

**DETERMINANTS OF POLIO VACCINE UTILIZATION IN KENYA: A  
Case of New Born Mothers**

**By**

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## DECLARATION

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## **DEDICATION**

I dedicate this project paper to my late parents Mr. Moses Nyamasi and Mrs. Josephine Nyamasi for their sacrifice to facilitate my education. I also thank my entire family for their support and encouragement. Finally to my best friend Angela Kandu for encouraging me to fight on.

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## **ACRONYMS AND ABBREVIATIONS**

APHRC- African Population and Health Research Consortium

BCG - Bacille Calmette-Guerin (Vaccine)

DPT - Diphtheria Pertusis and Tetanus

DVI - Division of Vaccines and Immunization

EPI - Expanded Programme on Immunization

GIVS- Global Immunization Visions and Strategy

GOK - Government of Kenya

KDHS - Kenya Demographic and Health Survey

MYP - Multi Year Plan

NHSSP - National Health Sector Support Programme

OPV - Oral Polio Vaccine

WHO - World Health Organization

## **ABSTRACT**

Polio vaccination coverage is indicated as a perennial challenge which is persistently. Despite the fact that the current trend on global vaccination coverage increased whereby about 120 countries reached 90% polio coverage rates, under-vaccination remain to persist in many parts of Sub-Saharan Africa. Literature shows under-five children as faced and thus vulnerable of childhood diseases such as polio, measles and DPT amongst others. Based on this, the study pursued factors behind utilization of polio vaccine in Kenya among the new-born mothers. Kenya Demographic and Household survey (KDHS) of 2008 which contains factors associated with polio vaccine was used. The probit regression model has been employed in estimation. The dependent variable used was polio vaccine utilization while the independent variables used include: the age of the mother, marital status, maternal education, place of current residence, household head, employment, household size, female autonomy, wealth index and access to information. At 1%, 5% and 10% significance levels, the study findings revealed urban residence, primary education, being employed, wealth index and female autonomy as significant determinants of utilization of polio vaccine. Urban residence reduced polio vaccine utilization while being employed, primary education, female autonomy and wealth index positively and statistically increased utilization of polio vaccine among the new-born mothers. The study suggests development and implementation of policies targeting individuals in higher wealth cadres. As from the study, movement from lower wealth quintiles towards higher wealth quintiles is associated with increase in polio vaccination. Similarly, there is need to conduct workshops among the new-born mothers to inform them on their right and responsibility as parents to ensure the new-born is fully vaccinated against polio. This kind of awareness would lead to increase of female autonomy which in turn would lead to increase of utilization of polio vaccine.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

Low and Middle Income Countries (LMICs) experience death of more than ten million children who die before reaching their fifth birthdays since they do not have an access to operative interventions which can fight common and preventable childhood diseases (Arevshatian, et al., 2007). Some of the preventable childhood diseases are measles, polio, DPT among others. According to Gupta (2012), administering vaccines against vaccine preventable diseases alleviates poverty, saves lives and also increases productivity.

Poliomyelitis usually referred to as polio is a highly infectious viral disease. It mainly affects young children. The polio virus is mainly transmitted by person spread mainly through the faecal-oral route or less frequently by a common vehicle like contaminated water or food. The virus multiplies in the intestine, from where it can invade the nervous system and can cause paralysis. Polio had no cure however; it can be prevented by immunization. Polio vaccine is administered by mouth at birth, at six weeks, 10 weeks and 14 weeks.

Between 2001 and 2005, Polio Eradication Initiative was faced with a world crisis, when a reappearance of polio cases occurred across Africa due to termination of immunization activities in Nigeria which unfortunately became a major exporter of desolate polio virus to many other countries, threatening the gains that had been made (Ahmad, 2004). Due to this, the world governments examined the historical trend behind consumption of immunization services thus set the growth trajectory. This was meant to be followed up to the latter igniting a coverage rates of between 60-90%. Although World Health Organization interfered by participating in immunization campaigns together with local religious groups, there was an increased investment in the acquisition of vaccines, declaration of national immunization days and continuous improved surveillance among the countries across African Region. This was considered a success. According to Bates., et al. (1994) full surveillance is recommended in order to eradicate cases of preventable diseases.

However, considerable number of studies has indicated cases of inadequate immunization coverage and challenges in Sub-Saharan Africa (Bardenheier, et al., 2004). Considering the twenty nine Sub-Saharan countries surveyed, complete childhood immunization coverage levels varied largely from only 11% to 78% of children aged less than 23 months in Chad to Zambia respectively (Kamanda, 2010). Despite tremendous progress especially in polio vaccination experienced, it is still not yet established when the wild polio virus will be eliminated from the African Region. According to WHO/UNICEF (2001) missing the third dose of vaccine in the DPT and Polio series in some countries is the reason behind reported incomplete vaccination status.

Two years subsequent to the year 2000, we saw a good number of countries which were polio endemic decreasing from eleven to two countries by 2002. Also, it was reported that there was a decline in the incidence of polio cases that is 208 cases dropped making 89% decline by 2002. Nigeria, Chad and Niger were among countries which were more polio endemic compared to others. Having rumoured that polio vaccine had been contaminated in some states of Nigeria, the whole exercise of vaccination was stopped in 2003 which made the diseases to spread more to polio-free states within Nigeria and even spreading to other neighbouring countries, (Yameogo and Breugelmans, 2009). It was later reported by mid-2005 that eighteen more countries in three World Health Organization regions had wild polio virus cases (WHO, 2008). Burkina Faso, Central African Republic, Chad, Côte d'Ivoire and Mali in addition had re-established endemic transmission as well. This is how thorough campaign and polio vaccination was launched in conjunction with other campaigns across west and central Africa. As a result, surveillance data from the first half of 2005 suggest that polio cases were decreasing in Nigeria, and that previously polio-free countries were no longer being directly infected by the Nigeria-derived virus. Four of seven countries with endemic or re-established wild polio virus in 2004 had vaccine coverage of less than 50% putting some of the neighbouring countries at high risk of importation since they had routine polio vaccination coverage levels far below the 80% set target (Yameogo and Breugelmans, 2009).

Despite earmarked progress made towards improving routine polio vaccine coverage in the African Region, low coverage in several countries could be attributed as a significant contributory factor to the 2003–2004 regional resurgence of wild polio virus transmission. Coverage levels of other routine vaccines, oral polio, Bacillus Calmette Guerin (BCG) and

Tetanus Toxoid also lagged in many of the same areas. According to Arevshatian, et al., (2007) routine immunization services in the African Region has been halted by factors like lack of human resources within health ministries, civil unrest, little funding among other reasons.

## **1.2 Situation Analysis on vaccination in Kenya**

Immunization during childhood has been proven to be the most effective strategy for the prevention of many infectious diseases (Anderson, 1992). World Health Organization estimates that about 2.5 million deaths among children below five years worldwide are thwarted annually by immunization against diphtheria, tetanus, poliomyelitis and measles (WHO, 2008). For any country committed to eradication of vaccine preventable diseases, a well-functioning health system for the effective scaling up of immunization intervention is important. Although Yameogo and Breugelmans, (2009) claims that both immunization and health systems are dynamic and interacting, it's true that some aspects of an immunization system have a direct relationship with aspects of the overall health system. Nevertheless, the immunization system is an integral part of the overall health system. According to WHO, (2000) the immunization system has five major elements which includes advocacy and communications, vaccine delivery, disease surveillance, logistics and vaccine supply and quality.

