Child Immunization Coverage in Kiandutu Slums, Thika District, Kenya.

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

I dedicate this thesis to my parents Mr. V.P Kariuki and Mrs. Leah Wanjiku Kariuki, my brother Richard Wokabi and sister Veronica Mugure for their love, support, and encouragement.

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To all of you and many others who may have not been mentioned here, may God bless you.

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LIST OF ABBREVIATIONS

AIDS Acquired Immunodeficiency Syndrome

BCG	*Bacille Calmette-Guérin* vaccine
DHS	Demographic Health Survey.
DMOH	District Medical Officer of Health
DPT	Diptheria**,** Tetanus and Pertussis Vaccine
EPI	Extended Programme on Immunization
GAVI	Global Alliance for Vaccines and Immunization
Hep B	Hepatitis B Vaccine
Hib	Haemophilus Influenza Type B Vaccine.
HIV	Human Immunodeficiency Virus
IMR	Infant Mortality Rate
ITROMID	Institute of Tropical Medicine and Infectious Diseases
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KDHS	Kenya Demographic Health Survey
KEPI	Kenya Expanded Program on Immunization
KEMRI	Kenya Medical Research Institute
MCH	Mother Child Health clinic
MDG	Millenium Development Goals
MOH	Ministry Of Public Health and Sanitatio
NCSS	Nairobi Cross-Sectional Slum Survey
OPV	Oral Polio Vaccine
SPSS	Statistical Package for Social Scientists
TB	Tuberculosis

UNICEF	United Nations Children Fund
WHO	World Health Organization

ABSTRACT

Immunization is a cornerstone of public health that has seen diseases like small pox

completely eradicated worldwide, poliomyelitis and measles eradicated in many regions of the world. Immunization has been seen as one of the most cost effective public health interventions in most regions of the world. This, however, may not apply to slum settings due to certain prevailing conditions. A cross sectional study was carried out in Kiandutu slums, Thika District, Central Province between March and May 2009. The slum has an approximate population of 50,000 people most of whom have limited access to health services. This study aimed at determining immunization coverage and associated factors in Kiandutu slum. The primary sampling units were households within the slum that were covered by the Thika District Hospital Outreach Team. 189 households were randomly selected from a list of 560 households covered by the outreach team. One child aged 12-23 months whose mother or guardian gave consent to participate in the study was selected from each household.

The mean age of the children was 17.3 months with a range of 12-23 months, while the mothers' mean age was 25.5 years. Of the mother's interviewed, 35.4% had completed primary education while 40.2% started primary education but dropped out. Mothers who completed secondary education were 10.1%, and those that had incomplete secondary education were 7.9%. Those who had attained tertiary education were 2.6%. The immunization card retention rate among parents/guardians was 79.9%. Children who had received the BCG vaccine were 94.7%. Those who received the pentavalent vaccine constituting of BCG, 3 doses of DPT and OPV vaccines were 79.8%. Children who had received the pentavalent vaccine plus the measles dose were 77%. Therefore, infants who received full immunization by virtue of having received the complete pentavalent

vaccine and measles vaccine were 77% of the total sample, 18% were partially immunized and 5.3% were not immunized at all. The DPT1-DPT3 drop out rate was 15.6%. Reasons given as to why children had not been immunized included distance to the health centre and forgetfulness due to preoccupation with family activities. From this study, there was no significant association at 95% confidence level between, immunization status of child and marital status of the mother (P=0.232), immunization status of child and mother's education level (P=0.128) and between immunization status and immunization card availability (P=0.285). There was however a significant association between the age of the mother and immunization status of the child (P=0.006).

In comparison to other slums in Kenya and other countries, the immunization coverage of 77% in Kiandutu slum among households covered by the district hospital outreach team was close to the district's target of 80%. The drop out rate was however high and it was recommended that incentives to reduce the drop out rate be introduced.

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Immunization can be termed as the process of protecting a person from a specific disease. Stimulation of the body's own immune response (by administration of a vaccine) is referred to as active immunization; while passive immunization is temporary immunity brought about by the transfer of pre-formed antibody, or specifically sensitized lymphocytes, from an immune individual to a non-immune individual – the latter thus becoming immune without necessarily having had contact with the corresponding antigen(s). Immunization is an important form of primary prevention which protects the individual and the wider population by impeding the spread of infectious disease (John *et al.,* 2000) and is a cornerstone of public health. The World Health Organization (WHO) estimates, that in 2006, immunizations saved two to three million lives (WHO, 2006). Since the launch of the Expanded Program on Immunization in 1974, vaccination programs have been seen as one of the world's most cost-effective public health strategies in reducing the burden of infectious diseases globally and serve as a key building block for health systems in the developing world.

Immunization is a story of both successes and failures. With the push to universal immunization in the 1980s, the world accelerated immunization coverage in an unprecedented fashion, reaching reportedly over 70 percent globally for the pentavalent and measles vaccines by the end of 1990. Yet coverage has stagnated since then, leading to 2 million unnecessary deaths annually from vaccine preventable diseases. Global and

regional averages also mask lower local coverage, particularly in sub-Saharan Africa, where some 17 countries have immunization coverage levels under 50 percent. In fact, 30 million infants worldwide are still not immunized with even basic vaccines. In many countries, immunization services do not reach the poorest and most excluded populations. Even when services are available, a substantial number of caregivers still fail to complete the immunization schedule (Waisbord *et al.*, 2005).

Developing countries, including Kenya, do not have sufficient employment opportunities for their rapidly increasing population. As a consequence, many cities are characterized by a high incidence of informal employment opportunities, which are unstable and yield low incomes. The resulting poverty in combination with a lack of affordable housing are driving forces behind the formation of informal settlements commonly know as slums, which offer sub-standard living conditions. Although immunization has been seen as one of the most equitable of health programs, prevailing conditions in slum settings such as inaccessibility to health services, illiteracy among others hinder immunization coverage.

This study aimed at determining the immunization coverage and factors associated with immunization coverage in Kiandutu slums, Kenya.

1.2 Statement of the Problem

Immunization has proved to be one of the most important and cost-effective ways of ensuring child survival. It is therefore necessary to ensure that children from all backgrounds have access to immunization (WHO, 2005). In the past two decades immunization prevented an estimated 20 million deaths from vaccine-preventable infections globally. Despite these successes, much remains to be done. In 2004, an estimated 27 million infants did not receive three doses of diphtheria-tetanus-pertussis vaccine (DPT3). An estimated 1.4 million children under five died from the six major vaccine-preventable diseases.

The situation is even worse in slum settings, where factors such as poverty perpetuate ill health, because the poor, compared with the rich, are less likely to report health problems and are less likely to seek treatment in the event of illness (Kimalu *et al.,* 2002). Slums are also affected by poor access to health facilities and therefore there is little or no information on the health status or health seeking behavior of slum dwellers. Kiandutu slum is an example where such a situation exists. There is very little information on the health seeking behavior, which includes immunization coverage of children, of people living within the slum.

1.3 Justification

Immunization coverage in Central province rose to 79% in 2003 (KDHS, 2003), but there is no substantial data to show that the case was the same for Thika district and in particular, Kiandutu slums.

This study sought to determine the immunization coverage in Kiandutu slums by collecting information on immunization status and factors associated with immunization coverage. The resulting information will be used to answer questions related to immunization coverage in the slum, reasons for non/delayed immunization, and factors associated with immunization uptake in slums. The results will also provide baseline data for other research studies on immunization in Kiandutu slums.

The findings from this study will be useful to the Thika District Hospital, MCH clinic and KEPI in deciding on the best approach to use to increase or maintain coverage in the slum.

1.4 Objectives

1.4.1 General Objective

To determine immunization coverage of children and socio-demographic factors that may influence immunization status of children in Kiandutu slums.

1.4.2 Specific Objectives

To determine the immunization status and coverage of children in Kiandutu slums.

To determine the effect of socio-demographic factors of mothers living in Kiandutu on the immunization coverage in children in Kiandutu slums.

CHAPTER TWO: LITERATURE REVIEW

2.1 Basics of Immunization

A major goal for the World Health Organization is the global control of certain infectious diseases (WHO, 1997). The main strategies for the prevention of infection are: to eliminate or diminish the amount of infecting microorganism from circulation; to enhance the host immune response and to treat the infected host. Of these, the first and second together have the greatest impact since they protect the individual and control the spread of disease (WHO, 2000).

A vaccine is any preparation administered with the object of stimulating the recipient's protective immunity to specific pathogen(s) and/or toxin(s). A vaccine should elicit antibodies and/or a cell-mediated response to protective antigens. Antibodies must be formed in those parts of the body where they can efficiently counteract the specific pathogen or toxin; moreover, antibodies must be present when required, and in sufficient quantity.

2.2 History of Immunization

The history of immunization begins with Edward Jenner, a country doctor living in Berkeley (Gloucestershire), England, who in 1796 performed the world's first vaccination (Baxby, 1981; Baxby, 2001). His assertion that 'the cow-pox protects the human constitution from the infection of smallpox' laid the foundation for modern vaccinology (Jenner, 1798).

The eradication of smallpox was an outstanding display of concerted global action in a

war against microbial invaders (WHO, 1996). The progress in expanding poliomyelitis and measles vaccination efforts and their elimination from many regions further demonstrate that vaccines are among the most powerful public health tools. National vaccination programs, which grew out of the smallpox eradication initiative, have developed in many countries through the administrative, technical, and financial support of UNICEF, WHO, and many bilateral or multilateral partner agencies (WHO, 1996). In its 1993 *World Development Report,* the World Bank classified vaccination as one of the most cost-effective public health interventions (Gordis, 2002). In addition, vaccination programs have been cited as providing one of the most equitable of public health programs, providing protection to the entire population when successfully implemented.

The WHO created the Expanded Program on Immunization (EPI) in 1974 as a means to continue the great success that had been achieved earlier with the eradication of smallpox. At that time less than 5 percent of the world's children in the developing world were receiving immunization. The six diseases chosen to be tackled under this new initiative were tuberculosis, diphtheria, tetanus, pertussis, polio, and measles. It was not until 1988 that the WHO recommended that yellow fever vaccine be added to the national immunization programs of those countries with endemic disease (WHO, 1996). Later, in 1992, the World Health Assembly recommended hepatitis B vaccination for all infants (WHO, 1996). Most recently the WHO has recommended that the *Haemophilus influenzae* type B (Hib) conjugate vaccines be implemented into national immunization programs unless epidemiological evidence exists of low disease burden, lack of benefit,

or overwhelming obstacles to implementation (WHO, 1996). The EPI was also initiated to provide countries with guidance and support to improve vaccine delivery and to help make vaccines available for all children (Hadler *et al.,* 2004).

2.3 Burden of Vaccine Preventable Diseases

A number of vaccine-preventable diseases are not reportable events in many countries. The estimates of the burden of disease by WHO are based on a combination of often incomplete vital registration data, mortality survey data, and mathematical models using numerous assumptions. Most models of vaccine-preventable diseases are derived from the susceptible fraction of the population (calculated from natural immunity from presumed historical infections in regions without previous vaccination and historical immunization coverage rates), infectivity rates of disease, sequelae of diseases, and estimates of local case fatality rates. The degree of accuracy of these models is only as good as the data supporting the assumptions (Wolfson and Lydon, 2005). The disease burden is most appropriately represented by a range of values reflecting uncertainty especially if ranges used are from historical and not current data.

2.3.1 Poliomyelitis

Poliomyelitis is caused by a virus that is most often transmitted fecal-orally among persons living in unsanitary and crowded conditions. Acute infections are caused by any one of three serotypes of poliovirus that initially replicate in the gastrointestinal tract. Before the availability of polio vaccines, 90% of children in the developing world were infected with all three types of the polio virus in the first two or three years of life

(Sutter and Kew, 2004). In developed countries, transmission occurred primarily in school-age children and more than 90 percent of infections were asymptomatic; 4 to 8 percent of children had nonspecific febrile illness and less than 1 percent developed acute flaccid paralysis (Sutter and Kew, 2004).

