PREVALENCE AND DETERMINANTS OF CHILDHOOD VACCINATION COVERAGE AT SELECTED PRIMARY HEALTH CARE FACILITIES, BUSHBUCKRIGDE SUB-DISTRICT, MPUMALANGA PROVINCE, SOUTH AFRICA

by

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MINI-DISSERTATION

Submitted in Partial fulfilment of the requirements for the degree of

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DECLARATION

"I declare that the mini-dissertation hereby submitted to the University of Limpopo, for the degree of Master of Public Health, **PREVALENCE AND DETERMINANTS OF CHILDHOOD VACCINATION COVERAGE AT SELECTED PRIMARY HEALTH CARE FACILITIES, BUSHBUCKRIDGE SUB-DISTRICT, MPUMALANGA PROVINCE, SOUTH AFRICA** has not previously been submitted by me for a degree at this university or any other university, that it is my work in design and in execution, and that all the materials used here has been acknowledged".

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Pilusa Thabo Difference **Date**

DEDICATION

I dedicate this study to my special wife Metro Pilusa, my lovely daughter Mmathabo , my son Truth and my mother Reina Pilusa, my father Jackson Pilusa, for supporting me throughout this study process. I would like to assure them that I will always love them and I am grateful to have them in my life.

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This mini-dissertation would not have been possible without roles played by the following influential people and my special thanks go to them:

- Dr Maimela, my great supervisor for supervising, advising and guiding me through the period of my study;
- Dr Ntuli, co-supervisor for advising and guiding me.

DEFINITION OF CONCEPTS

Immunization

The process of inducing immunity by administering an antigen to allow the immune system to prevent infection or illness when it subsequently encounters the same pathogen (Marshall, Warrington, Watson & Kim, 2018). In this study, immunization is a process in which a fluid like substance is injected in a child body or given orally for protection and prevention of infections.

Fully Immunized Child

According to the World Health Organization (WHO) guidelines, a child is fully immunized with all basic vaccinations if the child has received Bacillus Calmette-Guerin (BCG) vaccine against tuberculosis at birth; three doses each of polio and pentavalent (diphtheria-tetanus-pertussis-hepatitis B (Hep), Haemophilus influenza type B (Hib) vaccines at 6, 10 and 14 weeks of age; and a vaccination against measles at 9 months of age. Pneumococcal conjugate vaccine (PCV) given in three doses (6, 10 and 14 weeks) (Mutua, Kimani-Murage, Ngomi, Ravn, Mwaniki & Echoka, 2016). In the current study, a child will be regarded as fully immunized if he or she had received all relevant immunisations at the appropriate time period as per the South African National Department of Health guidelines guided by WHO.

According to guidelines developed by the World Health Organization (WHO), children are considered fully immunized when they have received one dose of Bacillus Calmette Guerin (BCG), three doses of DPT, three doses of polio vaccines, and one dose of measles vaccination by the age of 9–12 months (WHO. 2019). In the present study, a child is considered full immunized if he/she has not missed any vaccine irrespective of age, otherwise is not fully immunized.

Primary Health Care

Primary healthcare is defined as essential health care that is based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to all individuals and families in a community through their full

participation and at a cost that the community country can afford to maintain at every stage of their development in the spirit of self-reliance and self- determination (Rifkin, 2018). In the context of this study, primary health care will refer to essential health services provided by public health facilities for patients to consult, collect treatment for prevention of infectious, non-infectious diseases and immunization.

Prevalence

Prevalence is defined as the number of affected persons present in the population at the specific time divided by the number of persons in the population at that time (Gordis 2014). In this study, prevalence will imply the proportion of children who received all relevant immunization in a population divided by the number of children in the population.

Determinants

A determinant is defined as a factor which determines the nature or outcome of something (Kenneth & Rothman 2012). In the context of this study, a determinant with refer to factors that contribute to the child to be fully immunized.

ABBREVIATIONS

BCG	**:**	Bacille Calmette Guerin
DoH	**:**	Department of Health
DTaP	**:**	Diphtheria Tetanus acellular Pertussis
EPI	**:**	Expanded Programme on Immunization
FHDC	**:**	Faculty of Higher Degree Committee
GAVI	**:**	Global Alliance for Vaccines and Immunization
Hep B	**:**	Hepatitis B
HMIS	**:**	Health Information Management System
LMICs	:	Low- and middle-income countries
OPV	**:**	Oral Polio Vaccine
PCV	:	Pneumococal Conjugate Vaccine
PHC	**:**	Primary Health Care
RV	:	Rotavirus Vaccine
SDC	**:**	Senior Degree Committee
SDG	:	Sustainable Development Goal
Td	:	Tetanus Toxoid Vaccine
TREC	**:**	Turfloop Research and Ethics Committee
UNICEF	:	United Nations Children's Fund
VPDs	:	Vaccine Preventable Diseases
WHO	:	World Health Organization

ABSTRACT

Background:

Achieving high vaccination coverage is crucial in the control, prevention and elimination of childhood vaccine preventable diseases. The Expanded Program of Immunization (EPI) aims for 95% coverage for each antigen and complete vaccination schedules for 90% of children under 12 months of age. All the vaccines included in the national vaccination schedule (Bacille Calmette Guerin (BCG), Oral Polio Vaccine, Diphtheria-Pertussis-Tetanus (DPT) vaccine, Measles and Hepatitis B vaccine are provided free of charge in the primary health services in South African public health care facilities. Although the coverage of all vaccines in South Africa has increased especially in recent years, the EPI targets has not been achieved yet in some parts of the coutnry and there are still differences within provinces. Therefore, the primary objective of this study was to investigate the prevalence and determinants of childhood immunization coverage at Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.

The mean age of the children was 1.4±2.5 years (ranged: 1 months to 12 years. Slightly more than half (56%) of the children were less than 6-months. Nearly two-thirds (63%) of the children were females and only 37% were males.

Methodology:

A cross-sectional descriptive study was conducted among selected Primary Healthcare facilities in Ehlanzeni District, Bushbuckridge Sub- district, Mpumalanga Province. Simple random sampling was used to get a minimum sample size of 426 mothers and/or caregivers paired with their children required for the study. The researcher administered a validated or tested self-designed questionnaires to the participants. Data analysis was done using the STATA statistical software version 12 for Windows (STATA Corporation, College Station, Texas).

Results:

The mean age of the participants was 34.1±9.2 years ranged from 15 to 57 years. Almost one-third (28.6%) of the mothers and/or caregivers were 40 years and older and the majority (70%) were unmarried. Majority of the participants had secondary

education with 65.5% and 23.4% had primary education. Nearly eighty per cent (79.2%) of the maternal and/or caregivers were unemployed.

The prevalence rate of fully immunized children was 88% and a significant higher proportion of children in the age group 12 years at 57% were likely not to be fully immunized ($p<0.05$), followed by age group 6 -11 years, 18 months – 5 years, 6-8 months and 9-11 months at 48%, 26%, 17% 13% respectively.

No statistical significant relationship was found between maternal and/or caregiver age, marital status, level of education, employment status and immunization coverage of the child. However, participants aged 40 years and older, less educated and unemployed were likely to have missed immunization of their children. Mother and/or caregivers with a tertiary education were 3.46 times more likely to get their children immunized than those with none/primary education [OR = 3.46, (95% CI:0.75;15.9), $p<0.2$)]. The employed mother and/or caregivers were 2.01 times more likely to get their children immunized than the unemployed mother and/or caregivers [OR = 2.01, (95% CI: 0.82; 4.89), $p<0.20$]. In the multivariate model, level of education and employment status were found not to be significantly associated with immunization of the child.

Conclusion:

The overall immunization coverage in the present study was relatively high and significantly decreased with age. At 6 weeks, all age groups between 0-6 weeks were immunized, while at 10 weeks, with exception of children in the age group 10 -13 weeks and 18 months – 5 years. At 6 months, the young children (age 9-11 months) were likely to default or missed measles vaccination. At 6 and 12 years, the Td vaccination coverage was relatively low. Mothers and/ or caregivers who missed child immunization were likely to experience shortage of vaccines at health facility and said it takes the whole day to immunize a child but the result were not significant. Mother and/or caregivers with a tertiary education and employed were more likely to immunize their children than mothers and/or caregivers with primary, secondary education and the unemployed.

Key concepts

Immunization coverage, Expanded Program of Immunization, Prevalence, Vaccine preventable diseases

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1. CHAPTER 1

1.1. BACKROUND AND INTRODUCTION

Global Vaccine Action Plan (2011-2020) as the entity of the World Health Organization (WHO) highlighted that the number of deaths of children under the age of 5 years dropped from estimated 9,6 million in 2000 to 7,6 million in 2010 (WHO, 2013). The drop occurred as a result of improved access to clean water, improved immunization coverage, and integration of essential health care services interventions (Owais, Khowaja, Ali, & Zaidi, 2013). Despite the improvements made in global immunization coverage for children over the past decade, an estimated 21.8 million infants worldwide are still not being reached by routine immunization services (Restrepo-Méndez, Barros, Wong, Johnson, Pariyo, Franca & Wehrmeister et al., 2016). In 2013, most of the WHO regions reached more than 80% of their target populations with three doses of diphtheria, pertussis and tetanus (DTP) vaccine but coverage with such vaccine remained well short of the 2015 goal of 90%, particularly in the African (75%) and South-East Asia regions (WHO, 2013; Mutua et al., 2016; Mbengue, Mboup, Ly, Faye, Camara & Thiam et al., 2017).