In 2008, estimates show the global DTP3 immunization coverage of infants to be 82% whereas approximately 23.5 million children never received DTP3 vaccine (WHO, 2008). Although the recent trend related to global vaccination coverage is positive with 120 countries reaching 90% DTP3 coverage in 2008, pockets of under vaccination continue to persist in parts of sub-Saharan Africa (WHO, 2009).

The Kenya national health system operates within the context of other international health initiatives. In this regard, achievement of the MDGs targets is of primary importance, especially MDG4 meant to reduce the childhood mortality. The policy frameworks within which the Annual Operational Plans (AOPs) and programmes are implemented include: The Kenya Health Policy Framework of 1994 and the NHSSP II 2005-2010 which form the internal policy environment for programmes' and AOPs' implementation.

Kenya's NHSSP II 2005-2010 went a step higher and aims to reverse the downward trends of most health indicators by correcting the poor access to health, limited utilization of promotive and preventive health services, poor quality of service delivery, limited efficiency and effectiveness of the support services, insufficient collaboration and coordination with the other stakeholders that contribute to health provision and lastly insufficient funding to health sector (WHO/UNICEF, 2001). This has been extended to focus the preventable diseases compared to curative prevention. The Government of Kenya provides vaccines for the vaccine preventable diseases free of charge through Division of Vaccine and Immunisation which is mandated to reduce morbidity, mortality and disability due to life threatening infections due to vaccine preventable diseases (GOK, 2011)

In Kenya, the proportion of children aged 12-23 months that are reported to have received all recommended vaccinations is 77.4% (KDHS, 2008). However, this proportion varies from 48.3% in the North Eastern Province to 85.8% in the Central Province. This geographical inequality in coverage reflects the variation in the influence of determinants of full vaccination across the different provinces. In Nairobi, 73% of children in this age range are reported to have received all vaccinations (KDHS, 2008), but estimates in the slums within the city are usually much lower (APHRC, 2002). A study across the slums of Nairobi showed that full vaccination coverage of children was about 44% in these settlements compared to 73% for the whole of Nairobi (Magadi, 2004). Polio and measles vaccinations coverage in these settlements were substantially lower in Nairobi, but slightly higher than that in the rural areas of Kenya, despite the overall immunization coverage being lower than in the rural areas (Magadi, 2004). Lower immunization coverage rates have also been observed in facilities that serve slums settlements in Nairobi and may be due to missed opportunities among clinic attendees and inappropriately administered vaccines (Borus, 2004).

### **1.3 Problem Statement**

Trends in global vaccination coverage have shown increases with most countries reaching 90% DTP3 coverage in 2008, although under vaccination continue to persist in parts of sub-Saharan Africa particularly in the urban slums (Aaby and Benn, 2009). In an effort to attain human development as well as economic growth, Kenya became one of the signatory states committed towards achieving the millennium development goals. This was meant to reduce poverty and improve human development. Vaccination is among the major contribution on the roadmap towards achieving the goal of reducing deaths among children under five years

(MDG4). The challenges against vaccination on combating the deadly diseases in the developing countries cannot be overstressed. The low full immunization coverage documented in the literature among children both in urban and rural areas, particularly for polio vaccination, indicates the need for strategies to address the situation (Sharma et al., 2009). Studies have further indicated the challenge of polio vaccination associated with poor timely administration of vaccines, given the documented consequences of administering vaccine at the inappropriate time (Odusanya, et al. 2008; Watson, Shaw, and Wallace. 2009). The Kenya demographic and household survey (KDHS, 2008) revealed the increase in missed opportunities for administration of the different types of vaccines expected to be given concurrently especially the zero dose of polio which is administered at birth which Kamau and Esamai, (2001). This was majorly attributed to lack of vigilance amongst health professionals. It is against this background that this study is carried out to enable development and implementation of timely and effective strategies meant to improve consumption of polio vaccination especially by new-born mothers across the country. In order to achieve this objective, there is a dire need of appropriate and up to date information pertaining to determinants of polio vaccine utilization in Kenya, status and quality of polio vaccination services offered.

#### **1.4 Research questions**

1. What are the current trends in polio vaccine utilization among new born mothers in Kenya?
2. What are the demographic and socio-economic factors associated with demand for polio vaccine among the newborn mothers in Kenya?

#### **1.5 Objectives of the study**

The aim of this study is to establish the determinants of polio vaccine utilization among the new born mothers in Kenya. The specific objectives are;

1. To determine the current trends in polio vaccine utilization among new born mothers in Kenya.
2. To estimate demographic and socio-economic factors associated with demand for polio vaccine among newborn mothers in Kenya.

## **1.6 Research Justification**

According to APHRC (2002), on Regional Strategic Plan (2001–2005) based on the first Expanded Programme on Immunization had five main objectives to be achieved. Among them was to halt circulation of wild polio virus in all countries. This implied that there was a need of emphasising routine polio vaccination for the children below five years. Despite the fact that the current trend on global vaccination coverage increased whereby about 120 countries reached 90% polio coverage rates, under-vaccination remain to persist in many parts of Sub-Saharan Africa. Estimates from world health organization show that that the global polio vaccination coverage of infants is 82%, where 23.5 million children missed polio vaccination in 2008 (WHO, 2008). In Kenya, 77.4% is the proportion of children aged 12-23 months reported to have complete vaccinations (KDHS, 2008) which varies from 48.3% in the North Eastern Province to 85.8% in the Central Province and in Nairobi province is 73%. However, the low vaccination coverage documented among children in the north eastern province and other areas especially for polio vaccination, indicates the need for strategies to address the situation. This geographical inequality in coverage reflects the variation in the influence of determinants of polio vaccination across different regions. Apart from adding to literature on immunization, this study may also lead to policy intervention as far as factors associated with lower vaccination in Kenya are concerned. The government will be informed on the appropriate programmes targeting mothers of lower consumption of polio vaccination to improve its coverage rates. The study will show the extent to which children residing in rural and urban areas are underserved with polio vaccination to ensure that all children are reached in the country.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Theoretical literature

Despite many efforts in place, vaccination against polio has remained low in sub-Saharan Africa especially in countries like Kenya and Zambia (Kamanda, 2010). The current average vaccination coverage in Africa is estimated to be 70% which is lower than the expected 80% coverage level. Insufficient social mobilization and little community participation have been attributed mainly to low vaccination coverage (WHO, 2002). Further, it has been argued that actual social mobilization initiatives would have a significant impact on the attitudes of the society specifically towards implementation of the positive values of vaccination (Kamanda, 2010).

