ADDIS ABABA UNIVERSITY

OFFICE OF GRADUATE STUDIES

DEPARTMENT OF STATISTICS

DETERMINANTS OF FAMILY PLANNING PRACTICE IN ETHIOPIA

By

Nibret Alene

A Thesis submitted to the Office of Graduate Studies of Addis Ababa University in Partial fulfillment of the requirement for the Degree of Masters of Science in Statistics

June 2010
Addis Ababa, Ethiopia

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DECLARATION

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

Name: Nibret Alene

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Place of submission: Department of Statistics, College of Natural Sciences, Addis Ababa University

Date of submission: June, 2010

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

Prof. Eshetu Wencheko **---------------------------------**

Advisor's Name signature

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ABSTRACT

This study is an attempt to identify socio-economic, demographic and proximate predictors of couples practice of family planning in Ethiopia. In this study the data source is the Ethiopian Demographic and Health Survey conducted in 2005(EDHS 2005) by the Central Statistical Agency (CSA). From the analysis of the data it was found that “visit by family planning (FP) workers in the last 12 months”, “discussing FP with partner”, “husbands/partners approval of a method”, “exposure to information from mass media”, “educational level of women”, “partners education level”, “number of living children”, “age of a woman”, “occupation of a women and that of her partner” are the most important factors that influence the practice of FP by couples at national level.

In demographic studies, large-scale surveys often follow a nested structure of data because information is collected at different levels of hierarchy. It is thus necessary to elicit the inherent variations, which occur between different levels. In order to explore this idea, multilevel logistic regression analysis has been employed.

The random coefficient model for the selected few predictor variables (“Place of residence”, “visit by family planning (FP) workers in the last 12 months”, “discussing FP with partner”, “husbands/partners approval of a method” and “exposure to FP information from mass media”) are significant determinants for practice of family planning, and these vary from region to region. The analysis showed there is difference in the status of couples on FP practice that depend on place of residence.

Key words: Family planning, couples practice, multilevel logistic regression model.

CHAPTER ONE

1 INTRODUCTION

1.1 Background

The continuing growth of the world population has become an urgent global problem. Most of this growth is occurring in developing countries where the fertility rate is very high (Bandura 2002; Merrick 2002; Potts 2000; Ross & Winfrey 2002; WHR 2005). Ethiopia, like most countries in sub-Saharan Africa, is characterized by high fertility and rapid population growth. It stands third after Nigeria and Egypt in this respect (Fitaw et al. 2003). Total fertility rate (TFR) declined by one birth per woman (or about 15 percent) from 6.4 births in 1990 to 5.4 births in 2005, but that rate remains critically high in a country already burdened by severe poverty and resource depletion. Under-five childhood mortality declined by about 25 percent, from 166 per 1,000 in 2000 to 123 in 2005. Maternal mortality declined by about 23 percent from 871 per 100,000 in 2000 to 673 in 2005(Mizanur et al., 2007).

In most developing countries in general, and in sub-Sahara Africa in particular, the problem of population growth and reproductive health challenges include - high maternal mortality, high population growth rate, total fertility rate and much unmet need for family planning in the world. The situation in Ethiopia is still much worse than most African countries (Ethiopia Trend Report (ETR; 2007)). In spite of the fact that family planning service delivery facilities and other supplies have increased in number in the country, a significant portion of the Ethiopian population is still living in abject poverty.

The high population growth creates a hindrance to economic development of the country. Urbanization in the country is at a very low stage with 15 percent of the population residing in urban areas and the rest living in rural areas. A substantial segment of the population is under poverty line. The population living on less than USD1 per day accounts for 31 percent of the population (MOH, 2001).

Family planning is the practice of a couple to prevent or avoid unwanted birth and control the spacing between child birth to help create a small and planned family. It is the best way to control the rapidly and massively growing population. So, family planning contributes to promote the health and welfare of the family and thus contribute effectively to the social development of a country. The health of mothers is not only affected by nutrition status but also by early marriage, frequent pregnancies, early motherhood, abortion etc. Moreover, the health of a child is also affected by the mother's health status. In this context family planning provides advices and methods to avoid the above events.

Family planning is essential to the well-being of women, men, adolescents, and the community at large. It offers women opportunities to plan and space pregnancies in order to achieve personal goals and self-sufficiency.

The controversy over abortion has influenced family planning programs and also had implications for women's health. To appreciate how the controversy has affected family programmes, some background on the relationship between family planning programmes and abortion is useful. From the earliest days of family planning programs, prevention of abortion to reduce related maternal mortality and morbidity has been an important part of the health rationale for promoting contraception (Seltzer J., 1998). Abortion is illegal in Ethiopia; studies indicate that abortion is widespread and generally performed by untrained persons. The work of Planned Parenthood Federation of America (PPFA) in Ethiopia focuses on reducing maternal death and disability by preventing unintended pregnancies and increasing the availability of affordable, safe abortion services. Despite the decriminalization of abortion, many medical providers are not offering services due to discomfort, lack of knowledge about the law, or lack of skills. According to Planned Parenthood, Ethiopia has among the highest fertility and maternal death rates in the world. Approximately 1 out of every 7 women die from pregnancy or abortion related complications. Ministry of Health (MOH, 1996) of Ethiopia provide family planning services to 8.5 million women across the country during the next years. If the program fully implemented, the plan will definitely have a positive ripple effect across the Ethiopian society.

Although family planning tools are available in Ethiopia, access to them has been a major hindrance for the majority of the women. Planned Parenthood states that only 13% of Ethiopian women - and only 4% in rural areas - use modern contraception. This is despite the fact that, as studies show, approximately 60% of the women in the country approve family planning. Undoubtedly, improved access to family planning and other reproductive health services in the country could significantly combat the incidence of maternal mortality and improve the state of women. Comprehensive, high-quality sexual reproductive services can help to prevent the unnecessary deaths of women in the country. "Traditionally, women in Ethiopia have been consigned to strict societal roles, based on cooking, raising children, and a muted voice in decisions affecting them," says World Bank (2001).

Family planning methods vary according to their convenience, cost, effectiveness, side effects, risks, and benefits for the individual. Family planning users are best able to evaluate the relative importance of these factors based on their preferences; their desired family size; stage of life which is period in the development of progress; goals of delaying, spacing, or limiting future pregnancies; health status; relationship status; and living conditions. Family planning costs are often treated as a minor issue in parents' decision making. In the developing world, 137 million women who do not want to get pregnant are not practicing contraception. The key cause of this unmet need for contraception is that contraception is often quite costly to individuals in terms of commodities (pills, condoms, IUDs, etc.), transportation, and provider fees for contraceptives and health care services, even when subsidies are provided by the government. In addition, there are significant non-economic costs, such as health concerns, social disapproval and spousal resistance, as well as unnecessary medical barriers (e.g., requiring a doctor instead of a nurse or other trained health care workers to provide contraceptives). This unmet need is in turn responsible for most of the 76 million unplanned pregnancies that occur each year. About half of these pregnancies end in abortion and the other half end in births; both contribute unnecessarily to health risks for mothers and children, to the cost of raising families and to the adverse impact of population growth (Bongaart et al., 2009).

More than 40 years ago, Congress authorized the US Agency for International Development to start working on family planning and population issues. Over the ensuing decades, while contraceptive use in the developing world increased from 10 to 60 percent of married couples and average fertility declined from about six to three children per woman. USAID was the source of the majority of the money, information and ideas in the field of family planning (Levine., 2007). High rates of population growth are largely the result of frequent childbearing or high fertility often corresponding with a large unmet need for family planning (FP). In Ethiopia, women have, on average, about five children and surveys show that the unmet need for family planning services is high (35 percent of married women of reproductive age want to space or limit births but are not currently using any method of family planning) . If access to family planning services was increased, this unmet need could be met, therefore slowing population growth and reducing the costs of meeting the MDGs (USAID, 2007).

Many countries have introduced family planning programs since the 1960s. The resources devoted to them and hence their fertility impacts have varied widely. The aggregate effect of all these efforts has been substantial: Fertility declined in the developing world from more than six to fewer than four births per woman between 1960–1965 and 1985–1990, and almost half of that decline 43% (i.e. in the year between 1960-1965 it is at least six births but in between 1985-1990 it is fewer than four births) is attributable to family planning programs. Voluntary family planning programs are intended to reduce the number of unplanned pregnancies, but they also legitimize and diffuse the idea of smaller families, thus accelerating the transition to lower fertility. This is important in countries where women still want large families. In such populations, there will have to be declines in the number of children desired before sustained fertility decline can occur. Desired family size is highly responsive to improvements in human development, in particular in female education and child survival (Bongaart et al., 2009).

The benefits of family planning extend beyond slowing the pace of population growth. By using contraception, women can avoid the high risk of poorly timed pregnancies that jeopardize their health and that of their children. For instance, children spaced three to five years apart are more than twice as likely to survive to age five than are children born within two years of a sibling.
The poorest countries, beset by high maternal and child mortality rates, have the most to gain from family planning's health benefits. One estimate suggests that meeting the unmet need for modern contraception among women in less developed countries could prevent 1.4 million infant deaths and 142,000 maternal deaths each year (Population Reference Bureau, November 2004).

There is a safe and effective family planning method for every woman that can enable her to protect her health and that of her children. More than half of all couples in the developing world are using family planning to delay, space, or limit future pregnancies, yet the need for family planning keeps increasing as the number of women of reproductive age continues to grow. An estimated 137 million women worldwide have an unmet need for family planning—they are not using any method and report that they want to avoid a pregnancy (Rhonda *et al.*, 2009).

1.2 Statement of the Problem

Many demographers and scholars believe and recommend the need to conduct in-depth studies on the various aspects of family planning (FP) practice of couples in different demographic, economic and socio-cultural settings in developing countries. This study attempts to explore the major socio-economic, demographic, cultural and environmental factors that affect awareness and practice of women and men about family planning in Ethiopia.

A major debate in the recent literature is that a major justification for the less than ideal family planning performance in sub-Saharan Africa is the neglect of men in that endeavor. Almaz Terefe and Larsen (1993) have shown that modern contraceptive use improved significantly when husbands were involved in family planning interventions in Ethiopia. In fact, in many cultures men often have more power than women in decision making with regard to use of contraceptive and the number of children that the couple will have (McCauley *et al.,* 1994).
Husband's approval of family planning is an influential factor to women's contraceptive use behavior. Many women do not use contraceptive since their husbands disapprove of using contraception. In seven sub-Saharan countries, contraceptive use among women whose husbands disapprove of family planning averaged only one third as much as among women whose husbands approve of it (Robey *et al.*, 1996).

Recently family planning programs and providers are seeing that involving men in addition to women in family planning results in an improved program effectiveness. The 1994 International Conference on Population and Development also encouraged family planning programs and providers to consider both men and women jointly. This new interest in men is in consideration that although most reproductive health burden is born by the women, the majority of the decisions that affect both women and men reproductive health are made by men or by men and women jointly. And also if men are involved they may be a potential partner in and advocates for good reproductive health rather than bystanders, barriers, or adversaries. According to the guidelines for family planning services in Ethiopia, family planning is a means of promoting the health of women and families. Accordingly, all individuals male or female who can conceive or cause conception regardless of age or marital status are eligible for family planning services in the country. Also this study shares the idea and the main reason behind the need to study the socio-economic, demographic and cultural determinants of couples to practice family planning methods.

So far, there are very few studies conducted on the practice of men and women jointly about family planning methods in Ethiopia particularly on the effects of economic, demographic and socio-cultural factors. There is still a need to educate and motivate couples and improve family planning services to achieve more effective and appropriate use of contraceptives and to arrest the trend towards increase in population.

1.3 Objective of the study

General objective of the study

The general objective of this study is to examine factors that influence practice of various available family planning methods by married couples (men and women) in Ethiopia. Also, the study examines the regional differences about status of family planning practice.

Specific objectives of the study

1) To identify socioeconomic, demographic and cultural determinant of couples practice and awareness about family planning methods based on DHS (2005) for rural, urban and national level.

2) To select the most important factors that are associated with couples practice of the family planning methods based on EDHS.

3) To analyze within and between regional level differences by identifying the determinant factors for the married couples to practice the family planning methods in Ethiopia.

1.4 Significance of the Study

The findings or results obtained from this research could be useful in many ways. Governmental and non-governmental organizations could take intervention measures and set appropriate plans to reduce and improve the existing level of awareness and practice of family planning by identifying and giving priority for the areas which have low and poor practice.

The findings could also be helpful for policy making, monitoring and evaluating the activities for the government and different concerned agencies. And it helps individuals (women and men) to have enough knowledge about the practice of family planning. It is hoped that this study could contribute to the improvement of family planning services in the country through appropriate service delivery approaches and strategies.

1.5 Limitation of the study

The data used here being secondary may have a number of limitations on the outcome of this study.

- ❖ The study is based on couples status of FP practice at the time of survey.
- ❖ Limited literature on Ethiopia related to the subject.
- ❖ In the analysis of data using multilevel logistic regression, a student version of LISREL software is used which is restricted to handle few explanatory variables. Because of this, only a limited number of predictor variables are used in multilevel logistic regression analysis.
- ❖ The study did not identify the status of family planning practice of women and men separately.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Overview of Family Planning

The widespread adoption of family planning represents one of the most dramatic changes of the 20th century. The growing use of contraception around the world has given couples the ability to choose the number and spacing of their children and has had tremendous life saving benefits. Yet despite these impressive gains, contraceptive use is still low and the need for contraception is high in some of the world's poorest and most populous places (Rhonda *et al.*, 2009).

Family planning is defined as birth spacing, preventing unwanted pregnancies or secure wanted pregnancy (WHO, 1995). Family planning is adopted voluntarily through the practice of contraception or other methods of birth control on the basis of knowledge, attitude and responsible decision by individuals and couples, in order to promote the health welfare of the family and contribute to the social and economic development of the country.

Comparative studies conducted in DHS-surveyed countries during 1986-1989 have shown that despite the relatively high fertility rate in Africa, women's feeling about desired future fertility indicate that in several countries a decline in fertility could possibly happen. Indeed, in some African countries (e.g. Kenya, Mali, Togo and Uganda) the projected declines equal or exceed those in lower fertility areas in which family planning services and information are already much better established, such as in North Africa and Latin America (Sinding, 1994).

Shane (1997) and Bandarage (1997) have pointed out that the majority of people in developing countries are reluctant to use modern contraceptives even when they have a widespread knowledge to the benefits obtainable from family planning due to many social, economic, and cultural reasons. This indicates that couples in developing countries are unable to regulate fertility because of various social, economic, cultural, psychological and demographic reasons. Thus, at present development programs that focus on women empowerment as a poverty reduction strategy are accepted as a quick fix solution of population growth and economic development United Nations Fund for Population Activities (UNFPA, 1999).

In most countries surveyed by the Demographic and Health Surveys (DHS), between 20% and 30% of all married women of reproductive age have an unmet need for family planning. Outside sub-Saharan Africa, most women with an unmet need do not want to have any more children. In sub-Saharan countries surveyed, most unmet need is for spacing births. Most couples want to plan their families, when they have the opportunity to do so. Women everywhere want to avoid unintended pregnancies. Young and unmarried people want to avoid the consequences of unprotected sexual relations, both pregnancy and sexually transmitted diseases (Rhonda *et al.*, 2009).

2.1.1 Situation of family planning in the world

The era of modern contraception began in the 1960s, when both the birth control pill and intrauterine contraceptive device (IUCD) became available. These effective and convenient contraceptive methods resulted in widespread changes in birth, fertility and demography in the United States. Since 1972, the average family size of United States had leveled off at approximately two children, with increasing safety, efficacy, diversity, accessibility and use of contraceptive methods (Forrest, 1994).

China established a one-child policy in 1979 in order to keep the total population at fewer than 1.2 billion by 2000. The Chinese population in mid-2000 is estimated at 1.265 billion (Population Reference Bureau, 2000). Despite an official national policy stating that family planning program is voluntary, not compulsory, and that people are persuaded but not forced to practice birth control, a system of mandatory fertility control was instituted in China. Couples had little choice about whether they practiced birth control, how many children they would have, and the timing of births. Family planning contracts that include a one-child pledge were required of couples. Births were either approved as part of the local government's birth plan or they were forbidden and outside the official birth plan. A practice of requiring use of specific contraceptive methods was also instituted in which women with one child had to use an IUD, couples with two children had to have one partner sterilized, and those with unauthorized pregnancies had to undergo abortion. Thus the primary methods of fertility regulation used to implement the program were sterilization, IUD, and abortion, and women or couples had little choice of which method to use.

Throughout the 1980s, the Chinese program was characterized by regulations, and guidelines were established at the national level and then "prescribed to provincial and lower levels of government and ultimately to couples of childbearing age" (Hardee-Cleaveland and Banister, 1988). Family planning was rarely considered a personal matter. China is the prime example of a program driven to achieve collective welfare by reducing population growth, but which sacrificed individual rights and welfare through an essentially involuntary program. While the one-child policy was not uniformly implemented in all areas of China—particular exceptions pertain to rural areas and ethnic minorities—it was nevertheless the driving force of the family planning program (Hardee-Cleaveland and Banister, 1988).

