	61.4	16	16	1.2	3.4
Muslims	19	8.7	2.2	71.7	10.8	4.4	0	2.2
Other	29	1	0	48	14.6	29	3.1	4.2
Age cohort: 15-19	736	2.1	0.7	73	11.2	12.6	0.6	0.2
20-24	1187	2.3	0.8	65.2	15.2	14.5	1.1	0.9
25-29	1156	2.3	0.6	63	16.3	15.8	0.7	1.7
30-34	1025	1.8	0.8	60.2	15.4	16	1.3	4.6
35-39	738	1.3	0.7	57.2	18	15.3	1.6	6
40-44	464	1.2	0.3	52.4	20	14	1.3	10.3
45-49	147	2.8	0.5	44	22	14.7	2.8	13.8
Exposure to radio: Not at all	2106	1.8	0.6	55	19	18	1.1	4.2
<once a week	595	1.9	0.9	62	16	15	1.1	2.8
Atleast once a week	983	2.2	0.8	64	15	14	1.1	3.1
Every day	1763	2.1	0.6	70	12.3	11.8	1.1	2.5
Ethnic diversity: Low	158	3.2	0	62.7	15.8	12	1.3	5.1
High	5295	2.7	0.7	70.1	12	11	1.2	2.4

Community households poor: Low	3001	3.7	0.7	80.5	5.9	6.7	0.7	1.7
High	2452	1.4	0.7	56.8	19.6	16.4	1.8	3.4
Community level education: Low	2021	2.1	0.6	62	16	14.5	1.5	3.4
High	3432	3	0.7	74.5	9.8	9.1	1	2
Total	5453	2.3	0.7	63	15	15	1.2	3.6

Source: Author's own Calculations - ZDHS 2013 - 2014

4.1 Multilevel Regression Results

4.1.0 Diagnostic Tests

In this study, we corrected for heteroskedasticity by running robust multilevel models. Multicollinearity was checked using the Variance Inflation Factors (VIF). The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were used to test for the goodness of fit of the models.

4.1.1 Model Specification

4.1.1.1 The T-test

A bivariate analysis of association of each independent variable and dependent variable was performed. A p-value of less than (1) percent (p-value<0.0000) in each pair showed all explanatory variables were significantly associated with their appropriate dependent variables. This analysis ensured that the model was correctly specified. A test on omission of relevant variable was conducted on all the models. The models were all significant at ten percent level with models on prenatal visits, TT uptake and skilled attendants being marginally significant at ten percent (Table 1). However, despite this, all the models satisfied the criteria for the goodness of fit. The mean values of 1.76 for variance inflating factor (VIF) for all the models indicated lower levels of multicollinearity since the value

was less than the threshold of 10. Interestingly, there was no collinearity however, between maternal education and paternal education.

Table 5: Test of Omission of Relevant Variables

Model	**F-statistic**	**Prob>F**
Number of antenatal visits	2.39	0.0671
TT uptake	6.46	0.0521
TT uptake (ordered)	6.46	0.0520
Antenatal care utilization	1.09	0.3530
Skilled birth attendants	17.79	0.0110

4.1.1.2 Heteroskedasticity

The study adopted robust standard errors to correct for heteroskedasticity that was found in all the five models. Robust standard errors are particularly important as they are asymptotically valid in the presence of many forms of heteroskedasticity (Green, 2012).

4.1.1.3 Model Fitness

We estimated the maximum likelihood by integrating the random effects for each model using the Adaptive Gaussian Quadrature, AGQ (Gutierrez, 2007); while the significance of the random effects were evaluated using the likelihood ratio (LR) statistics (Ononokpono et al., 2014). The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were used to test the goodness of fit of the models. For all the models, the values of AICs and BICs for the full models, was smaller than for the empty models.

4.1.2 Tetanus Toxoid Utilization (Individual and Community Level Effects)

The variation in tetanus toxoid utilization across communities was significant with $T = 1.8021,\ p < 0.001$ (see table 6: Model 1). The intra class correlation (ICC) was 13 percent, which explained the variability in tetanus toxoid use attributed to community level variables. This implies that community level variables are able to explain 13 percent effect on tetanus toxoid use. This means that 13 percent of the total variance in TT use in Zambia can be attributed to the communities in which expectant mothers were residing. This also implies that the correlation between mothers living in the same community regarding the likelihood of using TT inoculation was 0.13.

Model 2 in Table 6 contains individual and community-level variables. Female education at higher level was significantly associated with the use of tetanus toxoid inoculation. Surprisingly, at individual level, women with tertiary education had 40 percent lower log-odds of being injected with tetanus toxoid inoculation than women of no education. At the same time women with primary and secondary education had 10 percent and 13 percent lower log-odds of being injected with TT inoculation than women with no education respectively, though the results were not significant. These findings are similar to those obtained using the ordered probit model and are presented in Appendix B, Table $1B$. This suggest that immunization campaigns in Zambia have succeeded in educating women from diverse education backgrounds (see also Raghupathy, 1996). Furthermore, unlike for deliveries, TT use in Zambia is more or less a mandatory exercise. Overall, women who seek antenatal care are often encouraged to take TT inoculation if they have not received any. At the community level, community education had a 1.4 times greater log-odds effect on TT utilization, a finding which is consistent with Raghupathy, (1996). Husband's

education is also an important predictor of pregnant women's antenatal utilization of TT. Women with partners that had secondary education had 1.5 greater log-odds more of receiving TT inoculations than women whose husbands have no education.

The results show that being well endowed reduces the log-odds of being injected by TT inoculation by 12 percentage points for those in the wealthiest quintile though the results are not significant compared to the poorest households, an indication that immunization campaigns have been successful at targeting the poorer households. Similar to previous literature (Magadi et al., 2000), this study found that older women are less likely to seek modern health care services than younger counterparts. The study revealed that women in the age cohorts 45-49 had 63 percent lower log-odds of using TT injection compared to those in the age cohort 15-19.

