

**THE DETERMINANTS OF MEASLES- RUBELLA VACCINE SECOND
DOSE UPTAKE AMONG CHILDREN AGED 19-59 MONTHS AT
MWINGI CENTRAL SUB COUNTY KITUI, KENYA**

JAMES MULWA MUNYITHYA

**A Research Thesis Submitted to South Eastern Kenya University in Partial
Fulfillment for the Award of Master of Science in Epidemiology in the School of
Health Sciences**

2023

DECLARATION

I understand that plagiarism is an offence and I therefore declare that this research project report is my original work and has not been presented to any other institution for any other award.


Signature..... Date.....

James Mulwa Munyithya
H419/KIT/20017/2020

This research project report has been submitted for examination with our approval as University Supervisors.

Signature..... Date.....

Prof. Catherine Mwenda
School of Health Sciences
South Eastern Kenya University

Signature.......... Date.....

Dr. Maxwell Philip Omondi
Lecturer, Epidemiology and Biostatistics
South Eastern Kenya University

ACKNOWLEDGEMENT

I am grateful to the Almighty Farther for guidance and provision of good health and well-being that have seen me accomplish this research.

I am deeply indebted to my supervisors, Professor Catherine Mwenda, and Dr Maxwell Philip Omondi for their unwavering guidance and intellectual support throughout this Research work development.

Special gratitude goes the ministry of health, County Government of Kitui for permission to undertake the course. Special regard goes to Dr. Allan Owino. (Director of health Kitui).

DEDICATION

This Research is dedicated to my mother; Margaret Munyithya, my wife; Susan Katali and my children; Kelvin, Margaret and Emanuel. You are the reason I work Hard.

TABLE OF CONTENTS

Declaration	ii
Acknowledgement	iii
Dedication	iv
Table of Contents	v
List of Tables	ix
List of Figures.....	x
List of Appendices.....	xi
List of Abbreviation.....	xii
Definition of Terms.....	xiii
Abstract.....	xiv

CHAPTER ONE

1.0 Introduction.....	1
1.1 Background Information	1
1.2 Problem Statement	4
1.3 Study Justification.....	6
1.4 Significance of the Study	6
1.5 Study Objectives	6
1.5.1 Broad Objective	6
1.5.2 Specific Objectives	6
1.6 Study Questions	7

CHAPTER TWO

2.0 Literature Review	8
2.1 Introduction.....	8
2.2 Socio-Demographic Factors (confounding variables)	8
2.2.1 Age of the Mother	8
2.2.2 Care Giver’s Education Level.....	8
2.2.3 Place of Residence	9
2.3 Client Related Factors Influencing Measles and Rubella Vaccine Second Dose Uptake	10

2.3.1	Birth Order	10
2.3.2	Additional Children for Parents	10
2.3.3	Knowledge on Measles Two Schedule	11
2.3.4	Fear of Vaccine Reaction	11
2.4	Institutional Related Factors Influencing Measles and Rubella Vaccine Second Dose Uptake	12
2.4.1	Facility Distance from the Households	12
2.4.2	Parents Past Experience with Healthcare Workers	13
2.4.3	Vaccine Waiting Time	14
2.4.4	Health Education	14
2.5	Frameworks	15
2.5.1	Theoretical Framework	15
2.5.2	Conceptual Framework	16

CHAPTER THREE

3.0	Research Methodology	17
3.1	Research Design	17
3.2	Study Area	17
3.3	Target Population	17
3.4	Study Population	17
3.5	Study Variables	18
3.6	Sample Size	18
3.7	Sampling Technique	18
3.8	Data Collection Tools and Procedure	19
3.9	Pre-Testing	20
3.9.1	Reliability	20
3.9.2	Validity	20
3.10	Data Management	20
3.10.1	Data Cleaning	20
3.10.2	Data Analysis	21
3.10.3	Data Presentation Techniques	21
3.11	Ethical Considerations	21