A number of studies conducted in various parts of sub-Saharan African countries have shown several factors contributing to poor vaccination and immunization coverage of children (Lakew, Bekele & Biadgilign, 2015; Rosso et al., 2015; Malande, Munube, Afaayo, Annet, Bodo & bakainaga et al., 2019). These factors include amongst others the knowledge and attitude of mothers, accessibility to vaccination clinics and availability of safe needles and syringes, staff attitude, social problems, lack of parents' knowledge about immunization, maternal illiteracy, vaccine cost, low socioeconomic status, availability of vaccines; and vaccination policies, demographic characteristics of a child's family, minority children who live below the poverty line (Rosso et al., 2015; Malande et al., 2019).

The majority of deaths associated with childhood pneumococcal disease occur in Africa and in 2009, South Africa became the first African country to incorporate vaccination with a pneumococcal conjugate vaccine (PCV) in its routine infant immunization program (Von Gottberg et al., 2014). The national surveillance data

for invasive pneumococcal disease (IPD) from South Africa showed a 69% reduction in the incidence of all-serotype IPD among children aged <2 years by 2012, with contributions by PCV and HIV-associated interventions (Von Mollendorf, Tempia, Von Gottberg, Meiring, Quan & Feldman et al., 2017). Again the sentinel surveillance in children aged <5 years in South Africa showed that diarrheal hospitalizations decreased by about a third in 2010 and 2011 compared to 2009, the year of rotavirus vaccine introduction (Groome, Zell, Solomon, Nzenze, Parashar & Izu et al., 2016).

1.2. PROBLEM STATEMENT

Vaccine-preventable diseases (VPD) still represent a major cause of morbidity and mortality worldwide (Odone, Ferrari, Spagnoli, Visciarelli, Shefer & Pasquarella et al., 2015). Childhood vaccinations are among the most cost-effective public health interventions to prevent and control childhood vaccine-preventable diseases (VPDs), yet coverage for several vaccinations is far from universal coverage in many countries including South Africa (Anekwe, Newell, Tanser, Pillay & Bärnighausen, 2015). However, it is important to note that vaccines remain effective only when all the required doses are received (Montwedi, Burnett & Meyer, 2019).

In 2016 an estimated 245,000 measles cases and 68,000 associated deaths occurred globally. Low- and middle-income countries (LMICs) bear the largest burden of the disease (Nandi, Shet, Behrman, Black, Bloom & Laxminarayan, 2019). The measles vaccine is a highly efficacious and cost-effective vaccine that prevented an estimated 21.1 million child deaths globally during 2000–2017. Recent observational, epidemiological modeling, and laboratory-based studies suggest additional benefits of the vaccine for children's health. Large-scale observational studies indicate that receipt of measles vaccine is associated with expectedly large reductions in measles-specific and all-cause childhood mortality (Nandi et al., 2019).

According to the study conducted in Muldersdrift, Krugersdorp, it has been found that the overall under one year-old vaccination coverage was 79.5% which is below the national set target (Ndlovu et al., 2014).

In that study children were partially vaccinated, with no child being totally unvaccinated and the primary reason for non-immunisation was that time of immunisation inconvenient at 63.6%, child not vaccinated due to illness at 15.2%, vaccinator absent at 12.1%, mother too busy at 6.0% and place of immunisation too far at 3.0% (Ndlovu, Fernandes & Burnett, 2014). In this study, we focus on the prevalence and determinants of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa. This is done with an aim to determine what proportion of children are vaccinated and of those who are not fully vaccinated and what are the contributory factors to their non-fully vaccination. Therefore, recommend interventions to improve childhood immunization coverage based on the findings of the study.

1.3. PURPOSE OF THE STUDY

The purpose of this study was to investigate the prevalence and determinants of childhood immunization coverage at Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa

1.3.1. Objectives

The objectives of the study were:

- To determine the prevalence of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.
- To investigate the determinants of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.
- To determine the association between socio-demographics, mothers and health system factors and immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.

1.4. RESEARCH QUESTIONS

What is the prevalence and determinants of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa?

1.5 RESEARCH METHODOLOGY

1.5.1 *Research design*

Research design is defined as type of inquiry within qualitative, quantitative and mixed methods approaches used to provide specific direction for designing research (Creswell, 2013). A cross-sectional descriptive study design was used to help explore the research question posed in this study to investigate the prevalence and determinants of childhood immunization coverage including other variables of interest as they exist within a defined population at a particular point in time (Detels, Gulliford, Karim & Tan, 2015).

1.5.2 Sampling

Simple random sampling was used and the excel spreadsheet was used to generate random numbers to select the study participants (Brink et al., 2013). A minimum sample size of 426 mothers or caregivers paired with their children required for the study, which was calculated based on a population size of 12 411 (Table 1), sampling error of 5%, 10% non-response rate. The formula below was used for calculation (Yamane, 1967)

$$n = \frac{N}{1 + N(e)^2} = \frac{12411}{1 + 12411(0.05)^2} = 388$$

1.5.3 Data collection and analysis

In the current study, The researcher administered a validated or tested self-designed questionnaire to the participants at the Brooklyn and Cottondale clinic and the questionnaire included maternal demographics such age, marital status, level of education, employment status, health facility factors and child demographics including the vaccinations the child has received and the Likert scale coded from 0 to 5, then the mean and standard deviation calculated where strongly agree coded 0 , agree -1, disagree-2 and strongly disagree- 3.

Mothers who volunteered to participate in this study completed a consent form before participating in the study. Data analysis was done using the STATA statistical software version 12 for Windows (STATA Corporation, College Station, Texas). A detailed description of how reliability and validity of the data was achieved including the data analysis and the measures to minimise bias is presented in chapter 3.

1.6 ETHICAL CONSIDERATIONS

To ensure ethical considerations were taken into account in this study; permission to conduct the study was sought from University of Limpopo's Turfloop Research Ethics Committee(**TREC/11/2021:PG**) and then from the Limpopo Department of Health Provincial(**Appendix F**). In addition, a storage system was implemented to store the extracted data and records were kept in such a manner as not to reveal the identity of the patients in order to ensure their confidentiality, privacy and anonymity. There were no foreseeable risks associated with participation in this study since secondary data was used.

1.7 SIGNIFICANCE OF STUDY

This study hopes to provide information to health care practitioners and policy makers regarding factors contributing to low immunisation coverage at Primary Health Care facility. The study has yielded information and the results will also assist the Department of Health (DoH) to introduce measures, and reinforce existing policies and strategies on children immunization programme.

2. CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

In this chapter, the researcher discussed prevalence and factors contributing to immunization coverage at selected health care facilities. The researcher further discussed the facility and personal factors of mothers affecting immunization coverage. The results will also assist the Department of Health (DoH) to introduce measures, and reinforce existing policies and strategies on children immunization programme.

2.2. Prevalence of childhood immunization coverage

2.2.1. Global prevalence of childhood immunization coverage

In 1976, World Health Organization (WHO) and UNICEF launched the expanded childhood immunization programme aim to control childhood diseases worldwide (Lim, Stein, Charrow & Murray, 2008). The World Health Organization (WHO) estimates that every year 1.5 million children die from VPD; this represents 17% of all deaths in children under five years of age (Odone et al., 2015). The global coverage of diphtheria, tetanus, and pertussis (DTP3) increased from 59% in 1986 to 65% in 1990 and this increased from 70% in 2000 to 74% in 2006 (Lim et al., 2008).

In the United States, the immunization coverage remained ≥90% for ≥3 doses of poliovirus vaccine (91.9%), ≥1 dose of measles, mumps, and rubella vaccine (MMR) (91.1%), ≥1 dose of varicella vaccine (90.6%), and ≥3 doses of hepatitis B vaccine (HepB) (90.5%) among children aged 19-35 months (Hill, Elam-Evans, Yankey, Singleton, Kang, 2017). In China, in the childhood immunization coverage was 80.6% in Zhejiang province (Hu, Liang, Wang, Chen, 2018). In high and middle-income settings vaccination coverage is relatively high. However, in many countries coverage rates are still below the

targets established by international and national advisory committees, particularly for specific vaccinations. For example, in several countries including Austria, Indonesia, Denmark, the United Kingdom, and Italy measles vaccination coverage was far below the Organisation for Economic Co-operation and Development (OECD) countries' average of 93.6% (Odone et al., 2015).

In Greece, Vaccination coverage of the total study population exceeded 95% for most doses of (DTP/DTaP), poliomyelitis (polio) and measles. The Haemophilus influenzae type B vaccine (Hib) coverage was high ranging from 94.7% to 100% depending on the dose while newer ones like the varicella vaccine (VAR) reached 92.0%. Despite very high final coverage, delayed vaccination was observed for several vaccines such as hepatitis B vaccine (HepB) coverage ranged from 99.4% to 96.2% according to the dose, only 48.0% had completed the first 2 doses by 6 months' age and 48.3% the 3-dose schedule by 12 months of age.

A significant delay was recorded for the fourth dose of pneumoccoccal conjugate vaccines (PCV), although the final coverage of PCV3 doses surpassed 95%, however a significant delay observed in both timely administrations of the fourth dose (13.9% by month 15) and completion of vaccination; 82.3% of the total population received 3 doses by month 12, while 62.3% received the fourth dose by 24 months and 76.2% by the age of 30 months, but the booster doses were lower at (77.6%). Other remarkable examples of moderate or low coverage were hepatitis A (HepA), rotavirus (RV) and inactivated influenza (IIV) vaccines. A 79.5% of the total population had received one dose of HepA while the rate dropped to 41.7% for the second dose and 2 doses of HepA by 24 months were 6.1%. The rates for RV and IIV was low as fully vaccinated with either the monovalent (RV1) or the pentavalent (RV5) were under 20% of the total study population (Georgeakopoulos, Menegas, Katsioulis, Theodoridou, Kremastinou et al,. 2017).