Between 1990 and 1994, the global average contraceptive use by married women of reproductive age, that is ages from 15 to 49, rose from 57% to 60% (Hamilton, 1997). The introduction of combined oral contraceptive pill also brought about the sexual revolution in the West, where it was possible for sex without any fear of pregnancy. Worldwide, however, there are still unmet needs especially in developing countries, where a scarcity of resources and information, cultural and political barriers, and societal attitudes or misconceptions, conspire to exact a heavy toll on all women health, with unwanted pregnancies, unsafe abortions, maternal mortality and HIV infection still leading causes of death of women. Even in developed countries, the situation is far from ideal and policies and provision of services vary considerably within each country. Unwanted side effects, inconvenience of the chosen method, and media scares about safety of modern contraceptives are some of the issues that limit their acceptability. Poor contraceptive use is further compounded by ignorance among users and providers of a wide range of methods available now and likely to be so in the future. Giving women reproductive autonomy through comprehensive and up-todate information about all methods is vital for successful and long-term use of contraception (Kubba *et al.*, 2000).

2.1.2 The situation of family planning in developing countries

The history of family planning programs in the developing countries partly originates with concern about a "world population problem". In the late 1940s and 1950s, the phenomenon of rapid population growth, resulting from the gap between declining mortality and continuing high fertility, was emerging in some South and East Asian countries. The results from postwar censuses of the early 1950s provided the initial evidence that population growth could be an impending problem. By the mid-1960s, more countries, including a number in Latin America and the Middle East, were experiencing unprecedented rates of population growth of more than 3 percent annually. The implementation of voluntary family planning programs has been the principal policy initiative pursued by governments in the developing world that wish to reduce population growth. The major justification for this programmatic approach is an unfulfilled demand for family planning that presumably exists in many populations (Bongaarts, 1990).

The effectiveness of family planning was premised on the assumption that couples in developing countries wanted fewer children, and that to achieve smaller families, they would practice contraception. The evidence supporting this assumption has come from surveys that have been carried out since the 1960s. The surveys of women and couples provide information about their attitudes regarding desired family size, whether they wanted to have additional children and if so when, and contraception. Over more than 35 years, these surveys have shown that a large proportion of couples had favorable attitudes toward contraception and that many couples wanted no more children. The surveys also showed that among those not wanting no more children, many were not practicing family planning methods. The discrepancy between women's stated preferences for children (both the number and the timing) and their actual contraceptive use is referred to as the "Unmet need" for family planning. Reducing or filling this unmet need has been an objective of family planning programs for many years (Seltzer, 1998).

In Ethiopia family planning was initiated in 1960's. However even after such a long period of time the level of family planning in Ethiopia is amongst the lowest in Africa with contraceptive prevalence rate (CPR) 15% and unmet need for family planning is very high 36% (CSA, 2005). Several factors had been incriminated for the low coverage of family planning services. The reasons include desire to have more children, lack of knowledge about contraceptive use and where to find contraceptives, health concerns, religious prohibition, husband opposition and low involvement of men (Tularo *et al.*, 2006).

2.1.2.1 Socio-economic factors

The factors associated with family planning practice can be divided into personal, demographic, socio-cultural, religious, economic, and health services. Among the personal factors associated with family planning practice are knowledge of family planning methods and influence of family members and friends, especially those who have experience in family planning methods. Demographic factors such as parity, age, marital status, religion of a woman, husband's education, husband's occupation, monthly family income, and woman's occupation are also known to be associated with family planning practice.

Among the socio-economic factors that may affect the practice of family planning methods by married couples are place of residence, work status/occupation, education level of women, partner's education level, visited by FP worker in the last 12 months are considered to be important (Daniel, 1995).

High fertility and rapid population growth have an impact on the overall socio-economic development of a country in general and maternal and child health in particular. Maternal and child mortality are two of the major health problems challenging healthcare organizations, especially in developing countries. The majority of maternal deaths are the direct result of complications encountered during pregnancy and arising from unsafe terminations (Gaym 2000; Merric 2002; Population Reports 1999). The World Health Report (WHR 2005) noted that unwanted, mistimed and unintended pregnancy is the most common cause of maternal mortality in developing countries. The Ethiopian demographic and Health survey (DHS 2000) identified that one in four deaths among Ethiopian women in the period 1994–2000 was due to a pregnancy or pregnancy-related cause. One of the reasons for this is lack of skilled healthcare personnel attending births. The WHR (2005) reported that in 2000 only 6% of births in Ethiopia were attended by an appropriately skilled person. However, there is also evidence to suggest that up to 100,000 maternal deaths could be avoided each year if women who did not want children used effective contraception (Marston and Cleland 2003). Children with many siblings are less likely to enter and remain in school and more likely to have poor health and high mortality rates as compared with children who have fewer siblings (Asefa et al. 2000; Merrick 2002; Population Reports 1999). This problem in the developing world is disproportionately higher than in the developed world. For example, in Ethiopia, mortality rates under the age of 5 years for the 1996–

2000 period were 166 per 1000 live births (WHR 2005). The issue of family planning clearly has implications for the planning and development of educational and healthcare policies and strategies. Pregnancy, poor health and nutritional status, communicable diseases, high workload, early marriage, high fertility, inadequate access to and underutilization of health services, and the low status of women in the society are among the many underlying causes of maternal mortality (MOH, 1996).

Birth control is a priority in Ethiopia and many programmes to increase contraceptive practice have been implemented by the Ethiopian National Population Policy since 1993. However, the problem of high fertility and low contraceptive practice remains unresolved. The total fertility rate of the country for the year 2000 was found to be 5.9 children per woman and the contraceptive prevalence was only 8%. This is too low to affect the fertility levels significantly (DHS 2000; Fitaw et al. 2003), and the fertility rate of the country actually increased to 6.1 children per woman for the year 2003 (WHR 2005). High population growth prevents the long-term socio-economic development needed to alleviate poverty and to meet the immediate basic needs of the burgeoning population (Bandura 2002; Merrick 2002). Accurate and specific data about the reason behind the low contraceptive practice in a country should be available in order to develop an effective and relevant family planning strategy.

In most developing countries, especially in Sub-Saharan Africa, promoting family planning through radio and television is an important means of raising awareness, improving knowledge, and motivating use of modern contraceptive methods (ETR, 2007). In most countries regular exposure to mass media has a positive effect on use of contraceptive. In relation to Ethiopia, a study based on DHS (2005) indicated that family planning information is largely disseminated through radio with limited dissemination through television or print media. According to EDHS (2005) 29 percent of women heard about family planning on radio compared with only 11 percent of women who get family planning information from television and 8 percent who got such information from newspapers or magazines.

2.1.2.2 Demographic factors

Various studies identified different demographic variables as influential in the practice of family planning methods by couples in Ethiopia. These variables among others include age, number of living children and lack of exposure to the risk of pregnancy. The social cognitive theory for social change was used as a theoretical framework because it helps to understand and explain how social and cultural norms, values, people’s beliefs, behaviors, gender roles and social networks influence people’s choices about family planning (Bandura, 2002).

According to Bandura (2002), one of the important components of social cognitive theory is efficacy belief. It plays an important role in the adoption of change and regulates human functioning through cognitive, motivational, affective and decisional processes. Bandura (2002) states that among the mechanisms of self influence for change, none is more central or pervasive than beliefs in one’s efficacy to exercise control over one’s functioning and events that affect one’s life. This core belief system is the foundation of human motivation and accomplishments. Unless people believe they can produce desired effects by their actions they have little incentive to act or to preserve in the face of difficulties whatever other factors serve as guides and motivators, they are rooted in the core belief that one has the power to effect changes by one’s actions. However, in many spheres of life, people do not live their lives independently. They depend on those who have power and resources, and they act according to the desires of the powerful (Bandura 2002; Hogan et al. 1999; Nagase, 2003).

Furthermore, low socio-economic, occupational and educational status, and cultural and community norms affect behavior through their influence on people’s sense of control over their own lives (Bandura 2002; Hogan et al. 1999). This is particularly true in the use of contraception, which is subject to strong social and normative constraints. Therefore, assessment of the various socio-economic, demographic and cultural variables that contribute to low contraceptive practice is essential for promoting the use of contraception and lowering the birth rate.

According to Sayed et.al (1986), the need for family planning is positively related with the number of surviving children. The percent in need increases with the number of living children. For instance in Egypt, out of those women with no living children, only 3 percent were in need of family planning while 35 percent of the women with seven or more living children were in need . In the case of Mali the same result was observed. The intention among non-users to start contraception soon rose from 7.7 percent for those with no children to 14.7 percent for those with four surviving children (Bongaarts, 1990). Similar results were recorded by Sathara and Chictambara (1984). For African and Asian countries, some studies have found relatively highest contraceptive use mostly among women with four or more children (Sathara and Chictambara, 1984). With regard to Ethiopia, a study based on 2005 EDHS indicated contraceptive use is highest among currently married women with one or two children (17%) and lowest among women with no children (12%).

CHAPTER THREE

3 DATA AND METHODOLOGY

3.1 Data source

The source of data is the 2005 Ethiopia Demographic and Health Survey (EDHS) which is obtained from Central Statistical Agency (CSA). It is the second comprehensive survey designed to provide estimates for the health and demographic variables of interest for the following domains: Ethiopia as a whole, urban and rural areas of Ethiopia (each as a separate domain), and all geographic areas (nine regions and two city administrations), namely: Tigray, Affar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples (SNNP), Gambela and Harari regional states and two city administrations, that is, Addis Ababa and Dire Dawa. In the 2005 EDHS a representative sample of approximately 14,500 households from 540 clusters was selected. The sample was selected in two stages. In the first stage, 540 clusters (145 urban and 395 rural) were selected from the list of Enumeration Areas (EA) from the 1994 Population and Housing Census sample frame. In the second stage, a complete listing of households was carried out in each selected cluster. Between 27 and 32 households from each cluster were then systematically selected for participation in the survey.

All women age 15-49 who were either permanent residents of the households in the 2005 EDHS sample or visitors present in the household on the night before the survey were eligible to be interviewed. In addition, in a sub-sample of half of all the households selected for the survey, all men age 15-59 were eligible to be interviewed if they were either permanent residents or visitors present in the household on the night before the survey.

From among the 14,500 households, 14,717 women were identified as eligible for the individual interview. Interviews were completed with 14,070 women, yielding a response rate of 96 percent. Of the 6,778 eligible men identified in the selected sub-sample of households, 89 percent were successfully interviewed. Response rates were higher in rural than in urban areas, with the rural-urban difference in response rates most marked among eligible men. Thus, the analysis presented in this study on couples (women and men) about practice of family planning method is based on the 25,240 couples in Ethiopia.

3.2 Variables of the Study

3.2.1 The Response Variable

The response variable of this study is status of couples about family planning methods practice. For the analysis purpose practice of a couple about FP method covers modern, traditional and folkloric methods of contraception.

Among the methods, 'modern method' includes methods like Pill, IUD, Injectables, condom, LAM etc, 'traditional method' includes periodic abstinence, withdrawal etc and 'folkloric method' includes use of herbs etc. For our study purpose the response variable 'status of a couple about FP practice' is recoded as follows: those couple who are currently practicing any of the above three methods are coded as 1 and those who do not practice any method are coded as 0. The response variable for the i^{th} couple is represented by a random variable Y_i with two possible values coded by 1 and 0. In view of this, the response variable of the i^{th} couple Y_i was measured as a dichotomous variable.

$$Y_i = \begin{cases} 1, & \textit{if the } i^{th} \textit{ couple practice any FP method} \\ 0, & \textit{otherwise} \end{cases}$$

3.2.2 Explanatory Variables/factors

The explanatory variables considered for this analysis include current age of women, number of living children, education level of women, religion of women, place of residence, region, occupation of women, occupation of male partner/husband, partner's education level, current martial status, economic status of household, knowledge of FP method, visited by FP worker during the last 12 months, husband approves FP, discussed FP with partner and exposure to any mass media.

Table 3.1: Description of the variables and coding

The description of socioeconomic, demographic and other related variables with the practice of couples about family planning methods are presented below.

The Response variable

Variable	Representation of variable	Factor categories
Status of a couple about FP method practice (Practice)	Y	0= Do not practice a FP method 1= Practice a FP method

Explanatory variables

No.	Factors/ variables	Categories
1	Age of a woman (AGEW)	1=15-19 2=20-34 3=35-49
2	Place of Residence (RESIDE)	1= Urban 2= Rural
3	Region (REGION)	1=Tigray 2=Affar 3=Amahra 4=Oromiya 5=Somali 6=Ben-Gumuz 7= SNNP 8=Harari 9=Gambela 10=Dire Dawa 11= Addis Ababa
4	Occupation of a woman (OCCPW)	0=Not working 1=Non-Agriculture 2=Agric-employee
5	Religion group of a woman (RELIGION)	1=Orthodox 2=Protestant 3=Muslim 4=Others

6	Current martial status (CMS)	1=Married 2=Living together
7	Women's education level (EDUW)	0=No education 1=Primary 2=Secondary and higher
8	Occupation of a man (OCCPM)	0=Non-agriculture 1=Agric-employee
9	Exposure to any mass media (MEDIA)	0=No 1= Yes
10	Partner's education level (PartEdu)	0=No education 1=Primary 2=Secondary and higher
11	Economic status of household (WEALTH)	0=Poor 1=Medium and higher
12	Knowledge of a couple on a FP method (KnowMethd)	0= Knows no FP method 1= Knows a FP method
13	Number of living Children (Numchild)	0= No children 1= 1 or 2 children 2= Three or more
14	Discuss FP with partner (DiscPart)	0=Never 1=Once or more than
15	Visited by FP worker during the last 12 months (VisitedFP)	0= No 1= Yes
16	Male partner/Husband approves FP (HusApprov)	0=Disapproves 1=Approves 2=Don't know

3.3 The Methodology

3.3.1 The Logistic Regression Analysis

Logistic regression is a popular modeling approach when the dependent variable is dichotomous or polytomous as well. This model allows one to predict outcomes, from a set of variables that may be continuous, discrete, dichotomous, or a mix of any of these. Hosmer and Lemeshow (2000) has described logistic regression focusing on its theoretical and applied aspect.

Logistic model, as compared to its competitor, the probit model, is less sensitive to outliers and easy to correct a bias (Copas, 1988). In instances where the independent variables are categorical or a mix of continuous and categorical, logistic analysis is preferred to discriminant analysis (Agresti, 1996). The assumptions required for statistical tests in logistic regression are far less restrictive than those for ordinary least squares regression. There is no formal requirement for multivariate normality, homoscedasticity, or linearity of the independent variables within each category of the response variable. However, the assumptions that apply to logistic regression model include: meaningful coding, inclusion of all relevant and exclusion of all irrelevant variables in the regression model, low error in the explanatory variables, no outliers and sampling adequacy.

In the terminology of logistic regression analysis the odds of a success is defined to be the ratio of the probability of a success to the probability of a failure. Hence if p is the true success probability the odd of a success is *p/ (1-p).*

Let Y be a dichotomous outcome random vector with categories 1 (a couple practices a FP method) and 0 (a couple does not practice a FP method). Let X be an n x $(p+1)$ matrix denotes the collection of P-predictor variables of Y, i.e.

$$X = \begin{bmatrix} 1 & x_{11} & \ldots. & x_{1p} \\ 1 & x_{21} & \ldots & x_{2p} \\ . & \ldots\ldots\ldots. & & . \\ . & \ldots\ldots\ldots.. & & . \\ 1 & x_{n1} & \ldots. & x_{np} \end{bmatrix}$$

X without the leading column of 1s, is termed as predictor data matrix. Then, the conditional probability that the i^{th} individual couple practice any of family planning methods given the individual characteristics $\mathbf{X}_i$ is given by:

$$p_i = P(Y_i = 1 \mid x_i)$$

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

$$\text{logit}(p_i) = \log\left(\frac{p_i}{1-p_i}\right) \tag{3.1}$$

The transformed variable logit (p_i) is related to the explanatory variables as:

$$\text{logit}(p_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_p X_{pi} = X_i^{/}\beta. \tag{3.2}$$

where $\beta = (\beta_0, \beta_1, \beta_2, \ldots, \beta_p)^{/}$ are the model parameters and $X_i = (x_{0i}, x_{1i}, \ldots x_{pi})^{/}$

with $x_{0i} = 1, i=1,\ldots,n$

The probability of success can be expressed as

$$p_i = P(Y_i = 1 / x_{1i}, x_{2i}, \ldots, x_{pi}) = \frac{e^{X^{/}_i\beta}}{1+e^{X^{/}_i\beta}} \tag{3.3}$$

With further rearrangement we obtain the odds of success

$$\text{Odds}(Y_i = 1) = \frac{p_i}{1-p_i} = e^{X^{/}_i\beta} \tag{3.4}$$

The above three equations give suitable representations of log-odds, the success probability, and odds, respectively. Indeed, these representations facilitate interpretations of parameter estimates. The estimated logistic coefficients $\hat{\beta}_j$'s are interpreted as the change in the log-odds for every unit increase/decrease (depending on the variable change in x_i) holding other predictors constant. Hence, the odds of being in the category of interest for the i^{th} subject, namely $\frac{\hat{p}_i}{(1-\hat{p}_i)} = e^{X^{/}_i\beta} = e^{\hat{\beta}_j}$ represents the multiplicative factor by which the odds change for every unit change in x_i controlling for the other predictor variables, where $X_i = (0, 0,\ldots,1, 0,\ldots,0)$ with the 1 in the j^{th} position. For predictor variables having L levels ($L \geq 2$), interpretation can be made by making one of the L-levels as a reference category.