With regards to community level characteristics, ethnicity diversity and poverty concentration were not statistically significant at determining the use of TT inoculations, contrary to findings by Worku et al., (2013) and Ononokpono et al., (2014). In the Zambian context, this result is plausible as receipt of maternal health services, in general, is not determined by one's tribe or severity of poverty in the community given that services are provided universally and free of charge. The study also revealed that there are significant regional and residential differences in the utilization of TT inoculations across the different provinces and that urban women, had a 1.5 times higher log-odds of being injected a TT inoculation compared to their rural counterparts. A more detailed analysis was conducted by disaggregating the data into rural and urban samples (see, Appendix A table 2A). The proportion of educated women in the community was significant and positively associated with TT use only in the rural sample. Women residing in

communities with high proportion of educated women were 1.4 more likely to use TT inoculation compared to those communities with women of low proportion of education. However, partner's education appears also to be important in the rural sample. Women whose partner's had secondary education were 1.5 times greater log-odds of using TT inoculation than women whose partner's had no education. Further, women whose partner's had primary and tertiary education were 1.2 and 1.3 times greater log-odds of using TT inoculation than those with partner with no education respective

Table 6: Factors Associated with Utilization of TT Immunization

Variable description	**Model 1** Empty model	**Model 2** Full model	**Confidence Intervals**
	Odds ratio	Odds ratio	CI (95%)
Female education			
None		1	
Primary		0.898	(0.671, 1.202)
Secondary		0.867	(0.612, 1.230)
Tertiary		0.608*	(0.340, 1.086)
Husband education			
None		1	
Primary		1.123	(0.791, 1.593)
Secondary		1.469**	(1.019, 2.118)
Tertiary		1.044	(0.641, 1.701)
Religion			
Catholic		1	
Protestants		1.134	(0.911, 1.412)
Muslims		0.925	(0.240, 3.566)
Others		1.451	(0.539, 3.906)
Age cohorts			
15-19		1	
20-24		1.297	(0.872, 1.928)
25-29		2.052***	(1.248, 3.374)
30-34		1.397	(0.816, 2.393)
35-39		0.821	(0.472,1.429)
40-44		0.666	(0.377, 1.176)
45-49		0.376***	(0.200, 0.709)
Birth order			
Birth order number one		1	
Birth order number two		1.072	(0.739, 1.575)
Birth order number three		0.931	(0.604, 1.434)

Birth order four plus		0.676*	(0.431, 1.061)
Wealth index			
Poorest household dummy		1	
Poorer household dummy		0.938	(0.725, 1.211)
Middle household dummy		1.145	(0.859, 1.527)
Richer household dummy		0.917	(0.647, 1.298)
Richest household dummy		0.884	(0.562, 1.391)
Household size		0.963**	(0.931, 0.996)
Caesarian section dummy		0.912	(0.646, 1.298)
Community characteristics			
Region of residence			
Lusaka		1	
Central		0.532***	(0.349, 0.812)
Copperbelt		0.467***	(0.312, 0.698)
Eastern		0.583***	(0.393, 0.866)
Luapula		1.072	(0.674, 1.707)
Muchinga		0.887	(0.567, 1.386)
Northern		0.964	(0.615, 1.510)
North western		0.514***	(0.334, 0.791)
Southern		0.511***	(0.344, 0.761)
Western		0.538***	(0.344, 0.840)
Urban residence dummy		1.469***	(1.105, 1.391)
Secondary/Higher educated women, 1=yes		1.262**	(1.033, 1.543)
Poverty concentration, 1=high		0.867	(0.651, 1.155)
Ethnolinguistic index, 1=yes		0.896	(0.534, 1.502)
Variance (standard error)	0.35 (0.08) α ***	0.11 (0.07)**	
Variance partition coefficient	13	9	
Proportional change in variance	Reference	69	
Log-likelihood	-2421.019	-1897.3275	
Akaike information criterion	4846	3872.7	
Bayesian information criterion	4122.8 *b*	3834.9	

Deviance	4842	3794
Number of observations	5458	4511

Significance: * = 10 percent, ** = 5 percent, *** 1 percent

Dependent variable: Tetanus toxoid utilization (1=had TT injection, 0=otherwise)

a Standard errors eform in parentheses

b N=Observation was used in calculating BIC

4.1.3 Use of Skilled Assistants in Delivery (Individual-effects and Community-effects)

The results show that 36 percent of the variation in use of an assistant during child delivery is explained by community level effects, (see table 7: Model 1). This implies that community level variables are able to explain 36 percent effect on delivery assistance utilization.

At individual level, female education, birth order, wealth index and caesarian section birth history were found to be important predictors of the choice of childbirth attendants while at community level, regional and locational differences do matter as well (see Table 6: Model 2). Women with secondary education had 2 times greater log-odds of being assisted by a skilled provider (or childbirth attendant) than women with no education. Even though the results are not statistically significant, women with primary and higher level education had 1.2 and 2.0 times greater log-odds of being assisted by childbirth attendants than women with no education respectively, these findings are consistent with those by Guloba and Bbaale, (2014); Ononokpono et al., (2014); Boco, (2010) and Gage, (2007). The wealth quintile of a household was found to be positively associated with maternal health care utilization. The middle class, richer class and richest class quintiles had 1.4, 2.1, and 3.4 times higher log-odds of being assisted at childbirth than those in the poorest wealth quintiles.

At the community level, women living in urban areas had 2.7 higher log-odds of using a skilled provider compared to the rural residents during delivery. The results showed that poverty concentration, proportion of educated women in the community and ethnicity diversity were not significantly associated with the choice of childbirth attendants. However, women who lived in communities with a high proportion of educated women

are more likely to be attended to by skilled child birth attendants compared with women who reside in communities with less educated women. The detailed analysis by disaggregating the data into rural and urban samples (see, Appendix A table 3*A*), shows that, at the individual level female education is significant and positively associated with the choice of child birth attendants in the rural sample. Women who had reached secondary school of their education had a 2.0 times greater log-odds of being assisted by a skilled provider during child birth compared to those with no education. On the other hand, women with primary and tertiary education had a 1.2 and 1.9 greater log-odds of being assisted by a skilled provider during child birth compared to those with no education respectively.

Table 7: Factors Associated with the Choice of Skilled Birth Attendants

Variable description	**Model 1** Empty model	**Model 2** Full model	**Confidence interval**
	Odds ratio	Odds ratio	CI (95%)
Female education			
None (ref)		1	
Primary		1.152	(0.881, 1.505)
Secondary		1.999**	(1.445, 2.757)
Tertiary		1.822	(0.839, 3.956)
Husband education			
None (ref)		1	
Primary		0.837	(0.598, 1.173)
Secondary		0.996	(0.703, 1.410)
Tertiary		1.501	(0.866, 2.601)
Religion			
Catholic		1	
Protestants		0.886	(0.713, 1.101)
Muslims		3.523	(0.362, 34.277)
Others		0.876	(0.347, 2.209)
Age cohort			
15-19		1	
20-24		0.825	(0.570, 1.193)
25-29		0.303	(0.816, 2.083)
30-34		1.45	(0.874, 2.405)
35-39		1.469	(0.865, 2.495)
40-44		1.431	(0.828, 2.474)
45-49		1.002	(0.529, 1.898)
Birth order			
Birth order number one		1	
Birth order number two		0.57***	(0.399, 0.815)
Birth order number three		0.466***	(0.310, 0.700)