Global efforts toward polio eradication have included vaccination campaigns and active surveillance. The annual incidence of paralytic polio was reduced from an estimated 350,000 in 1988 to about 1,000 in 2004 worldwide (WHO, 2004). Africa and South Asia are the last regions in the world where poliomyelitis is still endemic. False accusations of tainted vaccines by local leaders has led to a local resurgence of poliomyelitis cases and consequent spread to other parts of Africa (Heymann *et al.*, 2004).

The oral polio vaccine (OPV) is administered as three doses to protect against poliomyelitis at six months after birth. Volunteers, rather than trained health workers can administer oral polio vaccine, as it does not require injection equipment. Some countries also use a killed, inactivated polio vaccine that needs to be administered intravenously.

2.3.2 Measles

Measles is an acute, highly infectious viral disease that is transmitted from person to person through respiratory droplets. In the absence of vaccination, measles is estimated to infect virtually the entire population with the exception of isolated communities (Black, 1976) Most children born to immune mothers are protected from the virus for the first six months of their lives from acquired maternal antibodies (Strebel *et al.*, 2004). The number of deaths due to measles has been a subject of considerable

controversy for the past several years, mostly because of the inability to specify accurately the cause of death in children infected by measles and other, similar conditions (Dean *et al.,* 2006).

The measles vaccine is a live attenuated vaccine that can be administered alone or in combination with rubella vaccine, or with mumps and rubella vaccines. It is administered as a single dose during the first year of life, usually at 9 months (but at 12-15 months in industrialized countries). Nearly 95% of children vaccinated with at least one combination of the vaccine develop immunity. Large-scale urban and nationwide vaccination campaigns over the last few years have reduced measles mortality to 250,000–500,000 deaths per year, most of which still occur in Sub-Saharan Africa (Miller, 2000). In the absence of vaccination, the measles virus would infect almost 100 percent of the population, including most of the 688 million children under five in the developing world. Transmission can be blocked if population-based immunity exceeds approximately 93 percent, limiting cases only to importations. Control in many urban parts of Africa may be difficult, given that transmission is higher in densely populated environments with low levels of hygiene (Miller, 2000).

2.3.3 Diphtheria-Pertussis-Tetanus

2.3.3.1 Diphtheria

Diphtheria is caused by toxin-producing strains of the bacterium *Corynebacterium diphtheriae,* which can be transmitted from person to person via respiratory droplets. The bacterium often affects the tonsils, pharynx, nasal mucosa, inner ear, vagina, or skin.

Death can result from severe cases in which swelling from pharyngeal and tracheal exudates obstruct the airway. Cutaneous diphtheria presents as skin lesions and causes far fewer complications and deaths among those infected.

The EPI has traditionally recommended three doses of the combined diphtheria-tetanus-pertussis (DPT) vaccine in the first year of life (Geldermalsen and Wenning 1993). Most developed countries give subsequent booster doses in childhood and diphtheria-tetanus boosters in adulthood. In Africa, the need for boosters is overcome by the natural immunity provided by the presence of *C. diphtheriae* in skin ulcers as well as asymptomatic carriage in the throat, which spreads the organism throughout the population. Carrier rates in Africa have been estimated to be as high as 9.3% in children in the general population (Geldermalsen and Wenning, 1993).

2.3.3.2 Pertussis

Pertussis, or whooping cough, is a highly contagious disease caused by the bacterium *Bordetella pertussis,* which is transmitted through respiratory excretions and occurs throughout the world. Most pertussis in developing countries occurs in school-age children. In developed countries, mild or asymptomatic infections in adults are believed to be common sources of transmission to very young infants (Edwards, 2004). Each year there are an estimated 20 million to 40 million cases of pertussis and another 200,000 to 400,000 deaths attributed to the disease, 90 percent of which occur in developing countries (WHO, 2004).

2.3.3.3 Tetanus

Tetanus is the only EPI vaccine preventable disease that is not communicable but acquired through environmental contamination. The bacterium *Clostridium tetani,* which can grow in dirty wounds, produces a neurotoxin causing convulsions and eventual death. Neonatal tetanus (NNT), the most common form of tetanus in developing countries, is the result of contamination of the umbilical stump either by the use of nonsterile instruments after delivery or the application of animal dung to the cut cord, a custom in many cultures, especially among groups in Sub-Saharan Africa (Elmore-Meegan *et al.,* 2001). Neonatal Tetanus which causes an estimated 450,000 infant deaths is defined as tetanus in the first month of life. Another 40,000 maternal deaths are estimated to occur from tetanus acquired during delivery (WHO, 2004).

2.3.3.4 DPT Vaccine

Usually three doses of a combined vaccine that protects against diphtheria, pertussis, and tetanus are given during the first year of life. Inactivated diphtheria and Tetanus Toxoid can be combined with whole-cell or acellular pertussis vaccines, such as DPTw or DPTa, respectively, and administered as a single injection. In most of Africa, the national EPI schedule of vaccination is at 6, 10, and 14 weeks of life. Although most developed countries administer booster doses, this does not routinely occur in Africa. Pertussis vaccine efficacy is 70 to 90% in fully vaccinated children (Cherry, 2004); however, continuous protection requires booster doses.

2.3.4 Tuberculosis

Tuberculosis (TB) is a bacterial infection caused by *Mycobacterium tuberculosis*. Transmitted through respiratory droplets, tuberculosis is highly contagious, with studies showing a 25 to 50% infection rate of those in close contact with infected individuals (Smith and Stark, 2004).

Tuberculosis causes nearly 2 million to 3 million deaths annually, and is believed that another 8 million people are infected with the bacterium each year. In much of the world the TB incidence rates continue to grow, especially in Sub-Saharan Africa, despite the widespread use of the *Bacille Calmette-Guérin* (BCG) vaccine (Cantwell and Binkin, 1996). In Africa, co-infections of human immunodeficiency virus (HIV) and TB have led to increases in the incidence rate of TB by approximately 20 percent (Smith and Stark, 2004).

BCG is a live attenuated bacterial vaccine most commonly administered intradermally at birth to prevent tuberculosis. The effectiveness of the BCG vaccine against TB has been debated, with a range estimated from 0 to 80 % (Fine, 2001). Most proponents claim that it is effective against TB meningitis, but it is not commonly believed to prevent TB in adults or its transmission. The real impact of BCG may have been confounded by many other improvements in public health that could have contributed to the decrease in disease burden associated with tuberculosis (Smith and Stark, 2004).

2.3.5 Haemophilus Influenza Type b (Hib)

Haemophilus Influenza Type b is a bacterium transmitted through respiratory excretions and may be carried in the nasopharynx of about 15% of non immunized children (WHO, 1998). The most common forms of invasive disease are meningitis, pneumonia, arthritis and cellulitis.

Estimates of Hib disease burden are derived from incidence rates and case fatality rates for meningitis and pneumonia. Country-specific estimates of the incidence of Hib meningitis are derived from the literature on incidence in the pre-vaccine era (Bennett et *al.*, 2002). Regional averages have been seen to range from 219 cases per 100,000 to 3 per 100,000 population in children under one, and 1 to 15 per 100,000 population in children age one to four.

Since 1988, safe and effective vaccines have been developed to prevent Hib infection. A conjugate vaccine can be co-administered with DPT, IPV, and HBV vaccine. A full course of vaccine confers more than 95 percent protection against invasive Hib disease and results in a herd effect (Wenger and Ward, 2004).

Three doses of the Hib vaccine are administered to protect against meningitis and pneumonia. They are administered as part of DPT immunization and can also be delivered as a combined DPT-Hepatitis B-Hib vaccine. The first dose is administered at 6weeks, the second at 10 weeks and the third at 14 weeks.

2.3.6 Hepatitis B

Many viral agents cause hepatitis. Available vaccines can counteract two of them—hepatitis A virus (HAV) and hepatitis B virus (HBV). Although a licensed vaccine against HAV is used in developed countries, it is currently not considered to be cost-effective for Africa. Hepatitis B virus, transmitted through blood-borne infections, sexually, or from mother to infant, can potentially cause more severe illness, including fulminant hepatitis, cirrhosis, and liver cancer. In many African countries, transmission occurs primarily in early childhood through mucosal contact with infectious body fluids and unsafe injection practices (Margolis *et al.,* 1997). National sero-surveys for antibodies and antigenic markers for carrier states of HBV are available for almost all nations at various stages of resolutions due to blood-banking practices (Dean *et al.,* 2006).

Three doses of HBV vaccine, the first given at birth, could effectively prevent a child from becoming infected and from becoming a chronic carrier of the virus. Therefore, HBV vaccine could exert a powerful herd effect on the population by eliminating the long latency period during which persons could be infectious to others.

2.3.7 Yellow Fever

Yellow fever is an acute viral infection transmitted by the mosquito. After an incubation period of three to six days, onset of symptoms: rigors, headache, nausea, joint pain, jaundice, and myalgia is rapid. In approximately 15 to 20% of cases, severe disease causes multiple organ failure. Yellow fever is endemic in parts of South America as well

as Sub-Saharan Africa in areas bordering jungles. Between 1986 and 1995, reported incidence of yellow fever dramatically increased from previous reporting intervals, due to cessation of vaccinations (Monath, 2004). In Africa alone, 22,952 cases were reported, accounting for 89 percent of the total global cases during that period (Monath, 2004). A case-fatality rate of 23 percent (5,357 deaths) was reported throughout Africa. On the basis of surveillance data adjusted for underreporting, estimates the global burden of yellow fever at 200,000 cases and 30,000 deaths in 1990 (WHO, 1992). The yellow fever vaccine is administered during the first year of life for children over 6 months of age in the endemic countries of tropical and subtropical Africa and South America, often administered at the same time as measles immunization.

2.4 Status of Immunization Coverage in Africa

Vaccine preventable diseases are still a major cause of morbidity, disability and mortality among children and adults in the African Region (Taskforce on Immunization in Africa, 2001).

Today, national immunization programs in developing countries are responsible for improving access to the traditional EPI antigens and introducing new vaccines. In 2002, the EPI introduced the Reaching Every District (RED) strategy, which focused on achieving an 80 percent coverage rate of DPT3 in 80 percent of districts and using immunization contacts to deliver other high-priority child health interventions (Jamison *et al.*, 2006). In most developing countries, immunizations are provided through a system of fixed facilities at different levels of the health system. Immunization

campaigns are discrete, time-limited efforts at national or sub national levels that usually focus on specific antigens (for example, polio). Mobile strategies rely on the use of specialized vehicles to transport health professionals and vaccines to deliver services to remote or migrating populations. Outreach is a strategy by which staff members from a health facility travel to villages and surrounding areas to administer vaccines. Extended outreach refers to more targeted and intensive efforts (Jamison *et al.*, 2006).

Though immunization goals to protect the worlds' children were established in 1974 by the World Health Assembly, most African countries started their immunization programs during the first half of the decade. Some of the countries conducted their immunization services with a minimum set up. The services were mostly delivered as campaigns from the district level. The Universal Child Immunization (UCI) campaign that was conducted during the second half of the 1980-Decade aimed at accelerating immunization services. Even after the UCI campaign, countries of the Africa Region have remained behind in all indicators of immunization (Msambichaka, 2000).

Since 1995, immunization coverage rates have generally been stagnant or on a decline, with important variation by geographic area and between countries within the Region (Msambichaka, 2000). Routine coverage for the African Region and by Epidemiological Block is presented in Table 2.1 and shows that the African region is still lagging behind in coverage of vaccines as compared to other regions worldwide.