In assessing the communication programs in support of polio eradication, Waisbord, (2004) points out those dwindling coverage levels of polio vaccination is due to factors such as the level of sensitization by health workers and lack of political will by political leaders to mobilize and support those crucial routine services. On the other hand, Singh and Yadav (2001) suggests that demand for vaccination services requires clear understanding of the benefits, acceptability, no fear of vaccines, specific knowledge of the vaccine doses, motivation to avail services and overcoming barriers for seeking those respective services. They further argue that slum dwellers are unable to demand for services owing to weak community organization and low collective confidence, which is known to increase utilization of health services in public institutions.

According to suggestions by Watson, et al., (2009) socio-cultural acceptability of new vaccines may contribute to low utilization of immunization system. Considering HPV vaccines which may be associated with sexually transmitted infections thus prompting stigmatisation. As well, entry of HPV may affect HBV uptake. Therefore, information regarding polio vaccine should be clear because disapproval from say socially conservative groups and ethical considerations may negatively affect its acceptability and thus usage (Schneider, 2007). To increase uptake of polio vaccines to some extent may require changes in the sorts of messages provided to the public (Goldstein, 2001).

Introduction of vaccines have had many positive impacts on both the immunization and health systems, (Branzel, et al., 2011). The impacts however have not been automatically positive or negative. This is due to the effect which is likely to vary depending on strengths and weaknesses in the existing health systems. Similarly, variation may be as a result of the type and relevance of the model of service delivery in a given set of socio-economic, institutional and cultural circumstances.

According to Gupta (2012), development of new vaccines proves to be greatest achievement not only in medical history but also increased vaccination coverage. Considering areas where there is no existence and/ or resistance of already existing vaccines, new vaccines have high chances of increased penetration. Further, it is argued that vaccine developments need to be channelled towards improving efficiency, lowering costs or enhancing distribution to the target population. Wilson (2010) asserts that there is a need for developing nations to focusing on strategies in place to increase immunization coverage. This involves examining existing policies made by decision makers and other relevant stakeholders.

The Global Immunization Visions and Strategy (GIVS) developed and proposed by WHO and UNICEF a decade ago was adopted by most developing countries and some other developed nations as a new roadmap to prevent mortality of vaccine preventable illnesses by 2020 (WHO-UNICEF, 2013). This was to be achieved through more equitable access to existing vaccines in all communities. However, there are still coverage gaps which persist between low and high economies of the world. These variations are attributed to changing of populations patterns based on various aspects such as per capita income, social status and geographical location, (WHO, 2015).

## **2.2 Empirical Literature**

The study considered empirical works conducted on polio vaccination based on coverage rates and pointing out the major factors behind consumption of polio vaccines. This will enable us understand the scope, polio vaccine development period, role of the government as well as current state of the success of polio vaccination.

Nuwaha, et al. (2001) suggests that vaccination coverage levels were mainly anchored to awareness created on vaccination, attitudes and influence from parents (social) for example the mothers and fathers involved in the study agreed that routine immunization were well intentioned and meant to eradicate childhood diseases. However, in terms of social influence, the authors showed that the (father) man was regarded as the one who makes important

decisions whether vaccination will be carried out or not. This study was carried out among the fathers and mothers in Bushenyi District, Uganda to investigate attendance at National Immunization days and routine immunization where polio vaccination coverage was found to be 81%.

A study to identify factors influencing urban and rural vaccination coverage for households with children 12-13 months of age in a rural district of Ethiopia showed that higher community awareness was significantly linked to effective community mobilization for polio vaccination (Kidane and Tekie, 2000). To achieve the best results, the study employed the World Health Organization multi-stage cluster sampling method with stratification. This procedure is open to conscious or unconscious bias of the interviewer, and does not lead to a sample selected with known probability. The method also included all the eligible children in the household in the sample. From a sample of 220 households, the study found that vaccination coverage for Polio in these areas was 92.7% which was significantly associated with high literacy levels in the region.

Borus (2004) examined missed opportunities and immunization coverage among children below two years in the slum areas in Nairobi, Kenya whereby, on overall, 84% of the children were fully immunized with only 75% vaccinated against Polio. Although the overall coverage levels were above the recommended 80%, DPT3 coverage levels was far below the threshold. Insufficient vaccines in the stock, underweight child, child is under age, not appropriate day for vaccination and including syringes out of stock were among many other reasons cited as leading to failure of getting full vaccination. However, scarcity of Polio vaccine greatly contributed to missed opportunities for full vaccination.

A cohort study of seven hundred and sixty new borns on childhood vaccination was conducted in rural parts of Malawi where 91% of children less than thirteen months were found to be vaccinated against Polio according to Vaahtera, et al, (2000). Further, on exploring the same children at two years of age, the corresponding vaccination coverage was 93%. The authors suggested based on the results that the low coverage was as a result of staying in the rural villages where mobile vaccination was not conducted as well as home delivery by pregnant mothers.

In Eastern Uganda, Jinja town, a cross-sectional descriptive study was carried out by Odiit and Amuge (2003) who investigated vaccination status of under five children born in health units versus those born at home. The authors established that 68% of the children were up to-

date with their vaccines with a child born in a health unit was more likely to be up to-date on vaccination compared to a child born at home. The study suggests that home birth is a risk factor for partial or no vaccination. Similarly, prolongation of vaccination was poor in children born at home.

Arevshatian, L., et al, (2007) reviewed national infant immunization programmes in the 46 countries of WHO's African Region. This was in an effort to achieve the set key objective to be met by 2005 that is circulation of wild polio virus to be interrupted in all countries. Vaccination coverage was estimated by clustering countries with similar target disease control dynamics weighted by population. The authors revealed that the coverage levels of other routine vaccines, especially oral polio and tetanus toxoid lagged in many of the same areas. This was attributed to a lot of civil unrest, scarcity of human resources within the respective health ministries, little or no funding for routine immunization services and competition for staff time among specific persons involved in polio supplementary vaccination activities.

A prospective study which was hospital based using immunization cards and immunization history method, in an effort to eliminate missed opportunities was conducted among children below six years in South-Eastern Nigeria, (Udo., et al, 2006). The study showed that out of the total proportion of children whose vaccination status was established, 26.6% were partially vaccinated, 60.9% were fully vaccinated, and 12.5% had no form of vaccination. The study further revealed that polio vaccination stood at 62.4% with several other reasons for missing scheduled vaccination which included illiteracy on continuous visits, child being ill at the time of vaccination, change of the place of residence by parents and fever associated with the last vaccination.

In a study conducted by Chhabra et al. (2007) covered a total sample of 693 children between 24 to 47 months in the two urban villages of East Dehli. The researchers utilized systematic random sampling method to select the respondents in order to assess vaccination coverage of BCG, DPT/OPV and Measles with their respective determinants. The results revealed that immunization coverage for DPT3/OPV3 was 70.7% while for Measles vaccine was 65.3%. The coverage levels were significantly associated with mother's education levels, residential status, place of delivery and father's occupation. In a related study, a representative sample was used in investigating the reasons for non-vaccination and the effects of socio-demographic factors on vaccinations in a district of Istanbul, Turkey, (Sebahat and Nadi

2006). It was shown that distance from the health centre and internal migration from less developed parts to more developed parts of the country, were significantly related to the level of immunization coverage. Similar to the study by Chhabra et al. (2007) it was revealed that vaccination coverage was associated with educational levels of the father and the mother.

