Influence of Maternal Education on Child Health in Kenya

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Abstract

In 2003, child mortality rate was 115/1000 children in Kenya compared to 88/1000 average for Sub-Saharan African countries. This study sought to determine effect of maternal education on immunization (n=2,169) and nutritional status (n=5,949) on child's health. Cross-sectional data, Kenya Demographic Health Survey (KDHS)-2003 were used for data analyses. 80% of children were stunted and 49% were immunized. After controlling for confounding, overall (model 8) children born to mothers with primary education were 2.17 times more likely to be fully immunized compared to those whose mothers lacked any formal education, $p<0.001$. For nutrition, unadjusted results, children born to mothers with primary education were at 94% lower odds of having stunted growth compared to mothers with no primary education, $p<0.01$. Overall (model 8) maternal education was not significant predictor-nutritional status. Policy implications for child health in Kenya should focus on increasing health knowledge among women for better child's health outcomes.

Keywords: *Child health; Maternal education; Immunization; Child nutrition; Health knowledge; Kenya*

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Introduction

Prevention of child mortality is one of the Millennium Development Goals (MDGs) expected to be achieved by 2015 (MDG Report, 2008). However, in 2008, the infant and child mortality rates for sub-Saharan African countries and Kenya stands at 88 deaths per 1000 and 77 per 1000 children born, respectively (PRB, 2008). In Kenya, the under five mortality rate is equally high standing at 115 for every 1000 children born (Kenya Demographic and Health Survey (KDHS), 2003); 70% of the children succumbing to death before their fifth birthday, from childhood diseases that are preventable (KDHS 2003; World Bank 2004). Child health remains a critical issue in Kenya, where infant and child mortality is still substantially high; the country's infant mortality rate stands at 67%. Although polio had been declared not a threat to children in Kenya, 25 years ago, recent reports indicate that the disease is now a real threat months (Capital News, 2009).

Child health is a significant marker of the quality of life in less developed countries (LDCs) (Glewwe, 1999). Existing research continues to show a strong correlation between maternal education and improved child health (Caldwell, 1979; Glewwe, 1999; Mirowsky & Ross 2003; Schultz 2002). Increased years of schooling of mothers have been shown to have a positive effect on child health. So important is the role of maternal education that it has a greater impact on children's health outcomes than fathers' education, use of modern health services, and socioeconomic status (Martin, Trussel, Salvail, & Shah, 1983; Young, Edmonson, & Andes, 1983). Cross country comparisons have shown that in developing countries, there is an inverse relationship between higher levels of education (particularly maternal education) and child deaths (Bicego, & Ahmad, 1996; Bicego & Boerma, 1993; Boerma, Sommerfelt & Rustein, 1991; Cleland, & Van Ginnneken, 1988; Cochrane, 1980; Hobcraft, McDonald, & Rustein,

1984; United Nations, 1985; Ware, 1984), a sign that education is still an important factor in the fight against infant and child mortality in developing countries.

Despite the consensus that maternal education is associated with better health outcomes in children, caveats still remain in the causal effect of maternal education on child health, and on the potential pathways linking the two variables (Desai & Alva, 1998). Additional research is still needed to unravel the links. The current study highlights the role of mother's education on two key child health outcomes—immunization and nutritional status, (measured by complete vaccination and height for age, respectively). Immunization protects children against five childhood diseases namely: pertussis (whooping cough); neonatal tetanus, contracted through contamination of umbilical cord at birth; polio (a major course for lameness in the developing world); tuberculosis, which can be especially severe in young children; and diphtheria, which is less common but kills 10%-15% of its victims (Caldwell, 1986). Height for age is a measure of a child's linear age—used as a measure for stunting (KDHS, 2003). According to the KDHS (2003), stunting is an outcome of lack of adequate nutrition for a child that usually occurs over a long period of time—representing long-term malnutrition effects on a population of children.

In Kenya, national estimates show that among children under five years, 30% are stunted, while 11% suffer from severe stunting. Stunting is highest among the children who are between 12-23 months. Additionally, male children (33%) are more likely to suffer from stunting than female children (28%) (KDHS, 2003).

Pathways linking maternal education and child health

Socio-economic status

Socio-economic status (SES) is one of the important and most researched links between mothers' education and child health (Caldwell, 1994; Cleland & Kaufman 1993; Frost, Forste, &

Haas, 2005; World Bank, 1993). Education is related to the socioeconomic status of a family. Education and socioeconomic status predict children's health status because they influence the individual mothers' knowledge, attitudes and behavior, which in turn impact the health outcomes of their children (Cleland, 1990). Caldwell & Caldwell (1993) highlight two potential mechanisms through which education of the mother improves the health of children—through enhanced use of health services, and, promotion of healthy behaviors and practices. Previous research attributes better child health to the link between the educational attainment of a child's mother and her ability to purchase goods and services that are essential for improving the child's health outcomes (Cleland & Van Ginneken, 1988; Defo, 1997, Victoria, Smith & Vaughan, 1986). In this regard, education seems to be connected to better income (Frost, Forste, & Haas, 2005), which then leads to better health status**.** With increased levels of education, women are more likely to obtain steady and better paying jobs, thereby making them more able to supplement the family income (Barrette & Brown, 1996). Additionally, women with higher levels of education are more likely to marry better educated men, with well paying jobs (Barrette & Brown, 1996; Cleland & Van Ginneken, 1988). Additional family income is equated to access to better healthcare for children, including improved housing conditions such as availability of better latrine facilities, piped water, floors that are non-dirt, and electricity. Living in these conditions means that these households will be less contaminated on average (Barrette & Brown, 1996: Frost, Forste, & Haas, 2005; Martin et al., 1983).

Desai & Alva (1998) found that although maternal education had a strong correlation with markers of child health; this relationship is greatly reduced by the introduction of individual SES variables and community effects. They conclude that maternal education acts as a proxy for SES and geographic residence. Frost, Forste, & Haas (2005) in their Bolivian study, establish

that SES is the most important mechanism that links maternal education and child nutrition. Previous research has consistently linked maternal education and SES to child health, by asserting that SES explains a half of the effect of a mother's education on the health outcomes for children (Cleland & Van Ginneken, 1988; Desai & Alva, 1998).