Table 2.1: Vaccination coverage, by vaccine and WHO region, 2010

WHO region	Vaccine coverage (%)					
	BCG	DPT3	Polio3	MCV1	HepB3	Hib3
Total (worldwide)	**90**	**85**	**86**	**85**	**75**	**42**
African	85	77	79	76	76	62
American	96	93	93	93	89	92
Eastern Mediterranean	88	87	87	85	84	58
European	94	96	96	95	78	75
South-East Asian	89	77	77	79	52	9
Western Pacific	97	96	96	97	91	10
Abbreviations: BCG = Bacille Calmette-Guérin; DTP3 = 3 doses of diphtheria-tetanus-pertussis vaccine; Polio3 = 3 doses of polio vaccine; MCV1 = 1 dose of measles-containing vaccine; HepB3 = 3 doses of hepatitis B vaccine; Hib3 = 3 doses of *Haemophilus influenzae* type b vaccine.						
* Weighted regional average.						

Source: Centers for Disease Control Global Routine Vaccination Coverage, 2011

By convention, the success of routine immunization programme has been measured by the coverage achieved with the third dose of DPT-3 among children aged twelve to twenty three (12-23) months. Coverage levels of DPT vaccine are considered one of the best indicators of a health system's performance (WHO, 2OO6).

Vaccination coverage levels for the third dose of DPT have remained the lowest among all WHO Regions. In 1997 the global vaccination coverage for DPT3 was 82%. The Africa region had coverage of 55% while all the other regions in the world ranged between 82 and 93 percent (Melgaard, 1998). By 2004, global immunization coverage had increased during the past decade to levels of around 78% for DTP-3. However, WHO Africa region still remained consistently low, reaching only 69% DTP-3 coverage

by 2004 (WHO, 2005). In 2010, as shown in Figure 2.1, coverage in Africa had improved to 77% for DPT3, but was still below the target of 80%.

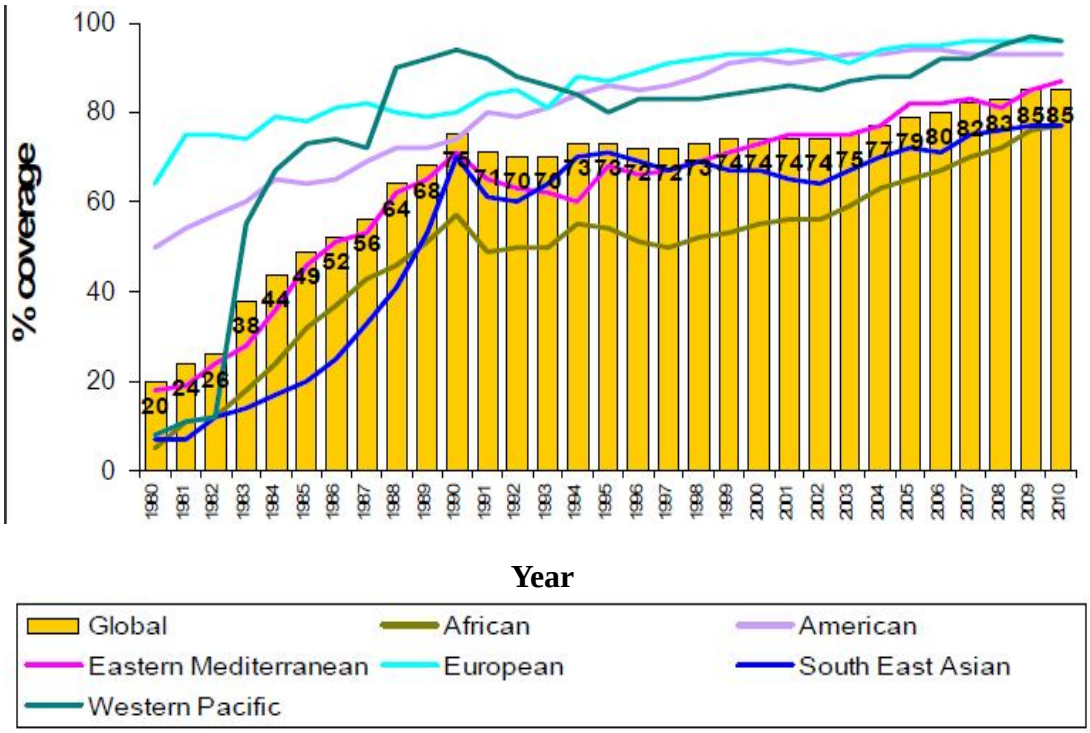

Figure 2.1: Global Immunization 1980-2010, DTP3 coverage global coverage at 85% in 2010

*Source: Progress towards Global Immunization Goals-2011, UNICEF and WHO.

2.5 Immunization Coverage in Kenya

Kenya's population is estimated at 38.6 million people with approximately 3.5 % of the population under one year of age as per the 2009 Kenya Population Census Report. The population growth rate is estimated at 2.9%. Over the last 10 years progress has been observed. Total number of children aged 12-23 months receiving full vaccination against vaccine preventable diseases were 57% in 2003 but rose to 72% by 2007, with the highest rates recorded in Central province 88% and Nairobi 75% while Western province recorded a low of 57%. North Eastern province recorded the highest improvements in immunization,

rising from 48% in 2005 to 73% in 2007 though rate of increase was inadequate. Measles threat has declined with active case-based and laboratory surveillance systems. When sporadic outbreaks of measles are reported, the Ministry of Health has responded effectively by conducting mass immunization campaigns thus explaining the increase from 52% in 2002 to 85% in 2008. With regard to polio, Kenya has been polio free except eighteen recent cases in North Eastern province, where the response included launching of several rounds of vaccination campaigns to contain the disease. The RED approach that covers the hard to reach districts has also significantly contributed to the improvements in immunization coverage in the areas (UNDP/GoK, 2010).

The under-five mortality rate has shown impressive decline over the period under review. The KDHS 2008/2009 shows a remarkable decline in levels of childhood mortality compared to the rates observed in the 2003 KDHS. For example, the infant mortality rate decreased to 52 deaths per 1,000 live births in 2008-09 from 77 in 2003 (UNDP/GoK, 2010). Similarly, the under-five mortality rate decreased to 74 deaths per 1,000 live births in 2008-09 from 115 in 2003. The decrease in infant mortality between 2003 and 2008 can be associated with increased campaigns against five diseases, namely, acute respiratory infections, diarrhoea, measles, malaria and malnutrition (UNDP/GoK, 2007).

The Ministry of Health continues to strengthen immunization activities throughout the country under the Kenya Expanded Programme on Immunization (KEPI). Over the 10 year period under review, coverage has maintained an upward trend as seen in Figure 2.2. KEPI has also stepped up surveillance on AFP and B (Hip) while the government and Global Alliance for Vaccine Initiative (GAVI) have introduced B (Hip) vaccination and a site at Kenyatta National Referral Hospital to vaccinate children aged between one month and five

years.

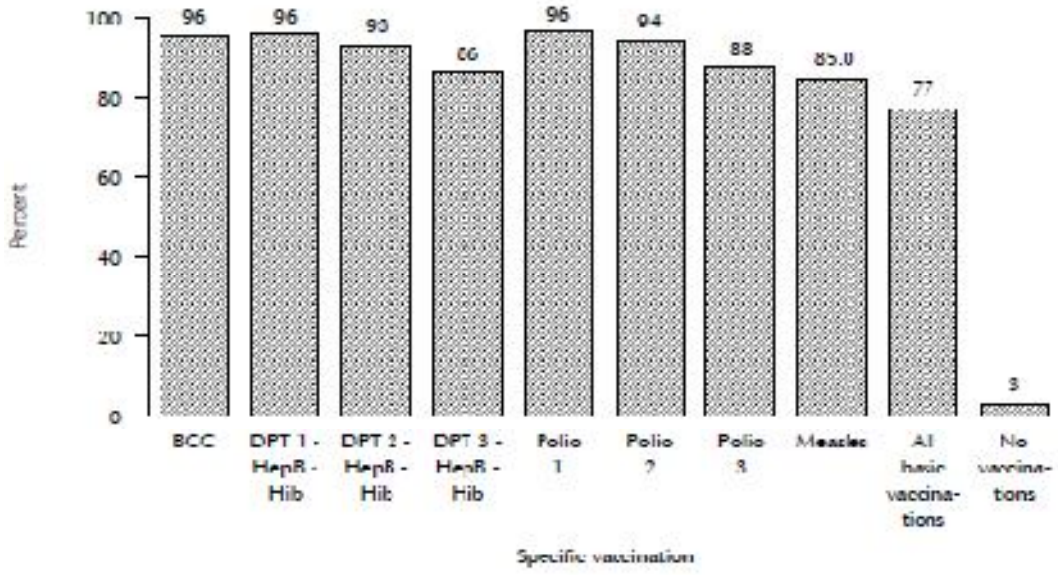

Figure 2.2 Immunization Coverage in Kenya.
Source: Central Bureau of Statistics, KDHS 2009

The under five mortality rate is estimated at 122 deaths per 1000 children under five and the infant mortality rate is approximately 78 per thousand live births; the latter represents an increase from the estimate of 62 during the period 1993-1998 (Fig. 2.3) (Natasha, 2004).

Infant mortality in Kenya has been increasing since the early 1990s (Fig. 2.3). This increase in childhood mortality was observed in both rural and urban areas but was generally faster in slums than in rural areas (Fotso et al., 2007).

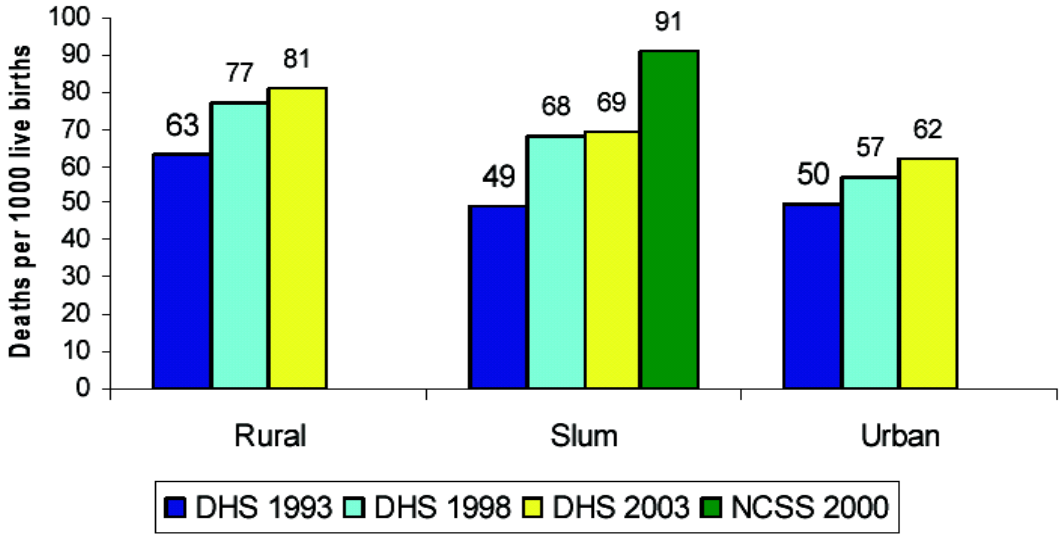

Figure 2.3: Infant mortality in Kenya, 1993-2003
Source: Fotso *et al*., 2007

Figure 2.4 shows results derived from various surveys in Kenya showing access to clean piped water and full vaccination of children in three settings, namely rural, urban and slum. Access to clean water and immunization coverage are considered key indicators of health in a population. The proportion of urban children who were fully immunized dropped markedly from 76% in 1993 to 48% ten years later. Within slums, immunization rates were lower and dropped from 71 to 43% in the respective years (Fotso, 2007).