			(0.247, 0.581)
Birth order four plus		0.379***	
Wealth index			
Poorest household dummy		1	
			(0.904, 1.440)
Poorer household dummy		1.141	
			(1.064, 1.787)
Middle household dummy		1.379**	
			(1.527, 2.951)
Richer household dummy		2.122***	
			(2.300, 5.568)
Richest household dummy		3.444***	
			(0.945, 1.012)
Household size		0.978	
			(12.634, 131.780)
Caesarian section		40.8***	
Community characteristics			
Region of residence			
Lusaka		1	
			(0.281, 0.731)
Central		0.453***	
			(0.355, 0.923)
Copperbelt		0.573**	
			(0.710, 1.766)
Eastern		1.120	
			(0.577, 1.534)
Luapula		0.941	
			(0.363, 0.950)
Muchinga		0.587**	
			(0.319, 0.836)
Northern		0.517***	
			(0.617, 1.674)
North western		1.017	
			(0.335, 0.835)
Southern		0.529***	
			(0.577, 1.592)
Western		0.958	
			(1.988, 3.660)
Urban residence dummy		2.697***	
Secondary/Higher educated women, 1=yes		1.111	
			(0.671, 1.241)
Poverty concentration, 1=high		0.912	
			(0.695, 2.151)
Ethnolinguistic index, 1=yes		1.223	
Variance (standard error)	1.82 (0.19)α***	0.58 *** (0.10)	
Variance partition coefficient	0.36	0.15	
Proportional change in variance	Reference	68	
Log-likelihood	-2913.8268	-2171.9039	
Akaike information criterion	5831.7	4421.8	

Bayesian information criterion	5844.9 *b*	4672
Deviance	5827.7	4343.8
Number of observations	5458	4511

Significance: * = 10 percent, ** = 5 percent, *** 1 percent

Dependent variable: Choice of child birth attendants (1=skilled provider, 0=otherwise)

a Standard errors eform in parentheses

b N=Observation was used in calculating BIC

4.1.3 Maternal Antenatal Care Utilization (Individual-effects and Community-effects)

The variation in antenatal care utilization across communities is significant with $T = 6.431\text{T}$ (see table 8: Model 1) with 39 percent of the variation in skilled provider attendants during antenatal care attributed to community level variables. The results revealed that female education is a predictor for the choice of skilled provider during antenatal. An increase in the years of female education increases the relative chance of pregnant women using a skilled provider during antenatal, relative to using none by 1.1, 1.26 and 1.3 for a woman with education attainments of primary, secondary and higher level respectively, although not statistically significant. The results are not surprising as antenatal care service use in Zambia is almost 100 percent and therefore, we don't expect any variations in these individual-level variables. However, previous studies have found that female education is an important predictor of antenatal care utilization (Caldwell, 1979; Boco, 2010).

The wealth index of a household was found to be positively associated with maternal health care utilization. An improvement in the wealth status (middle class) of the household increased the relative chance of a pregnant woman using a skilled provider during antenatal visits, relative to using none by 1.5. Households in the middle class cohorts had the greater log-odds of being assisted by the skilled provider compared to the poorest households. Urban residence was found to be significantly associated with the log-odds of antenatal uptake. Residing in urban area compared to the rural area increased the log-odds of antenatal uptake by 3. Compared to women counterparts in Lusaka province of Zambia, women in Central, Copperbelt, Muchinga, Luapula, Northern, North western,

Southern, and Western were less likely to be assisted by the skilled provider during antenatal care. The study also revealed that community-level poverty, the proportion of women educated in the community and ethnicity diversity were not associated with the choice of antenatal care attendants. With regards to the non-significance of ethnic diversity, this finding is particularly important as ethnic and tribal issue differences are not a factor in the Zambian context. The results of a disaggregating analysis by rural and urban status are presented in Appendix A, table $4A$.

Table 8: Factors Associated with the Choice of Antenatal Care Attendants

Variable description	**Model 1** Empty model	**Model 2** Full model	**Confidence interval** (CI %)
	Odds ratio	Odds ratio	
Female education			
None		1	
Primary		1.131	(0.724, 1.772)
Secondary		1.26	(0.735, 2.159)
Tertiary		1.314	(0.466, 3.764)
Husband education			
None		1	
Primary		1.5	(0.892, 2.524)
Secondary		1.535	(0.894, 2.637)
Tertiary		1.73	(0.774, 3.866)
Religion			
Catholic		1	
Protestants		1.064	(0.745, 1.523)
Muslims		3.797	(0.750, 7.323)
Others		0.529	(0.529, 1.841)
Age cohort			
15-19		1	
20-24		0.899	(0.517, 1.567)
25-29		0.887	(0.444, 1.772)
30-34		0.967	(0.448, 2.099)

35-39	0.674	(0.302, 1.506)
40-44	0.779	(0.337, 1.796)
45-49	0.94	(0.345,1.897)
Birth order		
Birth order number one	1	
Birth order number two	1.461	(0.852, 2.505)
Birth order number three	1.559	(0.840, 2.899)
Birth order four plus	1.404	(0.737, 2.675)
Wealth index		
Poorest household dummy	1	
Poorer household dummy	1.06	(0.733, 1.534)
Middle household dummy	1.514	(0.981, 2.336)
Richer household dummy	1.532	(0.883, 2.658)
Richest household dummy	1.876	(0.877, 4.011)
Household size	0.983	(0.931, 1.039)
caesarian section dummy	1.652	(0.863, 3.162)
Community characteristics		
Region of residence		
Lusaka	1	
Central	0.228***	(0.0830, 0.628)
Copperbelt	0.0606***	(0.0234,0.157)
Eastern	0.469	(0.171, 1.284)
Luapula	0.279**	(0.100, 0.779)
Muchinga	0.206***	(0.0749, 0.569)
Northern	0.276***	(0.0988, 0.768)
North western	0.384 *	(0.132, 1.112)
Southern	0.150***	(0.0574, 0.393)

Western		0.193 *	(0.0988, 0.768)
Urban residence dummy		3.188***	(1.851, 5.494)
Secondary/Higher educated women, 1=yes		0.972	(0.670, 1.410)
Poverty concentration, 1=high		1.21	(0.726, 2.017)
Ethnolinguistic index, 1=yes		0.803	(0.300, 2.149)
Variance (standard error)	2.07 (0.32)α ***	1.17 (0.24) ***	
Variance partition coefficient	0.39	0.26	
Proportional change in variance	Reference	43	
Log-likelihood	-1287.3564	-1024.6882	
Akaike information criterion	2578.7	2127.4	
Bayesian information criterion	2591.9 *b*	2377.5	
Deviance	2574.7	2049.4	
Number of observations	5458	5458	

