SOCIAL DETERMINANTS AND IMMUNISATION IN GHANA: IS THERE AN ASSOCIATION?

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ABSTRACT

This study investigates the relationship between social determinants of health and immunisation using data from the 2003 Ghana DHS (Demographic and Health Survey). Classical and alternative social determinants of health were identified using the Sustainable livelihood framework. The classical social determinants comprise of education, occupation and wealth. The alternative social determinants in this study include specific factors such as source of drinking water and the possession of a radio. The analyses utilised data from 5691 women who took part in the survey. It compared a national sample with the three northern-most regions rural sub-sample. These samples were women who were permanent residents of a household with a first born child below five years. The weighted national and three northern-most rural regions usual resident extracted sample numbered 2460 and 462, respectively. Bivariate correlation analyses and logistic regression analyses were carried out in both samples.

The analyses yielded the following results. Being fully immunised and having a health card was associated with ethnicities in the rural sample. Being fully immunised and having a health card in the national sample was, however, associated with both the classical and alternative social determinants of health.

The results of this study suggest that the classical determinants of health do not explain the immunisation status of children in very poor rural localities in the northern-most regions of Ghana. It should be noted that separate wealth indices were not originally constructed for rural and urban areas.

ABBREVIATIONS

BCG-Bacille Calmette- Guerin

DHS-Demographic Health Survey

DPT- Diphtheria, Pertussis (whooping cough) and Tetanus.

EPI-Expanded programme on immunisation

GDP- Gross Domestic Product

HIV/AIDS- Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome.

SL framework- Sustainable Livelihood framework

STI-Sexually Transmitted Infection

TV-Television

UK-United Kingdom

U.S.A. - United States of America

CHAPTER 1.BACKGROUND

1.1 Structure of the thesis

This chapter starts with a history of immunisation and reviews the global and national (Ghana) situation. The social approach to health is reviewed. The social determinants of immunisation are discussed in a wider context using the 'Sustainable Livelihood (SL) framework' in the second chapter. The associations of the framework with immunisation status (livelihood outcome) are reviewed. Chapter three is primarily concerned with research methodology. The results of the analyses are presented in chapter four and discussed in chapter five.

1.2 Introduction

Immunisation can be said to have its origins in the ancient practice of 'Variolation' which is a process whereby people are inoculated with viruses produced from the vesicles of mildly infected cases in order to induce immunity. Edward Jenner was the first person to test and demonstrate that human to human vaccination could be utilised as a control measure for cowpox in 1798. The word vaccine is from the word 'vacca', meaning cow. From 1877, Louis Pasteur utilised the principles of active immunisation to introduce vaccines for anthrax in animals and rabies in humans. The discovery of the tubercle bacillus by Robert Koch in 1890, later paved way for the successful trial of a large-scale bacterial vaccination against tuberculosis in 1921. The successful BCG trial vaccines were prepared by Léon Charles Albert Calmette and Cameille Guérin of the Pasteur Institute. Also, Emil Adolf Behring and Shibasaburo Kitasato found antitoxins against diphtheria in 1890. The next major development was by Johannes Marius Madsen who also carried out studies on the preparation of Bordetella

Pertussis (Whooping cough) vaccine during the outbreaks of epidemics on the Faroe Islands from 1923-1929 (Parish, 1965). Active immunisation against tetanus in humans using toxoid was demonstrated by Gaston Léon Ramon and Christian Zoeller of the Pasteur Institute. Extending the work of Franklin Enders on tissue-cultures, Jonas Edward Salk prepared inactivated poliomyelitis vaccine which was tried on 650,000 American children in 1954. From 1953 to 1955, Albert Bruce Sabin developed live, attenuated oral poliomyelitis vaccine. There have been various debates on the Salk and Sabin types of vaccines and it has been suggested that the Sabin type of vaccine can completely eradicate poliomyelitis. Franklin Enders and Milan Milovanovic research on measles involved growing the 'Edmonston' strain on human and chick embryo tissue culture. Samuel Katz later produced measles vaccines from the chick embryo tissue cultures (Parish, 1965).

Presently, a core component of the millennium development goals is on child health of which immunisation is vital (NDPC, 2006). Immunisation is a cost-effective public health intervention and a way of maintaining the health of children (UNICEF; 2007 and 2000). An estimated 9.2 million deaths occurred in children under five in 2007, and half of these deaths occurred in Africa (UNICEF, 2008). An estimated 30 million infants are not protected by immunisation in developing countries. Immunisation can save the lives of 2.5 million children every year in developing countries because of its efficacy (UNICEF, 2000). Increased attention to this problem led to the initiation of EPI (Expanded Programme on Immunisation) in 1974, when less than five percent of children worldwide were immunised (WHO, 1996). In 1990, the target of immunising 80% of the 130 million children born each year was reached (WHO, 1996). The world development report 2006 indicates that there are disparities in access to immunisation within and across countries (World Bank, 2005). The EPI was introduced into Ghana

in 1978 (NDPC, 2006). Ghana is situated in West Africa and comprises of ten administrative regions. The total population of Ghana according to the 2000 census is 18,912,079 (GSS, 2006). The Ghana DHS 2003 report documented that 69% of Ghanaian children between the ages of 12-23 months were completely immunised whilst five percent had not received any vaccinations at all. The Pentavalent 3 coverage increased from 84.2% in 2006 to 87.8% in 2007 and declined slightly to 87.0 in 2008 (GHS, 2008). According to the (UNDP, 2007) Ghana is striving to reach a 100% coverage rate by the year 2015. This makes it important to study the factors associated with the utilisation of immunisation.

The social determinants of health have been defined as 'both specific features of and pathways by which societal conditions affect health and well-being' (Patrick et al., 2006, p. 2). The social approach to health can be traced to the special emphasis placed on sanitary conditions in the nineteenth century and the pioneers of modern public health (Irwin and Scali, 2007). The definition of health as 'a state of complete physical, mental and social well being, and not merely the absence of disease or infirmity' (WHO, 1946 p. 2) stresses the social model of health (Irwin and Scali, 2007). The longitudinal National Child Development Study of 1958 in England, Scotland and Wales created awareness on the influence of societal factors on health. The study was primarily concerned with child health. It reported associations between social class and immunisation (Davie, Butler, and Goldstein, 1972). The 'Health for All' concept through primary health care adopted in the Alma Ata declaration of 1978 reflected global commitment to the social determinants of health (Irwin and Scali, 2007). The social dimension of health has also received significant attention after the publication of the Black Report on health inequality in 1980. This report depicts inequalities in the mortality and morbidity rates of people living in Britain and other

developed countries as a result of their social class (Black, Davidson and Townsend 1983). Similarly, there are large inequalities in the health of people living in poor rural areas of developing countries. However, the classical indicators of socio-economic circumstances have not always successfully measured health in these localities. This for example, could be attributed to minimal diversity in employment and poor education (Bull and Mittelmark, 2010). Ghana is a developing country with a life expectancy of 56.5 years, GDP (Gross Domestic Product) per capita of 1,334 PPP US $ and a combined gross enrolment ratio in education of 56.5% (UNDP, 2009). This raises the question as to whether the classical ways of measuring social determinants of health are applicable and relevant to Ghana. The thesis will address this important question.

1.3 Objectives of the study

The general objective of this study is to identify societal factors that influence the utilisation of immunisation in Ghana.

Specific objectives:

- Are the classical social determinants of health relevant for the utilisation of immunisation in Ghana?
- Are there variations for the social determinants of immunisation in the national and three northern-most rural regions of Ghana?
- Which areas in the SL (Sustainable Livelihood) framework require further studies with regard to immunisation in Ghana?
- Would specific social factors other than the classical indicators of socio-economic status (education, occupation and wealth) influence immunisation, such as:

- Source of drinking water?
- Possession of a radio?

1.4 Main hypotheses of the study

1. Significant relationships exist between immunisation and the social (classical and alternative) determinants of health in the Ghanaian national sample.

2. Significant relationships exist between immunisation and the social (classical and alternative) determinants of health in the Ghanaian rural sample.

1.5 Significance of the study

The results of the study are envisioned to be constructive in the following ways in Ghana:

- Better understanding of how social pathways influence immunisation of children.
- Gain an insight on how to improve upon current EPI in Ghana.

CHAPTER 2.THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 The Sustainable Livelihood Framework

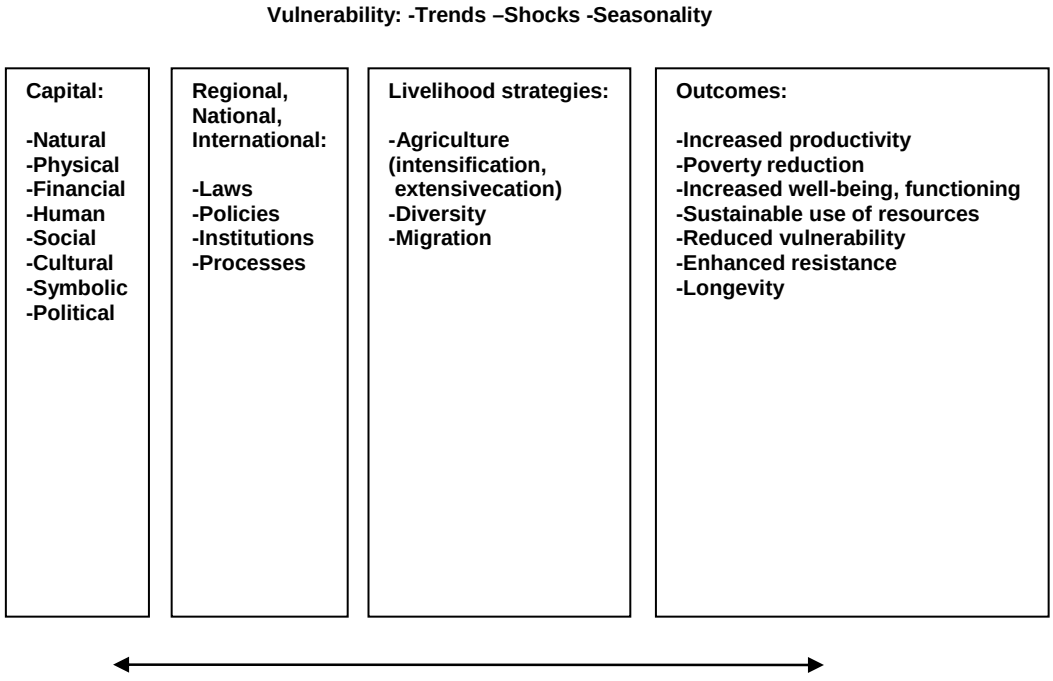

Figure 1. Sustainable livelihood framework with enhanced attention to health. Adaptation by MB Mittelmark of the Sustainable Livelihoods Conceptual Framework. See Carney, D., with M. Drinkwater, T. Rusinow, K. Neefjes, S. Wanmali, and N. Singh. (1999).

A sustainable livelihood refers to the capacity to cope with vulnerabilities in the environment as well as maintaining assets (i.e. natural, social etc.) over a long period of time. The vulnerabilities in the SL framework comprise of: shocks (i.e. floods, war), trends (i.e. economy) and seasonality (i.e. temporary employment) (DFID, 1999a and b). Mittelmark (2009) adapted the SL framework above due to his conceptualisation of health in very poor, rural communities. The SL framework is utilised in this study because Ghana is a developing country. The Ottawa Charter identifies the importance of the political, economic, social, cultural, and environmental systems on health (WHO, 1986) which is also depicted in the SL frame work. Immunisation is placed as a livelihood outcome in the current study because it has the potential of increasing productivity, well-being, functioning, resistance,

longetivity and reducing poverty. The bidirectional arrow at the foot of the framework indicates that immunisation can be affected by the components of; capitals, livelihood strategies and decision-making processes at national, regional and international levels or vice versa within the SL framework. Previous studies that associate immunisation as a health outcome with the components of the SL framework will be discussed.

The various types of capitals identified in the framework are interrelated and important for immunisation. Berkes and Folke (1994) illustrate how human capital is generated from natural and cultural capital. **Natural capital** has been defined as 'the natural resource base (land, water, trees) that yields products utilised by human populations for their survival' (Ellis, 2000 p. 8). Natural capitals have been formed into three groups: renewable resources such as water, non-renewable capital such as minerals and environmental services such as, sewage treatment (Berkes and Folke, 1994 p. 129). **Physical capital** represents 'the basic infrastructure and producer goods needed to support livelihoods' (DFID, 1999b p. 13)**.** Physical capital can be integrated into natural capital over a long term period through the process of technological advancement (Ellis, 2000). A natural capital such as drinking water has been associated with health problems like guinea worm (Henderson, Fontaine and Kyeyune, 1988; Diamenu and Nyaku, 1998). The source of drinking water has been identified as an important variable in the utilisation of immunisation in the Cebu city of Philippines (Becker, Peters, Gray, Gultiano and Black, 1993).