2.2.2. The prevalence of childhood immunization coverage in Africa

The immunization coverage in Uganda was found to be below 95% as measles was low at 65.6%, BCG at 95%, OPV0 at 96%, DPT1 at 93%, DPT2 at 84.5%, DPT3 at 81% (Malande et al., 2019). In another study conducted in Uganda it was found that on average, 54% of children were fully immunized, 89% received a full dose of BCG, 24% received DPT, 52% received polio, and 64% received the measles vaccine (Bbaale, 2013). In Nigeria, the immunization rate was 34.4% with south- zone having the highest rate of 51.5% and North-west the lowest at 9.5% (Adeloye, Jacobs, Amuta, Ogundipe, Mosaku et al., 2017).

In Senegal, the childhood immunization coverage as documented on vaccination cards was 37.5% (Mbengue, Sarr, Faye, Badiane, Camara et al.,2017), whereas in Ethiopia, the prevalence of BCG vaccination was 63.6% (Tsehay, Worku & Alemu, 2019). Adokiya and co-authors in their study conducted in Ghana, found that 89.5% of the children were fully immunized (Adokiya, Baguune & Ndago, 2017). Another study in Ghana, found that 85% of the children were fully immunized (Wemakor , Helegbe, Abdul-Mumin, Amedoe, Zoku et al., 2018). In Cameroon, the vaccination completeness rate was 96.3% (Chiabi, Nguefack, Njapndounke, Kobela, Kenfack et al., 2017).

According to the study conducted in Nigeria, about two third (62.8%) of the children were not fully immunized by one year of age, 33.4% had experienced a missed opportunity for immunization and 36.4% were partially and incorrectly immunized. (Abdulraheem et al.,2011). Abdulraheem et al.,(2011) stated the following reasons contributing to incomplete vaccination of the children and these includes long waiting time at the health facility (15.2%), lack of vaccine on the appointment day (3.5%), absence of personnel at the health facility (5.4%), child ill-health at the time of immunization (3.6%), lack of information about the days for vaccination (2.5%), forgetting the days of immunization(1.5%), long distance walking (17.5%), mother's illness on the day of vaccination (0.5%), social engagements (0.4%), lack of money (10.6%), schooling mothers (0.5%), parents objection, disagreement or concern about immunization safety (38.8%) and other miscellaneous reasons (3.5%).

2.2.3. South Africa and Mpumalanga province

Despite the benefits that vaccines offer in mitigating the effects of VPDs, the leading causes of morbidity and mortality in South Africa are still due to vaccines preventable diseases. This together with the sporadic outbreaks of VPDs may indicate a failure of implementation of EPI-SA which is exacerbated by a paucity of reliable and consistent data on vaccination coverage and timeliness (Motha, Sibanda & Meyer, 2019). Approximately 90.4% of the South African children were fully immunized in 2011 with Limpopo province recording the highest at 96.8% (Van den Heever, 2012). A community survey conducted in the Western Cape Province of South Africa, found that 95% of the children received a campaign vaccination of which 33.0% had not received a measles vaccination before the campaign and this was reduced to 4.5% after the campaign (Bernhardt, Cameron, Willems, Boulle & Coetzee, 2013).

According to the WHO (2015), the South Africa immunization coverage was 82.3%, almost 10% lower than the national target of 90%. Interestingly, the national immunization coverage increased from 83.6% in 2012/13 to 89.8% in 2014/15 - then slightly declined to 83.2% in 2016/17. The reasons for decline are multifactorial which included the global shortage of hexavalent that lasted for 9 months. In some of the provinces or districts the distribution of available stock was done without considering the demands and the population size (WHO 2015). There is a wide provincial variation in the immunization coverage ranging from 96.7% in Gauteng (GP) to 64.5% in Limpopo (LP). In 2016/17, Gauteng is the only province that surpassed the national target of 90%. Immunization coverage between year 2015/16 and 2016/17, except for KwaZulu-Natal (KZN) which showed an increase by 0.8% in immunization coverage, however the rest of the provinces showed a decline in coverage. The decline was most marked in Limpopo (14.7%). Similarly, the reduction was seen in Western Cape (9.3 %); Eastern Cape (8.2 %); Mpumalanga (7.5 %); followed by North West (9.5%); Northern Cape (NC) (3.4 %) and Free State (2.0 %) (WHO 2015), however, WHO (2020), indicates that South Africa is experiencing challenges with optimising its national immunisation coverage, with a gradual decline in uptake of the third dose of diphtheria–tetanus–pertussis-containing vaccines (DTP3) from 85% in 2014 to 77% in 2019

According to the study conducted recently in South Africa by Ndwandwe et al,. (2020), the national prevalence of missed opportunities for vaccination among children aged 12–23 months was 40.1%. Children whose mothers attended facility-based antenatal care were considerably less likely to experience missed opportunities for vaccination than those whose mothers did not attend antenatal care: odds ratio (OR) 0.41, 95% confidence interval (CI) 0.19 to 0.88. Conversely, the independent predictor of an increased missed opportunities for vaccination among children was residence in either the Gauteng province (OR 2.97, 95% CI 1.29 to 6.81) or Mpumalanga province (OR 2.32, 95%CI 1.04 to 5.18); compared to residence in the Free State province. The study findings suggest a high burden of missed opportunities for vaccination among children in South Africa and that missed opportunities for vaccination may be associated with individual and contextual factors (Ndwandwe, Chukwudi, Nnaji, Charles, Wiysonge et al, 2020).

The prevalence of incomplete vaccination coverage was higher than the national average among female children (41.5%), children of 7th+ birth order (70.0%), those born of mothers who did not attend antenatal care during pregnancy (58.8%), and those whose mothers were aged 15–24 years (41.5%). Prevalence was also higher than the national average among children from poor households (43.0%), those whose mothers had only primary education (46.0%), those whose mothers had media exposure (45.4%), those born of working mothers (42.3%), those residing in rural areas (41.1%), as well as those residing in the North West (45.5%), Gauteng (50.7%), and Mpumalanga (48.6%) provinces. (Ndwandwe, Chukwudi, Nnaji, Charles, Wiysonge et al., 2020).

2.3. Factors contributing to low coverage of childhood Immunization

There are various personal and healthcare facility factors contributing to low coverage of childhood immunization.

2.3.1. Healthcare facility factors

The primary reasons contributing to lack of vaccination, delayed vaccination, missed vaccination and poor vaccination are vaccines unavailability, failure for health care professionals to give parents date of the next vaccination, shortage of road to health booklets (Msimang et al., 2013, Brown & Gacic-Dobo, 2018), poor access and long distances to health facility, lack of proper roads, terrains, lack transports, rainy seasons (Malande et al., 2019) and attitudes of the health professional staff (Rosso, Massimi, De Vito, Adamo, Baccolini et al., 2019). Perceived health institution support, institutional delivery and antenatal care (ANC) attendance and household visited by health workers including proximity to health facilities were factors identified to be associated with immunization coverage (Lakew et al., 2015).

2.3.2. Personal factors

In a study conducted in Uganda, the percentage of immunized children increased with maternal education; 63% of children whose mothers had post-secondary education were immunized compared to 53% of children having mothers with no education (Bbaale, 2013). In contrary to a study conducted in Ethiopia, lower parental education was found to be a contributory factor to low immunization coverage (Lakew et al., 2015). Mothers' knowledge about child immunization, postponing child immunization and place of residence including women's decision making autonomy and number of under-five children in the household were factors identified to be associated with immunization coverage (Lakew et al., 2015). Other studies found that lack of information (Brown & Gacic-Dobo, 2018; Rosso et al., 2019), living in rural and poor urban areas, low socioeconomic status (Hoest, Seidman et al., 2017; Faye et al., 2019) vaccine safety concerns, mother's level of education, mothers with greater antenatal visits and poor information (Adeloye et al., 2017; Mbengue et al., 2017; Tsehay et al., 2019), maternal age and birth place (Hoest, Seidman et al., 2017) as the factor contributing to low childhood immunization coverage. Other personal

factors such as mother's myth that multiple vaccination may predispose their children to a risk of developing side effects, and measles vaccine causes autism to their children also influence immunization coverage (Rosso et al., 2019).

Table 2.1: Immunization schedule currently offered in South Africa

Age of Child	Vaccines needed	How and where is it given
At Birth	**BCG** Bacilles Calmette Guerin	**Right Arm**
	OPV(0) Oral Polio Vaccines	**Drops by mouth**
6 Weeks	**OPV(0)** Oral Polio Vaccines	**Drops by mouth**
	RV (1) Rotavirus Vaccines	**Liquid by mouth**
	DTaP-IPV-Hib-HBV (1) Diphtheria,Tetanus,Acellular Pertusis, Inactive Polio Vaccine,Haemophilus Influenzae type b and Hepatitis B Combined	**Intramuscular/Left thigh**
	PCV (1) Pneumococcal Conjucated Vaccine	**Intramuscular/Right thigh**
10 Weeks	**DTaP-IPV-Hib-HBV (2)** Diphtheria,Tetanus,Acellular Pertusis, Inactive Polio Vaccine,Haemophilus Influenzae type b and Hepatitis B Combined	**Intramuscular/Left thigh**
14 Weeks	**RV (2)** Rotavirus Vaccines	**Liquid by mouth**
	DTaP-IPV-Hib-HBV (3) Diphtheria,Tetanus,Acellular Pertusis, Inactive Polio Vaccine,Haemophilus Influenzae type b and Hepatitis B Combined	**Intramuscular/Left thigh**
	PCV (2) Pneumococcal Conjucated Vaccine	**Intramuscular/Right thigh**
6 Months	**Measles Vaccine (1)**	**Subcutaneous/Right arm**
9 Months	**PCV (3)** Pneumococcal Conjucated Vaccine	**Intramuscular/Right thigh**
12 Months	**Measles Vaccine (2)**	**Subcutaneous/Right arm**
18 Months	**DTaP-IPV-Hib-HBV (4)** Diphtheria,Tetanus,Acellular Pertusis, Inactive Polio Vaccine,Haemophilus Influenzae type b and Hepatitis B Combined	**Intramuscular/Left arm**
6 Years	**Td Vaccine** Tetanus and reduced strength of Diphtheria Vaccine	**Intramuscular/Left arm**
12 Years	**Td Vaccine** Tetanus and reduced strength of Diphtheria Vaccine	**Intramuscular/Left arm**

3. CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction.

This chapter focuses on the methodology, which includes research design, study site, population, sampling, data collection, reliability, validity, bias, data analysis and ethical considerations.