Significance: *=10 percent, **=5 percent, *** 1 percent

α Standard errors in parenthesis

b N= was used in calculating BIC

Dependent variable: Antenatal care utilization (1=Seen a skilled provider during antenatal, 0=otherwise)

4.4 Frequency of Antenatal Care Visits (Individual-level and Community-level Effects)

The results in Table 9 indicate that female education as well as partner's education are important predictors of the frequency of antenatal visits. An increase in female education raises the frequency of antenatal visits by 16 percentage and 60 percentage points for women with secondary and higher education. However, an increase in female education at primary level raises the frequency of antenatal visits by 0.5 percentage points though the results are statistically insignificant. These findings are in line with previous literature (Guloba and Bbaale, 2014; Gage, 2007 and Caldwell, 1979). However, partner's education appeared to have a much weaker effect than female education. An increase in the partner's education raises the frequency of antenatal care visits by 26 percentage points, 26 percentage points and 36 percentage points for women with primary, secondary and higher education respectively. The evidence on the relationship between religious affiliation and the frequency of antenatal visits shows that Muslim women are significantly less likely to have more antenatal visits than catholic women.

As expected, higher wealth status is associated with increased antenatal visits. For example, compared to poorest households, wealthier households are 0.14 times, 0.24 times, 0.24 times and 0.46 times for the poorer, middle class, richer and the richest households respectively to have more antenatal visits. Guloba and Bbaale, (2014) attributes this to the fact that wealthy households can finance antenatal care costs easily than poorer household. In some countries, antenatal care sessions inherently involve financial costs for medical care and diagnosis coupled with transport costs to get to and from the health facility. However, in Zambia, antenatal care in public health centers is

provided free of charge but the cost of transportation still needs to be catered for by a pregnant woman. In most cases, antenatal is offered on scheduled days. The long waiting times during the scheduled antenatal days could attenuate greater inertia to visit health facilities among the women in poor households. The opportunity cost for women in poorer households is higher as the time spent waiting at the health facilities could be spent in other income generating activities or household activities. However, birth history does not matter as regards the number of antenatal care visits. We also found that women with previous caesarean birth, compared to those with normal birth were 27 percentage points more likely to seek antenatal care.

Surprisingly, urban residence compared to the rural residence reduces antenatal visits by 20 percentage points. Increased urban poverty within the context of rapid and unplanned urbanization are possible contributors of this effect (Boco, 2010; Brockerhoff and Brennan, 1998). Interestingly, antenatal visits were 0.33 times higher for women in Copperbelt and 0.16 times lower in Luapula, compared with those from Lusaka province.

The results showed that the proportion of educated women in the community and ethnicity diversity were not associated with antenatal visits. However, the proportion of educated women in the community showed an expected direction of association in the number of antenatal visits. Women who lived in communities with a high proportion of educated women are more likely to have more antenatal visits compared with women who reside in less educated communities. Surprisingly, community poverty index had a positive significant effect on antenatal visits. Women in wealthier communities are less likely to have more antenatal visits compared to those in the poorer communities. The women in wealthier communities are caught up in a situation where they have a myriad of work to

do and that conflict with their health seeking behavior (See detailed disaggregated analysis by rural-urban status, Appendix A table$1A$). Individual as well as the proportion of educated women in the community were significant and positively associated with the frequency of antenatal visits. Whereas the proportion of educated women in the community was significant in the rural sample (14.1 percentage points increase), individual female level education is important in the urban sample (63.9% percentage points increase). However, partner's education appears to be important in the rural sample. An increase in partner's education raises the frequency of antenatal visits by 31 percentage points, 28 percentage points and 34 percentage points for women with primary, secondary and higher education in the rural sample.

Table 9: Factors Associated with the Frequency of Antenatal Care Visits

Variable description	**Model 1** Empty model	**Model 2** Full model	Confidence interval
	Coefficients	Coefficients	CI (95%)
Individual characteristics			
Female education			
None		Ref	
Primary		0.00475	(-0.155, 0.165)
Secondary		0.159*	(-0.0161, 0.334)
Tertiary		0.60***	(0.293, 0.907)
Husband education			
None		Ref	
Primary		0.262***	(0.070, 0.453)
Secondary		0.258**	(0.057, 0.458)
Tertiary			(0.110, 0.605)
Religion		0.358***	
Catholic		Ref	
Protestants		0.0569	(-0.041, 0.155)
Muslims		0.967***	(0.403, 1.532)
Others		-0.666**	(-1.227, -0.105)
Age cohort			
15-19		Ref	
20-24		-0.00733	(-0.175, 0.160)
25-29		0.0146	(-0.191, 0.220)
30-34		0.0403	(-0.180, 0.260)
35-39		0.184	(-0.052, 0.421)
40-44		0.0746	(-0.171, 0.320)
45-49		0.0636	(-0.254, 0.381)
Birth order			
Birth order number one		Ref	
Birth order number two		-0.0918	(-0.235, 0.051)

Birth order number three		0.0116	(-0.168, 0.191)
Birth order four plus			(-0.159, 0.219)
Wealth index		0.0298	
Poorest household dummy		Ref	
Poorer household dummy		0.142**	(0.020, 0.264)
Middle household dummy		0.247**	(0.111, 0.383)
Richer household dummy		0.238***	(0.086, 0.391)
Richest household dummy		0.459***	(0.262, 0.656)
Household size		0.00192	(-0.014, 0.018)
Caesarian section dummy		0.274***	(0.102, 0.446)
Community characteristics			
Region of residence			
Lusaka		Ref	
Central		-0.0533	(-0.232, 0.126)
Copperbelt		0.329***	(0.115, 0.543)
Eastern		-0.0605	(-0.228, 0.107)
Luapula		-0.156*	(-0.336, 0.023)
Muchinga		0.0755	(-0.118, 0.269)
Northern		0.00439	(-0.184, 0.193)
North western		0.0193	(-0.159, 0.198)
Southern		0.123	(-0.041, 0.288)
Western		-0.0461	(-0.255, 0.163)
Urban residence dummy		-0.197***	(-0.336, -0.059)
Secondary/Higher educated women, 1=yes		0.0681	(-0.043, 0.180)
Poverty concentration, 1=high		0.144**	(0.006, 0.282)
Ethnolinguistic index, 1=yes		0.107	(-0.102, 0.317)
	0.14	1.52***	
Variance (standard error)	(0.03)*a***	(0.05)	
Variance partition coefficient	0.08	0.06	
Log-likelihood	-1287.3564	-1024.6882	
Akaike information criterion	2578.7	2127.4	
Bayesian information criterion	2591.9 *b*	2377.5	
Deviance	2574.7	2049.4	
Number of observations	5458	5458	