Regression methods have an integral component of any data analysis concerned with describing the relationship between a response variable and one or more explanatory variables. The estimated coefficients tell us the increased or decreased chance of status of couples practice about FP given a set of level of the determinant factors while controlling for the effects of other variables in the model. When the outcome variable is binary the logistic regression model can be used mainly for two reasons. The first is from a mathematical point of view, it is extremely flexible and easily used function. The second is, it leads itself to meaningful interpretation.

Multiple and multilevel logistic regression analysis is a methodology for analysis of data with complex patterns of variability, with a focus on nested sources of variablities on multiple categories. For this study the variation in FP practice by couples within regions means that not only unexplained variation between couples but also unexplained variation between regions. This can be expressed by statistical models with random coefficients.

3.3.1.1 Test of Goodness of Fit

Once a model has been developed, we would like to know how effective the model is in describing the outcome variable. This is referred to as goodness-of-fit. In testing the hypothesis that the model fits the data, the two common approaches are Pearson's X^2 statistic and the likelihood-ratio statistic G^2; see details in Agresti (1996).

The Hosmer-Lemeshow test is another alternative to check model fit. In this approach, data are divided into 10 groups. From each group, the observed and expected number of events will be computed. Then, the Hosmer-Lemeshow test statistic is given by

$$\hat{C} = \frac{\sum_{k=1}^{g}(O_k - E_k)^2}{V_k}, \tag{3.5}$$

where $E_k = nP_k$, $V_k = nP_k(1-P_k)$, g is the number of group, O_k is observed number of events in the k^{th} group, E_k is expected number of events in the k^{th} group, and V_k is a variance correction factor for the k^{th} group. If the observed number of events differs from what is expected by the model, the statistic $\hat{C}$ will be large and there will be evidence against the null hypothesis that the model is adequate to fit the data. This statistic has an approximate chi-square distribution with (g-2) degrees of freedom.

If the calculated value of the Hosmer-Lemeshow goodness-of-fit test statistic is greater than 0.05, we will not reject the null hypothesis that there is no difference between observed and model-predicted values, implying that the model estimates are adequate to fit the data at an acceptable level.

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

$$W = \frac{\hat{\beta}_i^{\,2}}{\operatorname{var}(\hat{\beta}_i)} \qquad (3.6)$$

For large sample size this statistic has an approximate chi-square distribution with one degree of freedom.

3.3.2 The Multiple Logistic Regression Analysis

Multiple logistic regression analysis is used to study the effects of each independent variable controlling other factors on the response variable, which is status of a couple to practice family planning.

An important aspect in multiple levels of analysis is the partitioning of unexplained variability over the various levels. The logistic regression can have an arbitrary number of parameters and terms in the model representing qualitative variables, quantitative variables and interaction terms in order to model a dichotomous or categorical outcome variable. When explanatory variables are included to model probabilities, a problem is that probabilities are restricted to the domain 0 and 1whereas a linear effect for an explanatory variable could take the fitted value outside this interval.

Three different models are fitted in this study to see the basic determinant factors for couples about practice of family planning methods in Ethiopia.

The first model is fitted to identify the socio-economic and demographic factors for couples to practice FP in urban Ethiopia. The second model demonstrates the socio-economic and demographic factors related to the practice of FP among couples in rural Ethiopia. Similarly, the third model identifies the factors which contribute for couples to practice FP practice at national level both in urban and rural Ethiopia.

Consider a collection of *k* independent variables which will be noted by the vector

X= $(x_1, x_2, ..., x_k)'$. Let the conditional probability that the outcome is present be denoted by P(Y=1| X) = p(X). Then the logit of the multiple logistic regression is given by the equation g(X) = $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k$

And the odds in favor of success for the multiple logistic regression will be

$$\log it\left[\frac{p}{1-p}\right] = \log\left[e^{g(x)}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \qquad (3.7)$$

in which case

$$\text{p(x)} = \frac{e^{g(x)}}{1+e^{g(x)}} = \frac{e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots+\beta_k x_k}}{1+e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots+\beta_k x_k}}, \qquad (3.8)$$

where a model parameters β_i will be interpreted as the change in the log-odds for a one unit increase in x_i, holding all the other predictor's constant, or after adjusting for the other predictors. In order to estimate the parameters, maximum likelihood-based iteration algorithms can be employed. Inspite of the attractive properties of the logit function, it is by no means the only suitable function for transforming probabilities to arbitrary real values. The general term for such a transformation function is the *link function*, as it links the probabilities (or more generally, the expected values of the dependent variable) to the explanatory variables.

3.3.3 Multilevel Logistic Regression Model

3.3.3.1 Two-Level Model

Basically, the two-level logistic model is equivalent to model (3.2) except for the notation in the outcome variable. Let y_{ij} be the binary outcome variable, coded '0' or '1', associated with level-one unit *i* nested within level two unit *j*. Also let p_{ij} be the probability that the response variable equals 1, and p_{ij} = Pr(y_{ij} = 1). Here, y_{ij} follows a Bernoulli distribution. Like the logistic regression the p_{ij} is modeled using the link function, logit. The two-level logistic regression model can be written as,

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 x_{ij} + u_{0j} \qquad (3.9)$$

where u_j is the random effect at level 2. Without u_j, Equation (3.9) can be considered as a standard logistic regression model. Therefore, conditional on u_j, the y_{ij}'s can be assumed to be independently distributed. Here, u_{0j} is a random quantity and follows N(0, δ_u^2).

The model (3.9) can be written as follows splitting up into two models: one for level 1 and the other for level 2.

$$\log it\,(P_{ij}) = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{0j} + \beta_1 x_{ij} \qquad \text{[model: level 1]}$$

and

$$\beta_{0j} = \beta_0 + u_{0j} \qquad \text{[model: level 2]}$$

The multilevel logistic regression model cannot be derived in the way the simple logistic regression model is derived.

A multilevel logistic regression model as a hierarchical model, can account for lack of independence across levels of nested data (i.e., individuals nested within groups). Conventional logistic regression assumes that all experimental units are independent in the sense that, for example, any variable affecting dropout from contraceptive use, has the same effect in all groups. Multilevel modeling relaxes this assumption and allows the effects of these variables to vary across groups.

Consider a population having two-levels. The basic data structure of two-level logistic regression is a collection of N groups (units at level-two (regions)) and within group *j* (*j*=1, 2,…, N) a random sample of n_j level-one (couples) units. The outcome variable is dichotomous and denoted by Y_{ij} (i=1,2,…,n_j, j=1,2,…,N) for level-one unit *i* in group *j*. The outcomes are supposed to be coded 0 and 1: 0 for 'failure', 1 for 'success' or vice versa. The total sample size is $M=\sum_{j=1}^{N} n_j$. If one does not take explanatory variables into account, the probability of success is assumed constant in each group. Let the success probability in group j be denoted by p_j. The dichotomous outcome variable for the individual *i* in group *j*, Y_{ij}; which is either 0 or 1 can be expressed as the sum of the probability in group *j*, p_j (the average proportion of *j* levels in group *j*, E (y_{ij}) = p_j) plus some individual-dependent residual ε_{ij}, that is, $Y_{ij} = p_j + \varepsilon_{ij}$ the residual term is assumed to have mean zero and variance, $\mathrm{var}(\varepsilon_{ij}) = p_j(1-p_j)$.

Since the outcome variable is coded 0 and 1, the group sample average is the proportion of successes in group j given by

$$\hat{p}_j = \frac{1}{n_j}\sum_{i=1}^{n_j} Y_{ij}. \qquad (3.10)$$

$\hat{p}_j$ is an estimate for the group-dependent probability p_j. Similarly, the overall sample average is the overall proportion of successes, $\hat{p}.$, and is given by

$$\hat{P}. = \frac{1}{M}\sum_{j=1}^{N}\sum_{i=1}^{n_j} Y_{ij}. \qquad (3.11)$$

This is an estimate for the overall probability of success, $p.$ An estimator of the variance of p_j can be obtained by using

$$\hat{\tau}^2 = S^2{}_{between} - \frac{S^2{}_{within}}{\tilde{n}}, \qquad (3.12)$$

where

$$\tilde{n} = \frac{1}{N-1}\left\{ M - \frac{\sum_{j=1}^{N} n_j{}^2}{M} \right\}$$

$S^2{}_{between} = \frac{\hat{P}.(1-\hat{P}.)}{\tilde{n}(N-1)}\hat{C}$, where $\hat{C}$ is as given by equation (3.5), and

$$S^2{}_{within} = \frac{1}{M-N}\sum n_j P_j (1-P_j).$$

3.3.3.2 Heterogeneous Proportion

For the proper application of multilevel analysis the first logical step is to test heterogeneity of proportions between groups. Here we present two commonly used test statistics that are used to check for heterogeneity. To test whether there are indeed systematic differences between the groups, the well-known chi-square test for contingency table can be used. In this case the chi-square test statistic is

$$X^2 = \sum_{j=1}^{N} n_j \frac{(\hat{P}_j - \hat{P}.)^2}{\hat{P}.(1-\hat{P}.)}. \qquad (3.13)$$

This statistic follows approximately chi-square distribution with N-1 degrees of freedom. The approximation is valid if the expected numbers of success and of failures in each group, $n_j \hat{P}_j$ and $n_j(1-\hat{P}_j)$, respectively, are at least 1 while 80 percent of them are at least 5 (Agresti, 1990). This condition will not always be satisfied, and the chi-square test then may be seriously in error. For a large number of groups the null distribution of the test statistic of the chi-square can be approximated by a normal distribution with the correct mean and variance (McCullagh and Nelder, 1989).

A second test of heterogeneity of proportions was proposed by Commenges and Jacqmin (1994). The proposed test statistic is

$$Z = \frac{\sum_{j=1}^{N} \left\{ n_j^{\,2} \; (n_j \hat{P}_j - \hat{P}.)^2 \right\} - M\hat{P}.(1-\hat{P}.)}{\hat{P}.(1-\hat{P}.)\sqrt{2\sum_{j=1}^{N} n_j (n_j - 1)}}. \qquad (3.14)$$

The statistic, Z, follows the standard normal distribution for large value of M. Thus, large calculated values of this statistic are indication of heterogeneous proportions.

In the statistic Z the numerator contains a weight of $n_j^{\,2}$ where chi-square test uses a weight n_j. This shows that the two tests combine the groups in different ways. Hence, when the group sizes n_j are different, it is possible that the two test lead to different outcomes. The test statistic Z is shown to have high power over the chi-square test and it can be applied whenever there are many groups, even with small group sizes, provided that no single group dominates (Snijders and Bosker, 1999).

Multilevel logistic regression can be employed in the simplest case without explanatory variables, (usually called empty model) and also with explanatory variables by allowing only the intercept term or both the intercept and the slopes (regression coefficients) to vary randomly. Mainly the normal (multivariate normal) distribution is assumed for the varying coefficients. To keep the discussion on multilevel logistic regression models simple and taking into account the data to be analyzed in this study, we concentrate on the case of two-levels. The extensions to the case of three or higher levels is straight forward (Snijders and Bosker, 1999).

3.3.3.3 The Empty Logistic Regression Model: The empty two-level model for a dichotomous outcome variable refers to a population of groups (level-two units (regions)) and specifies the probability distribution for group-dependent probabilities p_j in $Y_{ij} = p_j + \varepsilon_{ij}$ without taking further explanatory variables into account. We focus on the model that specifies the transformed probabilities $f(p_j)$ to have a normal distribution. This is expressed, for a general link function $f(p)$, by the formula

$$f(p_j) = \beta_0 + U_{0j}, \qquad (3.15)$$

where β_0 is the population average of the transformed probabilities and U_{0j} the random deviation from this average for group *j*. If $f(p)$ is the $\log it$ function, then $f(p_j)$ is just the log-odds for group *j*. Thus, for the $\log it$ link function, the log-odds have a normal distribution in the population of groups, which is expressed by

$$\log it\ (p_j) = \beta_0 + U_{0j}, \qquad (3.16)$$

For the deviations U_{0j} it is assumed that they are independent random variables with a normal distribution with mean zero and variance σ_0^2.

This model does not include a separate parameter for the level-one variance. This is because the level-one residual variance of the dichotomous outcome variable follows directly from the success probability, as indicated by equation $\text{var}(\varepsilon_{ij}) = p_j(1-p_j)$.

Denote by π_0 the probability corresponding to the average value β_0, as defined by

$f(\pi_0) = \beta_0$

For the $\log it$ function, the so-called logistic transformation of β_0, is defined by

$$\pi_0 = \log istic(\beta_0) = \frac{\exp(\beta_0)}{1+\exp(\beta_0)}. \qquad (3.17)$$

Note that due to the non-linear nature of the $\log it$ link function, there is no a simple relation between the variance of the deviations U_{0j}. However, there is an approximate formula which is valid when the variances are small and is given by

$$\text{var}(p_j) = (\pi_0 (1\text{-}\pi_0))^2 \sigma_0{}^2. \qquad (3.18)$$

Note that an estimate of population variance var(p_j) can be obtained by replacing sample estimates of π_0 and $\sigma_0{}^2$. The resulting approximation can be compared with the nonparametric estimate, $\hat{\tau}^2$, given in equation (3.12).

3.3.3.4 The Random Intercept Logistic Regression Model: In the random intercept logistic regression model the intercept is the only random effect meaning that the groups differ with respect to the average value of the response variable. But the relation between explanatory and response variables can differ between groups in more ways.

The random intercept model expresses the log-odds, i.e. the $\log it$ of p_{ij}, as a sum of a linear function of the explanatory variables. That is,

$$\log it\,(P_{ij}) = \log\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_1 x_{1ij} + \beta_{2j} x_{2ij} + \ldots + \beta_k x_{kij}$$

$$= \beta_{0j} + \sum_{h=1}^{k} \beta_h x_{hij}, \qquad (3.19)$$

where the intercept term β_{0j} is assumed to vary randomly and is given by the sum of an average intercept β_0 and group-dependent deviations U_{0j}, that is

$$\beta_{0j} = \beta_0 + U_{0j}$$

As a result

$$\log it\ (p_{ij}) = \beta_0 + \sum_{h=1}^{k} \beta_h x_{hij} + U_{0j}, \qquad (3.20)$$

Solving for p_{ij}

$$p_{ij} = \frac{e^{\beta_0 + \sum_{h=1}^{k} \beta_h X_{hij} + U_{0j}}}{1 + e^{\beta_0 + \sum_{h=1}^{k} \beta_h X_{hij} + U_{0j}}}. \qquad (3.21)$$

Thus, a unit difference between the X_h values of two individuals in the same group is associated with a difference of β_h in their log-odds, or equivalently, a ratio of exp(β_h) in their odds. Equation (3.20) does not include a level-one residual because it is an equation for the probability p_{ij} rather than for the outcome Y_{ij} . The level-one is already included in (3.19).

Note that the first part of the right-hand side of (3.20), incorporating the regression coefficients, $\beta_0 + \sum_{h=1}^{k} \beta_h x_{hij}$ is the *fixed part* of the model, because the coefficients are *fixed.* The remaining part, U_{0j} , is called the *random part* of the model. It is assumed that the residual, U_{0j} , are mutually independent and normally distributed with mean zero and variance $\sigma_0^{\ 2}$.

3.3.3.5 The Random Coefficient Logistic Regression Model: In logistic regression analysis, linear models are constructed for the log-odds. The multilevel analogue, random coefficient logistic regression, is based on linear models for the log-odds that include random effects for the groups or other higher level units.

Consider explanatory variables which are potential explanations for the observed outcomes. Denote these variables by $X_1, X_2, \ldots, X_k$. The values of X_h (h=1, 2,…, k) are indicated in the usual way by X_{hij}. Since some or all of these variables could be level-one variables, the success probability is not necessarily the same for all individuals in a given group. Therefore, the success probability depends on the individual as well as the group, and is denoted by P_{ij}.

Now consider a model with group-specific regressions of $\log it$ of the success probability, $\log it\,(P_{ij})$, on a single level-one explanatory variable X,

$$\log it(P_{ij}) = \log\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{oj} + \beta_{1j} x_{1ij}, \qquad (3.22)$$

The intercepts β_{0j} as well as the regression coefficients, or slopes, β_{1j} are group-dependent. These group-dependent coefficients can be split into an average coefficient and the group-dependent deviation:

$$\beta_{0j} = \beta_0 + U_{0j}$$
$$\beta_{1j} = \beta_1 + U_{1j}$$

Substitution into (3.20) leads to the model

$$\log it(P_{ij}) = \log\left[\frac{P_{ij}}{1-P_{ij}}\right] = (\beta_0 + U_{0j}) + (\beta_1 + U_{1j}) x_{1ij}$$

$$= \beta_0 + \beta_1 x_{1ij} + U_{0j} + U_{1j} x_{1ij}, \qquad (3.23)$$

There are two random group effects, the random intercept U_{0j} and the random slope U_{1j}. It is assumed that the level-two residuals U_{0j} and U_{1j} have means zero given the value of the explanatory variable X. Thus β_1 is the average regression coefficient like β_0 is the average intercept. The first part of equation (3.23), $\beta_0 + \beta_1 x_{1ij}$, is called the fixed part of the model and the second part, $U_{0j} + U_{1j} x_{1ij}$, is called the random part.