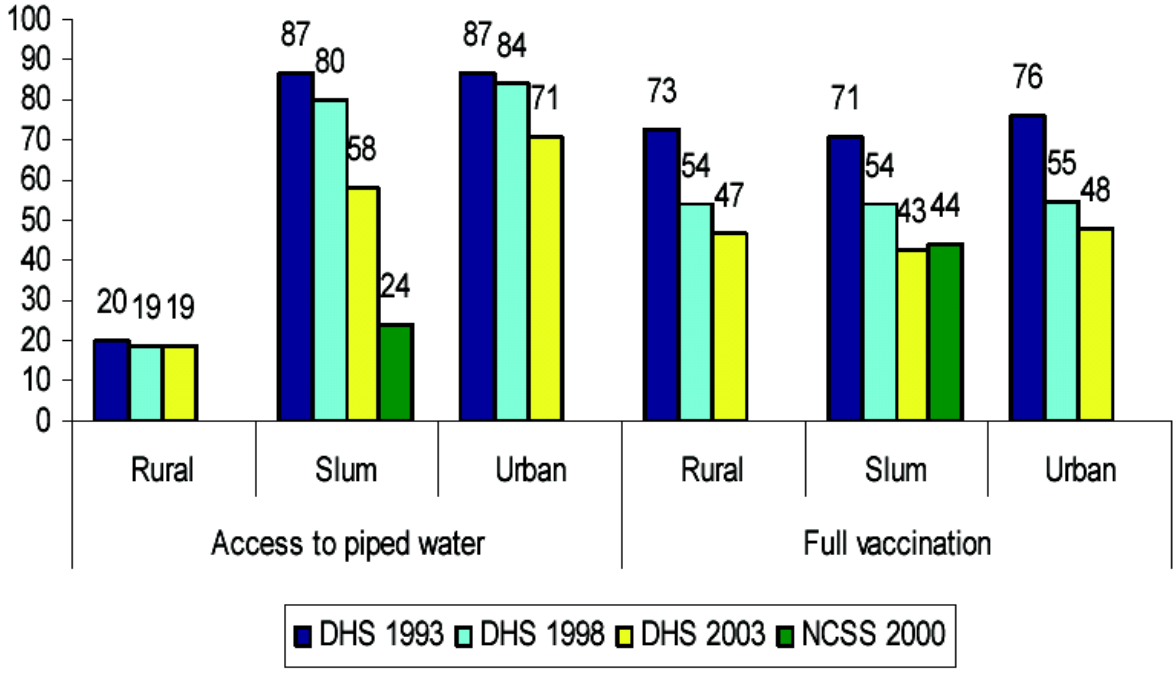

Figure 2.4: Access to safe water and vaccination status in Kenya, 1990s-2000s
Source: Fotso, 2007
The graph shows results on access to clean water and full immunization, from various surveillance surveys carried out in Kenya. It is clear that vaccination in slum settings is lower than in both rural and urban settings.

2.5.1 Kenya Expanded Programme on Immunization (KEPI)

Kenya Expanded Programme on Immunization (KEPI) was created in 1980 and was gradually introduced in phases throughout the country between 1980 and 1990. Currently, KEPI is an established unit within the Division of Vaccines and Immunization in the Ministry of Public Health and Sanitation. The National Health Sector Strategic Plan for 1999-2004 has identified KEPI as one of seven programs in its "high priority" category, which refers to priority in terms of allocating government resources. The MOH embarked on a new strategic plan for 2005-2010 that saw KEPI will remain in the top priority category (Natasha, 2004). Below is the vaccination schedule provided by KEPI.

Table 2.2: Vaccination Schedule as proposed by KEPI.

VACCINATION SCHEDULE		
Vaccination	**Age**	**Remarks**
BCG Polio (Birth)	At Birth	or at first contact with child
DPT 1st Dose POLIO (OPV1)	6 weeks (1.5 months)	or at first contact with child after that age
DPT 2nd Dose POLIO (OPV2)	10 weeks 2.5 months	4 weeks after DPT1 and OPV1. Can also be given anytime after this period, when in contact with child
DPT 3rd Dose POLIO (OPV3)	14 weeks 3.5 months	4 weeks after DPT1 and OPV1. Can also be given anytime after this period, when in contact with child
Measles	9 months	May be given between6 and 9 months if they are admitted to hospital for any other illness. Repeat at 9 months as KEPI schedule.
Tetanus Toxoid	Pregnant mothers	 2 shots at least 4 weeks apart, as early as possible in pregnancy. One booster dose at every subsequent pregnancy.

Source: Ministry of Public Health and Sanitation, Kenya, (2004).

2.5.2 Challenges facing Immunization coverage in Kenya

The EPI has shown remarkable progress throughout the world, but there are now several potentially competing demands for expansion (Cutts, 1998). Coverage of existing vaccines needs to be increased, particularly in sub- Saharan Africa. Additional activities are being promoted to eliminate or eradicate diseases. The quality and safety of vaccines and injections must be ensured, and countries are being encouraged to become self-sufficient in vaccine procurement and/or supply. A range of new vaccines is being developed and licensed. There may be tension between global priorities *{e.g.* disease eradication) and local priorities *{e.g.* introduction of new vaccines), and careful evidence-based decision-making will be necessary.

2.5.3 Slum Situation in Kenya

In 2002, the UN operationally defined slums as those communities characterized by: insecure residential status, poor structural quality of housing, overcrowding, and inadequate access to safe water, sanitation, and other infrastructure (UN-Habitat, 2002). Until recently, Kenya's development has been mostly focused in the urban areas. This has led to a large influx of migrants from the rural to the urban areas. Together with political and economic instability, this influx has forced more people to live below the poverty line, concentrated in the slums. The rapid concentration of people in slums has created social and medical problems (Gulis *et al.*, 2004)

Life in the slums has common characteristics. The majority of migrants are driven to the city by poverty and start their urban life in the worst areas. Overcrowding and lack of drainage and sanitary systems create conditions hazardous to health. The general education level in slums is low, with only 14% of the population finishing high school and 33% not going beyond primary school. Only 2% have post high school education (USAID, 1993). In most slums, there are no public, government or municipal health facilities.

CHAPTER THREE: MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Kiandutu slums located within Thika municipality in Thika district, Central Province and until recently, falls under Kiambu County (Figure 3.1). Thika District is one of the seven districts in Central Province. The district covers an area of 1,960.2 sq Km². It borders Nairobi City to the south, Kiambu District to the west, Maragua District to the north and Machakos District to the east. The district lies between latitudes 3°53' and 1° 45' south of Equator and longitudes 36° 35' and 37° 25' east (Google maps). Kiandutu is estimated to have a population of 50,000 people most of whom are jobless, mainly as a result of the closure of many industries in Thika town and collapse of coffee plantations. This has rendered the residents to live in abject poverty with poor access to health services, clean water and infrastructure. Most of the slum dwellers are casual labourers and this means that they live mainly on a hand to mouth basis. (Ministry of Planning and National Development, 1999)

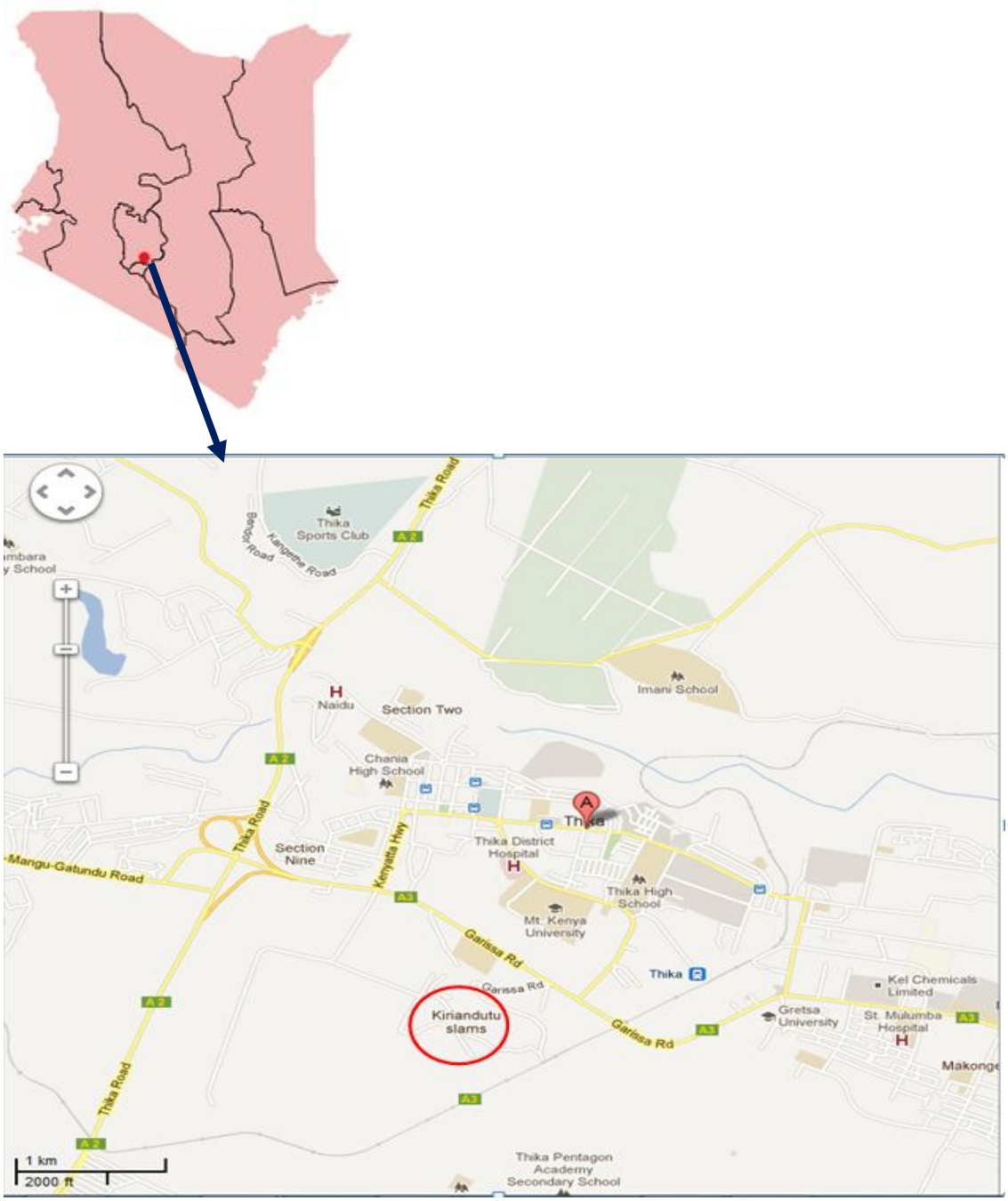

Figure 3.1 Map showing location of Kiandutu slum in relation to Thika town
http://www.maplandia.com/kenya/central/thika/ (22/05/2012)

3.2 Study Design

The study was a cross sectional assessment of immunization coverage in Kiandutu slum, Thika district. The study was carried out between March and May 2009. The primary sampling units were households within the slum that were covered by the Thika District Hospital Outreach Team. 189 households picked by systematic sampling from a list of 560 households covered by the outreach team. One child aged 12-23 months whose mother or guardian gave consent to participate in the study was selected from each household. In cases where a household did not have a child within the set criteria, the house was skipped and not considered part of the sample. In cases where a household had more than one child aged 12-23 months, one was randomly selected so as to reduce bias of homogeneity if children from the same household were picked. The mothers or guardians of the children were then interviewed. Information on immunization status of the child was collected from immunization cards provided by the mother/guardian and verbally by recall from the mother/guardian if an immunization card was not available.

3.3 Study Population

The study population in the study comprised of the occupants of Kiandutu slums, more so households who had children.

3.4 Target Population

Children aged 12 to 23 months in Kiandutu slum and covered by the Thika District Hospital Outreach Team (TDHOT).

3.4.1 Inclusion criteria

Any child aged 12-23 months in Kiandutu and covered by the TDHOT, whose parents/guardian gave consent to participate in the study.

3.4.2 Exclusion criteria

Any child below 12 months or above 23 months in Kiandutu slum or any child aged 12-23 months, whose parents/guardian did not consent to the study.

3.5 Sampling Technique

The primary sampling unit was the household. Households were picked from a list used by the Thika District Hospital Outreach team during visits to Kiandutu slums. This list of 560 households served as the sampling frame. The first household was picked by simple random sampling and the other households picked by systematic sampling at intervals of 3 households. This interval was derived by dividing the total number of households in the sampling frame by the sample size (Kirkwood, 1988).