3.12	Limitations	21
3.13	Delimitations.....	21

CHAPTER FOUR

4.0	Results	22
4.1	Introduction.....	22
4.2	Socio-Demographic Characteristics of the Study Population.....	22
4.1	Measles- Rubella Second Dose Uptake in Mwingi Central Sub County.....	25
4.2	Client Related Factors Influencing Measles- Rubella Vaccine Second Dose Uptake Among Children Aged 19-59 Months at Mwingi Central Sub County.....	27
4.3	Institutional Related Factors Affecting Measles- Rubella Vaccine Second Dose Uptake among Children Aged 19-59 Months at Mwingi Central Sub County	31

CHAPTER FIVE

5.0	Discussion.....	32
5.1	Instruction	32
5.2	Measles- Rubella Second Dose Uptake in Mwingi Central Sub County.....	32
5.3	Client Related Factors Influencing Measles- Rubella Vaccine Second Dose Uptake among Children Aged 19-59 Months at Mwingi Central Sub County.....	33
5.4	Institutional Related Factors Affecting Measles- Rubella Vaccine Second Dose Uptake among Children Aged 19-59 Months at Mwingi Central Sub County	36

CHAPTER SIX

6.0	Conclusion and Recommendations.....	39
6.1	Introduction.....	39
6.2	Conclusions.....	39
6.2.1	Measles- Rubella Second Dose Uptake in Mwingi Central Sub County.....	39
6.2.2	Client Related Factors Influencing Measles- Rubella Vaccine Second Dose Uptake among Children Aged 19-59 Months at Mwingi Central Sub County.....	39

6.2.3	Institutional Related Factors Affecting Measles- Rubella Vaccine Second Dose Uptake among Children Aged 19-59 Months at Mwingi Central Sub County	40
6.3	Recommendations	40
	References	41

LIST OF TABLES

Table 1: Measles and Rubella second dose coverage	5
Table 2: Sample size selection	19
Table 3.1: Sociodemographic profile of the study population	22
Table 3.2: Sociodemographic profile of the study population at Mwingi	23
Table 4: Measles-rubella second dose uptake	25
Table 5: Bivariable analysis of the client-related factors	27
Table 6: Logistic regression analysis of the client-related factors	29
Table 7: Bi-variable analysis of the facility-related factors	31

LIST OF FIGURES

Figure 1: Conceptual Framework	16
--------------------------------------	----

LIST OF APPENDICES

Appendix i: Introduction Letter	45
Appendix ii: Consent	46
Appendix iii: Questionnaire	47
Appendix iv: Mwingi Central Sub County Map	51
Appendix v: Ethical Approval Letter	52
Appendix vi: Research License.....	53

LIST OF ABBREVIATION

BCG	:	Bacillus Calmette-Guerin vaccine
CDC	:	Centers for Disease Control and Prevention
CHVs	:	Community Health Volunteers
CI	:	Confidence Intervals
CRS	:	Congenital Rubella Syndrome
DHS	:	Demographic and Health Survey
DPT	:	Diphtheria, pertussis, tetanus vaccine
EPI	:	Expanded Program on Immunization
FGD	:	Focus group discussion
FIC	:	Fully Immunized Child.
IEC	:	Information, education, and communication
KAP	:	Knowledge, attitudes, practices
KDHS	:	Kenya Demographic health survey
MCV	:	Measles Containing Vaccine
MOH	:	Ministry of Health
MOI	:	Missed opportunity for immunization
MR2	:	Measles- rubella second dose
OPV	:	Oral Polio Vaccine
UCI	:	Universal Childhood Immunization
UNICEF	:	United Nations Children's Fund
USAID	:	United States Agency for International Development
RI	:	Routine Immunization
WHO	:	World Health Organization

DEFINITION OF TERMS

- Fully Immunized Child:** An infant who received dose of BCG, three doses of OPV, three doses of Pentavalent vaccines and first dose of Measles vaccine before reaching year old (Mutua M.K et al 2016).
- Immunization Coverage Rate:** Proportion of the target population that has gotten the recommended dose of recommended vaccine in the national schedule. This includes all vaccines within a country's routine immunization schedule (Maina, L.C, 2013).