The term $U_{1j} x_{1ij}$ can be regarded as a *random interaction between group* and X. This model implies that the groups are characterized by two random effects: their intercept and their slope. These two group effects U_{0j} and U_{1j} will not be independent, but correlated. Further, it is assumed that, for different groups, the pairs of random effects (U_{0j}, U_{1j}) are independent and identically distributed. Thus, the variances and covariance of the level-two random effects (U_{0j}, U_{1j}) are denoted as follows:

$$\text{var}(U_{0j}) = \sigma_{00} = \sigma_0^{\ 2}$$
$$\text{var}(U_{1j}) = \sigma_{11} = \sigma_1^{\ 2}$$
$$\text{var}(U_{0j}, U_{1j}) = \sigma_{01}$$

The model for a single explanatory variable discussed above can be extended by including more variables that have random effects. Suppose that there are k level-one explanatory variables $X_1, X_2, \ldots, X_k$, and consider the model where all X-variables have varying slopes and random intercept. That is

$$\log it\,(P_{ij}) = \log\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_{0j} + \beta_{1j}x_{1ij} + \beta_{2j}x_{2ij} + \ldots + \beta_{kj}x_{kij}\,. \qquad (3.24)$$

Letting $\beta_{0j} = \beta_0 + U_{0j}$ and $\beta_{hj} = \beta_h + U_{hj}$,   h = 1, 2,…, k.

We have from (3.24)

$$\log it\,(P_{ij}) = \log\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_0 + \sum_{h=1}^{k}\beta_h x_{hij} + U_{0j} + \sum_{h=1}^{k}U_{hj}x_{hij}\,, \qquad (3.25)$$

The first part of equation (3.25), $\beta_0 + \sum_{h=1}^{k}\beta_h x_{hij}$, is called the fixed part of the model. The second part, $U_{0j} + \sum_{h=1}^{k}U_{hj}x_{hij}$, is called the random part.

3.3.3.6 Estimation and Testing Technique

Parameter estimation for multilevel logistic model is not straightforward like the methods for logistic regression. The most common methods for estimating multilevel logistic models are based on likelihood. Among the methods, Marginal Quasi Likelihood or MQL [Goldstein (1991), Goldstein and Rasbash (1996)] and Penalized Quasi Likelihood or PQL [Laird (1978) and Breslow and Clayton (1993)] are the two prevailing approximation procedures. Both MQL and PQL are based on Taylor series expansion to achieve the approximation. Based on the usage of first and second term of Taylor expansion, MQL and PQL are often known as first-order MQL and second-order MQL, first-order PQL and second-order MQL respectively. After applying these quasi likelihood methods, the model is then estimated using iterative generalized least squares (IGLS) or reweighted IGLS (RIGLS) [Goldstein (2003)].

Besides, there are other estimation methods: Maximum Likelihood Method (several simulation based; McCulloch (1997)), Bayesian methods using Markov Chain Monte Carlo (MCMC), and the Iterative Bootstrap method. Using MCMC simulation technique has come to the forefront of statistical research over the last one and half decade [Gelfand et al. (1990)] and also it is being used with greater extent in multilevel modeling recently. An important part of modeling involves testing parameters and models to see which parts of the multilevel model are statistically important. In fixed coefficients simple logistic regression tests about parameters are done using the Wald test.

Parameter estimation in hierarchical generalized linear models is more complicated than the hierarchical linear models. The most frequently used kind of approximation method used are based on a first-order or second-order Taylor series expansion of the link function. There are different methods of parameter estimation which are implemented in various softwares like MLwiN and LISREL among others. In this study, the multilevel data analysis is supported by the software LISREL.

CHAPTER FOUR

4 STATISTICAL DATA ANALYSIS AND RESULTS

4.1 Major Socio-economic, demographic and proximate characteristics of family planning practice status of couples

The major socio-economic, demographic and proximate background characteristics of the respondents (couples) are presented in Table 4.1. The total number of couples covered in the study is 25,240. Among these, 19,340 (76.6 percent) did not practice FP methods whereas 5,900 (23.4 percent) practiced a FP method.

The proportion of couples who do not practice FP, as can be seen in Table 4.1, differs by type of place of residence: urban and rural. Accordingly, more than eighty percent of couples who do not practice a method (86.8 percent) reside in rural areas. A small number of those couples who are not practicing a FP method (31.2 percent) reside in urban areas. The status of couples on a FP practice varied from one region to the other. For example, the highest status of couples not practicing the method was recorded in Somali (96.7 percent) followed by Affar (87.1 percent) as opposed to the lowest status which was recorded in Addis Ababa (16.3 percent) followed by Dire Dawa (55.1 percent). Moreover, region-wise and urban-rural difference showed that in almost all regions, the highest status of couples who do not practice family planning method was observed in rural parts.

Age of women was found to be an important and determinant variable of family planning practice. The highest number of couples not practicing the method was observed among women age group of 15-19 years (83.9 percent) followed by age group 35-49 years (79.7 percent) and age group 20-34 years (74.0 percent).

The educational status of a woman and her male partner under consideration is also an important variable. Among the respondents (couples), those who have secondary or higher educational level were less likely to not practice any FP method (34.7and 34.5 percent) than primary level (74.8 and 74.9 percent) and no education (88.4 and 88.1 percent), respectively, for a woman and male partner/husband. This indicates that completing at least primary level of school would help to decrease the number of couples who do not practice the FP methods.

The status of not practicing a FP method among couples from poor households (79.2 percent) is higher than couple from medium and higher economic status households (75.0 percent). As can be seen from Table 4.1, the occupation of a woman and that of her partner has a contribution not to practice a FP. Women who are agriculture employees (82.6 percent) and not working (76.3 percent) were not using any family planning method. When we look at the figures for the male partners/husbands who are agricultural employee (88.2 percent) do not practice a FP method whereas those who are non-agriculture employee (39.1 percent) are not using any method.

With regard to the number of living children, the greater number of couples who do not practice FP were those who have three and more children (78.3 percent) followed by couples with no living children (76.8 percent). Among couples with 1-2 living children 26.2 percent practiced a family planning method. It is believed that exposure to any kind of family planning methods through the mass media like radio, TV and newspapers and magazines enhance practice of family planning. Couples who are exposed to any kind of mass media (56.0 percent) are less likely not to practice a FP method than those who are not (87.3 percent). Couples with no knowledge about a family planning method are not using family planning method. Those couples who have knowledge about at least one family planning method (77.1 percent) do not practice FP. "Access to health facility", "visited by FP worker" and "discuss FP methods with partners" are important variables. About 77.4 percent of couples who are not visited by a FP worker during the last 12 months did not practice a FP method, while 42.9 percent of couples who were visited by a FP worker during the last 12 months did not used a method. Discussion of couples about FP methods helped reduce the number by 44.9 percent. When men did not participate in FP issues it was observed that 82.1 percent of couples did not practice FP.

The status of FP practice of couples whose women's were agriculture employee (82.6 percent) did not practice FP methods is greater than that of couples whose women's do not have job (76.3 percent) and non-agriculture employees(52.9 percent). When we look at male partners who are agricultural employee in a couple about (88.2 percent) do not practice FP than that of non- agriculture employees (39.1 percent).

The number of couples who do not practice FP method is higher for those women's who are followers of catholic, traditional and other (93.8 percent) followed by muslim, protestant and orthodox, 84.4 percent,78.6 percent and 67.5 percent, respectively. As can be seen from Table 4.1, husbands approval of a method is important determinant factor for FP practice of a couple. For approval of husband about a method (51.6 percent) couples are less likely not to practice FP methods than for disapproval of husband (88.5 percent).

Table 4.1 Distribution of Couples by Socio-economic, demographic and proximate related characteristics and by region

Background Characteristic	Urban			Rural			Total		
	Number of couples who do not practice a FP method	Percent	Total number of couples	Number of couples who do not practice a FP method	Percent	Total	Number of couples who do not practice a FP method	Percent	Total
Residence									
Urban							1440	31.2	4620
Rural							17900	86.8	20620
Region									
Tigray	100	41.7	240	1380	80.2	1720	1480	75.5	1960
Affar	40	40.0	100	1180	90.8	1300	1220	87.1	1400
Amhara	60	25.0	240	3040	86.4	3520	3100	82.4	3760
Oromiya	60	20.0	300	3780	86.7	4360	3840	82.4	4660
Somali	140	77.8	180	1620	98.8	1640	1760	96.7	1820
Ben-Gumuz	100	62.5	160	1680	84.8	1980	1780	83.2	2140
SNNP	80	36.4	220	2960	84.6	3500	3040	81.7	3720
Gambela	120	66.7	180	1180	81.9	1440	1300	80.2	1620
Harari	200	45.5	440	500	89.3	560	700	70.0	1000
Dire Dawa	280	29.2	960	580	96.7	600	860	55.1	1560
Addis Ababa	260	16.3	1600				260	16.3	1600
Age of a woman									
15-19	140	50.0	280	1420	89.9	1580	1560	83.9	1860
20-34	780	26.7	2920	10400	85.4	12180	11180	74.0	15100
35-49	520	36.6	1420	6080	88.6	6860	6600	79.7	8280
Educational level of women									
No education	480	63.2	760	12680	89.8	14120	13160	88.4	14880
Primary	380	33.3	1140	4440	83.8	5300	4820	74.8	6440
Secondary and higher	580	21.3	2720	780	65.0	1200	1360	34.7	3920
Male partner's education level									
No education	460	57.5	800	13100	89.7	14600	13560	88.1	15400
Primary	380	35.8	1060	4040	83.5	4840	4420	74.9	5900
Secondary and higher	600	21.7	2760	760	64.4	1180	1360	34.5	3930
Occupation of a woman									
Not working	620	31.6	1960	6320	88.5	7140	6940	76.3	9100
Non-agriculture	560	33.3	1680	1100	75.3	1460	1660	52.9	3140
Agric-employee	260	26.5	980	10480	87.2	12020	10740	82.6	13000

Male partner's occupation									
Non-agriculture	1260	29.2	4320	1060	65.4	1620	2320	39.1	5940
Agric-employee	180	60.0	300	16840	88.6	19000	17020	88.2	19300
Number of living children									
No children	320	39.0	820	1860	92.1	2020	2180	76.8	2840
1 to 2 children	460	26.1	1760	5780	86.3	6700	6240	73.8	8460
Three or more	660	32.4	2040	10260	86.2	11900	10920	78.3	13940
Knowledge of a couple about any FP method									
Knows no FP method	100	100.0	100	4301	100.0	4301	4401	100.0	4401
Knows a FP method	1340	29.6	4520	13599	83.3	16319	14939	71.7	20839
Visited by FP worker last 12 months									
No	1360	31.1	4380	17740	87.4	20300	19100	77.4	24680
Yes	80	33.3	240	160	50.0	320	240	42.9	560
Discussed FP with partner									
Never	1300	37.4	3480	16360	90.8	18020	17660	82.1	21500
More than once	140	12.3	1140	1540	59.2	2600	1680	44.9	3740
Partners/husbands approval of FP									
Disapproves	460	56.1	820	7220	91.9	7860	7680	88.5	8680
Approves	560	17.5	3200	4160	70.0	5940	4720	51.6	9140
Don't know	420	70.0	600	6520	95.6	6820	6940	93.5	7420
Exposure of a couple to any media									
No	540	49.1	1100	13960	90.1	15500	14500	87.3	16600
Yes	900	25.6	3520	3940	77.0	5120	4840	56.0	8640
Religion of a woman									
Orthodox	600	21.6	2780	6760	83.3	8120	7360	67.5	10900
Protestant	120	30.0	400	2820	84.4	3340	2940	78.6	3740
Muslim	640	47.8	1340	7500	90.4	8300	8140	84.4	9640
Others	80	80.0	100	820	95.3	860	900	93.8	960
Wealth index									
Poor	497	33.0	1505	7194	87.6	8209	7691	79.2	9714
Medium or higher	943	30.3	3115	10706	86.3	12411	11649	75.0	15526
Marital status of a couple									
Married	1440	32.6	4420	17839	86.8	20559	19279	77.2	24979
Living together	0	0.0	200	61	100.0	61	61	23.4	261
Total									**25,240**

4.2 Determinants of family planning practice among couples in Ethiopia: Logistic Regression Analysis

Multiple logistic regression analysis was used to examine the effect of an independent variable in the model to study the status of FP practice methods, while controlling the other independent variables. Three different models are fitted in this study to identify the basic determinants of family planning practice. The first model for couples not practicing FP in the urban areas, the second model is for rural areas, and the third model is for both rural and urban (national) level.

4.2.1 Determinants of family planning practice in urban areas

The most important explanatory variables of status of family planning practice in urban couples are identified using forward selection in logistic regression. In the model for urban areas, region of residence, age of a woman, religion of a woman, educational level of women and men, occupation of a female, visited by FP worker in the last 12 months, discussion about FP with partners, husband's approval of a method, exposure to mass media and number of living children were found to be significant. Results of all variables in the logistic regression are presented in Appendix B using enter method.

The urban sample showed that, odds of couples practice a FP method compared to those who do not practice a method is decreased by a factor of 0.06 by being a couple in Somali rather than Addis Ababa, controlling for other variables in the model. When age of a woman increases one unit for age group 20-34 years rather than for age group 35-49 years, the odds that couples practice of family planning increase by a factor of 2.327, when other variables are controlled. "Visited by FP worker during last 12 months before the survey" is also another important variable. We can say that odds of practicing the FP methods of couples compared to those who do not practice a method are increased by a factor of 2.498 by being visited by FP worker in the last 12 months rather than those who are not visited, controlling for other variables in the model. Exposure to mass media is also found to be important determinant variable. The odds of couples practice of a method compared to not practice a FP method are decreased by a factor of 0.649 for being not exposed to any kind of mass media like radio, TV, newspapers and magazines rather than those who are exposed to family planning messages on mass media, while controlling for other variables in the model for urban areas. In urban areas, when a husband approves a FP method increase by one unit, the odds that a couple practice FP increase by a factor of 10.718, when other variables are controlled.

Table 4.2 Selected Important Variables in the Model for Urban areas

Covariates	$\hat{\beta}$	S.E.($\hat{\beta}$)	Wald	*df*	p-value	*Exp*($\hat{\beta}$)
Region			241.880	10	.000*	
Tigray	-1.354	.181	55.998	1	.000*	.258
Affar	-.440	.257	2.921	1	.087	.644
Amhara	-.602	.227	7.022	1	.008*	.548
Oromiya	-1.094	.201	29.562	1	.000*	.335
Somali	-2.814	.296	90.597	1	.000*	.060
Ben-Gumuz	-2.434	.241	102.143	1	.000*	.088
SNNP	-1.805	.219	67.673	1	.000*	.164
Gambela	-1.967	.271	52.561	1	.000*	.140
Harari	-1.270	.151	70.570	1	.000*	.281
Dire Dawa	-.484	.121	16.108	1	.000*	.617
Addis Ababa(ref.)						1.000
Age of a woman			102.841	2	.000*	
15-19	-.325	.197	2.708	1	.100	.723
20-34	.845	.107	62.255	1	.000*	2.327
35-49(ref.)						1.000
Number of living children			61.668	2	.000*	
No children	-.964	.145	43.925	1	.000*	.382
1-2 children	-.802	.115	48.558	1	.000*	.449
Three or more(ref.)						1.000
Educational level of woman			37.447	2	.000*	
No education	-.698	.360	3.761	1	.052	.498
Primary	.694	.251	7.643	1	.006*	2.002
Secondary and higher(ref.)						1.000
Women's occupation			76.901	2	.000*	
Not working	-.828	.134	38.083	1	.000*	.437
Non-agriculture	-1.173	.134	76.733	1	.000*	.309
Agric-employee(ref.)						1.000
Educational level of partner			8.126	2	.017*	
No education	-.647	.360	3.233	1	.072	.524
Primary	-.717	.252	8.075	1	.004*	.488
Secondary and higher(ref.)						1.000
Visited by FP worker in the last 12 months						
No	.916	.202	20.581	1	.000*	2.498
Yes(ref.)						1.000
Discuss FP with partner						
Never	-1.414	.130	117.776	1	.000*	.243
Once and more (ref.)						1.000

Husband/partner approval of FP			330.299	2	.000*	
Disapproves	1.097	.153	51.542	1	.000*	2.996
Approves	2.372	.139	292.124	1	.000*	10.718
Don't know(ref.)						1.000
Exposure to mass media						
No	-.432	.107	16.178	1	.000*	.649
Yes(ref.)						1.000
Religion of a woman			147.932	3	.000*	
Orthodox	3.756	.359	109.417	1	.000*	42.768
Protestant	5.066	.425	142.388	1	.000*	158.554
Muslim	3.638	.374	94.723	1	.000*	38.022
Other(ref.)						1.000
Constant	-2.458	.376	42.625	1	.000*	.086

* Statistically Significant at ($p<0.05$) ref. = reference category

4.2.3 Determinants of family planning practice in rural areas

Logistic regression analysis with forward variable selection procedure was also employed for rural couples alone. The results showed region of residence, age of a woman, number of living children, educational level and occupation of men and women, discussion about FP with partner, visited by FP worker in the last 12 months, exposure to mass media, approval of male partner's on FP and economic status of household are found to be important predictors of family planning practice status for rural couples (Table 4.4).