Therefore: Sampling interval = 560 households/189 (sample size) = 2.92

Rounded off value = 3 households.

3.6 Sample size determination

The sample size was calculated based on the formula of Fisher, (1960).

$$n = \frac{Z^2 \times pq}{t^2}$$

where Z = Confidence interval (1.64 for 90% C.I)

p = immunization coverage from KDHS 2003 study (79%)

q = (1-p)

t = precision (0.05 = 5%)

n = minimum sample size.

Assuming 79 % immunization coverage of Central province from the 2003 Kenya Demographics and Health Survey was the same for Kiandutu slums, then number of samples calculated from the formula was 178; allowing a 5% margin of error from non response, sample size considered was 189 since this statistically allowed and is used in many studies. No pilot study was carried out due to logistical and financial encumbrances.

3.7 Data Collection

Information on immunization status of the child was collected using WHO immunization coverage questionnaires which were formatted for use in the study (Appendix 2). Mothers or guardians of the children were interviewed and the information recorded. Data on socio-demographic characteristics and immunization history of the child was collected. Data on immunization status of the child was either recorded directly from the child's immunization card and if no card was available, the data was collected by verbal recollection of the mother. In cases where the child had not received any immunization, the mother/guardian was asked to give reasons as to why the child had not received immunization.

3.8 Data Analysis

Data was analyzed using SPSS version 12. Socio-demographic characteristics were analyzed using descriptive statistics. Data on immunization status and coverage was presented as percentages of the total sample. Pearson's Chi square was used as a test of

association to determine if there was any significant association between immunization status of the children and socio demographic characteristics.

The Pearson's contingency coefficient was used to determine statistical association, with a value of 0 signifying no significant association, and a value of 1 signifying a strong association (*SPSS Statistical Algorithms, 2nd Edition* (1991).

The immunization drop out rate was calculated as the percentage point difference between successive doses of a vaccine, expressed as a percentage of the first dose (Bos *et al.,* 2000). In this study, the vaccines used were DPT3 as the last dose, DPT1 as the first dose, since this has been adopted by the Ministry of Health. The drop out rate was therefore calculated using the formula developed by Bos *et al.,* (2000)

$$\frac{\text{DPT1} - \text{DPT3}}{\text{DPT1}} \times 100\%$$

3.9 Ethical Considerations

The study was approved by the KEMRI Ethical Review Committee (ERC) and assigned a study number of SCC: 1368. Informed consent was sought from the mothers or guardians of participating children (Appendix 2).

CHAPTER FOUR: RESULTS

4.1 Socio Demographic Characteristics of households in Kiandutu slum

4.1.1 Distribution of children according to sex

The sex of the children who were included in the study is as shown in Fig. 4.1. The proportion of males was 50.3% while that of was females 49.7% and these were not significantly different.

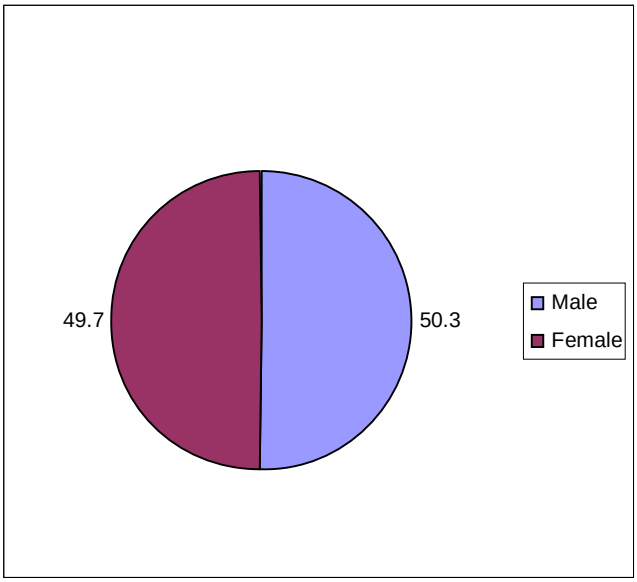

Figure 4.1: Distribution of children according to sex

4.1.2 Age of children

The ages of the children in the study ranged between 12-23 months. Children who were one year old at the time of the study were 7.5%. The mean age was 17.3 months while the mode and the median ages were 14 months (23%) and 17 months respectively (Fig 4.2).

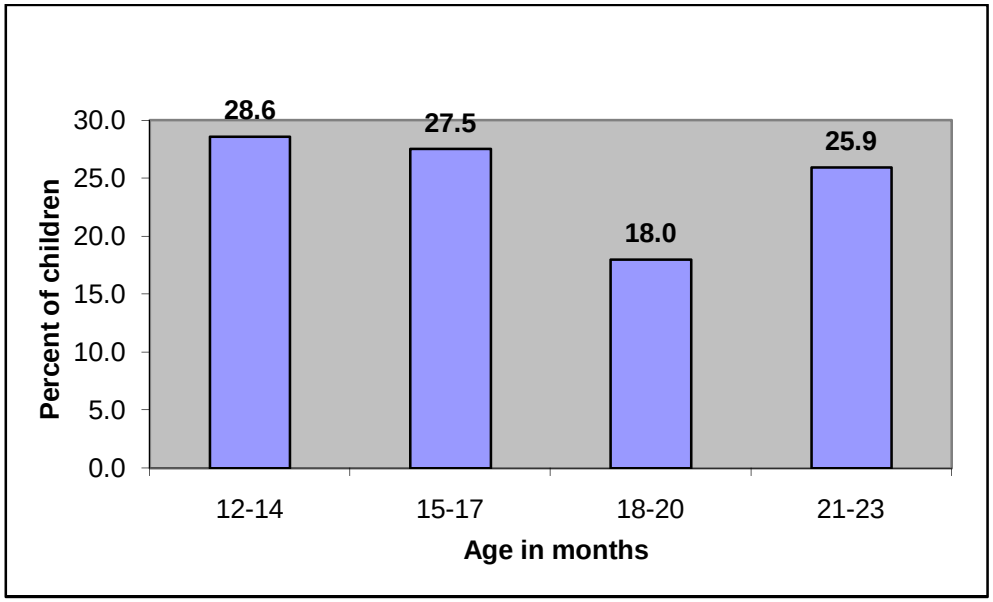

Figure 4.2: Age of children

4.1.3 Age of mothers

The mean age of respondent mothers was 25.5 years. The youngest mother was18 years while the oldest was 36 years (Fig. 4.3).

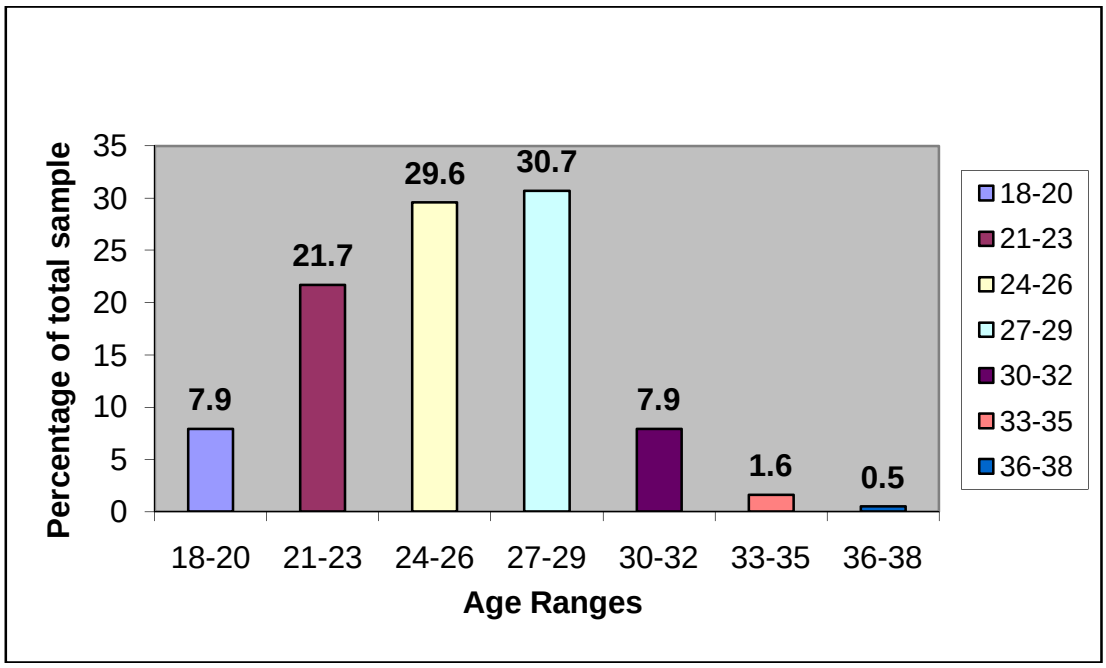

Figure 4.3: Age of mother/guardian at time of study

4.1.4 Education level of the mothers

Of the mother's interviewed, 75.7% had completed primary education. Mothers who received complete secondary education were 17.99%. Those who had attained tertiary education were 2.6%. Of all the mothers interviewed, 3.7% did not have any formal education (Fig 4.4).

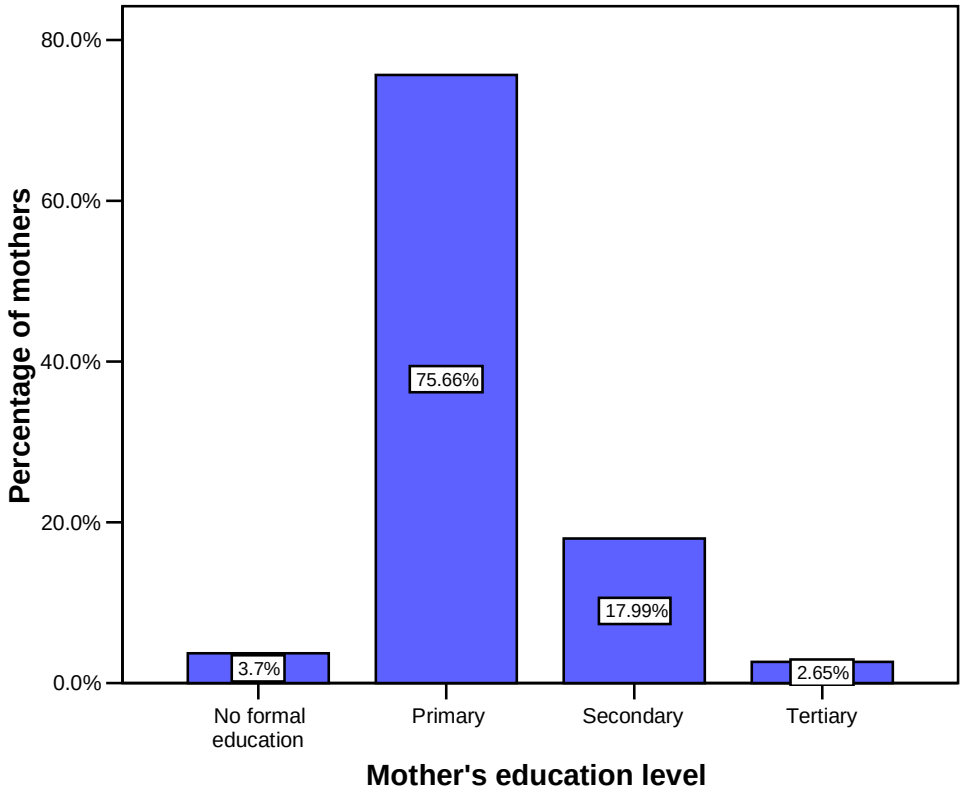

Figure 4.4: Highest Education level of the mothers/ guardians

4.1.5 Marital status of the mothers

The proportion of mothers interviewed who were married was 75.7%. The proportion of single mothers was 15.9%, while the proportion of widowed and divorced mothers was 4.2% respectively (Fig 4.5).