Knowledge

School attendance by women enables them to acquire formal education, which makes them knowledgeable on a whole range of health issues about themselves and their children. This knowledge is imparted through a number of ways, including learning about the causes of diseases and illnesses, recognition, prevention and curative measures, the nutritional requirements for effective growth and development, and exposure to and synthesizing health-related messages and recommendations from various sources, including the mass media (Caldwell, 1979; Casterline, 2001; Castro & Juarez, 1995; Cleland, 1990; Cleland & Van Ginneken, 1988; Defo, 1997; Frenzen & Hogan, 1982; Streatfield, Singarimbun, & Diamond, 1990).

Despite the fact that family members may contribute to how a child is raised, mothers' knowledge is more important because it determines how the children's illnesses are treated (Heaton, Forste, Hoffmann, & Flake, 2005). In developing countries, health outcomes are perceived to be influenced by traditional beliefs about causes and symptoms of illnesses and diseases—especially in an atmosphere of limited biomedical knowledge—where mothers will often attribute children's illnesses to various folk beliefs (Goldman, Pebley, & Gragnolati, 2002). On the contrary, mothers who are more educated and with favorable views toward modern health care are expected to seek health care assistance from medical professionals (Heaton et al., 2005). However, the evidence linking maternal education, health knowledge and child health is not

conclusive. Glewwe (1999) found that health knowledge intervenes between maternal education and child health; whereas other research in the same area has found little and sometimes no association between maternal education and health knowledge (Cleland & Van Ginneken, 1988; Cleland 1990).

Attitudes

Education also helps to shift negative attitudes toward modern medicine by promoting awareness and acceptance of modern medical practices and disease interpretations that are rooted in scientific data as opposed to fatalistic beliefs (Barrette & Brown, 1996; Caldwell & Caldwell 1993; Cleland & Van Ginneken, 1988; Defo 1997). Therefore, it is expected that educated mothers will readily embrace modern medicine, will be more open to using preventive health care, and will not think that the reason their child is sick is because of fate or supernatural causes (Bicego & Boerma 1993; Heaton et al., 2005). An attitudinal link in the study of child health has been established by several studies. For example, Zeiltin, Ghassemi & Mansour (1990) have established that mothers who are optimistic and enterprising achieve more success with their child's nutrition despite being poor, while children of mothers who have a fatalistic attitudes and views often lack proper nutrition.

Autonomy

Research shows that education is linked to child health through its influence on the ability of women to make decisions within their families (Frost, Forste, & Haas, 2005), which in turn determines how much power she wields in the marital relationship (Heaton et al., 2005). Women usually are the primary caregivers in the households, and in most cases, the first person in the home to recognize that a child is sick is usually the mother (Caldwell & Caldwell, 1993; Caldwell, 1993; Frost, Forste, & Haas, 2005). When a woman is uneducated they will often wait

until other household members have noticed that the child is sick—usually the persons who have authority in the household (Caldwell et al., 1990). The more educated a woman is the more she is able to make the initial decisions that are related to the health of her children (Jejeebhoy, 1995; Mason, 1984).

Education increases a mother's personal responsibility towards her children, drawing more attention towards the child's illness. Education demands that action should be taken and results into a visit to the medical practitioners for the sick child instead of waiting for the decisions to be made by traditional authority figures (Caldwell, 1979; 1993; Caldwell et al., 1990; Heaton et al., 2005). Saraswathi (1992) further reports that improved nutritional status for female infants is dependent on their mother's control over family's income. Kishor (1995) and Jejeebhoy (1995) also document that there is a positive relationship between a mother's autonomy and the survival of her children.

Reproductive Factors

Previous research links a mother's reproductive factors to child health. The argument is that better educated mothers have more control over their reproductive choices/decisions, including the number and the spacing of births. These factors ultimately influence child health (Cleland & Van Ginneken, 1988; Mason, 1984; LeVine et al., 1994).

Research documents that in the developing countries women get married at early ages, and as a consequence, they enter the childbearing period when their bodies are still not mature enough to carry babies. The teenage mothers often do not use prenatal care even when these services are available. Consequently, these young mothers are exposed to a myriad of health risks, such as miscarriages and still births and low birth weight (LBW) (Bachrach, Clogg, & Carver 1993; Shawky & Milaat, 2001),

Birth interval is an important reproductive behavior that influences the child health and survival (Forste, 1994; Lindstrom, 2000; Manda, 1999). Three mechanisms help to explain the birth interval and child health linkage: women who give birth in a relatively short time do not give themselves enough time to regain their nutritional status; children born close together are often competing for mother's care and resources; short birth interval exposes the younger child to diseases due to inadequate care arising from less attention by the mother (Bicego & Boerma 1993). Thus, increased child mortality is a consequence of birth intervals that are 2 years or less apart (Sullivan et al., 1994; Tagoe-Darko, 1995; Curtis & Steele, 1996; Gubbaju, 1986). On the other hand, children whose birth spacing's are is two years or more apart have a higher chance of being better cared for, are breastfed and have better health outcomes such as proper physical growth and body weight (Bastien, 1992; Gubbaju, 1986). In addition, Birth order/parity also influences child health and survival (Alam, 2000). However, some scholars argue that the effect of maternal education on child mortality has nothing to do with the shifts in the reproductive behavior (Cleland & Van Ginneken, 1988). Other scholars argue that there are reproductive linkages between mother's education and the ability of the child to survive (Mason, 1984).

Conceptual model

This study will be guided by the human capital and status attainment model of schooling. In the human capital and status attainment model of schooling, it is hypothesized that schooling enables people to acquire skills which they use to work in the various sectors of the economy (Becker 1964; Hyman, Wright, & Reed, 1976; Sewell & Hauser, 1976; Spaeth, 1976). More years of schooling increase people's stock of human capital (Mirowsky & Ross, 2003). According to Mirowsky & Ross (2003, p. 26), education is "a learned effectiveness" whereby people are enabled to acquire skills, abilities and accumulated resources which help them to

shape their health and well being. Therefore, education leads to an individual's increased control over his/her life course events, through developing the ability of gathering and interpreting information (Mirowsky & Ross, 1989). Thus, *personal control* is an outcome of high levels of education and an important pathway between education and health (Ross & Mirowsky, 1999).

Glewwe (1999), in his study of Moroccan schools connects schooling of parents to child health through influencing and enhancing parental values, cognitive skills of parents (literacy, numeracy), raising household income, and parents' health knowledge. He posits that the linkage between mother's education and child health operate through mechanisms such as: health knowledge which is acquired through formal education—by directly teaching health related information; literacy and numeracy skills acquired through formal education, which help mothers in the diagnosis and treatment of children health problems. In addition, formal schooling exposes women to modern society, making them more receptive to modern medicine. Other studies have reported that education acts as a source of knowledge by providing literacy, information, and cognitive skills, as well as transforming people's attitudes by encourages the acceptance of modern ideas that enable people to relegate the traditional beliefs and authority (Cleland, Bicego, & Fegan, 1991; Castro & Juarez, 1995).

