CHILDHOOD IMMUNIZATION IN MMAKAUNYANE VILLAGE IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

by

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DISSERTATION

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DEDICATION

I dedicate this work to my family:

My husband, Dr Stanley Mankgana Sanyane; my children, Tebogo, Aobakwe and Moatisi Sanyane; my parents, Lentoa Andrew and Gloria Gaogakwe Sehume and my siblings, Thabo Moses Ramoshate Sehume and Kedibone Refilwe Bridget Sehume.

"I can do anything through Christ who strengthens me" Philippians 4:13

DECLARATION

I declare that this research hereby submitted to the University of Limpopo, for the degree of M.Med (Paediatrics and Child Health) has not previously been submitted by me for a degree at this or any other university; that it is my work in design and execution, and that all material contained herein has been duly acknowledged.

_____ _____

K.L Sehume (MBChB, BSc) **Date**

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DEFINITIONS AND ABBREVIATIONS

Definition of terms:

- Primary care giver: The person who looks after the child and is primarily responsible for all the needs of the child including shelter, food, emotional and financial needs and is in possession of the child's Road to Health Card.
- Road to Health Card: The card that belongs to a child in which his or her health record including birth, immunizations, growth and other health matters are recorded.
- Immunization coverage rate: The percentage of all children between 0 to 6 years who have received full immunization according to the South African Expanded Programme of Immunization during the study period. (Rotavirus vaccine and pneumococcal conjugate vaccine are excluded from this definition)
- Missed opportunity: A situation where a child has been in contact with a health care worker in a clinic or hospital and an opportunity to give due immunizations was not utilized.

Abbreviations:

RHC	-Road to Health Card
SA-EPI	-South African Expanded Programme on Immunization
WHO	-World Health Organization
MDG	-Millennium developmental goals
UN	-United Nations
HIV	-Human Immunodeficiency Virus
AIDS	-Acquired Immune Deficiency Syndrome

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ABSTRACT

BACKGROUND AND OBJECTIVE:

Immunization is one of the most cost effective preventative health care interventions that is available to communities; it has greatly reduced the burden of infectious diseases in childhood. Since the World Health Organization launched the expanded programme of immunization in 1974, routine childhood immunization is widely available and it forms an integral part of preventative healthcare. Unfortunately, many children lack access to this life saving health care intervention. Communities in poor, rural areas often lack access to basic services, including health care and immunization services. We studied immunization coverage in a poor, rural community in South Africa and further explored what factors put children in this community at risk for under-immunization.

METHOD:

This was a cross sectional study, in which the immunization status of children from birth to six years of age living in Mmakaunyane was assessed. The primary caregivers of these children were also interviewed to determine their knowledge, attitudes and their practices with regards to immunizations; they were further asked about their perception of healthcare service delivery in the village. Using a map of the village, it was divided it into 30 blocks with 4 clusters in each block. Field workers were looking for a maximum of 5 eligible children in each cluster. We used the Road to Health Card to check if immunization was complete for age according to the SA EPI.

RESULTS:

There were 567 children enrolled in the study. The majority of the children were above 18 months of age (64.4%) We found that 92.1% of children were in possession of a RHC. In total, 432 (76.2%) of the children were fully immunized for their age, 97 (17.1%) had incomplete immunizations and immunization status was unknown for 38 (6.7%). The primary caregiver for most of the children was the biological mother (85.5%). There was a low level of education amongst the primary caregivers with only 15.3% having completed matric or attained higher level of education. Caregiver knowledge of immunization was poor and only 21.1% of caregivers correctly mentioned three diseases that can be prevented by

immunization. The majority of the caregivers (96.0%) believed that immunizations help to keep children healthy.

Approximately half (49.9%), of the caregivers perceived immunization service delivery in Mmakaunyane village to be good. Factors that were found to be associated with incomplete immunization included age of caregiver, gender of the child and knowledge of the caregiver on immunization.

CONCLUSION:

Only 76.2% of children were fully immunized for their age in Mmakaunyane village. This immunization coverage rate is less than the National target of 90% for all children aged one year. The proportion of children under one year of age that are fully immunized is higher than that of the whole group. This indicates that the older children have a lesser level of immunization coverage (>18 months: 74.2%). The major factors that were found to be associated with under-immunization include lack of knowledge about immunizations, older age of the caregiver as well as poor accessibility of health care services. Female children were also found to be at increased risk for under-immunization. Measures to improve immunization coverage in this community need to take all these factors into consideration.

CHAPTER 1
INTRODUCTION

FROM THEN TILL NOW

Before the era of immunizations, global morbidity and mortality from infectious disease was very high. Many people, especially children, suffered from diseases such as smallpox, polio, measles and influenza and other infectious diseases. Smallpox was a major infectious disease in the 20th century causing more than 300 million deaths worldwide (PATH, 2009). Poliomyelitis is reported to have caused over 3000 deaths and paralyzed more than 21000 people in the United States of America in 1952 (Simoes, 2003), and the influenza pandemic of 1918 is estimated to have resulted in more than 20 million deaths worldwide.

The modern history of immunizations dates back to the 18th century where an English country doctor, Edward Jenner, advanced the concept of vaccination for the world by vaccinating patients against smallpox using pus from cowpox infected milkmaids (Stern et al., 2005). Edward Jenner's efforts were inspired by his observation that milkmaids who were infected with cowpox did not get ill from smallpox (Stern et al., 2005). This was a major medical breakthrough and it provided the basis for the development of vaccines as a preventative health care measure

In 1885, almost a century after Edward Jenner's smallpox vaccine, another breakthrough in the history of vaccines came through Louis Pasteur. This famous French scientist developed the concept of weakening or attenuating microorganisms and using them as vaccines (Wilson, 2007). This was how the first viral vaccine against rabies was developed. In the past the word vaccine referred specifically to the cowpox vaccine and is derived from the Latin word "vacca" which means cow (Sykes, 1982). The word now encompasses vaccines to other diseases and is often used synonymously with immunization which means the development of a required immune response after the administration of an immunologic agent. Louis Pasteur helped to broaden the definition of vaccine to include not only cowpox but other microorganisms or their components (Stern et al., 2007).

These breakthroughs lead to the development of many other vaccines using the attenuation method. The era of modern day vaccines coincides with the Second World War. It was in the

late 1940's that new technologies of creating vaccines were found and many new vaccines were developed.

The whole-cell pertussis vaccine was developed in the 1940s and in the 1950's Jonas Salk pioneered the development of the polio vaccine; both these vaccines contained killed or inactivated organisms (Miller, 2000). The attenuation technique that was initially developed by Louis Pasteur was advanced further by Sabin to create the oral polio vaccine, the vaccine responsible for the eradication of polio worldwide (Miller, 2000). Vaccine composition varies according to the technique employed to develop it and can be made up of either live inactivated organism, organism toxin, specific antigen extract or killed pathogens. Some vaccines have added proteins or antibiotics in them to make them more effective. Recent technology employs the conjugation of the polysaccharide antigen of an organism with a carrier protein to develop vaccines against *Haemophilus influenzae* type B and more recently against meningococcal and streptococcal disease.

The success of developing new and effective vaccines in the 20th century saw the development of routine childhood vaccination, mostly in the developed countries. The formation of global health structures such as the WHO and the United Nations Children's Fund (UNICEF) helped to spread routine immunizations globally (Stern et al., 2005). In 1967, the WHO led the campaign to eradicate smallpox in the world with mass immunization; the last known case of smallpox was in 1977 in Somalia (PATH, 2009). This is the most successful story of the impact of immunization on disease prevention and eradication: "within ten years, this disease that had plagued human civilization for thousands of years had been vaccinated out of existence." (PATH, 2009).

IMMUNIZATION FOR US ALL:

Immunization is a preventative healthcare measure that is beneficial to all people and it should be available to all people. In many parts of the world governments recommend and even fund routine immunizations, particularly in children. Despite immunization being freely available, there are those communities that struggle to access this life saving preventative healthcare intervention. In developing countries, including South Africa, many of the people who are meant to benefit from such life saving interventions do not benefit due to remote location and neglect by political structures. People in these poverty stricken areas are often unemployed and uneducated. This may be the reason why they are often neglected by the

policies that are meant to benefit them and it is usually because they are not economically active that they do not have a voice and end up being excluded in the system that is meant to help them.

THE MMAKAUNYANE IMMUNIZATION STUDY:

Study setting:

This study took place in Mmakaunyane, a village approximately 60 kilometers from the capital city of South Africa, Pretoria. This is a rural village in the North West province of the country, with very weak service delivery measures. At the time of the study, there was no clinic and primary healthcare services were provided by a weekly mobile service and a church based organization within the community. Many households are not electrified and the community still relies on boreholes and communal taps for water supply. There is also no proper sanitation in the village. Of note is that there was not even a single private medical practitioner in the village, probably because the people do not have the money to afford that kind of service. This study was undertaken to explore routine childhood immunization coverage and factors associated with it in the village of Mmakaunyane.

Aim of the study:

To investigate childhood immunizations in a rural village in the North West province of South Africa.

Objectives of the study:

- To determine what percentage of children who are younger than six years are fully immunized for their age according to the South African childhood immunization schedule
- To investigate the knowledge of caregivers regarding vaccination of children
- To investigate the attitudes of caregivers regarding vaccination of children
- To investigate service delivery factors as experienced by the caregivers
- To measure associations between childhood immunization and the factors studied in the second and third objectives

Inclusion criteria:

All children who are younger than six years; who live in Mmakaunyane and have been living there for at least 6 months and their primary caregivers.

Exclusion criteria:

- Children who were visiting the village or have not been living there for at least 6 months before the study period.
- Caregivers who were not the primary care giver to the child.

CHAPTER 2
LITERATURE SURVEY

INTRODUCTION:

The World Health Organization (WHO) stated that clean water and vaccines are the two public health interventions that have greatly improved the health of people around the world (Mahdi et al., 2007). The WHO Expanded Programme of Immunization (EPI) was launched in 1974; its aim was to reduce mortality from six major vaccine preventable infectious diseases namely: measles, poliomyelitis, diphtheria, pertussis, tetanus and tuberculosis. Since then, more than 20 million deaths have been prevented worldwide and a global immunization coverage rate of more than 80 % has been achieved (Vandelaer et al., 2008). There continues to be extensive scientific research to improve the safety and efficacy of available vaccines and to develop new vaccines to target other diseases with high morbidity and mortality such as malaria and human immunodeficiency virus infection (HIV). The disadvantage with this great medical achievement is that immunizations are not equally available to all people around the world and are often lacking in populations and communities that are most in need of them.

It was because of the resounding success of mass vaccination against smallpox that the possibility of prevention and eradication of infectious diseases all over the world seemed achievable. The other aim of the launch of the WHO's EPI in 1974 was to expand routine immunization globally. Until then, routine immunization was practised mainly in developed countries while millions of children in developing countries continued to succumb to vaccine preventable infectious diseases. It is estimated that less than 5% of the world's children were being immunized against vaccine preventable infectious disease by their first birthday at the time the EPI was launched (Mphahlele et al., 2008). In 1977, the WHO set a goal to achieve universal immunization of all children by 1990 as part of its aim to achieve health for all by the year 2000. Now more than 75% of children less than one year receive immunizations and more than 20 million lives have been saved (Mphahlele et al., 2008).

Routine childhood immunization is one of the most important preventative health measures and it forms the backbone of preventative primary health care. Childhood immunization forms part of active immunity, where the host's (child's) immune system is stimulated by the introduction of components of pathogenic organisms in order to develop immunity to the

diseases caused by those organisms. The dose of vaccination that is given should be enough to initiate an immune response but not to cause overt disease. For some vaccines to be optimally effective several doses should be given and boosters need to be given for continued protection with some vaccines. Depending on the vaccine being given, vaccination is administered by either the oral, intra-muscular, intradermal or subcutaneous route. In small infants, the anterolateral aspect of the thigh is used and in older children and adults the deltoid muscle can be used. For intra-muscular injections the gluteal muscle is never used for immunization because it can result in low immunogenicity and there is a risk of damaging the sciatic nerve.

With advancing technology and research, newer, more effective and safer vaccines are being developed and current vaccines continue to be improved upon. We now have the acellular pertussis vaccine which has less side effects and the inactivated poliomyelitis vaccine is slowly replacing the oral polio vaccine because it does not have the risk of causing paralysis. Routine immunization now protects for far more than the six infectious diseases initially targeted by the WHO. Currently, about 25 vaccines are available for disease prevention (Bloom et al., 2005). These include the hepatitis B vaccine, the *Haemophilus influenzae* type B (HiB) vaccine, the pneumococcal conjugate vaccine, the rotavirus vaccine, the meningococcal vaccine, the yellow fever vaccine, the varicella vaccine and many others. The other advancement in immunization science is the development of combination vaccines. Even though some vaccines can be given via the oral route, the majority of vaccines are given via the intramuscular route and they require repeated doses. This implies that an infant may be exposed to numerous injections at a single visit and this would of course distress many parents and children. Combination vaccines reduce the number of injections and they thus improve compliance with immunization schedules by allaying parental anxiety due to multiple injections. Combining vaccines is not merely a matter of putting different vaccines together, it is a strategic process which needs to take into account all the different components and compatibility of each of the individual vaccines. Most importantly, each individual vaccine in the combination must retain its efficacy and all of the different components of each vaccine must be safe enough to be given to patients together. "When considering which vaccines to combine, the following parameters must be considered: current immunization schedule; compatibility of components; availability of antigens for targeted diseases; safety; efficacy and immunogenicity; and route of administration" (Yeh et al., 2001).