The second model on rural areas showed odds of couples practice FP compared to those who do not practice FP are increased by a factor of 8.139 and 7.272 for being a couple in Tigray and Ben-Gumuz regions, respectively rather than for a couple being in Dire Dawa region, controlling other variables in the model for rural part of Ethiopia. Odds of couples practice FP compared to who do not practice FP are decreased by the factor of 0.887 for a women being completed primary education rather than those who completed secondary and higher level of education, while controlling other variables in the model. In rural areas odds of practice a FP method compared to not practice are increased by a factor of 3.072 for a husband employed in non-agriculture rather than agricultural employee in a couple, when other variables in the model are controlled. In rural areas, when a husband approves a FP method increase by one unit, the odds that a couple practice FP increase by a factor of 4.826, when other variables are controlled. The odds of couples practice a method compared to not to practice a FP method are decreased by a factor of 0.958 for a couple with 1-2 living children rather than those with three and more children, controlling for other variables in the model for urban areas. Results of all variables in the logistic regression are presented in Appendix C using enter method.

Table 4.3 Important Selected Variables in the Model for Rural areas

Covariates	$\hat{\beta}$	S.E.($\hat{\beta}$)	Wald	*df*	p-value	*Exp*($\hat{\beta}$)
Region			271.182	9	.000*	
Tigray	2.097	.258	66.226	1	.000*	8.139
Affar	1.347	.276	23.801	1	.000*	3.846
Amhara	1.683	.255	43.572	1	.000*	5.380
Oromiya	1.388	.256	29.311	1	.000*	4.008
Somali	-.666	.345	3.734	1	.053	.514
Ben-Gumuz	1.984	.261	57.797	1	.000*	7.272
SNNP	1.462	.258	32.031	1	.000*	4.316
Gambela	.939	.267	12.383	1	.000*	2.558
Harari	1.411	.290	23.678	1	.000*	4.099
Dire Dawa(ref.)						1.000
Age of a woman			6.495	2	.039*	
15-19	-.047	.137	.120	1	.729	.954
20-34	.125	.057	4.752	1	.029*	1.133
35-49(ref.)						1.000
Number of living children			25.170	2	.000*	
No children	-.632	.128	24.598	1	.000*	.531
1-2 children	-.043	.056	.572	1	.449	.958
Three or more(ref.)						1.000
Educational level of woman			6.725	2	.035*	
No education	.243	.450	.291	1	.590	1.274
Primary	-.120	.428	.079	1	.779	.887
Secondary and higher(ref.)						1.000
Women's occupation			44.521	2	.000*	
Not working	.248	.057	18.929	1	.000*	1.282
Non-agriculture	.525	.086	37.646	1	.000*	1.691
Agric-employee(ref.)						1.000
Educational level of partner			16.708	2	.000*	
No education	-.993	.449	4.886	1	.027*	.370
Primary	-.427	.428	.996	1	.318	.652
Secondary and higher(ref.)						1.000
Male Partner's occupation						
Non-agriculture	1.122	.076	215.581	1	.000*	3.072
Agric-employee(ref.)						1.000
Visited by FP worker in the last 12 months						
No	-1.896	.142	177.350	1	.000*	.150
Yes(ref.)						1.000

Discuss FP with partner						
Never	-1.362	.057	575.381	1	.000*	.256
Once and more (ref.)						1.000
Husband/partner approval of FP			565.579	2	.000*	
Disapproves	.693	.076	82.848	1	.000*	1.999
Approves	1.574	.071	494.038	1	.000*	4.826
Don't know(ref.)						1.000
Exposure to mass media						
No	-.472	.053	79.873	1	.000*	.624
Yes(ref.)						1.000
Economic status of HH						
Poor	-.098	.049	4.009	1	.045*	.907
Medium and higher (ref.)						1.000
Constant	-.609	.289	4.444	1	.035*	.544

* Statistically Significant at (p<0.05)   ref. = reference category

4.2.3 Determinants of family planning practice at national level

The combined urban and rural (national) sample results showed that type of place of residence, region, age of a woman, religion of a woman, educational level of women and men, occupation of a female, visited by FP worker in the last 12 months, discussion about FP with partners, husband's/partner's approval of a method, media exposure and number of living children are found to be important variables (Table 4.5).

The third model on both rural and urban areas showed odds of couples practice FP compared to who do not practice FP are decreased by a factor of 0.642 and 0.599 for being a couple in Ben-Gumuz and Tigray regions, respectively rather than for a couple being in Addis Ababa, controlling other variables in the model for all parts of Ethiopia. For a couple being reside in urban areas rather than rural counterparts, odds of practice FP method compared with do not practice a method is increased by a factor of 2.365, when other variables are controlled in the model. When age of a woman increases one unit for age group 20-34 years rather than for age group 35-49 years, the odds that couples practice of family planning increase by a factor of 1.405, when other variables are controlled in the model for Ethiopia. The odds of couples FP practice are increased by a factor of 2.925 for a male partner being non-agricultural employee rather than agricultural employee, controlling for other variables in the model. When a husband approves a FP method increases by one unit, the odds that a couple practice FP increase by a factor of 5.37, when other variables are controlled in the model for national level.

The odds of couples practice of a FP method compared to not to practice a method are decreased by a factor of 0.632 for being not exposed to any kind of mass media like radio, TV, newspapers and magazines rather than those who are exposed to family planning messages on mass media, while controlling for other variables in the model. Results of all variables in the logistic regression are presented in Appendix A using enter method. The estimated coefficients ($\hat{\beta}$'s) for the covariates in the final model, their standard error (S.E.($\hat{\beta}$)) and the odds ratio corresponding each estimated coefficients of not practicing family planning among urban couples is presented in the following Table 4.5.

Table 4.4 Important Selected Variables in the model at National Level

Covariates	$\hat{\beta}$	S.E.($\hat{\beta}$)	Wald	*df*	p-value	*Exp*($\hat{\beta}$)
Place of residence						
Rural	.861	.082	109.705	1	.000*	2.365
Urban (ref.)						1.000
Region			319.145	10	.000*	
Tigray	-.512	.116	19.534	1	.000*	.599
Affar	-.830	.134	38.120	1	.000*	.436
Amhara	-.722	.110	42.927	1	.000*	.486
Oromiya	-.876	.107	67.464	1	.000*	.417
Somali	-2.499	.175	203.685	1	.000*	.082
Ben-Gumuz	-.443	.117	14.401	1	.000*	.642
SNNP	-.636	.113	31.545	1	.000*	.529
Gambela	-1.329	.125	113.069	1	.000*	.265
Harari	-1.025	.120	72.853	1	.000*	.359
Dire Dawa	-.905	.104	75.351	1	.000*	.404
Addis Ababa(ref.)						1.000
Age of a woman			57.688	2	.000*	
15-19	.010	.111	.009	1	.925	1.010
20-34	.340	.049	47.931	1	.000*	1.405
35-49(ref.)						1.000
Martial Status						
Married	-2.133	.216	97.774	1	.000*	.118
Living together(ref.)						1.000
Number of living children			100.354	2	.000*	
No children	-.874	.088	99.017	1	.000*	.417
1-2 children	-.210	.048	18.769	1	.000*	.811
Three or more(ref.)						1.000
Educational level of partner			141.528	2	.000*	
No education	-.817	.069	141.096	1	.000*	.442
Primary	-.480	.063	57.683	1	.000*	.619
Secondary and higher(ref.)						1.000

Male Partner's occupation						
Non-agriculture	1.073	.068	250.191	1	.000*	2.925
Agric-employee(ref)						1.000
Visited by FP worker in last 12 months						
No	-.814	.115	49.841	1	.000*	.443
Yes(ref.)						1.000
Discuss FP with partner						
Never	-1.307	.050	673.682	1	.000*	.271
Once and more (ref.)						1.000
Husband/partner approval of FP			881.877	2	.000*	
Disapproves	.765	.067	131.327	1	.000*	2.150
Approves	1.681	.061	770.039	1	.000*	5.370
Don't know(ref.)						1.000
Exposure to mass media						
No	-.459	.046	98.870	1	.000*	.632
Yes(ref.)						1.000
Religion of a woman			154.313	3	.000*	
Orthodox	2.087	.172	147.345	1	.000*	8.060
Protestant	1.810	.177	104.031	1	.000*	6.109
Muslim	2.009	.174	132.585	1	.000*	7.456
Other(ref.)						1.000
Constant	.699	.323	4.675	1	.031*	2.012

* Statistically Significant at ($p<0.05$)   ref. = reference category

4.2.4 Goodness of Fit and Model Diagnostics

a. Goodness of Fit

In our logistic regression analysis of the data by SPSS package, results of several goodness of fit test accompany the SPSS output. The classification table given below shows that of 25,240 couples included in the analysis 86.4% were correctly classified providing evidence that the model will fit well.

Table 4.5 Classification Table

Observed			Predicted		
			Status of a couple about FP method practice		Percentage Correct
			Do not practice a FP method	Practice a FP method	
Step1	Status of a couple about FP method practice	Do not practice a FP method	18245	1095	94.3
		Practice a FP method	2329	3571	60.5
	Overall Percentage				86.4

The cut value is .500

The goodness of fit test for the multiple logistic regression model was assessed using the Hosmer-Lemeshow test and the deviance-based chi-square test. For national level the Hosmer-Lemeshow test the p-value 0.080 shows that the model adequately fits the data at 0.05 level of significance. Similarly, the deviance-based chi-square test provided chi-square value of X^2= 4455.702, *d.f* =10, P<0.01 imply good fit for the combined model.

b. Model Diagnostics

The adequacy of the fitted model was checked for possible presence and treatment of outliers and influential values. The diagnostic test results for detection of outliers and influential values are presented in Appendix C. The DFBETAs for model parameters including the constant term and Cook's influence statistic were both less than unity. DFBETAs less than unity imply no specific impact of an observation on the coefficient of a particular predictor variable, while Cook's distance less than unity showed that an observation had no overall impact on the estimated vector of regression coefficients β. The value of the leverage statistic less than one shows that no subject has a substantial large impact on the predicted values of model. Thus, from the above goodness of fit tests and diagnostic checking, we can say that our model is adequate.

4.3 Determinants of family planning practice: A Multilevel Logistic Regression Analysis

In the multilevel analysis, a two-level structure is used with regions as the second-level units and couples as the first level units. This is basically with the expectation that there would be a difference in the status of couples not to practice family planning methods among regions. The nesting structure is couples within regions with a total of 25,240 couples.

A chi-square test statistic in equation (3.13) was applied to assess heterogeneity in the proportion of couples who do not practice FP methods among the 11 regions. The test yield X^2= 4455.702, *d.f*=10, P<0.01. Thus, there is evidence for heterogeneity among regions with respect to FP practice of couples.

The results presented in the subsequent sections are carried out using a student-version software LISREL 8.8 for window. The program is restricted to analyze few number of explanatory variables. As a result, only five explanatory variables (place of residence, discussion about FP with partner, visited by FP worker in the last 12 months, male partners/husbands approval of FP and exposure to mass media) are considered. These predictor variables have two categories each.

4.3.1 The empty logistic regression model

The simplest non–trivial specification of the hierarchical linear model is a model in which only the intercept varies between level two units and no predictor (explanatory) variables are entered in the model. The empty model contains no explanatory variables and it can be considered as a parametric version of assessing heterogeneity among regions with respect to couples's family planning practice status.

Table 4.6 Estimates for empty model

Fixed Part	**Coefficient**	**S.E.**	**Z-value**	**P-value**
$\beta_0 =$ **Intercept**	-1.2182	0.0164	74.3669	0.0000*
Random Part	**Variance Component**	**S.E.**	**Z-value**	**P-value**
Level-two variance: $\sigma^2_0 = \text{var}(U_{0j})$	1.3480	0.4239	3.1800	0.0015*
Deviance-based chi-square	3960.7895			0.000*

* Statistically Significant at ($p<0.05$)

The deviance-based Chi-square (deviance = 3960.7895) indicated in Table 4.6 above is the difference in deviance between an empty model without random effect (deviance = 27449.7626 see Appendix D) and an empty model with random effect (deviance =23488.9731 see Appendix D). This implies that an empty model with random intercept is better than an empty model without random intercept. The variance of the random factor in empty model is significant which indicates that there are regional differences in the family planning practice status of couples. The test indicates that the fitted model is good.

4.3.2 The random intercept model and fixed explanatory variables

In order to identify the effect of some selected explanatory variables a multilevel logistic regression model with random intercept and fixed slope for explanatory variables were estimated with the help of LISREL software. The variables considered were place of residence (1= urban, 2= rural), discussion about FP with partner (0= never, 1= once and more), visited by FP worker in the last 12 months (0= no, 1= yes), male partners/husbands approval of a FP method (1= approves, 2= otherwise) and exposure to any mass media (0= no, 1= yes).The results of two-level random intercept and fixed slope (coefficient) model are presented in the following Table 4.7 below. The deviance based chi-square test for significance of random effects (X^2=349.8995, df=1, P<0.05) indicates that the random intercept model with the fixed slope is found to give a better fit as compared to the empty model discussed in Section 4.3.1. From Table 4.7, we observe that place of residence, husbands/partners approval of a FP method, visited by FP worker in the last 12 months, exposure to mass media and discussion about FP with male partner were found to be significant determinants of variation in couples practice of family planning methods among regions. As we can see in Table 4.7, all predictors are significant determinants of variation of contraceptive methods of couples among regions.

Table 4.7 Estimates for random intercept and fixed coefficient model

Covariates	Estimate coefficient	S.E.	Z-value	P-value
Intercept	-3.5743	0.1080	-33.0809	0.0000*
Place of Residence				
Urban	1.9089	0.0462	41.2895	0.0000*
Rural (Ref.)				
Husband's/partner's approval of a method				
No	1.3792	0.0409	33.7433	0.0000*
Yes (Ref.)				
Visited by FP worker in the last 12 months				
No	-0.7758	0.1157	-6.7034	0.0000*
Yes (Ref.)				
Discuss FP with partner				
Never	-1.2715	0.0472	-26.9396	0.0000*
Once and more (Ref.)				
Exposure to mass media				
No	-0.7168	0.0410	-17.4637	0.0000*
Yes (Ref.)				

Random Part	Estimate Variance component	S.E.	Z-value	P-value
Random Intercept: $\sigma_0^{\ 2} = \text{var}(U_{0j})$ intercept variance	0.2571	0.0816	3.1486	0.0016*
Deviance-based chi-square	349.8995			0.0000*

* Statistically Significant at (p<0.05), (Ref.) = indicates the reference category

4.3.3 The random coefficient model

The random coefficient model is useful, because it shows how much variability exists at each level. Result in Table 4.8 below is obtained by including level-2 random coefficients of Place of residence, visited by FP worker in the last 12 months, discuss FP with partner, husband's approval of a FP method and exposure to mass media and an overall (level-2) or regional variance constant term ($\sigma_0^{\ 2}$) together with variance and covariance terms representing the random effects of predictors.

Table 4.8 Results for Fixed and Random Effects of Random Coefficient Model

Covariates	Estimate coefficient	S.E.	Z-value	P-value
Intercept	-4.2287	0.1101	-38.4217	0.0000*
Place of Residence				
Urban	2.1290	0.0478	44.5611	0.0000*
Rural (Ref.)				
Visited by FP worker in the last 12 months				
No	-2.0345	0.1198	-16.9824	0.0000*
Yes (Ref.)				
Discuss FP with partner				
Never	-1.7434	0.0480	-36.2938	0.0000*
Once and more (Ref.)				
Husband's/partner's approval of a method				
No	1.6852	0.0409	33.7433	0.0000*
Yes (Ref.)				
Exposure to mass media				
No	-0.6638	0.0421	-15.7743	0.0000*
Yes (Ref.)				