Datar., et al (2005) suggests that facilities which are larger in terms of size and better equipped including hospitals and health centres impacts significantly and positively on vaccination coverage. Upon conducting a comprehensive study on health infrastructure and vaccination coverage of 43,416 children aged between 2-35 months in rural India, authors established that availability of health infrastructure significantly improved immunization coverage for non-Polio vaccines. This implies that the nature of health infrastructure could either increase or decrease vaccination coverage.

Kamanda, (2010) explored comprehensively on immunization coverage and factors associated with failure to complete childhood immunization in Uganda, Kawempe Division. The study utilized cross sectional survey and employed chi-square test where the study indicated that the married constituted the highest percentage (52%) of respondents. It was shown that there is a significant relationship between marital status and completion of the immunization schedules against Polio. Educational levels of mothers were assessed where the results indicated that there was no significant relationship between education level and completion of immunization schedules of children against Polio. Under occupation of the parents, it was showed that 46% were employed while 49% were not employed. Also the results indicated that there was no significant relationship between immunizations of children against Polio with employment status. On income levels, 36% had a monthly income below 100,000 UGx. Results showed that there is a significant relationship between completions of immunization schedules of children against Polio with monthly income. Religion was assessed as well; 31% were Protestants, 29% Moslems, 22% Catholics, 5% born again Christians, 3% Adventist, 4% Pentecostal and 5% pagans. On this regard, the results indicated that there was no significant relationship between completion of immunization schedules against Polio and religion. Age of respondents showed that 38% of the respondents 15-24 years that completed immunization schedules, 47% were in age group 25-34 and 15% were 35 years and above. However, it was revealed that age of respondents does not affect completion of vaccination schedules against Polio.

A study conducted among children on immunization coverage in Mathare, Nairobi Kenya found out that young age of mothers was associated with high immunization coverage as compared with the older mother (Kamau and Esami 2001). Apart from maternal characteristics, the authors revealed that complete coverage is associated with educational status of the mother, income and living conditions. They showed that mothers with lowest education as well as households with limited monthly income and place of current residence were likely to complete a child immunization.

Wanjala, (2014) explored immunization coverage levels in Kenya. The study employed Probit regression model in estimation. The variables used include the age of the mother, education levels of the mother, marital status, literacy levels of the mother, place of delivery, household size and birth order. The study results show that at 5% significance level, the age of the mother, literacy levels, place of delivery, and birth order are significant factors that determine utilization of immunization of services. On the other hand, education levels, marital status and household size were found not to be statistically significant. The study findings further indicate that the age of the mother, literacy levels and place of delivery were positively related to the utilization of immunization services in Kenya while birth order was found to be negatively related to child immunization.

### **2.3 Overview of the Literature Review**

Based on the available literature, we have found out that knowledge on polio vaccination, by parents as well as attitudes and influence from parents especially on decision making contributes to increase in polio vaccination as well as infrastructure and size of the health facility. Place of residence as suggested by Kidane and Tekie, (2000) contributes to vaccination coverage levels. On the other hand, Chhabra et al. (2007) points out that mother's education levels, residential status, place of delivery and father's occupation are significant factors which lead to increased polio vaccination. However, Kamanda, (2010) fails to concur on the contribution of education, age and occupational status which the study found to be insignificant factors and indicated income levels as significant factor. Most of the studies are inconclusive on this area of study given most of them relies on studies done on small coverage areas like studies done by Kamanda, (2010) and Sebahat and Nadi (2006) in Kawempe Division, Uganda and District of Istanbul, Turkey respectively. Such studies have challenges on inference of their results to the wider population for policy action. Therefore, the study was conducted on a national cross sectional survey (KDHS, 2008) which gave national representation on utilization for polio vaccine.

## CHAPTER THREE

### METHODOLOGY

#### 3.1 Introduction

This chapter presents the description of the theoretical framework, model estimation, definition of variables and measurements, Source Data and Estimation Issues.

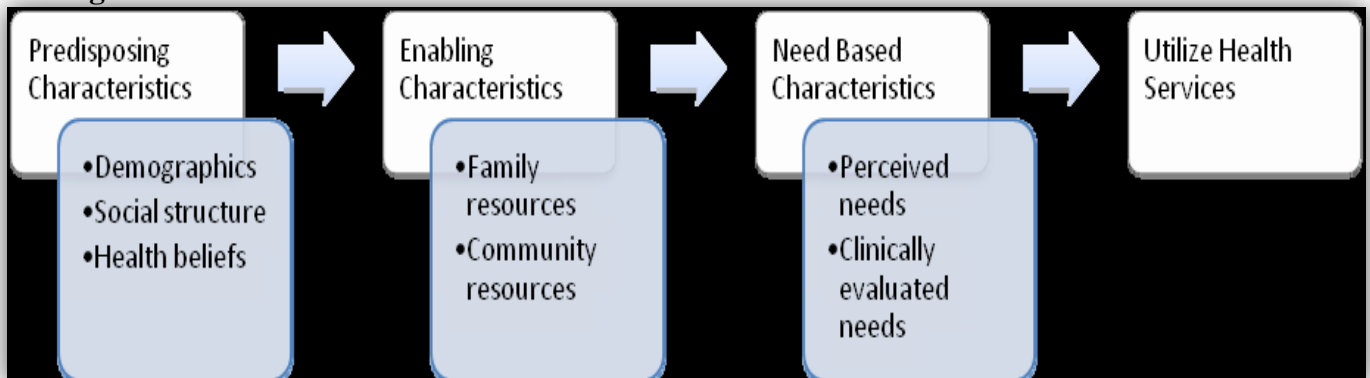
#### 3.2 Theoretical Framework

This model is based on Andersen (1968) model of health care utilization which analyses three different categories that is predisposing, enabling and need characteristics. The tendency to utilize health care services is represented by predisposing characteristics. According to this category, an individual is more or less likely to use health services based on demographics, position within the social structure and beliefs of health services benefits. An individual who believes health services are useful for treatment will likely utilize those services.

Secondly, there is enabling characteristics, a category where resources found within the family and the community determines health care utilization. Mostly, family resources encompass economic status and the location of residence while community resources incorporate access to health care facilities and the availability of persons for assistance.

Lastly, the need based characteristics includes the perception of need for health services. Wolinsky, (1988b) suggests that the need can either be social or clinically evaluated perceptions of need as well; it can be the perceived susceptibility and perceived severity of a health condition.