Human capital, 'represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives' (DFID, 1999b p. 7). Education is generally grouped into three categories: formal, non-formal and informal. Formal education is 'a system with its

own distinct structure, interlocking parts, and internal coherence' (Coombs, 1976 p.282). Non-formal education is 'a convenient label covering a bewildering assortment of organised educational activities outside the formal system that are intended to serve identifiable learning needs of particular subgroups in any given population' (Coombs, 1976 p. 282). Informal education occurs in the context of the every day life of children as they participate in adult activities (Scribner and Cole, 1973). A major difference between non-formal and informal types of education according to Belle, (1982 p.162) is 'the deliberate instructional and programmatic emphasis present in non-formal education but absent in informal education'. Education is usually measured by the number of school years completed (Liberatos, Link and Kelsey, 1988). Faia (1981) showed that the regression co-efficient for academic certification at the under and post-graduate levels, a neglected indicator of education, was comparable to the number of college years completed. Hadden (1996) cross-examined the number of school years completed as a measure for education. He argued that the number of school years completed failed to account for the different types of training received in educational systems. Galobardes, Shaw, Lawlor, Lynch, and Davey Smith (2006) add that the quality of education received and the training of individuals outside their home country may not be reflected in the measurement of educational levels. Formal education can be utilised as a continuous or categorical variable (Liberatos et al., 1988).

Despite challenges in the measurement of education as an indicator for socio-economic position or class, several studies have documented associations between it and health. Previous studies have suggested maternal education as an important factor for child survival (Caldwell, 1979; Cleland and Ginneken, 1988; Agha, 2000). Winkleby, Jatulis, Frank and Fortmann (1992), after their analysis of the Stanford

Five City Project in the U.S.A., concluded that higher education could be the strongest socio-economic indicator for good health. This study excluded respondents who were not working and measured education in terms of the number of school years completed. Also, it categorised annual household income and occupation. It is important to note that the distribution of the respondents in the Stanford Project indicated that more men compared to women held executive occupations and had the highest education as well as annual household income. Examples of studies that have found associations between immunisation of children and the individual education of a mother are Cutts, Diallo, Zell, Rhodes (1991) in Guinea; Bhuiya, Bhuiya, Chowdhury (1995) in Bangladesh; Matthews and Diamond (1997) in Ghana; and Racine and Joyce (2007) in the U.S.A.. Hobcraft (1993) cautioned that it was not clear how the association between maternal education and immunisation contributes to mortality gain. Fantahun, Berhane, Wall, Byass, Högberg (2007) have however documented a strong association between the absence of immunisation and mortality in children under five using data collected from the Butajira Demographic Surveillance Site in Ethiopia. Macassa, Ghilagaber, Bernhardt, Diderichsen, Burström (2003) found significant associations between a fathers educational status and mortality in children and post neonates when they conducted a multivariate analysis of the Mozambican DHS. Significant associations between fathers' education and complete childhood immunisation have been documented by Gatchell, Thind and Hagigi (2008) in the Maharashtra and Bihar states of India. Interestingly, in both studies education was categorised, however, whilst the study in Mozambique combined secondary and higher education into one group during analysis, the study in India analysed these categories separately. A major conclusion of Torun, Demir, Hidiroglu and Kalaca (2008) from their study in Istanbul was the need to provide

paternal education on immunisation because the lack of authorisation from fathers' was a frequent explanation given for non-vaccination. Parashar (2005) found a positive link between the completion of immunisation amongst infants and the number of literate women within a given community in India. This relationship existed after controlling for individual and structural characteristics. It is worthwhile noting that literacy in this study is referred to as the capacity to demonstrate one's reading and writing skills simultaneously. A possible explanation given for this finding was the exchange of information that occurs between educated and uneducated women in a given community.

'**Financial capital** refers to stocks of cash that can be accessed in order to purchase either production or consumption goods, and access to credit might be included in this category' (Ellis, 2000 p. 8). Different measures of poverty have been suggested over the years. Townsend (1954) advocates for expenditure whereas Wilkinson (1997) argues for relative income. Poverty lines can be created using national and international standards which are based on measures of absolute or relative poverty. The DHS wealth index is generated from a list of assets and services from households. The construction of the wealth index is formulated by selecting indicator variables such as, the type of flooring material and the ownership of specific items (i.e. cars and bicycles etc.). This is then followed by weighting the indicator variables through utilising principal component analysis and then computing a wealth index value which is ascribed to each member of the household. The wealth quintiles are then generated from the wealth index values based on the distribution of the national household population. The DHS is important for measuring wealth in poor rural areas where information on income and expenditure measures is not readily available. Also, the wealth index has been more successful at predicting health (Rutstein and Johnson

2004). Household income can explain the socio-economic circumstances of the various members in a particular household who may not be working (Galobardes, Shaw, Lawlor, Lynch and Smith, 2006). Findings from a study involving various developed countries revealed that low birth weight (mainly in the UK) and high infant mortality (mainly in the U.S.A) was significantly related to income inequality using Pearson correlation coefficients. This study utilised data from both the Luxembourg Income Study and the World Values Survey (Lynch et al., 2001). Peña, Wall, Persson (2000) working in Nicaragua showed that infants belonging to poor households living in a relatively wealthy environment had very high mortality risks. This finding, according to the authors, reflects the impact of relative poverty in developing countries. Full immunisation coverage rates amongst the poorest 20% of societies in developing countries have been documented to be lower when compared to the richest 20% (Gwatkin et al., 2007). Analysis of data from the Nigeria and Kenya DHS indicates that children belonging to the poorest wealth quintile do not have access to immunisation services (CPRC, 2009). According to the 2006 world development report, the immunisation coverage amongst the poorest fifth of Eritreans is half that of the wealthiest fifth (World Bank, 2005). A study by Pande and Yazbeck (2003) utilising data from the National Family Health Survey collected in 1992–93 suggests that children of the poorest wealth quintiles were likely to be unimmunised in rural residences of India when compared to those living in urban areas. A possible explanation given for this observation by the authors was inadequate knowledge amongst the rural poor regarding potential benefits derived from utilising immunisation. Also, inequalities in the accessibility and availability of immunisation amongst the rural poor in India were cited as a possible reason for this observation. Different variables utilised in the computation of the wealth index have been

associated with health. Mohan (2005) found that even though both the poor and rich living in Rajasthan, India had access to different sources of safe drinking water, inequalities still existed in the completion of immunisation by children from the different social groups. It is important to note that, the participants in the Rajasthan study were all patients of health centres and the findings therefore cannot be generalised to the population as a whole. Previous studies have found significant associations between the possession of radio and immunisation (Becker, et al., 1993; Bhuiya, et al., 1995). Access to electricity has been linked to reduced child mortality in developing countries at the national level after analysing DHS data from several countries and complementing it with the World Development Indicators (Wang, 2003). A possible explanation given for this finding was better food storage through the use of refrigerators.

There are various occupational measures for socio-economic status. The British Registrar General's Scale and the Edwards' Social-Economic Grouping of Occupations classify employment into categories. The Nam-Powers' Occupational Status Scores provides a cumulative percentile of occupation based on education and income. Siegel's Prestige Scale and Treiman's Standard International Occupational Prestige Scale were designed to generate prestige scores for occupations (Liberatos et al., 1988). Currently, the international standard classification of occupations 2008 categorises jobs into ten major groupings (ILO, 2008). Occupational measures utilised for dependents can be derived from the household as a whole (Galobardes et al., 2006).

Smith et al. (1998) indicates that occupation is a better indicator of non-cardiovascular disease and non-cancer mortality than education. This finding was

based on an analysis of men living and working in the United Kingdom during 1970-73. Also, a possible explanation given for this finding was the different hazards experienced in the work-place. Poorer-quality diet (Bolton-Smith, Smith, Woodward and Tunstall-Pedoe, 1991), higher lung cancer mortality rates (Hart et al., 2001) and higher mortality rates from coronary heart disease and stroke (Bennett, 1996) have been found in manual workers as compared to non-manual workers. A study conducted in the Mashonaland area of Zimbabwe using different occupational groups showed that children who belonged to farming areas had poorer health when compared to their counterparts in mining and manufacturing areas (Loewenson, 1986). An analysis of the 2003 Nigerian DHS indicates that the odds of not being fully immunised significantly increased when mothers belonged to clerical, sales, services and skilled manual occupation groups when compared to those belonging to professional, technical and managerial occupation groups (Antai, 2009).

Cultural capital influences health and the utilisation of immunisation. Cultural norms, beliefs and attitudes have an important role to play in health (Nguyen, 1985; Uba, 1992; Greenhalgh, Helman, and Chowdhury, 1998). Studies conducted in Ghana and Tanzania have identified that families prefer to manage childhood illnesses like malaria first at home, then subsequently utilise traditional and or modern medical care (Adongo, Kirkwood, and Kendall, 2005; Makundi, Malebo, Mhame, Kitua, and Warsame, 2006). The type of health seeking behaviour adopted by a family in the management of illnesses have been linked to the bio-cultural interpretation of diseases (Adongo et al., 2005) and the designation of illnesses as ‘not-for-hospital’ (Hill, Kendall, Arthur, Kirkwood and Adjei, 2003). A study conducted by Bennett and Smith (1992) revealed that attitudes and beliefs concerning vaccination against pertussis explained why there was 18 to 22% variance in immunisation status of

children. This study utilised data from the Welsh Health Common Services Authority**.** A review of fifteen qualitative studies by Mills, Jadad, Ross and Wilson (2005) identified parental beliefs like 'vaccines cause disease' as an obstacle to immunisation. Myths arising out of inadequate or complete lack of knowledge and misinformation have been identified as a barrier against immunisation (Begg and Nicoll 1994). In Ghana, there are five main ethnic groups: Akan, Ewe, Mole Dagbani, Guan and Ga-Adangbe (UNDP, 2007). A study by Gyimah (2006) utilising the 1998 Ghana DHS revealed that the risk of infant mortality within the first year of birth amongst various ethnic groups was due to the differences in socio-economic status. Also, this study suggests that southern ethnic groups are relatively more developed than the north.

Several studies have associated religion with health (Comstock and Partridge, 2008; Larson et al., 1989; Koenig, George, and Peterson, 1998; Benjamins and Brown, 2004). It is interesting to note that a qualitative study conducted by Allotey and Reidpath (2001) in the Kassena Nankana district of Ghana revealed that religious beliefs in 'chichuru' or spirit children who are perceived as a threat to society accounted for 20.8% of infanticides in 24 deaths from a sample size of 241 births. It is important to note that the confidence interval given for 'chichuru' deaths in this study was wide. Antai (2008) found that the risk of not being immunised with any of the recommended childhood vaccines was significantly increased amongst children from a Muslim background compared to that of Christians, after analysing the 2003 Nigerian DHS. It is important to note that the study adjusted for socio-economic and demographic factors. Simpson, Lenton and Randall (1995) reported that 16% of parents who had children in Bath District Health Authority from January 1987-1993

cited religious beliefs as a reason for failing to immunise their children. Identification with a particular religious sect in Ghana has also been cited as a reason for failure to immunise children against polio (BBC report by Sakyi-Addo, 2005).

Social capital is an important determinant of health and various definitions of it have been given over the years. Social capital is represented within relationships in the family and community (Coleman, 1988). Putnam (1995 p.67) identified social capital as the 'features of social organisation such as networks, norms and social trust that facilitate coordination and cooperation for mutual benefit.' Szreter and Woolcock (2004) examined three forms of social capital that are relevant for health: bonding, bridging and linking. Bonding social capital consists of trusting and collaborating relationships found amongst a group of people with a collective social identity. Bridging social capital involves respect and mutual interactions amongst a group of people with different social identities. Linking social capital is defined by Szreter and Woolcock (2004 p.655) as 'norms of respect and networks of trusting relationships between people who are interacting across explicit, formal or institutionalised power or authority gradients in society.'

Previous studies have found associations between social relationships, family ties, networks and activities with mortality **(**Berkman and Syme, 1979; House, Robbins and Metzner, 1982). Also this applies to health behaviour (Broman, 1993) and the utilisation of immunisation services (Topuzoglu, Ay, Hidiroglu, Gurbuz, 2007). A comparative study was conducted in the Roseto and Bangor regions of America for a period of fifty years. This study utilised the death records and suggested that social cohesion and support has an important role to play in the reduction of mortality rates from myocardial infarction (Egolf, Lasker, Wolf and Potvin, 1992). This study did not

mention the pre-existing morbid states of the individual death records utilised. The pre-existing morbid states could have increased risk of death from myocardial infarction. An ecological study by Kawachi, Kennedy, Lochner and Prothrow-Stith (1997) found social allegiances and poor relational trust was linked to mortality after adjusting for age. This study utilised data from the General Social Survey in the United States from 1986 to 1990. The risk of poorly rating one's health (Kawachi, Kennedy and Glass, 1999), increased problems when accessing medical care (Hendryx, Ahern, Lovrich, McCurdy, 2002) and higher under-five mortality (Fantahun, Berhane, Wall, Byass, Högberg, 2007) have also been linked with low social capital. Pruitt, Kline, and Kovaz (1995) identified the social support network as an important factor for the utilisation of immunisation services by parents for their children.