ABSTRACT

Measles has been considered as one among the many vaccine preventable diseases and it remains a major public health concern in Kenya. (MOH, 2013). Immunization coverage is the most common indicator used to evaluate the performance of immunization services. The study aimed to assess the determinants influencing measles- rubella second dose uptake among children aged 19-59 months at Mwingi Central Sub County, in which the level of uptake, client related determinants and the institutional related determinants influencing measles-rubella second dose were assessed. A descriptive cross-sectional study design was used. A stratified proportionate sampling method was used to pick 380 mothers. Simple random sampling was applied in selecting children who had received first dose of Measles-rubella vaccine in the year 2020. Semi structure questionnaire was used for data collection. The measles –rubella uptake was 68.9% (95% CI: 62.45% - 71.99%) while difference age groups of the mother had the following uptake: 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years and above 40 years were 60% (95% CI: 26.24% - 87.84%), 63.8% (95% CI 48.52% - 77.33%), 73.6% (95% CI: 65.16% - 81.01%), 70.1% (95% CI 60.93%-78.20%), 68.6% (95% CI 54.11%-80.89%) and 53.8% (95% CI 33.37%-73.41%) respectively. In client related determinants, the study showed there was statistically significant positive association between residence of the mother, employment status, religion, knowledge of measles vaccination schedule and on the uptake of the 2nd dose of measles-rubella vaccine (P-value < 0.05). Finally, in facility related determinants, the study showed statistically significant positive association between distance from households, facility always being open and the uptake of the 2nd dose of measles-rubella vaccine for children between 19 -59 months (p-value < 0.05). The study recommends that the Mwingi central sub county health management team to ensure that its catchment population is educated on measles-rubella second dose vaccination schedule, ensure all immunizing health facilities are always open and ensure they provide outreach service for hard to reach community.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Measles is a highly contagious, serious disease caused by a virus. Measles is caused by a virus in the paramyxovirus family and it is normally passed through direct contact and through the air. The virus infects the respiratory tract, then spreads throughout the body. Measles is a human disease and is not known to occur in animals. Before the introduction of measles vaccine in 1963 and widespread vaccination, major epidemics occurred approximately every 2–3 years and measles caused an estimated 2.6 million deaths each year (Orenstein et al, 2000).

Rubella is a mild febrile rash illness caused by the rubella virus. Childhood illness is characterized by a transient, erythematous rash, low grade fever, post-auricular and sub-occipital lymphadenopathy, sore throat, red eyes, headache, malaise and anorexia¹. The most serious outcome of rubella is congenital rubella syndrome (CRS), which occurs if the infection occurred during pregnancy, hence leading to infection of the placenta and the fetus. The risk for congenital defects has been estimated at 90% for maternal infection before 11 weeks of gestation. Nerve deafness is the single most common finding among infants with CRS. However, susceptibility to rubella is known to occur in adults as well. (Masresha et al, 2018).

Rare complications include thrombocytopenic purpura and encephalitis. Rubella is transmitted through direct or droplet contact from nasopharyngeal secretions and has an average incubation period of 17 days. Persons with rubella are most infectious when rash is erupting, but they can shed virus from 7 days before to 7 days after rash onset. There is no specific treatment for rubella but the disease is preventable by vaccination.

Measles-rubella have been considered as one among the many vaccine-preventable diseases. The World Health organization (WHO) reported 142, 000 deaths related to measles had occurred in 2018, a report which was compared to two million six hundred

deaths that had occurred before the introduction of measles vaccine in 1963. Between the year 2000 and 2017 there was a recorded decrease of measles cases by 80% from 853,479 in the year 2000 to 173,330 in the year 2017. There was also a noted decrease of measles incidence by 83% from 145 to 25 cases per million populations worldwide. There has been a global measles related deaths decrease over the last six decades until the year 2018 and late 2019 in which the cases tripled in the first half of 2019 compared to the previous year of 2018. Globally, the current trends indicate that about 21 million children missed their first dose of measles between the year 2010 and 2017 which seems to directly relate to the reported measles outbreaks, morbidity and mortality (Gastañaduy et al, 2021).