Significance: * = 10 percent, ** = 5 percent, *** 1 percent

Dependent variable: Frequency of antenatal visits

a Standard errors eform in parentheses

b N=Observation was used in calculating BIC

CHAPTER FIVE

DISCUSION

In general, the findings revealed significant association between community contextual factors and use of maternal health care services. At the community level, the level of education is strongly associated with tetanus toxoid utilization. These findings are similar with evidence established elsewhere (Gage, 2007), that communities with a high proportion of women with secondary or higher education, tend to have higher maternal health care utilization rates. This is partly explained by collective socialization and contagion processes, which may result from imitating behaviors between the educated and uneducated women.

The study clearly shows new evidence with regards to the importance of collective efficacy and spill-over effects. While educated-residents may serve as role models to the uneducated women in disadvantaged communities, they also help the less-educated women to understand the importance of using maternal health care services such as TT inoculation (see Cubbin et al., 2008; Sampson, 2003; Coleman, 1990). Social networks in areas with a high concentration of educated women provide women with information on safe mother-hood practices and reduce uncertainty about formal health systems (Gage, 2007).

On the other hand at individual level, educated women tend to have more material resources at their disposal and are able to employ these scare resources more effectively than the less educated women (Boco, 2010; Ononokpono et al., 2014). We find that both the proportion of educated women in the community and individual level female education have significant positive effect on maternal seeking behavior except for use of TT

inoculation. This entails that level of education does not matter for use of TT inoculation. This possibly suggests that immunization campaigns in Zambia have succeeded in educating women from diverse education backgrounds (see also Raghupathy, 1996). However, an important question is why campaigns may have worked for TT but not for other indicators. Further research is needed to distill these findings. Furthermore, unlike for deliveries TT use in Zambia is more or less a mandatory exercise. Overall, women who seek antenatal care are often encouraged to take TT inoculation if they have not received any.

However, although the influence of the proportion of educated women in the community on antenatal care, number of antenatal visits and delivery assistance was not statistically significant, the direction of the influence was positive. The results also indicated a much stronger effect of female education in the rural sample than the urban sample for all the outcome variables. Specifically, both individual level education and the proportion of educated women in the community had a positive effect on TT use and the choice of child birth attendants in the rural sample. These results suggests the need to target the rural areas at community levels by providing school infrastructure that benefit the entire community coupled with an early introduction of elementary school curricular and adult literacy or health promotion programs.

With respect to individual level factors, female education and partner education were significantly associated with use of maternal health services. Specifically, partner's education consistently showed a positive effect on maternal seeking behavior across all health services. The results are consistent with other studies elsewhere (Gage, 2007; Boco, 2010; Guloba and Bbaale, 2014 and Ononokpono et al., 2014). Educational attainments

(female and partner's education) coupled with household wealth are markers of economic resources which empower women to take control of their own health and facilitate easy access to quality maternal health care (Ononokpono et al., 2014). These findings suggest the need to promote gender-parity policies in health education and encourage husbands to support women in appropriate health care seeking behaviors.

With respect to antenatal care, delivery assistance and frequency of antenatal visits, there significant relationship between female education and utilization coupled with the educational differences in impact for use of delivery assistance and antenatal visits, starting to emerge after secondary school. This presents an opportunity for the government to tackle education needs at higher level by strengthening efforts aimed at discouraging early marriages and reducing school drop outs. The government should abolish early marriages which are a deterrent to being in schools for school going girls.

However, we find surprising results with regards to use of tetanus toxoid inoculation at individual level. The study revealed a curvilinear relationship between TT use and education, with women of higher education showing a lower likelihood of TT use compared to those with no schooling. We observe that secondary education seem to have the strongest effect compared to primary or higher education for all the utilization outcomes.

The study also provided important secondary findings. Region of residence (province) was significantly associated with maternal health care utilization. Results further indicated differences in impacts of residence on different types of maternal health care services. Compared to women counterparts in Lusaka province, women in Central, Copperbelt, Luapula, Eastern, North western, Southern, and Western were less likely to use maternal

health services across all utilization outcomes. These regional differences could reflect disparities in social economic developments in these regions (Ononokpono et al., 2014; Guloba and Bbaale, 2014). Interestingly, women in urban areas were more likely to receive TT injection, antenatal care, delivery assistance coupled with increased prenatal number of visits. Therefore, concerted efforts to reduce provincial and region disparities in the provision of health care services need to be strengthened**.**

With regards to poverty concentration, it is apparent that maternal health services such as TT vaccinations are nearly universal regardless of socio-economic status. At individual level, birth history with regards to caesarian section, birth order, household size and wealth index were found to be significant. Women from large households were less likely to seek maternal health care services because of resource constraints larger households are faced with and the opposite is true for women from small households.

CHAPTER SIX

CONCLUSION AND POLICY RECOMMENDATIONS

6.0 Conclusion

The study set out to investigate the association of female education with maternal health seeking behavior, its differences in impact and consistency across antenatal and delivery care services. Using the 2013-2014 Zambia Demographic and Health Survey (ZDHS) data, we specified multilevel logistic models, to assess factors associated with tetanus toxoid use, the choice of skilled birth–attendants, the choice of skilled provider during antenatal care and the frequency of prenatal visits.

The results confirm the differences in impacts of individual-level female education and community-level education on maternal health-seeking behaviors with the stronger positive association of secondary and higher education levels consistently being more pronounced across all health services with an exception of TT use. The proportion of educated women in the community is particularly important for TT use. However, the proportion of educated women in the community is important for prenatal visits only in the rural sample. This highlights the importance of collective efficacy in the community when it comes to TT use and prenatal care. One the other hand, individual level female education is necessary for assisted deliveries. This finding suggest that assisted deliveries are responsive to educating "*individual*" women through increased enrolment and quality of education at secondary schools. These findings have implications with regards to policy targeting at the two variant levels.

The study further found relevant secondary findings. Health seeking behavior is influenced by partners' education, region of residence, place of residence, wealth, and

household size. Women whose husbands are educated seem to seek more health care services and this is essential for policy. In this case, promotion of gender-parity policies in health education and encouraging husbands to support women in appropriate health care seeking behavior is necessary. Further, women who reside in urban areas and Lusaka province in particular, had more access to maternal health care services across all utilization outcomes. Provision of school infrastructure that benefit the entire community coupled with an early introduction of elementary school curricular, adult literacy and health promotion programs is essential.