A number of vaccines have been successfully combined to contain two in one, three in one, and even up to six in one formulations. If anything, combination vaccines are an important necessity; they will make vaccine administration easier, reduce parental anxiety and make all stakeholders more receptive to new vaccines.

Although childhood immunization remains the main targeted period of immunization programmes, newer developments include the immunization of adolescents as part of routine immunization. In adolescence, an effective immunization programme including primary vaccines and boosters of some of the vaccines given in childhood can help with disease prevention for vaccinated individuals as well as strengthening herd immunity in the population (Finn et al., 2011). The human papilloma virus (HPV) vaccine is recommended in adolescent girls and young women for protection against this sexually transmitted infectious agent that is strongly associated with cervical carcinoma. In some countries, such as the United Kingdom (UK) it forms part of the routine immunization schedule. Another vaccine that is beneficial in adolescent girls and young women is the vaccine against rubella as it can help to reduce the incidence of congenital rubella syndrome, particularly in the developing world where resources are limited and affected children do not get the appropriate care.

For effective and successful immunization, health care workers who administer childhood vaccines need to be knowledgeable about all aspects of immunization and about the different vaccines in use including storage and handling of vaccines, proper administration technique, vaccine side-effects and contraindications. There is a lot of misinformation, even amongst health care workers, about contraindications to immunization and many children's immunization can be delayed or even missed due to misconceptions. Most vaccines are sensitive to temperature changes and can be inactivated by heat or cold. Strict temperature control needs to be maintained at all times during manufacturing, transportation and handling of vaccines. Healthcare workers need to follow manufacturer guidelines with respect to storage and handling. Although some vaccines can be frozen, general recommendations are that they must be stored at two to four degrees Celsius in a fridge with the use of a fridge thermometer. Vaccines should not be stored in the refrigerator door as the temperature is higher. Absolute contraindications to immunizations are very few and include anaphylactic sensitivity to any of the particular vaccine's composition such as eggs or some antibiotics. A previous anaphylactic event following a previous dose of any vaccine is also a contraindication and immunization may need to be postponed in an acute febrile or non

febrile illness. Minor illness and recovery from illness is not a contraindication. Prematurity and low birth weight, cerebral palsy, neonatal jaundice, common cold, asthma, HIV infection and other chronic illnesses are not contraindications to immunization. In special circumstances including organ transplantation, in chemotherapy or radiotherapy for malignancy and in patients on high dose corticosteroid therapy specialist advice should be sought before giving any vaccines because some vaccines, especially live vaccines should not be given to such patients (Smith, 2006). It is very important for healthcare workers to be properly educated in all aspects of immunization and vaccines so as to give the correct information and advice and to administer the correct vaccines safely at all times. Healthcare workers should also be knowledgeable about vaccine catch up schedules for those who have missed vaccinations or have had a delay in their vaccination schedule. Healthcare workers should seek expert advice when uncertain about vaccines in some special circumstances; more importantly, they should know where to get the expert advice. In many healthcare settings, expertise on immunizations is found in specialists who deal with infectious diseases also infection control and disease surveillance.

IMMUNIZATION IS VALUABLE

Immunization saves lives. This statement is echoed all over the world daily in immunization campaigns because it is true. Routine immunization of children protects them from debilitating diseases. Children can grow up healthy and reach their full intended potential in life. Even when protection by immunization from a disease is incomplete, if a child contracts that disease the illness is less severe and the outcome is better than if the child was not vaccinated (Andre et al., 2008). Vaccines improve quality of life as they can prevent diseases that can cause physical and mental disability such as poliomyelitis and meningitis. Immunization has also helped to enable people to travel around the world and remain protected from certain infectious diseases; immunization requirement for travelers depend on where a person is travelling to and from where. Most common vaccines for travelers include yellow fever, hepatitis and influenza. Life expectancy and severe outcomes of some diseases in the elderly can be overcome by immunization; older patients who receive vaccinations for influenza have reduced risks of suffering sequelae such as strokes and heart attacks (Andre et al., 2008). Immunization, due to its effect on child survival has lead to the empowerment of women as they spend more time being more productive than looking after sick or disabled children. Immunization has also decreased the need for women to bear more children as it leads to improved survival (Andre et al., 2008; Shearly, 1999). Immunization is not only

valuable to individuals and families but also to communities, societies and governments. If in a community sufficient numbers of people have been immunized against an infectious disease, the likelihood of disease outbreaks occurring within that community is reduced. Immunized individuals protect those that are not immunized by a phenomenon referred to as herd immunity. Herd protection or herd immunity occurs when the level of immunity against a particular disease is high enough in a community to prevent transmission of the particular pathogen and thus to decrease the likelihood of the disease occurring in that community. In such instances, the whole "herd", or community, is protected against the disease. Herd protection results in some diseases being eliminated without 100 % immunization coverage. This means that in a given population, when enough people have been vaccinated against a particular disease, the likelihood of that particular disease occurring is greatly reduced; such that even those individuals who are not vaccinated against that disease are protected against it. "The required level of immunity in populations to prevent epidemics of infectious diseases has been estimated at about 95 % and 85 % for measles and polio, respectively" (Anderson & May, 1985 cited by Corrigal et al., 2008). *Haemophilus influenzae* type B was eliminated with vaccination coverage of less than 70 % in the Gambia (Adegbola et al., 2005).

Immunizations can foster the economic growth of a country in a number of ways. Firstly, the adults in a society can spend less time looking after ill children and more time in their jobs. Children can grow up and become productive members of society if they are immunized and don't succumb to infectious diseases. In a study conducted in the Phillipines, Bloom and colleagues found that immunizations not only benefit children with regard to their health but it also improved their cognitive ability in later childhood which also translated into more productive and economically active adults (Bloom et al., 2005). Vaccine preventable illnesses such as *Haemophilus influenzae* and pneumococcal infections including meningitis can have clinical sequelae which can result in severe long term outcomes including seizures, mental retardation, sensorineural hearing loss and even motor abnormalities (Sáez-Llorens et al., 2003).

Significant savings in a country's economy can be achieved by investing in immunizations. Immunization against infectious disease decreases the need for hospital admissions and antibiotic treatment; less usage of antibiotics can also help to prevent the development of antibiotic resistance organisms (Andre et al., 2008). Immunization helps to keep children healthy. When children are healthy, parents can spend their time at work to generate income

for their families rather than be at home looking after ill children. Healthy children also mean economically productive adults, which can translate into increased household income. Parents of healthy children would want to work harder and earn more in order to secure a bright future for their children. Bärninghausen and colleagues have summarized the benefits of immunization in the table below relating to both the broad and narrow perspective of the economic value of vaccines.

TABLE 2.1: Types of benefits in economic evaluations of vaccines

Types of benefits in economic evaluations of vaccinations			
Perspective		Type of benefit	Definition
Broad	Narrow	Health gains	Reduction in morbidity and mortality through vaccination
		Health care cost savings	Savings of medical expenditures because vaccination prevents illness episodes
		Care-related productivity gains	Savings of parents' productive time because vaccination avoids the need for taking care of a sick child
		Outcome-related productivity gains	Increased productivity because vaccination improves cognition, physical strength, and school attainment
		Behaviour-related productivity gains	Benefits accruing because vaccination improves child health and survival and thereby changes household behavior
		Community externalities	Benefits accruing because vaccination improves outcomes in unvaccinated community members

Adopted from Bärninghausen T, Bloom D, Canning D, O'Brien J. (2008).

Creese and colleagues grouped the benefits of immunization into five main domains which included the following: "(1) savings in treatment costs following reduced incidence of disease; (2) reductions in mortality; (3) reductions in morbidity; (4) avoidance of "intangible"costs e.g., suffering, to children and their families; (5) "external" or spill over

benefits." (Creese et al., 1980). Spill over benefits refer to the success of immunization programmes leading to strong healthcare services and in turn improved confidence in the ability to access effective healthcare. Although avoidance of pain and suffering of both child and caregiver are difficult to measure, they are still very important benefits of immunization because the quality of life is improved by their absence.

The Millennium Development Goals (MDG) are eight international development goals that have been initiated by the United Nations to improve social and economic conditions in the poor countries of the world. The MDG 4 goal is to reduce childhood mortality. The target is to reduce the under-five child mortality rate by two thirds, between 1990 and 2015. Of the 10.8 million under-five child deaths in 2000 an estimated 4.4 million occurred in Africa (Clement et al., 2008). It is estimated that close to 50 % of these childhood deaths were due to pneumonia, diarrhoea, malaria, measles and HIV/AIDS as shown in the chart below (WHO, 2003). Of the five causes mentioned above, three can be prevented by immunization. Therefore, immunization plays a significant role in reducing the under-five mortality rate; that is why immunization against measles is one of the indicators for reaching MDG 4. It is estimated that immunizations have reduced the under-five mortality by 30% (Global Alliance Vaccine Initiative (GAVI), 2011).

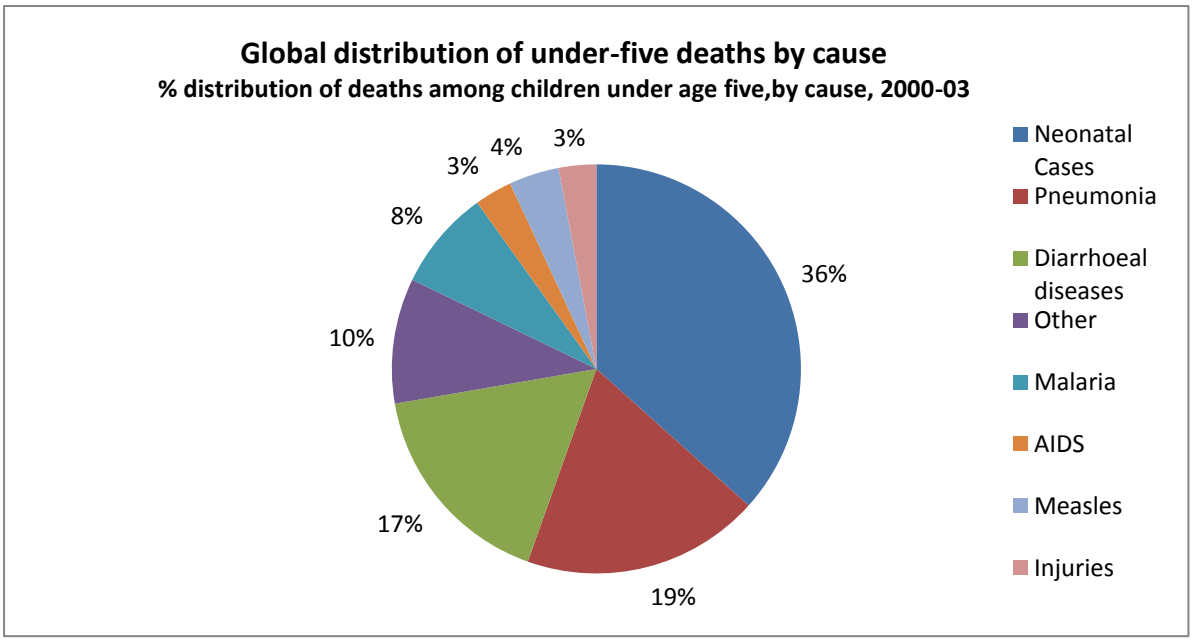

Figure 2.1: Child Health Epidemiology Reference Group (CHERG) estimates of the percent distribution of under-five deaths by cause available in the WHO World Health Report 2005

The other valuable aspect of immunization is that it can be used to identify children that are vulnerable to other conditions. Immunization clinics provide an entry point into the healthcare system. Children who come for immunizations may be vulnerable to conditions such as malnutrition and malaria; they may be infected or affected by HIV and they may be victims of domestic violence and abuse. Immunization clinics provide a good window of opportunity for such children to be evaluated and be given the appropriate care. Immunization clinics also assist healthcare practitioners to evaluate and treat caregivers who bring children for immunization. Other healthcare measures that can be given together with immunizations include growth monitoring, vitamin A, anti-helminthics, malaria prevention measures and health education on prevention of dehydration at home, HIV awareness and family planning (Clement et al., 2008).

IMMUNIZATION COVERAGE

For different reasons immunization coverage is not optimal in both developed and developing countries. Before the WHO EPI of 1974, routine immunization was mostly the privilege of people in the developed world. This EPI launch was an attempt to make immunizations available to all the world's children. Now about 75% of the world's children receive the required immunizations before the age of one year and immunization continues to save millions of children's lives all over the globe. It is estimated that three million lives are saved by immunizations each year (Miller, 2000).

The uptake of immunizations has been generally very good in the developed world. The decline in immunization uptake started in the late 1990's and it can be attributed mainly to misinformation about vaccine effectiveness and safety. For as long as immunizations have been available, so long have there been people who are against immunization. In recent years this anti-vaccination lobby that claims vaccines cause cancer, learning and developmental delays, allergies and other illnesses has gained much publicity (Mahdi et al., 2007). One of the reasons for suboptimal vaccination has been the issue of combination vaccines. The combination vaccine against measles, mumps and rubella (MMR) has in particular been blamed for causing inflammatory bowel disease and autism. There are many other combination vaccines available and while some parents are skeptical about them, most prefer them as they reduce the number of injections given to a child at a single visit (Tickner et al., 2006). The issue with combination vaccines for some parents could be that it makes it difficult to know which specific vaccine can cause unwanted side-effects if they are all given

together. In reality, the absence of major disease outbreaks due to vaccine preventable diseases are what make vaccines come under scrutiny; now that the diseases have been prevented and people no longer need to worry about them, they scrutinize the way they are being prevented.