The purpose of this study is to highlight the importance of mother's education on child health in Kenya. We seek to answer the following questions: 1) Does mother's education affect the immunization status of the children in Kenya? and 2) Does mother's education affect children's height for age through changing nutritional status of children in Kenya?

Data and Methods

The data source for this study was the 2003 KDHS. The 2003 KDHS is the first in a series of the DHS surveys to cover all parts of the country, including marginal areas that were

not previously surveyed—Turkana, Samburu, Isiolo, Marsabit, and Moyale. The KDHS 2003 collected demographic and health issues on a sample of women aged 15-49 years, and from men aged 15-54 years. A sample selection allowed for estimation of key indicators for each of the eight provinces, and at the same time estimate rural-urban differences. Data collection has previously been described somewhere else (CBS, 2004). All analyses utilized the KDHS 2003 women dataset.

Measurement

This analysis focuses on the effect of mother's education on child health, while establishing the mediating effect of socioeconomic status (SES), access to information, attitudes, autonomy, and mother's reproductive variables. The covariates include partner's education, region of residence, mother's age, and rural urban differences. The dependent variables are immunization status and height for age. Child immunization information is collected for children born 35 months preceding the 2003 KDHS. For the immunization analysis, the sample was restricted to children who were between 12 and 35 months at the time of the survey (n=2,169). This restriction is based on the premise that children less than 12 months may not be fully immunized and according to the World Health Organization (WHO) recommendations, child vaccination coverage should be assessed for children who are over the age of 12 months (Bronte-Tinkew & Dejong, 2005). The 35-month threshold is included in the analysis to cover the cases where children were late in getting all the eight vaccines as stipulated by the 24 month immunization schedule which is common in developing countries.

Immunization is operationalized as the number of vaccinations a child receives. To be fully immunized, a child should have received the following eight vaccinations: one dose of Bacille Galvette-Guerin (BCG) vaccine, one dose of measles vaccine, three doses of polio

vaccine, and three doses of Diphtheria-pertusis-tetanus (DPT) vaccine (Bronte-Tinkew & Dejong, 2005). The 2003 KDHS contains data on all the eight forms of childhood immunizations. Data on the immunization cards—both "vaccine marked on card" and "vaccine date on card", as well as vaccine "reported by mother" (those children whose mother reported that they were immunized but the vaccination card was missing) were used in determining receipt of vaccinations. The cases from the latter category (vaccination card missing) were not dropped from the analysis. Immunization status was coded as a dummy variable, where "1" means that a child has received all the eight vaccines and "0" if otherwise.

Nutritional status is measured by a child's height for age, n=5,949 were retained for analysis. Child height for age is a dichotomous variable, coded as "1" for children who are below negative two standard deviations of the median population and "0" otherwise (Heaton et al., 2005). Height for age is an anthropometric index that shows the growth of a child during the pre- and post-natal period. It denotes the long term deficiencies and effects of malnutrition on health (Gillespie & Haddad, 2001). The National Center for Health Statistics and the WHO growth reference classify children who are below two standard deviations on the height-for-age growth curve to be stunted (Dibley, Goldsby, Strehling, & Trowbridge, 1987).

Maternal education is the main predictor variable. The three education categories (no education, primary, and secondary and higher) were coded as "0", "1", and "2" respectively. Socioeconomic status (SES) is measured by the wealth index variable, which indicates the poverty level in a household. Wealth index thus gives one consistent measure of SES without having to build an index out of the household ownership and household environment—which varies across different studies. Wealth index has three categories – poor, middle, and rich coded as "0", "1", and "2" respectively.

Access to information is measured by three variables: Listening to radio, newspaper reading and watching television. Each of the variables is coded as "0" does not listen to radio, reads no newspaper, and watches no television, and "1" listens to the radio, reads the newspaper and watches television. Direct measures of knowledge, attitude, and autonomy are limited in the KDHS 2003. Several measures are used as proxies to capture mothers' knowledge, attitude, and autonomy. Mothers' knowledge is an index computed using the following variables: whether the mother has ever heard of oral rehydration therapy for the treatment of diarrhea (ORS), whether the mothers received AIDS information at antenatal visit and whether the mothers recognized signs of illnesses in their children (coughing, crying, diarrhea, fever/shivering, not able to drink, and repeated vomiting). The index for knowledge ranges from (0-7), where "0" denotes no health knowledge while and "7" indicates that a mother is highly knowledgeable.

Mothers' attitude is influenced by her education and consequently learns to challenge the traditional attitudes and beliefs making it possible for her to utilize modern healthcare services (Frost, Forste, & Haas, 2005). According to Frost, Forste, & Haas (2005), a measure of attitude assumes that the use of preventative health services by mothers is a sign of how receptive they are to modern health care compared to those mothers who do not frequent emergency and curative heath care services. Therefore, we base our measure of attitude towards on how well mothers are receptive to, and use of preventative healthcare services. Thus, our measure for utilization of healthcare (a proxy indicator for mothers' attitude toward modern medicine) combines measures of receipt of prenatal care, doctor/nurse attendant at birth, receipt of tetanus injection before birth, and use of any modern method of contraception. The attitude index has a range of (0-6); "0" denoting no receptivity to modern healthcare use, and "6" denoting high receptivity to use of modern healthcare. The KDHS 2003 lacks measures of autonomy.

Therefore, autonomy is measured using two proxy variables – who made the decision for using contraception, and who decides how to spend money in the household. The autonomy index ranges from (0-2), with "0" referring to no autonomy while "2" referring to high autonomy regarding health related decisions.

The reproductive variables that are included in the analysis are mother's age, birth interval and birth parity. Maternal age is a continuous variable measured in single years. Birth parity/order is measured from the first birth to the sixteenth birth. Birth interval is measured in months and is coded into three dummy categories: ≤24 months, 25-47 months, and ≥48 months. We also control for rural/urban settings, region of residence, partners' education, and mothers' age.

Method of analysis

The dependent variables (complete immunization and child nutrition-height for age) in the analysis are dichotomous and hence the estimation is done using logistic regression. The logit equation is log [p / 1- p] = a +bX, where p / (1- p) is the odds of an outcome occurring given the independent measure of explanatory variable X, and where *a* indicates the constant and *b* represents the coefficient being estimated. Therefore, this equation estimates the log odds of a child being fully vaccinated and whether the child is stunted. The derived coefficients are interpreted based on their significance and are then exponentiated to give odds ratios (Bronte-Tinkew & Dejong, 2005), which show the effect of the independent variables and covariates on the probability of complete immunization and child stunting.