Finally, multilevel logistic modelling gave as better estimates of results than ordinary logistic models. The model should be used for future research to obtain robust results.

6.1 Policy Recommendations

On a much broader level, the results suggest simultaneous targeting of health policy at both individual and community-levels. In particular, to achieve the intended effects of health policy, multi-sectoral policies are needed. In this case government needs to concentrate on increasing the number of educated women in a community if immunization campaigns and prenatal visits are to be fully realized. Concerted efforts to providing universal secondary education or higher in rural areas of Zambia and hard-to-reach communities coupled with building more school infrastructure at primary, basic and secondary level if we to achieve more ANC visits among rural women are needed.

6.2 Study Limitations

The study findings should be interpreted in light of certain limitations. The use of the Standard Enumeration Areas (SEAs) or neighborhoods bias the results because of

selection effects (see also, Vu, 2005; Gage, 2007; Boco, 2010; Ononokpono et al., 2014). The bias was further attenuated by SEAs coinciding with the neighborhood boundaries. Despite these limitations, the study findings still remain significant.

6.3 Areas for Future Research

Based on the identified study limitations, future research could consider mixed approach studies to understand the link between cultural factors (i.e. the role they play at community level when combined with regional differences) and maternal health seeking behavior. Future research should further explore the influences of transport costs and the availability of health facilities in nearby places on maternal health seeking behavior.

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Appendix

Appendix A

Table 1A. Factors Associated with the Frequency of Antenatal Care Visits

Variables	(Urban sample) Full model	(Rural sample) Full model
Female education = 1, primary	-0.0956	0.0316
	(0.154)	(0.0948)
Female education = 2, secondary	0.131	0.103
	(0.166)	(0.105)
Female education = 3, higher	0.639***	0.237
	(0.227)	(0.277)
Husband education = 1, primary	0.134	0.308***
	(0.180)	(0.116)
Husband education = 2, secondary	0.186	0.278**
	(0.177)	(0.127)
Husband education = 3, higher	0.306	0.343*
	(0.196)	(0.188)
Women religion = 2, protestant	0.0968	0.0389
	(0.0804)	(0.0655)
Women religion = 3, muslim	1.204***	-0.313
	(0.275)	(0.286)
Women religion = 4, 4	0.0784	-0.908***
	(0.509)	(0.315)
Age cohorts = 2, 20-24	0.0603	-0.0774
	(0.135)	(0.107)
Age cohorts = 3, 25-29	-0.0911	0.209
	(0.154)	(0.144)
Age cohorts = 4, 30-34	-0.0233	0.177
	(0.168)	(0.152)
Age cohorts = 5, 35-39	0.250	0.211
	(0.178)	(0.166)
Age cohorts = 6, 40-44	0.125	0.132
	(0.202)	(0.163)
Age cohorts = 7, 45-49	-0.0680	0.204
	(0.271)	(0.205)
Birth order = 2	-0.114	-0.0663
	(0.100)	(0.108)
Birth order = 3	0.118	-0.196
	(0.128)	(0.126)
Birth order = 4	0.0607	-0.0881
	(0.136)	(0.139)

Wealth groups = 2, poorer	0.157	0.139**
	(0.347)	(0.0637)
Wealth groups = 3, middle	0.156	0.276***
	(0.345)	(0.0761)
Wealth groups = 4, richer	0.146	0.314***
	(0.346)	(0.0963)
Wealth groups = 5, richest	0.387	0.273
	(0.350)	(0.209)
number of household members (listed)	-0.00467	0.00851
	(0.0127)	(0.0109)
Caesarian section dummy, 1=yes = 1	0.299***	0.199
	(0.115)	(0.139)
provn = 2 = Central	-0.0942	-0.111
	(0.126)	(0.136)
provn = 3 = Copperbelt	0.487***	0.00894
	(0.142)	(0.144)
provn = 4 = Eastern	-0.178	-0.104
	(0.118)	(0.131)
provn = 5 = Luapula	-0.0465	-0.303**
	(0.119)	(0.142)
provn = 6 = Muchinga	0.0574	0.0246
	(0.137)	(0.149)
provn = 7 = Northern	-0.0819	-0.0421
	(0.111)	(0.157)
provn = 8 = North Western	0.118	-0.106
	(0.120)	(0.142)
provn = 9 = Southern	0.226**	-0.0615
	(0.105)	(0.131)
provn = 10 = Western	-0.0438	-0.102
	(0.129)	(0.167)
Community with primary/secondary or higher dummy, 1=high-yes = 1	-0.0517	0.141**
	(0.102)	(0.0661)
Household poor dummy, 1=high = 1	0.223*	0.0921
	(0.136)	(0.0832)
High ethnicity, 1=yes = 1	0.477***	0.0526
	(0.171)	(0.120)
Constant	2.732***	3.154***
	(0.455)	(0.225)
Observations	2,073	2,438
Number of groups	305	415

Robust
Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2A. Factors Associated with Utilization of TT Immunization

Variables	(Urban sample) odds ratio	(Rural sample) odds ratio
eq1		
Female education = 1, primary	1.171	0.847
	(0.399)	(0.140)
Female education = 2, secondary	1.378	0.714
	(0.500)	(0.150)
Female education = 3, higher	0.906	0.648
	(0.409)	(0.371)
Husband education = 1, primary	0.980	1.196
	(0.412)	(0.236)
Husband education = 2, secondary	1.329	1.541**
	(0.548)	(0.326)
Husband education = 3, higher	0.807	1.297
	(0.369)	(0.471)
Women religion = 2, protestant	1.120	1.127
	(0.216)	(0.156)
Women religion = 3, muslim	0.736	2.080e+08
	(0.522)	(7.065e+11)
Women religion = 4, 4	627,057	1.204
	(3.908e+08)	(0.637)
Age cohorts = 2, 20-24	0.849	1.240
	(0.386)	(0.297)
Age cohorts = 3, 25-29	1.533	1.649
	(0.767)	(0.545)
Age cohorts = 4, 30-34	0.807	1.351
	(0.422)	(0.482)
Age cohorts = 5, 35-39	0.514	0.751
	(0.276)	(0.275)
Age cohorts = 6, 40-44	0.384*	0.610
	(0.216)	(0.226)
Age cohorts = 7, 45-49	0.262**	0.350***
	(0.163)	(0.142)
Birth order = 2	0.992	1.244
	(0.284)	(0.344)
Birth order = 3	0.844	1.156
	(0.272)	(0.360)

