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UNIVERSITY OF THE WITWATERSRAND

JOHANNESBURG

SOUTH AFRICA

Master's Degree Research Report Submitted to the Faculty of Humanities, in Partial Fulfilment of the Requirements for the MA Degree in Demography and Population Studies.

Polygyny and Childhood Immunisation in Ethiopia: Is there an association?

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DECLARATION

I **Johan Mduduzi Sibiya**, declare that this research report is my own unaided work. It is submitted for the degree of Master of Arts in Demography and Population Studies at the University of the Witwatersrand, Johannesburg, South Africa. To the best of my knowledge, it has not been submitted before for any other degree or examination in any other university.

Signed

Date: 27 September 2016

ACKNOWLEDGEMENTS

Firstly, I would like to thank God for his strength.

I would like to thank Prof. Clifford Odimegwu, my supervisor, for all the guidance and comments throughout the process of completing this research report. Further, I would like to thank Dr. Nicole De Wet, Mr. Azam Khan, Mr. Leonard Ahuejere, Mr. Richard Machava, Mr. Shepstone Musiyarira and Ms. Julia Mamabolo for their invaluable guidance, inputs and overall contributions to my work.

A special thank you and gratitude to Ms. Anisha Panchia for proof-reading my work. To my family and friends, thank you for the support and encouragement throughout my student and academic life. Last, but not least, I would like to thank Ms. Phumzile Sigasa for believing in me.

DEDICATIONS

With gratitude and love, to:

Sphiwe

Thando

Gee

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DEFINITION OF TERMS

FAMILY STRUCTURE: The composition and membership of a family and the organisation and patterning of relationships among individual family members.

POLYGYNOUS FAMILY STRUCTURE: Consists of a male head, more than one female spouse, their biological children and any other persons present.

MONOGAMOUS FAMILY STRUCTURE: Consists of a male head, one female spouse and their biological children, with or without any other persons present.

SINGLE-PARENT FAMILY STRUCTURE: Consists of a female head and her biological children with or without any other persons present

IMMUNISATION: The process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease.

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Abbreviations and acronyms

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
CI	Confidence Interval
CSA	Central Statistics Agency
DPT	Deptheria-pertusis-tetanus
EDHS	Ethiopian Demographic Health Survey
EPI	Expanded Program in Immunisation
HIV/AIDS	Human Immune Deficiency Syndrome/Acquired Immune Deficiency
ICRW	International Centre for Research on Women
MCV	Measle-containing vaccine
NCBC	National Catholic Bioethics Centre
OR	Odds Ratio
SNNPR	Southern Nations Nationalities and People
SSA	Sub-Saharan Africa
STATA	Statistics and Data (syllabic abbreviation)
UNICEF	United Nations Children's Fund
UOR	Unadjusted Odds Ratio
VPDs	Vaccine Preventable Diseases
WHO	World Health Organisation

ABSTRACT

BACKGROUND: Childhood vaccination has proved to be one of the most successful and cost-effective health interventions in the world. However, one in eleven children in Ethiopia die before their fifth birthday, mostly as a result of vaccine preventable diseases and childhood immunisation coverage remains very low by any standard in the country. Little is known about the linkage between family structure and child health-seeking behaviour in Ethiopia where polygyny is common. This study examines the association between the type family structure with a particular interest in polygynous family structure and childhood immunisation among children aged 12 to 60 months in Ethiopia.

METHODOLOGY: Data from the 2011 Ethiopia Demographic and Health Survey, containing a sample of 3 188 children aged 12-60 months were analysed and the vaccination history of children in relation to selected mother and child characteristics were examined. Bivariate tests as well as binary logistic regression models were used to examine the levels of childhood immunisation and the association between family structure and immunisation in Ethiopia.

RESULTS: The data analysis revealed that 27% of Ethiopian children were immunised, 17.4% of children from polygynous households, and 27% of children in single-parent and monogamous households were immunised. Overall family structure was not found to be significantly associated with childhood immunisation. Geographical region, poverty status, mother's age, parity, antenatal care and mother's place of delivery were found to be significant determinants of child immunisation in Ethiopia.

CONCLUSION: Complete immunisation coverage among children aged 12-60 months remains very low by any standard in Ethiopia. Findings show that although a polygynous family structure is not a significant determinant of childhood immunisation it has a positive effect on it. Improved awareness of child immunisation services among mothers would greatly increase immunisation coverage.

CHAPTER 1: INTRODUCTION

This chapter introduces the background of the study; reference is made to background information, statement of the problem, justification, research questions and objectives.

1.1 BACKGROUND

The type of family structure into which a child is raised presents both disadvantages and advantages which subsequently affect the child's health outcomes (Craigie et. al. 2010). In Africa, polygyny, the practice of having more than one wife remains common and the most distinguishing characteristic of a family structure in Africa (Fenske, 2012). Furthermore, polygyny is more prevalent in less developed countries, and in the sub-Saharan African (SSA) region, with large regional variations (Westoff, 2003). In the "polygyny belt", stretching from Senegal to Tanzania, it is common for more than one third of women to be in polygynous unions (Fenske, 2012).

Much has been written about the reasons for the practice of polygyny, but the standard approach to understanding this practice comes from the "threshold model" found in biology literature (Gould et.al, 2008). This model is based on two underlying assumptions:

- Males, in contrast to females, can only increase the quantity of their children by acquiring more mating partners;
- There is heterogeneity in male resources but no variation in female endowments (Gould et al., 2008).

The 2005 Ethiopia Demographic Health Survey shows that although polygyny has decreased slightly since 2000, its prevalence is as high as 27% in some regions of the country, with a

national average of 12%, a two percentage point decrease since the year 2000. The level of education of women has a significant influence on whether they wed into polygynous unions or not. Less than 5% of women with some secondary or higher education are in polygynous unions, compared to 13% of women with no education (EDHS, 2011). This study however, is not concerned with the determinants of polygyny, rather its effect on childhood immunisation.

Childhood vaccination has been shown to be one of, if not the most cost-effective health interventions in the world. Some serious childhood diseases in the world have been successfully prevented or eradicated using vaccinations (Etana & Deressa, 2012); for example, the 1967-77 World Health Organisation (WHO) immunisation campaign eradicated the natural occurrence of small pox (Angela, et. al., 2010). Despite these efforts, it is estimated that in 2007, approximately 27 million infants were not vaccinated against measles (WHO, 2009) and as a result, preventable infectious diseases remain the major cause of death among children under five years in the world, with as many as 2-3 million children dying annually (WHO, 2009).

The WHO estimated that in 2008 more than 1.5 million children died globally from vaccine preventable diseases (VPDs). Furthermore, in spite of the significant advances in science and technology, the implementation of global vaccination coverage remains a pipe dream, especially in the Sub-Saharan African region (Whitney and Pickering, 2002; Pang, 2006). Although estimates show that 82% of children under five had received a routine measles vaccination in 2007 globally, more than 23 million were unvaccinated; more than two thirds were in eight countries in Africa (WHO, 2009). In Ethiopia, an estimated 1 million children

were estimated to be unvaccinated (WHO, 2009), whilst more than 15% of under five deaths are attributed to vaccine preventable diseases (Lulsegad, et. al., 2006).

Appropriately identifying high risk groups is crucial in terms of allocating and providing relevant healthcare services such as vaccinations to those who need them the most. This will ultimately reduce child mortality caused by vaccine preventable diseases. Children solely depend on their caregivers for their health and well-being, especially the uptake of vaccines. In the absence or inaction of parents or caregivers, children are unable to access their critically needed vaccines on time. A study by Biblarz and Gottainer (2000) exhibited that single-parent families usually have the least resources when compared to nuclear and polygynous families. Children from single-parent families are expected to have the worse health outcomes as such, because the time allocated to caring for children is usually positively linked to their wellbeing (Carlson & Corcoran, 2001; Omariba & Boyle, 2007). This study, therefore aims to examine the effects of a family structure, with a special focus on polygynous families on childhood immunisation in Ethiopia.

1.2 ETHIOPIA AT A GLANCE

The Federal Democratic Republic of Ethiopia is the tenth largest country in Africa in terms of population size, with a reported population of 87. 9 million and an annual average population growth rate of 2.5 percent (CSA, 2014). Ethiopia is an entirely landlocked country in East-central Africa with a total land surface area of about 1.1 million square kilometres (EDHS, 2011). It is bordered by Sudan in the west, Somalia and Djibouti in the east, Kenya in the south, and Eritrea in the northeast. The country is composed of nine national regional states namely: Tigray, Afar, Amhara, Oromiya, Somali, Benishangul-Gumuz,

Southern Nations Nationalities and People Region (SNNPR), Gambella and Harari and two Administrative states (Addis Ababa City administration and Dire Dawa city council).



Figure 1: Map of Ethiopia by political regions. (www.lahistoriaconmapas.com)

Ethiopia is one of the least urbanised countries in the world; with only 16 percent of the population living in urban areas (CSA, 2011). The majority of the population lives in the highland areas. The main occupation of the settled rural population is farming, while the lowland areas are mostly inhabited by a pastoral people who depend mainly on livestock production and move from place to place in search of grass and water. More than 80% of the country's total population lives in the regional states of Amhara, Oromiya, and SNNP.

Christianity and Islam are the main religions in Ethiopia; about half of the population are Orthodox Christians, one-third are Muslims, one in every five (18%) are Protestants, and 3% are followers of African traditional religions. The country is home to more than 80 ethnic groups (CSA, 2011).