**Figure 3.1: Andersen's Behavioural Model of Health Services Utilization**



Source: Wolinsky, F. (1988b). Seeking and using Health Services.



transforming  $x_i\beta$  into a probability. Therefore, the probability of a child being vaccinated against polio was represented as shown below;

$$\text{prob} = (v_i = 1/x_i) = \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(v_i - x_i\beta)^2}{2\sigma^2}} dx$$

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x_i\beta} e^{-\frac{(v_i - x_i\beta)^2}{2}} dx = \Phi x_i'\beta \dots \dots \dots (2)$$

From equation (2), the probability of a new born mother to take a child for polio vaccination given the values of the various independent variables( $x_i$ ), and  $\Phi x_i'\beta$  is the cumulative density function evaluated at  $x_i\beta$ . Therefore, the resulting probabilities is interpreted as changes/predicted probabilities, that is, considering the estimates, a unit change in any of the independent variable results to a change in the probability of a child of a new-born mothers being vaccinated against polio ceteris paribus.

### 3.3.2 Variable Definition

**Table 3.1: Variable definition and measurement**

<b>Variables</b>	<b>Measurement</b>
<b>Dependent Variable</b>	
Utilization of polio vaccine by new-borns	We code 1 if child of a new-born mother received polio vaccination and 0, otherwise
<b>Explanatory variables</b>	
Age	Age of new born mother in years.
Education	No Education; 1 if Primary level, 2 if Secondary level and 3 if Tertiary level.
Marital Status	Marital status=1 if new born mother is married, 0 if not married.
Gender of the head of the household	Gender= 1 if male headed household, 0 if female headed household.
Wealth index	Wealth Quintiles; 1 if poorest, 2 if poorer, 3 if middle, 4 if richer and 5 if richest.
Occupational status	Employment Status=1 if employed, 0 otherwise.
Current residence/region	Residence= 1 if urban, 0 if rural.

Household size	Number of persons under one Household Head.
Access to information	Access to information = 1 if possess radio, TV or reads newspapers, 0 otherwise.
Female autonomy	If a mother makes decisions on own health and purchase of large household assets

**Source: Own**

### **3.4 Diagnostic tests and other Estimation Issues**

The study undertook some of the diagnostic tests like Multicollinearity test since its presence may inflate the variance of the parameter estimates through correlation matrix as suggested by Mukras, (1993). Shapiro Wilk test was used to check for normality as well as lastly conduct a Pseudo R squared test for goodness of fit. The probit regression model employed in estimation unlike ordinary least square method provided a probability of  $v_i$  lying between the range of zero and one and a measure of goodness of fit (Gujarati, 2004). Heteroscedasticity was tested through scatter plots of residual-square against the fitted values of the dependent variable.

### **3.5 Data Source and Type**

Kenya Demographic Household Survey (KDHS, 2008) which is a household-based cross sectional data usually collected after duration of every five years was used. This survey contains general information regarding to the target population (new-born mothers). This survey also contains household information on the vaccination where information on polio vaccination was collected comprehensively across the counties and country as a whole. Other specific information pertaining to mothers is also available for example information which can be obtained include occupation, age, region of residence, place of delivery, education levels among other pertinent factors necessary for this study. The study identified these respective factors and cleaned them before conducting estimation.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1. Introduction**

This chapter presents the descriptive Statistics as well as an assessment of correlation and empirical estimates. The study used Stata v12.1 software with application of the binary probit model in assessing determinants of polio vaccine utilization among the new born mothers in Kenya.

#### **4.2. Descriptive Statistics**

In describing polio vaccine utilization and the relevant determinants, the study considered mainly average, range and standard deviation. As indicated in Table 4.1 below, a total of 6079 respondents were surveyed. Specifically, the study considered polio vaccination as the dependent variable, age of the mother, marital status, maternal education, place of current residence, sex of household head, employment, household size, wealth index, female autonomy and access to information as independent variables. Based on the findings in Table 4.1, 88.7% of the respondents were reported to have received polio vaccination with the average age being 28 years old where the older respondent was 49 years while the young respondent was 15 years. Furthermore, 62.7% of the respondents were married with 24.1% staying in urban area.

**Table 4.1: Summary Statistics**

Variable	Observations	Mean	Std. Dev.	Min	Max
Vaccination	5699	.8868222	.3168378	0	1
Age of the mother	6079	28.23557	6.664807	15	49
Married	6079	.6267478	.4837081	0	1
Urban residence	6079	.2413226	.4279207	0	1
No education	6079	.213851	.4100566	0	1
Primary education	6079	.5642375	.4958972	0	1
More than secondary education	6079	.2219115	.4155661	0	1
Sex of household age	6079	.7080112	.4547146	0	1
Household size	6079	1.544991	.5919062	1	3
Employed	6056	.5475561	.4977744	0	1
Wealth index	6079	2.81214	1.516036	1	5
Female Autonomy	6079	.2105609	.4077406	0	1
Frequency of reading the newspaper	4344	.0448895	.2070853	0	1
Frequency of listening radio	4569	.6911797	.4620574	0	1
Frequency of watching TV	5069	.203985	.4029977	0	1

**Source: Own computation based on KDHS, (2008)**

The study also revealed that 56.4% and 22.2% of the respondents had primary education and secondary/more than secondary education while 21.4% had no education respectively. On household size the average size was 2 whereby the highest household size was 3 and the lowest being 1. On household head, the study found that approximately 70.8% of the respondents households were male headed with 54.8% of the mothers reporting to be employed. Most of the respondents on the other hand in the study belonged to the mid-level wealth index classification. Similarly, the study established that 21.1% of the respondents were autonomous in making decision regarding their own health. Access to information on polio vaccination from the respondents revealed that 4.5%, 69.1% and 20.4% is from newspaper, radio and television respectively.

### 4.3 Diagnostic tests

#### 4.3.1 Multicollinearity test

Correlation matrix was undertaken to establish the relationship between polio vaccine utilization related variables and independent variables of interest to the study. The Positive and negative signs in the analysis are indicative of the direction of association between variables. From Table 4.4, polio vaccination was found to be negatively correlated with urban residence and household size while there is a positive correlation with the rest of the study variables. Age of the mother was negatively related to urban residence, sex of the household head and wealth index. On the other hand, education and wealth index were negatively correlated to household size and female autonomy respectively. To confirm existence of Multicollinearity, the study computed Variance of Inflation Factors (VIF) as indicated below;

**Table 4.2: Variance Inflation Factors (VIF)**

Variable	VIF	1/VIF
Access to information	9.66	0.103519
Age	9.40	0.106383
Wealth index	8.88	0.112613
Household size	8.21	0.121799
Primary education	7.93	0.126031
Sex of the household head	6.86	0.145693
More than secondary education	5.68	0.176166
Married	4.90	0.203933
Employed	2.68	0.373230
Urban	2.65	0.376654
Female autonomy	1.31	0.765326
Mean VIF	6.20	

Since all the VIF values were less than the recommended threshold of 10, Multicollinearity is deemed absent.

#### 4.3.2 Normality test

The study undertook a normality check of the distribution of the residuals/error term. Table 4.3 indicates the results.