Given that the 2003 KDHS employed a complex survey design, adjustments were made to account for clustering, stratification, and unequal weighting. According to An (2002) and Cassell (2006), accounting for complex survey design in data analysis is important because it

allows for estimation of accurate standard errors in cases where the sample has been drawn using clusters, stratification, and unequal weights.

Findings

Descriptive statistics for child immunization and nutrition

The descriptive statistics presented in Table 1 show that almost half of the children who are between 0-36 months are fully immunized in Kenya. Overall, the level of maternal education is low as well with only 57% of women having primary education, 23% with secondary education and higher, and 20% of the women having no education at all. Socioeconomic level as measured by the wealth index variable shows that a higher proportion of women in Kenya are still poor: 44% of women are categorized as poor; 18% are in the middle rich; and 38% are rich. The results show that the mothers in this sample have moderate health knowledge as indicated by an average score of 3.4 out of the total score of seven. The attitude index is low with mothers' attaining an average score of 2.17 out of a total score of six. The autonomy score is modest with mothers scoring an average of 0.93 out of a possible score of two.

The reproductive measures show that 26% of children were born within an interval of two years. Forty nine of the children have a birth spacing of between 2-4 years, and 25% of children were born after four years. The average age of mothers was 28 years. Overall, the level of partners' education is low, with 48% of men having primary education, 36% with secondary education and higher, and 16% of the men having no education. Three quarters of mothers live in the rural areas. A majority of the mothers live in the Rift valley Province (21%) followed by Western (14%). The most common source of information for mothers was the radio, with 78% reporting they listen to radio.

Eighty percent of the children are stunted in Kenya, out of all children who are 0-60 months have higher proportion of lacking proper nutrition. Overall, among the sample of children (n=5,949) whose data was used to estimate height for age, their mothers' level of education can be termed as low; with 58% of women have primary education, 22% have secondary education and higher, and 20% of the women have no education at all. Socioeconomic level as measured by the wealth index variable shows that among women with children between 0-60 months, 44% are categorized as poor, 18% are in the middle rich, and 38% are rich. The results show that mothers in this sample have low levels of health knowledge as indicated by an average score of 2.87 out of the total score of seven. For the attitude index, the average score was 1.88 out of a total score of six. The autonomy score was slightly lower with the mothers' average score being 0.58 out of a possible of two items.

[Insert table 1]

Multivariate Logistic Regression Results (Effect of Maternal Education on Complete Child's Immunization)

Table 2 presents the univariate/unadjusted logistic regression (model 1) and multivariate logistic regression (model 2-8) predicting the effect of maternal education on child health in Kenya. In model 1, children born to mothers with a primary education were 2.17 times more likely to be fully immunized compared to those who do not have any education at all, $p<0.001$. In addition, those children born to mothers with a secondary education were 2.68 times more likely to be fully immunized compared to those who do not have any education at all, $p<0.001$. After controlling for confounding (place of residence, mother's current age, partner's education, and region of residence) i.e. model 2, mother's education effect attenuated, such that children born to mothers with a primary education were 1.85 times more likely to be fully immunized

compared to those who do not have any education at all, p<0.01. Those children born to mothers with a secondary education were 2.16 times more likely to be fully immunized compared to those who do not have any education at all, p<0.01. Furthermore, women from North Eastern, Nyanza, and Western Provinces were significantly at less odds of having their children fully immunized (OR:0.23, p<0.001, OR:0.38, p<0.001, and OR:0.59, p<0.05, respectively) compared to those in Nairobi Province..

Consistent attenuation of the odds ratios was observed through model 5 after controlling for socioeconomic factor (measured by wealth index), knowledge index, mother's attitudes index, and autonomy index. Children born to mothers with a primary education were 1.53 times more likely to be fully immunized compared to mothers with no education at all, p< 0.05. After further controlling for reproductive behavior birth interval, and source of information mothers who have completed a primary education were notably associated with complete immunization of children. Those children born to mothers with a primary education were 2.20 times more likely to be fully immunized compared to children born to mothers with no education at all, p<0.05.

[Insert table 2]

Multivariate Logistic Regression Results (Effect of Maternal Education on Child's Nutritional Status)

Table 3 indicates results predicting the effect of maternal education on child's nutritional status in Kenya. Model 1 (unadjusted results), mother's primary education is significantly related to stunted growth among children. Children born to mothers with a primary education were at 94% lower odds of having stunted growth, p<0.01) compared to children born to mothers with

no education at all. However, after control for place of residence, mother's current age, partner's education, region of residence, and wealth index (models 2 and 3), there was no significant association between maternal education and child's nutritional status. However, after controlling for knowledge index (model 4) children born to mothers with a primary education were 15% more likely to have stunted growth compared to those born to mothers with no education at all, $p< 0.05$. There was significant association between maternal education and child's nutritional status after further controlling for mother's attitude index, autonomy index, birth order parity, birth intervals, and information source (model 8)..

[Insert table 3]

Discussion

The objective of this study was to assess the effect of maternal education on child health in Kenya, as measured by complete immunization and nutritional status. We find that mother's health knowledge, receptive attitude toward modern medicine, reading newspapers, and birth interval (25-47 months) are significantly related to children's complete immunization. The findings on receptive attitude and use of modern health care are similar to those of previous studies (Frost et al., 2005; Castro & Juarez, 1995; Glewwe, 1999), which demonstrated that there is an important link between mothers' attitudes toward modern medicine, maternal education, and child health. Therefore, we conclude that transforming the attitudes of mothers in Kenya, is one way of encouraging them to seek immunization services, hence increasing the number of children who are fully vaccinated against childhood diseases and illnesses.

Concurrent with previous research (Castro & Juarez, 1995; Glewwe 1999), our findings support the association between health knowledge and children's complete immunization. We can conclude that formal education is important in imparting health knowledge to women, which

in turn leads to important improvements in child health. In addition, as indicated in the multivariate analysis, the significance of reading newspapers as a source of information and maternal education makes us conclude that education is critical in enhancing women's understanding and synthesis of information about health issues. These issues include immunization campaigns appearing in the print media. We had expected to find a significant relationship between mother's autonomy and child health (both complete immunization and stunting) as shown in previous literature. One plausible reason is the lack of reliable measures of autonomy in the KDHS data set, which could have affected the results of the current study. In addition, the socioeconomic indicators did not have a significant impact on children's immunization status, which is contrary to previous research by Desai and Alva (1998).