Vaccination safety and efficacy in the developed countries has come under scrutiny due to exposure to information and religious or cultural beliefs (Mahdi et al., 2007). In general vaccines are safe and effective; most of the complaints raised against them are incorrect and are not supported by scientific evidence. It is important for health care workers to be well informed and educated to challenge misconceptions because vaccines are beneficial. With their doubts and questions, the anti-vaccination lobbyists have brought vaccine controversies into the public domain. Although this may have influenced the public domain, it does not have much influence on the scientific evaluation and surveillance of vaccinations. A vaccine for rotavirus infection was withdrawn after reports emanating from vaccine surveillance that it was associated with the development of intussusception in vaccinated children and this relationship was later confirmed in a study (Bloom et al., 2005). "Potential distrust of immunization is perhaps unavoidable because vaccines entail, on the face of it, an inversion of the healing paradigm: one goes when healthy to the clinician, who injects a substance in one's arm that causes discomfort and, in rare occasions, an actual case of illness." (Gauri et al., 2002).

The benefits of immunization are unfortunately not equally shared by all the world's children. In developing countries, the burden of infectious diseases including vaccine preventable diseases is still very high. About 24 million children around the world do not have access to basic immunizations and the majority of them are in developing countries including sub-Saharan Africa. A child in Africa has access to an average of only 6 to 8 vaccines whereas his counterpart in a first world country such as the United States of America (USA) has access to over 15 vaccines (Wiysonge et al., 2009). The reasons for lack of immunization access in the developing world are many and they have been the subject of major discussions amongst researchers.

Cost effective health care interventions such as immunizations require strong health care systems with adequate human, financial and material resources on top of good infrastructure and strong political commitment. In many African countries, resources are limited,

infrastructure is poor and planning, forecasting and monitoring of performances are weak (Clement et al., 2008) often with lacking political commitment. Many developing countries, particularly in Sub-Saharan Africa, are struggling with conflict and unstable governance. People are often displaced due to wars and ethnic violence and this can make the establishment of effective healthcare programmes very challenging in such situations. Political stability and good governance have been found to be associated with good immunization coverage (Gauri et al., 2002). Natural disasters such as famine, droughts and floods also lead to communities being displaced and not able to have access to healthcare interventions. Poor rural communities and displaced people are the most vulnerable as they are often far from fixed healthcare facilities and service delivery is often poor in these communities. This may be attributed to low education levels, high unemployment levels and apathy in these communities (Clement et al., 2008). Rural communities also tend to follow a more traditional and cultural way of life. Immunizations may be perceived as western health care and not be easily acceptable in such communities.

Acceptance of immunization has also been compromised by sub-standard immunization practices: unhygienic vaccination with the use of dirty and unsterile needles that can spread or cause disease, lack of explanation by healthcare workers or lack understanding of information by caregivers as well as healthcare workers who are without proper training and skills (Gauri et al., 2002). Unsafe immunization practices lead to reduced immunization coverage and can actually lead to disease, disability and even death.

IMMUNIZATIONS IN SOUTH AFRICA:

One of the goals of the South African national EPI goals is to achieve immunization coverage of 90% for each vaccine in the routine EPI schedule in 80% of the districts by 2005 (National Department of Health, 2005). According to the demographic health survey of 2003 by the Medical Research Council, the reported immunization coverage rate in children aged 12 and 23 months of age ranged from 62 % for measles vaccine to 81 % for Bacille Calmette-Guerin (BCG) vaccination in 2003 with the total immunization coverage rate of 79 % in that same year (National Department of Health, 2007). The immunization coverage target in South Africa is 90% for all children under one year and it is yet to be reached.

In 2007/2008 immunization coverage in rural areas was 79 % which is below the national coverage of 84 % while the average coverage in metro (urban) districts was 91 %. (Shung

King, 2009). This reflects that obvious disparities exist between rural and urban areas as far as health care service delivery is concerned and it is of great concern that health care services are lacking in poor, rural communities where they are needed most. In 2008/2009 the immunization coverage rate was just half a percent less than the target. Table 1.2 shows immunization coverage for children under one year by province from 2003 till 2009. In 2009, the target of reaching 90% immunization coverage was still not met.

Table 2.2: Immunization coverage for children under one year by province

The proportion of children under 1 year who have been fully immunised						
PROVINCE	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**
Eastern Cape	68.9	67.9	73.4	75.7	78.9	84.3
Free State	*74.8*	*78.9*	*86.8*	*88.1*	*86.6*	*90.4*
Gauteng	*79.2*	*78.6*	*88.9*	*91.1*	*91.6*	*101.5*
KwaZulu-Natal	*76.9*	*77.0*	*82.6*	*84.5*	*82.1*	*85.3*
Limpopo	*74.9*	*74.4*	*79.5*	*84.9*	*78.6*	*84.3*
Mpumalanga	*73.9*	*79.2*	*83.4*	*81.4*	*78.5*	*72.4*
North West	*71.1*	*70.6*	*78.2*	*73.5*	*77.9*	*88.7*
Northern Cape	*83.2*	*87.5*	*92.9*	*96.2*	*82.6*	*93.2*
Western Cape	*91.2*	*90.0*	*91.6*	*101.8*	*100.5*	*103.9*
South Africa	*76.4*	*76.8*	*82.9*	*85.4*	*84.2*	*89.5*

Adopted from Shung King M, HIV and Health Immunization coverage of children (2009). Children's Institute, University of Cape Town.

The under-five childhood mortality rate in South Africa was 69 per 1000 births in 2006 and is not on target to achieving the MDG 4 target of 20 per 1000 live births (Bärninghausen et al., 2008). South Africa is one of the many Sub-Saharan countries including the 15 SADEC (Southern African Development Community) countries that are not on target to achieve MDG 4 (United Nations, 2010). Even though the HIV pandemic is a major contributor to this high childhood mortality rate, immunization still plays a vital role in its reduction. The proportion of one year old children immunized against measles is an indicator for the MDG 4 and measles on its own accounts for 4 % of the under-five mortality rates. In South Africa, primary healthcare clinics are required to render a service that not only provides immunization but other healthcare interventions including vitamin A supplementation,

growth monitoring, developmental assessment, anti-helminthics, nutritional advice, dental health care, HIV/AIDS counseling and testing and the home treatment of diarrhoea with oral rehydration solution and these are all incorporated in the new child Road to Health Booklet. This new strategy is aimed at reducing the under-five mortality rate by providing comprehensive primary health care to all children in South Africa on a monthly basis from birth up to the age of 18 months.

In 2009, the South African National Department of Health added two new vaccines to the routine immunization schedule: the pneumococcal vaccine and the rotavirus vaccine. Streptococcus pneumoniae is an organism that is associated with a number of diseases with a high rate of mortality and morbidity. Furthermore, the organism is associated with the challenge of antibiotic resistance. Addition of this vaccine will not only help to reduce its associated morbidity and mortality but it will also lead to a reduction in the antibiotic requirements for treatment of its associated diseases. Diarrhoea accounts for 18% of the under-five mortality rate in the developing world (GAVI, 2011). Rotavirus infection is one of the leading causes of diarrhoeal disease and the introduction of the vaccine against Rotavirus is an important step in reducing its impact on the under-five mortality rate.

The benefits of all the healthcare changes are still to be made evident. The biggest challenge remains for government policies to reach all the children of South Africa, especially those in poor rural communities where service delivery still lags far behind.

CHAPTER 3
STUDY METHODOLOGY

STUDY SETTING:

The study was conducted in the rural village of Mmakaunyane which is in the Moretele sub-district of the Bojanala district of the North West Province of South Africa. This village is situated approximately 60 kilometers to the North West of Pretoria, the capital city of South Africa.

When the study was conducted, the total population in the village of Mmakaunyane was unknown. Attempts were made to get this information and it was obtained from Statistics South Africa (Stats SA). The population figures received form Stats SA were from Census 2001, showing Mmakaunyane to have a total population of 424. These figures were not a true reflection of the population during the study period and were therefore not used.

STUDY DESIGN:

This study was a questionnaire based cross sectional survey conducted to obtain community based information on immunization coverage and to find factors that may be associated with under immunization

STUDY POPULATION AND SAMPLING:

The study population included all children from 0 to 6 years who live in Mmakuanyane village and their primary caregivers. The sample was obtained using cluster sampling. A map of the village was obtained from the municipality and on this map the village was divided into 30 blocks and 4 clusters were selected in each block to find 5 eligible children in each cluster. This gave us a sample size of 600 children

Using a map of the area and a GPS navigation system in the car, each field worker was placed at a different block on each day of data collection. There were four trained field workers who covered an area of one block each day with the last two blocks covered on the last day. With the GPS navigation system, only the main tarred roads that enter the village were recognizable on the system. This proved a challenge to identify the blocks that were created on the map. We then had to use landmarks that were identifiable from the map to guide us in allocating the blocks. These landmarks included school and church buildings,

open fields and a sports field. Each block had to have 4 clusters starting from the first house to the left of the field worker from where they started. Where the houses were in a linear pattern, each row of ten houses formed a cluster starting from the first house to the field worker's left side where she started on that day.

Where the houses were more scattered and not following a linear pattern, the assistant started at the first house to their left from the starting area and went in a clock-wise direction from that house with 10 houses forming a cluster. In some parts of the village there were areas with fewer than 10 houses or less than 5 eligible children but they were still considered as clusters. In each cluster, the research assistant went into each and every household looking for eligible children. If there were no children in a household or there was no one at home, the research assistant would then move on to the next house until she found 5 children. In some clusters less than 5 children were found.

STUDY MEASUREMENT TOOL:

The study measurement tool was a 4 page questionnaire with 3 sections (Appendix C) and each child's Road to Health Card. The first section of the questionnaire delt with the demographic data of the primary caregivers of the children to help in assessing the socioeconomic status.

The second part of the questionnaire was about the child's immunization record. The interviewer checked the RHC for date of birth and immunization dates and entered them on the questionnaire for each child who had a RHC. Verbal reports of immunizations without RHC proof were not recorded. The third part of the questionnaire was to assess caregiver knowledge and attitude, and service delivery perceptions of caregivers with regards to immunizations. Each part of this section had 5 questions.

DATA COLLECTION:

Four research assistants were employed to administer the questionnaire to the primary care givers of the children in the study. The field workers received training on the questionnaire. These field workers were fluent in both Setswana (local language) and English. The questionnaire was translated into Setswana and administered in the language preferred by the primary caregiver (either English or Setswana). The field workers received training from the researcher about how to administer the questionnaire and how to record the vaccinations from

the Road to Health Card onto the questionnaire. To further standardize the questionnaire, the research assistants were trained on how to ask questions in order not to prompt the interviewees when they asked them questions.

Before embarking on the study, the questionnaire was piloted in the paediatric outpatient clinic at Dr George Mukhari Academic Hospital for a period of 3 days.

The research assistants were also given each a copy of the child Road to Health Card so as to familiarize themselves with it and the immunization record in particular. Each day after data collection, the field workers and the researcher checked the completeness of the data collection sheets/questionnaires and discussed any challenging experiences during field work. These included mistrust by the community with perceptions that field workers were employed by the Government to stop payment of the social and child care grants they were receiving. It was also mentioned that some community members questioned why the field workers were able to work in the community whereas the people in the community did not have employment.

DATA ANALYSIS:

Data was analyzed using SAS, Release 9.2. Descriptive analysis was done using the mean and standard deviation with frequency measures and graphs. The chi square test was used for statistical significance with results regarded as significant at a p-value of <0.05. Logistic regression analysis was used to evaluate variables that were risk factors for under-immunization.

ETHICAL CONSIDERATIONS:

Ethical approval was obtained from the Medunsa Campus Research Ethics Committee (MREC) before the study commenced. Written permission to conduct the study was obtained from the local municipality. Information leaflets were distributed in the community one week before the study. Written consent was obtained from each participant before the interview was begun. All participants remained anonymous as no names, addresses or any other information that can help identify the participant where recorded on the study questionnaire. All participants were informed that their participation was completely voluntary and that they could withdraw at anytime they wanted to. No participant withdrew once the interview was started. Each research assistant estimated that approximately less

than 25 people refused to participate in the study; the assistants were asked this question in retrospect.

Only one participant refused to show the research assistant her child's Road to Health Card but she signed consent and participated in all other aspects of the interview. The results of this study will be made available to the community through the local municipality so that necessary interventions can be made.

CHAPTER 4
RESULTS

STUDY CHILDREN

There were 567 children enrolled in the study. The mean age of the children was 30.5 months (range 2 days to 79 months). There were 290 (51.1 %) males and 275 (48.5 %) females. In two of the children the gender was not stated.

There were 16 (2.8 %) children below the age of 6 weeks; 10 (1.8 %) children were between the ages of 6 weeks and 10 weeks; 13 (2.3 %) children were between 10 and 14 weeks of age; 45 (7.9 %) were between the ages of 14 weeks to 9 months; 96 (16.9 %) were between the ages 9 and 18 months and 365 (64.4 %) were over the age of 18 months. In 22 (3.9%) of the children, the age was not stated.