**Table 4.3: Shapiro Wilk test of normality**

<b>Variable</b>	<b>Observations</b>	<b>W</b>	<b>V</b>	<b>z</b>	<b>Prob&gt;z</b>
Vaccination	5699	0.99778	6.746	5.029	0.00000
Age	6079	0.96997	96.764	12.069	0.00000
Married	6079	0.99991	0.277	-3.391	0.99965
Urban	6079	0.99925	2.401	2.312	0.01039
Primary education	6079	0.99998	0.066	-7.159	1.00000
More than secondary education	6079	0.99911	2.858	2.772	0.00279
Sex of the household head	6079	0.99971	0.926	-0.204	0.58067
household size	6079	0.99859	4.528	3.987	0.00003
Employed	6056	0.99999	0.044	-8.237	1.00000
Wealth index	6079	0.99088	29.378	8.922	0.00000
Female autonomous	6079	0.99902	3.164	3.040	0.00118
Access to information	3386	0.99044	18.271	7.528	0.00000

The results show that the data used was distributed to some variables such as married, primary education, sex of the household head and employed while other variables were not normally distributed since their respective p values were less than 5% led to rejection of the null hypothesis of normality of the residuals. This is however expected in such dynamic data sets as the one utilized in this study.

**Table 4.4: Correlation Matrix**

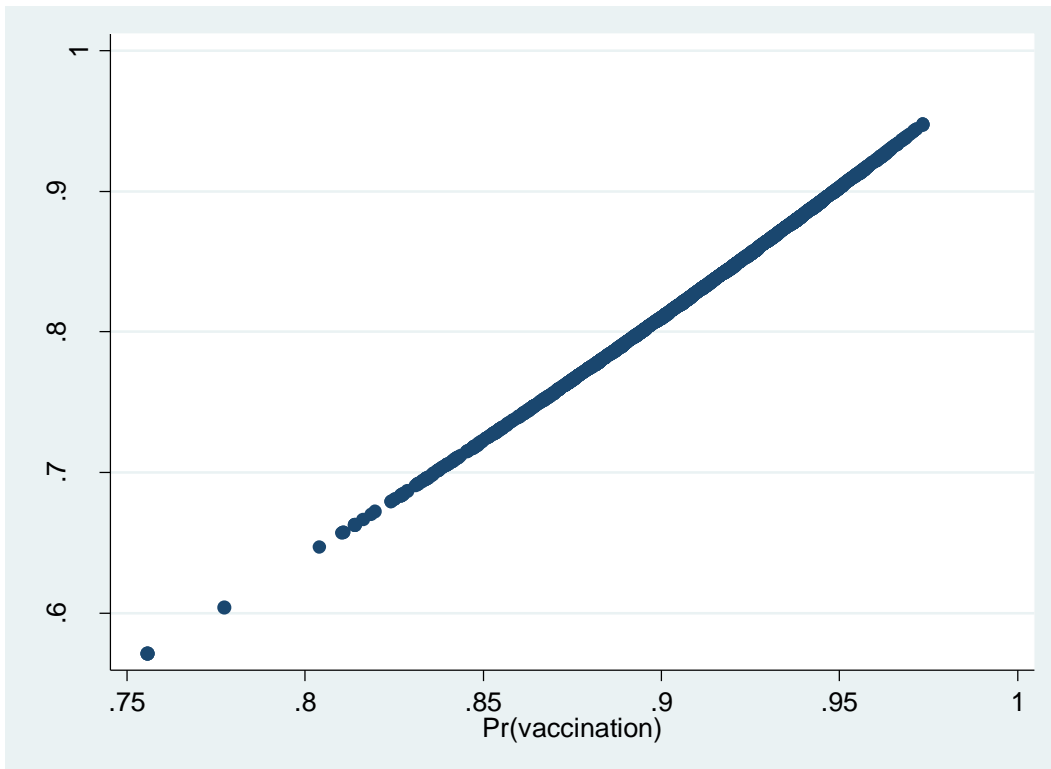
<b>Variables</b>	<b>Vaccination</b>	<b>Age of the mother</b>	<b>Married</b>	<b>Urban</b>	<b>Education</b>	<b>Sex of the household head</b>	<b>Household size</b>	<b>employed</b>	<b>Wealth index</b>	<b>Female autonomy</b>	<b>Access to information</b>
<b>Vaccination</b>	1.0000										
<b>Age of the mother</b>	0.0221	1.0000									
<b>Married</b>	0.0224	0.0889	1.0000								
<b>Urban</b>	-0.0183	-0.0879	0.0529	1.0000							
<b>Education</b>	0.0352	0.0888	-0.0040	0.2697	1.0000						
<b>Sex of the household head</b>	0.0081	-0.0078	0.6328	0.0591	0.0144	1.0000					
<b>Household size</b>	-0.0262	0.2223	-0.0326	-0.2013	-0.1534	0.0624	1.0000				
<b>Employed</b>	0.0663	0.1757	0.0224	-0.0750	0.1297	-0.0069	0.0039	1.0000			
<b>Wealth index</b>	0.0335	-0.0416	0.0280	0.6513	0.3840	0.0442	-0.2381	-0.0143	1.0000		
<b>Female autonomy</b>	0.0361	0.1038	0.0472	-0.0354	0.0099	-0.0116	-0.0750	0.0417	-0.0171	1.0000	
<b>Access to information</b>	0.0268	0.0381	0.0513	0.3940	0.3437	0.0620	-0.1089	-0.0397	0.5267	-0.0362	1.0000

Source: Own computation based on KDHS, (2008)

### 4.3.3 Heteroscedasticity test

Heteroscedasticity implies variation of the residuals across all the observations under study. The study used scatter plots method of residual-square against the fitted values of the dependent variable. The results are as shown in Figure 4.1.

**Figure 4.1 : A graph of Residual Square against predicted value of vaccination**



From Figure 4.1, it was revealed that the plot exhibited a systematic pattern which implied that there was constant variance as expected. Therefore there is no heteroscedasticity.

## 4.4. Regression Results

### 4.4.1. Introduction

Probit model was applied in the study to estimate the influence of various factors on polio vaccine utilization among new –born mothers in Kenya. Findings are tabulated in Table 4.5 below. To summarize the effects of the independent variables on the dependent variable, marginal effect was examined. From the Table 4.5, study found a p value of 0.0003 which was less than 5% with the log likelihood ratio of -892.3196 implying that the variables considered fit

the model well hence variables used in the model were jointly significant in explaining utilization of polio vaccine in Kenya.

The pseudo R was very low (0.0189). This is normal for cross sectional studies. From the results of the model, staying in urban, primary education, wealth index, female autonomy and being employed were found to be statistically significant in determining polio vaccination. On the other hand age of the mother, married, access to information, sex of the household head, household size and more than secondary education were shown to be statistically insignificant at all significance levels. Table 4.5 below indicates more other details of marginal effects of the probit model of various independent variables.