Birth order = 4	0.643	0.804
	(0.220)	(0.254)
Wealth groups = 2, poorer	0.302	0.957
	(0.331)	(0.129)
Wealth groups = 3, middle	0.497	1.062
	(0.542)	(0.167)
Wealth groups = 4, richer	0.325	0.950
	(0.357)	(0.205)
Wealth groups = 5, richest	0.319	1.157
	(0.354)	(0.550)
number of household members (listed)	0.923***	0.978
	(0.0268)	(0.0211)
Caesarian section dummy, 1=yes = 1	0.915	0.932
	(0.225)	(0.241)
provn = 2 = Central	0.428***	0.581*
	(0.129)	(0.184)
provn = 3 = Copperbelt	0.508***	0.458**
	(0.131)	(0.151)
provn = 4 = Eastern	0.399***	0.649
	(0.115)	(0.194)
provn = 5 = Luapula	2.031	0.854
	(0.876)	(0.282)
provn = 6 = Muchinga	1.206	0.767
	(0.424)	(0.251)
provn = 7 = Northern	1.073	0.850
	(0.381)	(0.278)
provn = 8 = North western	0.562*	0.475**
	(0.175)	(0.153)
provn = 9 = Southern	0.816	0.403***
	(0.246)	(0.121)
provn = 10 = Western	0.509**	0.538*
	(0.170)	(0.177)
Community with primary/secondary or higher dummy	1.097	1.353**
	(0.212)	(0.164)
Household poor dummy, 1=high = 1	0.925	0.857
	(0.314)	(0.142)
High ethnicity, 1=yes = 1	0.664	1.001
	(0.513)	(0.282)
lns1_1_1		
Constant	74.97***	6.464***
	(110.4)	(3.134)
Observations	2,073	2,438
Number of groups	305	415

seEform in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A. Factors Associated with the Choice of Child Birth Attendants

Variables	(Urban sample) odds ratio	(Rural sample) odds ratio
eq1		
Female education = 1, primary	0.989	1.183
	(0.317)	(0.180)
Female education = 2, secondary	1.745	1.994***
	(0.604)	(0.382)
Female education = 3, higher	1.354	1.858
	(0.785)	(1.144)
Husband education = 1, primary	0.889	0.828
	(0.360)	(0.157)
Husband education = 2, secondary	1.308	0.901
	(0.522)	(0.180)
Husband education = 3, higher	1.693	1.823
	(0.859)	(0.673)
Women religion = 2, protestant	1.053	0.839
	(0.225)	(0.109)
Women religion = 3, muslim	2.143	2.747e+06
	(2.474)	(1.778e+09)
Women religion = 4, 4	1.195	0.783
	(1.453)	(0.413)
Age cohorts = 2, 20-24	0.473*	0.969
	(0.209)	(0.210)
Age cohorts = 3, 25-29	0.996	1.305
	(0.500)	(0.374)
Age cohorts = 4, 30-34	1.277	1.331
	(0.682)	(0.411)
Age cohorts = 5, 35-39	1.425	1.327
	(0.794)	(0.429)
Age cohorts = 6, 40-44	1.175	1.382
	(0.686)	(0.457)
Age cohorts = 7, 45-49	0.571	1.113
	(0.384)	(0.424)
Birth order = 2	0.458***	0.690
	(0.134)	(0.160)
Birth order = 3	0.443**	0.472***
	(0.157)	(0.122)
Birth order = 4	0.361***	0.386***
	(0.136)	(0.104)
Wealth groups = 2, poorer	1.876	1.159

	(1.048)	(0.143)
Wealth groups = 3, middle	3.431**	1.301*
	(1.881)	(0.187)
Wealth groups = 4, richer	5.843***	1.611**
	(3.316)	(0.331)
Wealth groups = 5, richest	10.44***	1.489
	(6.293)	(0.672)
number of household members (listed)	0.904***	1.022
	(0.0276)	(0.0214)
Caesarian section dummy, 1=yes = 1	1.425e+07	32.27***
	(1.065e+10)	(19.58)
provn = 2 = Central	0.539*	0.344***
	(0.197)	(0.116)
provn = 3 = Copperbelt	0.818	0.355***
	(0.276)	(0.127)
provn = 4 = Eastern	1.165	0.883
	(0.446)	(0.281)
provn = 5 = Luapula	1.222	0.744
	(0.484)	(0.253)
provn = 6 = Muchinga	0.521*	0.540*
	(0.181)	(0.187)
provn = 7 = Northern	0.781	0.380***
	(0.285)	(0.130)
provn = 8 = North western	0.939	0.944
	(0.351)	(0.330)
provn = 9 = Southern	0.773	0.372***
	(0.274)	(0.120)
provn = 10 = Western	1.023	0.801
	(0.418)	(0.281)
Community with primary/secondary, 1=high-yes = 1	1.246	1.071
	(0.258)	(0.144)
Household poor dummy, 1=high = 1	0.920	0.878
	(0.287)	(0.163)
High ethnicity, 1=yes = 1	2.585	1.020
	(1.655)	(0.326)
lns1_1_1		
Constant	1.449	2.689**
	(1.463)	(1.347)
Observations	2,073	2,438
Number of groups	305	415

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.

Table 4A. Factors Associated with the Choice of Antenatal Care Attendants

Variables	(Urban sample) odds ratio	(Rural sample) odds ratio
eq1		
Female education = 1, primary	0.997	1.172
	(0.741)	(0.281)
Female education = 2, secondary	1.404	1.197
	(1.097)	(0.359)
Female education = 3, higher	1.408	1.354
	(1.348)	(1.222)
Husband education = 1, primary	1.950	1.409
	(1.394)	(0.401)
Husband education = 2, secondary	2.805	1.317
	(1.942)	(0.395)
Husband education = 3, higher	2.168	2.017
	(1.740)	(1.142)
Women religion = 2, protestant	0.644	1.170
	(0.269)	(0.244)
Women religion = 3, muslim	9.189e+07	123,388
	(3.137e+11)	(6.960e+07)
Women religion = 4, 4	4.846e+09	0.528
	(5.931e+14)	(0.344)
Age cohorts = 2, 20-24	0.544	1.043
	(0.397)	(0.336)
Age cohorts = 3, 25-29	0.547	0.996
	(0.438)	(0.422)
Age cohorts = 4, 30-34	0.539	1.143
	(0.474)	(0.531)
Age cohorts = 5, 35-39	0.383	0.794
	(0.357)	(0.382)
Age cohorts = 6, 40-44	0.273	1.016
	(0.267)	(0.506)
Age cohorts = 7, 45-49	0.640	1.099
	(0.893)	(0.642)
Birth order = 2	1.925	1.274
	(0.891)	(0.447)
Birth order = 3	2.291	1.329
	(1.265)	(0.529)
Birth order = 4	2.558	1.104
	(1.554)	(0.447)
Wealth groups = 2, poorer	0.677	1.051
	(0.886)	(0.200)