For nutritional status, our findings suggest that the amount of wealth in a household is a primary driving factor in children's health. Contrary to our expectations, it is SES and not mother's education that predicts children's nutritional status. We also find surprising results in North Eastern Province, where the findings suggest that children are less likely to be stunted. Because of the nomadic lifestyle, harsh living conditions, and the low levels of education associated with this region, we expected a reverse relationship. We speculate that three factors may be influencing this outcome. First, ownership of large herds of cattle provides the families with milk, which is a rich source of nutrients for their children at early ages. Secondly, because of low levels of education, most mothers in the province do not work outside the home. Thus, the mothers are available to breastfeed their infants for longer durations. Third, children in North Eastern province may be benefiting from the food supplies provided by the various government agencies and non-governmental organizations (NGOs) that operate in the province. Listening to radio was associated with less likelihood of children being stunted. This means that radio

broadcasts are important tools for disseminating public health awareness and information campaigns in Kenya.

Our results are *limited* by the absence of direct measures for attitude and autonomy of mothers in relation to child health; these indices were constructed using proxy and not direct indicators. This construction might have affected the impact of these variables on the dependent variable. Since this study was cross–sectional in nature, it was not possible to assess the impact of maternal education on children's health over time. In addition, our findings are limited to one context—Kenya; therefore, cannot be generalized to other African countries. Future research should seek to establish the determinants of low immunization coverage particularly in Nyanza province, as well as the reasons why children in North Eastern are not stunted.

Overall, our findings have significant *policy implications* for child's health in Kenya. Increasing levels of health knowledge among women is important in achieving better children health outcomes, especially complete immunization. One way of improving the knowledge levels is through incorporating health knowledge into the primary school curricula so as to reach the majority of children—among them young girls who are future mothers and more likely to be mothers themselves at a younger age (Magadi, 2006). Transforming mothers' attitudes toward modern medicine is critical in ensuring that the majority of children in Kenya are fully immunized against childhood diseases and illnesses. Thus, targeted information campaigns—through media sources such as the radio and newspaper that are aimed at changing women's attitudes toward modern health care should be implemented in order to educate mothers about the benefits of having their children fully immunized, as well as the importance of proper nutrition for healthy growth and development. This is a key issue to reducing the infant/child

mortality rates in Kenya, hence, bringing Kenya a step closer to achieving the MDG goal of improving child health and reducing child mortality.

A closer government attention is required in Nyanza Province to boost the immunization coverage for children between 12-35 months in the province. These results show that an integrated approach that includes improving schooling levels, increasing the levels of health knowledge, and developing positive attitudes toward modern health care among mothers is beneficial for children immunization. However, improved wealth in the household is a primary driving force behind better nutrition of children. Thus, targeted policy initiatives aimed at eradicating poverty and malnutrition are critical to ensuring that children across all the eight provinces have access to nutritious food critical for healthy growth and development.

References

Alam, N. (2000). Teenage motherhood and infant mortality in Bangladesh: Maternal age dependent effect of parity one. *Journal of Biosocial Science, 32*, 229-236.

An, A. B. (2002). Performing logistic regression on survey data with the new Surveylogistic Procedure [cited 2007 May 27th]; Available from: http://www2.sas.com/proceedings/sugi27/p258- 27.pdf.

Bachrach, C. A., Clogg, C. C., & Carver, K. (1993). Outcomes of early childbearing: Summary of a conference. *Journal of Research on Adolescents, 3*, 337-348.

Barrette, H., & Brown, A. (1996). Health, hygiene, and maternal education: Evidence from Gambia. *Social Science & Medicine, 43*(11), 1579-1590.

Bastien, J. W. (1992). *Drum and stethoscope: Integrating ethno medicine and biomedicine in Bolivia*. Salt Lake City, UT: University of Utah Press.

Becker, G. S. (1964). *Human capital*. New York: Columbia University Press.

Bicego, G. T., & Ahmad, O. C. (1996). *Infant and child mortality. Demographic and health surveys comparative studies No. 20.* Calverton, MD: macro International Inc.

Bicego, G. T. & Boerma J. T. (1993). Maternal *Education and child survival: A comparative analysis of DHS data*. (pp 177-204). In Proceedings of the Demographic and Health Survey World conference, vol.1. Columbia, MD: IRD/Macro International Inc.

Boerma, J. T., Sommerfelt A. E, & Rustein S. O. (1991). *Child Morbidity and treatment patterns. DHS Comparative Studies, No. 4*. Columbia, MD:IRD/Macro International, Inc.

Bronte-Tinkew, J., & Dejong, F. G. 2005. Do household structure and household economic resources predict childhood immunization? Evidence from Jamaica and Trinidad and Tobago. *Population Research and Policy Review, 24*, 27-57.

Caldwell, J. C. (1979). Education as a factor in mortality decline: An examination of Nigerian data *Population Studies, 33*, 395-413.

Caldwell, J. C., (1986). Routes to low mortality in poor countries. *Population and Development Review, 12*(2), 171-220.

Caldwell, J. C., Caldwell, P., Gajanayake, I., Orubuloye, I. O., Pieris, I., & Reddy, D. H. (1990). Cultural, social and behavioural determinants of health and their mechanisms: A report on related research programs. In J. C. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid, & D. Broers-Freeman (Eds), *What we know about the health transition: The cultural, social, and behavioural determinants of health*, Vol. 2. (pp. 534-541). Canberra, Australia: The Australian National University Printing Service.

Caldwell, J. C. (1993). Health transition: the cultural, social, and behavioural determinants of health in the third world. *Social Science and Medicine, 32*(2), 125-135.

Caldwell, J. & Caldwell, P. (1993). Roles of women, and communities in preventing illness and providing health services in developing countries. In J. gribble, & S. Preston (Eds.), *The epidemiological transition: policy planning and implications for developing countries; workshop proceedings* (pp. 252-271). Washington DC. National Academy Press.

Caldwell, J. C. (1994). How is greater maternal education translated into child health? *Health Transition Review, 4*, 224-229.

Capital News, Nairobi. Kenya in second polio drive [cited 2009 April 22nd]; Available from: http://www.capitalfm.co.ke/news/Local/Kenya-in-second-polio-immunisation-drive-4143.html.