Random Part	**Estimate Variance component**	**S.E.**	**Z-value**	**P-value**
Random Coefficient: Level-2 variance covariance				
$\sigma_0^{\ 2} = \text{var}(U_{0j})$	5.5077	1.7535	3.1410	0.0017*
$\sigma_1^{\ 2} = \text{var}(U_{1j})$	1.2381	0.3888	3.1844	0.0015*
$\sigma_2^{\ 2} = \text{var}(U_{2j})$	8.7196	2.8732	3.0348	0.0024*
$\sigma_3^{\ 2} = \text{var}(U_{3j})$	0.9700	0.3075	3.1544	0.0016*
$\sigma_4^{\ 2} = \text{var}(U_{4j})$	1.0199	0.3221	3.1662	0.0015*
$\sigma_5^{\ 2} = \text{var}(U_{5j})$	1.9157	0.6097	3.1420	0.0017*
$\sigma_{01} = \text{cov}(U_{0j,}U_{1j})$	-1.8754	0.7101	-2.6410	0.0083*
$\sigma_{02} = \text{cov}(U_{0j,}U_{2j})$	0.7902	1.5658	0.5047	0.6138
$\sigma_{03} = \text{cov}(U_{0j,}U_{3j})$	1.4357	0.6085	2.3594	0.0183*
$\sigma_{04} = \text{cov}(U_{0j,}U_{4j})$	-1.2805	0.6130	-2.0888	0.0367*
$\sigma_{05} = \text{cov}(U_{0j,}U_{5j})$	-2.5071	0.9289	-2.6990	0.0070*
$\sigma_{12} = \text{cov}(U_{1j,}U_{2j})$	1.2381	0.3888	3.1844	0.0015*
$\sigma_{13} = \text{cov}(U_{1j,}U_{3j})$	-0.1596	0.2503	-0.6376	0.5238
$\sigma_{14} = \text{cov}(U_{1j,}U_{4j})$	-0.1747	0.2572	-0.6794	0.4969
$\sigma_{15} = \text{cov}(U_{1j,}U_{5j})$	0.8698	0.3887	2.2377	0.0252*
$\sigma_{23} = \text{cov}(U_{2j,}U_{3j})$	1.8967	0.7899	2.4011	0.0163*
$\sigma_{24} = \text{cov}(U_{2j,}U_{4j})$	-2.3455	0.8541	-2.7462	0.0060*
$\sigma_{25} = \text{cov}(U_{2j,}U_{5j})$	0.9318	0.9548	0.9759	0.3291
$\sigma_{34} = \text{cov}(U_{3j,}U_{4j})$	-0.8061	0.2852	-2.8262	0.0047*
$\sigma_{35} = \text{cov}(U_{3j,}U_{5j})$	-0.1298	0.3146	-0.4124	0.6800
$\sigma_{45} = \text{cov}(U_{4j,}U_{5j})$	0.4159	0.3390	1.2268	0.2199
Deviance-based chi-square	1358.7496			0.0000*

*Statistically Significant at (P<0.05), (Ref.) = indicates the reference category

Table 4.9 Level-2 covariance matrix of the random coefficient

	intercept	RESIDE	VISIT_FP	DISSCPAR	HUSAPPRO	MEDIA
Intercept	5.507681					
RESIDE	-1.875390	1.238128				
VISIT_FP	0.790197	1.427065	8.719584			
DISSCPAR	1.435746	-0.159564	1.896726	0.970009		
HUSAPPRO	-1.280482	-0.174733	-2.345508	-0.80611	1.019946	
MEDIA	-2.507134	0.869833	0.931815	-0.129753	0.415866	1.915709

Table 4.10 Level-2 correlation matrix of the random coefficient

	intercept	RESIDE	VISIT_FP	DISSCPAR	HUSAPPRO	MEDIA
Intercept	1.000000					
RESIDE	-0.718165	1.000000				
VISIT_FP	0.114026	0.434323	1.000000			
DISSCPAR	0.621163	-0.145601	0.652182	1.000000		
HUSAPPRO	-0.540257	-0.155490	-0.786503	-0.810438	1.000000	
MEDIA	-0.771842	0.564792	0.227991	-0.095184	0.297509	1.000000

Table 11. Test of the significance of Correlations

		Place of residence	Visited by FP worker in the last 12months	Discussed FP with partner	Male partner/ Husband approves FP	Exposure to any mass media
Place of residence	Pearson Correlation	1	-.096**	-.131**	.326**	-.419**
	Sig. (2-tailed)		.000	.000	.000	.000
Visited by FP worker in the last 12m	Pearson Correlation	-.096**	1	.073**	-.088**	.073**
	Sig. (2-tailed)	.000		.000	.000	.000
Discussed FP with partner	Pearson Correlation	-.131**	.073**	1	-.359**	.132**
	Sig. (2-tailed)	.000	.000		.000	.000
Male partner/Husband approves FP	Pearson Correlation	.326**	-.088**	-.359**	1	-.283**
	Sig. (2-tailed)	.000	.000	.000		.000
Exposure to any mass media	Pearson Correlation	-.419**	.073**	.132**	-.283**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

In Table 4.8 above, the value of Var (U_{0j}), Var (U_{1j}), Var (U_{2j}), Var (U_{3j}), Var (U_{4j}) and Var (U_{5j}) are the estimated variance of intercept, slope of place of residence, slope of visited by FP worker in the last 12 months, slope of discussion about FP with partner, slope of husband's approval of a FP method and slope of exposure to mass media, respectively. All are regionwise intercepts and the slopes vary significantly, that is, there is a significant variation in the effects of these explanatory variables across the regions. Some of the variances of the interaction terms between intercepts and slopes of explanatory variables are also found significant. Interpretation of significant covariance terms can be easily made in terms of the correlation coefficients displayed in Tables 4.9 and 4.10. The correlation matrix contains the estimated correlation between random intercepts and slopes.

Positive correlation between intercepts and slopes implies that regions with higher intercepts tend to have on average higher slopes (Table 4.10**)**. For example, the correlation between the intercept and random slope of "discuss FP with partner" is 0.621163, meaning that couples who discuss family planning issues have better status of using family planning methods than those who did not by a larger factor at regions with higher intercepts compared to regions with lower intercepts.

The negative sign for the correlation between intercepts and slopes implies that regions with higher intercepts tend to have on average lower slopes on the corresponding predictors (Table 4.10). Couples whose place of residence is in urban, who have access to family planning lessons through mass media and whose husband/partner approve FP methods are less likely not to practice the methods of contraception.

The results in Table 4.8 show that the listed predicted variables contribute significantly to the status of couples practice of family planning. The deviance-based Chi-square (deviance = 1358.7496) with degrees of freedom $d.f = 21$ indicated in Table 4.8 is the difference between the model without any random effects (deviance = 18029.8087 see Appendix F) and the model with fixed and random effects (deviance = 16671.0590 see Appendix F). This difference indicates that a model with a random coefficient is more appropriate to explain regional variation than a model with fixed coefficients and the variables included are significant.

We note that the student version of the software LISREL does not provide model diagnostic tests. We only checked a goodness of fit by using deviance-based chi-squared test.

In general, the results of the multilevel logistic regression suggest that there exist differences in the status of couples practicing family planning methods among regions in Ethiopia. As a result, the random coefficient model analysis generates separate estimates of logistic regressions for each region (Table 4.11).

Table 4.12 Parameter estimates for regions

Region	**Coefficients**						
		intercept	RESIDE	VISIT_FP	DISSCPAR	HUSAPPRO	MEDIA
Tigray	Estimate	2.5094	-.9560	.8689	1.1941	-.7224	-.5102
	S.E	.0810	.0225	.1441	.0138	.0096	.0139
	Z-value	30.9839*	-42.4489*	6.0306*	86.4316*	-75.6215*	-36.6273*
Affar	Estimate	-.0019	-1.3457	-6.7284	-1.9348	1.5856	-2.0228
	S.E	.3402	.1078	1.8726	.2133	.1138	.0569
	Z-value	-.0055	-12.4815*	-3.5931*	-9.0690*	13.9327*	-35.5695*
Amhara	Estimate	.2430	.1432	.0589	.5277	-.5218	.1230
	S.E	.1123	.0294	.0730	.0094	.0072	.0173
	Z-value	2.1645*	4.8644*	.8065	56.1186*	-72.7367*	7.0997*

Oromiya	Estimate	.3254	-.0053	2.1321	.3749	-.3965	.1683
	S.E	.0834	.0230	.5861	.0081	.0074	.0088
	Z-value	3.9019*	-.2297*	3.6376*	46.5526*	-53.2759*	19.1940*
Somali	Estimate	-5.4788	1.0841	-2.0021	-1.3816	2.1081	3.4080
	S.E	1.2216	.0970	2.5712	.2485	.2567	.3688
	Z-value	-4.4850*	11.1783*	-.7787	-5.5593*	8.2123*	9.2397*
Ben-Gumuz	Estimate	3.1336	-1.4993	-.4925	1.0877	-.3231	-.8331
	S.E	.1421	.0313	1.3855	.0188	.0141	.0193
	Z-value	22.0476*	-47.9649*	-.3554	57.7883*	-22.9067*	-43.2217*
SNNP	Estimate	-1.6432	.3282	.3180	-.3641	.3839	.9941
	S.E	.1324	.0316	.0701	.0122	.0087	.0163
	Z-value	-12.4066*	10.3996*	4.5342*	-29.8301*	44.2797*	60.9245*
Gambela	Estimate	1.9015	-.7762	2.4685	.8094	-.4804	-.0074
	S.E	.1301	.0354	.7164	.0163	.0116	.0186
	Z-value	14.6133*	-21.9434*	3.4456*	49.7556*	-41.3870*	-.3966
Harari	Estimate	1.4568	-.3648	-1.9610	-.6476	.2986	-1.5979
	S.E	.1580	.0424	1.7065	.0480	.0283	.0533
	Z-value	9.2195*	-8.6002*	-1.1492	-13.4804*	10.5520*	-29.9607*
Dire Dawa	Estimate	-1.2409	1.4878	.7282	.3410	-.5319	.4163
	S.E	.1468	.0512	.0827	.0324	.0192	.0342
	Z-value	-8.4552*	29.0366*	8.8080*	10.5272*	-27.7199*	12.1872*
Addis Ababa	Estimate	-1.2049	-.0068	4.6095	1.9041	-1.4000	-.1385
	S.E	.3087	.0458	.0620	.2967	.0186	.0271
	Z-value	-3.9025*	-.1479	74.3407*	6.4164*	-75.3997*	-5.1127*

* Statistically significant at ($p<0.05$)

As we can see resuts in Table 4.11 above, all explanatory variables are statistically significant in Tigray, Oromiya, SNNP and Dire Dawa regions and hence they are determinants of family planning practice. For Addis Ababa region all predictor variables are statistically significant except place of residence (because for Addis Ababa place of residence cannot be categorized as urban and rural). "Visited by FP worker in the last 12 months" before the survey was conducted is not significant factor in Amhara, Somali, Benishangul-Gumuz and Harari for couples practice of FP.

Table 4.11 shows there prevails variation among regions with respect to the impact of the predictor variables on the couples practice of family planning methods.

CHAPTER FIVE

5 DISCUISSION, CONCLUSION AND RECOMMEDATION

5.1 DISCUISSION

This study is an attempt to identify some determinants of family planning practice of couples based on Ethiopian Demographic and Health Survey (EDHS 2005) data. Accordingly descriptive analysis, multiple logistic regression and multilevel logistic regression techniques were used. Multiple logistic regression was applied separately for urban, rural and national level. The results which are obtained are discussed as follows.

At first the study included sixteen predictor variables that were categorized under socio-economic, demographic and proximate characteristics. The descriptive analysis of the study revealed that only 23.4 percent of the sample couples were practicing family planning methods and 76.6 percent did not practice family planning.

A finding that is consistent with past studies is that couples in urban areas practice FP method more than their rural counterparts. Concerning the regional variation in couples FP practice status, the results for both rural and urban parts of Ethiopia confirmed that couples in Somali and Affar regions practice family planning methods less than couples who live in other regions.

Another important statistical method used in this study is multilevel logistic regression which is an example of generalized hierarchal linear model. In the multilevel analysis couples are nested within various regions in Ethiopia. Three multilevel models: empty model, random intercept and slope or random coefficient model were applied in order to explain regional differences in family planning practice among couples. The results obtained are discussed briefly in the following paragraph.

Before the analysis of data using multilevel approach, first heterogeneity of the status of FP practice of couples with regard to regions was checked. A nonparametric approach based on the chi-square test and the parametric approach based on the empty model suggests that couples status of FP practice differs among regions. Such heterogeneity is a requirement in the multilevel analysis. In addition to a model without explanatory variables, two other models were used in multilevel logistic regression for the national sample a whole. In both models (random intercept and random coefficient) the overall variance constant term is found to be statistically significant which may again imply the differences in couples status of FP practice. Among the five variables considered due to restriction in the software used, the effect of the random part of “place of residence”, “visited by FP worker in the last 12 months”, “discussed FP with partner”, “husband’s approval of a FP method” and “exposure to mass media” differs across regions. Similarly, the interaction of random parts of “place of residence” and “visited by FP worker in the last 12 months”, “exposure to mass media” provided significant effect on status of couples FP practice across regions. Also, the interaction of the random parts of “visited by FP worker in the last 12 months” and “discussed FP with partner”, “husband’s approval of a FP method” were found to be determinant factors for the practice of FP among regions. The goodness-of-fit of the model is checked by deviance-based chi-square test in multilevel logistic regression analysis by LISREL software and found comparatively from the three models fitted the random coefficient model is better.

5.2 CONCLUSION

The study identified the following socio-economic, demographic and proximate variables as determinants of family planning practice of couples in Ethiopia: Visited by FP worker in the last 12 months, discuss FP with partner, husbands/partners approval of a method, exposure to mass media, educational level of women, partners education level, number of living children, age of a woman, occupation of male/female are the most important ones. The descriptive results show that more than 50% of the respondents (couples) in the study do not practice family planning methods.

Educational level of women and men do have a strong positive and significant association with family planning practice status of couples. It is observed that couples with no education are less likely to practice a FP than those who have completed primary, secondary and higher levels. Educating individuals can significantly reduce the number of non users of family planning methods. The study results also showed that couples engaged in agricultural activities practiced FP less than those couples who are non-agricultural workers.

Even though couples have information about FP methods practice they do not practice it due to religion of a woman and some other causes. Couples who had discussions about family planning methods with their partners and whose husband/partner approved FP practice do practice FP more. Involvement of men has contributions for couples to practice family planning methods.

Although there is region-wise disparity in couples FP practice status, in all regions it is observed that couples in rural parts of the country are more likely not to practice family planning methods. Couples who are exposed to mass media like radio, TV, newspapers and magazines have higher chance to practice FP methods than those who are not exposed to family planning information from the media. When couples are visited by family planning worker in the last 12 months before the survey they have more chance to practice FP.

5.3 RECOMMEDATIONS

Based on the findings of the current study we forward the following recommendations:

- In order to ensure wider expansion of contraceptive usages, government and non-government organization involved in family planning should organize discussion groups of couples on issues of family planning methods practice.
- Enhance information and communication activities regarding family planning services using mass media, family planning workers and health centers.
- Policy makers should consider the adoption of family planning services for couples who are living in rural areas of Ethiopia.
- All concerned bodies should conduct similar research to solve problems related to family planning in all parts of the country so as to decrease the maternal mortality and infant mortality and contribute to lower population growth.
- Family planning programs should be designed and implemented in accord with the overall features of the regions to safeguard couples for practice of FP at each region.

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APPENDIX

Logistic Regression Output using Enter method

APPENDIX A National level

Case Processing Summary

Unweighted Cases(a)		N	Percent
Selected Cases	Included in Analysis	25240	100.0
	Missing Cases	0	.0
	Total	25240	100.0
Unselected Cases		0	.0
Total		25240	100.0

a If weight is in effect, see classification table for the total number of cases.

Classification Table (a, b)

Observed			Predicted		
			Status of a couple about FP method practice		Percentage Correct
			Do not practice a FP method	Practice a FP method	
Step 0	Status of a couple about FP method practice	Do not practice a FP method	19340	0	100.0
		Practice a FP method	5900	0	.0
	Overall Percentage				76.6

a Constant is included in the model.
b The cut value is .500

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	15969.901(a)	.365	.551

a Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	11479.862	33	.000
	Block	11479.862	33	.000
	Model	11479.862	33	.000

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	162.012	8	.080

Contingency Table for Hosmer and Lemeshow Test

		Status of a couple about FP method practice = Do not practice a FP method		Status of a couple about FP method practice = Practice a FP method		Total
		Observed	Expected	Observed	Expected	
Step 1	1	2531	2531.000	0	.000	2531
	2	2509	2520.518	20	8.482	2529
	3	2396	2456.844	140	79.156	2536
	4	2459	2401.698	71	128.302	2530
	5	2378	2326.677	149	200.323	2527
	6	2079	2189.425	443	332.575	2522
	7	2055	1994.887	463	523.113	2518
	8	1633	1658.244	894	868.756	2527
	9	1000	949.650	1520	1570.350	2520
	10	300	311.056	2200	2188.944	2500

Classification Table (a)

Observed			Predicted		
			Status of a couple about FP method practice		Percentage Correct
			Do not practice a FP method	Practice a FP method	
Step 1	Status of a couple about FP method practice	Do not practice a FP method	18245	1095	94.3
		Practice a FP method	2329	3571	60.5
	Overall Percentage				86.4

a The cut value is .500

Variables in the Equation (National Level)

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1(a)	RESIDENCE(1)	.816	.083	97.612	1	.000*	2.261	1.923	2.659
	AGEWOM			54.631	2	.000*			
	AGEWOM(1)	.069	.113	.369	1	.543	1.071	.858	1.337
	AGEWOM(2)	.346	.050	47.744	1	.000	1.413	1.281	1.559
	MARTIAL(1)	-2.071	.227	83.411	1	.000*	.126	.081	.197

NUMCHILD			90.436	2	.000*			
NUMCHILD(1)	-.832	.089	87.213	1	.000	.435	.365	.518
NUMCHILD(2)	-.236	.049	23.083	1	.000	.790	.718	.870
WOMEDU			3.395	2	.183			
WOMEDU(1)	.074	.234	.100	1	.751	1.077	.681	1.703
WOMEDU(2)	.232	.206	1.261	1	.261	1.261	.841	1.889
PARTOCCUP(1)	.998	.069	208.143	1	.000*	2.714	2.370	3.108
VISITEDFP(1)	-.705	.113	38.964	1	.000*	.494	.396	.616
DISSCPART(1)	-1.202	.050	573.022	1	.000*	.301	.273	.332
HUSAPPROV			773.518	2	.000*			
HUSAPPROV(1)	.800	.068	136.833	1	.000	2.225	1.946	2.544
HUSAPPROV(2)	1.611	.061	691.541	1	.000	5.009	4.442	5.648
MEDIA(1)	-.357	.047	57.931	1	.000*	.700	.638	.767
RELIGWOM			113.279	3	.000*			
RELIGWOM(1)	1.782	.178	100.521	1	.000	5.941	4.193	8.416
RELIGWOM(2)	1.451	.183	62.686	1	.000	4.265	2.979	6.108
RELIGWOM(3)	1.705	.181	88.677	1	.000	5.499	3.856	7.840
REGION			307.352	10	.000*			
REGION(1)	-.565	.116	23.854	1	.000	.568	.453	.713
REGION(2)	-.649	.138	21.970	1	.000	.523	.398	.686
REGION(3)	-.722	.111	42.506	1	.000	.486	.391	.604
REGION(4)	-.907	.106	73.124	1	.000	.404	.328	.497
REGION(5)	-2.351	.175	179.702	1	.000	.095	.068	.134
REGION(6)	-.269	.119	5.121	1	.024	.764	.605	.965
REGION(7)	-.547	.114	22.958	1	.000	.579	.463	.724
REGION(8)	-1.192	.127	88.610	1	.000	.304	.237	.389
REGION(9)	-1.032	.120	73.402	1	.000	.356	.281	.451
REGION(10)	-.885	.104	72.327	1	.000	.413	.336	.506
OCCUPWOM			4.801	2	.091			
OCCUPWOM(1)	.109	.050	4.796	1	.029	1.116	1.012	1.230
OCCUPWOM(2)	.056	.066	.715	1	.398	1.057	.929	1.203
PARTEDU			14.073	2	.001*			
PARTEDU(1)	-.874	.233	14.027	1	.000	.417	.264	.659
PARTEDU(2)	-.704	.207	11.549	1	.001	.494	.329	.742
KNOWLEDGE(1)	-18.668	573.709	.001	1	.974	.000	.000	.
WEALTH(1)	-.034	.042	.646	1	.422	.967	.890	1.050
Constant	.803	.332	5.843	1	.016*	2.233		

-* Statistically significant at $p < 0.05$

a. Variable(s) entered on step 1: RESIDENCE, AGEWOM, MARTIAL, NUMCHILD, WOMEDU, PARTOCCUP, VISITEDFP, DISSCPART, HUSAPPROV, MEDIA, RELIGWOM, REGION, OCCUPWOM, PARTEDU, KNOWLEDGE, WEALTH.