1.3 PROBLEM STATEMENT

One in every 11 Ethiopian children dies before their fifth birthday (EDHS, 2011); mostly from vaccine-preventable diseases while childhood immunisation coverage remains very low by any standard. Suboptimal vaccination remains a major public health problem in Ethiopia, with reports indicating poor coverage for several essential vaccines, such as the measle-containing vaccine (MCV) (55.7%) and deptheria-pertusis-tetanus (DPT3) (36.5%) in children aged between 12 and 23 months (EDHS, 2011). On the other hand, reports show exceptional immunisation coverage in developed countries; with America, Eastern Mediterranean, Europe and the Western Pacific regions having achieved coverage ranging between 85% and 97% for the MCV and DPT (Immunisation Summary Statistical Reference, 2010). Reports further show that some developing countries have achieved optimal immunisation coverage, while others are making great strides in doing so (UNICEF, 2011). For example, an immunisation coverage rate of more than 70% has been reported in a rural area in Mozambique (Jani et, al. 2008).

Reasons for incomplete vaccination, especially in African countries are poorly understood. To develop and improve vaccination coverage strategies, it is critical to identify risk factors for the suboptimal childhood immunisation. The type of family structure in which a child is raised is cited as one factor that contributes to their health outcomes. Although some studies have shown children in nuclear, monogamous families to have better health outcomes (Amey, 2002; Sellen et al., 2002; Basu, 2002), this thread of research indirectly views families as monolithic and monogamous by default as found in western societies. However, in the Ethiopian society, it is necessary to distinguish between polygynous,

monogamous and single-parent family structures, these family structures may suggest varying levels of parental support required for optimum child health outcomes.

1.4 RESEARCH QUESTIONS

- What are the levels of childhood immunisation in Ethiopia?
- What are the determinants of childhood immunisation in Ethiopia?
- Is a polygynous family structure a significant determinant of childhood immunisation status in Ethiopia?

1.5 RESEARCH OBJECTIVES

1.5.1 General objective:

- To examine the association between the polygynous family structure and childhood immunisation among children aged 12-60 months in Ethiopia.

1.5.2 Specific objectives:

- To estimate childhood immunisation coverage among children aged 12-60 months in Ethiopia by selected characteristics.
- To determine the demographic, socio-economic and mothers' health-seeking practices factors associated with childhood immunisation in Ethiopia.
- To examine if a polygynous family structure is a significant determinant of childhood immunisation among children aged 12-60 months in Ethiopia.

1.6 JUSTIFICATION

Janicke and Finney (2000) argued that although efforts in understanding child healthcare utilisation have increased, our knowledge of factors that influence child healthcare utilisation still remains limited. This study aims to generate essential information and contribute to literature regarding factors that influence child preventative health-seeking behaviour. It is crucial to identify the types of family structures contributing to adverse child health outcomes so that interventional efforts can be appropriately targeted to the neediest. Although vaccines are made freely available in most countries by national governments and non-governmental organisations through programmes such as the EPI, this aspect of child healthcare requires action by their caretakers.

The family structure is a fundamental social unit in which men, women, and children, live. It is also frequently identified as a prime determinant of children's economic and social well-being (Victorino & Gauthier, 2009). However, little is known about the linkages between the family structure and health-seeking behaviour for children especially in the sub-Saharan Africa (Quansa, et. al, 2016; Ntoimo & Odimegwu, 2014). The issues of family structure and childhood immunisation is important for understanding how the welfare of children is shaped by their living arrangements in diverse settings, particularly because models of family structure and function tend to be applied uniformly across cultures.

It cannot be over-emphasised that young children depend on their families to meet their basic human needs. In the African context, polygyny remains the most distinguishing characteristic of the family structure (Baloyi, 2013). Depending on their rank, some women in polygynous unions may have no access or less access to resources and decision-making authority on behalf of their children and as a result, their children may be less likely to be

vaccinated. Thus, understanding the impact of family structure on childhood immunisation is critical as it directly impacts on child survival and child mortality. Such information and knowledge will inform and improve programs aimed at providing full coverage of vaccinations to children in Ethiopia.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 LITERATURE REVIEW

2.1.1 FAMILY STRUCTURE AND CHILDHOOD IMMUNISATION

Although some progress has been made towards understanding family structures in various cultures and societies, research has been dominated by information from western societies (Adams, 2004). Polygyny, however, constitutes one of the most distinctive features of sub-Saharan African marriages, and although the practice is in decline, it is still widely practiced and accounts for 20-50% of all unions in the region (Westoff, 2003). Large variations persist between countries (Timaeus and Reynar, 1998) and homogenising married women in such cultures could conceal subtle but important factors that might impact on child health outcomes. In the Ethiopian context there is a need to make a distinction between polygynous and monogamous (nuclear) family structures, because these marital arrangements may imply varying levels of the parental support that is necessary for optimum child health outcomes (Gyimah, 2009).

Studies have shown that polygynous unions have either a positive or no effect at all on child health outcomes and survival (Ukwuani et al., 2002). Amankwaa (1996) asserts that the positive effect of polygyny is mainly associated with the protective benefits of breast-feeding and longer inter-birth intervals. Furthermore, gender-biased childcare in polygynous families has been associated with better health outcomes for the favoured gender, which in most cases is the male child (Gillet-Netting & Perry, 2005).

Even though the nature of the association between polygyny and child health outcomes seems to offer contradictory views, available evidence generally suggests that polygyny adversely impacts child health outcomes and survival (Gyimah, 2009). Therefore, consistent with the existing literature, children in polygynous households are expected to have a higher risk of being unimmunised compared to children in monogamous (nuclear) and single-parent households.

A study on household structure and childhood immunisation conducted for two countries (Niger and Nigeria) by Gage et al (1997) was inconclusive in its findings, with conflicting results from the two countries. In Nigeria, family structure (single-parent, nuclear, polygynous, and three generational families) was found to be a significant determinant of childhood immunisation, whilst in Niger, the study showed the opposite. In Nigeria, the study established that children from nuclear, polygynous and three-generational households were worse off than those from laterally extended households— which include primarily siblings, cousins, and other relatives of the head. Furthermore, they found that the lower odds of full vaccination for children from three-generational and polygynous households were attributable to lower economic status and low maternal education levels, respectively. In Niger, family structure had no significant effect on the likelihood of children's immunisation (Gage et. al. 1997).

Sub-Saharan African countries affected by the HIV/AIDS pandemic continue to experience shifting population dynamics (Saleson, 2008). HIV/AIDS mostly affects the under-30 age group, who then leave behind a large cohort of orphans. These shifting dynamics have substantial implications on family and household structure which in turn adversely impact on childhood healthcare utilisation, specifically immunisation. Moreover, the role of

grandparents as primary care givers to children may be more pronounced in the near future (Noumbissi and Zuberi, 2001), as a result of the shifting population dynamics.

The relationship between a family structure and child health also reflect differences in the household's time and energy limits for healthcare. These differences are in turn manifested in different household practices in the management of illness and use of health services (Gage et. al. 1997). The opportunity cost of taking children to health facilities is greatest in single-parent households.

2.1.2 TYPE OF PLACE OF RESIDENCE

One of the most consistent findings in public health literature is the strong association between place of residence and child health outcomes (Kumar, et. al., 2012; Fotso, 2007). Urban child health is often attributed to the provision of better-quality health care systems (Gage & Calixte, 2006). Moreover, the urban advantage in the utilisation of health care services has been repeatedly emphasised irrespective of the region in the world (Firestone, et. al., 2011). Generally, the limited utilisation of health care services in rural areas is associated with availability, accessibility and quality of services of services (Amin, et. al., 2010).

Singh (2013) found that children residing in rural India remained disadvantaged with regards to vaccination coverage. Furthermore, Munthali (2007) in his study in Malawi indicated that a significant proportion of children in urban areas were immunised compared to those in the rural areas. Lowery et. al., (1999) however found no significant differences in immunisation rates between rural and urban areas and Tabatabaei, et. al., (2015) found that

urban children in Iran were significantly more likely to miss scheduled vaccines than children in rural settings.

2.1.3 POVERTY STATUS

Research throughout Africa has identified parental poverty as one of the key factors adversely associated with childhood immunisation and child survival (Montgomery et al. 2000; Gwatkin 2002; Bawah & Zuberi 2005; Kahn et al. 2005; Nathan et al. 2005). As expected, studies have demonstrated that the burden of preventable disease is more prevalent among the poorer population (Gwatkin, 2002; Wagstaff, 2000). The poorer tend to be oblivious to the importance of preventative care, and more often than not at an elevated risk because of their high levels of undernourishment. In addition, the living arrangements that they are exposed to, often decrease their resistance to infectious diseases (Gadomski, et. al., 2001). Poor families are also less likely to comply with childhood vaccination schedules, enhancing children's risk of developing antibiotic resistance (Gwatkin, et. al., 2005).

2.1.4 RELIGION

Several studies have interrogated the linkages between religion and child health outcomes (Das, 2004; Jegede, 2007, Renne, 2006; Paulussen et. al, 2006). These studies examined religious affiliation as one of the predictors of children's immunisation status. Nath and colleagues (2007) found families/parents who were affiliated to the Muslim religion were significantly associated with both partial immunisation and total unimmunisation of children aged between 12 and 23 months in the Lucknow urban slums of India. A study by Sanou et al (2009) conducted in the Nouna district in Burkina Faso established that children from

Muslim families had lower immunisation coverage compared to children from other religious-affiliated families. However, the study found that religion was significantly associated with lower immunisation coverage in the rural areas and showed no association in the urban areas. Similarly, in Nigeria, Chidiebere and colleagues (2014) found that being non-Muslim was significantly associated with higher odds of childhood immunisation.