Table 4.1: Age and gender distribution of the study children

	Gender n(%)			
Age	***Male***	***Female***	***Unknown***	***Total***
<6 weeks	5	11	0	16(2.8%)
6-10 weeks	6	4	0	10(1.8%)
10-14 weeks	9	4	0	13(2.3%)
14 weeks-9 months	20	24	1	45(7.9%)
9-18 months	49	47	0	96(16.9%)
>18 months	191	173	1	365(64.4%)
Age not stated	10	12	0	22(3.9 %)
Total	**290(57.1%)**	**275 (48.5%)**	**2 (0.4%)**	**567 (100 %)**

ROAD TO HEALTH CARDS

There were 522 (92.1 %) children whose caregivers were in possession of their Road to Health Cards (RHC) that were seen by the field worker. In 45 (7.9 %) there were no RHC that the field worker could identify. Reasons given for unavailable RHC were as follows (n=39):

- Card missing/lost (11)
- Card burned (4)

- Card left at school, crèche or at relative's place (21)
- Mother missing (1)
- One caregiver stated that she does not believe in immunization as she is of the Makhondo tradition. In this tradition they do not believe in nor do they practice any health practices but their own, the child therefore had no RHC (1)
- Mother refused to show us her child's RHC (1)

IMMUNIZATION STATUS OF THE CHILDREN

In total 432 children (76.2 %) were fully immunized for their age, 97 (17.1 %) were not fully immunized for their age and immunization status was unknown for 38 (6.7 %) of the children. Of the 97 children whose immunization status was in incomplete, there was a reason given in 32 (33.0 %) why their immunization status was incomplete.

The reasons given can be grouped as follows:

1. *Clinic Factors (18 ;56.3%)*

- No vaccines available at the clinic 12 (37.5 %)
- Bad attitude from health care workers 3 (9.4 %)
- Missed opportunities 2 (6.3 %)
- Distance to the clinic too far 1 (3.1 %)

2. *Caregiver factors (14 ;43.8 %)*

- Illness (caregiver) 6 (18.8 %)
- Apathy, lack of interest 6 (18.8 %)
- Employment 1 (3.1 %)
- Fear of immunization side effects 2 (6.3 %)
- Illness (child) 3 (9.4 %)

The following table (Table 4.2) and the following graph (Fig 4.1) shows immunization status of the children according to age distribution, the ages of the children are divided into immunization bands according to the SA EPI.

Table 4.2: Immunization status of the study children

Age	*Immunization status*				
	Complete	***Incomplete***	***Unknown***	***Percentage immunized***	***Total***
<6 weeks	14	0	2	87.5 %	16 (2.8 %)
6-10 weeks	8	2	0	80.0 %	10 (1.8 %)
10-14 weeks	8	5	0	61.5 %	13 (2.3 %)
14 weeks-9 months	37	7	1	82.2 %	45 (7.9 %)
9-18 months	76	17	3	73.1 %	96 (16.9 %)
>18 months	271	62	32	74.2 %	365 (64.4 %)
Age not stated	18	4	0	81.8 %	22 (3.9 %)
Total	432	97	38	76.2 %	567 (100 %)

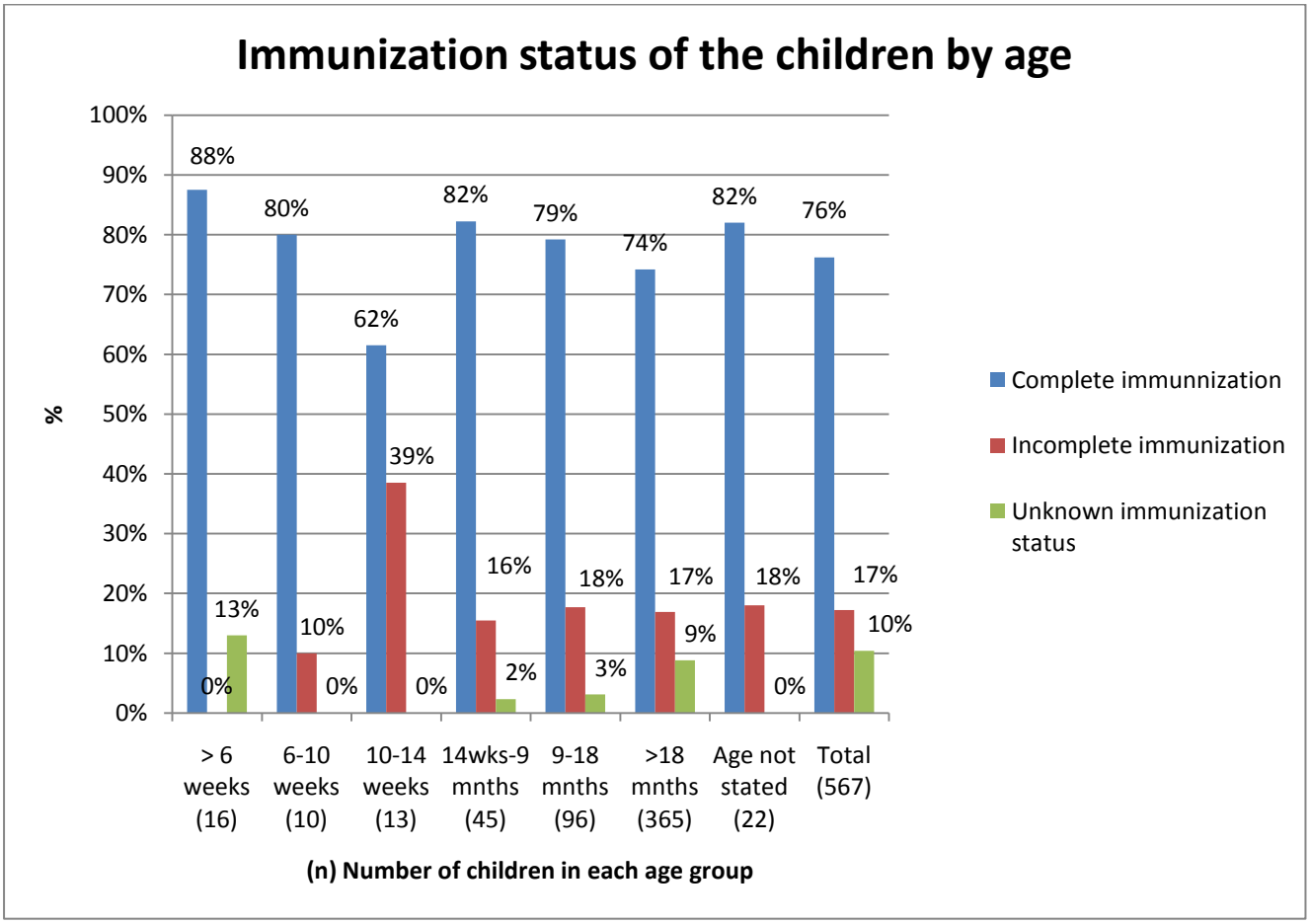

Figure 4.1: Graphic representation of immunization status of the children in the study by age group

The highest immunization coverage rate is in the smallest age group of less than six weeks at 87.5% followed closely by the children between the ages of 14 weeks to nine months at an immunization coverage rate of 82.2 %. The lowest rate was in the age group of 10 to 14 weeks at 61.5 %. The immunization coverage rate is 79.8 % for all the children from birth up to 9 months.

CAREGIVERS OF THE STUDY CHILDREN

In 78 (13.7%) of the children, the primary caregiver was not the biological mother, while the mother was the primary caregiver in 485 of the study children. Four (0.7%) of the children were cared for by their fathers, 45 (7.9%) by their grandmothers, 9 (1.4%) by their sisters and 22 (3.9%) by their aunts.

Reasons given for the caregiver not being the child's mother included mother living, working or studying away from home (54; 69%), mother ill or hospitalized (2; 2.6%), Mother dead (17; 21.7%) and unknown whereabouts of the mother for 5 (6.4%) of the children.

The demographic characteristics of the primary caregivers of the study children are summarized in table 5.4

The mean age of the primary caregivers was 30.3 years (range 16-80 years). More than 80 % of the caregivers were single, around 16% were married, and four were divorced or widowed. The marital status of the primary caregivers in nine children was unknown.

There were 210 (37.6%) children in the study who were the only preschool children in their homes, 192 of the children were one of two preschool children in their households and 111 (19.9 %) were one of three preschool children in the household while in 45 children, there were four or more preschool children in the household

Table 4.3: Demographic characteristics of the primary caregivers of the study children

Age	***n(%)***
16-18 years	20 (3.5%)
19-20 years	39 (6.9%)
21-30 years	300 (52.9%)
31-40 years	140 (24.7%)
41-60 years	51 (9.0%)
61-80 years	17 (3.0%)
Unknown	0 (0.0%)
Total	567
Relationship to Child	***n (%)***
Mother	485 (85.5%)
Father	4 (0.7%)
Aunt	22 (3.9%)
Granny	45 (8.0%)
Sister	9 (1.4%)
Unknown	3 (0.5%)
Total	567
Marital Status	***n (%)***
Single	451 (79.5%)
Married	94 (16.6%)
Divorced	4 (0.7%)
Widowed	9 (1.6%)
Unknown	9 (1.6%)
Total	567

Over 70% (402) of the children in the study received the Government Child Support Grant (GSG) while 154 (27.7 %) did not. In the case of 11 children, it was not known whether they were receiving the grant or not as the caregivers refused to answer this question.

SOCIO-ECONOMIC STATUS (SES):

To assess socio-economic status, three components in the caregiver demographics were used (Table 5.3). These included caregiver's level of education, monthly household income and type of household.

Table 4.4: Socio-economic demographics of primary caregivers in the study

Level of Education	***n(%)***
None	95 (16.8%)
Grade 0-5 (Standard 3)	164 (28.9%)
Grade 6-11 (Standard 9)	208 (36.7%)
Completed Matric or higher	87 (15.3%)
Unknown	13 (2.3%)
Total	567
Household Income per month	***n(%)***
<R500	337 (59.8%)
R501-1000	106 (18.6%)
R1001-2000	77 (13.5%)
R2001-3000	26 (4.5%)
>R3000	9 (1.5%)
Unknown	12 (2.1%)
Total	567
Type of housing structure	***n(%)***
Zinc Shack	126 (22.2%)
Mud Brick	314 (55.3%)
Brick House	113 (20.0%)
Other	0 (0.0%)
Unknown	14 (2.5%)
Total	567

Approximately 15% of the children's primary caregivers had completed matric or studied further, 17% had no formal education while 30% had elementary primary schooling and 40% had attained higher primary up to some high school education.

The caregivers of 31 children (5.6%) were employed while 524 (94%) were unemployed. Further details of the employment were not elucidated. The monthly income was very little (less than R500) in the majority of households of the participants (61%); was between R501 and R1000 for approximately 20%. Only about a fifth of all the households had more than R1000 to spend per month.

Of the study children, 126 (22.8%) lived in zinc shacks; 314 (56.8%) in mud brick houses and 113 (20.4%) in brick houses. The type of housing structure was not stated for 14 children in the study.

Each of these variables was given a weight from 1 to 4 and added together to assess socio-economic status as good, poor and very poor. This was done as follows:

SES	Type of housing	Zinc Shack	1
		Mud brick house	2
		Brick house	4
	Household income	<R500	1
		R501-1000	2
		R1001-2000	3
		R2001 or more	4
	Caregivers' education level	None	1
		Grade 0-5 (Standard 3)	2
		Grade 6-11 (Standard 9)	3
		Completed matric or higher	4

Highest possible score is a 12, lowest possible score is a three. Socio-economic status was regarded as very poor if the SES score was <4, poor if score was between five and eight and good if score was ≥ nine. Socio-economic status was found to be very poor for 86 (15.9.%) of all caregivers, poor for 381 (70.2%) of the caregivers and good for 75 (13.8%) of the caregivers.

KNOWLEDGE OF IMMUNIZATION

When asked, 535 (94.5%) of the caregivers thought that immunizations are required by law in South Africa. When asked about diseases which can be prevented by immunization 453 (79.9%) of the caregivers correctly mentioned measles, 359 (63.3%) poliomyelitis, 91 (16.0%) whooping cough, five (0.8%) diphtheria, eight (1.4%) tetanus, 87 (15.3%) diarrhoea, 10 (1.8%) Hepatitis B and 91 (16.0%) mentioned tuberculosis. Other diseases that were mentioned that could be prevented by immunizations include chicken pox, cholera, worms, and malaria, meningitis, disability, ears and eyes diseases.

Knowledge of immunization was assessed as adequate if the caregiver knew three or more diseases that can be prevented by immunizations. Three diseases were correctly mentioned by 120 (21.1%) of the caregivers, 42 (7.4%) correctly mentioned four diseases, five (0.9%) correctly mentioned five diseases and only one (0.2%) correctly mentioned six diseases that can be prevented by immunization. In total knowledge of immunization was regarded as adequate in 148 (26.1%) of the caregivers.

Possible side effects to immunizations that were mentioned by the caregivers included fever (131; 23.1%), swelling (150; 26.5%), excessive crying (205; 26.2%), diarrhoea (21, 3.7%), rash (9; 1.6%), upper respiratory tract infection (1; 0.2%), abscess (3; 0.5%), convulsions (1; 0.2%). Other side effects that were mentioned by the caregivers included dizziness, kwashiorkor, decreased appetite and sleepless nights.

Of all the caregivers 58 (10.2%) were not sure which diseases can be prevented by immunizations and 191 (33.6 %) thought that immunizations had no side effects.

The caregivers mentioned the following to be contraindications to immunizations: fever (138, 24.3%), diarrhoea (69; 12.2%), illness/infections (14, 2.5%), upper respiratory tract infection (7; 1.2%), allergy to components of some vaccines (4; 0.7%) and previous severe reaction after immunization (2; 0.5%). There were 94 (16.6%) caregivers who said that there were no contraindications to immunizations while 281 (49.5%) did not know what the contraindications to immunizations are.