APPENDIX B: For Urban Areas

Case Processing Summary

Unweighted Cases(a)		N	Percent
Selected Cases	Included in Analysis	4620	18.3
	Missing Cases	0	.0
	Total	4620	18.3
Unselected Cases		20620	81.7
Total		25240	100.0

a If weight is in effect, see classification table for the total number of cases.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	2225.498	32	.000
	Block	2225.498	32	.000
	Model	2225.498	32	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	3507.412(a)	.382	.538

a Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	166.417	8	.051

Contingency Table for Hosmer and Lemeshow Test

		Status of a couple about FP method practice = Do not practice a FP method		Status of a couple about FP method practice = Practice a FP method		
		Observed	Expected	Observed	Expected	Total
Step 1	1	420	439.779	40	20.221	460
	2	380	340.181	80	119.819	460
	3	180	227.779	283	235.221	463
	4	233	154.937	237	315.063	470
	5	86	105.128	380	360.872	466
	6	41	72.781	453	421.219	494
	7	71	49.451	410	431.549	481
	8	29	32.207	438	434.793	467
	9	0	15.457	458	442.543	458
	10	0	2.298	401	398.702	401

Variables in the Equation (Urban)

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step1 (a)	REGION			253.786	10	.000*			
	REGION(1)	-1.260	.185	46.385	1	.000	.284	.197	.408
	REGION(2)	-.370	.263	1.975	1	.160	.691	.412	1.157
	REGION(3)	-.616	.234	6.929	1	.008	.540	.342	.854
	REGION(4)	-1.117	.209	28.445	1	.000	.327	.217	.493
	REGION(5)	-2.830	.303	87.022	1	.000	.059	.033	.107
	REGION(6)	-3.471	.295	138.060	1	.000	.031	.017	.055
	REGION(7)	-1.794	.224	64.192	1	.000	.166	.107	.258
	REGION(8)	-2.411	.329	53.681	1	.000	.090	.047	.171
	REGION(9)	-1.223	.154	62.860	1	.000	.294	.217	.398
	REGION(10)	-.506	.125	16.255	1	.000	.603	.472	.771
	AGEWOM			103.391	2	.000*			
	AGEWOM(1)	-.237	.215	1.209	1	.272	.789	.518	1.203
	AGEWOM(2)	.941	.111	72.105	1	.000	2.562	2.062	3.183
	MARTIAL(1)	-22.456	2279.619	.000	1	.992	.000	.000	.
	NUMCHILD			76.113	2	.000*			
	NUMCHILD(1)	-1.333	.160	69.469	1	.000	.264	.193	.361
	NUMCHILD(2)	-.710	.118	36.206	1	.000	.492	.390	.620
	WOMEDU			39.186	2	.000*			
	WOMEDU(1)	-.642	.367	3.057	1	.080	.526	.256	1.081
	WOMEDU(2)	.820	.258	10.121	1	.001	2.270	1.370	3.760
	OCCUPWOM			80.477	2	.000*			
	OCCUPWOM(1)	-.771	.137	31.540	1	.000	.462	.353	.605
	OCCUPWOM(2)	-1.224	.138	78.961	1	.000	.294	.224	.385
	PARTEDU			13.274	2	.001*			
	PARTEDU(1)	-.865	.367	5.555	1	.018	.421	.205	.864
	PARTEDU(2)	-.939	.258	13.249	1	.000	.391	.236	.648
	PARTOCCUP(1)	-.002	.206	.000	1	.993	.998	.667	1.495
	KNOWLEDGE(1)	-18.365	3569.502	.000	1	.996	.000	.000	.
	VISITEDFP(1)	.828	.210	15.561	1	.000*	2.289	1.517	3.453
	DISSCPART(1)	-1.639	.139	138.854	1	.000*	.194	.148	.255
	HUSAPPROV			278.535	2	.000*			
	HUSAPPROV(1)	1.008	.164	37.682	1	.000	2.739	1.986	3.779
	HUSAPPROV(2)	2.331	.153	233.282	1	.000	10.287	7.627	13.873
	MEDIA(1)	-.557	.116	23.102	1	.000*	.573	.456	.719
	RELIGWOM			133.782	3	.000*			
	RELIGWOM(1)	3.765	.375	100.651	1	.000	43.147	20.680	90.024
	RELIGWOM(2)	5.107	.442	133.721	1	.000	165.246	69.531	392.724

RELIGWOM(3)	3.875	.392	97.909	1	.000	48.200	22.370	103.854
WEALTH(1)	.028	.094	.089	1	.765	1.029	.855	1.237
Constant	20.220	2279.619	.000	1	.993	604394683.070		

-* Statistically significant at $p < 0.05$

a Variable(s) entered on step 1: REGION, AGEWOM, MARTIAL, NUMCHILD, WOMEDU, OCCUPWOM, PARTEDU, PARTOCCUP, KNOWLEDGE, VISITEDFP, DISSCPART, HUSAPPROV, MEDIA, RELIGWOM, WEALTH.

APPENDIX C: For Rural Areas

Case Processing Summary

Unweighted Cases(a)		N	Percent
Selected Cases	Included in Analysis	20620	81.7
	Missing Cases	0	.0
	Total	20620	81.7
Unselected Cases		4620	18.3
Total		25240	100.0

a If weight is in effect, see classification table for the total number of cases.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	4429.873	31	.000
	Block	4429.873	31	.000
	Model	4429.873	31	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	11653.848(a)	.193	.357

a Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	105.473	8	.100

Contingency Table for Hosmer and Lemeshow Test

		Status of a couple about FP method practice = Do not practice a FP method		Status of a couple about FP method practice = Practice a FP method		
		Observed	Expected	Observed	Expected	Total
Step 1	1	2056	2056.000	0	.000	2056

	2	2065	2065.000	0	.000	2065
	3	2034	2025.426	20	28.574	2054
	4	1961	1978.176	100	82.824	2061
	5	1968	1933.980	83	117.020	2051
	6	1961	1897.595	100	163.405	2061
	7	1752	1807.428	314	258.572	2066
	8	1567	1679.909	494	381.091	2061
	9	1531	1483.890	538	585.110	2069
	10	1005	972.595	1071	1103.405	2076

Variables in the Equation (Rural)

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1(a)	REGION			262.737	9	.000*			
	REGION(1)	2.048	.264	60.341	1	.000	7.750	4.623	12.993
	REGION(2)	1.605	.277	33.669	1	.000	4.979	2.895	8.563
	REGION(3)	1.693	.259	42.649	1	.000	5.438	3.271	9.040
	REGION(4)	1.533	.257	35.548	1	.000	4.632	2.799	7.668
	REGION(5)	-.382	.346	1.218	1	.270	.683	.347	1.344
	REGION(6)	2.411	.264	83.492	1	.000	11.148	6.646	18.699
	REGION(7)	1.921	.266	52.308	1	.000	6.829	4.058	11.494
	REGION(8)	1.289	.272	22.524	1	.000	3.630	2.131	6.182
	REGION(9)	1.459	.290	25.352	1	.000	4.301	2.437	7.588
	AGEWOM			9.079	2	.011*			
	AGEWOM(1)	-.037	.139	.069	1	.792	.964	.735	1.265
	AGEWOM(2)	.155	.059	7.014	1	.008	1.168	1.041	1.310
	MARTIAL(1)	18.862	4570.759	.000	1	.997	155422807.580	.000	.
	NUMCHILD			18.028	2	.000*			
	NUMCHILD(1)	-.550	.130	17.892	1	.000	.577	.447	.745
	NUMCHILD(2)	-.092	.058	2.561	1	.110	.912	.815	1.021
	WOMEDU			14.803	2	.001*			
	WOMEDU(1)	14.210	489.366	.001	1	.977	1483836.840	.000	.
	WOMEDU(2)	13.650	489.366	.001	1	.978	847709.433	.000	.
	OCCUPWOM			35.318	2	.000*			
	OCCUPWOM(1)	.177	.059	8.971	1	.003	1.193	1.063	1.340
	OCCUPWOM(2)	.509	.088	33.704	1	.000	1.663	1.401	1.974
	PARTEDU			26.934	2	.000*			
	PARTEDU(1)	-14.922	489.366	.001	1	.976	.000	.000	.
	PARTEDU(2)	-14.152	489.366	.001	1	.977	.000	.000	.
	PARTOCCUP(1)	1.073	.078	188.451	1	.000*	2.923	2.508	3.407
	KNOWLEDGE(1)	-27.228	692.281	.002	1	.969	.000	.000	.
	VISITEDFP(1)	-1.710	.142	145.494	1	.000*	.181	.137	.239
	DISSCPART(1)	-1.257	.057	490.364	1	.000*	.285	.255	.318

HUSAPPROV			484.198	2	.000*			
HUSAPPROV(1)	.718	.078	84.572	1	.000	2.051	1.760	2.390
HUSAPPROV(2)	1.483	.071	436.314	1	.000	4.407	3.834	5.065
MEDIA(1)	-.363	.054	45.688	1	.000*	.695	.626	.773
RELIGWOM			75.936	3	.000*			
RELIGWOM(1)	1.346	.184	53.277	1	.000	3.840	2.676	5.512
RELIGWOM(2)	.936	.188	24.886	1	.000	2.549	1.765	3.682
RELIGWOM(3)	1.394	.188	54.746	1	.000	4.033	2.787	5.835
WEALTH(1)	-.081	.050	2.657	1	.103	.922	.836	1.017
Constant	-21.062	4570.759	.000	1	.996	.000		

-* Statistically significant at $p < 0.05$

a Variable(s) entered on step 1: REGION, AGEWOM, MARTIAL, NUMCHILD, WOMEDU, OCCUPWOM, PARTEDU, PARTOCCUP, KNOWLEDGE, VISITEDFP, DISSCPART, HUSAPPROV, MEDIA, RELIGWOM, WEALTH.

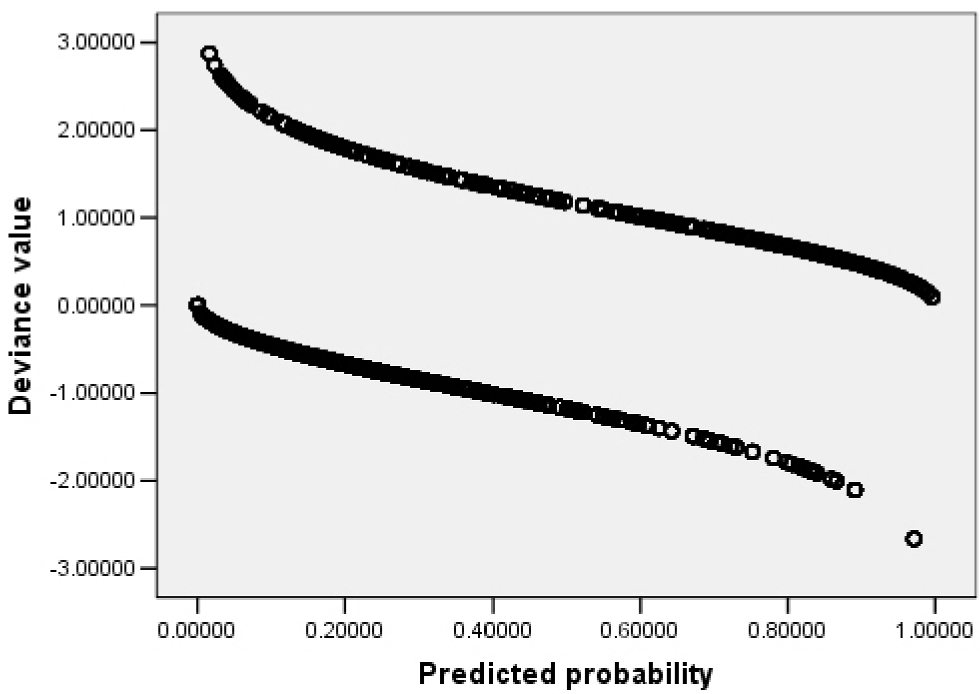
Result of diagnostic tests for outliers and influential value