2.1.5 MATERNAL FACTORS

Maternal education is one of the most significant determinants of child health and it has been widely documented that parental knowledge and maternal education levels influence immunisation uptake (Siddiq et. al., 2010; Wang et. al., 2007). Education empowers women to access significant health services and gain knowledge relating to childhood immunisation and nutritional needs (Becker et. al., 1993). In a study of mothers' knowledge and perception of adverse events following immunisation in Nigeria, Nnenna et. al., (2013) found that knowledge about the importance of immunisation was significantly associated with the mothers' education and that most educated mothers understood that the major content of vaccines were chemicals that prevents diseases.

In a study of maternal education and vaccination status of infants in Uganda, Nankabirwa et. al., (2010) found that maternal education was significantly associated with infants' vaccination status. Results showed that infants of mothers who had a secondary education were at least half less likely to miss a scheduled vaccine compared to infants of mothers who had only a primary education. Similarly, Sanou et. al., (2009) in a study in Burkina Faso established that the adult literacy of mothers significantly determined children's vaccine uptake, especially in the rural settings. Likewise Bbaale's (2013) study of factors affecting

childhood immunisation in Uganda confirmed that children whose mothers had a primary education were more likely to receive the full vaccination schedule by 8-14% compared to children whose mothers had no education.

Streatfield et. al., (1990) discovered that mothers' education was correlated with enhanced consciousness of the importance of correct immunisation schedules in Indonesia. Danish, et. al., (2014) also found that mothers' education was positively associated with mothers' awareness of children's immunisation schedule (Danish et. al., 2014).

Maternal age is undeniably one of the key factors associated with childhood immunisation. A positive association between maternal age and childhood immunisation uptake has been demonstrated (Singh, Pallikadvath, et. al, 2012; Singh, Rai, et. al, 2012). Bbaale (2013) asserted that this association may be attributed to experience accumulated over time on the importance of immunisation. Antai (2011) emphasised that maternal age served as a proxy for the women's accumulated knowledge of health care services and stressed that it is conceivable that older mothers are more liberal about child-bearing matters as well as the benefits of childhood vaccines. A number of studies have confirmed this relationship (Luman, et, al. 2003; Chidiebere, et. al, 2014; Antai, 2011).

Children of teenage mothers have been found to be at increased risk for a multitude of adverse health outcomes (Koniak-Griffin, 2001). In addition to a possible independent association of vaccine coverage and maternal age, younger mothers are more likely to have lower income and education levels compared with older mothers, both risk factors for under-immunisation (CDC, 1997). Breiman, et. al., (2004) in their analysis of data spanning over one and a half decades found that greater maternal age was significantly associated with full immunisation. Similarly, a study In Kenya found that older mothers were more

likely to have their children vaccinated compared with children of mothers who were less than 20 years old (Mutua, et. al., 2011).

Studies have shown a significant relationship between mothers' high parity and under immunisation of children and specific studies in Kenya, Nigeria and Bangladesh have confirmed this relationship (Mutua, et. al, 2011; Sule, et. al, 2014; Rahman & Obaida-Nasrin, 2010). This relationship can be explained by and is linked to the higher cost and demands on resources caused by having more children, which may adversely affect parents' child health-seeking behaviour and healthcare utilisation (Rahman & Obaida-Nasrin, 2010; Ndiritu, et. al., 2006). Moreover, Mutau (2011) found that mothers who had higher parity were less likely to fully immunise their children compared to mothers who had fewer children.

2.1.6 CHILD-LEVEL FACTORS

The role of sex disparities in childhood immunisation coverage has been subject to much deliberation in recent years. In some societies, especially those in South East Asian countries, son preference is a well-documented phenomenon (Singh, 2013; Clark, 2000; Pande & Malhorta, 2006). In India, for example, Census data indicates a considerable gap between male and female populations; which can be attributed to decisions made at the most local societal level—the family (Pande & Malhorta, 2006). Common wisdom is that the preference for sons is motivated by economic, religious, social and emotional desires and norms that favour males and make females less desirable: Parents expect sons—but not daughters—to provide financial and emotional care, especially in their old age and it is believed that sons add to family wealth and property while daughters drain it (Pande &

Malhotra, 2006). Fewer studies, however, have systematically examined son preference in the African context, particularly in Ethiopia (Short & Kiros, 2002)

The sex of a child can therefore predict their immunisation status, especially in societies where boy preference and gender inequality is persistent. Singh (2013) found that girl children remained highly disadvantaged compared to the boys when it came to being immunised. Similarly, discrimination against girls in seeking full immunisation was observed in rural Bangladesh (Jamil, et. al., 1999). Antai (2010) however, found no significant association between sex and childhood immunisation in Nigeria. Nevertheless, data from the 2006 Ethiopia EPIS showed no statistical difference between boys and girls with regards to immunisation coverage (Kidane, et. al., 2008). In Malawi, the proportion of immunised girls aged between 12-23 months recorded from 1992 to 2000 was equal to the proportion of immunised boys in the same age group (Munthali, 2007).

Birth order of a child appears to be an important factor of childhood immunisation status (Munthali, 2007). Some studies have shown a strong association between immunisation status and child birth order; with firstborn children being more likely to be fully immunised than children of higher birth order (Schaffer & Szilagyi, 1995). Similarly, Demographic and Health Survey (DHS) data in Malawi showed that four out of every five firstborn children aged 12 to 23 months were fully vaccinated compared to three of every five children of higher birth order (Munthali, 2007). Evidence from Nigeria show that vaccination coverage increased as birth order increased, with 27% of first born children fully vaccinated, compared to 14% of children of sixth and above birth order (NDHS, 2008).

2.1.7 HEALTH FACILITIES UTILISATION PRACTICES

Women's reproductive health behaviour has been found to be a major area of concern, especially in developing countries because of its positive effect on maternal mortality and child health (Mahapatro, 2012). Reproductive health behaviour including antenatal care (ANC) and assisted delivery are associated with child immunisation; mothers who use ANC and deliver at a health care facility are more likely to get their children immunised. The usage of these services means improved awareness of immunisation and other child health care programmes (Mutua, et. al., 2011). Adebayo et. al., (2009) found that more than one third of women in a study in Nigeria became aware of child immunisation during a visit at an antenatal clinic.

Furthermore, in a study in the informal urban settlements in Nairobi, Mutua, et. al. (2011) found that children who were delivered at a health facility were 1.5 times more likely to receive all recommended childhood vaccines, compared to those who were delivered at home. Similarly, a study in Ethiopia found a statistical significant association between place of delivery and child immunisation status and confirmed that children delivered at a health facility were two times more likely to be immunised compared to their counter-parts delivered at home (Etana & Deressa, 2012).

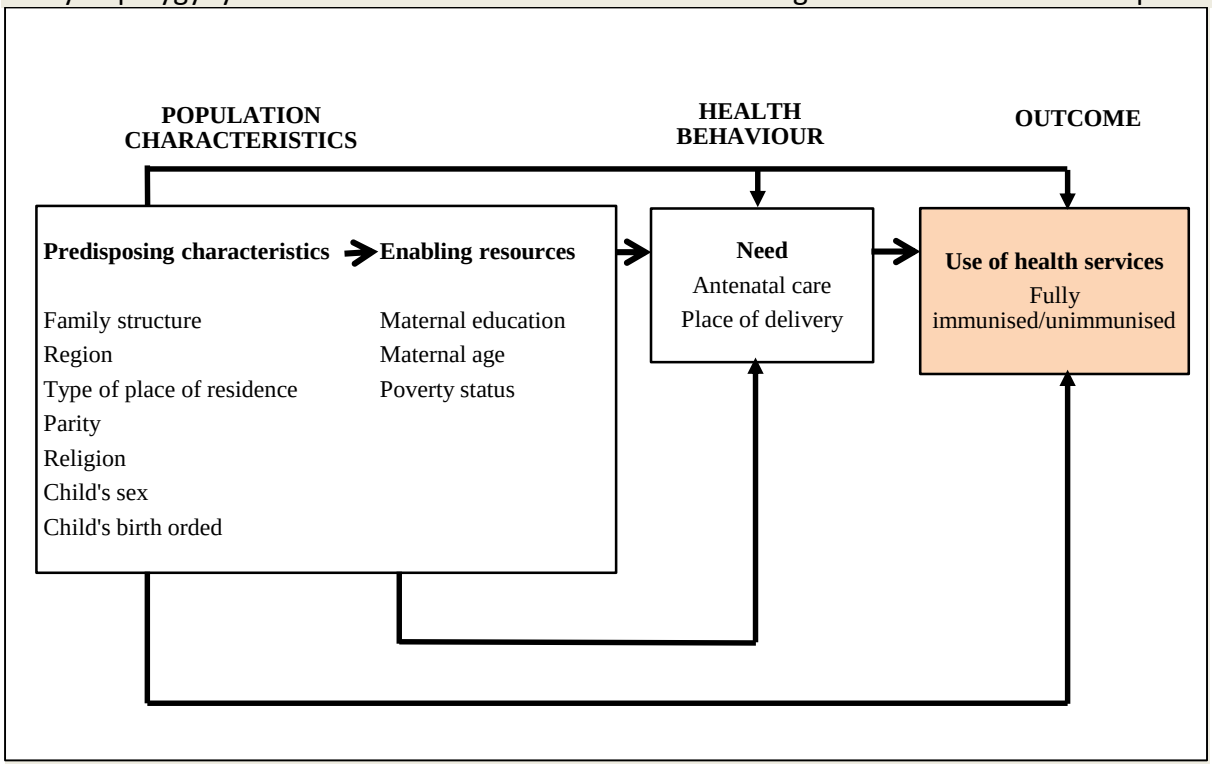
2.2 THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretically, studies have shown that children of mothers from monogamous two-parent unions have better health outcomes when compared to those in polygynous, single-parent and extended households (Amey, 2002; Sellen et al., 2002). Basu (2002) maintains that the advantage of monogamy is usually attributed to the availability of financial resources for

healthy childbearing and greater ability of mothers to make decisions about the health of their children. In developing countries such resources are provided mostly by fathers, who are more often than not, the heads of the households (Omariba and Boyle, 2007).