There were 447 (79.2%) caregivers who received their information about immunizations from the health care worker at the clinic or hospital, 63 (11.1%) received their information

from their mother or other relatives, while 32 (5.6%) mentioned television and radio as their source of immunization information. Posters and pamphlets were mentioned by 10 caregivers (1.8%) and only one caregiver mentioned the crèche as her source of information about immunization. There were 14 caregivers who did not respond to this question.

CAREGIVERS' ATTITUDES TOWARDS IMMUNIZATION

Caregivers were asked questions about their opinions and practices regarding immunization. They were asked five questions to which they could answer "yes" or "no" or "not sure" to assess whether their overall attitude towards immunization was favorable or not.

The questions and answers were as follows for all those who responded to the questions:

- The caregivers were asked if immunizations help to keep children healthy; 546 (96.3%) answered yes, 3 (0.5%) answered no and 16 (2.8%) said they were unsure.
- Caregivers were asked if a child should still receive immunizations even if he/she was or is being treated by a traditional healer; 302 (53.5%) caregivers answered yes, 229 (40.6%) answered no and 33 (5.9%) said they were unsure.
- Caregivers were asked if a child can still receive immunizations at a later stage if they missed an immunization appointment; 472 (84.0%) answered yes, 61 (10.9%) answered no and 29 (5.2%) said they were unsure.
- Caregivers were asked if they should keep their children's immunization cards safely; 538 (96.2%) answered yes, 10 (1.9%) answered no and 11 (2.0%) said they were unsure.
- Caregivers were asked if they make any enquiries to the health care worker about the immunizations given to their children when they take them to the clinic to be immunized; 264 (46.9%) answered yes, 278 (49.4%) answered no and 21 (3.7%) were unsure.

Calculation to assess overall response:

Number of favourable responses "yes" answers: 546+302+472+538+264 = 2122

Number of total responses to the questions = 2813

Conclusion: 75.4 % of caregivers had a favourable attitude towards immunization.

CAREGIVERS' PERCEPTIONS OF IMMUNIZATION SERVICE DELIVERY

In this part of the questionnaire, caregivers where asked five questions to which they could respond with either yes, no or not sure. This was intended to assess whether they perceived the health care service delivery, particularly of immunizations, to be good or not. This was then calculated for all those who responded to the questions, as a percentage, the perception of caregivers on immunization service delivery as illustrated below.

Table 4.5: Caregiver responses to questions about immunization health care services delivery

n(%)

	Yes	***No***	***Not Sure***
a. Do you find that it is easy for you to get to a clinic that provides immunization services?	256 (46%)	295 (52%)	12 (2%)
b. Have you ever been turned away from the clinic because medication or Health Care Workers were unavailable?	211 (37%)	337 (60%)	16 (3%)
c. Have you ever had to return from the clinic without getting any help because it was too full or you were too late?	107 (19%)	442 (78%)	15 (3%)
d. the last time you took your child to the clinic for immunization did you receive full information and explanation about the immunizations form the Health Care Worker?	199 (35%)	345 (61%)	20 (4%)
e. The last time you took your child to the clinic for immunization did the health Care Worker ask any questions about your health or your child's health that were unrelated to immunization?	172 (31%)	367 (65%)	22 (4%)

Number of favourable answers (Yes to questions a, d and e; No to questions b and c): 256+337+442+199+172= 1406

Number of total answers to the questions = 2816

Conclusion: Approximately half (49.9%) of the caregivers perceived immunization service delivery in the village of Mmakaunyane to be good.

AGE OF CAREGIVER AND IMMUNIZATION KNOWLEDGE

Knowledge of immunization was regarded as knowledge of 3 or more diseases that can be prevented by immunization. Knowledge about immunization was found to be adequate in 168 (29, 6%) of all the caregivers. The table below shows caregiver knowledge of immunization by age of caregiver.

Table 4.6: Caregiver knowledge of immunization by age group

Immunization knowledge			
Age	***Good***	***Poor***	***Total***
>21 years	21 (35.6 %)	38 (64.4 %)	59
21-30 years	83 (27.7 %)	217 (72.3 %)	300
31-40 years	43 (30.7 %)	97 (69.3 %)	140
41-60 years	16 (31.4 %)	35 (68.6 %)	51
61-80 years	5 (29.4 %)	12 (70.6 %)	17
Total	168	399	567

The majority of the caregivers were in the ages between 21 and 30 years and only 83(49.4%) of these were knowledgeable on immunizations. The oldest caregivers (61-80 years) were the least knowledgeable about immunizations.

FACTORS ASSOCIATED WITH UNDER-IMMUNIZATION

The following table shows the results of a stepwise logistic regression analysis performed on the variables to determine which ones had any statistical significance as factors influencing immunization status.

Table 4.7: Results of logistic regression analysis

Complete vaccination	***p value***	***OR (CI:95%)***
Age of Caregiver	0.007	0.97 (0.95-0.99)
Gender of child (male vs. female)	0.014	1.85 (1.13-3.03)
Caregiver's knowledge (yes vs. no)	0.033	1.84 (1.05-3.25)
Socioeconomic status (good vs. very poor)	0.096	0.71 (0.71-4.06)
Age of child	0.202	1.00 (0.99-1.02)

Only three explanatory variables were found to be statistically significant for immunization status. These included age of caregiver (p = 0.007), knowledge of caregiver (p=0.033) and the gender of the child (p=0.014). There was no relationship between socioeconomic status (p=0.096), and age of child (p=0.202) with immunization status. Data analysis also showed that for each one year increase in the age of the caregiver, complete immunization decreases by 2.9%. The odds (chances) of complete immunization for age if the caregiver is knowledgeable about immunization is 1.84 times the odds if the caregiver is not knowledgeable (OR=1.84). The odds for complete immunization in a male child are 1.85 times the odds for a female child (OR=1.85)

CHAPTER 5
DISCUSSION

Our study included 567 children between zero and six years of age in whom we assessed immunization status using their RHC and interviewed their primary caregivers on their knowledge, attitudes and practices with regard to immunization. More than 60% of the children in our study were above 18 months of age, which is above the age at which they are actively attending the immunization clinic. Children between six and 10 weeks of age were the lowest in number, accounting for less than 2% of the study population.

We found an immunization coverage rate of 76.2 % in the children in our study. In South Africa, the immunization coverage rate refers to the percentage of children younger than one year who are fully immunized; meaning that they have received all the required vaccines that are given from birth up to nine months according to the SA EPI (Appendix E). The national immunization coverage rate for 2008/2009 was 89.5 % and the provincial (North West) immunization coverage rate for that same period was 88.7 % (Shung King, 2010). This national coverage rate is just half a percent short of the target set by the national Department of Health (National Department of Health, 2002)

The ages of the children in our study were divided according to immunization bands of the SA EPI. We had 84 children below one year (from 6 weeks up to 9 months) and 67 of these were fully immunized for age. This gave us an immunization coverage rate of 79.8% in this age group. The immunization coverage rate in this sub district is clearly much lower than what is reflected in the country and in the province of North-West. Even though we had only 84 children below the age of one year, this immunization coverage rate affirms our opinion that immunization coverage is lower in rural compared to urban communities. The limitation of our result is that it does not include the children who are above the age of nine months but below one year and those whose immunizations were delayed but complete.

The overall trend in the results shows decreasing immunization coverage with increasing age (Table 4.2). This finding is similar to other studies where the highest immunization coverage was for immunization given at birth and the lowest for those given at 18 months (Corrigal et al., 2008 and Ndirangu et al., 2009). In this study however, the lowest immunization coverage rate of 62% is in the age group of 10 to 14 weeks. In this age group, because immunity is still

developing, infants are prone to mild recurrent infections. Anecdotally, it is well known that health care workers are reluctant to give immunizations to infants that are ill even in mild illnesses for which immunizations should not be withheld. The low immunization rate in this age group may be due to missed opportunities; it is possible that these infants were taken to the clinic appropriately but health care workers failed to give the required immunizations. This may have been due to the health care worker's perception of illness in the infant and thus withholding due immunizations or unavailability of some or all of the required vaccines for the particular age group at the clinic. An American study found missed opportunity to be a significant barrier to immunization coverage in three months old infants (Bardenheier et al., 2004). The other reason for the low immunization coverage rate in the age group 10 to 14 weeks could be due to a slight delay in the immunization schedule. If immunization was delayed by a few weeks for an infant who is due to receive his immunizations at 14 weeks it would be incomplete according to the age band because the immunization was not given at exactly 14 weeks. Immunization is given every four weeks from six weeks to 14 weeks; because of this shorter time frame in between, immunization status will appear as incomplete if it has not been given at the exact age.

In a study done in Ethopia on immunization coverage, they found that only 41.8% of children were validly fully immunized; this was far lower than the objective of 90% immunization coverage by 1990 in that country (Kidane and Tekie, 2000). The study also reported that immunization coverage was much higher in the rural areas as compared to urban areas and this was attributed to better community mobilization (community leaders and organizations help to increase awareness in the community by spreading information) amongst the people in rural areas (Kidane and Tekie, 2000).

The immunization target in most developed nations, in accordance with the WHO recommendation is 95% in order to achieve herd immunity. In 2005 the coverage rate in the United States of America and United Kingdom were 94.3% and 90.5% respectively (Unicef, 2007). In the United Kingdom, failure to reach the WHO target was attributed to controversies around combination vaccines such as the MMR vaccine (Tickner et al., 2006).

The RHC was used to determine immunization status in the study children. In the 45 children whose caregivers could not produce a RHC, immunization status was assessed as unknown. Caregiver's recall of immunizations received by the child was not included in the

assessment of immunization status in order to avoid recall bias. This is because we included children up to the age of 6 years in the study. The length of recall for all caregivers would be anything from a few weeks to more than four years; for some caregivers this may be too long to remember accurately. It has been found in previous studies that caregiver recall and immunization record card was more accurate in determining immunization status than Immunization record alone (Corrigal et al., 2008). This is usually in children up to the age of two years.

Several reasons were given for unavailable RHC's. For most children the RHC was left at crèche or at a relative's place. It is our experience that daycare centers and crèche's require the child's RHC as a part of the admission process, probably to ensure that the child is fully immunized and does not pose a risk to other children or as proof of birth in children who do not have birth certificates. Some RHC's were reported to have been lost or burnt. Hazards such as fires are more common in informal shack dwellings where houses can become completely gutted with resultant loss of property and unfortunately, lives. There was a mother who refused to show the research assistant her child's RHC even though she agreed to participate in the study. She said that she heard of people who are investigating children who are receiving child support grants with the intention to stop these grants in children who are not worthy of them. In general, the community of Mmakaunyane was wary of the researchers in their village.Some people enquired why the researchers come to do "work" in their village when they are struggling to find jobs. It is perhaps an oversight on the part of the researchers not to employ the people from the community of Mmakaunyane to be the research assistants.

About a third of the caregivers whose children had incomplete immunizations gave reasons why this was so. We divided the reasons given by those caregivers into clinic factors and caregiver factors.

The clinic factors (no vaccines available at the clinic, bad attitude of health care workers, missed opportunities, distances to the clinic too far) are similar to those found in other studies conducted in Cape Town and Mozambique (Corrigal et al., 2008; Jani et al., 2008).

Although only one caregiver cited distance to the clinic as a reason for incomplete vaccination in this study, this reason is one that commonly contributes to decreased

immunization uptake in rural communities (Jani et al., 2008; Ndirangu et al., 2009). More often than not, people have to travel some distance to the clinic in rural areas even in those areas that are serviced by mobile clinics.

It is possible that some of the reasons given reflected suboptimal care on the part of the healthcare workers and also reflect poor service delivery. Primary health care clinics should have vaccines available at all times. Some caregivers complained that the health care workers at the clinic displayed bad attitudes or unwelcoming behaviour. This is not an uncommon complaint in our experience and there have been numerous reports in the media over the years about the ill treatment of patients by healthcare workers. A study done in obstetric units in Cape Town, South Africa (S.A.), found that nurses displayed verbally and even physically abusive behaviour towards their patients (Jewkes et al., 1998). Decreased morale due to low salaries, increased work load and shortage of staff and equipment are common problems in the health care sector of government and may be contributing to stress that can have the end result of unprofessional behavior in some healthcare workers. A study done to determine occupational stress for nurses in S.A. found that nurses experience staff shortages and potential exposure to health hazards from dealing with patients to be the most severe stressors (Rothmann et al., 2006).

In a Gambian study on immunization in rural and urban areas, it was found that rural mothers had no complaints about the health care workers and generally found them to be helpful and respectful (Cassell et al., 2006). A similar finding was expressed in a study done in Ghana (Bosu et al., 199).

With overloaded health care resources, emphasis is usually placed on more serious conditions with high morbidity and mortality such as the overwhelming epidemics of HIV, TB and other chronic diseases, this results in less attention being given to preventative health care measures such as immunization because recipients of these measures are not ill and do not therefore require urgent attention from the health care workers (Corrigal, et al., 2008).

In our study, more than 80 % of the children were cared for and living with their biological mothers. It is estimated that in 2007, 35 % of African children in South Africa were not living with any of their biological parents (Meintjes , 2010). In our study, only 14% of the children

were not living with their biological parents. Even though we found some mothers to be as young as 16 years, we did not find any child headed households.

The primary caregivers' ages ranged from 16-80 years, with more than half of them between the age of 21 and 30 years. This is an expected finding for mothers of young children to be in this age group. Over 80% of the primary caregivers were single. This is not a common finding in the rural setting. In rural areas, we expect to find the majority of people married even if the husbands are away working in urban areas. In our opinion single, young mothers are found more commonly in urban and peri urban areas. In a Gambian study they found that 98% of rural women were married compared to 89% in an urban area (Cassell et al., 2006) and a Ghanian study found mostly married women (Bosu et al., 1997). In Ethopia, a study on immunization coverage found that 94% of rural women were married compared to 78% of women living in a peri urban area (Kidane and Tekie, 2000).