**Table 4.5: Marginal Effects of the Probit Model**

Variables	Marginal Effects	Std. Err.	z	P>z	[95% Conf.	Interval]
Age of mother	0.0003528	0.0008093	0.44	0.663	-0.0012333	0.001939
Married	0.0139826	0.0129981	1.08	0.282	-0.0114932	0.0394585
Urban	-0.0360284**	0.0143014	-2.52	0.012	-0.0640587	-0.0079981
Primary education	0.0303079*	0.0179533	1.69	0.091	-0.00488	0.0654958
More than secondary education	0.0250635	0.0198053	1.27	0.206	-0.0137541	0.0638811
Sex of the household head (male)	-0.0047089	0.0143387	-0.33	0.743	-0.0328123	0.0233945
Household size	-0.0083053	0.0090177	-0.92	0.357	-0.0259796	0.0093691
Employed	0.0310956***	0.0102466	3.03	0.002	0.0110127	0.0511785
Wealth index	0.011362**	0.0051682	2.20	0.028	0.0012325	0.0214915
Female Autonomy	0.0222677*	0.0128987	1.73	0.084	-0.0030133	0.0475486
Access to information	0.0144565	0.0128138	1.13	0.259	-0.0106582	0.0395711
Probit regression Number of obs = 3150 LR chi2(11) = 34.39 Prob > chi2 = 0.0003 Log likelihood = -892.31968 Pseudo R2 = 0.0189						

\*\*\*Significant at 1%, Significant at 5% and Significant at 10%.

#### **4.4.2 Discussion of the results**

From Table 4.3 above, the study indicates significant values at 1%, 5% and 10% significance levels. Only being employed was found to be statistically significant at 1% significance level. Urban residence and wealth index were shown to be significant at 5% significance level. On the other hand, primary education and female autonomy were found to be statistically significant at 10% significance levels.

At 1% significance level, the study revealed that being employed increased the probability of polio vaccination by 1.02% holding other factors constant. This implies that as one gets employed, the likelihood of accessing polio vaccination is high. The extra income earned is used to purchase or access health care (polio vaccination). This finding contradicted with the results obtained by Kamanda (2010) on immunization coverage and factors associated with failure to complete childhood immunization in Uganda. The results indicated that there was no significant relationship between immunizations of children against Polio with employment status.

The study sought to understand the contribution of current place of residence whereby residing in urban areas increased the probability of polio vaccination by 3.60% holding other factors constant as compared to residing in rural areas. Urban residence is associated with ease of access to information and transport among other factors. As suggested by Kidane and Tekie, (2000) place of residence determines the vaccination coverage levels.

Among the socio economic factors, the study considered the wealth index in levels and found out that a change from lower wealth level to higher wealth level leads to a 1.14% probability increase in polio vaccination other factors held constant. This may be attributable to individuals in higher wealth cadres being more concerned about their well-being. Kamanda (2010) indicated in the findings that there is a significant relationship between completions of immunization schedules of children against Polio with monthly income. This concurs with our study finding.

Female autonomy was found to be a significant factor that increases the probability of accessing polio vaccination and thus reduces infant mortality by 2.23% holding other factors constant. The likelihood of a woman accessing polio vaccination increases significantly if a woman autonomously makes decisions about her child's health. This concurs with study findings of Nuwaha, et al. (2001). The authors indicated that vaccination coverage levels

were attributed to social influence whereby mostly men were regarded as the one who makes important decisions whether vaccination will be carried out or not. However, if mothers could make such decisions vaccine utilization in this case polio vaccine increases since they spend most of their time with the new-borns compared to men.

Considering the level of education, at 10% significance level, the study showed that primary education significantly increases the probability of accessing polio vaccination by 3.03% holding other factors constant. This implies that mothers of the new-borns with this level of education have the capacity of comprehending messages on vaccination as indicated in table 4.1 majority of this population had primary education. Other studies revealed that vaccination coverage was associated with educational levels of the father and the mother (Chhabra et al., 2007).

## CHAPTER FIVE

### SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

#### 5.1 Introduction

This chapter explores the study findings, policy recommendations on factors influencing polio vaccination. Also areas to be considered in further studies are provided.

#### 5.2 Summary and Conclusions of the study findings

The study reviewed theoretical and empirical literatures to establish the factors behind polio vaccination in Kenya. From the literature, polio vaccination coverage is indicated as a perennial challenge which is persistently. On the other hand, under-five children are faced with childhood diseases such as polio, measles and DPT amongst others. Based on this, the study pursued factors behind utilization of polio vaccine in Kenya among the new-born mothers. Kenya Demographic and Household survey (KDHS) of 2008 which contains factors associated with polio vaccine was used. The probit regression model has been employed in estimation. The dependent variable used was polio vaccine utilization while the independent variables used include: the age of the mother, marital status, maternal education, place of current residence, household head, employment, household size, female autonomy, wealth index and access to information. At 1%, 5% and 10% significance levels, the study findings revealed urban residence, primary education, being employed, wealth index and female autonomy as significant determinants of utilization of polio vaccine. Urban residence reduced polio vaccine utilization while being employed, primary education, female autonomy and wealth index positively and statistically increased utilization of polio vaccine among the new-born mothers. In Conclusion, to control the immunization of polio and coverage, there is a need to consider the study findings obtained and indicated to be statistically significant.

#### 5.3. Policy Recommendations

Kenya has been committed to eradicate vaccine preventable diseases to reduce the rate of infant mortality which foresaw introduction of administering free polio vaccine. Currently, policies in place include access to health care, efficient health care service delivery. In order to improve on policies which safeguard polio vaccination, there is need to consider place of residence, being employed, female autonomy, wealth index and primary education.

The ministry and the other relevant stakeholders need to target new-born mothers to reduce inadequacies of polio vaccination. This could be done through creation of awareness on the consequences of failing to utilize polio vaccination especially on the new-borns in primary schools. Also there is a need of introducing or including polio vaccination in primary school curriculum.

There is need to develop and implement policies targeting individuals in higher wealth cadres. As from the study, movement from lower wealth quintiles towards higher wealth quintiles is associated with increase in polio vaccination. Similarly, there is need to conduct workshops among the new-born mothers to inform them on their right and responsibility as parents to ensure the new-born is fully vaccinated against polio. This kind of awareness would lead to increase of female autonomy which in turn would lead to increase of utilization of polio vaccine.

The governments need to establish more health facilities and improve accessibility to health facilities in urban areas. This will maintain and even increase the rate of utilization of these services. This is because urban residence was associated with low utilization of these services. Finally, employment indicated higher utilization compared to unemployed population. Therefore, there is a necessity of the government subsidizing the cost of accessing care as this would maintain and lead to increased utilization of polio vaccination. Mothers especially in low income groups would also have opportunities to access the services. These costs may be in terms of time, distance to polio vaccination centers.

#### **5.4. Areas of further study**

The study has mainly considered factors influencing polio vaccine utilization among the newborn mothers in Kenya using a cross sectional data. Various factors were considered in the study as indicated in the methodology section, however, other factors such as regional variations, and birth order were not considered. Therefore there is need to include these factors in future studies as well as include other datasets over time relating with other independent factors.