Therefore, the presence of other women or the absence of a father in a household is expected to dilute the resources for healthy childbearing and obviate the expected advantages associated with monogamous unions (Sellen, 1999; Sellen et al., 2002). With resources held constant, an addition of a wife and a child or children reduces the amount of per capita resources in the households (Brabin, 1984). Moreover; decisions about the health of children may be made by other wives, since the authority of the mother will be affected by her ranking as a wife. Consequently, children of mothers in polygynous unions become more susceptible to poorer health outcomes including non-immunisation and subsequent death at an early age (Omariba and Boyle, 2007).

Figure 2: A modified version of the Andersen behavioural model of health services for the study of polygyny and childhood immunisation for children aged 12-60 months in Ethiopia.



In this study the Andersen behavioural model of health service utilisation (Andersen, 1968, 1995; Andersen & Newman, 1973) is adapted to examine the relationship between family structure and childhood immunisation in Ethiopia. The behavioural model (Andersen, 1968) was designed to empirically test hypotheses about inequality of access to health services; it addresses among other things the concern that some societies receive less health care provision than the rest of the population (Andersen & Newman, 1973). The model considers access to health care services as an individual's decision which is constrained by their position in society and the availability of such services. The model contains three sets of predictive factors: predisposing, enabling and need factors. (Willis, Glaser & Price, 2007). It espouses that a sequence of factors determines the utilisation of health services, specifically vaccines in this case.

The predisposing factors are based on the argument that a family's propensity to use health services can be predicted from a set of personal characteristics. In this study predisposing factors include type of family structure, geographical region, type of place of residence, parity, religion, child's sex, and child's birth order. The enabling factors are based on the argument that even if a family has a predisposition to use health services, certain characteristics must exist to enable them to be aware of and access service (Willis, et. al, 2007). For the purpose of this report maternal education, maternal age, and poverty status have been classified as enabling resources.

Andersen (1968) asserted that in order for a health service to be used, the must first be a need to use that service. For this report the need factors include the mother's use of antennal care services and mother's place of delivery. These two, however are indirectly

related to childhood immunisation; nevertheless they play a direct role in raising awareness of the need for childhood immunisation to the mothers. Thus, this report sought to examine whether the usage of these services by mothers influence the uptake of children' vaccines.

2.3 RESEARCH HYPOTHESES

$\boldsymbol{H_0}$**:** A family structure is not a significant determinant of immunisation status among children aged 12-60 months in Ethiopia.

$\boldsymbol{H_1}$**:** A family structure is a significant determinant of immunisation status among children aged 12-60 months in Ethiopia.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The following chapter details the study setting, survey design, study population and sample, variable definitions and measurements, statistical analysis, ethical issues, and study limitations.

3.2 DATA SOURCE AND SAMPLING DESIGN

To achieve the study objectives, this study made use of the children's recode file which consisted of all the household and maternal variables needed. SAS Base 9.4 was used to recode the two main variables (immunisation status, household structure) of the study. The 2011 EDHS sample was selected using a stratified, two-stage cluster design. Enumeration areas (EAs) were the sampling units in the first stage. The sample included 624 EAs, 187 in urban areas and 437 in rural areas. Households comprised the second stage of sampling. A complete listing of households was in each of the 624 selected EAs and a representative sample of 17,817 households was chosen. In the Somali region, 18 of the 65 selected EAs listed households were not interviewed for various reasons, such as drought and security problems. Data processing consisted of office editing, coding of open-ended questions, data entry, and editing computer-identified errors.

3.3 SURVEY DESIGN

This study is a secondary cross-sectional data analysis of the 2011 EDHS. The sample was designed to provide data for a wide range of monitoring and impact evaluation indicators at the national (urban and rural) and regional levels. The sample design allowed for specific

indicators, such as childhood immunisation coverage, to be calculated for each of Ethiopia's 11 geographic or administrative regions (the nine regional states and two city administrations). The 2007 Population and Housing Census, conducted by the Central Statistics Agency (CSA), provided the sampling frame from which the 2011 EDHS sample was drawn.

3.4 STUDY POPULATION AND SAMPLE

The study present immunisation results for children born 12-60 months prior to the interview by mothers aged 15-49 years. The standard practice is to calculate immunisation rates only for children aged 12-23 months as recommended by the WHO: however, in the Ethiopian context restricting the sample to children 12-23 months would greatly decrease the sample size and thus increase variance in the findings. The sample comprised of 3 188 children who were selected from a total of 11 654 children whose mothers participated in the survey.

3.5 THE INSTRUMENTS

The household questionnaire was used to create a roster of usual members and visitors in the selected households. Some basic information is collected on the characteristics of each person listed, including age, sex, education, and relationship to the head of the household. The household questionnaire provides the mechanism for identifying women eligible (of reproductive age) for individual interview and children under the age of five years. Mothers were then asked questions regarding their biological children in topics including child health,

nutrition, immunisation, child survival and mortality. In addition, information is collected about the dwelling, such as the source of water, type of toilet facility, materials used to construct the dwelling and the ownership of various household goods. Standard model questionnaires have been developed which allows data collected to be comparable across countries.

3.6 VARIABLE DEFINITIONS AND MEASUREMENTS

STATA Version 11 was used for all data management and analyses. Data cleaning was done in cases where there were inconsistencies and recoding was carried out to create binary and dummy variables as required by the study. Renaming of variables was done to allow ease of identification during analysis.

3.6.1 Dependent variable:

The dependent variable of this study is whether a child has been immunised or not immunised by the age of 12 months. According to the WHO guidelines, children are considered immunised when they have received a vaccination against Tuberculosis: Bacilli Calmette-Guerin (BCG), three doses each of the diphtheria-pertusis-tetanus (DPT) and polio vaccines, and a measles vaccine by the age of 12 months (i.e. a total of eight doses). In this study, a dummy variable for immunisation was created where children are considered immunised (1) when they have received all eight doses as recommended and are considered unimmunised (0) when they have received anything less than the eight vaccines by age 12 months.

The 2011 EDHS collected data on vaccination coverage from child health cards shown to the interviewer and from mothers' verbal reports. If the cards were available, the interviewer copied the vaccination dates directly onto the questionnaire. In cases where the cards were not available or if a vaccine had not been recorded, the respondent was asked to recall the vaccines given to the child. These two sources of information were combined to create the immunisation status variable.

3.6.2 Independent variables

The study adopted a nominal categorisation of the family structure variable: single-parent (0): consisting of a female head only and her biological children with or without any other persons present; monogamous (1): consisting of a male head, one female spouse and their biological children, with or without any other persons present and polygynous (2): consisting of a male head, more than one female spouse, their biological children and any other persons present.

Table 1 below shows the independent variables of this study; separated into key independent, socio-economic, maternal, child-level and healthcare factors. Family structure is the key independent variable of the study. Empirical studies have shown that polygynous unions either have a positive effect (Ukwuani et al., 2002) or no effect on child health outcomes and survival (Desai, 1992). The 2011 EDHS collected information on polygyny by asking currently married women whether their husband or partner had other wives, and the number of wives that he had.

A relationship between socio-economic factors and child health has been demonstrated in various studies. For example, parents' low income has been linked with children's poor

health status (Siponen et. al. 2011). The presence of multiple socio-economic risk factors may also pose a cumulative effect on children's poor health (Larson et. al. 2008).

Table 1: Independent variables of the study.

Variable	**Definition**
Predisposing characteristics	
Family structure	Single-parent (0), Monogamous (1), Polygynous (2)
Region	Tigray (1), Amhara (2), Oromiya (3), SNNPR (4), Addis Ababa (5), Other regions (6)
Type of place of residence	Urban (1), rural (2)
Religion	Orthodox (1), Protestant (2), Muslim (3), Other (4)
Parity	1 (1), 2 (2), 3 (3), 4+(4)
Sex of child	Male (1), Female (2)
Birth order	1^{st} (1), 2^{nd} (2), 3^{rd} (3), 4^{th}+ (4)
Enabling resources	
Mother's education level	No education (1), Primary (2), Secondary (3), Higher (4)
Mother's age	15-24 (1), 25-34 (2), 35-44 (3), 45-49 (4)
Poverty status	Poor (1), Average (2), Rich (3)
Healthcare services	
Place of delivery	Home (1), Government facility (2), Private facility (3), Other (4)
Antenatal care	None (1), 1-3 times (2), 4 or more times (3)

The analysis has included geographical region as one of the variables, with Tigray (1), Amhara (2), Oromiya (3), SNNPR (4), Addis Ababa (5) and Affar, Somali, Benishangul-gumuz, Gambela, Harari and Dire Dawa, which had relatively fewer cases were combined into Other regions (6).

The analysis further distinguished between mothers with no education, primary, secondary and higher education: A significant number of demographic studies demonstrate a strong

correlation between maternal education and child health outcomes (Abuya, et. al, 2011; Nkabirwa, et. al, 2010). Maternal age is vital because studies suggest that young children of teenage mothers are developmentally disadvantaged, with substantially worse outcomes in their preschool years than children of older mothers (Luster et al., 2000). The variable was recoded into four age-group categories: 15-24 years, 25-34 years, 35-44 years and 45-49 years.