Of the caregivers in our study, only every sixth had completed matric or obtained education higher than matric. Just under half (47%) of the study participants are functionally illiterate, having no formal education at all or obtaining up to only five years of formal education (Table 5.4). Estimates of functional literacy in South Africa are correlated to approximately five years of formal education (Prinsloo, 1999). With the problems facing education in this country, especially within the black population, this level of functional literacy is totally unacceptable. Education is compulsory from the age of seven years up to 15 years (Grade one to Grade nine) for all South Africans (SA Schools Act, 1996). These compulsory nine years of schooling may be what each individual requires to be functionally literate and have the capability to be health literate.

Only six percent of caregivers that were interviewed were employed. We did not ask whether being employed means formally employed caregivers who earn salaries or wages or whether employment was informal or even self employed. In South Africa, unemployment is estimated at 40 %. Amongst our study participants, unemployment is 94 %. Like most rural settings in South Africa, the people of Mmakaunyane rely on their land, animals and those people who have migrated to cities for their livelihood. Employment opportunities are limited in rural areas.

In over 60 % of the study participants, the monthly household income was below R500. The estimated poverty line is R570 per month and in 2008 about 63 % of children in South Africa (70 % in North West) were estimated to be living in poverty (Hall, 2010).

For more than half of the study participants, the type of housing structure was mud brick houses. This is the typical housing structure of rural areas where people build their own houses from bricks that they make for themselves. They are sometimes referred to as traditional dwellings and some parts of the house such at the roof may be made out of grass or sticks. These mud brick houses are not adequate as they can collapse and be swept away by heavy rain during floods. These mud bricks are bricks made from mud and are usually dried in the sun and not 'baked'. Some rural houses are also built using stones and mud. It was not asked in our study whether the participants owned the land on which they lived. This may have been an important question as ownership of land is an important asset in most societies, particularly in rural areas where the livelihood is obtained from the land itself. The demographic characteristics of participants in a Gambian study included a question on ownership of the land on which the participants were living on and in the rural area the land either belonged to the husband or wife or their extended family (Cassell et al., 2006). Zinc shacks are considered to be informal housing structures and are not adequate for their occupants as there are risks of hazards such as flooding and shack fires.

Zinc shacks are not very common in rural villages although they may be in villages that are not too far from big cities. They are also commonly used as additional rooms in some compounds. Fewer than 25 % of our study participants lived in the zinc shacks. There were 402 children in our study who were receiving the government Child Support Grant. This grant is a poverty alleviation measure by the government to help parent or caregivers who struggle to support their children. This grant was started in 1998 through the government's social welfare department with a value of R100. The grant has been increased over the years, it now applies to all children from birth to 18 years of age and currently it amounts to R280. Since its inception, there have been controversies surrounding the CSG; public opinion suggests that the caregivers are not using it for its intended purpose of helping to support children whose parents cannot afford to do so without assistance and that it is associated with an increase in teenage pregnancy.

However, It has been shown in studies that the implementation of the grant is not associated with an increase in teenage pregnancy (Makiwane and Udjo, 2006) and that this grant has actually helped families to provide for the needs of their children including education (Case et al, 2005). Almost 30 % of the children in the study were not receiving this grant. It is estimated that 682,991 children in North West province and 9,071,862 children in the whole of South Africa are receiving this grant (Hall, 2010). This child support grant is subject to eligibility on the part of the caregiver. This may explain why caregivers of 11 children refused to answer whether or not they were receiving this grant for their children. They probably feared that they may not have been eligible for this grant and that through the study we would be able to detect this and somehow stop them from receiving this grant. It is possible that because of the same reasons stated above that some caregivers answered that they are not receiving the above grant for their children when they actually are. Child poverty alleviation measures in other countries include Mexico's PROGRESA-OPORTUNIDADES; this is a cash payout to poor families with children on condition that these families make use of the state education, nutrition and health care programmes (Braine, 2006). In New Zealand, the Childcare Assistance programme offers financial assistance to low income level parents for child care of pre-school children and after school care for school going children between five and 13 years of age (Ministry of Social Development, New Zealand).

The three components of the caregiver demographics we used to assign a socio-economic status were caregiver level of education, monthly household income and type of housing structure to assign participants as having a very poor, poor or good socio-economic status. It is well known that people who are more educated have better income and living conditions than those with little or no education and are thus socio-economically better off. Education is therefore an important measure of socio-economic status; and this is why the MDG goals which are aimed at improving the socio-economic circumstance of all people around the world and end poverty include universal primary education (UN Summit, 2010). In general, we found that most people in Mmakaunyane (70 %) came out as poor on assessment of socio economic status and very few were assessed to be having a good socio-economic status. This is because just under half of the caregivers had no or very little education. Almost two thirds were living on less than R500 a month and more than three quarters were living in inadequate housing.

In a study done in Uganda, socio-economic status was assessed using multiple correspondence analysis on "possession of a TV, radio, mobile phone, chair, cupboard, refrigerator, type of toilet, type of house walls as well as presence of electricity or water in the home" to assign participants as being poor, middle income or rich (Nankabirwa et al., 2010). In an American study, they defined poverty as "an annual household income at or below the federal poverty level, a measure that takes into account income as well as the number of people in the household" (Bardenheier et al., 2004).

The results of our study reveal that caregiver knowledge of immunization was poor. Almost all respondents answered that immunization is required by law in South Africa. Although immunization is free and is recommended for all children in South Africa, it is not mandated by law and not having your children immunized is not against the law. In some countries such as Iran, immunization of children is required by law (Roodpeyma et al., 2007). It is possible that the caregivers thought that immunization is required by law because of the fact that it is free and for the majority of the people it can be accessed from public health clinics that are run by government. It may also be thought that immunization is required by law due to the fact that the RHC is required as part of the documentation for school entry and it can also be used as proof of birth for a child to acquire a birth certificate.

Measles was the vaccine preventable disease that was known by most caregivers as almost 80 % were able to mention it. More than 60 % also mentioned poliomyelitis as a vaccine preventable disease. About a quarter of the respondents could mention three vaccine preventable diseases. Other studies done in developing countries also had similar results where caregiver knowledge of immunizations or vaccine preventable disease was poor (Bosu et al, 1997; Manjunath and Pareek, 2003; Roodpeyma et al, 2007).
As most of the caregivers reported to have received their information form health care workers, it means that health education and information given by the health care workers is inadequate. It is also possible that due to low education levels, retention and understanding of the information that the caregivers receive from the healthcare workers is low.

In our clinical context, in the first 6 months of a baby's life, the caregiver is supposed to take the child for immunization and growth assessment (well baby clinic) at least five times in the primary health care clinics at two weeks, six week, 10 weeks, 14 weeks and again at six months. It is in this setting that babies are assessed for adequate growth and are given due

immunizations and other preventative health care measures such as vitamin A drops and de-worming medication. The two and six week visit are also postnatal assessment visits for the mothers. This is the platform where infant feeding and nutrition, disease preventative measures and other issues pertaining to looking after young children should be discussed between health workers and mothers. This is the platform that should be used by the healthcare workers to give health education and information.

Due to high patient volumes, staff shortages and increased numbers of patients with serious and chronic illnesses such as tuberculosis, malnutrition and HIV, health care workers are forced to attend to and care for sick patients rather than focus on disease prevention. This also leads to high stress levels and low morale amongst health care workers leading to apathy and decreased quality of care.

Our results showed that caregivers had a generally good attitude and are accepting of immunizations. Most of them agreed that immunization helps to keep children healthy and agreed that immunizations can still be given later if they were not given when they were due.

The majority of caregivers also thought that it the important to keep their children's RHC safely. We found that despite inadequate knowledge, and the low immunization coverage rate in the children, caregivers had a positive attitude towards immunization. Positive towards immunization was displayed in other studies conducted in Africa, the Middle East and Southern Asia (Adegbola et al., 2005; Jani et al., 2008; Bosu et al., 1997; Roodpeyma et al., 2007). This reveals that there is general trust of western medicine by people in rural areas even when there is little knowledge and understanding of it. People generally view health care workers as knowledgeable, and people happily practice their traditional medicine and western immunization such that when a baby is seen in a primary health care clinic for immunization she/he will be having traditional healer markings. In SA, it is often required that infants undergo protective treatment by a traditional healer before they reach one year of age in order to prevent illness and even death from illnesses known as hlogwana and thema (De Villiers and Ledwaba, 2003)

A study in Gambia showed that mothers regarded western medicine and traditional medicine as complementary and continued to use a range of healthcare providers depending on practical issues and the particular illness (Cassell et al., 2006).

The perception of immunization service delivery as experienced by the caregivers was good for only about half of the caregivers. The majority expressed that they have never been turned away from the clinic due to unavailability of medicines or healthcare workers. With regards to communication almost a third of them expressed that during their visits to the clinic, they did not receive full information about the immunizations that their children received and that the health care workers did not ask about any other health related matters pertaining to the child or caregiver on that clinic visit. In a Ghanaian study, caregivers were generally satisfied with the immunization service in their area and they appreciated being educated on child care; the timing of the immunization sessions was suitable as these have been discussed and decided upon with the community leaders; financial difficulty and transport problems were the only problems raised by caregivers in this study (Bosu et al., 1997).

We asked these questions to determine if the health care is holistic, in that the health care worker gives full information and health education during the visit and also enquires about any other health related problems in the child or caregiver during a visit. As mentioned earlier, if health care workers are overwhelmed they are more likely to deal with only the reason for the current visit in order to save time and help other patients

More than half of the respondents found it difficult to access a clinic that provides immunization services.

Accessibility to clinics, usually in terms of distance is a major issue in rural areas. The other issue with regards to accessibility would be the reliability of mobile clinic services i.e. how often does the mobile clinic come to an area might be too infrequent for the community. Distance to the nearest clinic has been found to be a major hindrance to complete immunization in a number of studies (Bosu et al., 1997; Jani et al., 2008; Ndirangu et al., 2009).

With regard to the results of logistic regression analysis, we found that the age of the caregiver, the gender of the child and caregiver knowledge of immunization were the biggest factors associated with under-immunization. Children under the care of older caregivers were less likely to completely immunized, this was similar to findings in an Iranian study

(Roodpeyma et al., 2007) but in a Mozambique study, mother's age was not seen to be associated with under-immunization (Jani et al., 2008).

It was a surprising finding that female gender was associated with under immunization. Gender discrimination against girl children is a known issue in some countries but it is not known to happen in South Africa. A long time ago it was known that girl children may be less likely to attend school because they are taught to take care of the house so they can be able to look after their husbands and homes once they are married but it is not common practice in this day and age. This may be an incidental finding. A study on the uptake of the CSG did not show gender of the child to influence uptake of this grant (Case et al., 2005).

Poor knowledge of immunization by the caregiver was found to be factor for under immunization (p-value=0.03). Even though caregivers have limited knowledge about immunization, most agree that it is necessary and it helps to keep children healthy. In a study in rural Ghana, mothers knew less than three vaccine preventable diseases or exaggerated the health benefits of immunization (Bosu et al., 1997). This shows that better knowledge of immunization can greatly improve immunization coverage. Poor caregiver knowledge reflects on the education level of the caregivers and on the health care providers.

Good quality health education on immunization should lead to improved immunization in caregivers who accept immunization as necessary for child health and also, better educated caregivers would be able to listen and retain better information that they receive from healthcare workers.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

The majority of the children in our study were above the age of 18 months. This means that at the time of our study, more than 60% the study participants were not actively participating in the routine immunization program according to the SA EPI.

The majority of the children that participated in our study were in possession of a RHC (92%), and we were thus able to check and confirm their immunization status. The immunization coverage rate in our study is much lower than national and provincial rates. This rate of just over 76% is not enough to achieve herd immunity and confer protection to unimmunized children in this population. The recommended immunization coverage to achieve herd immunity is 95% according to the WHO.

There were a number of factors that we found to be responsible for this low immunization rate. Reasons given by caregivers for incomplete immunization of their children included both caregiver (44%) and clinic (56%) factors. Caregiver factors included illness of both the child and the caregiver, fear of immunization side-effects, lack of interest and being employed. Clinic factors included unavailability of vaccines at the clinic, bad attitude of the health care workers, missed opportunities and clinic distance being too far. Half of the caregivers in our study were not satisfied with immunization health care service delivery. Even though our findings reflected caregiver knowledge of immunizations to be poor (29%) including immunization preventable diseases, immunization side-effects and immunization contraindications, they displayed a good attitude towards immunization and believed that it is necessary to keep children healthy. Knowledge of immunization for most caregivers was obtained from healthcare workers and was found to be poorest in the oldest caregivers. Poor knowledge of immunization, advancing age of caregiver and female gender of the child were found to be associated with incomplete immunization.

The socioeconomic circumstances of the caregivers in this study were generally poor including low education levels, inadequate housing and low monthly household income in close to 80% of the participants.

Even though knowledge of immunization amongst the care givers was poor, the fact that they believed that immunization is useful to keep their children healthy means that with better immunization education, the immunization rate can be greatly improved. It is important that caregivers have a clear understanding about which diseases can be prevented by immunizations, about the side effects and also the contraindications thereof. It is the responsibility of the health care providers to give the caregivers correct information and educate them on immunization and other health care measures. Healthcare workers themselves need to be educated and have the correct information to give to the community.