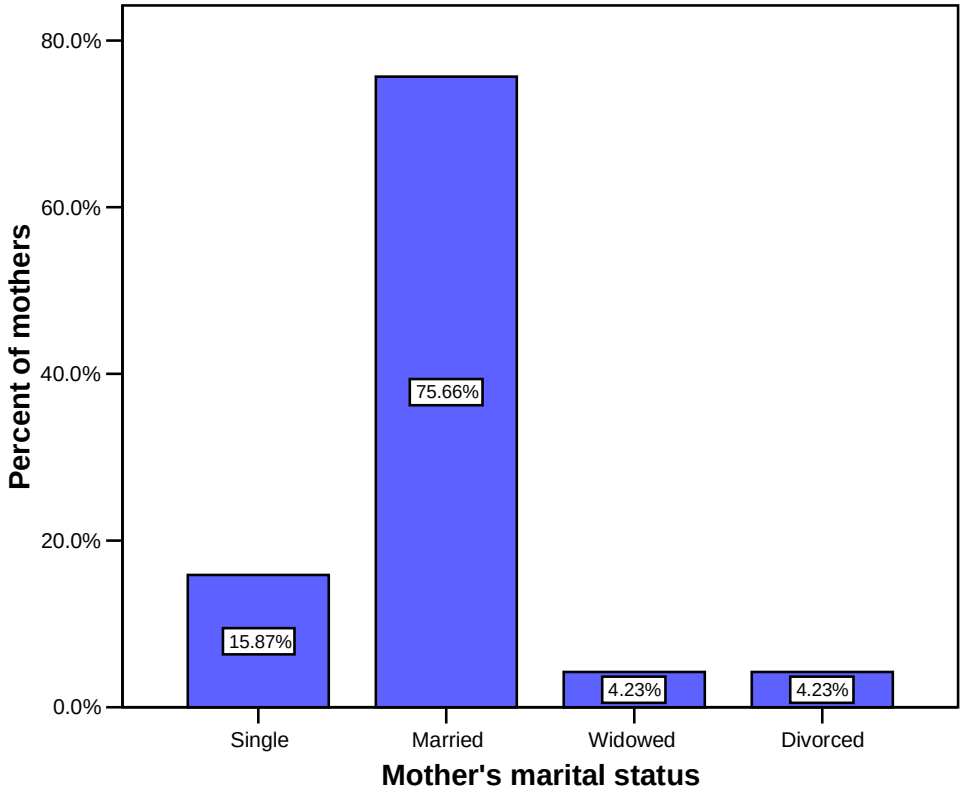

Figure 4.5: Marital status of the mothers

4.2 Immunization coverage levels

4.2.1 Immunization card retention by mothers/guardians

The percentage of mothers who had retained the immunization cards was 79.9%, while that of the mothers who had did not have the card was 20.1 %. (Fig. 4.6)

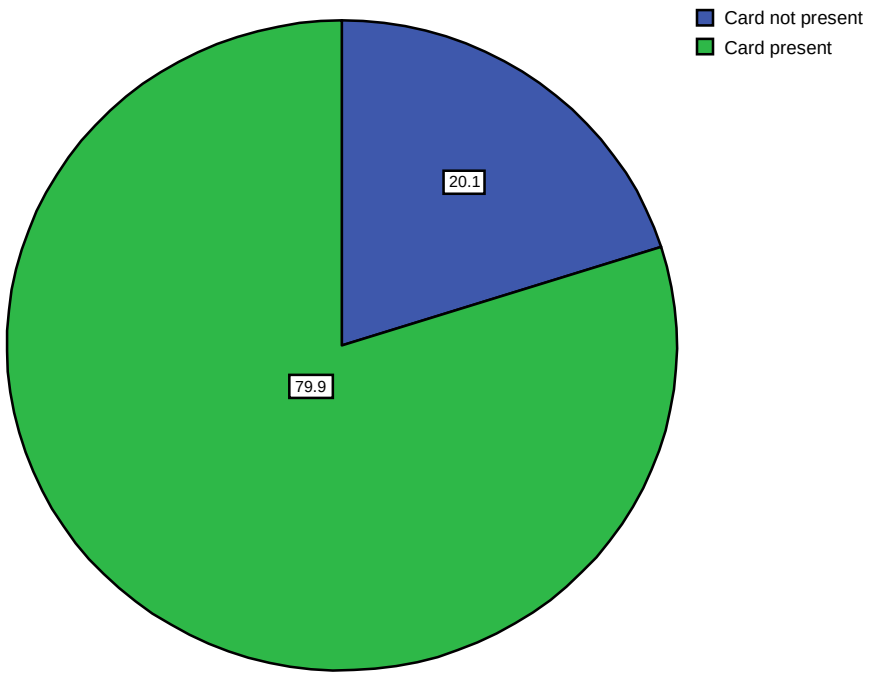

Figure 4.6: Immunization card retention by mothers/guardians

4.2.2 Infant Immunization status

Figure 4.7 shows the coverage by each vaccine that had been administered to the children in the study, as per the Kenya Extended Programme on Immunization (KEPI) schedule except for the polio vaccine given at birth. Children that received the BCG vaccine at birth were 94.7%. Those who received the pentavalent vaccine constituting of BCG, 3 doses of DPT and OPV vaccines were 79.8%. Children who had received the pentavalent vaccine plus the measles dose were 77%. Therefore, infants who received full immunization by virtue of having received the complete pentavalent vaccine and measles vaccine were 77%. Eighteen percent of children were partially immunized while 5.3% were not immunized at all. The high coverage of the BCG vaccine is an indication of access to health services.

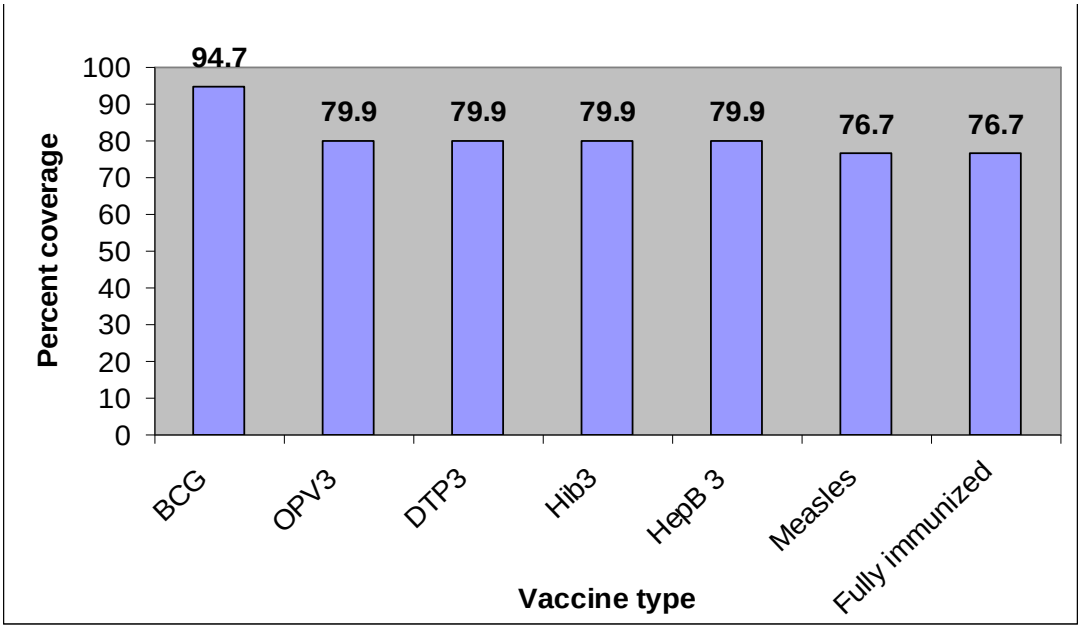

Figure 4.7: Vaccine coverage levels among children

4.2.3 Source of immunization service

The sources where immunization services were provided are shown in Figure 4.8. The District hospital provided 69% of the immunizations, while the District hospital outreach team provided the service to 26% of the children. Five percent of the children did not receive immunization.

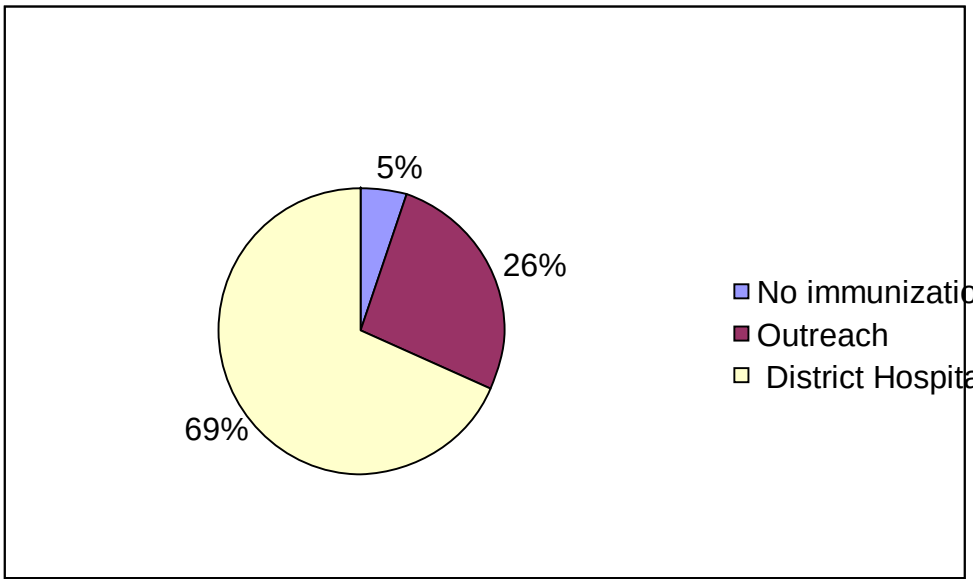

Figure 4.8: Source of immunization services

4.2.4 Immunization Drop-out Rate

The immunization drop out rate was calculated as shown (refer to Methodology)

DPT1 to DPT3 drop out rate was 15.64%. BCG to Measles drop out rate was 19%.

4.2.5 Reasons for failure to immunize among mother/guardians

From the study, 10 of the mothers interviewed (5.3%) had children who were not immunized at all. These mothers were asked to give reasons why their children had not received any immunization. The reasons given were, forgetfulness due to other responsibilities (n = 4, 40%), distance from District Hospital (n = 4, 40%) and religion (n=2, 20%) (Fig. 4.9).