Dyson and Moore (1983) refer to autonomy as the ability to alter one's personal circumstances and utilise knowledge to make informed decisions for their family or themselves. Previous studies have found associations between the utilisation of maternal health services and female autonomy. These studies, however, utilised different variables to measure autonomy (Bloom, Wypij, and Gupta, 2001; Keera, 2007). Interestingly, prenatal care, which denotes access to maternal health services, has also been associated with immunisation (Wood et al., 1995; Choi, and Lee, 2006). Fantahun, Berhane, Wall, Byass, Högberg (2007) documented that the inability of women to fully make decisions was strongly associated with higher mortality in children under five.

National, regional and international law, policies, institutions and processes have a role to play in the utilisation of immunisation. WHO (2005) emphasises the need for all key stakeholders to be politically committed to improving the accessibility of immunisation at international, national and local levels. The enactments of international policies have been suggested to enhance the utilisation of immunisation (Gauri and Khaleghian, 2002). The external debt crisis is highlighted by Quaye (1991) as having an adverse effect on the health of Ghanaians. WHO (2002) has drawn attention to the fact that government expenditure on health in developing countries is not adequate. Houweling, Kunst, Looman and Mackenbach (2005) have documented significant associations between government expenditure on health and the utilisation of medical services, such as skilled birth attendance amongst the poor in forty-three developing countries. This study took into account socio-economic factors like the literacy rates of women and GDP. Findings from this study also indicated that there were no significant associations between governments' expenditure on health and under-five mortality. Schell, Reilly, Rosling, Peterson and Ekstrom (2007) have also demonstrated that there are no significant associations between governments' expenditure on health and infant mortality rates using data from 152 low, middle and high income countries. This study also took into account confounding factors like the literacy rates of women, and gross national income. Frankenberg and Mayon-White (1991) reported that a policy to discontinue vaccination amongst school children in 1981 gave rise to an increase in the incidence of tuberculosis amongst the Asian community of Oxfordshire, UK. The application of school immunisation laws have been linked to a decrease in the incidence of measles (Robbins, Brandling-Bennett, and Hinman, 1981) and an improvement in the utilisation of immunisation (Averhoff et al., 2004).

The utilisation of immunisation has also been associated with factors such as place of delivery, parity, provision of health services and side-effects from vaccinations (Cutts, Rodrigues, Colombo, Bennett, 1989). Bosu, Ahelegbe, Edum-Fotwe, Bainson, Turkson (1997) identified the contribution of social and managerial factors to the utilisation of immunisation in rural Ghana. Some of these factors according to them are; unsuitable facilities, extended waiting periods, problems with transportation and inadequate cohesion between different stakeholders. Belcher, Nicholas, Ofosu-Amaah and Wurapa (1974) add that the length of time needed to get to health facility and problems with communication affected immunisation in rural Ghana.

Livelihood strategies refer to a set of activities undertaken in order to attain an advantageous livelihood goal. In this context, improved health and immunisation for one's children could be perceived as an advantageous livelihood goal (DFID, 1999a). The flow of remittances by international migrants to their local communities in Mexico has been documented to improve child survival (Kanaiaupuni and Donato, 1999; Frank and Hummer, 2002). Migration from rural to urban areas over a long period of time has been found to enhance the survival of children in several developing countries. These studies adjusted for socio-economic variables and utilised DHS data from Asia, Latin America, North and sub-Saharan Africa (Brockerhoff, 1990 and 1994). Stephenson, Matthews, and McDonald (2003) on the other hand have found that the differences observed in the survival of children residing in rural and urban areas can be explained partially by socio-economic circumstances. Kiros and White (2004) reported that rural-rural migration of mothers had an adverse effect on the immunisation status of children after analysing data from the 1997 Community and Family Survey in Ethiopia. A possible explanation given for this finding was the

inadequate integration of mothers into their new environments. A study by Lee, McDermott and Elliott (1990) found that the initiation of poliomyelitis, diphtheria, tetanus and pertussis vaccination was postponed in the children of migrants who work on farms when compared to the general population. This study utilised 1985 data from the South Carolina department of education as well as gathering information on the level of antibodies in the serum of those vaccinated.

2.2 Conclusion of literature review

The literature review supports the sustainable livelihood framework. However, some aspects of the framework in relation to immunisation have not been explored rigorously within the evidence reviewed. The association of immunisation with natural, physical and symbolic capitals within the framework requires further studies.

2.3 Focus of this thesis

It is clear from the literature review that the sustainable livelihood framework depicts that a wide range of factors affect health and with reference to this current study immunisation. It is however beyond the scope of this study to examine all the factors associated with utilisation of immunisation as proposed by the framework. The analysis and discussion therefore focuses on the level of immunisation received by children in Ghana as predicted by;

1) Parental factors such as education.
2) Household factors such as wealth.
3) Alternative social determinants.

CHAPTER 3.RESEARCH METHODOLOGY

3.1 Research Design and Sampling

A two-stage stratified sample design was adopted for both rural and urban areas in Ghana. The stratification ensured that rural and urban areas were adequately considered. The sampling frame for the Ghana DHS was generated from the 2000 Population and Housing Census. At the first stage of the sampling, 412 enumeration areas or clusters were selected based on a probability that was proportional to size of the population. At the second stage, systematic sampling was utilised to select households from the list of enumeration areas or clusters (DHS, 2003). The use of clusters or enumeration areas increases sampling error and possible bias when compared to simple random designs. Cluster sampling is however cost effective, time efficient and enhances the feasibility of large surveys.

3.2 Participants

An estimated 6,600 households were selected throughout the country for the Ghana DHS. A total of 5,691 females aged 15-49 and 5,015 males between ages 15-59 were included in the survey. The distribution of respondents varied regionally. From the DHS (2003) report, the majority of respondents were Christians (77% women and 70% men), married or living together (62% women and 53% men) and had Akan (51% women and 47% men) ethnic backgrounds. The percentage of women and men who had no education was twenty-eight and eighteen percent respectively. Rural to urban residence indicated that men were more likely to reside in rural areas than women. There were more females under the age of 30 as compared to males (DHS, 2003). The present study was limited to the 5691 females who participated in the survey. From the survey, the analysis extracted weighted permanent resident samples

who had a first born child below five years; totalling 2460 (nationally) and 462 (rural dwellers in the three northern-most regions). The analysis selected only first born children to obtain an independent sample and minimise the confounding effect of birth order. The samples were weighted to account for stratified sampling design utilised in the survey and to generalise results. The three northern-most regions in the rural sample are the Upper East, Upper West and Northern Region. Refer to Figure [2] (Appendix, p.59) and Table [1] (Appendix, p.62).

3.3 Data collection methods and Data

The Ghana DHS was conducted for a period of three months in June to October 2003 using interviews based on questionnaires. The three types of questionnaire used in the survey were: women questionnaire, men questionnaire and household questionnaire. The areas covered in the survey include demographics, socio-economic status, sexual activity, marriage, family planning, nutrition, fertility levels, breast-feeding practices, HIV/AIDS (Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome), STI (Sexually Transmitted Infection), child and maternal health. The questionnaires were pre-tested by five teams each comprising of a supervisor, nurse and four interviewers in urban and rural areas. Interviewers for the survey were trained on how to measure height and weight, 23 people, mainly nurses, were trained on how to test for anaemia, collect blood samples for HIV/AIDS and informed consent procedures. All the trainees for the data collection were briefed on the themes of the questionnaires as well as the interviewing techniques. Data collection for the survey was done by fifteen teams each comprising of a supervisor, nurse, four interviewers, an editor and a driver. Data on immunisation was obtained from health

cards and in cases where health cards were not available, verbal reports of vaccination details were accepted from mothers (DHS, 2003).

3.4 Data management methods

The data entry operators for the Ghana DHS received training and entered data twice for accuracy. The data was also assessed for sampling errors using statistical methods (DHS, 2003). The independent variables chosen for the analysis were assessed for multicollinearity. For the independent variables that were highly correlated, only one variable was selected for each logistic regression model.

3.5 Strategy for analyses

Two models were used for each dependent variable in the analyses. The initial regression model examines the effect of all statistically significant independent variables from the chi-square test with first born children under five having a health card and those fully immunised. Non-significant variables are removed to give the final and most precise fitting logistic regression model. Only the results of the final regression models are shown in tables. The independent variables were entered into the logistic regression model in the following order: age of child, age of mother, wealth index, education of respondent, occupation of respondent, education of partner, occupation of father, decision latitude, religion, and ethnicity to obtain a classical social determinant model. To obtain the alternative social determinant model, education was replaced with literacy, and wealth quintile was replaced with frequency of reading a newspaper, listening to radio, watching TV (Television), possession of electricity, TV and radio, source of drinking water and money for taxi. The models were specified this way in order to; identify measures that work best in

poor rural areas; assess whether wealth quintiles or specific items are appropriate in developing countries; examine whether education or literacy is preferable in developing countries; and investigate if there are differences in the significant predictors of immunisation in the national and rural sample.

3.6 Choice of significance levels in the two samples

Only significant Pearson Chi-Square values less than 0.001 were entered in the logistic regression model for the national sample. In the three northern-most rural sub-sample, all significant results were entered in the logistic regression model. This was because of the relatively larger number of participants selected for the national sample in comparison to the three northern-most rural regions sub-sample. It was, therefore, easier to obtain statistically significant values that were less than .001 in the national sample.

3.7 Variables utilised in the study

Recoding of the variables was done to reduce the number of sub-categories in the initial coding and increase the number of respondents in each sub-category. Two dependent variables are utilised in this study. Firstly, the initial immunisation variables were coded 0 = no, 1 = vaccination date on card, 2 = reported by mother, 3 = vaccination marked on card. This was recoded into two groups: 0 = vaccination date on cad, reported by mother and vaccination marked on card and 1= no. The immunisation status of a child was labelled fully immunised if the child had received BCG (Bacille Calmette-Guerin), Measles, DPT (Diphtheria, Pertussis and Tetanus) 1-3 and Polio 1-3 (Gwatkin et al., 2007). Not fully immunised implies that the child had not received all of the vaccines mentioned above which was coded 1. Secondly, owning a health card was initially coded 0 = no card, 1 = yes, seen, 2 = yes, not seen

and 3 = no longer has card. This was recoded into 0 if the respondents answered yes irrespective of whether the card was seen or not and 1 if the answer was no card and no longer has a health card.

The independent variables were recoded and categorised into groups. Education was measured as a categorical variable by educational levels. The original educational variable was categorised into 0 = no education, 1 = primary, 2 = secondary, 3 = higher and 8 = don't know. Education was recoded into three groups: 0 = higher and secondary, 1 = primary and 2 = no education. Occupation was initially coded into 0 = don't work, 1 = professional, technical and managerial, 2 = clerical, 3 = sales, 4 = agricultural self employed, 5 = agricultural employee, 7 = services, 8 = skilled manual, 9 = unskilled manual and 98 = don't know. Occupation was recoded into four groups: white collar occupations, skilled manual, unskilled manual and not working. White collar occupations were coded 0. This covered technical, managerial, professional, service and clerical jobs. Skilled manual jobs were recoded 1. Agricultural self-employed, agricultural employee and unskilled jobs were grouped into unskilled manual and recoded into 2. Not working was recoded as 3. According to the DHS (2003) report, the indicators utilised in the computation of the wealth index involved variables such as the possession of a bicycle, car and type of floor material. Also, a single wealth index was utilised for rural and urban areas (DHS, 2003). The wealth index factor score was binned into 20% wealth quintile groups for the current study. This procedure was separately performed on each of the samples for the current study. The wealth quintile groups were then recoded into following categories: 0 = richest, 1 = richer, 2 = middle, 3 = poorer and 4 = poorest. The initial religious variable was coded 0 = no religion, 1 = Roman Catholic, 2 = Anglican, 3 = Methodist, 4 = Presbyterian, 5 = other Christian, 6 = Moslem, 7 =

Traditional/Spiritualist, 8= other. Religion was recoded into dummy variables: 1 = Muslim and 0 = all others, 1 = Christian and 0 = all others, 1 = Traditional religion and 0 = all others. The previous ethnicity variable was coded 1 = Akan, 2 = Ga/Dangme, 3 = Ewe, 4 = Guan, 5 = Mole-Dagbani, 6 = Grussi, 7 = Gruma, 8 = Hausa, 96 = other. Ethnicity was also recoded into dummy variables: 1 = Akan and 0 = not Akan, 1 = Ga/Dangme and 0 = not Ga/Dangme, 1 = Ewe and 0 = not Ewe, 1 = Guan and 0 = not Guan, 1 = Mole-Dagbani and 0 = not Mole-Dagbani, 1 = Grussi and 0 = not Grussi, 1 = Gruma and 0 = not Gruma, 1 = Hausa and 0 = not Hausa, 1 = Other minor languages and 0 = not a part of minor languages.

The age of the child was measured by the DHS Century Month Code variable (CMC). This gives a very precise calculation of child age by month, which is of value when assessing immunization status as the outcome. The construction of this variable is quite complex, and the final variable is negatively correlated to the actual age of the child. This must be kept in mind when interpreting the results from the logistic regression analyses.