To improve immunization coverage in this village, the health care workers need to raise awareness and sensitize the community about the value and importance of immunization. Together with some volunteers from within the community, they should go into the community to educate, inform and advise the public on issues of immunization. The health care workers can target places such as church gatherings, ante natal clinic visits, pay points for social grants and other places where there are community gatherings. This can be done in the form of talks, posters and pamphlet distribution. An immunization campaign will also be very beneficial in this community. Such a campaign can involve the health care workers going into the community and giving children a variety of outstanding immunizations. Immunization points can be set up around the village where the caregivers can take their children to receive immunizations. The points can be set up in different parts of the village on a weekly basis. This campaign can be done over one month since this is not a big village. Health care workers should also attend vaccinators' workshops so they can improve their knowledge and skills. Adequate training of health care workers will lead to better immunization practices and this will help to reduce missed opportunities and incorrect immunizations.

The problem of staff shortages, of despondent and demoralized healthcare workers is a common one in our society. More healthcare workers need to be trained and the government must make means to retain already qualified healthcare personnel in the public healthcare system. Healthcare workers need to be able to work under pressure without compromising patient care while dealing with overwhelming patient numbers. Given all these demands and complexities of their job, it is only fair that they are remunerated adequately. Half of the caregivers in our study were not satisfied with immunization health care service delivery. In South Africa, community health centers and clinics are under the authority of the

municipalities; which have been marked by underperformance, corruption and service delivery protests. Improvement of immunization health care delivery is not isolated from overall service delivery of the basic needs in a community such as piped water, basic sanitation, and proper housing. These are the challenges that the communities are facing and it is up to the authorities including national, provincial and local government to see that the needs of the people they serve are met.

Efforts to improve healthcare service delivery include a number of issues that the minister of health continues to engage with. These include a shift from hospital centered care to primary health care with emphasis on disease prevention. Two new vaccines were added to the immunization schedule in April 2009. The new RHC has been improved to a booklet form which includes comprehensive information about the child including growth, immunizations, oral health, HIV exposure and infection and child development. Other measures to improve health care include the training of mid-level medical workers, training of more nurses, improving working conditions of healthcare workers and dealing decisively with corruption and under-performance (South African National Department of Health, 2011).

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APPENDICES

APPENDIX A

MEDUNSA CONSENT FORM

Statement concerning participation in a Research Project

Name of Study: CHILDHOOD IMMUNIZATION AT MMAKAUNYANA VILLAGE, NORTH WEST PROVINCE OF SOUTH AFRICA

I have read the information on the aims and objectives of* the proposed study and was provided the opportunity to ask questions and given adequate time to rethink the issue. The aim and objectives of the study are sufficiently clear to me. I have not been pressurized to participate in any way.

I understand that participation in this. Study is completely voluntary and that I may withdraw from it at any time and without supplying reasons. This will have no influence on the regular treatment that holds for my condition neither will it influence the care that I receive from my doctor.

I know that this Study has been approved by the Medunsa Research Ethics Committee. I am fully aware that the results of this results of this Study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this Study

---------- ----------

Name of patient/volunteer Signature of patient or guardian.

---------- ---------- ----------

Place. Date. Witness

Statement by the Researcher

I provided verbal and written information regarding this Study as best as I am able. I will adhere to the approved protocol.

---------- ---------- ----------

Name of Researcher Signature Date

Place

MOMELLO YA A

UNIBESISTI YA LIMPOPO (Medunsa campus)

TOKOMANA YA TUMELANO KA KUTLWISISO

Setlogo sa thuto-patlisiso: MOENTO WA BANA MO MOTSENG WA MMAKAUNYANA PROFENSENG YA BOKONE BOPHIRIMA MO NAGENG YA AFRIKA BORWA

Ke buisitse maitlhomo le maikaello a thuto-patlisiso e. ke filwe tetla ya go botsa dipotso le nako ya go ikakanya pele ke tsaa tshwetso, Maitlhomo le maikaello a patlisiso e, ke a tlhaloganya mo go kgotsofatsang. Ga ke a pateledіwa ka gop go dumela gore ngwanake a tseye karolo.

Ke thaloganya gore go tsaya karolo ga ngwanake ke ka go ithaopa, le gore ke ka mo gogela morago nako nngwe kwa ntle ga go fa lebaka. Se se ka se kgoreletse kalafi e a e amogelang ya ka metlha, le gore ga se na go fetola tlhokomelo ya ngaka ya gagwe ya ga jaana.

Ke thaloganya gore thuto-patlisiso e, e reboletswe tiriso ke komiti ya tsa Diphasalatso ya tsa pholo le tsa Setho a MEDUNSA. Ke tlhaloganya sentle gore dipholo tsa patlisiso e di ka dirisediwa tsa saense, legone go ka phasaladiwa. Ke dumela le se, fa fela ke tiisediwa gore tsotlhe ka ga me le ba go ngwanake e ya go nna sephiri.

Ke ithaopa gore ngwanake a tseye karolo

Leina La Motsadi/Motlhokomedi	SAENA	LETLHA

LEFELO	PAKI

MAIKANO A MMATLISISO

Ke file tshedimosetso e e kwadilweng/ya molomo ka ga thuto-patlisiso e. ke dumela go tla araba dipotso tsotlhe tse di amanang le patlisiso e ka moo ke ka kgonang. Ke solofetsa go tshegetsa tsotlhe tse di anamang le patlisiso e go ya ka moo e letleletswengka teng.

LEINA LA MMATLISISI	SAENA	LETLHA

APPENDIX B

CHILDHOOD IMMUNIZATION AT MMAKAUNYANA VILLAGE, NORTH WEST PROVINCE OF SOUTH AFIRICA

Participant information leaflet

1. **Introduction**
   My name is Dr Kgomotso Sehume. I am post graduate student in the Department of Pediatrics and Child Health at the University of Limpopo (Medunsa campus). I am conducting a research study as part of my studies towards obtaining my degree. You are invited to participate in this research study that will take place in your community. This information leaflet will help you to decide if would to participate in this study. It is intended for you to fully understand what is involved and will be required of you before you decide to participate in the study. If you have any questions that are not fully explained in this information leaflet, you are welcomed to ask the interviewer. You should be completely happy with the information given to you before you agree to take part.

2. **Purpose of study**
   This study intends to determine whether the children in our community, those 6 years and under in particular are immunized according to the Expanded Programme of Immunization of South Africa. In addition the study aims to identify factors that affect immunization coverage including parental/caregiver attitudes towards immunization.

3. **What the study involves**
   Should you decide to participate in this study, you will be required to participate in a questionnaire interview about yourself and child. Questions about you and your child's age, level of education, household income, marital and employment status will be asked by the interviewer. The information on your child's Road to Health Card about the vaccines he/she has received will be required as well. This study only involves personal interviews with the parent or caregiver to children six years and younger. Participants will not be subjected to any invasive tests.

4. **Ethical considerations**
   Permission to conduct this study has been requested and granted by the Medunsa Research Ethics Committee (MREC). Permission has also been requested from the Moretele Local Municipality and has granted. As it has already been indicated above participants will not be subjected to any invasive tests.

   Costs: All expenses for this study will be incurred by the researcher and not the participants. Participants will not receive any re-numeration for taking part in this study.

5. **Benefits of this study**
   This will give information on the status of immunization in this village. It will further help us to understand what can be done to improve the immunization of children in your community and thus prevent debilitating disease and death in the community.

6. **Participant Rights**
   Participation in this is entirely voluntary and participants can withdraw at any point should they wish to do so without giving any reason.

7. **Confidentiality**
   All information obtained in this study will be treated with the strictest confidence and no participant name or that of their child will be recorded on any of the forms used. Data which be reported will not include any information which will identify you or your child as a participant in the study.

   Researcher and contact person: Dr K L Sehume, Department of Paediatrics and Child Health, MEDUNSA Campus, University of Limpopo
   Contact No: 012 521 4444/ 082 567 6746

MOMELLO B

Tokomane Ya Tshedimosetso

MOENTO WA BANA MO MOTSENG WA MMAKAUNYANA PROFENSENG YA BOKONE BOPHIRIMA MO NAGENG YA AFRIKA BORWA

Matseno:
Ke nna Ngaka Kgomotso Sehume. Ke dira mo lefapheng la tsa pholo ya bana mo Unibesiti ya Limpopo mo Medunsa. Ke dira thuto patlisiso ga go lekanyetsa go entiwa ga bana lemebaka a a thibelang go entiwa ga bana. Ke go laletsa go nna mongwe wa ba tsaa karolo mmogo le ngwana kgotsa bana bagago mo thuto patlisiso e. tokomane e ya tshemosetso eya go go thusa go tsaa karolo. Fa onale dipotso tse di sa arabegang ka botlalo mo tokomaneng e, o letlaletswe gobotsa mmotsolotsi. O tshwanetse wa bo o kgotsofaditswe ke tshedimosetso e o e filweng pele o dumela gore lenne ba tsaa karolo.

Maikaelo a thuto patlisiso:
Patlisiso e e ikemiseditse go lekanyetsa gore bana bothle, bogolo segolo ba dingwaga tse 6 go ya kwa tlase, ba entilwe go ya ka Lenaneo le le katolositsweng la moento la Afrika Borwa. Godimo ga moo, patlisiso e ikaella go batlisisa le go lemoga mabaka a a kgoreletsang go entiwa a akaretsa kitso le maikutlo a batsadi/bathlokomadi ka ga moento.

Thuto patlisiso e akaretsa eng:
Ga o ka tsaya tshwetso ya gore wena le ngwana/bana bagago le tsee karolo mo patlisong e, o ya kopiwa go araba tokomane ya dipotsolotso ka gagago le ka ga ngwana/bana bagago. Dipotso di akaretsa dijara tsa gago le ngwana, maemo a gago a thuto, maemo a letseno a lelapa la gago, ka ga nyalo le gore a oa dira, di ya go bodiwa ke mmotsolotsi. O ya go kopiwa karata ya ngwana ya tliniki gore re bone phithlello ya meento e elaotsweng. Patlisiso e e ama fela batsadi kgotsa ba thlokomedi ba bana ba ko tlase ga dingwaga tse 6. Ga go dithlathlobo dipe tse di fapogileng tse ditla dirwang mo baneng kgotsa batsadi.

Ka ga tsa setho
Tumella ya go tsweletsa patlisiso e e kopilwe ya boya fewa ke komiti ya tsa Dipatlisiso le Diphasalatso ya tsa setho ya MEDUNSA. Jaaka ke umakile fa godimo fa, batsaya – karolo ga ban a go baona ditlhatlhabo dipe(tse di fapogileng)

Ditshenyegelo
Ditshenyegelo tsothle mabadi le thuto patlisiso di ya go nna maikarabelo a mmatlisiso e seng motsaya karolo.

Dipoelo
Thuto-patlisiso e e ya go rethusa go itse fa moerito o fitlhella ngwana mongwe le mongwe mo lefelong le. E ya go re thusa gape go tlhaloganya ae ae ka dirwang go tokafatsa maemo a go entiwa fa bana mo motseng o gore go thibelwe go anama ga malwetsi le go bakega ga maso mo motseng o. Ga o solofediwe dikatso dipe o le motsaya-karolo

Ditokelo tsa motsaya-karolo
Go tsaya karolo mo thuto-patisiso e ke ka go ithaopa, e bile, o ka gogela ngwana wagago morago nako nngwe le nngwe fa o batla ntle la go fa lebaka**.**

Khupamarama/bosehiri
Tshedimoserso yotlhe ka ga thuto-patlisiso e ya go tsholwa e le sephiri se se tseneletseng. Leina la gago le la ngwana ga le ye go tlhagella ka gope mo tokomaneng efe kappa efe e e diriswang. Diphitlhello tse di tla begwang ga di kitla di go senola kgotsa ngwana wagago o le motsaya-karolo mo thutu-patlisisong.

Tsa go ikgolaganya:
Ngaka K.L. Sehume. Lefapha la Tlhkomelo-pholo ya Bana mo University ya Limpopo (Medunsa campus)
MOGALA:012-521 4444/082-567 6746

BLOCK NO	
HOUSEHOLD NO	
CHILD NO	

APPENDIX C

CHILDHOOD IMMUNIZATION AT MMAKAUNYANA VILLAGE NORTH WEST PROVINCE OF SOUTH AFRICA

STUDY QUESTIONNNAIRE

Questionnaire No: _____ Date of interview: _____

A. CAREGIVER INFORMATION

1. Age of caregiver: _____

2. Relationship to child: _____

   If not mother, Reason: _____

3. Number of children in household (<Pre School): 1 | 2 | 3 | 4 or more

4. Marital status: Single[1] | Married[2] | Divorced[3] | Widowed[4]

5. Level of Education: None[1] | Grade 0 – Grade 5 (Std 3)[2] | Grade 6 – Grade 11[3] | Complete Matric or higher[4]

6. Employment status: Employed[1] | Unemployed[2]

7. Monthly Household income :< R500
   R 501 - R1000
   R1001- R2000
   R2001- R3000
   >R3000

8. Type of household: Zinc Shack[1] | Mud Brick[2] | Face brick/Plastered house[3] | Other[4]

9. Is the child receiving a child support grant?

   Yes[1] | No[2]

B. Road to Health Card information:

1. Date of Birth: _____ Age of child: _____

2. Gender: Male[1] | Female[2]

3. is the RHC available? Yes[1] | No[2]

   If not, reason _____

4. Immunization Record:

Age	Vaccine	Date given	Reason for late/missed vaccine
Birth	Polio 0		
	BCG		
6 Weeks	Polio 1		
	RV 1		
	DTaP-IPV//Hib 1		
	Hep B 1		
	PCV_7 1		
10 Weeks	Polio 2		
	DTaP-		
	IPV//Hib 2		
	Hep B 2		
14 Weeks	RV 2		
	DTaP-IPV//Hib 3		
	Hep B 3		
	PCV_7 2		
9 Months	Measles Vaccine 1		
	PCV_7 3		
18 Months	DTap-IPV//Hib 4		
	Measles Vaccine 2		
6 Years Both boys and girls	Td Vaccine		
12 Years Both boys and girls	Td Vaccine		

Has this child been fully immunized for their age according to the SA EPI Schedule

Yes[1]	No[2]

C.