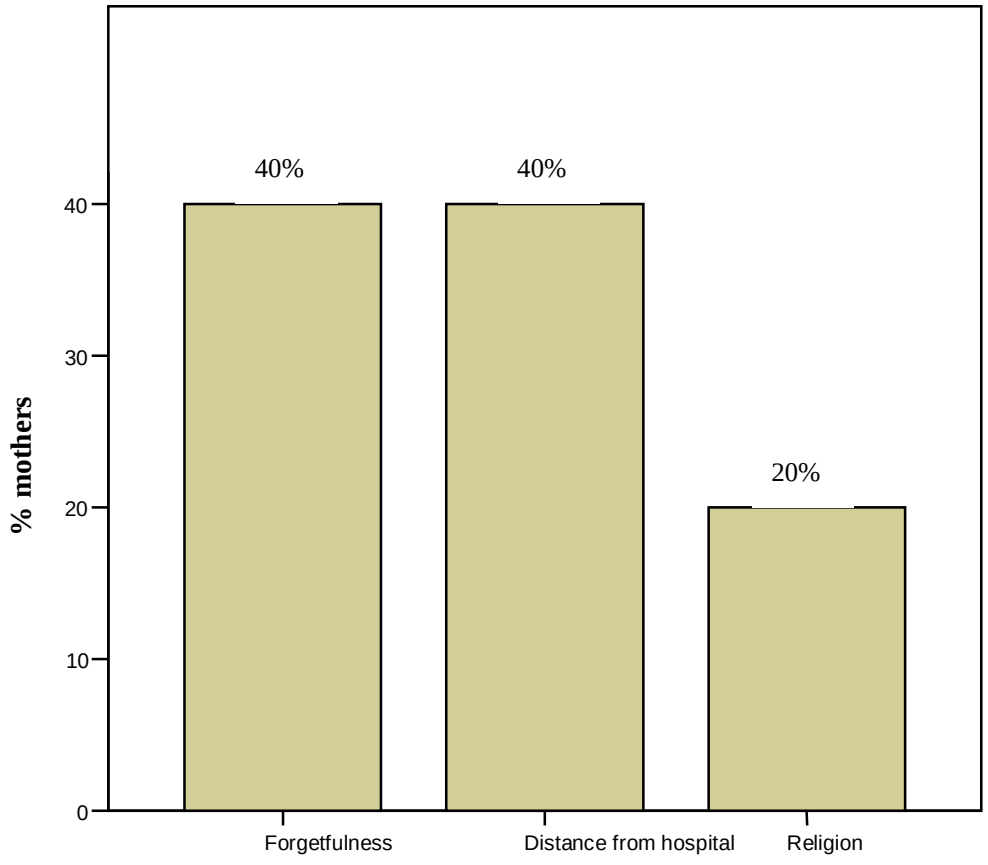

Fig 4.9 Reasons for failure to immunize children among the mothers

4.2.5 Association between socio-demographic factors of mothers and immunization status

The contingency coefficient was used to determine any significance in association between the socio demographic characteristics of the mothers/guardians and the immunization status of the children. As shown in Table 4.1 the p-value between mother's age and immunization status of the child was 0.006, and this showed significance in the association. Figure (4.10) below shows the percent number of fully immunized children for mothers with different ages. The p-value between marital status of the mother and immunization status of the child was 0.232, and did not show any significant association between the two variables. The association between mother's education and immunization status of the child was not significant with a p-value of 0.128. The association between availability of the immunization card and immunization status of the child was not significant, with a p-value of 0.285.

Table 4.1: Association between socio-demographic factors and immunization coverage

Socio Demographic characteristics	Chi square value	Degrees of freedom (df)	P value at 95% confidence interval	Significance of Association
Mothers Age	34.891	17	0.006	Association significant
Marital status	4.289	3	0.232	Association not significant
Mothers Education	5.679	3	0.128	Association not significant
Immunization card	1.142	1	0.285	Association not significant

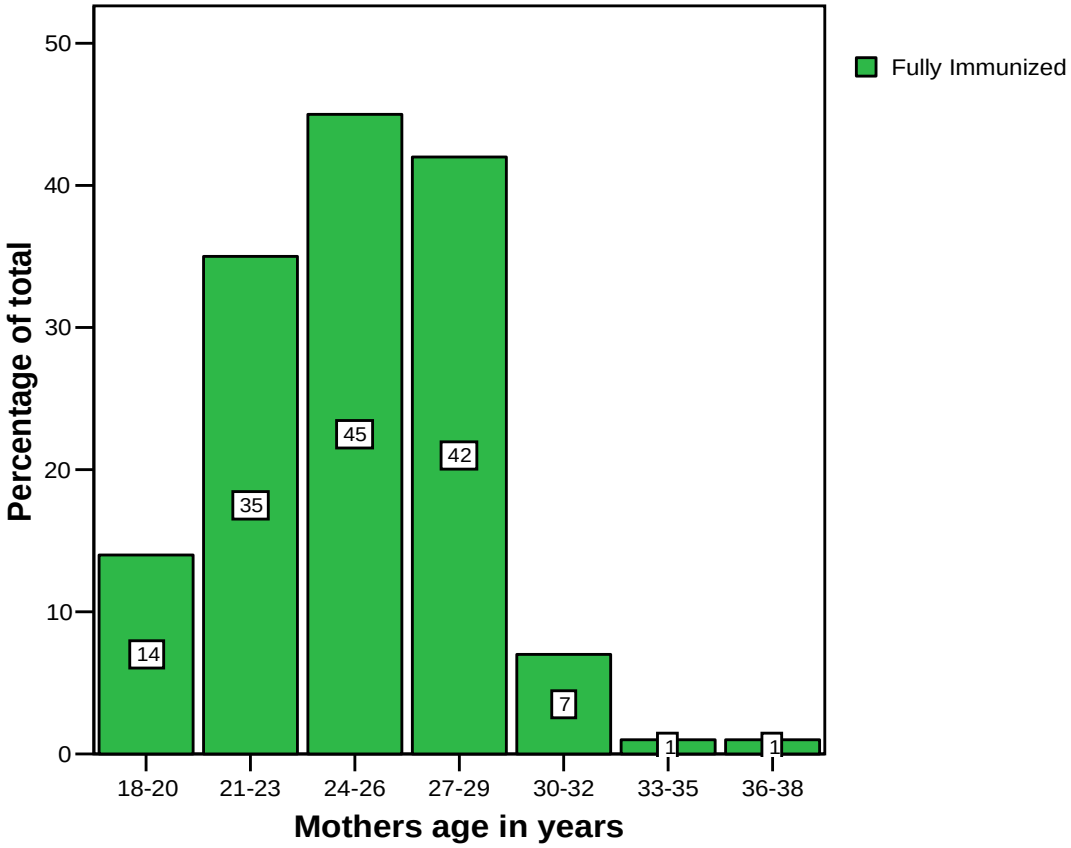

Fig. 4.10 Full immunization status and age of mother

CHAPTER FIVE: DISCUSSION

5.1 Immunization Coverage in Kiandutu Slum

From the households covered by the District Hospital Outreach Team and included in this study, 77% of the children whose parents were interviewed were fully immunized. A study conducted in six health facilities that covered some key slums in Nairobi area, showed immunization coverage of 80% (Borus, 2004) a figure higher than that in Kiandutu but that shows some level of comparability. Although the coverage in Kiandutu slum is still low as compared to the general population coverage, it shows that there has been concerted effort by the government through the health facilities to improve health services and in particular, MCH services to slums. The Thika District Strategic Plan for 2005-2010, proposed under Reproductive health policy, to equip health care facilities appropriately so as to provide quality maternal and child services in the district (District Strategic Plan, 2005-2010). There have also been several intervention programs from organizations such as UNICEF, Faith Christian Centre and the Ministry of Health through the Thika District Hospital aimed at improving health services and health seeking behavior in the slums. These programs could have resulted in the coverage being high as compared to slums where such interventions have not been adequately implemented. This concurs with other studies that have shown that areas with history of health interventions have greater awareness on health issues (Msambichaka, 2000).

Immunization coverage in the slum could have been higher if all households within the slum were equally accessible to the outreach services. A study conducted in Bangladesh showed that children living in communities where outreach clinics were farther than 2 miles were 30 percent less likely to be immunized than children living in communities where outreach clinics were within 2 miles (Jamil *et al*., 1999).

5.2 Effect of Socio-demographic factors on Immunization Coverage

In this study, the association between the immunization status of the child and the mother's age was significant, with a P value of 0.006 at 95% confidence interval. The results indicated that children born to mothers in the age group of 21-29 years had a higher coverage level, while those born to mothers aged over 30 years had lower coverage (Fig. 4.10). A similar study conducted in underprivileged suburbs in Dakar, Senegal showed significance association between age of the mother and immunization status of the children. However, the indication from this study was that children born of older mothers had a higher coverage. In the Dakar study the proportion of children not immunized was 34.7% and 35.3% for mothers aged above 25 years of age and below 25 years of age respectively (Fassin and Jeannee, 1989). A household survey conducted in an impoverished community in Dhaka city, Bangladesh, also showed similar results, with children of mothers below 30 years having a lower coverage than those whose mothers were above 30 years (Perry *et al.*, 1995).

From the results of this study, there was no significant association between the immunization status of the child and the level of education of the mother (p=0.128). The

results of this study do not agree with a household survey of 651 children aged between 12-23 months in Dhaka city, Bangladesh, which showed a significant correlation between mother's education and immunization coverage, with children of mothers having over 6 years education having a higher coverage than those whose mothers had less than 6 years education (Perry *et al*., 1995).

The results of this study are in agreement with a study conducted in Lucknow slums of India which showed that the literacy level of the mother did not significantly predict the immunization status of the child (Nath *et al*., 2007). This could indicate that if social mobilization activities are properly implemented in the community, they could have a significant impact in changing the attitude of the people irrespective of the education levels of the mother.

Waisbord and Larson in 2005 suggested that a key strategy that would help improve immunization coverage in areas where immunization coverage is low is communication for immunization. Communication can be considered in a broad sense including advocacy, social and community mobilization and information, education and communication (IEC) activities. This strategy, if applied in Kiandutu slum would help the mothers/guardians make informed decisions concerning immunization of their children. Education level of the mothers/guardians would be of importance when introducing some health interventions to help improve immunization coverage. An intervention in Ethiopia found that reminder/prompt materials reduced dropout rates compared to the control group (Berhane and Pickering, 1993). Community health

providers followed 6-week old to 23-month old children who visited vaccination centers to determine whether reminder stickers applied to the inside of their home front door would reduce immunization dropout rates. The health workers gave a circular sticker with the picture of a child receiving a vaccination and an appointment date to one group of the mothers. The immunization dropout rate of children whose mothers received a sticker was 55% lower than that of the control group. For the study on the prompts to have worked, the mothers would have had to understand the meaning of the information on the sticker.

The findings from this study did not show any significant association between the marital status of the mother and the immunization status of the child (p=0.232). Perry *et al* (1995), in a study on childhood immunization in slums of Dhaka city, India showed a significant association between marital status of the mother and immunization coverage, where children of mothers who were single, divorced, separated or widowed had a lower coverage than of those who were married .

The results of this study indicated no significance in the association between immunization status of a child and availability of the immunization card (p=0.285). It was however noted that 79.9% of the mothers retained their children's immunization cards. All the mothers who did not have the immunization cards (20.1%) gave information on their children's immunization status by recall method. Although the respondents in this case seemed to have the information on their children's immunization progress and current status, this method has been shown in other studies

to have poor sensitivity. A study carried out in India by Ramakrishan *et.al*., (1998) showed a sensitivity of 41.3 % in the recall method of obtaining information and concluded that the method was prone to biased results.

5.3 Immunization Drop-Out Rate

A dropout rate of 10% or less is acceptable. A higher dropout rate above 10% and negative dropout rate are considered unacceptable coverage for immunization. The EPI program's success depends on the administration of the full course of the vaccines at the right dose rate of the antigen at the right age (Prabhakaran, 1993).

From the results of this study, the drop out rate between the first and the third doses of DPT was 15.6%. This meant that one in six children was not able to complete the immunization schedule. The study also showed that 19% of the children started on the BCG vaccine dropped off before receiving the measles vaccine. This is much higher than the WHO recommended drop out rate of less than 10% (WHO, 2005) and could indicate that although concerted efforts on promoting immunization had been put in place, there was a shortcoming in the sustainability of routine immunization programmes. A study in the urban slums in India's Lucknow district showed a dropout rate of 28.6% between the first and third dose of DPT vaccine. This meant that one in three children was not able to complete the immunization schedule (Nath *et al*., 2007). The study suggested that the drop-out rate could be as a result of health program related implications. A study on immunization coverage in slums of urban Bangladesh showed

that the DPT1-DPT3 drop out rate was 6.7 times higher in slum children than in children from non slum households (Perry *et al*., 1995).

5.4 Reasons leading to non immunization of children by mothers

Mothers whose children had not received any immunization were asked to give reasons as to why their children were not immunized. From the study, the reasons cited by the mothers were forgetfulness due to other responsibilities, distance from the hospital and religion. The mothers who cited forgetfulness argued that they were engaged in livelihood-generating activities, which they considered more important at the time. This reflects the unmet basic needs of those living in impoverished communities, which make health seeking a secondary responsibility. Findings of this study were in agreement with a study conducted in slums in Lucknow District India, where 17.2% of mothers interviewed argued that they were pre occupied in fending for their families basic needs (especially food) and had forgotten about seeking immunization services for their children (Nath *et al*., 2007).