Alternative social determinants of immunisation were identified and re-coded. The initial coding for the source of drinking water was 11 = piped into dwelling, 12 = piped into compound/plot, 13 = public tap, 21 = open well in dwelling, 22 = open well in yard/plot, 23 = open public well, 31 = protected well in dwelling, 32 = protected well in yard/plot, 33 = protected public well, 41 = spring, 42 = river, stream, 43 = pond, lake, 44 = Dam, 51 = rain water, 61 = tanker truck, 81 = sachet water, 96 = other. The source of drinking water was recoded into 0 and 1. The 0 group included people who have pipes in their dwelling, compound or plot, those who utilise a public tap, protected well in dwelling, yard or plot, protected public well, sachet water and

water tankers. Group 1 included people who utilise open public well, open well in dwelling, yard or plot, spring, river, stream, pond, lake, dam and rain water. Main floor material was also originally coded as 11 = earth/sand/mud, 12 = mud mixed with dung, 21 = wood planks, 32 = linoleum, 33 = ceramic tiles, 34 = cement, 35 = carpet and 36 = terrazzo. This was also recoded and categorised into two groups: 0 = wooden planks, linoleum, ceramic tiles, cement, carpet, terrazzo as floor material whereas 1 = earth, sand, mud and mud mixed with dung as the main floor material. The field visit to the northern region revealed that having adequate financial resources for daily living was a source of anxiety to the women. Getting money needed for taxis in order to access medical help was previously coded as 1 = big problem and 2 = small problem. This was then recoded into two groups: 0 = small problem and 1 = big problem. Having a television, radio and electricity was earlier coded as 0 = No and 1 = Yes. This was then recoded into two groups: 0 = have television, radio and electricity and 1 = do not. Factor analysis was utilised to find the inter-relationships amongst the five items on 'final say.' An example of this variable is 'final say' on health. All the 'final say' variables were initially coded 1 = respondent alone, 2 = respondent and partner/husband, 3 = respondent and another person, 4 = husband/partner alone, 5 = someone else 6 = decision not made. Four of the 'final say' variables: making large household purchase, making purchases for daily needs, visit to family or friends and food to be cooked were computed. This newly computed variable and the 'final say' which is subsequently referred to as decision latitude were recoded into three groups: 0 = respondent alone and labelled optimal, 1 = respondent with husband or other person and named middle, 2 = husband or other person without respondent and identified as poorest. This was categorised in this manner to allow for the full effect of maternal autonomy on immunisation to be observed.

Literacy was previously coded 0 = cannot read at all, 1 = able to read only parts of a sentence, 2 = able to read whole sentence, 3 = no card with required language/visually impaired. This was then recoded 0 = able to read only parts of a sentence or whole sentence and 1 = cannot read at all. The three variables; frequency of listening to radio, watching TV and reading newspapers was initially coded 0 = not at all, 1 = less than once a week, 2 = at least once a week, 3 = almost everyday. These were recoded 0 = watches TV, reads newspaper, listens to radio less than once a week, at least once a week and almost everyday and 1 = not at all. Relationship with head of household was previously coded 1 = head, 2 = wife, 3 = daughter, 4 = daughter-in-law, 5 = grand-daughter, 6 = mother, 8 = sister, 9 = co-spouse, 10 = other relatives, 11 = adopted/foster, 12 = not related. This was recoded into: 0 = Wife and 1 = all others, 0 = Mother and 1 = all others, 0 = Daughter and 1 = all others, 0 = Sister and 1 = all others.

3.8 Validity and Reliability

The validity of the data is strengthened by the high response rate of 95.7% obtained for the 5,691 females interviewed. The response rate of females living in rural areas was 96.2% whereas those living in urban areas was 95.0% (DHS, 2003). To enhance the reliability of the study, a large number of children were included in the analysis to reduce random error. Also, the confounding variable, age of the child, was taken into account in the logistic regression analysis. Age was found to be significantly related to the possession of health cards and being fully immunised in the national and rural samples. According to the EPI Policy in Ghana, each child should receive one dose of BCG at birth, three doses of DPT (at 6, 10 and 14 weeks), four doses of oral polio vaccine (at birth, 6, 10 and 14 weeks), one dose of measles vaccine (at 9 months) and

one dose of yellow fever (at 9 months). Therefore, if the national policy is applied, a child should be fully immunised at the age of approximately 9 months. The DPT vaccine has been replaced with the pentavalent scheme which comprises of five vaccines; DPT, Haemophilus influenzae type B and Hepatitis B (WHO, n.d.). A potential confounding variable, sex of the child was considered in the logistic regression analysis but was found to be insignificant.

3.9 Ethical considerations

The quantitative data is public information provided for the Social Determinants of Health in Very Poor Ruralities. The DHS applied rigorous ethical procedures such as confidentiality, informed consent and anonymity to respect the rights of respondents. Also, ethical clearance was obtained from the Ghana Health Service Ethical Review Committee in Accra, Ghana and the Institutional Review Board of Opinions, Research and Corporation in Calverton, U.S.A (DHS, 2003).

CHAPTER 4. RESULTS

4.1 Descriptive statistics

The analysis was carried out using SPSS 15.0 for Windows. The percentage distribution of the dependent variables depict that 91.3% had health cards and 52.0% were fully immunised in the national sample as shown in Figure [3] and [4] (Appendix, p.60). The percentage distribution of the dependent variables indicate that 83.4% had health cards and 40.3 % were fully immunised in the rural sample as shown in Figure [5] and [6] (Appendix, p.61).

Descriptive statistics of the women who participated in the survey are presented in Table [1] (Appendix, p.62). The number and percentages of fully immunised first born children under five and those in possession of a health card, according to the various regions of Ghana, are presented in Table [3] (Appendix, p.63). It is interesting to note from Table [2] and [3] (Appendix, p.63) that 158 out of 285 first born children under five in the Greater Accra region of Ghana were fully immunised compared with 119 out of 324 first born children under five in the northern region of the national sample. The percentage of parents without education (90% of mothers and 81.2% of fathers) in the rural sample shown in Table [4] (Appendix, p.64) were more than those in the national sample (38.9% of mothers and 29.6% of fathers). The number of partners (one and none in the national and rural samples respectively) who were not working was very low when compared to mothers (275 and 58 women in the national and rural samples respectively) as shown in Table [4] (Appendix, p.64). A possible explanation for this may be the socially ascribed role of the father as ‘breadwinner’ within the Ghanaian family. This explanation has not however been scientifically verified. Interestingly, the percentages of mothers with the poorest decision latitude in both the rural (58.4%) and national (39.3%) samples were more than those with

optimal decision latitudes (9.4% and 22.1% in rural and national samples, respectively) as shown in Table [4] (Appendix, p.64). Table [12] and [13] (Appendix, p.70) provides the distribution of statistically significant independent variables from chi-square analyses considered in the logistic regression analyses for the rural sample. Table [14], [15] and [16] (Appendix, p.71-3) summarises the distribution of variables included in the logistic regression for the national sample. These variables were all statistically significant in the chi-square analyses.

4.2 Bivariate associations

The chi-square test for independence was performed after descriptive analyses to assess for the relationship between the dependent and independent variables. The results from the chi-square will be utilised to conduct a series of logistic regression analyses in the national and rural samples. The classical and alternative models are utilised for the logistic regression analyses. In the national sample, the chi-square test for independence indicated significant associations at $p<0.001$ between fully immunised first born children under five with maternal education, occupation, literacy level, reads newspapers, listens to radio, watches TV and decision latitude. The chi-square test for independence in the three northern-most rural sample indicated significant associations at $p<0.05$ and $p<0.01$ between fully immunised first born children under five with maternal occupation, listens to radio and watches TV as shown in Table [5] (Appendix, p.65).

In the national sample, the chi-square test for independence indicated significant associations at $p<0.001$ between first born children under five having a health card with maternal education, occupation, literacy level, reads newspapers, listens to radio,

watches TV and decision latitude. The chi-square test for independence in the three northern-most rural sample indicated significant associations at $p<0.05$ between first born children under five having a health card with listens to radio as depicted in Table [6] (Appendix, p.65).

In the national sample, the chi-square test for independence indicated significant associations at $p<0.001$ between fully immunised first born children under five with paternal education and occupation. In the three northern-most rural sample, none of the paternal independent variables were significantly associated with fully immunised first born children under five as shown in Table [7] (Appendix, p.66).

In the national sample, the chi-square test for independence indicated significant associations at $p<0.001$ between first born children under five having a health card with paternal education and occupation. In the three northern-most rural sample, none of the paternal independent variables were significantly associated with having a health card as depicted in Table [8] (Appendix, p.66).

In the national sample, chi-square test for independence indicated significant associations at $p<0.001$ between fully immunised first born children under five with electricity, wealth, has a radio, TV, source of drinking water, Christian religion, Akan and Gruma ethnicities. The chi-square test for independence in the three northern-most rural sample indicated significant associations at $p<0.05$ and $p <0.01$ between fully immunised first born children under five with a radio, Guan and Grussi ethnicities as shown in Table [9] (Appendix, p.67).

In the national sample, The chi-square test for independence indicated significant associations at $p<0.001$ between first born children under five having a health card with electricity, wealth, has TV, source of drinking water, money for taxi, Gruma ethnicity, Christian and Traditional religion. The chi-square test for independence in the northern-most rural sample indicated significant associations at $p<0.05$, $p<0.01$ and $p<0.001$ between first born children under five having a health card with money for taxi, Akan, Mole Dagbani, and Guan ethnicity as depicted in Table [10] (Appendix, p.68).

4.3 Variables rejected for logistic regression analyses in national and rural sample

The following independent variables included in the chi-square test failed to reach significance levels in the rural and national samples; current age of mother, age at first marriage, age of respondent at first birth, decision latitude on health, wife, daughter and sister to the head of household, current age of partner, number of household members, age of the head of household, main floor material, Ewe, Dangme, Hausa ethnicities as well as Muslim religion as depicted in Table [11] (Appendix, p.69). The variables; Guan, Grussi and Mole Dagbani ethnicities were rejected for logistic analyses in the national sample because they failed to reach a statistically significant value of less than 0.001 in the chi-square test. The variables; maternal education and occupation, literacy, reads newspapers/magazines, decision latitude on household decisions, paternal education and occupation, wealth index, possession of electricity and television, source of drinking water, Gruma ethnicity, Christian and Traditional religions were rejected for logistic analyses in the rural sample because they failed to reach a statistically significant values of 0.01 and 0.05.

4.4 Logistic regression results

4.4.1 The classical model: possession of health card in the national sample

Logistic regression was performed to investigate the effect of classical social determinants of health on the possession of a health card for immunisation by first born children under five in the national sample. The initial model contained twelve independent variables and was statistically significant. Chi Square = 220.192, df = 22 and p = .000. The initial model explained between 9.7% (Cox and Snell R^2) and 21.7% (Nagelkerke R^2) of variance in the possession of a health card and correctly classified 91.2% of cases. The non-significant variables that were removed to obtain the final model are: sex of the child, age of mother, mother's education and occupation, partner's education and occupation, Christianity, Traditional religion and Guan ethnicity. The final model shown in Table [17] (Appendix, p.74**)** have three independent variables: age of the child, wealth index quintiles, and decision latitude. The final model containing all the predictors was statistically significant. Chi Square = 207.534 and p < .001 indicates that the model could differentiate between children with a health card and those without. The final model explained between 8.2% (Cox and Snell R^2) and 18.4% (Nagelkerke R^2) of variance in the possession of a health card and correctly classified 91.4% of cases. The odds of not having a health card were significantly increased when children belonged to the richer, middle, poorer and poorest wealth quintile groups, and when women had the poorest decision latitude. Having a health card was not significantly associated with mothers who had middle decision latitude. The strongest classical social determinant for not having a health card was the poorest wealth quintile with an odds ratio of 8.004. This indicates that the odds of not having a health card were, 8.004 times higher for a child who belongs to the poorest wealth quintile compared to a child in the richest wealth quintile.

4.4.2 The alternative model: possession of health card in the national sample

Logistic regression was performed to investigate the effect of alternative social determinants of health on the possession of a health card for immunisation by first born children under five in the national sample. The initial model contained seventeen independent variables and was statistically significant. Chi Square = 243.809, df = 22 and p =.000. The initial model explained between 10.2% (Cox and Snell R^2) and 23.0% (Nagelkerke R^2) of variance in the possession of a health card and correctly classified 91.5% of cases. The non-significant variables that were removed to obtain the final model are: sex of the child, age of mother, source of drinking water, reading newspaper, watching TV, possession of TV, electricity, mother's occupation, Christianity, Traditional religion and Gruma ethnicity. The final model shown in Table [18] (Appendix, p.75) contains six independent variables: age of the child, frequency of listening to radio, money for taxi, literacy, partner's occupation, and decision latitude. The final model containing all the predictors was statistically significant. Chi Square = 228.604 and p<.001 indicates that the model could differentiate between children with a health card and those without. The final model explained between 9.4% (Cox and Snell R^2) and 21.3% (Nagelkerke R^2) of variance in the possession of health card and correctly classified 91.4% of cases. The odds of not having a health card were significantly increased when mothers did not listen to radio, when money for taxi to access medical help was a big problem to mothers, when mothers cannot read at all, when partners of mothers had unskilled jobs, and when women have the poorest and middle decision latitude. Having a health card was not significantly associated with partners with skilled manual jobs or was not working. The strongest predictor in the alternative social determinant of health model for not having a health card was partners with unskilled jobs with an odds ratio of 3.735. This indicates that the odds of not having a health card were 3.735 times higher

for a child when the partner of a mother had an unskilled job compared to a child whose mother's partner had a white collar job.