1. Caregiver/Parental knowledge of immunizations

a. Childhood immunization is required by law in South African (interviewer does not prompt)

Yes[1] No[2] Not sure[3]

b. Which diseases can be prevented by immunization (interviewer does not prompt)?

Measels [1] Polio [2] Whooping cough [3] Diptheria [4] Tetanus [5] Diarrhoea [6]

Hepatitis B [7] H. Influenza type B [8] Tuberculosis [9] Pneumonia [10] Not sure [11]

Other (specify): _____

c. What are the possible side effects of immunization (interviewer does not prompt)?

Fever [1] Swelling [2] Diarrhoea [3] Rash [4] URTI [5] Convulsion s [6] Abscess formation [7]

Excessive crying [8] Not Sure [9] No Side Effects [10]

Other (specify):_____

d. What are the contra-indications to immunization (interviewer does not prompt)?

Egg allergy [1] URTI [2] Diarrhoea [3] HIV Infection [4] If healthcare worker say so [5]

Fever [6] Previous severe reaction after immunization [7] Allergy to components of vaccine [8]

None [9] Not Sure [10]

Other (Specify): _____

e. Where did you receive information regarding immunization (interviewer does not prompt)?

Health care worker [1] Mother [2] Granny [3] Neighbour [4]

Television [5] Radio [6] Poster/pamphlets [7]

2. Caregiver/Parental attitudes towards immunization

a. Vaccinations help our children to stay healthy?

Yes[1] No[2] Not sure[3]

b. A child who has been treated or is under treatment by a traditional healer should still receive immunization:

Yes[1] No[2] Not sure[3]

c. The last time you took your child to the clinic for immunizations, did you ask the healthcare worker questions regarding the immunization your child/children received?

Yes[1] | No[2] | Not sure[3]

d. If your child missed an immunization appointment can he/she still receive immunizations at another visit to the clinic?

Yes[1] | No[2] | Not sure[3]

e. Should you keep your child's immunization record card safely?

Yes[1] | No[2] | Not sure[3]

3. Immunization Health Care Service Delivery:

a. Do you find that it is easy for you to get to a clinic or health care centre that provides immunization services?

Yes[1] | No[2] | Not sure[3]

b. Have you ever been turned away from the clinic or health care centre because vaccines, medication or health care workers were unavailable?

Yes[1] | No[2] | Not sure[3]

c. Have you ever had to return from the clinic or health care centre without getting any help because it was too full or you were too late?

Yes[1] | No[2] | Not sure[3]

d. The last time that you took your child to the clinic for immunization, did you receive full information and explanation about the vaccines that your child received from the health care worker?

Yes[1] | No[2] | Not sure[3]

e. The last time that you took your child to the clinic for immunization, did the health care worker ask you any questions about your child and your own health that were unrelated to the immunization?

Yes[1] | No[2] | Not sure[3]

BLOCK NO	
HOUSEHOLD NO	
CHILD NO	

MOMELLO YA D

MEENTO YA BANA MO MOTSENG WA MMAKAUNYANA MO PROFENSENG YA BOKONE BO PHIRIMA NAGENG YA AFRIKA BORWA

TOKOMANA YA DIPOTSOLOTSO

Nomoro ya potsolotso:_____ Letlha la dipotsolotso: _____

A. TSHEDIMOSETSO KA GA MOTLHOKOMEDI

1. Dingwaga tsa motlhokomedi: _____
2. Tsalano le ngwana: _____Fa o se mmangwana, faa lebaka: _____
3. Palo ya bana mo lelapeng (<ba khereche): 1 | 2 | 3 | 4 le go feta
4. Maemo a nyalo: Gaoanyalwa[1] | O nyetswe[2] | O tlhadile[3] | O motlhologadi[4]
5. Maemo a thuto: Gao a | Ofitlhile mophato wa 3[2] | Ofitlhile garata ya 3-5[3] | Garata ya 6-11[4] | O phasitse matiriki kgotsa go feta[5]
6. ka ga go thapiwa: Oa dira[1] | Gao dire[2]
7. Letseno la kgwedi la lelapa: Tlase ga:

   R500
   R 501 - R1000
   R1001- R2000
   R2001- R3000
   Go feta: R3000
8. Mofuta wa bonno/bodulo: Mpantji[1] | Ntlo ya mmu[2] | Ntlo ya setena[3] | Mofuta
9. A ngwana o amogela modende wa bana? Ee[1] | Nnyaa[2]

B. Road to Health Card information:

1. Date of Birth:_____Age of child: _____
2. Gender: Male[1] | Female[2]
3. is the RHC available? Yes[1] | No[2]

   If not, reason _____

4. Immunizations Record:

Age	Vaccine	Date given	Lebaka la gore moento o latelwe kgotsa o seke wa fiwa
Birth	Polio 0		
	BCG		
6 Weeks	Polio 1		
	RV 1		
	DTaP-IPV//Hib 1		
	Hep B 1		
	PCV_7 1		
10 Weeks	Polio 2		
	DTaP-2		
	IPV//Hib 2		
	Hep B 2		
14 Weeks	RV 2		
	DTaP-IPV//Hib 3		
	Hep B 3		
	PCV_7 2		
9 Months	Measles Vaccine 1		
	PCV_7 3		
18 Months	DTap-IPV//Hib 4		
	Measles Vaccine 2		
6 Years Both boys and girls	Td Vaccine		
12 Years Both boys and girls	Td Vaccine		

Has this child been fully immunized for their age according to the SA EPI Schedule

Yes[1]	No[2]

C.

1. Kitso ya motsadi/mothlokomedi ka ga moento

a. Ke molao wa naga eno ya Afrika Borwa gore bana bothle ba entiwe

Ea[1] | Nyaa[2] | Ga ke gopole[3]

b. Ke malwetsi a feng a a ka thibelang ke moento?

Mmoko [1] | Jwa kgolafalo ya marapo [2] | Khookhoo [3] | Mometso o mosweu [4] | Tetanus [5]

Letshollo[6] | Hepatitis B [7] | Mokgothlwane wa mofuto wa B [8] | TB [9] | Numonia [10] | Gake itse [11]

Tsedingwe (faa dikao): _____

c. Ditlamorago tse di kgonagalang tsa moento ke dife?

Gororomela [1] | Goruruga [2] | Letshollo [3] | Bogwata [4] | Go tswaetsega ga mometso | Di fitsi [6]

Lethopa [7] | Go lla thata [8] | Ga ke itse [9] | Ga gona ditlamorago [10]

Tse dingwe(faa dikao): _____

d. ke ditsupetso dife tse digananang le moento:

Go se amogelesege ga mae mo mmeleng | Tshwaetsego ya mometso | Letshollo [3] | Tshwaetso ya HIV [4]

Fa motlamedi wa tsa pholo a rialo [5] | Go roromela [6] | Tshupo e e masisi e e tlhageletseng morago ga goentiwa [7]

Go se amogelesege ga melemo ya moento [8] | Ga dio [9] | Ga ke itse [10]

Tse dingwe(faa dikao): _____

e. Naa o ke reile kae tshedimosetso ka ga tsa moento?

Mothlamedi wa tsa pholo [1] | Mme [2] | Koko [3] | Moagisane [4]

Television [5] | Radio [6] | Poster/phamplets [7]

2. Ditiro le maikaelelo a motsadi/mothlokomedi mababi le moento

a. Meento e thusa go tshola bana ba itekanetse.

Ea[1] | Nyaa[2] | Ga ke gopole[3]

b. Ngwana o ileng a nna kgotsa o a leng ka fa tlase ga tholokmelo ya nyaka ya Setswana o santse a tshwanetse go amogela moento:

Ea[1] | Nyaa[2] | Ga ke gopole[3]

c. La bofelo fa o ne o isitse ngwana wagago tlniking go entiwa, a one wa botsa mothlamedi wa tsa pholo dipotso mabapi le meento e ngwana wag ago a e entilweng?

Ea[1] | Nyaa[2] | Ga ke gopole[3]

d. Ga ngwana a ka thlaela ke tshono ya go entiwa naa a kanne a ya go entiwa mo motsati a a latelang?

Ea[1]	Nyaa[2]	Ga ke gopole[3]

e. A naa otshwanetse go tshola karata ya ngwana gago ya moento e babalesegile

Ea[1]	Nnyaa [2]	Ga ke tsware sentle[3]

3. Mabapi le tsa go fithlela tsa pholo le meento

a. A go bonolo gore o kgone goetela tliniki kgotsa lefelo la tsa pholo le le fang moento?

Ea[1]	Nnyaa [2]	Ga ke tsware sentle[3]

b. A o kile wa palelwa ke go bona thuso kwa tliniking gonne go sena melemo, meento, gotsa bona bathlamedi ba tsa pholo?

Ea[1]	Nnyaa [2]	Ga ke tsware sentle[3]

c. A o kile wa palelwa ke go bona thuso kwa tlinking gonne go ne go tletse kgotsa one o le thari?

Ea[1]	Nnyaa [2]	Ga ke tsware sentle[3]

d. La bofelo fa o ne o isitse ngwana wa gago tliniking go entiwa, a mothlamedi wa tsa pholo o ne a go fa thlaloso e e tletseng ka ga meento e a e fileng ngwana wa gago?

Ea[1]	Nnyaa [2]	Ga ke tsware sentle[3]

e. La bofelo fa one o isitse ngwana wag ago tliniking go ya go entiwa a mothlamedi wa tsa pholo one a go botsa dipotso mabapi le go itekanela ga ngwana le go itekanela ga gago, go sa amaneng le moento?

Ee [1]	Nnyaa[2]	Ga ke tsware sentle[3]

APPENDIX I

UNIVERSITY OF LIMPOPO
Medunsa Campus

P O Medunsa
Medunsa
0204
SOUTH AFRICA

Tel: 012 - 521 4000
Fax: 012 - 560 0086

MEDUNSA RESEARCH & ETHICS COMMITTEE

CLEARANCE CERTIFICATE

MEETING: 08/2009

PROJECT NUMBER: MREC/M/152/2009: PG

PROJECT :

Title: Childhood Immunization in Mmakaunyana village in the North West Province of South Africa.

Researcher: Dr K Sehume
Supervisor: Prof FPR de Villiers
Department: Paediatrics
School: Medicine
Degree: MMed Paediatrics

DECISION OF THE COMMITTEE:

MREC approved the project.

DATE: 06 October 2009

RESEARCH & PARTNERSHIP
2009 -10- 06
MEDUNSA CAMPUS

PROF N EBRAHIM
DEPUTY CHAIRPERSON MREC

Note:
I) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
II) The budget for the research will be considered separately from the protocol.
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

APPENDIX E

Expanded Programme on Immunisation – EPI (SA)
Revised Childhood Immunisation Schedule from April 2009

Age of Child	Vaccines needed	How and where is it given?
At Birth	BCG Bacilles Calmette Guerin	Right arm
	OPV (0) Oral Polio Vaccine	Drops by mouth
6 Weeks	OPV (1) Oral Polio Vaccine	Drops by mouth
	RV (1) Rotavirus Vaccine	Liquid by mouth
	DTaP-IPV//Hib (1) Diphtheria, Tetanus, acellular Pertussis, Inactivated Polio Vaccine and *Haemophilus influenzae* type b Combined	Intramuscular / Left thigh
	Hep B (1) Hepatitis B Vaccine	Intramuscular / Right thigh
	PCV7 (1) Pneumococcal Conjugated Vaccine	Intramuscular / Right thigh
10 Weeks	DTaP-IPV//Hib (2) Diphtheria, Tetanus, acellular Pertussis, Inactivated Polio Vaccine and *Haemophilus influenzae* type b Combined	Intramuscular / Left thigh
	Hep B (2) Hepatitis B Vaccine	Intramuscular / Right thigh
14 Weeks	RV (2) Rotavirus Vaccine*	Liquid by mouth
	DTaP-IPV//Hib (3) Diphtheria, Tetanus, acellular Pertussis, Inactivated Polio Vaccine and *Haemophilus influenzae* type b Combined	Intramuscular / Left thigh
	Hep B (3) Hepatitis B Vaccine	Intramuscular / Right thigh
	PCV7 (2) Pneumococcal Conjugated Vaccine	Intramuscular / Right thigh
9 Months	Measles Vaccine (1)	Intramuscular / Left thigh
	PCV7 (3) Pneumococcal Conjugated Vaccine	Intramuscular / Right thigh
18 Months	DTaP-IPV//Hib (4) Diphtheria, Tetanus, acellular Pertussis, Inactivated Polio Vaccine and *Haemophilus influenzae* type b Combined	Intramuscular / Left arm
	Measles Vaccine (2)	Intramuscular / Right arm
6 Years (Both boys and girls)	Td Vaccine Tetanus and reduced strength of diphtheria Vaccine	Intramuscular / Left arm
12 Years (Both boys and girls)	Td Vaccine Tetanus and reduced strength of diphtheria Vaccine	Intramuscular / Left arm

* Rotavirus Vaccine should NOT be administered after 24 weeks.