The mothers who gave religion as a factor were all from a religious group indigenously called the '*akorino*' who did not believe in seeking health services. This emphasizes the need for civic education on the benefits of health services to the community so as to increase awareness on such life saving measures as immunization.

5.5 Improving Immunization services in Kiandutu slum

From the study, it is evident that although the District Hospital, through its outpatient and outreach departments, is putting effort to increase coverage and raise awareness on health related issues within the district and in Kiandutu slum, a lot still needs to be done so as to increase the immunization coverage and reduce the drop out rate in the slum.

A key strategy that would help improve coverage in Kiandutu slum as well as other slums where immunization coverage is low is communication for immunization. Communication can be considered in a broad sense including advocacy, social and community mobilization and information, education and communication (IEC) activities (Waisbord and Larson, 2005). From the investigators observation during the study, it was evident that the outreach team involved in promotion of health services in the slum area was doing a lot to ensure that as many children as possible were immunized. However, no measures had been taken to monitor or track the progress of the children after the first vaccination or between successive vaccinations. The high dropout rate could have been as a result of this. Strategies that will help serve as reminders or prompts to seeking immunization or other health services can be put in place to help reduce immunization dropout rates.

The results of this study showed that the dropout rate in immunization coverage was of concern, and it is evident that measures needed to be put in place to reduce the drop out rate. Measures that have been used in other studies could be employed in Kiandutu to see if they would have an impact in reducing the dropout rate. A study in Burkina Faso

in the early 1990s showed that mothers who had been exposed to a variety of interpersonal and media messages were more likely to know the requirements to complete the vaccination schedule and know the dates for specific vaccines than mothers in control group (Bhattacharyya *et al*. 1994). Another study cited that door-to-door canvassing and strategic 'miking' (use of megaphones), accounted for increased immunization coverage in peri-urban and rural areas in Mozambique (BASICS, WHO and UNICEF 1999).

5.6 Limitations of the study

The participants in the study were selected from a list of households who were covered by the Thika District hospital outreach team. This was therefore a group who may have had better health seeking behavior as compared to the other members of the population who were not being covered at the time. Another limitation to the study was a sense of mistrust from the participants. This was a result of the previous political unrest in the country. The study was conducted at a time when the country was recovering from the post election violence and it was rather difficult to gain the trust of some of the participants even though the study was housed within the District hospitals outreach activities Communication to the participants was a limitation especially where they could only understand vernacular.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

From this study, the full immunization coverage for children based on having received full immunization by virtue of having received the complete pentavalent vaccine and measles was 77%. The children who got partial immunization were 18% while those who were not immunized at all were 5.3%. The proportion of fully immunized children fell below the WHO/UNICEF recommended target of 85%. The immunization card retention among the mothers was 79.9%, with 20.1% of the mothers not having the cards. The immunization dropout rate was 15.6%, and much higher than the WHO recommended dropout rate of less than 10%. For the socio demographic factors assessed in relation to immunization coverage the age of the mothers had a significant association with the immunization status and coverage of the children. Level of education and marital status did not have a significant effect on coverage of immunization. Children born to mothers between the age of 21 and 29 years had a higher rate of full immunization coverage compared to those whose mothers were aged over 30 years. For the children who had not been immunized, reasons given by the mothers were forgetfulness and religion.

RECOMMENDATIONS

From the, it is clear that a lot still needs to be done to increase the immunization coverage in Kiandutu slums to the recommended WHO standards and reduce the drop

out rates. This can be through more intense civic education and outreach services by health providers. The government through the Ministry of Public Health and Sanitation should also introduce ways of prompting or reminding mothers about immunization of their children to reduce the drop out rates. Civic education specifically targeting mothers aged 30 years and above should be implemented in the slum, to increase immunization coverage among their children. It should also address the importance of immunization to the children so as to address the issue of ignorance among the mothers and consequently reduce the number of non immunized children in the slum.

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APPENDICES:

Appendix 1: Informed Consent Form

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
INSTITUTE OF TROPICAL MEDICINE AND INFECTIOUS DISEASES (ITROMID)

Project Title: Factors Influencing Immunization Uptake in Kiandutu Slums, Thika District.

Principle Investigator: Arphaxad Chege Kariuki
Other Investigators: Dr. Peter Borus, Dr. PH, KEMRI.
Dr. Patrick Nguku, MBChB, MSc.

Purpose of this Research/Project

This research is aimed at finding out what proportion of children living in Kiandutu slums are immunized fully and against what priority diseases. The results of this study will be given to the Thika District Hospital who will take the necessary action depending on the outcomes. The study will therefore be of benefit to the participants and the community as a whole.

Procedures

The study will involve random recruitment of study subjects from Kiandutu slums. Your child has been selected to participate in this study because he/she is between 12 and 23 months of age and lives in Kiandutu slum. The children to participate in the study will be picked randomly from a list of households present within a specific cluster in Kiandutu slums.

In the interview, I will ask you questions regarding your child's immunization status, place of immunization or reasons for no immunization (if the child is of or past immunization age but has not undergone immunization). If you have an immunization card for the child, information will be taken directly from the card.

Risks

You and your child will not be put to any form of risk by participating in this study.

Benefits

Results of the study will (upon consent from subjects) be shared with MCH clinic and outreach team of the Thika District Hospital, who will take measures to immunize or otherwise, based on the results. If your child has not been immunized, he/she will benefit

from being immunized in the resulting catch up campaign.

Extent of Anonymity and Confidentiality

Information regarding you and your child be kept anonymous and confidential and results obtained will be made available to the health care givers only if you agree for it to be shared. To maintain anonymity subjects I will not use your name on the interview form but I will assign you a number. It is possible that the Ethical Review Board (ERB) may view this study's collected data for auditing purposes.

Compensation

You will not be compensated for participating in the study but your participation will be of great assistance to me and will be appreciated.

Freedom to Withdraw

You are free to withdraw your child from the study at any point and you will not be penalized in any way.

Subject's Permission

I have been fully informed about the study and conditions of this study. I have been given the opportunity to ask questions and they have been answered to my satisfaction. I hereby acknowledge the above and give my voluntary consent:

Signature: _____ Date: _____

If I have any pertinent questions about this research, its conduct, participants rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

Investigator(s) Name: Arphaxad Chege Kariuki

Investigator(s) Telephone: 0729 968 397

Email: arphaxadkariuki@yahoo.co.uk

Research Supervisor: Dr. Patrick Nguku Email: drnguku@yahoo.com

KEMRI National Ethical Review Committee: P.O Box 54840-00200, Tel: 020-2722541.

[NOTE: Subjects must be given a complete copy (or duplicate original) of the

signed Informed Consent.]

Fomu ya radhi ya makubaliano (Swahili version)

Mtafiti mkuu: Arphaxad Chege Kariuki
Watafiti wahusika: Dr. Peter Borus, Dr. PH, KEMRI.
Dr. Patrick Nguku, MBChB, MSc.

Maelezo ju ya utafiti huu.
Lengo la utafiti huu ni kujua ni takriban watoto wangapi ambao wanaishi katika kitongoji duni cha Kiandutu ambao wameweza kupokea chanjo kamili dhidi ya magonjwa muhimu. Matokeo ya utafiti huu yatatumika na hospitali ya wilaya ya Thika, ambao watachukua hatua zitakikanazo kuhakikisha watoto wanapokea chanjo.

Maelekezo za utafiti

Mtoto wako amechaguliwa kushiriki katika utafiti huu kwa kuwa ana umri wa kati ya miezi kumi na miwili na miezi ishirini na mitatu, na ni mkaazi wa Kiandutu. Watoto washiriki watachaguliwa bila mpangilio au ubaguzi wowote.
Nitaweza kukuuliza maswali kama mzazi wa motto mshiriki, ili kujua kama motto amepokea chanjo anavyo stahili.

Madhara

Wewe na motto wako ambaye ni mshiriki wa utafiti huu, hamtapata adhari zozote kwa kushiriki katika utafiti huu

Siri ya ushirika kwa utafiti

Maelezo utakayo toa kama mshiriki wa utafiti huu, yatachukuliwa kama siri na yatatumika kwa manufaa ya manufaa ya utafiti peke yake. Jina lako halitatumika katika utafiti huu ili kuhakikisha siri ya mhusika.

Malipo kwa ushiriki

Kushiriki kwako katika utafiti huu ni kwa hiari yko mwenyewe na hakuna malipo yoyote ya kifedha baada ya kushiriki. Ushiriki wako katika utafiti huu utakuwa wa usaidizi mno na utachukuliwa na shukrani.

Uhuru wa kujiondoa kwa utafiti

Wewe kama mshiriki katika utafiti huu, unaweza ukajiondoa kwenye utafiti huu kwa wakati wowote na kwa hiari yako mwenyewe, bila madhara au hasara yoyote.

Makubaliano juu ya radhi

Mimi nikiwa nimepata maelezo kamili na maswali yangu kuhusu utafiti huu kuwa yamejibiwa kwa ukamilifu, ninakubali kwa uelewa wangu kumruhusu mtoto wangu awe mhusika katika utafiti huu.

Sahihi:..... Tarehe:.....

Kama nitakuwa na maswali zaidi nimeruhusiwa kuwasiliana moja kwa moja na mtafiti Arphaxad Chege Kariuki kwenye simu ya mkono nambari 0729 968 397 na barua pepe arphaxadkariuki@yahoo.co.uk

Mtafiti mhusika: Dr. Patrick Nguku Barua pepe: drnguku@yahoo.com

Kamati ya KEMRI ya utafiti: P.O Box 54840-00200, Tel: 020-2722541.

[MUHIMU: Mhusika anafaa kupata kopi ya fomu ya makubaliano ya radhi ikiwa imetiwa sahihi kamili.]

Appendix 1: Questionnaire

APPENDIX 1: INFANT IMMUNIZATION CLUSTER FORM

Cluster Number: ☐			Subject Code: ☐
Date of interview:			
	Demographics		
Date of birth:			
Sex: M☐ F☐ (Tick as appropriate)			
Mother's Age:			
Marital Status(mother):			
Area of residence:			
	Immunization History		
Immunization Status:	Not	☐	
(Tick as appropriate)	Partially	☐	
	Fully	☐	
Fully immunized before 1 year of age:	☐ 0		
(Tick as appropriate)	☐ 1		
Immunization Card:	☐ 0		
(Tick as appropriate)	☐ 1		
BCG:		☐ 0	
(Tick as appropriate)		☐ 1	
	Scar:	☐ 0	
		☐ 1	
	Date:		
	Source:		
DTP 1		☐ 0	
(Tick as appropriate)		☐ 1	
	Date:		
	Source:		
DTP 2		☐ 0	
(Tick as appropriate)		☐ 1	
	Date:		
	Source:		
DTP 3		☐ 0	
(Tick as appropriate)		☐ 1	
	Date:		
	Source:		

Page 1

OPV 1	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
OPV 2	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
OPV 3	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
Measles	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
Hib	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
Hepatitis B	☐ 0	
(Tick as appropriate)	☐ 1	
	Date:	
	Source:	
Name of Interviewer(s):		Signature:
Name of field supervisor:		Signature:
KEY:		
Date:	Date immunized (Copy from card if available)	
0	No	
1	Yes	
Source: (example)	OUT Outreach	
	HOS-Hospital	
	HC-Health Centre	
	PRIV-Private	
	NGO-Non Governmental Organization	
NB: Immunization particulars to be filled if immunization card is available.		
	Page 2	

APPENDIX 2: REASONS FOR IMMUNIZATION FAILURE CLUSTER FORM

Cluster Number: ☐ Subject Code: ☐

Date of interview:

Demographics

Date of birth:

Sex: M☐ F☐ (Tick as appropriate)

Mother's Age:

Marital Status(mother):

Area of residence:

REASONS(Quote subject verbatim)