Poverty status was recoded from the wealth index variable in the data set into three levels: poor (poorer and poor=1), average (middle=2), rich (rich and richer=3). Parity, was categorised into four categories; mothers who had 1 (1), 2 (2), 3 (3) and 4 (4) or more children. The variable religion was recoded into four categories: Orthodox (1), Protestant (2), Muslim (3) and other religions (4) which consisted of "Catholic", "Traditional" and "Other" religions. Healthcare factors include place of delivery: home (1) government facility (2), private facility (3) and other (4). Antenatal care, which is the number of visits to a health facility or doctor a woman makes during her pregnancy, was recoded in to 0 visits (1), 1-3 visits (2) and 4 or more visits (3).

3.7 STATISTICAL ANALYSIS

Using STATA Version 11, analysis adopted a quantitative approach and was carried out at three levels to meet the objectives of the study. For the first objective of the study, which is to estimate childhood immunisation coverage among children aged 12-60 months in Ethiopia, a bivariate analysis method was used to acquire percentage distributions of childhood immunisation by selected characteristics. For the second objective, which is to determine the demographic, socio-economic and mothers' health-seeking practices factors

associated with childhood immunisation in Ethiopia, simple regression analysis was used to get unadjusted odds ratios (UOR) which measures the association between immunisation status and each of the independent variables in the analysis.

For the third objective: to examine if a polygynous family structure is a significant determinant of childhood immunisation among children aged 12-60 months in Ethiopia, a binomial logistic regression model was fitted to identify factors associated with childhood immunisation. Adjusted odds ratios (AOR) were acquired to measure the association. The binomial logistic regression model was used because the outcome variable is a binary variable (immunised (1); unimmunised (0)). The model enabled entering several variables and controlling for many confounders at the same time. It also gives the magnitude as well as the direction of the association between the outcome and the explanatory variables. The logistic regression model gives the probability that the outcome occurs as an exponential function of the independent variables. It involves fitting to the data the logistic function as depicted below:

In $\boldsymbol{Yi/(1-Yi)}$ **=** $\boldsymbol{\beta_0 + \beta_{1*1} + \beta_{2*2} + \ldots \beta_{n*n}}$

Where:

Yi=The proportion of children who are immunised

β_0=Constant

β_1=Family structure

β_2=Region

β_3=Type of place of residence

β_4=Poverty status

β_5=Mother's level of education

β_6=Mother's age

β_7=Parity

β_8=Sex of child

β_9=Birth order

β_{10}=Religion

β_{11}=Antenatal care

β_{12}=Place of delivery

3.8 ETHICAL ISSUES

This study is a secondary analysis of pre-existing data. Permission to download the dataset was authorised by Measure DHS (www.dhsprogram.com) and no ethical consideration is required.

3.9 STUDY LIMITATIONS

Since two methods were used to collect immunisation data, information was recorded directly from the children's health cards and in cases where the child health cards were not available or if a vaccine had not been recorded, mothers were asked to recall their child's vaccine information. The accuracy of mothers' verbal reports is difficult to assess and it is generally assumed that the lower the proportion of cards presented, the poorer the quality of data on immunisation (Gage et. al, 1997). However, after researching on the quality of mothers' recall, Cutts et al. (2013) found no indication of systematic biases and showed fairly good accuracy of mothers' recall of specific vaccinations.

In spite of potential sources of errors, the DHS is generally considered as one of the best sources of population-based health care information, especially in low-and middle-income countries (Murray et al., 2003). 2011 EDHS reported that only eight per cent of the data on all basic vaccinations were collected through mothers' verbal reports. Therefore, data from

both sources are used in the analysis. Furthermore, some potential community-level factors such as distance to health care facilities or immunisation centres, quality of immunisation services, behaviour and attitude of healthcare personnel that could be important determinants of full immunisation have not been included in this study due to data constraints.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter presents univariate and bivariate analyses findings of the study under selected characteristics of child, mother and health facility' utilisation practices in relation to childhood immunisation in Ethiopia.

4.2 UNIVARIATE ANALYSIS

4.2.1 Characteristics of the child

A total of 3 188 children aged 12-60 months were included in the analysis of this study. Distribution by sex show that just over half (50.1%) of the children were male and just less than half (49.9%) were female. The majority of the children (87.4%) lived in monogamous families while 6.7% and 5.9% lived in single-parent and polygynous families respectively. Geographically, four out of every five children (78.9%) resided in the rural areas and more than three thirds of the children in the study resided in three of the regions in the country (Amhara, Oromiya, and SNNPR) as shown in Table 2 below.

Table 2: Characteristics of study population: children aged 12-60 months (N=3 188), Ethiopia, 2011.

Variable	[n=3 188; n (%)]
Family structure	
Single-parent	215 (6.7)
Monogamous	2 787 (87.4)
Polygynous	188 (5.9)
Child's sex	
Male	1 598 (50.1)
Female	1 590 (49.9)
Type of place of residence	
Urban	672 (21.1)
Rural	2 516 (78.9)
Region	

Tigray	388 (12.2)
Amhara	694 (21.8)
Oromiya	1 245 (39.0)
SNNPR	553 (17.3)
Addis Ababa	173 (5.4)
Other regions	137 (4.3)

Notes: Columns (%) add up to 100 for each variable.

4.2.2 Characteristics of the mother

A majority of the mothers to the children in this study had either no formal education (59.3%) or had a primary education (33.6%) whilst 4.4% had acquired secondary education and 2.7% had higher education. Half the mothers were aged between 25 and 34 years, whilst the youngest age group (15-24 years) comprised of 27.5% of the mothers, 20.7% were aged 35-44 years and 1.7% were aged 45 years and older. Half the mothers had a parity of 3 or less children whilst the other half had four or more children.

Furthermore, 44.1% of the mothers did not receive or seek any antenatal care during their pregnancy, whilst about 28% visited a healthcare facility one to three times while 27.5% received antenatal care four or more times during their pregnancy. Four out of every five mothers (82%) in the study reported having had given birth at home, 15.2% gave birth at a government healthcare facility and the remaining 3% either gave birth at a private (2%) or other (0.8%) type of healthcare facility.

4.3 BIVRIATE ANALYSIS

The results indicate that about 27% of the children aged 12-60 months in the study had received all the recommended vaccines by age 12 months; on the other hand, results show that seven in every ten (73%) children had not received the complete set of vaccines as

recommended. Furthermore, the results indicate that the proportion immunised differed by type of family structure; 17.4% of children in polygynous families were immunised, 10 percentage points lower than those children in single-parent families (27.3%) and monogamous families (27.5%).

Table 3: Frequency and percentage distribution of children aged 21-60 Months by immunisation status (N=3 188).

Variable	Unimmunised [n=2 330 (73.1); n (%)]	Immunised [n=858 (27); n (%)]
Family structure		
Single-parent	156 (72.7)	59 (27.3)
Monogamous	2 019 (72.5)	768 (27.5)
Polygynous	155 (82.6)	33 (17.4)
Total	2 330 (73)	858 (27)
Region		
Tigray	186 (48)	202 (52)
Amhara	530 (76.4)	164 (23.6)
Oromiya	1 006 (80.8)	239 (19.2)
SNNPR	443 (80.1)	110 (19.9)
Addis Ababa	58 (33.6)	115 (66.4)
Other regions	107 (78.2)	30 (21.8)
Type of place of residence		
Urban	368 (54.7)	304 (45.3)
Rural	1 962 (78)	554 (22)
Poverty status		
Poor	893 (78.8)	240 (21.2)
Average	480 (81.5)	109 (18.5)
Rich	957 (65.2)	510 (34.7)
Mothers' education level		
No education	1 458 (77.1)	434 (22.9)
Primary	758 (70.7)	314 (29.3)
Secondary	81 (58.3)	58 (41.7)
Higher	33 (38.7)	53 (61.3)
Mothers' age		
15-24	672 (76.6)	205 (23.4)
25-34	1 152 (72.1)	446 (27.9)
35-44	465 (70.6)	194 (29.4)
45-49	41 (75)	14 (25)
Parity		
1	363 (67.5)	175 (32.5)
2	419 (70.3)	177 (29.7)
3	347 (73.8)	123 (29.7)
4 or more	1 201 (75.8)	384 (24.2)
Child's sex		
Male	1 178 (73.7)	420 (26.3)

Female	1 152 (72.4)	438 (27.6)
Religion		
Orthodox	946 (64.9)	513 (35.1)
Protestant	555 (80.3)	136 (19.7)
Muslim	779 (79.7)	199 (20.3)
Other	48 (81.7)	11 (18.3)
Antenatal care[†]		
None	988 (82.5)	210 (17.5)
1-3 times	593 (76.9)	178 (23.1)
4+ times	462 (61.8)	285 (38.2)
Total	2 043 (75.2)	673 (24.8)
Place of delivery		
Home	2 017 (77.2)	597 (22.8)
Government facility	261 (53.9)	224 (46.1)
Private facility	38 (59.7)	25 (40.3)
Other	14 (53.9)	12 (46.1)

[†] Missing antenatal care data for 472 respondents
Notes: Rows (%) add up to 100.

Addis Ababa, the capital city of the country had the highest proportion (66.4%) of immunised children followed by Tigray at 52%, whilst immunisation coverage in the remaining regions ranged between 19% and 24%, with the lowest coverage recorded in the Oromiya region at 19.2%. The results further indicate that immunisation coverage was higher among children in urban (45.3%) areas compared to those in rural areas (22%). Similarly, just over a third (34.7%) of children in rich families were immunised compared to 18.5% and 21.2% children among average and poor families respectively.