Cassell, D. L. (2006). *Wait wait, don't tell me… you're using the wrong proc!* [cited 2009

September 02nd]; Available from: from http://www2.sas.com/proceedings/sugi31/193-31.pdf.
Casterline, J. B. (Ed.), (2001). *Diffusion, processes and fertility transition*, Washington, DC: National Academy Press.
Castro M. T. & Juarez, F. (1995). The impact of women's education on fertility in Latin America: Searching for explanations. *International Family Planning Perspectives, 21*, 52-80.
Central Bureau of Statistics (CBS) [Kenya], Ministry of Health (MOH) [Kenya], and ORC Macro. 2004. *Kenya Demographic and Health Survey 2003*. Calverton, Maryland: CBS, MOH, and ORC Macro.
Cleland, J. (1990). Maternal education and child survival: Further evidence and explanations. In.: J. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid, & D. Broies-Freedman (Eds.), *What we know about the health transition: The cultural, social, and behavioural determinants of health*, 1, 400-419. Canberra, Australia: The Australian National University Printing Service.
Cleland, J. Bicego, G. & Fegan, G. (1991). *Socio-economic Inequalities in childhood Mortality: The 1970 compared to the 1980* pp135-54 in Proceedings of the Demographic and Health Surveys World Conference, Vol 1 Columbia, MD: IRD/ Macro International, Inc.
Cleland, J. & Kauffman, G. (1993). *Education, fertility and child survival: Unraveling the links*. Paper Presented at the Workshop of International Union for Scientific Study of the Population, held in Barcelona, November 10-14.
Cleland, J. G., & Van Ginneken, J. V. (1988). Maternal education and child survival in developing countries : the search for pathways of influence. *Social Science and Medicine, 27*(2), 1357-1368.
Cochrane, S. H. (1980). *The effects of education on health. World Bank staff working paper No 405*. Washington, DC: World Bank.
Curtis, S. L., & Steele, F. (1996). Variations in familial neonatal mortality risks in four countries. *Journal of Biosocial Science, 28*(2), 141-159.
Defo, B. K. (1997). Effects of socio-economic disadvantage and women's status on women's health in Cameroon. *Social Science & Medicine, 44*(7), 1023-1042.
Desai, S., & Alva, S. (1998). Maternal education and child health: Is there a causal relationship? *Demography, 35*(1), 71-81.
Dibley, M. J., Goldsby, J.,Strehling, M., & Trowbridge, F. L. (1987). Development of normalized curves for the international growth reference: Historical and technical considerations. *American Journal of Clinical Nutrition, 46*,736-748.
Frenzen, P. D., & Hogan, D. P. (1982). The impact of class, education and health care on infant mortality in a developing society: The case of Rural Thailand. *Demography, 19*(3), 391-408.
Forste, R. (1994). The effects of breastfeeding and birth spacing on infant mortality in Bolivia. *Population Studies, 48*, 497-511.
Frost, M. B., Forste, R., & Haas, D. W. (2005). Maternal education and child nutritional status in Bolivia: Finding the links. *Social Science and Medicine 60*, 395-407.
Ghubaju, B. B. (1986). Effect of birth spacing on infant and child mortality in Rural Nepal. *Journal of Biosocial Science, 18*(4), 435-447.
Goldman, N., Pebley, A. R., & Gragnolati, M. (2002). Choices about treatment for ARI and diarrhea in rural Guatemala. *Social Science and Medicine, 55*, 1693-1712.

Glewwe, P. (1999). Why does mother's schooling raise child health in developing countries? Evidence from Morocco? *The Journal of Human Resources, 34*(1), 124-136.
Heaton, T. M., Forste, R. Hoffmann, J. P. & Flake, D. (2005). Cross national variation in family influences on child health. *Social science and medicine 60*, 97-108.
Hobcraft, J. N., Mc Donald, J. W. & Rustein, S. O. (1984) "Socio-economic factors in infant and child mortality: A cross-national comparison" *Population Studies, 38*,193-223.
Hyman, H. H., C.R. Wright, and J. S. Reed. (1976). *The enduring effects of education*. Chicago, IL: University of Chicago Press
Jejeebhoy, S. J. (1995). *Women's education, autonomy, and reproductive behavior: Experience from developing countries*. Oxford: Clarendon Press.
KDHS 2003. *Kenya Demographic and Health Surveys,* Macro International: Baltimore
Kishor, S. (1995). Gender differentials in child mortality: A review of evidence. In Monica Das Gupta, Lincoln C. Chen and T. N. Krishnan (eds), *Women's Health in India: Risk and Vulnerability*, Bombay: Oxford University Press
LeVine, R. A., LeVine , S. E., Richman, A., Tapita Uribe, R. M., & Sunderland Correa, C. (1994). Schooling and survival: The impact of maternal education on health and reproduction in the third world. In L. C. Chen, A. Kleinman, &N. C. Ware (Eds.), *Health and social change in international perspective* (p. 303-338). Boston, MA: Harvard School of Public Health.
Lindstrom, D. P. (2000). The effects of breastfeeding and birth spacing on infant and early childhood mortality in Ethiopia. *Social Biology, 47*(1), 1-17.
Magadi, M. (2006). Poor pregnancy outcomes among adolescents in South Nyanza region of Kenya. *Afr J Reprod Health, 10*(1), 26-38.
Manda, S. O. (1999). Birth intervals, breastfeeding and determinants of childhood mortality in Malawi. *Social Science and Medicine, 48*, 301-312.
Mason, K. O. (1984). *The status of women: A review of its relationship to fertility and mortality*. Paper prepared for the Population Science Division of the Rockefeller Foundation. New York, NY.
Martin, L. G., Trussel, J., Salvail, F. R., & Shah, N. M. (1983). Covariates of child mortality in the Philippines, Indonesia, and Pakistan: An analysis based on hazard models. *Population Studies, 37*(3), 417-432.
Mirowsky, J., & Ross, C. E. (1989). *Social causes of psychological distress*, New York, NY: Plenum.
Mirowsky, J. & Ross, C. E. (2003). *Education social status and health.* Gruyter: New York.
Population Reference Bureau (2008). World Population Data Sheet: Global Demographic Divide Widens. Washington, D.C.
Ross, C. E., & Mirowsky, J. (1999). Refining the association between education and health: The effects of quantity, credential, and selectivity. *Demography, 36*(4), 445-460.
Saraswathi, T. S. (1992). Child survival and health and their linkages with psycho-social factors in the home and community. *Psychology and Developing countries, 4*(1), 73-87.
Sewell, W. H. and R. M. Hauser. (1976). *Education, occupation and earnings*. New York, NY: Academic Press.
Shawky, S., & Milaat, W. (2001). Cumulative impact of early maternal marital age during the childbearing period. *Pediatric and Perinatal Epidemiology, 15*(1), 27-33.
Schultz, T. P. (2002) "Why Governments Should Invest More to Educate Girls" *World Development, 30*(2), 207-225.