4.4.3 The classical model: Fully immunized first born child in the national sample

Logistic regression was performed to investigate the effect of classical social determinants on fully immunised first born children under five in the national sample. The initial model contained twelve independent variables and was statistically significant. Chi Square = 443.126, df = 22 and p =. 000. The initial model explained between 18.9% (Cox and Snell R^2) and 25.2% (Nagelkerke R^2) of variance in the number of children fully immunised and correctly classified 71.4% of cases. The non-significant variables that were removed to obtain the final model are: sex of the child, mother's age, partner's education and occupation, decision latitude, Christianity, Akan and Gruma ethnicities. The final model shown in Table [19] (Appendix, p.76) contains four independent variables: age of the child, wealth index quintile, education of mother, and respondent occupation. The final model containing all the predictors was statistically significant. Chi Square = 453.304 and p<.001 indicates that the model could differentiate between fully immunised children and those who were not. The final model explained between 17.2% (Cox and Snell R^2) and 23.0% (Nagelkerke R^2) of variance in the number of children fully immunised and correctly classified 69.9% of cases. The odds of not being fully immunised were significantly increased when children belonged to the poorest wealth quintile groups, when mothers had primary or no education and when mothers were not working. Being fully immunised was not significantly associated with children belonging to the richer, middle and poorer wealth quintile groups, and when mothers had skilled manual and unskilled jobs. The strongest classical social determinants for not being fully immunised were

the poorest wealth quintile and children with mothers who were not working. The odds of not being fully immunised were 1.835 times higher for a child who belonged to the poorest wealth quintile group compared to a child who belonged to the richest quintile. Also, the odds of not being fully immunised were 1.835 times higher for a child whose mother was not working compared to a child whose mother had a white collar job.

4.4.4 The alternative model: Fully immunized first born child in the national sample

Logistic regression was performed to investigate the effect of alternative social determinants on fully immunised first born children under five in the national sample. The initial model contained seventeen independent variables and was statistically significant. Chi Square = 471.277, df = 22 and p =.000. The initial model explained between 19.0% (Cox and Snell R^2) and 25.3% (Nagelkerke R^2) of variance in the number of fully immunised children and correctly classified 71.1% of cases. The non-significant variables that were removed to obtain the final model are: sex of the child, age of mother, frequency of listening to radio, reading newspaper, watching TV, possession of TV, partner's occupation, decision latitude, Akan and Gruma ethnicities. The final model shown in Table [20] (Appendix, p.77) contains seven independent variables: age of the child, electricity, radio, source of drinking water, literacy, respondent occupation, and Christianity. The final model containing all the predictors was statistically significant. Chi Square = 465.869 and p<.001 indicates that the model could differentiate between fully immunised children and those who were not. The final model explained between 17.8% (Cox and Snell R^2) and 23.7% (Nagelkerke R^2) of variance in the number of fully immunised children and correctly classified 69.8.3% of cases. The odds of not being fully immunised were significantly

increased when households did not have electricity and radio, when households had a poorer source of drinking water, when mothers cannot read at all and were not working. The odds of not being fully immunised significantly declined in Christian households. Being fully immunised was not associated with mothers who had skilled manual and unskilled jobs. The strongest predictor in the alternative social determinant of health model for not being fully immunised was mothers who were not working with an odds ratio of 1.812. This indicates that the odds of a child not being fully immunised were 1.812 times higher for a child whose mother was not working compared to a child whose mother had a white collar job.

4.4.5 Logistic regression model for being fully immunized in the rural sample

The alternative and classical models for the social determinants of health are not utilised in the rural sample because only two of the maternal independent variables (frequency of listening to radio and watching TV) and six of the household factors (money for taxi, possession of radio, Guan, Grussi, Akan and Mole Dagbani ethnicities) were related to the dependent variables in the Chi-square test. None of the paternal variables were related to the dependent variables in the Chi-square test. It was therefore impossible to obtain classical and alternative logistic regression models for the rural samples. Logistic regression was performed to investigate the effect of social determinants on fully immunised first born children under five in the rural sample. The initial model contained nine independent variables and was statistically significant. Chi Square = 102.382, df = 11 and p =.000. The initial model explained between 20.3% (Cox and Snell R^2) and 27.3% (Nagelkerke R^2) of variance in the number of fully immunised children and correctly classified 71.8% of cases. The non-significant variables that were removed to obtain the final model are: sex of the child, frequency of listening to radio, mother's occupation, frequency of watching TV,

possession of a radio and age of mother. The final model shown in Table [21] (Appendix, p.78) contains three independent variables: age of the child, Guan and Grussi ethnicities. The final model containing all the predictors was statistically significant. Chi Square = 89.259 and p<.001 indicates that the model could differentiate between fully immunised children and those who were not. The final model explained between 17.8% (Cox and Snell R^2) and 24.1% (Nagelkerke R^2) of variance in the number of fully immunised children and correctly classified 67.7% of cases. The odds of not being fully immunised were significantly increased when a child belonged to a Guan ethnic background. The odds of not being fully immunised significantly declined when the child belonged to a Grussi ethnic background. The strongest predictor for not being fully immunised in the rural sample was when children belong to a household with Guan ethnic background with an odds ratio of 7.601. This indicates that the odds of not being fully immunised were 7.601 times higher for a child whose family had Guan ethnic background compared to a child who belonged to other ethnicities.

4.4.6 Logistic regression model for possession of health card in the rural sample

Logistic regression was performed to investigate the effect of social determinants on the possession of a health card in the rural sample. The initial model contained eight independent variables and was statistically significant. Chi Square = 61.259, df = 8 and p =.000. The initial model explained between 12.5% (Cox and Snell R^2) and 21.0% (Nagelkerke R^2) of variance in the possession of health card and correctly classified 84.2% of cases. The non-significant variables that were removed in the final model are: sex of the child, age of mother, frequency of listening to radio, money for taxi to access medical help and Mole-dagabani ethnicity. The final model as shown in Table [22] (Appendix, p.78) contains three independent variables: age of the child,

Akan and Guan ethnicities. The final model containing all the predictors was statistically significant. Chi Square = 54.435 and p<.001 indicates that the model could differentiate between children who had a health card and those who did not. The final model explained between 11.1% (Cox and Snell R^2) and 18.8% (Nagelkerke R^2) of variance in the possession of a health card and correctly classified 83.7% of cases. The odds of not having a health card were significantly increased when the child belonged to Akan and Guan ethnicities. The strongest determinant for not having a health card in the rural sample was when children belong to a household with Guan ethnic background with an odds ratio of 8.297. This indicates that the odds of not having a health card were 8.297 times higher for a child whose family had Guan ethnic background compared to a child who belonged to other ethnicities.

CHAPTER 5

5.1 Discussion of findings

Results from the analyses reported above indicate that the classical and alternative social determinants are important predictors of having a health card and being completely immunised in Ghana. The multivariate analysis confirms the study's hypothesis that a significant relationship exists between immunisation and the social determinants of health in Ghana.

In the national sample, 91.3% and 52.0% of first born children under five years had health cards and were fully immunised respectively. Also, 83.4% and 40.3% of first born children under five had health cards and were fully immunised respectively in the rural sample. A possible explanation for the difference between the total number of fully immunised children and those with a health card, are the missed opportunities for immunisation. This explanation has not been scientifically verified. Also, the current study found that age was significantly related to being fully immunised and having a health card. This implies that not all the children who possessed health cards are fully immunised because they are not old enough. Matthews and Diamond (1997) add that self-reported measures of having a health card could be biased and also be influenced by the efficiency or otherwise of the local health administration. This could have resulted in an over estimation of the number of children with a health card.

The finding that mothers with primary and no education were less likely to immunise their children when compared to those with secondary or tertiary education in the national sample is similar to what Matthews and Diamond (1997) found in Ghana utilising the 1988 DHS. In contrast with the findings of Bhuiya et al. (1995) in rural

Bangladesh, the current study did not find significant associations between maternal education and the possession of a health card or the complete immunisation status of first born children under five in rural Ghana. The data did not allow for the effect of non-formal and informal education of mothers on immunisation and having a health card to be observed in the rural sample. Topuzoglu, Ay, Hidiroglu, Gurbuz (2007) have suggested that the relational networks of socio-economically disadvantaged women play an important role in accessing immunisation services. Non-formal and informal education acquired through one's social network could possibly explain the non-significant relationship observed between maternal education and immunisation or having a health card in the rural sample. Parashar (2005) showed an association between maternal literacy and complete immunisation in the rural district of India, but the present study found this association only in the national sample and not in the rural sample. It is worthwhile to note that the literacy test in the current study was only administered to respondents who reported to have no education or attended primary, middle and junior secondary schools (DHS, 2003). Mothers who cannot read at all in the current study were less likely to possess a health card and have fully immunised children when compared to those who could read in the national sample. Interestingly, education (primary and none) could only predict the full immunisation status of children in the national sample. This finding could be as a result of the large numbers of women who reported to have primary or no education: 60.9% in the national sample compared to 96.4% in the rural sample. Differences in the accessibility of educational opportunities amongst the various age groups (Liberatos et al., 1988; Hadden, 1996) and preference for male child education (UNDP, 2007) could account for the low levels of maternal education.

According to the CPRC (2009) report, data from the Nigeria and Kenya DHS indicates that children belonging to the poorest wealth quintile do not have access to immunisation services. This is in line with the present study, as children belonging to the poorest and middle wealth quintile in the national sample were less likely to be immunised when compared to the richest quintile. Also, children who belonged to the poorest, poorer and middle wealth quintile categories in the national sample were less likely to possess a health card when compared to the richest quintile. The confidence intervals for the significant associations found between the poorest, poorer and middle wealth quintiles with the possession of a health card were wide, suggesting an imprecise estimate of the odds ratio. The possession of a health card and being fully immunised could reflect access to immunisation services; this explanation is however not scientifically verified. Belonging to the poorer and richer wealth quintile groups did not affect the immunisation status of children. Pande and Yazbeck (2003) showed that children from poorer households were less likely to be fully immunised when compared to those from the richest households in rural India. On the contrary, the current study found no significant associations between wealth and being fully immunised or having a health card in the three northern-most rural regions of Ghana. It is possible that the assets utilised for the construction of the national wealth index were inappropriate for rural areas as the DHS (2003) report indicated that a single index was utilised for urban and rural areas. In terms of my personal knowledge, the measurement of wealth in northern rural Ghana should include the number of cattle owned, as well as the number of wives and children in a household. These factors are not accounted for in the wealth index. It is worthwhile noting, that the classical and alternative social determinants for having a health card and being fully immunised in the national sample, had almost equal classification accuracies. Mohan (2005) found

that wealthier families were more likely to be completely immunised and have access to piped water in India. Though Mohan's study did not assess the relationship between the source of drinking water and immunisation, and was focused on examining two public health programmes, findings of the current study suggest that significant associations exist between source of drinking water and immunisation. Becker et al. (1993) found that being fully immunised was related to the availability of clean drinking water in urban and rural areas of Cebu city in Philippines. This is in line with the findings of the current study which indicate that households with a poorer source of drinking water were less likely to have fully immunised children when compared to those with a better source of drinking water. This association, however, was only observed in the national sample but not in the rural sample. A possible explanation for this finding in the national sample is that households with a better source of drinking water are likely to be more educated, wealthier, have access to immunisation services and therefore more likely to complete routine schedules for immunisation. This explanation is not scientifically verified. Findings from Becker et al. (1993) in their analysis in the Philippines indicate that the possession of a radio and television are more important in determining the immunisation status of children in urban settings when compared to those living in rural areas. This finding is consistent with that of the present study which also indicates that households who do not possess a radio were also less likely to have fully immunised children when compared to those who do own a radio in the national sample. Becker et al. (1993) go on to suggest that the ownership of a radio and television may be a better indicator for measuring access to information on health rather than a measurement for wealth. Findings from the current study also revealed that mothers who did not listen to radio were less likely to have a health card when compared to those who listened to radio in

the national sample. It is therefore possible that the frequency of listening to radio and the possession of a radio improves access to health information in Ghana. This explanation is however not supported by significant tests. A previous study has found an association of childhood mortality with those who have access to household electricity in a cross-country analysis (Wang, 2003). Fantahun, Berhane, Wall, Byass, Högberg, 2007) add that the absence of immunisation is linked with mortality. Findings from the current study also suggest that households without electricity were less likely to have fully immunised children in the national sample. Care must however be taken in associating electricity with poverty in Ghana, as some areas may have not been connected to the national electrical grid and richer people living in such areas resort to the use of generators. The likelihood of not having a health card was significantly increased when money for transport to hospital was not available.