Wealth groups = 3, middle	1.672	1.369
	(2.151)	(0.315)
Wealth groups = 4, richer	1.286	1.505
	(1.676)	(0.504)
Wealth groups = 5, richest	1.886	1.867
	(2.552)	(1.366)
number of household members (listed)	0.911*	1.009
	(0.0495)	(0.0330)
Caesarian section dummy, 1=yes = 1	1.705	1.660
	(0.915)	(0.716)
region = 2, Copperbelt	0.129***	0.422**
	(0.0969)	(0.178)
region = 3, Eastern	1.014	2.371**
	(0.916)	(0.963)
region = 4, Luapula	1.236	1.239
	(1.211)	(0.520)
region = 5, Lusaka	3.167	4.908**
	(3.001)	(3.209)
region = 6, Muchinga	1.085	0.856
	(0.986)	(0.352)
region = 7, Northern	0.828	1.309
	(0.749)	(0.558)
region = 8, North western	1.102	1.884
	(1.011)	(0.872)
region = 9, Northern	0.573	0.677
	(0.476)	(0.260)
region = 10, Western	0.971	0.829
	(0.943)	(0.348)
Community with high secondary or higher dummy, yes = 1	1.180	0.969
	(0.560)	(0.198)
Household poor dummy, 1=high = 1	2.004	1.195
	(1.682)	(0.327)
High ethnicity, 1=yes = 1	4.44e-07	0.837
	(0.000437)	(0.412)
lns1_1_1		
Constant	1.109e+08	4.837**
	(1.090e+11)	(3.469)
Observations	2,073	2,438
Number of groups	305	415

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix B

Table 1B: Factors associated with Tetanus Toxoid inoculation, Ordered Choice Model-Only Coefficients

Variables	Coefficients dott
Female education = 1, primary	0.0112
	(0.0660)
Female education = 2, secondary	-0.0234
	(0.0753)
Female education = 3, higher	-0.220*
	(0.120)
Husband education = 1, primary	0.103
	(0.0808)
Husband education = 2, secondary	0.188**
	(0.0827)
Husband education = 3, higher	0.100
	(0.106)
Women religion = 2, protestant	0.0408
	(0.0467)
Women religion = 3, muslim	0.131
	(0.271)
Women religion = 4, 4	0.278
	(0.224)
Age cohorts = 2, 20-24	0.146*
	(0.0779)
Age cohorts = 3, 25-29	0.338***
	(0.0927)
Age cohorts = 4, 30-34	0.211**
	(0.102)
Age cohorts = 5, 35-39	0.0392
	(0.108)
Age cohorts = 6, 40-44	-0.0486
	(0.114)
Age cohorts = 7, 45-49	- 0.410***
	(0.140)
Birth order = 2	- 0.184***
	(0.0675)
Birth order = 3	-0.158**
	(0.0773)
Birth order = 4	-

	0.377***
	(0.0831)
Wealth groups = 2, poorer	-0.00385
	(0.0579)
Wealth groups = 3, middle	0.0152
	(0.0633)
Wealth groups = 4, richer	-0.00754
	(0.0754)
Wealth groups = 5, richest	-0.0978
	(0.0926)
number of household members (listed)	-0.0108
	(0.00729)
Caesarian section dummy, 1=yes = 1	-0.0333
	(0.0706)
provn = 2	-0.109
	(0.0855)
provn = 3	-0.222***
	(0.0792)
provn = 4	-0.238***
	(0.0781)
provn = 5	0.0484
	(0.0864)
provn = 6	0.000752
	(0.0852)
provn = 7	0.245***
	(0.0867)
provn = 8	-0.364***
	(0.0868)
provn = 9	-0.386***
	(0.0783)
provn = 10	-0.392***
	(0.0911)
Urban dummy, 1=yes = 1	0.0743
	(0.0594)
Community with primary/secondary or higher dummy	0.0546
	(0.0433)
Household poor dummy, 1=high = 1	-0.0289
	(0.0626)
High ethnicity, 1=yes = 1	-0.0171
	(0.110)
Constant	

Observations	4,503
Number of groups	720

seEform in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2B. Atleast Four Antenatal Visits

VARIABLES	(1) odds ratio	(2) odds ratio	(3) odds ratio	(4) odds ratio
eq1				
Female education				
Primary			1.041	
			(0.125)	
Secondary			1.155	
			(0.158)	
Tertiary			1.331	
			(0.304)	
Husband education				
Primary			1.319*	
			(0.194)	
Secondary			1.358**	
			(0.204)	
Tertiary			1.473**	
			(0.288)	
Religion				
Protestants			1.035	
			(0.0887)	
Muslim			1.886	
			(1.045)	
Others			0.421**	
			(0.176)	
Age cohort				
20-24			1.007	
			(0.142)	
25-29			0.987	
			(0.167)	

30-34	1.004
	(0.187)
35-39	1.320
	(0.262)
40-44	1.212
	(0.253)
45-49	1.053
	(0.268)
Birth order	
Birth order 1	1.024
	(0.127)
Birth order 2	1.012
	(0.143)
Birth order 3	1.096
	(0.167)
Wealth index	
Poorer	1.150
	(0.121)
Middle	1.239*
	(0.144)
Richer	1.342**
	(0.186)
Richest	1.930***
	(0.332)
Hhsize	0.992
	(0.0133)
Caesarian section	1.475***
	(0.201)
2.provn	1.004
	(0.159)
3.provn	1.481***

			(0.224)	
4.provn			0.938	
			(0.135)	
5.provn			0.889	
			(0.142)	
6.provn			0.966	
			(0.152)	
7.provn			1.080	
			(0.172)	
8.provn			1.131	
			(0.183)	
9.provn			1.182	
			(0.173)	
10.provn			0.879	
			(0.148)	
Urban dummy			0.741***	
			(0.0816)	
Secondary/higher educated			1.115	
			(0.0894)	
Poverty concentration			1.216*	
			(0.141)	
Ethnolinguistic index			1.051	
			(0.215)	
lns1_1_1				
Constant	1.473***	0.409***	0.634	0.347***
	(0.0516)	(0.0600)	(0.199)	(0.0662)
Observations	4,554	4,554	4,511	4,511
Number of groups	720	720	720	720

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1