Spaeth, J. L. (1976). *Cognitive complexity: A dimension underlying the socioeconomic achievement process, pp 103-31 in Schooling and Achievement in American Society*. Edited by W. H. Sewell, R. M. Hauser, and D. L Featherman. New York: Academic.

Streatfield, K., Singaribun, M., & Diamond, I. (1990). Maternal education and child immunization. *Demography. 27*,(3), 447-455.

Sullivan, J. M., Rustein, S. O. & Bicego, G. T. (1994). *Infant and child mortality. Demographic and health surveys comparative studies no. 15*. Calverton, MD: Macro International, Inc

Tagoe-Darko, E. D. (1995). *Maternal education and child health and survival in Ghana*. Dissertation, Department of Sociology, Brown University.

United Nations (1985). *Socio-economic differentials in child mortality in developing countries*. New York NY: UN Department of International Economic and Social Affairs.

Victoria, C. G., Smith, P. G., Vaughan, J. P. (1986). Social and environmental influences on child mortality in Brazil: Logistic regression analysis of data from census files. *Journal of Biosocial Science,18*(1), 87-101.

Ware, H. (1984). Effects of maternal education, women's roles, and child care on child mortality. In W. Mosley, & Chen (Eds.), *Child survival: Strategies for research, Population and development review, a supplement, 10*, 191-214.

World Bank. (1993). *World development report 1993; Investing in Health*, New York: Oxford University Press.

World Bank (2004). *Millennium development goals* [cited 2008 January 09th]; Available from: http://www.ddp-ext.worldbank.org/ext/GMIS.

Young, F.W., Edmonston, B., & Andes, N. (1983). Community level determinants of infant and child mortality in Peru. *Social Indicators Research, 12*(1), 65-81.

Zeiltin, M., Ghassemi, H., & Mansour, M. (1990). *Positive deviance in child nutrition—with emphasis on psychosocial and behavioral aspects and implications for development*. Tokyo, Japan: The United Nations University.

Table 1: Study summary descriptive statistic, KDHS-2003.

Study Characteristics		NUTRITION N=5949	IMMUNIZATION N=2169
Dependent Variables			
Child's nutrition status and Child's Immunization Status			
Stunted (Yes)	Immunized (Yes)	80%	49%
Not Stunted (No)	Not Immunized (No)	20%	51%
Primary Independent Variable			
Mother's education			
No education		20%	20%
Primary		58%	57%
Secondary +		22%	23%
Secondary Independent Variables			
Socioeconomic status			
Household wealth index			
Poor		44%	44%
Middle		18%	18%
Rich		38%	38%
Knowledge index			
Range		0-7	0-7
Mean		2.84	3.4
(SD)		1.44	1.24
Attitude index			
Range		0-6	0-6
Mean		1.88	2.17
(SD)		1.44	1.41
Autonomy			
Range		0-2	0-2
Mean		0.58	0.93
(SD)		0.57	0.47
Reproductive Variables			
Birth interval			
0-24 months		27%	26%
25-27 months		49%	49%
48+ months		24%	25%
Mother's current age			
Mean		28	28
(SD)		6.66	6.5
Birth Parity			
Range		1-16	1-16
Mean		3.48	3.53
(SD)		2.46	2.46
Control Variables			
Partner's education level			
No education		16%	16%
Primary		49%	48%
Secondary +		35%	36%
Place and type of residence			
Rural		74%	75%
Urban		26%	25%
Region of residence			
Nairobi		9%	9%
Central		12%	13%
Coast		12%	12%
Eastern		12%	12%
Nyanza		13%	12%
Rift Valley		20%	21%
Western		14%	14%
North Eastern		8%	7%
Sources of Information			
Listen to radio			
Yes		78%	78%
No		22%	22%
Read newspapers			
Yes		32%	33%
No		68%	67%
Watch TV			
Yes		28%	27%
No		72%	73%

Table 2: Adjusted odds ratios showing the effect of maternal education on children's complete immunization, KDHS-2003.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Maternal education								
No education (REF.)								
Primary education	2.168***	1.846**	1.805**	1.631*	1.527*	2.291**	2.083*	2.201*
	(0.19)	(0.22)	(0.22)	(0.22)	(0.22)	(0.29)	(0.30)	(0.31)
Secondary education	2.680***	2.158**	2.036**	1.650*	1.41	1.951*	1.60	1.80
	(0.20)	(0.25)	(0.25)	(0.25)	(0.25)	(0.33)	(0.34)	(0.36)
Place of residence								
Urban (REF.)								
Rural		0.84	0.79	0.77	0.73	0.76	0.73	0.74
		(0.17)	(0.19)	(0.18)	(0.18)	(0.25)	(0.25)	(0.26)
Age								
Mother's current age		0.99	0.99	0.99	0.99	1.00	1.04	1.04
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	0.02	(0.02)
Partner's education								
No education (REF.)								
Primary education		1.18	1.17	1.12	1.13	0.93	1.02	0.91
		(0.16)	(0.16)	(0.16)	(0.16)	(0.26)	(0.26)	(0.26)
Secondary education		1.38	1.36	1.25	1.23	1.33	1.44	1.35
		(0.18)	(0.18)	(0.18)	(0.18)	(0.26)	(0.25)	(0.25)
Region of residence								
Nairobi (REF.)								
Central		1.59	1.51	1.682*	1.59	1.69	1.60	1.55
		(0.23)	(0.26)	(0.27)	(0.28)	(0.34)	(0.35)	(0.34)
Coast		1.49	1.50	1.54	1.62	1.63	1.62	1.66
		(0.27)	(0.26)	(0.26)	(0.27)	(0.31)	(0.32)	(0.33)
Eastern		1.07	1.04	1.07	1.06	1.18	1.19	1.22
		(0.27)	(0.27)	(0.27)	(0.27)	(0.34)	(0.34)	(0.35)
North Eastern		.225***	.234***	.188***	.239***	0.65	0.65	0.69
		(0.37)	(0.38)	(0.37)	(0.37)	(0.71)	(0.68)	(0.71)
Nyanza		.375***	.385**	.370***	.388*	.384**	.409*	0.391**
		(0.30)	(0.30)	(0.29)	(0.30)	(0.36)	(0.37)	(0.36)
Rift Valley		0.92	0.93	0.92	0.96	1.08	1.12	1.10
		(0.26)	(0.25)	(0.25)	(0.26)	(0.34)	(0.35)	(0.35)
Western		.587*	0.60	.584*	0.62	0.57	0.61	0.58
		(0.27)	(0.28)	(0.27)	(0.27)	(0.33)	(0.34)	(0.32)
Socioeconomic factors								
Poor wealth index (REF.)								
Middle wealth index			1.31	1.32	1.28	1.04	1.22	0.99
			(0.17)	(0.17)	(0.17)	(0.20)	(0.14)	0.20
Rich wealth index			1.21	1.19	1.11	0.90	0.82	0.84
			(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	0.17
Knowledge index				1.296***	1.268***	1.229***	1.224***	1.237***
				(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Mother's attitude index					1.200***	1.167**	1.144**	1.137*
					(0.04)	(0.05)	(0.05)	(0.05)
Autonomy index						0.77	0.76	0.76
						(0.11)	(0.11)	(0.11)
Reproductive behaviors								
Birth order/parity							.894*	.883*
							(0.05)	(0.05)
Birth interval								
≥48 months (REF.)								
Less than 24 months							0.81	0.82
							(0.19)	(0.19)
Between 25 to 47 months							0.70	.701*
							(0.14)	(0.14)
Sources of Information								
Listen to radio								
No (REF.)								
Yes								1.36
								(0.20)
Read Newspaper								
No (REF.)								
Yes								.665*
								(0.16)
Watch TV								
No (REF.)								
Yes								1.07
								(0.17)
-2 Log Likelihood	2996.352	2876.17	2870.79	2822.83	2799.02	1711.61	1694.19	1678.35
N	2169.00	2169.00	2169.00	2169.00	2169.00	2169.00	2169.00	2169.00