Findings of the present study indicate that the odds of not being fully immunised significantly declined when children belonged to a Christian household in the national sample. An extended literature review showed that Muslim and indigenous religious adherents were less likely to use maternal health services in Ghana (Gyimah, Takyi and Addai, 2006). A benefit of utilising maternal health services is an increased possibility of completing the immunisation schedule of children. This explanation has not been scientifically verified, and it is important to note that Gyimah et al. (2006) research and this current study both utilised the Ghana 2003 DHS. In addition, Antai (2008) has demonstrated that risk of not being immunised in Muslim households is significantly higher than that of Christian households using the 2003 Nigerian DHS. An explanation given for this finding was the doctrines, beliefs and values associated with Islam. Traditional religious beliefs such as ‘chichuru’ or spirit children, who are

believed to be evil and a threat to society (Allotey and Reidpath, 2001), may play a role in the odds of not being fully immunised in the national sample and explain the findings of the current study. This has however not been scientifically verified.

In contrast to the findings of Antai (2009) in Nigeria, this study did not find any significant associations between the type of occupational group a mother belongs to and the immunisation status of children in the national sample. Findings of the present study, however, indicate that the odds of not being fully immunised significantly increased for children whose mothers were not working when compared to those with white collar jobs in data from the national sample. Also, Antai's (2009) did not find significant associations between the utilisation of immunisation and non-working mothers. It is important to note that there were differences in the categorisation of the various types of occupations in the current study compared to the Antai's (2009) study in Nigeria. An extended review of literature indicated that no significant associations exist between being fully immunised and a father's occupation in urban India (Chhabra, Nair, Gupta, Sandhir, Kannan, 2007). Findings of the current study however, indicate that the odds of not having a health card were significantly increased for children when the partner of a mother had an unskilled job when compared to those who had white collar occupations in the national sample. The non-significant relationship found between occupation and immunisation in the rural sample of the current study can be attributed to minimal diversity in employment (Bull and Mittelmark, 2010).

The findings of the current study indicate that the odds of not having a health card significantly increased among children from Guan and Akan ethnicities in the three

northern-most regions of Ghana. The odds of not being immunised also significantly increased among children from Guan ethnic backgrounds in the rural sample. The confidence intervals for these findings were, however, wide indicating an imprecise estimate of the odds ratio. The association between ethnicities and having a health card or being fully immunised were not observed in the national sample. Gyimah (2006) found that the risk of deaths amongst infants in the various ethnic groups can be accounted for by socio-economic differences after analysing the 1998 Ghana DHS. Fantahun, Berhane, Wall, Byass, Högberg (2007) also add that the absence of immunisation is associated with mortality. The current study, however, found no relationship between socio-economic position and immunisation amongst the northern rural sample. The odds of not being fully immunised significantly declined when children belonged to Grussi ethnic backgrounds in the rural sample. This finding is particularly interesting as the Grussi ethnicity comprised of only 9.1% of the rural sample size. This may be explained by findings from an extended literature review in which Amankwaa (2007) indicated that the number of children born in polygynous relationships to women from Grussi and Akan ethnicities were comparatively smaller than other ethnic groups. An extended review of literature revealed that families in Bangladesh with less than three children were more likely to have them immunised, compared to those with a larger number of children (Perry Weierbach, Hossain, Rafiq-ul Islam, 1998). It is possible that mothers from Grussi ethnic background may pay more attention to the health needs of their children because of the relatively smaller number of children in their care. In terms of the social status and reputation of a woman within a Grussi polygynous relationship, one can only imagine the imperativeness of nurturing healthy children. These explanations have, however, not been scientifically verified.

The findings of the current study extend on previous research by Fantahun, Berhane, Wall, Byass, Högberg (2007) in Ethiopia. In contrast to the previous research, this study compares the decision latitude of women with immunisation in a national and rural sample. It is interesting to note that the odds of not having a health card in the national sample significantly increased when mothers had the poorest and middle decision latitude, when compared to those with optimal decision latitude. A possible suggestion for this finding is that women with the poorest and middle decision latitudes may have limited opportunities and access to social services such as immunisation for their children (UNDP, 2007). This explanation has not, however, been scientifically verified. Decision latitude was not significantly associated with having a health card or being fully immunised in the rural sample. A possible explanation for this is that children in rural localities who are not immunised may be easier to identify in comparison to urban areas. Therefore, mothers need to be more assertive in urban areas to ensure the immunisation of their children. Another factor that should be considered is the reality of the unavailability of vaccines in certain rural isolated areas. This could make decision latitude inapplicable to the utilisation of immunisation and the possession of a health card in certain rural areas**.**

5.2 Implications for Health Promotion and Recommendations

The findings of this study, suggest that the social determinants of immunisation are different at the national and rural levels in Ghana. There is a need for further research to identify the specific social determinants of health relevant for the utilisation of immunisation in very poor rural areas.

Improving the utilisation of immunisation in very poor rural areas as well as to the marginalised will have to remain a priority for health promotion interventions in Ghana. Health promotion interventions should be aimed at reducing social disparities in the utilisation of immunisation at the national and rural levels in Ghana.

From the study, various recommendations are made. The dominant belief systems in Ghana need to be explored and understood in regard to their effect in undermining the utilisation of immunisation.

Women must be empowered to actively participate in the planning and implementation of immunisation programmes at the local level.

Items utilised in the computation of the wealth index for developing countries must be appropriate for both rural and urban areas.

5.3 Limitations of the study

Report and recall bias could have occurred when mothers were asked to give verbal reports of immunisations. Lack of data on the immunisation of dead children can distort information on the social determinants associated with the utilisation of immunisation (Matthews and Diamond, 1997). The average design effect for the variables in the DHS was 1.2. This implies that the errors in the cluster design were 1.2 times higher when compared to a simple random design (DHS, 2003). The predictors' of social determinants for developing countries are different from those of highly developed countries. The findings may therefore not be extended to highly developed countries. Variables such as attitudes associated with the utilisation of immunisation were not considered in the collection of data and analysis. The data

analysed was collected in 2003 and it is possible that changes in occupation, income and educational status may have occurred. Causal inferences cannot be drawn from the findings of this study. It is possible that there may be other confounding variables other than age and sex that were not considered in the regression analyses.

5.4 Summary and Conclusion

This study investigated the social determinants of health on the immunisation status of children below the age of five using data from the 2003 Ghana DHS. The analyses compared a national sample with the three northern-most rural sub-sample. The weighted national and three northern-most rural regions usual residents sample were 2460 and 462 respectively. Bivariate and logistic regression analyses were carried out in both samples.

The results of the study indicate that the classical social determinants of health are relevant for the utilisation of immunisation in the national sample. In addition, specific social factors, such as the source of drinking water and ownership of a radio, were found to be associated with the utilisation of immunisation in the national sample. The utilisation of immunisation in the rural sample was, however, only associated with ethnicities.

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APPENDIX 1 (FIGURES)

Figure 2. Flow chart for the selection of the national and the three northern-most rural samples