Furthermore, the study findings indicate a positive relationship between maternal education and childhood immunisation; the higher the mothers' level of education the higher the childhood immunisation coverage. Mothers with no formal education achieved the lowest coverage (22.9%) for their children, whilst 29.3% and 41.7% of children of mothers with a primary and a secondary education had received all vaccines respectively; meanwhile three in five children of mothers with higher education had completed their vaccination schedule (Table 3 above).

Children of younger mothers (15-24 years) achieved the lowest immunisation coverage at 23.4% compared to children of older mothers (25-34=27.9%, 35-44=29.4%, 45+=25%). Furthermore, mothers who reported a parity of one achieved the highest immunisation coverage for their children at 32.5%, whilst almost a quarter (24.2%) of mothers with a parity of four or more children had immunised their children as shown in Table 3 above. No differences were observed between the immunisation coverage of male and female children. Also, the results show that more than a third (35.1%) of children from orthodox affiliated religious families had been immunised while one in five children from Protestant, Muslim and other religious affiliations had been immunised.

The findings further revealed that one in every five children whose mothers did not receive any ANC (17.5%) and those whose mothers received ANC at least three times or less (23.1%) during pregnancy had been immunised. Whilst more than a third (38.2%) of children whose mothers attended ANC clinics four or more times during their pregnancy were fully immunised. While 23% of children of mothers who delivered at home had been immunised, more than 40% of those whose mothers delivered at a health care facility had been immunised.

CHAPTER 5: MULTIVARIATE ANALYSIS

5.1 INTRODUCTION

In the following chapter, the association between child's characteristics, mothers' characteristics and healthcare facilities utilisation practices with childhood immunisation status is discussed. The bivariate analytical method, examining the association between each independent variable and the dependent variable at a time, and the multivariate analysis method, taking into consideration the effects of all other independent variables in the model, were applied to acquire results as shown in Table 4 below.

5.2 MULTIVARIATE ANALYSIS

Observing the effect of the type of family structure on childhood immunisation and not taking into consideration the effect of the other factors, the results on Table 4 below imply that the odds of being immunised for children from monogamous families (UOR=1.01, 95% CI=0.741-1.383) and those in single-parent families were equal. Although the association between polygynous families and immunisation was statistically significant, children from these types of families were half as likely to be immunised (UOR=0.56, 95% CI=0.346-0.908) as compared to children in single-parent and monogamous families.

However, when taking all other factors in the model into consideration, results indicate that although there was no overall statistical significant association between type of family structure and childhood immunisation, children in monogamous (AOR=1.40, 95% CI=0.967-2.036) and polygamous (AOR=1.27, 95% CI=0.719-2.260) families were more likely to be immunised compared to those in single-parent families as shown in Table 4 below. This

implies that children staying in polygynous families had higher odds of being immunised compared to children of single mothers, but were less likely to be immunised compared to children residing in nuclear monogamous families.

Table 4: Association between immunisation status and sample characteristics in children aged 12-60 months (N=3 188)

Variable	Unadjusted OR (95% CI)	Adjusted OR# (95% CI)
Family structure		
Single-parent	(R)	
Monogamous	1.01 (0.741-1.383)	1.40 (0.967-2.036)
Polygynous	0.56* (0.346-0.908)	1.27 (0.719-2.260)
Region*		
Tigray	(R)	
Amhara	0.29* (0.219-0.372)	0.33* (0.242-0.448)
Oromiya	0.22* (0.172-0.280)	0.25* (0.181-0.349)
SNNPR	0.23* (0.172-0.306)	0.26* (0.170-0.397)
Addis Ababa	1.82* (1.255-2.648)	0.91 (0.555-1.481)
Other regions	0.26* (0.163-0.403)	0.25* (0.143-0.448)
Type of place of residence		
Urban	(R)	
Rural	0.34* (0.285-0.408)	0.79 (0.578-1.092)
Poverty status*		
Poor	(R)	
Average	0.84 (0.656-1.086)	0.90 (0.671-1.210)
Rich	1.98* (1.660-2.372)	1.47* (1.132-1.914)
Mothers' education level		
No education	(R)	
Primary	1.39* (1.175-1.649)	1.17 (0.930-1.464)
Secondary	2.41* (1.690-3.432)	1.05 (0.644-1.703)
Higher	5.33* (3.404-8.331)	2.21* (1.237-3.950)
Mothers' age*		
15-24	(R)	
25-34	1.27* (1.047-1.534)	1.56* (1.169-2.075)
35-44	1.36* (1.084-1.714)	1.95* (1.346-2.811)
45-49	1.09 (0.581-2.045)	2.19* (1.061-4.515)
Parity*		
1	(R)	
2	0.88 (0.682-1.128)	0.75 (0.552-1.027)
3	0.74* (0.560-0.969)	0.61* (0.424-0.887)
4 or more	0.67* (0.537-0.824)	0.57* (0.402-0.818)
Child's sex		
Male	(R)	
Female	1.07 (0.911-1.246)	1.13 (0.935-1.365)
Birth order		
1st	(R)	

2nd	0.77* (0.602-0.979)	
3rd	0.67* (0.519-0.874)	
4th or more	0.58* (0.472-0.708)	
Religion		
Orthodox	(R)	
Protestant	0.45* (0.365-0.562)	0.80 (0.572-1.113)
Muslim	0.47* (0.389-0.569)	0.84 (0.642-1.088)
Other	0.41* (0.211-0.805)	0.68 (0.284-1.621)
Antenatal care*		
None	(R)	
1-3 times	1.41* (1.127-1.765)	1.11 (0.871-1.410)
4+ times	2.91* (2.357-3.585)	1.47* (1.128-1.906)
Place of delivery*		
Home	(R)	
Government facility	2.89* (2.369-3.537)	0.97 (0.703-1.334)
Private facility	2.28* (1.365-3.804)	0.47* (0.230-0.957)
Other	2.89* (1.337-6.239)	1.24 (0.418-3.680)

*****=variable significant at *P<0.05*; *=category significant at *P<0.05.*
#=birth order omitted from multivariate model.
CI = confidence interval; OR = odds ratio.
Notes: (R) denotes reference category for each variable.

Findings show geographical disparities in terms of children's odds of being immunised. The bivariate analytical analysis show that children in Addis Ababa (UOR=1.82) were twice as likely to be immunised compared to those in the Tigray region, while those in the other regions of the country were way less likely to be immunised with odds ratios ranging between 0.22 and 0.29 when compared to children in the Tigray region. However, the multivariate analysis indicate that children in Amhara, Oromiya, SNNPR and other regions in the country were 0.25 times on average less likely to be immunised compared to those in Tigray and Addis Ababa. Geographical region had a statistically significant association with childhood immunisation.

Children in rural areas were less likely (AOR=0.79) to be immunised compared to those in the urban areas and type of place of residence was not significantly associated with childhood immunisation at *P<0.05*. Furthermore, before adjusting for other variables in the

model, results indicate that children from families considered rich were twice as likely (UOR=1.98) to be immunised compared to those in poor and average families. Multivariate analysis show that children in rich families were one and a half times more likely to be immunised compared to their counterparts in poor and average families.

A strong association between mothers' level of education and child immunisation status was shown in this study, before adjusting for other factors in the model. Children of mothers with higher education were more than five times (UOR=5.33) more likely to be immunised as compare to those of mothers with no education. After adjusting for other factors, results indicate that children whose mothers had higher education level were more than two times (AOR=2.21) more likely to be immunised compared to those whose mothers had a secondary or lower levels of education. However, overall mother's education was not significantly associated with child immunisation.

The number of children a mother has had a significant negative influence on the odds of a child being immunised. Children who had one or more siblings were 0.57 to 0.75 times less likely to be immunised compared to children who had no siblings. Meaning, a child who is the only child to their mother was protected from the risk of not being immunised. Results show no difference in the odds of being immunised between male and female children. Religion to which a family was affiliated to was found to have no significant association with a child's immunisation status. Whilst bivariate analytical analysis indicate that the first child had higher odds of being immunised compared to children of higher birth order, this variable was omitted from the multivariate model because of its close association with parity.

There was a strong positive association between mother's age and child immunisation status. Results show that children of younger mothers (15-24 years) were less likely to be immunised compared to those of older mothers. Children of mothers aged 25-34 years were one and a half times more likely (AOR=1.56) to be immunised whilst those of mothers aged 35-44 years (AOR=1.95) and 45-49 (AOR=2.19) were twice as likely to be immunised compared to those of the youngest mothers (15-24 years).

Taking all other factors in the model in to account, results indicate that the odds of being immunised for children of mothers who used ANC less frequently (1-3 times) during their pregnancy were marginally higher (AOR=1.11) than those of mothers who sought no ANC at all. On the other hand, children of mothers who used ANC more frequently (4 times or more) were slightly more likely (AOR=1.47) to be fully immunised compared to their counterparts whose mothers did not utilise any ANC. A statistically significant association was established between ANC and childhood immunisation at $P<0.05$.

It was also found that whilst children of mothers who delivered at a private health care facility were less than half as likely (AOR=0.47, 95% CI: 0.230-0.957) to be fully immunised compared to those of mothers who delivered at home, there was no difference in the likelihood of being immunised between children of mothers who delivered at home and those who delivered at a government facility. Lastly, children of mothers who delivered at other types of health care facilities were 1.24 times more likely to be fully immunised.