Note: ***** p<0.05; ****** p<0.01; ******* p<0.001. Standard errors are reported below the odds ratios.

Table 3: Adjusted odds ratios showing the effect of maternal education on children's nutritional status, KDHS-2003.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Maternal education								
No education (REF.)								
Primary education	.063**	1.07	1.15	1.152*	1.21	0.88	0.90	0.96
	(0.14)	(0.16)	(0.17)	(0.17)	(0.16)	(0.24)	(0.24)	(0.25)
Secondary education	0.32	0.72	0.85	0.86	0.95	0.68	0.64	0.67
	(0.15)	(0.17)	(0.17)	(0.17)	(0.17)	(0.26)	(0.25)	(0.27)
Place of residence								
Urban (REF.)								
Rural		1.09	0.85	0.84	0.82	0.88	0.93	0.94
		(0.14)	(0.16)	(0.16)	(0.16)	(0.19)	(0.21)	(0.21)
Age								
Mother's current age		0.99	0.99	0.99	0.99	0.99	1.01	1.02
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	0.02	(0.02)
Partner's education								
No education (REF.)								
Primary education		1.794***	1.791***	1.800***	1.770***	1.760**	1.18	1.32
		(0.14)	(0.14)	(0.14)	(0.14)	(0.20)	(0.25)	(0.26)
Secondary education		1.09	1.13	1.13	1.14	1.17	0.82	0.93
		(0.14)	(0.13)	(0.13)	(0.13)	(0.20)	(0.25)	(0.26)
Region of residence								
Nairobi (REF.)								
Central		1.679*	1.797*	1.775*	1.849*	1.57	1.41	1.38
		(0.25)	(0.25)	(0.25)	(0.25)	(0.34)	(0.38)	(0.38)
Coast		1.67	1.61	1.60	1.57	1.18	0.94	0.89
		(0.27)	(0.26)	(0.26)	(0.26)	(0.35)	(0.38)	(0.38)
Eastern		1.852*	1.850*	1.838*	1.832*	1.48	1.57	1.49
		(0.26)	(0.26)	(0.26)	(0.26)	(0.34)	(0.37)	(0.37)
North Eastern		0.69	0.62	0.62	.532*	.309*	.202**	0.162**
		(0.30)	(0.30)	(0.30)	(0.31)	(0.47)	(0.56)	(0.37)
Nyanza		1.23	1.11	1.11	1.07	0.91	0.85	0.84
		(0.24)	(0.23)	(0.23)	(0.23)	(0.31)	(0.34)	(0.34)
Rift Valley		1.784*	1.740*	1.732*	1.661*	1.78	1.44	1.37
		(0.23)	(0.23)	(0.23)	(0.22)	(0.30)	(0.32)	(0.32)
Western		1.54	1.38	1.37	1.31	1.25	1.14	1.13
		(0.24)	(0.24)	(0.24)	(0.24)	(0.32)	(0.35)	(0.35)
Socioeconomic factors								
Poor Wealth Index (REF.)								
Middle wealth index			0.84	0.84	0.86	0.84	0.76	0.78
			(0.14)	(0.14)	(0.13)	(0.18)	(0.19)	0.19
Rich wealth index			.601***	.603***	.637**	.595**	.564**	.607*
			(0.14)	(0.14)	(0.15)	(0.18)	(0.21)	0.22
Knowledge index				0.98	1.00	0.98	1.02	1.01
				(0.04)	(0.04)	(0.05)	(0.06)	(0.06)
Mother's attitude index					.886***	.905*	0.91	1.92
					(0.03)	(0.04)	(0.05)	(0.05)
Autonomy index						0.95	0.99	0.99
						(0.11)	(0.12)	(0.12)
Reproductive behaviors								
Birth order/parity							0.93	0.93
							(0.05)	(0.05)
Birth interval								
≥48 months (REF.)								
Less than 24 months							1.36	1.38
							(0.20)	(0.20)
Between 25 to 47 months							1.19	1.20
							(0.16)	(0.16)
Sources of Information								
Listen to radio								
No (REF.)								
Yes								.602*
								(0.22)
Read Newspaper								
No (REF.)								
Yes								1.13
								(0.16)
Watch TV								
No (REF.)								
Yes								0.09
								(0.15)
-2 Log Likelihood	4589.625	4493.53	4471.92	4470.27	4453.97	2646.33	2055.14	2040.97
N	5949.00	5949.00	5949.00	5949.00	5949.00	5949.00	5949.00	5949.00

Note: ***** p<0.05; ****** p<0.01; ******* p<0.001. Standard errors are reported below the odds ratios.