3.2. Research methods

The study adopted quantitative approach which is a formal, objective; systematic process of obtaining numerical data (Burns & Groove, 2011). The purpose of quantitative research was to describe situations using numbers (Brink, van der Walt & van Rensburg, 2013). The researcher utilized quantitative approach because it describes variables and examine relationships among variables.

3.3. Research design

A cross-sectional descriptive study was conducted among selected Primary Healthcare facilities in Ehlanzeni District, Bushbuckridge Sub- district, Mpumalanga Province over a period of 3-month depending on the approval of the proposal. A cross-sectional descriptive study is the design that examines the relationship between the variables that exists in a defined population that will form representatives (Houser, 2015). The descriptive design was used to describe contributory factors towards low childhood immunization coverage.

3.4. Study setting

Burns & Groove (2011) defines a study setting as a location for conducting research which can be natural, partial or highly controlled. The current study was conducted in Bushbuckridge sub-district which is located in Mpumalanga Province, consisting of 135 settlements, 34 wards of which 99,5% are black African (Census 2011). It has the highest unemployment rate leading to challenges associated with unemployment such as malnutrition and missed or delayed immunization opportunities. (Msimang et al.,2013). Brooklyn clinic has 8 professional nurses with 14 catchment rural villages while Cottondale clinic has 9 professional nurses with 9 catchment rural villages. The research setting for this study was Brooklyn clinic

and Cottondale clinic which is situated at Ehlanzeni District, Bushbuckridge Sub-district, Mpumalanga Province (Figure 1).

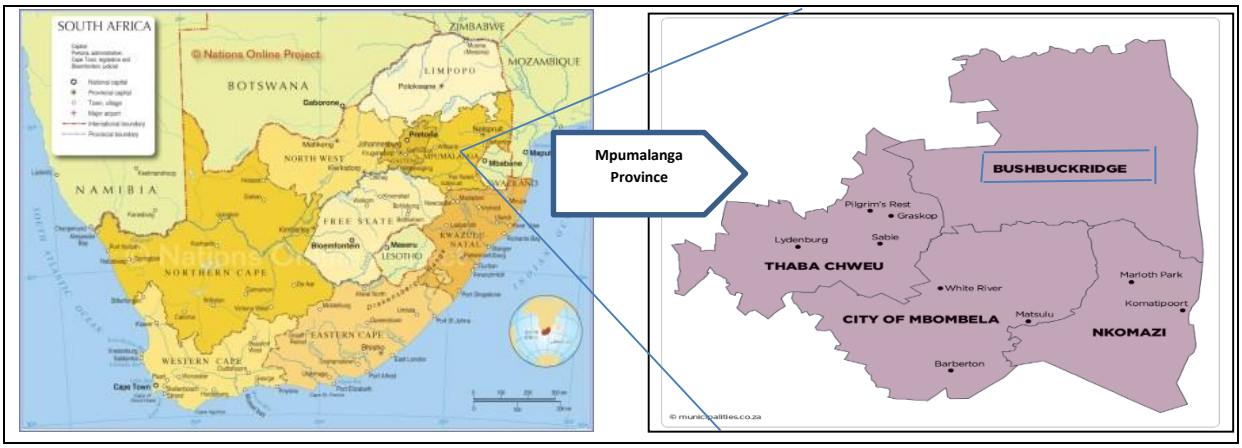

Figure 1 Maps of South Africa and the Mpumalanga Province showing with its district municipalities

3.5. Study populations

According to LoBiondo-Wood & Haber (2014), population is defined as people within the same community who have the same characteristics that is of interest to the researcher. The population for this study were all mothers or caregivers who have children under the age of 12 years eligible for immunization at Primary Health Care clinics at Bushbuckridge Sub District at Mpumalanga Province. These mothers or caregivers were paired with their children to investigate the prevalence of childhood immunization and their determinants. A total of 12 411 children under the age of 12 years were seen in the two facilities from January to December, 2018 (Personal Communication with the facility information officers),

3.5.1. Inclusion criteria

All mothers or caregivers that have children under the age of 12 years presenting at primary health care clinic for child immunization were paired with their children and included in the study.

3.5.2. Exclusion criteria

All mothers or caregivers who were not willing to participate and those with mental health illnesses were excluded in the study.

3.6. Sampling technique and sample size

Sampling refers to the process of selecting participants from a certain population that represent the whole population (LoBiondo-Wood & Haber, 2014). Simple random sampling was used and the excel spreadsheet was used to generate random numbers to select the study participants (Brink et al., 2013). A minimum sample size of 426 mothers or caregivers paired with their children required for the study, which was calculated based on a population size of 12 411 (Table 1), sampling error of 5%, 10% non-response rate. The formula below was used for calculation (Yamane, 1967)

$$n = \frac{N}{1 + N(e)^2} = \frac{12411}{1 + 12411(0.05)^2} = 388$$

Where

- n is the sample size
- N is the population size of the children under 12 years (Personal Communication with District Information Officer)
- e is the sampling error (5%)

The sample was distributed proportional to the population size in each site (Table 3.1).

Table 3.1: Sample size distribution

Health Facility Name	N	N
Brooklyn clinic	5060	174
Cottondale clinic	7351	252
Total	**12411**	**426**

3.7. Pilot study

Pilot study was defined as a small scale trial run of an actual research study (De vos, Strydom, fouche & Delport 2011). In this study, pilot study was done at the health facility that does not form the part of the major study were 5 participants were randomly chosen and given the tool to test it. All questions were answered well, no adjustment required, and no errors identified in wording of questions. The participants understood what was expected of them regarding the instructions and

the questions were not ambiguous, double barrel or channelling. The contents of the tool were related to the research topic.

3.8. Data Collection

Data collection is defined as a process of gathering information relevant to the study that answers the objectives and the research questions (Burns & Groove, 2011). The researcher administered a validated or tested self-designed questionnaires to the participants at the Brooklyn and Cottondale clinic and the questionnaire included maternal demographics such age, marital status, level of education, employment status, health facility factors and child demographics including the vaccinations the child has received (**Appendix A**). Mothers who volunteered to participate in this study completed a consent form before participating in the study (**Appendix B**).

3.9. Data analysis

Burns and Groove, (2011), defines data analysis as the strategy utilised to organise data which is in the form of words or numbers in order to give meaningful information and outcomes. The data have been interpreted using frequencies and percentage for categorical variables and mean ± standard for continuous variables. Chi-square test and student t-test were used for comparing groups for categorical and continues variable respectively. STATA statistical software version 13 was used to analyse data. A *p-value* of less than 0.05 was considered statistically significant

3.10. Validity

LoBiondo-Wood & Haber (2014), defines the validity as an extent which an instrument measures the attributes of the concepts accurately what is supposed to measure in the context in which it is applied. To ensure validity, the data collection tool was piloted from another clinic under Bushbuckridge sub-district that does not form part of the study setting with same characteristics to check its accuracy and identify errors. The completed questionnaires used for pilot study were not included in the research study.

3.11. Reliability

Reliability refers to the extent to which the instrument used to collect data will yield the same results on the repeated measure on the same participants (LoBiondo-Wood & Haber, 2014). To ensure reliability the questionnaires yielded the same results when used repeatedly to the same participants.

3.12. Bias

According to Houser (2015), bias is defined as any influence that has an impact on the final research findings leading to less quality or useless outcomes. Selection bias is a distortion in a measure of association due to a sample selection that does not accurately reflect the target population, and the researcher mitigated it by randomly selecting everybody presenting during the period of the study, not selecting participants because of their interest in the study and avoided asking leading questions. Interviewer bias can show itself in many different ways and, as a consequence, influence the selection process and interviewer bias was minimized by using a standardized data collection tool. Response bias also known as survey bias is defined as the tendency in respondents to answer untruthfully or inaccurately. It often occurs where participants are asked to self-report on behaviours, but can also be caused by poor survey design. This type of bias was minimized by keeping the questions short and clear then avoiding leading questions (Houser 2015).

3.13. Ethical considerations

According to Burns & Grove (2011), the credible research requires that a researcher be honest to the participants at all times. The following ethical standards were adhered to when conducting the study:

3.13.1. Ethical clearance and Permission to conduct the study

This proposal was presented at the Department of Public Health Research Committee then sent to School of Healthcare Sciences Research Committee (SREC), The approved document from SREC was submitted to Faculty of Higher Degree Committee (FHDC), and then eventually to Turfloop Research and Ethics Committee (TREC)-for ethical clearance. The approved proposal together with TREC certificate was submitted to Mpumalanga Department of

Health and social Development Research Committee, and Sub District Manager for permission to conduct the study.