CHAPTER 6: DISCUSSION AND RECOMMENDATIONS

6.1 DISCUSSION

In an effort to understand ways in which childhood immunisation coverage can be improved in Ethiopia, this study examined the relationship between type of family structure, with a particular focus on polygynous families and childhood immunisation. The study further provides socio-economic, demographic and healthcare utilisation practices analysis of the association between family structure and childhood immunisation on a national probability sample in Ethiopia. The study shows poor immunisation coverage levels nationally. Immunisation was found to be suboptimal across all types of family structures, with the lowest coverage observed in the polygynous families followed by single-parent families. Furthermore, the analysis showed an overall non-significant association between family structure and childhood immunisation in Ethiopia.

Although the study showed a significant association between family structure and childhood immunisation before adjusting for socio-economic and demographic factors and clearly demonstrated that children from polygynous families were half as likely to be immunised than those in monogamous nuclear families; after taking all factors into consideration, the study findings indicate that family structure is not significantly associated with childhood immunisation in Ethiopia. Furthermore, polygynous family structure was found to be not statistically significant when associated with childhood immunisation. This could partly be as a result of the relatively smaller sample used in the analysis as evidenced by the wide-ranging confidence interval exhibited in the results. This is partly consistent with the study

conducted by Gage (1997) and colleagues, where they found no association between childhood immunisation and household structure in Niger.

In line with the theoretical studies of polygyny, analysis confirms that a polygynous family structure has a moderately negative effect on childhood immunisation when compared to monogamous nuclear families. On the other hand, however, polygynous families exhibited a moderately positive effect when compared to children in single-parent families in Ethiopia. This clearly demonstrates that monogamous nuclear families are associated with an environment in which children's vaccines are used more effectively. This clearly resonates with Basu's (2002) suppositions that the advantages in monogamous households are usually attributed to the availability of financial and other essential resources associated with healthy child-bearing. In the absence of co-spouses, mothers can autonomously take favourable decisions concerning the health of their children. The presence of both biological parents warrants shared responsibilities and a stable environment conducive to raising healthy children.

Jankowiak and colleagues (2005) argue that in a polygynous union the degree to which a wife is materially dependent on her husband determines her willingness to co-operate or compete with a co-wife. However, among East African countries women's material dependence on their husbands is markedly reduced because of their predominantly agricultural and herding practices. The higher odds of immunisation among children in polygynous households in Ethiopia as seen in the results in this report may be explained by a healthy competition and co-operation among co-wives. This is partly because women in polygynous unions with no children are prone to attack a rival, whereas women with

children look at co-wives as a possible source of health care assistance (Jankowiak et. al, 2005).

Furthermore, children raised in single-parent families were found to be worse-off compared to those in either monogamous or polygynous families. The absence of a father in the household implies even greater responsibilities to the mother when it comes to raising children. In developing countries, especially in Sub-Saharan Africa, fathers are usually the heads and the financial providers in their families. Thus, a father's absence implies increased responsibilities to mothers when it comes to physically raising children and providing for them financially at the same time. Therefore, vaccines and other child health-seeking behaviours become less of a priority, especially in rural and mostly farming communities like Ethiopia. It is therefore expected for children in single-parent families to have the lowest immunisation coverage compared to children in the other types of family structures, as is the case in this study.

Geographical regions, irrespective of the part of the world, represent different levels of social development and population density and different economic, religious and political conditions (Antai, 2011). It is therefore expected that geographical location would influence the uptake of childhood vaccines (Antai, 2009). This is true for Ethiopia where geographical region was found to be highly associated with childhood immunisation. Children in four of the six regions in this study had about eighty percent lower likelihood of receiving the full vaccine schedule. This is not surprising given that Ethiopia is one of the least urbanised countries in the world (CSA, 2010). Possible explanation for the very low levels of immunisation in these regions includes the fact that they are usually characterised by hard-

to-reach communities, widespread poverty, and poor healthcare infrastructure (Antai, 2011).

Utilisation of healthcare services in rural areas is limited by factors associated with availability, accessibility and quality of services (Amin, et. al., 2010). The urban advantage, which has been widely emphasised (Matthews, et. al., 2010; Firestone, 2011) can be attributed to the improved modern healthcare system and the accompanying infrastructure (Amin, et. al., 2010). Furthermore, the advantages of urban mothers includes higher levels of education and knowledge of the benefits of utilising childhood vaccines emanating from health promotion programs that usually use urban-focused mass media (Fotso, 2007).

The analysis in this study confirms the strong relationship commonly found between child health and mother's education. In Ethiopia, the results show that mothers with higher levels of education were almost three times more likely to have their children immunised compared to mothers with only a secondary or lower education levels. Numerous previous studies have endorsed similar findings (Jani et. al., 2008; Adebayo et. al, 2012). Maternal education remains one of the most critical determinants of childhood immunisation. It has been associated with knowledge of when to start immunisations, the number of doses that children should take and the ability of mothers to name the diseases which immunisations protect their children against (Abuya et. al, 2011, Nankabirwa et. al, 2010).

However, the state of education in Ethiopia remains very poor by any standard and since most people feel that work is more important than education, they would attempt to start working at a very early age, many with little or no education. Children in rural areas rarely go to school and many rural families cannot afford to send their children to school. This applies more to the girl child, as it is generally believed that while children are in school they

cannot contribute to the household chores and cannot contribute to the generation of income desperately needed for the livelihood of the family (Nguyen et. al., 1998). Thus, only a small percentage of women will receive an education in Ethiopia. This is clearly reflected in the analysis where more than 90% of mothers reported having a primary education or no formal education whilst about 70% of their children were unimmunised.

Al-Matalka (2014) noted that a family's socio-economic status is based on income, parental education, parental occupation and social status in the community; thus families with a low socioeconomic status frequently lack the financial, social and educational support that characterise families with high socio-economic status. In Ethiopia, poverty status was significantly associated with childhood immunisation - children from poor families were found to be less likely to be immunised compared to those from rich families. Affluent households often have more success in vaccinating their children because they typically have access to a wide range of resources to promote and support young children's healthy development.

Additionally, the significantly higher odds of children of mothers 35 years and older receiving all recommended vaccines is consistent with findings from recent cross-sectional studies in countries in Africa and South East Asia (Antai, 2009; Rahman, et. al, 2010). Findings in this study showed that older mothers in Ethiopia were more likely to have their children fully immunised than their younger counterparts. This may be because maternal age serves as a proxy for the women's accumulated knowledge of health care services, which in turn may have a positive influence on acceptance of immunisation of children. Furthermore, it is conceivable that older mothers are more liberal about child-bearing matters as well as the benefits of childhood vaccines (Antai, 2011).

Very few studies have systematically examined the issue of son preference in the African context, particularly in Ethiopia, a highly gender-stratified society in the very early stages of fertility transition (Short & Kiros, 2002). Nevertheless, in their fertility preference study in Ethiopia, Short and Kiros (2002) concluded that although both wives and husbands generally prefer to have sons and daughters, they prefer more sons overall. Families in Ethiopia are patrilineal in nature, men are the heads of the households and there is a clear division of labour between the sexes. Both boys and girls help with agricultural activities and other household duties. Although boys are more likely to help with the animals, plough fields and collect firewood while girls prepare food and help with the rearing of children, roles can be transferred to the opposite sex if needs be. For example girls can take care of animals when there is a shortage of boys in the household.

However, in countries in South East Asia, especially India, sons are preferred over daughters, for a number of economic, social and religious reasons, including financial support, old age security, property inheritance, prestige and power (Singh, 2013). It is therefore not surprising that the results in this report show no differences in the odds of being immunised between male and female children in the Ethiopian context.

Furthermore, belonging to, or expressing religious affiliation to the Christian Orthodox denomination was found to be protective against non-compliance with childhood immunisation in Ethiopia. Findings show that belonging to the Protestant, Islam or other religious denomination was not associated with an environment where vaccination compliance was prevalent. Grabenstein's (2013) meta-review of religious beliefs about vaccines could not find any specific religion that was openly opposed to vaccinations. However, the Catholic Church recognises the value of vaccines and the importance of

protecting individuals and the community's health. The Church states, however, that its members should search for substitutes, when available, to vaccines that are made using cell lines derived from aborted foetuses (NCBC, 2006). The Church further asserts that "there would seem to be no proper grounds for refusing immunisation against dangerous [infectious] diseases" (NCBC, 2006).

Although religious affiliation was found to be not statistically significant in this study after adjusting for covariates, these findings are in consonance with other studies where religion was found to be significantly associated with the reduced risk of non-immunisation (Sanou et al., 2009; Nath et al., 2007; Antai, 2009). Variances in findings from studies that examined the influence of religion on immunisation may be as a result of differences in socio-cultural backgrounds between populations involved in the studies (Shuaib et al., 2010). Ethiopia is a predominantly Christian society; about half the population are Orthodox Christians which may explain the relatively increased immunisation coverage among the Christian affiliated families.

The study confirmed that the non- or under-utilisation of antenatal care services by the majority of mothers in Ethiopia adversely impacts on their child's vaccines uptake. Mahapatro (2012) observed that women's status in the household and in the society in general is an important determinant of maternal health. Mothers with higher a socio-economic status in terms of better education and employment have more autonomy with regards to their reproductive health and subsequently the health of their children. Thus, the non-utilisation of maternal health services in Ethiopia can be attributed to the generally low status of women in that country. Women in polygynous unions, depending on their rank are usually of low socio-economic status, where resources have to be shared among the larger

households. The autonomy of lower ranking wives is more often than not dependent on the higher ranking wife/wives.