## REFERENCES

- Aaby, P and Benn, S (2009). Assessment of Childhood Immunisation Coverage. *Lancet*; 373(9673).
- Ahmad, K. (2004). Kano to recommence vaccination against poliomyelitis. *Lancet Neurol*; 3: 388.
- Andersen, R. (1968). *A Behavioral Model of Families' Use of Health Services..* Chicago, IL: Center for Health Administration Studies. Research Series No. 25. University of Chicago.
- Anderson, R. (1992). The concept of herd immunity and the design of community-based immunisation programmes. *Vaccine*. 10:928–935.
- APHRC (2002). *Health and Livelihood Needs Of Residents of Informal Settlements on Nairobi City.* African Population and Health Research Center, Occasional Study Report 1. Nairobi.
- Arevshatian, L., Clements, C., Lwanga, S., Misore, A., Ndumbe, P., Seward, F and Taylor, P. (2007). An evaluation of Infant Immunization in Africa: is a Transformation in progress? *Vol 85, No. 6, 449-457.*
- Bardenheier B., Yusuf H., Rosenthal J., Santoli J., Shefer A. Cricket D., Abigail M. and Chu, S. (2004). Factors Associated with Under-immunization at three Months of Age in Four Medically Underserved Areas. *Public Health Reports*, **119**(5): 479-485.
- Bates A., Fitzgerald, F., Dittus R., and Wolinsky, D (1994). Risk factors for under-immunization in poor urban infants. *JAMA*. Vol; 272:1105–1110.
- Borus, K (2004). Missed opportunities and inappropriately given vaccines reduce immunization coverage in facilities that serve slum areas of Nairobi. *East African Medical Journal*. Vol;81(3):124–129.
- Chhabra, P., Nair, P., Gupta A., Sandhir, M and Kannan A. (2007). Immunization in urbanized villages of Delhi. *Indian J Pediatr*.vol;74:131–134.
- Datar, A., Mukherji, A. and Sood, N. (2005). Health Infrastructure and Immunization Coverage in Rural India. *Indian Journal of Medicine* **125**: 31-42.
- GOK (2011). *Division of Vaccines and Immunization (DVI) Multi Year Plan (MYP) 2006-2010.*
- Goldstein, S (2001). Factors associated with student participation in a School-Based Hepatitis B immunization program. *J Sch Health* **71**(5): 184-7.

- Gujarati, D. (2004). *Basic Econometrics*, 4<sup>th</sup> Edition. McGraw-Hill, Book companies, New York.
- Gupta, A (2012). Indian immunization programme: A literature review; *Imprimis Research and Advocacy* 1-24.
- Kamanda, B (2010). Immunization Coverage and factors associated with failure to complete childhood immunization in Kawempe Division, Uganda. Target; Mothers or care givers selected from households in Kawempe Division. A Mini- Thesis submitted at the School of Public Health, University of the Western Cape. (20-70).
- Kamau N and Esamai F (2001). Determinants of immunization coverage among children in Mathare Valley, Nairobi. *East African Medical Journal*. Vol;78:590–594.
- Kenya National Bureau of Statistics (KNBS, 2009), ICF Macro. Kenya Demographic and Health Survey 2008-09. Calverton, Maryland: KNBS and ICF Macro.
- Kidane, T. and Tekie, M. (2000). Factors Influencing Child Immunization Coverage in a Rural District of Ethiopia. *Ethiopian Journal of Health Development*, **18** (3).
- Kongstvedt, P.R. (2007). *Essentials of Managed Health Care*. Hong Kong: Jones and Bartlett Publishers.
- Magadi, M (2004). Maternal and child health among the urban poor in Nairobi, Kenya. *African Population Studies*. Vol;19:179–198.
- Mukras M. (1993). *Elementary Econometrics. Theory, Application and Policy*. East Africa Education Publishers Ltd. 162-163.
- Nuwaha, F., Mulindwa, G. and Balenzi, J. (2001). Causes of low attendance at National Immunization Days for Polio eradication in Bushenyi District, Uganda. *Tropical Medicine and International Health*, **5**(5): 364 – 369.
- Odiit, A and Amuge, B (2003). Comparison of vaccination status of children born in health units and those born at home. *East African Medical Journal*. Vol; 80(1):3–6.
- Odusanya, O., Alufohai, E., Meurice, F., and Ahonkhai, V. (2008). Determinants of vaccination coverage in rural Nigeria. *BMC Public Health*.;Vol;8(1):381.
- Schneider, A. (2007). Impact of vaccination against oncogenic human papillomavirus on the incidence and mortality of cervical cancer in Germany. *Med Klin (Munich)* **102**(7): 515-23.
- Sebanhat, D.T. & Nadi, B. (2006). Vaccination coverage and reasons for non-vaccination in a district of Istanbul. Marmara University Medical Faculty Department of Public Health, Istanbul, Turkey.

- Sharma R., Desai, K and Kavishvar, A (2009). Assessment of immunization status in the slums of surat by 15 clusters multi indicators cluster survey technique. *Indian J Community Med.* Vol; 34(2):152–155.
- Singh, P. & Yadav, R. (2001). Immunization Status of Children in Bihar States. *Indian Journal of Pediatrics*, 68:495-500.
- Udo, J., Anah, M., and Etuk, I. (2006). Opportunistic Immunization With In-Patient Programme: Eliminating a Missed Opportunity in Calabar, Nigeria, *Annals of African Medicine* 5(4)188-191.
- Vaahtera, M., Kulmala, T., Maleta, K., Cullinan. T., Salin, M.L. & Ashorn, P. (2000). Childhood Immunization in Rural Malawi: Time of Administration and Predictors of Non-compliance. *Annals of Tropical Paediatrics: International Child Health.* 20 (4): 305-312.
- Waisbord, S. (2004). Assessment of Communication Programs In Support of Polio Eradication: Global Trends and Case Studies. Academy for Educational Development. Washington, DC.
- Wanjala, S, (2014). Determinants of immunization coverage in Kenya: Unpublished master's thesis submitted at the University of Nairobi, school of economics.
- Watson, M., Shaw, D and Wallace, A. (2009). Challenges, lessons learned and results following the implementation of a human papilloma virus school vaccination program in South Australia. *Aust N Z J Public Health.* Vol; 33(4): 365-70.
- WHO (2000). Assessing new vaccines for national immunization programmes - A framework to assist decision makers. Geneva, WHO.
- WHO (2008). UNICEF. Global Immunization Data.
- WHO (2009). WHO Vaccine-Preventable Diseases: Monitoring System. Global Summary. Geneva.
- WHO/UNICEF. (2001). Five-year Regional Plan of Action 2001-2005. Nairobi, UNICEF Regional Offices.
- Wolinsky, F. (1988b). Seeking and Using Health Services. In *The Sociology of Health* (second edition; 117-144). Belmont, CA: Wadsworth.
- WHO-UNICEF (2013), Guidelines for Comprehensive Multi-Year Planning for Immunization, Pp 35-55.
- Wilson, P (2010). Giving developing countries the best shot: An overview of vaccine access and R&D.
- WHO (2015). Global Health Observatory Data Repository: The Health Equity Monitor Childhood Immunization.
- Yameogo, T.,and Breugelmans, G. (2009). Surveillance system for adverse events following immunization against yellow fever in Burkina Faso in 2008. *Good Practice Recommendations. Med Trop (Mars)* 69(4): 320-1.