3.13.2. Informed Consent

Informed consent was requested from the participants before participating in the study (**Appendix C**). Emphasis was placed on giving correct and complete information for enabling participants to fully comprehend the investigation and, consequently, to make a voluntary decision about possibility to participate in the study or not (LoBiondo-Wood & Haber, 2014).

3.13.3. Privacy and Confidentiality

From a legal perspective and research ethical considerations, the protection of privacy has been linked to the processing of personal data. Thus, the current research was conducted in accordance with basic considerations for data protection, such as personal integrity, privacy and responsible use and storage of personal data.

However, the researcher ensured that the data is accessed by professionals who were needed in the study. Additionally, the researcher protected the confidentially of participants by ensuring that information does not get published in a way that respondents could be identified. The eligible and interested respondents were individually and privately recruited to ensure that their participation is completely private as they were interviewed in their homes. The respondents were informed about their rights of privacy and no third parties were involved in the attainment of data to maintain privacy. Furthermore, the respondents were not forced to reveal information that they were not comfortable to reveal. The researcher ensured confidentiality by reassuring the participants that all information collected will not be disclosed to any unauthorised person without their permission but the data will be made accessible to the study supervisor and privacy was ensured by not forcing the participant to reveal the information to the researcher that the participant did not wish to reveal. (LoBiondo-Wood & Haber, 2014). Participants were given questionnaires that do not require them to include their names.

3.13.4. Principle of Autonomy

The right to self-determination implies that the participants have a right and competence to evaluate available information, weigh alternatives against one another and make their own decision. The researcher did not withhold information or give incorrect information to the participants when recruiting them to participate in the study (LoBiondo-Wood & Haber, 2014). The researcher ensured that no discomfort or inconvenience occured during the data collection. For the sake of anonymity, the participants were not asked to mention their names during data collection and further processes.

3.13.5. Principles of justice

The principle of justice may be defined as the ethical obligation to distribute the benefits and burdens of research fairly (Hammersley, 2015). Researchers have an obligation to ensure that the means used to select research participants are equitable. The researcher did not exploit the vulnerable, nor exclude any participant without good reason those who stand to benefit from study participation. In order for proposed eligibility criteria to be evaluated, each criterion has been accompanied by a clear justification in the study protocol. The inclusion of a vulnerable group (such as children, incapable adults) has been clearly justified to demonstrate that they are not being targeted merely as a matter of convenience.

3.13.6. Harm

The study requires information that is most likely to evoke psychological distress and discomfort on the respondents if they could realize the dangers of missing child vaccinations. To minimize such harm on the respondents, the researcher has sorted assistance from a social worker at the clinics for counselling services and also ensured that the right of the respondents to withdraw from continuing with the research is respected at all times.

3.14. Summary

Chapter three provided insights into the methodology applied in this study. The focus was mainly on scientific methods used to answer the research question, achieving the aims and objectives of the study. The main methodological aspects

included are; research design, study site, study population, sampling method, data collection, data analysis and ethical considerations.

4. CHAPTER 4: RESULTS

4.1. Introduction

In the previous chapter, the methodology used for the study were outlined. In this chapter, the results of the study are presented and interpreted. Data were analysed using STATA (version 13). The association between maternal and health system factors and immunization coverage were assessed using chi-square test and student ttest, respectively. To investigate the risk for missed childhood immunization bivariate logistics regression analyse was used with variables significant at p-value of < 0.2 included in the multivariate logistic regression model. Health system factors were assessed using Likert scale and were coded as 0-strongly disagree, disagree – 1, agree – 2 and strongly agree – 3.

4.2. Demographic characteristics of the mother and the child

Four hundred and twenty-three mothers and/or caregivers paired with their children participated in the study. Their mean age was 34.1±9.2 years ranged from 15 to 57 years. Nearly one-third (28.6%) of the maternal and/or caregivers were 40 years and older and more than two-thirds (70%) were unmarried (**Table 4.1**). The majority of the participants had secondary education with 65.5% and 23.4% had primary education. Nearly eighty per cent (79.2%) of the mothers and/or caregivers were unemployed.

Table 4.1: Maternal Demographic information

	No	**%**
Maternal/Caregiver's age (years)		
<20	15	3,5
20-24	61	14,4
25-29	65	15,4
30-34	89	21,0
35-39	72	17,0
40+	121	28,6
Marital Status		
Married	127	30,0
Unmarried	296	70,0
Level of Education		
None	2	0,5
Primary	99	23,4
Secondary	277	65,5
Tertiary	45	10,6
Employment status		
Employed	88	20,8
Unemployed	335	79,2

The mean age of the children was 1.4±2.5 years (ranged: 1 months to 12 years. Slightly more than half (56%) of the children were less than 6-months. Nearly two-thirds (63%) of the children were females and only 37% were males.

Table 4.2: Children Age and Gender Distribution

	n(%)	Gender	
		Girls (n=265)	Boys (n=158)
Age			
6-9 weeks	82(19.4)	53(20.0)	29(18.4)
10-13 weeks	74(17.5)	51(19.2)	23(14.6)
3 – 5 months	82(19.4)	52(19.6)	30(19.0)
6- 8 months	23(5.4)	16(6.0)	7(4.4)
9-11 months	24(5.7)	17(6.4)	7(4.4)
12 - 17 months	35(8.3)	18(6.8)	17(10.8)
18 months – 5 yrs	68(16.1)	36(13.6)	32(20.3)
6 – 11 yrs	21(5.0)	14(5.3)	7(4.4)
12 yrs	14(3.3)	8(3.0)	6(3.8)

4.3. Prevalence of childhood immunization coverage

As displayed in **Figure 4.1**, the prevalence rate of fully immunized children at birth to 12 months were (n=374, 88%) and those not fully immunised were 49 making, 12%.

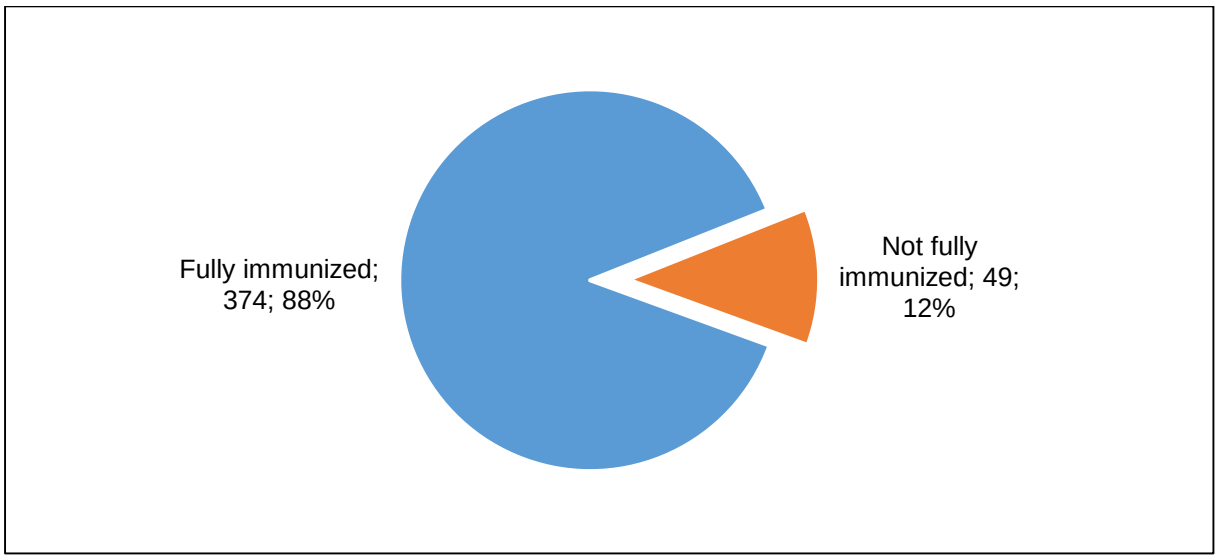

Figure 4.1: Immunization Coverage of children aged birth to 12 years

Table 4.3 presents the prevalence of childhood immunization coverage by age group, which indicates that a significant higher proportion of children in the age group 12 years at 57% were likely not to be fully immunized ($p<0.05$), followed by age group 6 -11 years, 18 months – 5 years, 6-8 months and 9-11 months at 48%, 26%, 17% 13% respectively as verified from child Road-to-Health Chart.