The limited utilisation of healthcare services for themselves and their children for single mothers can be attributed to limited financial resources and time available to take care of the child or children, which is generally associated with single-motherhood. In Ethiopia, however, the majority of unions were monogamous, thus the issue may not be the utilisation of maternal and child health services, but rather the access and availability of health care facilities.

6.2 CONCLUSION

Polygynous family structure, although not a significant determinant but has a positive effect on childhood immunisation, especially when compared to single-parent families in Ethiopia. Furthermore, study revealed the suboptimal immunisation coverage among children aged 12-60 months in the country. Whilst the type of family structure plays a very limited role in determining childhood immunisation, the overall socio-economic status of a family plays a crucial role. Maternal education, one of the key determinants of socio-economic status of women, is one of the most significant determinants of childhood immunisation in Ethiopia. This is because changes that accompany improved maternal education, such as changes in attitudes, traditions and beliefs, awareness, increased autonomy and control over household resources which in turn enhance mothers' and children's health-seeking behaviour.

6.3 RECOMMENDATIONS

6.3.1 POLICY

It is essential for the Ethiopian government and other stakeholders to strengthen the delivery and raise the awareness of healthcare services among the rural remote parts of the country, by establishing village-level health facilities that are well-stocked with recommended vaccines. Furthermore, educating and sensitising parents on the importance of a timely and complete immunisation schedule for young children is urgently needed. Government should also strengthen the delivery and access to antenatal care among women, findings in this study confirmed that children of mothers who sought antenatal care had higher odds of being immunised.

6.3.2 FURTHER RESEARCH

Further research is needed to clarify the mechanisms by which children in certain types of family structures, especially single-parent families become more susceptible to adverse health outcomes in order to ensure targeted services and intervention to the neediest of children.

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CORRECTIONS

Examination of MA Research Report by Johan M. Sibiya (Student No: 0412286D)

General comments

The research set out to assess the association between polygynous family structure and childhood immunisation in Ethiopia. The outcome of interest- child immunisation is an important issue as it has direct bearing on public health and overall human development especially in the developing countries.

Though, there are several corrections that the candidate need to make, I consider the research report to be satisfactory as regards the following:

Literary style and presentation
Acquaintance with methods of research and scientific investigation
Understanding of the nature and purpose of the research
Familiarity with relevant literature
Significance of the study findings

General point:

The candidate used the term polygamy and polygyny interchangeably. This is not correct. Considering the variables and data used, the correct term ought to be "polygyny". The entire report should be revised to reflect the correct term.

Quite a number of references cited were too old. There are many recent studies on this subject. Candidate should update the literature.

Abstract

It is not a standard practice to include references in the abstract. Candidate should remove the references in the background section of the abstract. Secondly, the knowledge gap should be specific to Ethiopia and not sub-Saharan Africa generally. The conclusion claimed that "a polygamous family structure has a positive effect on childhood immunisation" but this was not supported by the results in the abstract.

Chapter 1:

Most of the sub-sections are adequate except that some of the cited references are too old.

Chapter 2: Literature review

Section 2.1.1 was not coherent enough. Many of the variables reviewed in this section cannot be classified as socio-economic factors. In addition, it would be better if the candidate divide into logical sub-sections with relevant sub-headings.
Section 2.1.2 maternal factors-page 14, paragraph 2.

What is the nature of the association between maternal age and childhood immunisation? This should be clarified. The last sentence in the paragraph stated that "numerous studies have confirmed this relationship". This should be supported by references.

2.1.3 child-level factors

It is too vague to claim that son-preference is well-documented in many societies. The phenomenon is known to be common mostly in Asian countries and less in sub-Saharan Africa. Candidate also needs to substantiate this claim by providing literature references.

In the first 2 lines of page 16, candidate was mixing SSA and Asia. It is not correct that evidence on the relationship between sex of a child and immunisation coverage is inconclusive.

2.2 Theoretical and conceptual framework

Though the theoretical model used is appropriate, the candidate need to clearly and briefly describe it and explain how it was applied in this research. The main explanatory variable and other control variables analysed ought to have been classified as either pre-disposing or enabling factors. There is a contradiction that must be corrected. Candidate was claiming that a model proposed in 1973 built on a framework designed in 2014. This is a mix up which the candidate has to resolve.

Chapter 3: Methodology

Sample selection: The World Health Organisation recommends that immunisation be assessed among children aged 21-23 months. Candidate should clearly justify the selection of those age 12-60 months in this study.

What was described in section 3.2 was not study setting but data source and sampling design. Either the sub-heading is changed or the content is revised.

The first 2 lines of section 3.6 should be moved to data source. Section 3.6.2 was wrongly labelled control variable instead of independent variable. The description therein was about the main explanatory variable—family structure. I wonder if religion can be referred to as a socio-economic variable. Candidate should revise the description of the categories used for

maternal education. The use of the phrase “at least” implies that all the categories will overlap.

Results

The results were clear and correctly interpreted.

Discussion

Finding was properly discussed in lieu of the extant literature. The candidate is advised to use current citation (see page 41 for refs dated back as far as 1992, 1998 and 1993). The assertion in the first 3 lines of paragraph 2 page 42 should be placed in proper context and supported by literature. For example, is son preference well documented in Ethiopia? That’s what the first sentence implied.

Candidate should reflect on why the higher odds of childhood immunisation among children in polygynous households were not statistically significant. I suspect it is due to small sample size (this is evidenced from the confidence interval for the odds ratio). There should be some discussion about this.

Candidate should consider the possibility of peer influence and healthy competition among co-wives as an explanation for higher odds of immunisation for polygynous children.

Recommendations

Many of the policy recommendations suggested by the candidate were not premised on the study findings. These should be removed. Recommendation ought to come from results.

List of corrections effected to the MA: Demography and Population Studies research report titled "Polygyny and childhood immunisation in Ethiopia: is there an association?"

I have gone through the comments of both examiners and believe that they are a fair assessment of the research report. I have effected changes where due and necessary and I have noted the invaluable suggestions and inputs offered for future use. They will certainly be of colossal benefit.

Examiner 1

General point:

The term "polygyny" in the place of "polygamy" has been consistently used throughout the report in line with the data and variables used in the analysis.

Abstract:

References have been removed from the background section of the abstract.

Write-up has been revised to demonstrate that knowledge gap referred to in this report is specific to Ethiopia and not to Sub-Saharan Africa generally.

The statement "…a polygamous family structure has a positive effect on childhood immunisation" has been revised to "a polygynous family structure is not a significant determinant of childhood immunisation", this is in line with the findings of the report.

Chapter 1: Introduction

More recent references have been cited.

Chapter 2: Literature review

2.1.1 Section has been logically divided into subsections with relevant headings; "socio-economic factors" is now subdivided to 2.1.1 Family structure and childhood immunisation, 2.1.2 Type of place of residence, 2.1.3 Poverty status, and 2.1.4 Religion.

2.1.2 Nature of association between maternal age and childhood immunisation has been clearly scrutinised and substantiated with the relevant literature.

The sentence "numerous studies have confirmed this relationship" has been corroborated with supporting references.

2.1.3 The statement that claims “son-preference is well documented in many societies” has been revised to reflect that it is well-documented in South East Asian countries and not so much in the Sub-Saharan Africa. Substantiating references has been included.

The sentence stating that “evidence on the relationship between sex of a child and immunisation coverage is inconclusive” has been deleted.

2.2 Theoretical and conceptual framework

The theoretical framework has been revised. A modified version of Andersen-Newman (Andersen, 1968, 1995; Andersen & Newman, 1973) behavioural model of health services utilisation has been adapted and applied into the report. A brief description of the model and an explanation of how it was been used in the report has been included.

The independent variables in the study have been reclassified as predisposing characteristics, enabling resources or need factors as per the Andersen-Newman behavioural model of health services utilisation.

Chapter 3: Methodology

The selection of children aged 12-60 months in this study instead of the standard practice of 12-23 months has been clearly explained and justified.

Sub-heading 3.2 has been correctly revised; it has been labelled “data source and sampling design”.

The first 2 lines of section 3.6 (“To achieve the study objectives, this study made use of the children’s recode file which consisted of all the household and maternal variables needed. SAS Base 9.4 was used to recode the two main variables (immunisation status, household structure) of the study”) have been moved to section 3.2 (Data source and sampling design).

Section 3.6.2 has been labelled “independent variables” instead of “control variable” and sub-heading “3.6.3 independent variables” has been deleted and the content there-in has been added to sub-heading 3.6.2.

Religion has been correctly classified as a predisposing characteristic in line with the revised theoretical framework and not a socio-economic factor.

The description of the categories used for maternal education has been revised from “at least primary” and “at least secondary” to “primary” and “secondary” respectively.

Discussion

Recent references has been cited in the discussion.

The assertion that “son preference is well documented in Ethiopia” has been revised and relevant literature has been cited which reflects that actually a limited number of studies have systematically examined the phenomenon in the Ethiopian context.

A discussion on why the higher odds of childhood immunisation among children in polygynous households were not statistically significant has been incorporated.

A detailed discussion on the possibility of healthy competition and cooperation among co-wives as an explanation for higher odds of immunisation for children in polygynous households has been added to the discussions.

Recommendations

Policy recommendations have been revised and are now closely premised to the study findings.

Examiner 2

The conclusion has been aligned to the findings in this study. Results showed that although a polygynous family structure is not a significant determinant of childhood immunisation; it does however have a positive effect on it.

Literature has been updated and results have been correctly interpreted.

As much as the examiners comments were contradictory in terms of the interpretation of the results I sincerely hope that I have sufficiently addressed all the issues raised by both the examiners.

Thank you.

Regards
Johan Sibiya