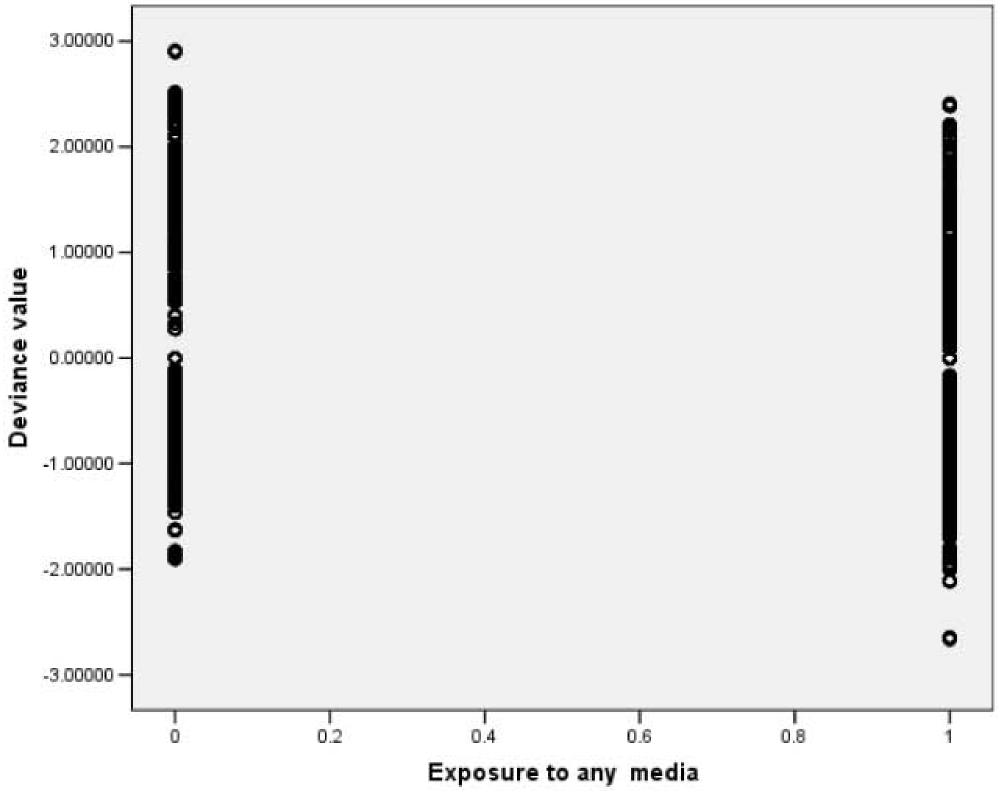
Descriptive Statistics

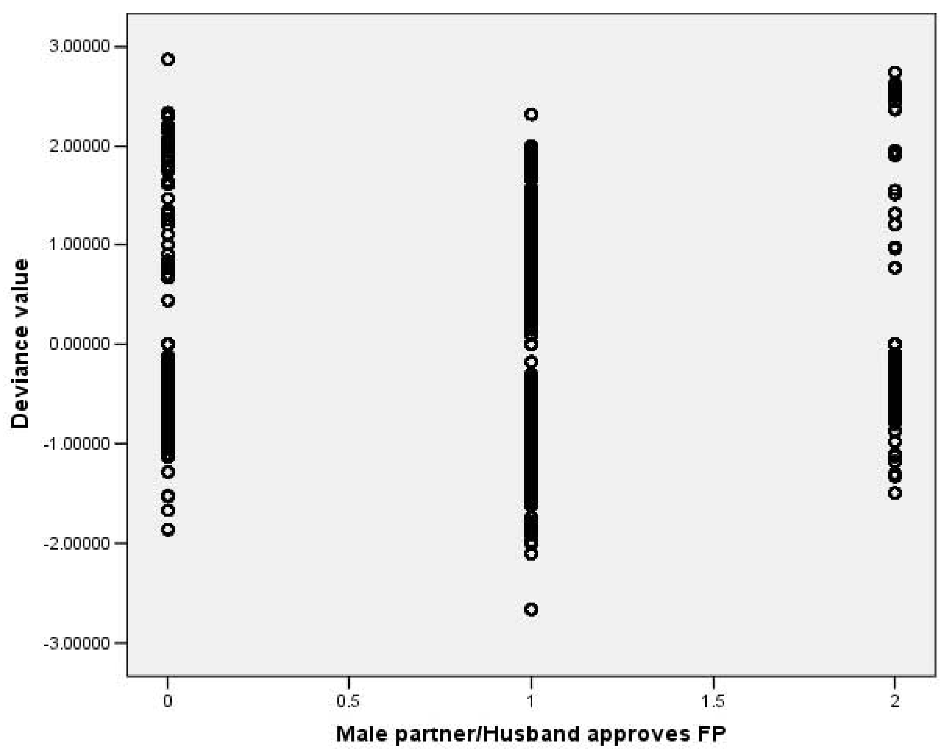
	N	Minimum	Maximum
Analog of Cook's influence statistics	25240	.00000	.04333
Leverage value	25240	.00001	.01319
Normalized residual	25240	-5.93748	7.77937
DFBETA for constant	25240	-.03855	.02499
DFBETA for REGION(1)	25240	-.00586	.00469
DFBETA for REGION(2)	25240	-.00553	.00993
DFBETA for REGION(3)	25240	-.00457	.00518
DFBETA for REGION(4)	25240	-.00422	.00465
DFBETA for REGION(5)	25240	-.00619	.02333
DFBETA for REGION(6)	25240	-.00643	.00502
DFBETA for REGION(7)	25240	-.00447	.00468
DFBETA for REGION(8)	25240	-.00838	.01008
DFBETA for REGION(9)	25240	-.00497	.00675
DFBETA for REGION(10)	25240	-.00456	.00593
DFBETA for AGEWOM(1)	25240	-.00638	.00840
DFBETA for AGEWOM(2)	25240	-.00178	.00188
DFBETA for MARTIAL(1)	25240	-.01656	.03639
DFBETA for NUMCHILD(1)	25240	-.00557	.00603
DFBETA for NUMCHILD(2)	25240	-.00188	.00160
DFBETA for WOMEDU(1)	25240	-.02167	.01321
DFBETA for WOMEDU(2)	25240	-.02113	.01331
DFBETA for OCCUPWOM(1)	25240	-.00150	.00175
DFBETA for OCCUPWOM(2)	25240	-.00240	.00362
DFBETA for PARTEDU(1)	25240	-.01323	.02125
DFBETA for PARTEDU(2)	25240	-.01320	.02094

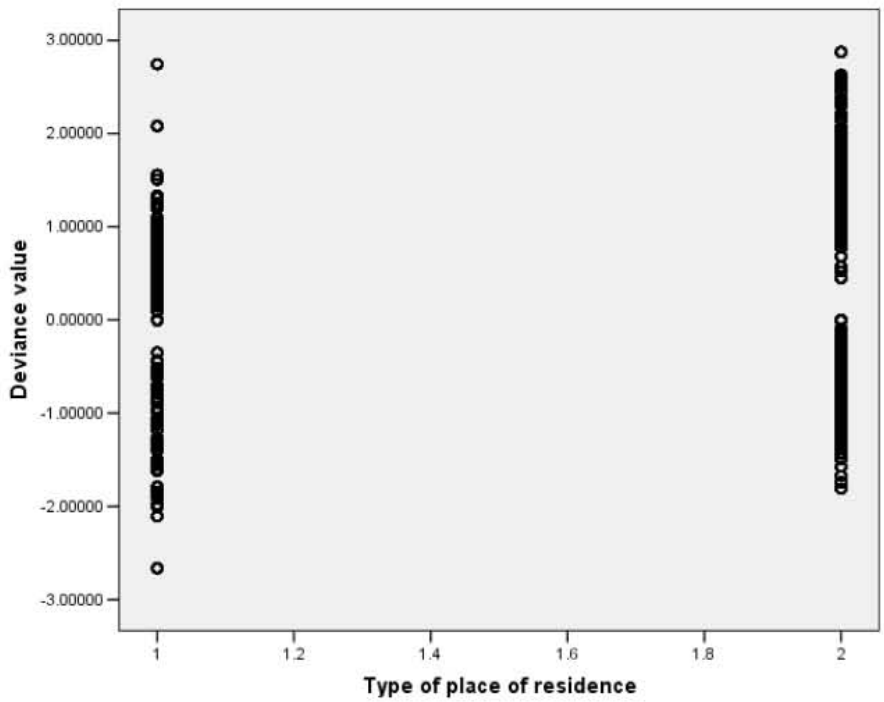
DFBETA for PARTOCCUP(1)	25240	-.00408	.00373
DFBETA for KNOWLEDGE(1)	25240	-.00381	.00064
DFBETA for VISITEDFP(1)	25240	-.01078	.01143
DFBETA for DISSCPART(1)	25240	-.00181	.00166
DFBETA for HUSAPPROV(1)	25240	-.00391	.00183
DFBETA for HUSAPPROV(2)	25240	-.00308	.00201
DFBETA for MEDIA(1)	25240	-.00205	.00157
DFBETA for RELIGWOM(1)	25240	-.02798	.01911
DFBETA for RELIGWOM(2)	25240	-.02969	.01864
DFBETA for RELIGWOM(3)	25240	-.02776	.01902
DFBETA for WEALTH(1)	25240	-.00129	.00126
DFBETA for RESIDENCE(1)	25240	-.00452	.00741
Valid N (listwise)	25240		

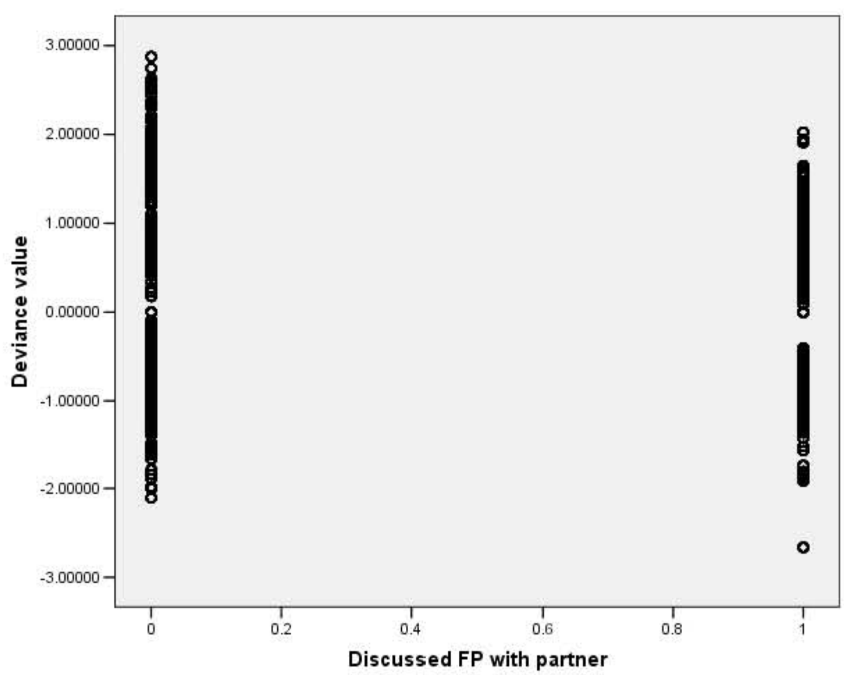
Change in Deviance against Predicted probabilities




3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
-3.00000
Deviance value
0
0.2
0.4
0.6
0.8
1
Exposure to any media


3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
-3.00000
Deviance value
0
0.5
1
1.5
2
Male partner/Husband approves FP


3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
-3.00000
Deviance value
1
1.2
1.4
1.6
1.8
2
Type of place of residence


3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
-3.00000
Deviance value
0
0.2
0.4
0.6
0.8
1
Discussed FP with partner

OUTPUT FOR MULTILEVEL LOGISTIC REGRESSION

APPENDIX D: EMPTY MODEL

Model and Data Descriptions

Sampling Distribution = Bernoulli
Link Function = Logistic
Weight Variable = Weights
Number of Level-2 Units = 11
Number of Level-1 Units = 25240
Number of Level-1 Units per Level-2 Unit =
1960 1400 3760 4660 1820 2140 3720 1620 1000 1600 1560

o==o
| Results for the model without any random effects |
o==o

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	27449.7626	25238	1.0876
Pearson Chi-square	25240.0000	25238	1.0001
Deviance	27449.7626		
Akaike Information Criterion	27453.7626		
Schwarz Criterion	27470.0350		

Estimated regression weights

Parameter	Estimate	Standard Error	z- Value	P- Value
intercept	0.0000	0.0000		
intercept1	1.1872	0.0149	79.8255	0.0000

o==o
| Results for the model with fixed and random effects |
o==o

Total number of (macro) iterations 4

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	23488.9731	25237	0.9307
Pearson Chi-square	25177.2204	25237	0.9976
Deviance	23488.9731		
Akaike Information Criterion	23492.9731		
Schwarz Criterion	23509.2455		

Estimated regression weights

Parameter	Estimate	Standard Error	z-Value	P-Value
intercept	0.0000	0.0000		
intercept1	1.2182	0.0164	74.3669	0.0000

Deviance-based Chi-Square test for significance of random effects

NDF	Chi-Square	P-Value
1	3960.7895	0.0000*

Estimated level 2 variances and covariance's

Parameter	Estimate	Standard Error	z-Value	P-Value
intercept/intercept	1.3480	0.4239	3.1800	0.0015

Level-2 covariance matrix

	intercept
intercept	1.348047

Level-2 correlation matrix

	intercept
intercept	1.000000

APPENDIX E: RANDOM INTERCEPT AND FIXED SLOPES VARIABLES

o==o
| Results for the model without any random effects |
o==o

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	18029.8087	25234	0.7145
Pearson Chi-square	25199.2362	25234	0.9986
Deviance	18029.8087		
Akaike Information Criterion	18041.8087		
Schwarz Criterion	18090.6258		

Estimated regression weights

Parameter	Estimate	Standard Error	z-Value	P-Value
Intercept	-4.1258	0.1058	-38.9919	0.0000
VISITE_FP	-0.8943	0.1154	-7.7495	0.0000
DISSCPAR	-1.2047	0.0473	-25.4787	0.0000
HUSAPPRO	1.4786	0.0404	36.5703	0.0000
MEDIA	-0.7236	0.0405	-17.8460	0.0000
RESIDE	2.1014	0.0451	46.6303	0.0000

o===o
| Results for the model with fixed and random effects |
o===o

Total number of (macro) iterations 12

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	17679.9091	25233	0.7007
Pearson Chi-square	25325.5563	25233	1.0037
Deviance	17679.9092		
Akaike Information Criterion	17691.9092		
Schwarz Criterion	17740.7263		

Estimated regression weights (interpretation)

Parameter	Estimate	Standard Error	z-Value	P-Value
Intercept	-3.5743	0.1080	-33.0809	0.0000
VISIT_FP	-0.7758	0.1157	-6.7034	0.0000
DISSCPAR	-1.2715	0.0472	-26.9396	0.0000
HUSAPPRO	1.3792	0.0409	33.7433	0.0000
MEDIA	-0.7168	0.0410	-17.4637	0.0000
RESIDE	1.9089	0.0462	41.2895	0.0000

Deviance-based Chi-Square test for significance of random effects

NDF	Chi-Square	P -Value
1	349.8995	0.0000*

Estimated level 2 variances and covariances

Parameter	Estimate	Standard Error	z-Value	P-Value
Intercept/intercept	0.2571	0.0816	3.1486	0.0016

Level-2 covariance matrix

	intercept
intercept	0.257050

Level-2 correlation matrix

	intercept
intercept	1.000000

APPENDIX F: RANDOM INTERCEPT AND RANDOM SLOPES VARIABLES

o===o
| Results for the model without any random effects |
o===o

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	18029.8087	25234	0.7145
Pearson Chi-square	25199.2362	25234	0.9986
Deviance	18029.8087		
Akaike Information Criterion	18041.8087		
Schwarz Criterion	18090.6258		

Estimated regression weights

Parameter	Estimate	Standard Error	z -Value	P -Value
intercept	-4.1258	0.1058	-38.9919	0.0000
RESIDE	2.1014	0.0451	46.6303	0.0000
VISIT_FP	-0.8943	0.1154	-7.7495	0.0000
DISSCPAR	-1.2047	0.0473	-25.4787	0.0000
HUSAPPRO	1.4786	0.0404	36.5703	0.0000
MEDIA	-0.7236	0.0405	-17.8460	0.0000

o==o
| Results for the model with fixed and random effects |
o==o

Total number of (macro) iterations 101

Goodness of fit statistics

Statistic	Value	DF	Ratio
Likelihood Ratio Chi-square	16671.0867	25228	0.6608
Pearson Chi-square	24141.5301	25228	0.9569
Deviance	16671.0590		
Akaike Information Criterion	16683.0590		
Schwarz Criterion	16731.8762		

Estimated regression weights (interpretation)

Parameter	Estimate	Standard Error	z-Value	P-Value
Intercept	-4.2287	0.1101	-38.4217	0.0000
RESIDE	2.1290	0.0478	44.5611	0.0000
VISIT_FP	-2.0345	0.1198	-16.9824	0.0000
DISSCPAR	-1.7434	0.0480	-36.2938	0.0000
HUSAPPRO	1.6852	0.0420	40.0884	0.0000
MEDIA	-0.6638	0.0421	-15.7743	0.0000

Deviance-based Chi-Square test for significance of random effects

NDF	Chi-Square	P-Value
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21	1358.7496	0.0000*

Estimated level 2 variances and covariances

Parameter	Estimate	Standard Error	z-Value	P-Value
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intercept/intercept	5.5077	1.7535	3.1410	0.0017
RESIDE/intercept	-1.8754	0.7101	-2.6410	0.0083
RESIDE/RESIDE	1.2381	0.3888	3.1844	0.0015
VISIT_FP/intercept	0.7902	1.5658	0.5047	0.6138
VISIT_FP/RESIDE	1.4271	0.8153	1.7503	0.0801
VISIT_FP/VISIT_FP	8.7196	2.8732	3.0348	0.0024
DISSCPAR/intercept	1.4357	0.6085	2.3594	0.0183
DISSCPAR/RESIDE	-0.1596	0.2503	-0.6376	0.5238
DISSCPAR/VISIT_FP	1.8967	0.7899	2.4011	0.0163
DISSCPAR/DISSCPAR	0.9700	0.3075	3.1544	0.0016
HUSAPPRO/intercept	-1.2805	0.6130	-2.0888	0.0367
HUSAPPRO/RESIDE	-0.1747	0.2572	-0.6794	0.4969
HUSAPPRO/VISIT_FP	-2.3455	0.8541	-2.7462	0.0060
HUSAPPRO/DISSCPAR	-0.8061	0.2852	-2.8262	0.0047
HUSAPPRO/HUSAPPRO	1.0199	0.3221	3.1662	0.0015
MEDIA/intercept	-2.5071	0.9289	-2.6990	0.0070
MEDIA/RESIDE	0.8698	0.3887	2.2377	0.0252
MEDIA/VISIT_FP	0.9318	0.9548	0.9759	0.3291
MEDIA/DISSCPAR	-0.1298	0.3146	-0.4124	0.6800
MEDIA/HUSAPPRO	0.4159	0.3390	1.2268	0.2199
MEDIA/MEDIA	1.9157	0.6097	3.1420	0.0017

Level-2 covariance matrix

	intercept	RESIDE	VISIT_FP	DISSCPAR	HUSAPPRO	MEDIA
intercept	5.507681					
RESID	-1.875390	1.238128				
VISIT_FP	0.790197	1.427065	8.719584			
DISSCPAR	1.435746	-0.159564	1.896726	0.970009		
HUSAPPRO	-1.280482	-0.174733	-2.345508	-0.806114	1.019946	
MEDIA	-2.507134	0.869833	0.931815	-0.129753	0.415866	1.915709

Level-2 correlation matrix

	intercept	RESIDE	VISIT_FP	DISSCPAR	HUSAPPRO	MEDIA
intercept	1.000000					
RESID	-0.718165	1.000000				
VISIT_FP	0.114026	0.434323	1.000000			
DISSCPAR	0.621163	-0.145601	0.652182	1.000000		
HUSAPPRO	-0.540257	-0.155490	-0.786503	-0.810438	1.000000	
MEDIA	-0.771842	0.564792	0.227991	-0.095184	0.297509	1.000000