Table 4.3: Child immunization coverage by age

	n	Fully immunized	
		Yes	No
Child age			
6-9 weeks	82	82(100)	0(0)
10-13 weeks	74	73(99)	1(1)
14 weeks-5months	82	80(98)	2(2)
6-8 months	23	19(83)	4(17)
9-11months	24	21(88)	3(13)
12-17months	35	32(91)	3(9)
18 months – 5 years	68	50(74)	18(26)
6-11 years	21	11(52)	10(48)
12 years	14	6(43)	8(57)

$\chi^2 = 95.8$; p-value = 0.000

Table 4.4: Vaccine specific immunization coverage per age group, (n=423)

	6-9 Wks (n=82)	10-13 Wks (n=74)	14 Wks -5 Mnths (n=82)	6-8 Mnths (n=23)	9-11 Mnths (n=24)	12-17 Mnths n=35)	18 Mnths - 5 Yrs (n=68)	6-11 Yrs (n=21)	12 Yrs (n=14)
At birth									
BCG	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
OPV – round 0	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
At 6 weeks									
OPV - round 1	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
RV - round 1	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
DTaP-IPV/ Hib –HBV - round 1	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
PCV - round 1	82(100)	74(100)	82(100)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
At 10 weeks (Round 2)									
DTaP-IPV/ Hib –HBV - round 2		73(98.6)	82(100)	23(100)	24(100)	35(100)	67(98.5)	21(100)	14(100)
At 14 weeks									
RV - round 2			80(97.6)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
DTaP-IPV/ Hib –HBV - round 3			80(97.6)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
PCV - round 2			80(97.6)	23(100)	24(100)	35(100)	68(100)	21(100)	14(100)
6 months									
Measles vaccine - round 1				19(82.6)	24(100)	35(100)	68(100)	21(100)	14(100)
9 months									
PCV – round 3					21(87.5)	35(100)	67(98.5)	21(100)	14(100)
12 months									
Measles vaccine - round 2						32(91.4)	67(98.5)	21(100)	14(100)
18 months									
DTaP-IPV/ Hib –HBV - round 4							52(76.5)	21(100)	14(100)
6 years									
Td Vaccine								11(52.4)	6(42.9)
12 yrs									
Td Vaccine									11(78.6)

As shown in **Table 4.4**, immunization rates at first round (**at birth**) for BCG and OPV was 100% for all age group. Similarly, immunization rates at first round (at 6 weeks) for four vaccine-specific immunizations (OPV, RV, DTaP-IPV/ Hib –HBV and PCV) for all age groups was 100%. At 10 weeks, only two children aged 10-13 weeks and 18 months to 5 years had missed round 2 of DTaP-IPV/ Hib –HBV.

The first round of measles vaccine is taken at 6-months, the prevalence was lower (83%, n=19) amongst children in the age group 6-8 months, while in those aged 9 months or more was 100%. The prevalence of the third dose of PCV at 9 months was 88% and 98.5% in those aged 9-11 months and 18 months - 5 years, respectively. In the other age groups, the round 3 PCV rates were 100%.

The prevalence rate for measles vaccine round 2 at 12 months was 91% and 98.5% in the children aged 12-17 months and 18 months - 5 years, respectively, whereas, the other groups were 100%. In the age group 18 months - 5 years the prevalence rate for DTaP-IPV/ Hib –HBV round 4 at 18 months was 76.5%. The prevalence of Td vaccine at 6 years was 52.4% and 42.8% for those aged 6-11 years and 12 years, respectively. While at 12 years, the rate of Td vaccine was 78.5%.

4.4. Factors associated with child immunization coverage

Maternal factors associated with child immunization coverage is illustrated in **Table 4.5.** There were not statistical significant relationship between maternal and/or caregiver age, marital status, level of education, employment status and immunization coverage of the child. However, participants aged 40 years and older, less educated and unemployed were likely to have missed immunization of their children.

Table 4.5: Maternal factors associated with immunization coverage (%)

	Fully immunized		p-value
	Yes	No	
Age (years)			
<20	13(87)	2(13)	0.480
20-24	55(90)	6(10)	
25-29	56(86)	9(14)	
30-34	82(92)	7(8)	
35-39	66(92)	6(8)	
40+	102(84)	19(16)	
Marital Status			
Married	112(88)	15(12)	0.924
Unmarried	262(88)	34(12)	
Level of Education			
None/Primary	87(86)	14(14)	0.249
Secondary	244(88))	33(12)	
Tertiary	43(96)	2(4)	
Employment status			
Employed	82(93)	6(7)	0.116
Unemployed	292(87)	43(13)	

Table 4.6: Health system factors associated with immunization coverage

	Full Immunized		p-value
	Yes	No	
I've access to health facility to vaccinate my child	2.32±0.67	2.18±0.75	0.2043
I've experienced shortage of vaccines at health facility.	1.20±0.56	1.36±0.60	0.0580
I experienced negative attitude during immunization	1.66±0.69	1.57±0.65	0.3813
I've information about immunization	1.41±0.79	1.39±0.79	0.8068
I've fear about immunization	1.11±0.66	1.06±0.69	0.6514
It takes the whole day to immunize a child	2.02±0.83	2.14±0.68	0.3290
I've positive attitude toward immunization	2.04±0.63	2.10±0.62	0.5742

Table 4.6 present the health system factors associated with child immunization coverage. Even though, participants who did not fully vaccinated their children had positive attitude towards immunization as compared to those who fully immunized their children (2.10±0.62 versus 2.04±0.63, $p>0.05$), they experience shortage of vaccines at health facility (1.36±0.60 versus 1.20±0.56, $p>0.05$) and they said it takes the whole day to immunize a child (2.14±0.68 versus 2.04±0.63, $p>0.05$) as compared to those who fully immunized their children, but the results were not statistically significant.

Table 4.7: Maternal risk factors associated with incomplete immunization

	Univariate Logistics Regression		**Multivariate Logistics Regression**	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age (years)				
<20	Ref			
20-24	1.41(0.25;7.80)	0.694		
25-29	0.95(0.18;4.97)	0.959		
30-34	1.80(0.34;9.64)	0.491		
35+	1.03(1.47;28.80)	0.966		
Marital Status				
Married	Ref			
Unmarried	1.03(0.54;1.97)	0.924		
Level of education				
None/Primary	Ref		Ref	
Secondary	1.19(0.61;2.32)	0.612	1.12(0.56;2.20)	0.741
Tertiary	3.46(0.75;15.9)	0.111	2.74(0.57;13.2)	0.206
Employment status				
Unemployed	Ref		Ref	
Employed	2.01(0.82;4.89)	0.123	1.69(0.67;4.22)	0.263

In the bivariate analysis, mother and/or caregivers with a tertiary education were 3.46 times more likely to get their children immunized than those with none/primary education [OR = 3.46, (95% CI:0.75;15.9), p<0.2)]. The employed mother and/or caregivers were 2.01 times more likely to get their children immunized than the unemployed mother and/or caregivers [OR = 2.01, (95% CI: 0.82; 4.89), p<0.20]. In the multivariate model, level of education and employment status were found not to be significantly associated with immunization of the child.

5. CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The previous chapter focused on the presentation and interpretation of the study findings on prevalence and determinants of childhood vaccination coverage at selected health care facilities, Bushbuckridge sub-district, Mpumalanga Province, South Africa. In this chapter, the findings of the present study are discussed and compared with relevant literature. The main objectives of this study were:

- To determine the prevalence of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.
- To investigate the determinants of childhood immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa.
- To determine the association between mothers and/or health system factors and immunization coverage at selected Primary Healthcare facilities, Bushbuckridge, sub district of the Mpumalanga Province, South Africa

5.2 Prevalence of childhood immunization coverage

In the present study, the prevalence of childhood immunization coverage was 88%, which significantly varied across age group. The finding of this study is in agreement with the prevalence rate of 89.5% (Adokiya et al., 2017) and 85% (Wemakor et al., 2018) reported in Ghana, however, lower than 96.3% found in Cameroon (Chiabi et al., et al., 2017). The result of this study is however higher than childhood immunization coverage of 37.5% reported in Senegal (Mbengue et al., 2017) and 55.4% in Myanmar (Nozaki, Hachiya, Kitamura, 2019). The disparity in the child immunization coverage observed in these studies could be as a result of the variation of the age group of the children studied.

Surprisingly, in the present study, the BCG and OPV coverage at birth and OPV, RV, DTaP-IPV/ Hib –HBV and PCV coverage at 6-weeks were high (100%) in all the age

groups. In a Ghana studies, the prevalence of BCG coverage were 95% (Malande et al., 2019) and 89% (Bbaale, 2013), respectively. The Senegalese Demographic and Health Survey data (2010-2011) indicates that the first dose of measles was 82.1% (Mbengue et al., 2017). In the present study, with exception of the children in the age group 6 to 8 months (82.6%) the first dose of measles was 100%, while the second dose coverage was 91.4% and 98.5% in those aged 12-17 months and 18 months – 5 years, respectively.

The first and final dose of Td vaccine commonly referred to as a “booster shot” is recommended when child is 6 and 12 years old, respectively. There is a lack on studies that access the coverage of vaccination of children in this age group. However, in the present study, only 52% and 42% of children aged 6-11 years and 12 years were up to date with the first dose coverage of Td vaccine, respectively, while the second dose of Td vaccine was received by more than two-thirds (79%) of the children aged 12 years.

5.3 Maternal factors associated with immunization coverage

5.3.1 Maternal Age:

In agreement with the other studies, there was no statistical significant association between maternal age and child immunization status (Mbengue et al., 2017; Balogun, Yusuff, Yusuf, Al-Shenqiti, Balogun, & Tettey, 2017; Kibreab, Lewycka & Tewelde, 2020). In contrast, other studies found a significant association between maternal age and child's immunization status (Adenike, Adejumoke, Olufunmi, Ridwan, 2017; Nozaki et al, 2019). In contrast, maternal age was revealed to be a factor influencing immunization intake conducted in children between 12 to 23 months of age, in which mothers over 19 years of age were approximately 10 times more likely to have their children fully immunised compared with mothers under 19 years of age (Negussie, Kassahun, Assegid, Hagan, 2015)

5.3.2 Level of education:

Previous study reported a significant relationship between maternal education and child immunization status (Mbengue et al., 2017; Balogun et al., 2017; Kibreab et

al., 2020). In contrast, other study found not significant association between level of education and child immunization status (Adenike et al., 2017). Similarly, the findings of the current study revealed no statistical significant association between level of education and child immunization status.