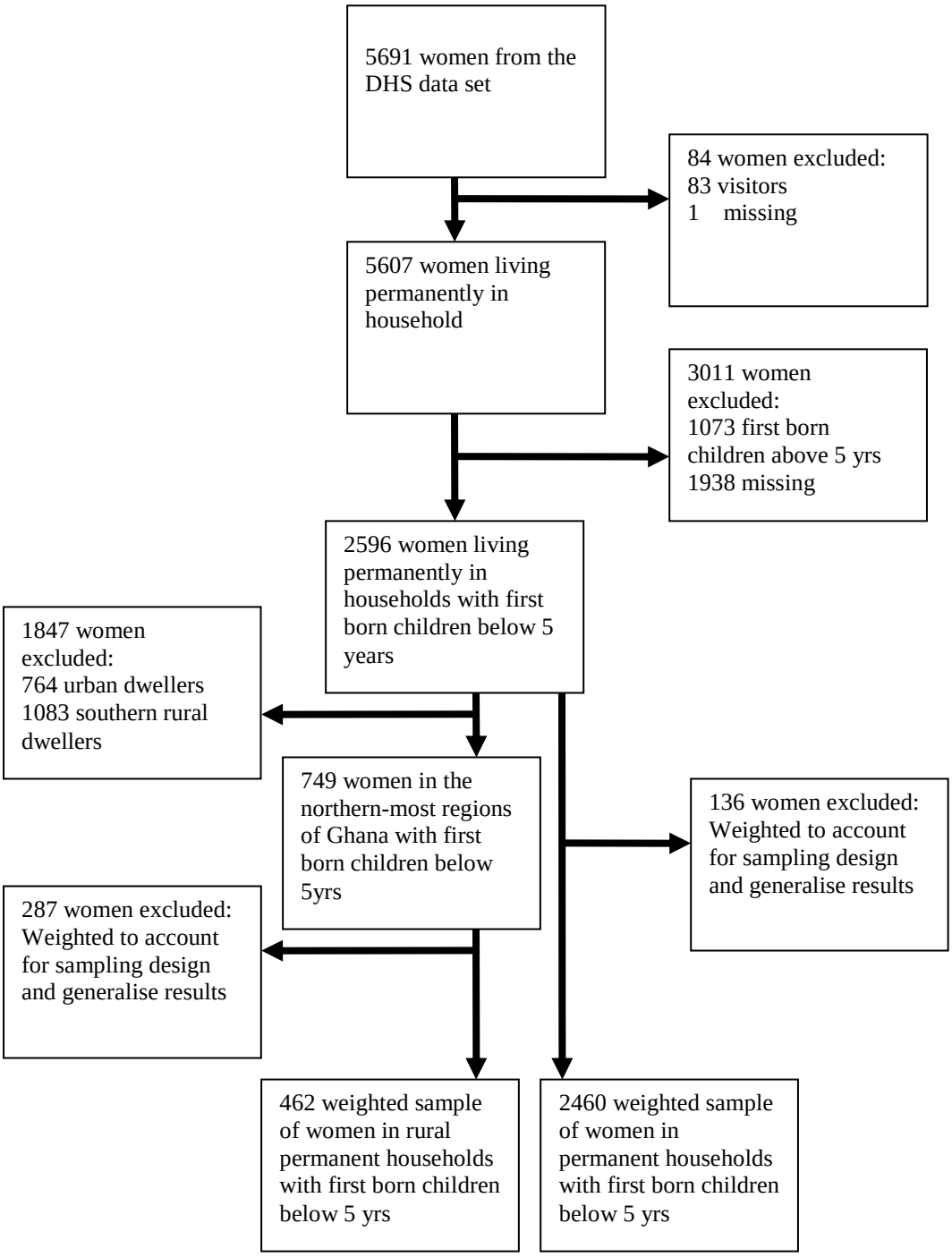


FIGURE 3

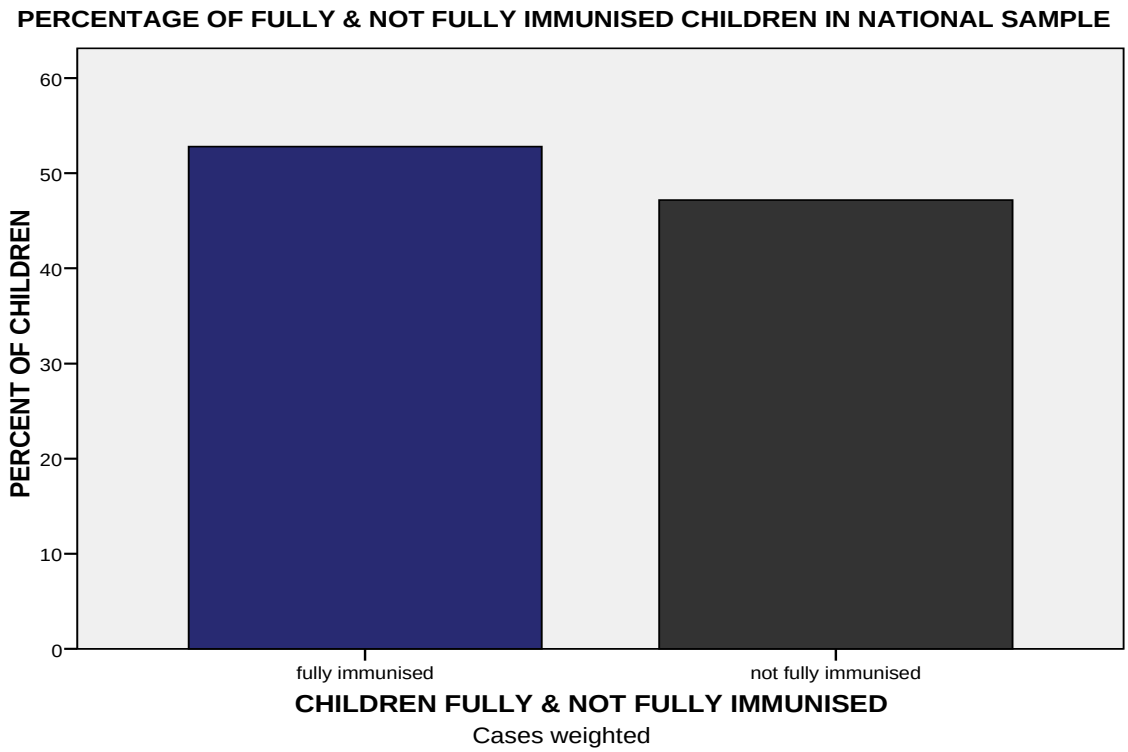


FIGURE 4

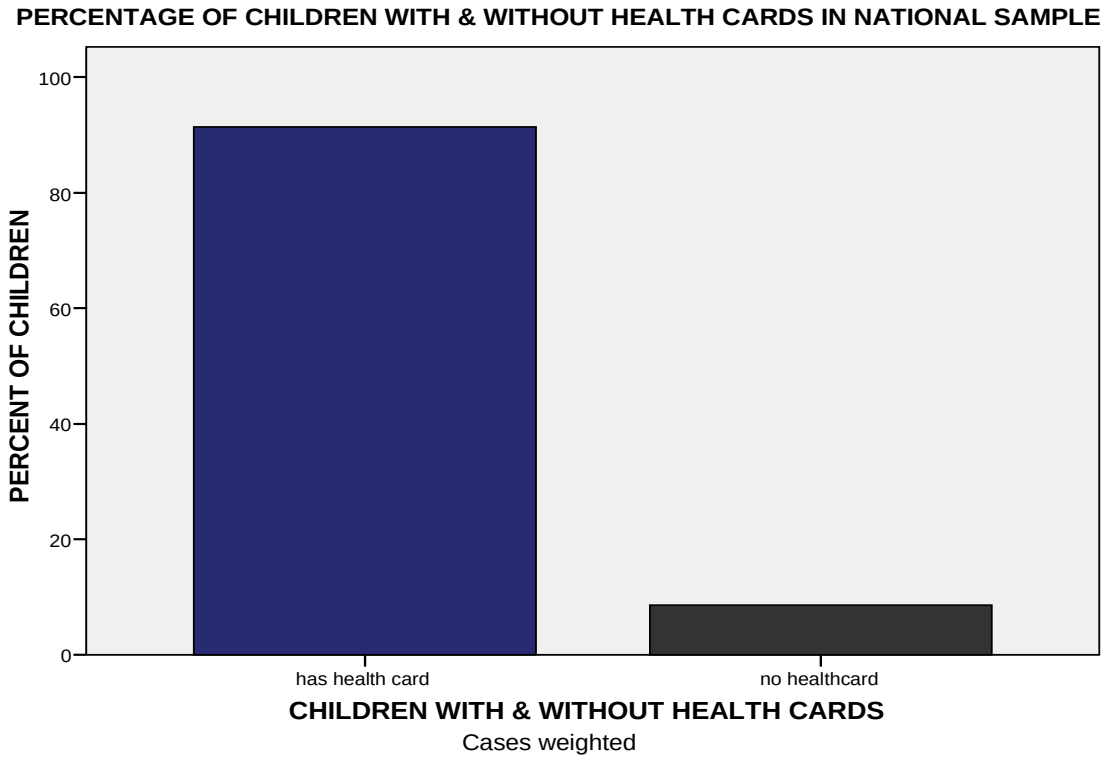


FIGURE 5

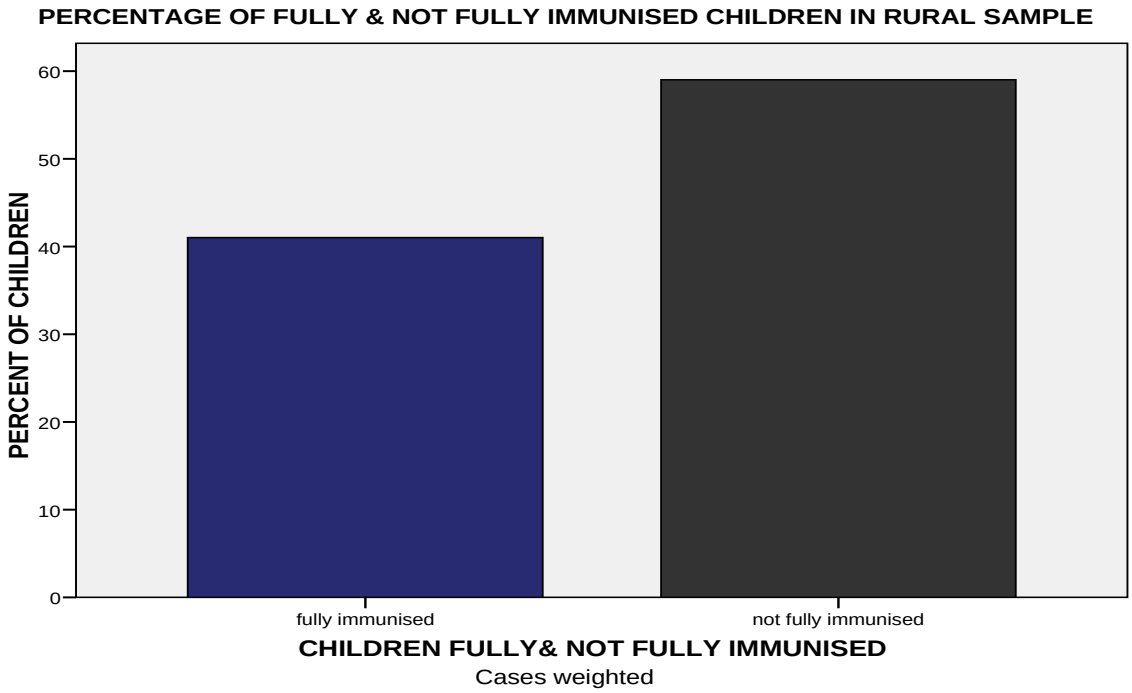
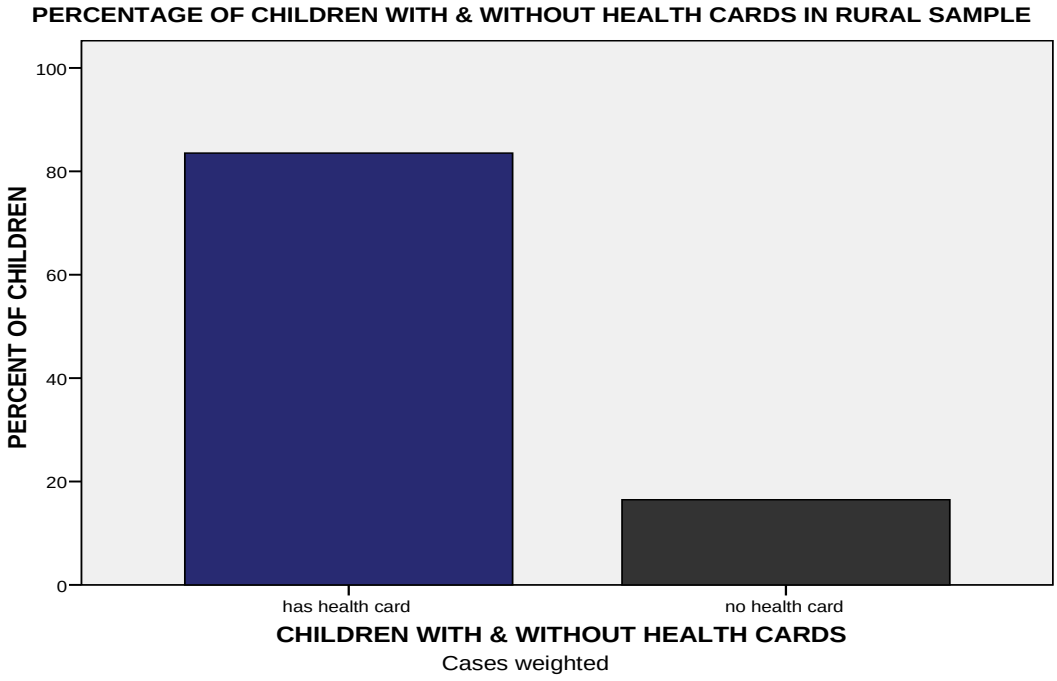


FIGURE 6



APPENDIX 2 (TABLES)

Table 1

Table 1. Number of households, interviews with women, eligible women response rate, women with permanent residents, weighted number of women in national and rural sub-sample; Ghana DHS 2003.

	Residence		
Source	Urban	Rural	Total
Household interviews			
Households selected	2,720	3,908	6,628
Households occupied	2,571	3,762	6,333
Households interviewed	2,517	3,734	6,251
Household response rate	97.9	99.3	98.7
Interviews with women			
Number of eligible women	2,500	3,449	5,949
Number of eligible women interviewed	2,374	3,317	5,691
Eligible women response rate	95.0	96.2	95.7
*Source of above data: Ghana DHS report, 2003			
Number of women who are permanent residents in household of interview	2340	3267	5607
Weighted number of women who are permanent residents with a first born child below 5 years nationally	878	1582	2460
Weighted number women in sub-sample consisting of all rural dwellers in Upper West, Upper East and Northern regions with a first born child below 5 years	---	462	462
** Source of above data: Ghana DHS female data set with 5,691 women			

Table 2. The number and percentage distribution of first born children under five by region in national sample (n = 2,460); Ghana DHS 2003.

		Frequency	Percent		
	Western	226	9.2		
	Central	199	8.1		
	Greater Accra	285	11.6		
	Volta	193	7.9		
	Eastern	249	10.1		
	Ashanti	467	19.0		
	Brong Ahafo	279	11.3		
	Northern	324	13.2		
	Upper West	77	3.1		
	Upper East	159	6.5		
	Total	2460	100.0		

Table 3. The number of fully immunised first born children under five and those having a health card by region in national sample (n = 2,460); Ghana DHS 2003.

		Frequency Health card	Frequency Fully immunised	
	Western	213	118	
	Central	176	110	
	Greater Accra	275	158	
	Volta	174	106	
	Eastern	234	132	
	Ashanti	438	246	
	Brong Ahafo	255	164	
	Northern	269	119	
	Upper West	73	37	
	Upper East	139	89	
	Total	2245	1278	

Table 4. Distribution of parental education, occupation and decision latitude variables from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National Sample		Northern- most rural sample	
	n	percent	n	percent
Maternal Education				
Higher and secondary	961	39.1	17	3.6
Primary	541	22.0	29	6.4
No education	957	38.9	416	90.0
Maternal Occupation				
White collar	821	33.4	46	10.0
Skilled manual	337	13.7	48	10.4
Unskilled	1006	40.9	308	66.7
Not working	275	11.2	58	12.6
Missing	20	0.8	1	0.2
Paternal Education				
Higher and secondary	1313	53.4	37	8.0
Primary	174	7.1	33	7.1
No education	729	29.6	375	81.2
Missing	243	9.9	18	3.8
Paternal Occupation				
White collar	464	18.9	22	4.8
Skilled manual	575	23.4	15	3.2
Unskilled	1292	52.5	420	90.9
Not working	1	0.0	-	-
Missing	127	5.2	6	1.2
Decision latitude				
Optimal	544	22.1	43	9.4
Middle	931	37.9	148	32.1
Poorest	966	39.3	270	58.4
Missing	18	0.7	1	0.2

Table 5. Bivariate associations of maternal factors in relation to fully immunised first born children under five from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Maternal factors						
	n	Chi Square	df	n	Chi Square	df
Education	2,420	54.93***	2	453	2.59	2
Occupation	2,401	61.49***	3	452	9.16	3
Literacy level	2,410	45.50***	1	452	0.87	1
Reads newspapers/magazines	2,416	19.35***	1	453	1.39	1
Listen to radio	2,418	27.47***	1	453	4.74*	1
Watch television	2,419	32.32***	1	454	7.48**	1
Decision latitude	2,402	36.66***	2	453	0.95	2
*** = statistically significant at $p < 0.001$ ** = statistically significant at $p < 0.01$ * = statistically significant at $p < 0.05$						

Table 6. Bivariate associations of maternal factors in relation to first born children under five with a health card from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Maternal factors						
	n	Chi Square	df	n	Chi Square	df
Education	2,456	50.12***	2	461	0.81	2
Occupation	2,439	56.29***	3	460	2.29	3
Literacy level	2,447	47.68***	1	459	0.02	1
Reads newspapers/magazines	2,453	14.27***	1	461	1.64	1
Listen to radio	2,455	45.74***	1	460	4.96*	1
Watch television	2,455	54.76***	1	461	2.25	1
Decision latitude	2,439	18.67***	2	461	4.82	2
*** = statistically significant at $p < 0.001$ ** = statistically significant at $p < 0.01$ * = statistically significant at $p < 0.05$						

Table 7. Bivariate associations of paternal factors in relation to fully immunised first born children under five from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Paternal factors						
	n	Chi Square	df	n	Chi Square	df
Education	2,185	34.71***	2	438	1.97	2
Occupation	2,297	39.74***	3	449	0.27	2

*** = statistically significant at p < 0.001
** = statistically significant at p < 0.01
* = statistically significant at p < 0.05

Table 8. Bivariate associations of paternal factors in relation to first born children under five with health card from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Paternal factors						
	n	Chi Square	df	n	Chi Square	df
Education	2,214	59.76***	2	444	5.36	2
Occupation	2,330	68.18***	3	455	0.19	2

*** = statistically significant at p < 0.001
** = statistically significant at p < 0.01
* = statistically significant at p < 0.05

Table 9. Bivariate associations of household factors in relation to fully immunised children under five from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Household factors						
	n	Chi Square	df	n	Chi Square	df
Wealth Index[1]	2,419	58.41***	4	455	3.20	4
Electricity	2,416	52.41***	1	453	0.48	1
Has radio	2,416	18.09***	1	454	6.51*	1
Has TV	2,416	18.86***	1	455	2.37	1
Drinking water source	2,417	25.18***	1	454	2.64	1
Akan ethnicity	2,416	17.11***	1	454	2.82	1
Guan ethnicity	2,416	2.28	1	454	8.30**	1
Grussi ethnicity	2,415	1.17	1	454	9.39**	1
Gruma ethnicity	2,417	17.01***	1	454	1.85	1
Christian religion	2,418	35.68***	1	454	3.86	1

*** = statistically significant at $p < 0.001$
** = statistically significant at $p < 0.01$
* = statistically significant at $p < 0.05$
[1] The wealth index for the two samples was generated separately

Table 10. Bivariate associations of household factors in relation to first born children under five having a health card from the national sample (n = 2,460) compared with a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

	National sample			Northern-most rural sample		
Household factors						
	n	Chi Square	df	n	Chi Square	df
Wealth Index[1]	2,457	85.97***	4	460	2.50	4
Electricity	2,453	48.44***	1	461	0.04	1
Has TV	2,453	36.85***	1	462	0.96	1
Drinking water source	2,452	29.36***	1	461	0.98	1
Money for taxi	2,455	28.03***	1	461	7.02**	1
Akan ethnicity	2,453	5.35*	1	462	5.34*	1
Mole Dagbani ethnicity	2,452	4.13*	1	462	4.91*	1
Guan ethnicity	2,453	11.51**	1	461	20.59***	1
Gruma ethnicity	2,453	24.34***	1	461	0.82	1
Christian religion	2,455	29.15***	1	462	0.76	1
Traditional religion	2,455	15.94***	1	462	1.89	1

*** = statistically significant at $p < 0.001$
** = statistically significant at $p < 0.01$
* = statistically significant at $p < 0.05$
[1] The wealth index for the two sample was generated separately

Table 11. Variables rejected for logistic regression analyses in the national and rural samples. These variables did not have significant Pearson Chi Square with significance values less than 0.001 in the national sample (n = 2,460) and values less than 0.01 and 0.05 in the rural sample (n = 462); Ghana DHS 2003.

Variables
Maternal
Current age of mother
Age at first marriage
Age of respondent at 1st birth
'Final say' on health
Wife to head of the household
Mother to head of the household
Daughter to head of the household
Sister to the head of household
Husband/Partner
Current age of partner
Household members' characteristics
Number of household members
Age of household head
Main floor material
Ethnicity
Ewe
Dangme
Hausa
Religion
Moslem

Table 12. Distribution of maternal variables considered for entry in logistic regression models with first born children under five having a health card and fully immunised as the dependent variables, using data from a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

Maternal variables	n	Percent
Listens to radio		
Less than once a week, at least once a week and almost everyday	289	62.6
Not at all	172	37.2
Missing	1	.2
Watches TV		
Less than once a week, at least once a week and almost everyday	46	10.0
Not at all	416	90.0

Table 13. Distribution of household variables considered for entry in logistic regression models with first born children under five having a health card and fully immunised as dependent variables, using data from a sub-sample (n = 462) consisting of all rural dwellers in the three northern-most regions- Upper East, Upper West and Northern; Ghana DHS 2003.

Household variables	n	Percent
Has radio		
Yes	300	65
No	162	35
Money for taxi		
Big problem	353	76.3
Small problem	110	23.7
Akan ethnicity	16	3.4
Not Akan	447	96.6
Mole Dagbani ethnicity	254	55.0
Not Mole Dagbani	208	45.0
Grussi ethnicity	42	9.1
Not Grussi	420	90.9
Guan ethnicity	21	4.6
Not Guan	441	95.4

Table 14. Distribution of maternal variables considered for entry in logistic regression models with first born children under five having a health card and fully immunised as dependent variables, using data from the national sample (n=2460); Ghana DHS 2003.

Maternal variables	n	Percent
Education		
Higher and secondary	961	39.1
Primary	541	22.0
No education	957	38.9
Occupation		
White collar	821	33.4
Skilled manual	337	13.7
Unskilled	1006	40.9
Not working	275	11.2
Missing	20	0.8
Literacy		
Able to read parts or whole sentences	660	26.8
Cannot read at all	1790	72.8
Missing	9	0.4
Listens to radio		
Less than once a week, at least once a week and almost everyday	2074	84.3
Not at all	384	15.6
Missing	1	0.0
Watches TV		
Less than once a week, at least once a week and almost everyday	1192	48.4
Not at all	1267	51.5
Missing	1	0.0
Reads news paper		
Less than once a week, at least once a week and almost everyday	239	9.7
Not at all	2218	90.2
Missing	3	0.1
Decision latitude		
Optimal	544	22.1
Middle	931	37.9
Poorest	966	39.3
Missing	18	0.7

Table 15. Distribution of paternal variables considered for entry in logistic regression models with first born children under five having a health card and fully immunised as dependent variables, using data from national sample (n=2460); Ghana DHS 2003.

Paternal variables	n	Percent
Education		
Higher and secondary	1313	53.4
Primary	174	7.1
No education	729	29.6
Missing	243	9.9
Occupation		
White collar	464	18.9
Skilled manual	575	23.4
Unskilled	1292	52.5
Not working	1	0.0
Missing	127	5.2

Table 16. Distribution of household variables considered for entry in logistic regression models with first born children under five having a health card and fully immunised as dependent variables, using data from the national sample (n=2460); Ghana DHS 2003.

Household variables	n	Percent
Electricity		
Yes	935	38.0
No	1521	61.8
Missing	4	0.1
Radio		
Yes	1761	71.6
No	695	28.3
Missing	4	0.1
Television		
Yes	534	21.7
No	1922	78.1
Missing	4	0.1
Drinking water source		
Better	1550	63.0
Poorer	906	36.8
Missing	4	0.2
Money for taxi		
Small problem	1028	41.8
Big problem	1429	58.1
Missing	3	0.1
Akan ethnicity	1164	47.3
Not Akan	1292	52.5
Missing	4	0.1
Gruma ethnicity	87	3.5
Not Gruma	2369	96.3
Missing	4	0.1
Christian religion	1778	72.3
Not Christian	680	27.7
Missing	1	0.1
Traditional religion	96	3.9
Not Traditionalist	2362	96.0
Missing	1	0.1

Table 17. Final logistic regression model of classical social determinants with has a health card as the dependent variable in national sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I For Odds Ratio Lower	Upper
	Age (century month age) of child	.058	.007	78.471	1	.000	1.060	1.047	1.074
	Wealth Index, quintiles	Richest is reference							
	Richer	.741	.430	2.974	1	.085	2.098	.904	4.872
	Middle	1.862	.382	23.757	1	.000	6.438	3.045	13.613
	Poorer	2.012	.379	28.251	1	.000	7.479	3.561	15.706
	Poorest	2.080	.375	30.839	1	.000	8.004	3.842	16.677
	Decision latitude	Optimal is reference							
	Middle	.486	.246	3.894	1	.048	1.626	1.003	2.634
	Poorest	.651	.238	7.479	1	.006	1.918	1.203	3.059

Model fit statistics: Chi Square = 207.534, df = 7, p = 0.000; Cox and Snell R^2 = 0.082; Nagelkerke R^2 = 0.184; classification accuracy = 91.4%

Table 18. Final logistic regression model of alternative social determinants with has a health card as the dependent variable in national sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I For Odds Ratio Lower	Upper
	Age (century month age) of child	.058	.007	71.887	1	.000	1.060	1.046	1.074
	Frequency of listening to radio	Less than once a week, at least once a week and almost everyday is reference							
	Not at all	.579	.181	10.299	1	.001	1.785	1.253	2.542
	Money for taxi to access medical help	Small problem is reference							
	Big problem	.459	.186	6.090	1	.014	1.583	1.099	2.279
	Literacy	Able to read parts or whole sentences is reference							
	Cannot read at all	.949	.299	10.064	1	.002	2.582	1.437	4.639
	Partners occupation	White collar is reference							
	Skilled manual	.627	.408	2.358	1	.125	1.871	.841	4.164
	Unskilled	1.318	.369	12.721	1	.000	3.735	1.810	7.704
	Not working	-16.49	39150.2	.000	1	1.000	.000	.000	
	Decision latitude	Optimal is reference							
	Middle	.676	.270	6.255	1	.012	1.967	1.158	3.341
	Poorest	.850	.264	10.364	1	.001	2.340	1.395	3.926

Model fit statistics: Chi Square = 228.604, df = 9, p =0.000; Cox and Snell R^2 = 0.094; Nagelkerke R^2 = 0.213; classification accuracy = 91.4%

Table 19. Final logistic regression model of classical social determinants with fully immunised as the dependent variable in national sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I For Odds Ratio Lower	Upper
	Age (century month age) of child	.053	.003	277.22	1	.000	1.055	1.048	1. 061
	Wealth Index, quintiles	Richest is reference							
	Richer	.086	.147	.341	1	.559	1.090	.817	1.454
	Middle	.440	.156	7.965	1	.005	1.553	1.144	2.108
	Poorer	.132	.163	.657	1	.418	1.141	.829	1.571
	Poorest	.607	.171	12.653	1	.000	1.835	1.313	2.564
	Education of mother	Higher and secondary is reference							
	Primary	.293	.124	5.636	1	.018	1.341	1.052	1.708
	No education	.453	.116	15.355	1	.000	1.574	1.254	1.974
	Respondent occupation	White collar is reference							
	Skilled manual	-.189	.147	1.660	1	.198	.828	.621	1.104
	Unskilled	.069	.125	.303	1	.582	1.071	.839	1.368
	Not working	.607	.159	14.561	1	.000	1.835	1.343	2.506

Model fit statistics: Chi Square = 453.304, df = 10, p = 0.000; Cox and Snell R^2 = 0.172; Nagelkerke R^2 = 0.230; classification accuracy = 69.9%

Table 20. Final logistic regression model of alternative social determinants with fully immunised as the dependent variable in national sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I. For Odds Ratio Lower	Upper
	Age (century month age) of child	.054	.003	275.55	1	.000	1.055	1.048	1.062
	Electricity	Has electricity is reference							
	No electricity	.305	.111	7.578	1	.006	1.357	1.092	1.687
	Radio	Has radio is reference							
	No radio	.313	.102	9.376	1	.002	1.368	1.119	1.672
	Source of drinking water	Better source of drinking water is reference							
	Poorer source of drinking water	.233	.100	5.388	1	.020	1.263	1.037	1.537
	Literacy	Able to read parts or whole sentences is reference							
	Cannot read at all	.314	.113	7.724	1	.005	1.369	1.097	1.708
	Respondent occupation	White collar is reference							
	Skilled manual	-.165	.147	1.270	1	.260	.847	.636	1.130
	Unskilled	.087	.117	.551	1	.458	1.091	.867	1.372
	Not working	.595	.160	13.872	1	.000	1.812	1.325	2.478
		Religion							
	Christian	-.312	.106	8.628	1	.003	.732	.595	.901

Model fit statistics: Chi Square = 465.869, df = 9, p = 0.000; Cox and Snell R^2 = 0.178; Nagelkerke R^2 = 0.237; classification accuracy = 69.8%

Table 21. Final logistic regression model with fully immunised as the dependent variable in rural sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I For Odds Ratio Lower	Upper
	Age (century month age) of child	.059	.008	60.774	1	.000	1.061	1.045	1.077
		Ethnicity							
	Guan	2.028	.763	7.068	1	.008	7.601	1.704	33.905
	Grussi	-.965	.361	7.137	1	.008	.381	.188	.773

Model fit statistics: Chi Square = 89.259, df = 3, p = 0.000; Cox and Snell R^2 = 0.178; Nagelkerke R^2 = 0.241; classification accuracy = 67.7%

Table 22. Final logistic regression model with has a health card as the dependent variable in rural sample.

		B	S.E.	Wald	df	Sig.	Odds ratio	95% C.I. For Odds Ratio Lower	Upper
	Age (century month age) of child	.061	.012	27.226	1	.000	1.063	1.039	1.088
		Ethnicity							
	Akan	1.414	.592	5.699	1	.017	4.112	1.288	13.127
	Guan	2.116	.500	17.888	1	.000	8.297	3.112	22.119

Model fit statistics: Chi Square = 54.435, df = 3, p = 0.000; Cox and Snell R^2 = 0.111; Nagelkerke R^2 = 0.188; classification accuracy = 83.7%