5.3.3 Marital Status:

Consistent with the findings of other study, maternal marital status was not statistically significantly associated with child immunization status (Nozaki et al, 2019; Kibreab et al., 2020). In contrast, a significant relationship between maternal marital status and child immunization status was reported in a study conducted in Senegal (Mbengue et al., 2017). In contrast, marital status of a mother was reported to have an influence in childhood immunization, it was found that divorced mothers were 3 times less likely to complete immunisation schedules of their children compared with mothers who were married (Anokye , Acheampong , Budu-Ainooson , Edusei , Okyere , 2018).

5.3.4 Employment status:

Again, similar to the results of many studies maternal employment status was not significantly related with child immunization status (Nozaki et al, 2019; Kibreab et al., 2020). In contradiction with other studies, this study found that, employed mothers (OR = 2.01 (95%Ci: 0.82 - 4.89) were more likely to have their child immunized in a bivariate logistic regression analysis, however, the multivariate logistic regression showed no statistical significant relationship between the two variables.

5.4 Maternal factors associated with incomplete immunization

5.4.1 Level of education

Kibreab et al in their study found that children of mothers with primary (OR = 2.75, 95% CI 1.74–4.37), and higher (OR = 3.16, 95% CI 2.09–4.78) education were more likely to be fully immunized (Kibreab et al, 2020). A study carried out in Senegal found that mothers with secondary and higher education (OR = 1.81 (95%

CI: 1.20–2.48) were more likely to get their children fully immunized (Mbengue et al., 2017). In the present study, the bivariate analysis indicated that mothers with tertiary education were significantly more likely to immunize their children, while in the multivariate model no statistical significant association was observed between maternal education and child immunization status. In agreement with other researchers who reported that urban residence and increasing parental education were associated with complete immunization levels (Obiajunwa & Olaogun, 2013).

5.4.2 Employment status

Previous study indicated that the unemployed mothers (OR = 1.05 (95% Ci: 0.72–1.53) were more likely to immunized their children as compared to those employed, however, the results were not statistically significant (Kibreab et al., 2020). In contradiction with other studies, this study found that, employed mothers (OR = 2.01 (95%Ci: 0.82 - 4.89) were significantly more likely to immunize their child in a bivariate logistic regression analysis, however, the multivariate logistic regression showed no statistical significant relationship between the two variables. The findings of the study are in agreement with Wonodi et al. (2012), it was identified that finance or unemployment, service delivery, logistics, and governance, are amongst several others as barriers to routine immunization

5.5 Health system factors associated with immunization coverage

5.5.1 Access to health facility

A study conducted in Uganda, indicate that poor access to health facility, long distances to health facility, lack of proper roads, terrains, lack transports, rainy seasons contribute to low immunization coverage (Malande et al., 2019). In Nigeria, one study also found that walking long distance to facility influences child immunization (Abdulalraheen et al., 2011). The finding of the present study indicates no significant differences to mothers and /or caregivers with regard to access to healthcare facility, however, the non-default mothers were more likely to have access to healthcare facility than default mothers. In contradiction, Kliptoo

(2015), found that children belonging to mothers or caregivers who travelled a short distance to the health facility for immunisation were 18 times more likely to be fully vaccinated compared with children whose mothers or caregivers travelled further to a health facility for their children's immunisations (Kiptoo, 2015).

5.5.2 Shortage of Vaccines

Vaccines and supplies stock outs has been commonly reported as the main reasons for defaulting or missed childhood immunization (Msimang et al., 2013; Brown & Gacic-Dobo, 2018; Mthiyane, Cohen, Norris, Walaza, Tempia et al., 2019). In the present study, even though there was not statistical significant difference between the two groups with regard to experience of shortage of vaccines, the mother who defaulted or missed childhood immunization were likely to report vaccine stock outs than the non-default mothers. The findings of this study is in agreement with the study conducted by Obiajunwa & Olaogun (2013), who reported challenges that were contributing to low immunization coverage rate which includes unstable political, socio economic environments, stock out of vaccine, transportation cost, maternal factors (low literacy level, ill health or travel out of state), low family socio-economic status, and various other health delivery system factors.

5.5.3 Staff attitudes

The negative healthcare workers attitutdes have previously been reported to be among the reasons for defaulting or missed immunization among children (Rosso, Massimi, De Vito, Adamo, Baccolini et al., 2019). The non-default mothers found to report negative attitude of healthcare workers during childhood immunization as compared to the default mothers, however, the results were not statistically significant.

5.5.4 Lack of information

Lack of information about importance of vaccination and the date of the next vaccination given to mother by healthcare workers have been found as the primary

reasons for contributing to lack of vaccination, delayed vaccination, missed vaccination and poor vaccination (Msimang et al., 2013, Brown & Gacic-Dobo, 2018; Abdulalraheen et al., 2011, Lakew et al., 2015; Murele et al., 2014). The finding of this study revealed that the non-default mothers had information about child immunization than the default mothers but the result were also not statistically significant. In agreement with the study conducted by Obiajunwa & Olaogun, (2013), they discovered that, although most parents had the required knowledge of vaccines preventable diseases, and place of immunization, but only 26.5% of their children were fully immunized with 11.9% of the children receiving no immunization at all.

5.5.5 Fear about immunization

Rosso et al (2019), in their study indicated that most mothers have myth or fear that multiple vaccinations may predispose their children to a risk of developing side effects, and measles vaccine causes autism to their children also influence immunization coverage (Rosso et al., 2019). Similarly, in a study carried out in Nigeria fear of side effects is one of the factor that influence the immunization coverage (Murele et al. 2014). This study found no significant difference between groups with regard to fear about immunization with non-default mothers reporting fear of vaccination than the default mother.

This finding contradict with the study conducted in Nigeria, about cultural beliefs against immunization are found to be destructive towards childhood immunization uptake, this could probably be due to the circulation of false information via the use of either family or religious networks, for example, beliefs that vaccines were composed of anti-fertility drugs and therefore could destroy the eggs of females and cause damage to her reproductive system (Duru et al,. 2016, & Kio , Agbede ,Mkpuruoma , 2016)

5.5.6 Long waiting time to Vaccinate

Long waiting time at the facility to vaccinate the child is one of the factor found to contribute to low immunization coverage (Abdulalraheen, Onajole, Jimoh & Oladipo, 2011). In this study, the mothers who defaulted or missed child immunization were likely to mention it takes the whole day to immunize a child than the non-default mothers.

5.5.7 Attitude of mothers

Mothers and/or caregivers' negative attitudes towards child vaccination (Msimang et al., 2013, Brown & Gacic-Dobo, 2018) and attitudes of the health professional staff (Rosso, Massimi, De Vito, Adamo, Baccolini et al., 2019) was found to be the primary reasons associated with low immunization coverage. Surprisingly, in this study, defaulter mother were found to have positive attitude toward immunization than the non-defaulters, but the results were not statistically significant. This finding contradict with the study conducted by Negussie et al., (2015), which indicates that children whose mothers had a positive perception towards vaccine side effects, were twice more likely to be fully immunised compared with children whose mothers had a negative perception towards vaccine side effects (Negussie, Kassahun, Assegid, Hagan, 2015).

5.6 Limitations of the study

Questionnaires were administered to the participants by the researcher, his presence might have influenced their responses.

5.7 Conclusions

The main purpose of this study was to determine the prevalence and determinants of childhood vaccination coverage at selected primary health care facilities, Bushbuckridge sub-district, Mpumalanga Province, South Africa. The overall immunization coverage in the present study was relatively high and significantly decreases with age. At 6 weeks, all age groups were immunized, while at 10 weeks, with exception of children in the age group 10 -13 weeks and 18 months – 5 years, all other age groups were fully immunized. At 6 months, the young children (age 9-11

months) were likely to default or missed measles vaccination. At 6 and 12 years, the Td vaccination coverage was relatively low.

The findings revealed no significant relationship between maternal age, marital status, level of education, employment status and childhood immunization. Defaulters or mothers who missed child immunization were likely to experience shortage of vaccines at health facility and said it takes the whole day to immunize a child but the result were not significant. Mother and/or caregivers with a tertiary education and employed were more likely to immunize their children than those with primary and secondary education..

5.8 Recommendations

It is recommended that the Department of health should ensure nurses, vaccines and health promoters are available in order to improve vaccination coverage, immunization waiting time, availability of vaccines, since the unavailability of resources contributes to low immunization coverage and staff establishment plan should be considered to address the shortage of human resources.

It is recommended that the employees cultivate positive attitudes towards mothers and/or care givers and also provide health education prior to immunization to all mothers so that they can be aware of the need to vaccinate their babies, since negative attitudes and lack of information regarding immunization may discourage mother/or care givers to vaccinate their children. The researcher recommend that a study should be done to children age 6 and 12 year who are eligible for **Td** booster vaccine with regard to prevalence and factors contributing to low uptake of Td vaccine.

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APPENDIX A: Data Collection Tool

ID | | | |

SECTION A: MATERNAL DEMOGRAPHICS

A1 Maternal Age(Year) ☐

A2 Marital Status
- ☐ Married
- ☐ Unmarried
- ☐ Divorced

A3 Level of Education
- ☐ Primary
- ☐ Secondary
- ☐ Tertiary
- ☐ None

A4 Employment status
- ☐ Employed
- ☐ Unemployed

SECTION B: HEALTHCARE FACILITY FACTORS

B1	I have access to health facility to vaccinate my child	Strongly agree	Agree	Disagree	Strongly Disagree
B2	I have experience shortage of vaccines at health facility.	Strongly agree	Agree	Disagree	Strongly Disagree
B3	I experience negative attitude during immunization	Strongly agree	Agree	Disagree	Strongly Disagree
B4	I have information about immunization	Strongly agree	Agree	Disagree	Strongly Disagree
B5	I have fear about immunization	Strongly agree	Agree	Disagree	Strongly Disagree
B6	It takes the whole day to immunize a child	Strongly agree	Agree	Disagree	Strongly Disagree
B7	I have positive attitude toward immunization	Strongly agree	Agree	Disagree	Strongly Disagree

SECTION C: CHILD INFORMATION (For Office use)

Age ☐ Gender ☐ Male ☐ Female

Participant number		CAREGIVER		RTHC	
IMMUNIZATION SCHEDULE		Received		Received	
VACCINE	**Age of child**	**YES**	**NO**	**YES**	**NO**
BCG	**At birth**				
OPV (0)	**At birth**				
OPV(1)	**6 weeks**				
RV(1)	**6 weeks**				
DTaP-IPV/Hib-HBV (1)	**6 weeks**				
PCV (1)	**6 weeks**				
DTaP-IPV/ Hib -HBV(2)	**10 weeks**				
RV (2)	**14 weeks**				
DTaP-IPV/ Hib -HBV(3)	**14 weeks**				
PCV (2)	**14 weeks**				
Measles vaccine (1)	**6 month**				
PCV (3)	**9 months**				
Measles vaccine (2)	**12 months**				
DTaP-IPV/ Hib -HBV(4)	**18 months**				
Td Vaccine	**6 years**				
Td Vaccine	**12 years**				

Immunization status	☐ Fully
	☐ Partially
	☐ None

APPENDIX B: Letter to the Provincial Research Officers

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT BROOKLYN & COTTONDALE CLINIC BUSHBUCKRIDGE SUB-DISTRICT

Mr Pilusa TD
PO BOX 3467
ACORNHOEK
1360

Mpumalanga Department of Health
Private Bag X 11285
Mbombela
1200

Dear Sir/Madam

Request for permission to conduct research at Broooklyn and Cottondale Clinics Bushbuckrigde Sub-District.

I am a student of University of Limpopo Turfloop Campus, studying Master's degree of Public Health. I am hereby requesting permission to conduct a research study at Brooklyn and Cottondale clinics.

The purpose of the study is to determine prevalence and factors contributing to low childhood immunization coverage and participation in the study is voluntary and consent to participate in the study will be signed by mothers who agree to participate.

The study is required for the degree I am doing.

Contact number for the researcher:

Cell numbers 0724348148/ 0719914522

Yours Sincerely

MR TD PILUSA

APPENDIX C: CONSENT FORM

Prevalence and determinants of childhood Immunization coverage at selected Primary Health Care Facilities, Bushbuckridge sub-district, Mpumalanga Province, South Africa.

I have understood the aims and objectives of the proposed study and I was granted opportunity to ask any questions prior to the study. The aim and objectives of the study are sufficiently clear to me. I have not been forced to participate in study.

I understand that participation in this study is voluntary and that I may withdraw from it at any time without any harm.

I know that this study have been approved by the Turfloop Research Ethics Committee (TREC), University of Limpopo (Turfloop Campus). I am fully aware that the results of the study will be used for scientific purposes and may be published. I agree to this, provided my privacy and confidentiality will be maintained.

I hereby give consent to participate in this study.

Signature of Parent/ Care Giver_____

Date.....Place..... Witness……

_____

Statement by the Researcher

I will maintain privacy and confidentiality as promised.

.

Name of Researcher …….Signature……Date…….

APPENDIX D: ETHICAL APPROVAL FROM UNIVERSITY OF LIMPOPO

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: makoetja.ramusi@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **17 February 2021**

PROJECT NUMBER: **TREC/11/2021: PG**

PROJECT:

Title: Prevalence and determinants of childhood vaccination coverage at selected primary health care facilities, Bushbuckrigde sub-district, Mpumalanga Province, South Africa

Researcher: TD Pilusa
Supervisor: Dr E Maimela
Co-Supervisor/s: Dr TS Ntuli
School: Health Care Sciences
Degree: Master of Public Health

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

APPENDIX E: LETTER OF SUPPORT FROM MPUMALANGA DEPARTMENT OF HEALTH

health
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

MPUMALANGA
THE PLACE OF THE RISING SUN

No.3, Government Boulevard, Riverside Park, Ext. 2, Mbombela, 1200, Mpumalanga Province
Private Bag X11285, Mbombela, 1200, Mpumalanga Province
Tel I: +27 (13) 766 3429, Fax: +27 (13) 766 3458

Litiko Letemphilo | Departement van Gesondheid | UmNyango WezeMaphilo

Letter of Support Signed by Chief Director (CD)/CEO/District Manager (DM)/Programme Manager (PM)

1. Name & contact no. of Applicant	Ms THABO DIFFERENCE PILUSA. tptpilusa at gmail.com		
2. Title of Study: Prevalence and determinants of childhood vaccination coverage at selected Primary health care facilities Bushbuckridge Sub-district, Mpumalanga Province, South Africa			
3. Aim and population target: To determine the prevalence and investigate the determinants of childhood immunization coverage at Primary Health care facilities. Target population: Mothers or caregivers who have children under the age of 12 years Eligible for immunization.			
4. Period to undertake the study	From: 01 MARCH 2021 to: 01 FEBRUARY 2022		
5. Resources Required from Facility/Sub-district/Community			
5.1: Facility Staff Required to assist with the Study	Yes How many: Nurses: Doctors: Other, please specify:		NO X
5.2: Patient Records/Files	Yes		NO X
5.3: Interviewing Patient at Facilities	Yes X		NO
5.4: Interviewing Patients at Home	Yes		NO X
5.5: Resource Flow (Are there benefits to Patients/community)	Yes X Please list: Understanding the need for immunization		NO
5.6: Resource Flow (Are there benefits to Facility/District)	Yes X Please list: I will send the findings to DDH		NO
6. Availability of Required Clearance			
6.1: Ethical Clearance	Yes X Clearance Number: TREC/11/2021:PG	Pending	NO
6.2: Clinical Trial	Yes Clearance Number:	Pending	NO X
6.3: Vaccine Trial	Yes Clearance Number:	Pending	NO X
6.4: Budget	Yes X Source of fund: Self Funding		NO

Declaration by Applicant:
I (Mr/Ms/Dr/Prof/Adv. Thabo Difference Pilusa agree to submit/present the result of this study back to the CEO/Institution/District.

Comment by CEO/CD/DM/PM: Supported / Not Supported
I support the undertaking of the study herein mentioned

Signature of CEO/CD/DM/PM
Name: D Mdluli

EHLANZENI DISTRICT OFFICE
PRIVATE BAG X 11278
66 ANDERSON STREET NELSPRUIT 1200
Date Received: 2021 -03- 02
DISTRICT MANAGER'S OFFICE
DEPARTMENT OF HEALTH

Stamp/Date: 2/3/2021

Please email completed form to: JerryS@mpuhealth.gov.za or ThembaM@mpuhealth.gov.za

APPENDIX F: PERMISSION FROM MPUMALANGA DEPARTMENT OF HEALTH

health
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Indwe Building, Government Boulevard, Riverside Park, Ext. 2, Mbombela, 1200, Mpumalanga Province
Private Bag X11285, Mbombela, 1200, Mpumalanga Province
Tel I: +27 (13) 766 3429, Fax: +27 (13) 766 3458

Lisiko Lotomphilo | Departement van Gesondheid | UmNyango WezeMaphilo

Enq: 013 766 3766/3511
Ref: MP_202103_006

Research Approval Letter

Mr T Pilusa
PO BOX 3467
ACORNHOEK, 1360

TITLE: **APPLICATION FOR RESEARCH APPROVAL: PREVALENCE AND DETERMINANTS OF CHILDHOOD VACCINATION COVERAGE AT SELECTED PRIMARY HEALTH CARE FACILITIES, BUSHBUCKRIDGE SUB-DISTRICT, MPUMALANGA PROVINCE, SOUTH AFRICA**

Dear Mr Pilusa

The Provincial Department of Health Research Committee has approved your research proposal in the latest format you sent.

- Approval Reference Number: MP_202103_006
- Data Collection Period: 10/04/2021 to 15/12/2021.
- Approved Data Collection Facilities:

  * Brooklyn Clinic & Cottondale Clinic

Kindly ensure that conditions mentioned below are adhered to, and that the study is conducted with minimal disruption and impact on our staff, and also ensure that you provide us with a soft or hard copy of the report once your research project has been completed.

Conditions:
- *Researchers not allowed to make copies or take pictures of medical records.*
- *Kindly notify the facility manager a week BEFORE you start with data collection to ensure that conditions are conducive in the facility*

Kind regards

DR C NELSON
MPUMALANGA PHRC CHAIRPERSON
DATE: 21/03/2021

MPUMALANGA PROVINCE
DEPARTMENT OF HEALTH
24 -03- 2021
PRIVATE BAG X11285
SPRUIT 1200

APPENDIX G: LANGUAGE EDITOR'S CONFIRMATION

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Date: 13 June 2021

To Whom it May Concern

I hereby confirm that I have proof-read the document entitled: "**Prevalence and determinants of childhood vaccination coverage at selected primary health care facilities, Bushbuckrigde Sub-District, Mpumalanga Province, South Africa**" authored by Pilusa TD with student number 200402518. The document has been edited and proofread for grammar, spelling, punctuation, overall style and logical flow. Considering the suggested changes that the author may or may not accept, at his discretion, each of us has our own unique voice as far as both spoken and written language is concerned. In my role as proof-reader I try not to let my own "written voice" overshadow the voice of the author, while at the same time attempting to ensure a readable document.

Please refer any queries to me.

Rapetsoa DB