There were highest numbers of cases reported in the year 2019 in several countries to include Madagascar, Ukraine, India, Nigeria, Kazakhstan, Chad, Myanmar, Thailand, and the Philippines. Of much interest is that measles cases spikes have been found to be affecting not only the low-income countries but also the developed countries globally. Measles-related deaths and complications are also being linked to the countries and global development. Globally the measles-rubella second dose vaccination has been reported to have reached 64% which is over four times compared to the year 2000 report (Mkopi et al, 2021). Studies done have indicated that it is rare to have individuals vaccinated with two doses of measles vaccine suffer from the disease (Panda et al., 2020).

A significant change in the epidemiology of measles was realized and recorded in Europe upon introduction of the measles vaccine in 1960s to 1970s. A good number of European countries virtually eliminated measles upon the vaccine introduction while the few who did not achieve the required immunization coverage experienced rapid outbreaks. Italy measles vaccine was first introduced in the Year 1976 to its national immunization program in association with Mumps and Rubella. The vaccine was included in the list of essential health interventions however it was realized that its uptake still remains low with irregular levels across the region (WHO, 2015). In 2010, Sicily reported a non-satisfactory measles vaccine coverage and prolonged outbreak which accounted for 2000 cases. The cases were found to affect essentially peoples of age two and ages 15-20 Years. (Restivo et al, 2015).

In the year 2010 measles immunization coverage had good progress in African region from 56% to 85%. (Torracinta et al, 2021). Despite all the efforts, the African region also experienced measles outbreaks and a lot low vaccine coverage. Conflicts in the region have been associated with the outbreaks due to un-expected disruption of the immunization activities mostly by resistance religious groups. It was also noticed that there was upward shift of measles cases in older age groups (Kanyiru et al, 2019).

The African Region of the WHO had developed a strategic plan, which includes a number of targets to be achieved by 2020, as part of the Regional measles elimination goal. These targets and milestones included, Reducing annual regional measles incidence to less than five cases per million and maintain that level in all countries By the end of 2015, Achieving 90% MCV1 coverage (WHO-UNICEF coverage estimates) nationally in at least 60% of the countries and exceed 80% vaccination coverage in every district or equivalent administrative unit in all countries and Achieving at least 95% coverage with measles vaccines during SIAs nationally and in at least 80% of districts (WHO, 2015).

WHO regions had adopted the target to eliminate measles by 2020 and two of the regions were also committed to eliminating rubella by the same year. However, progress was slow. As of 2015, none of the regions had met their targets except the Americas, where elimination of the endemic rubella virus was declared in 2015, followed by the endemic measles virus in 2016. In the coming years, the other five regions were to have met their current targets for elimination in order to determine whether by 2020 it was possible to set a worldwide goal of measles and rubella eradication (WHO, 2017).

A measles elimination goal was to be reached by end of 2020 by WHO African Region countries. Activities for measles control and elimination include routine immunization (RI), supplemental immunization activities (SIAs), case management, outbreak response, and surveillance. Routine Immunization builds protection against measles virus by providing two doses of a measles-containing vaccine (MCV) to infants aged 9-18 months. Supplemental immunization activities (SIAs) are immunization campaigns targeting children in a defined age group in a specified geographical area. SIAs provide a second

opportunity for measles immunization in children not reached by RI or those not seroconverting after routine immunization. SIAs are usually the initial campaigns conducted, targeting children aged 9 months through 14 years, with the aim to achieve high population immunity quickly and interrupt measles transmission, while "follow-up" SIAs are Conducted at regular intervals, usually 3-4 years, among children aged <5 years, to reduce accumulation of susceptible children. The WHO Africa Regional Office (AFRO) has established measles elimination indicators, including: measles incidence <1 case per million populations at national level; $\geq 95\%$ MCV coverage in RI at national and at sub-national levels; 95% coverage in measles SIAs (Kisangau et al, 2018).

In Kenya, the Expanded Program on Immunization (EPI) was started in 1980 with the first dose of measles-containing vaccine (MCV) or MCV1 given at 9 months of age. Accelerated control for measles was started in 2002 when the first catch-up SIA that targeted children aged 9 months to 14 years was conducted, followed by periodic SIAs and the establishment of a case-based surveillance for measles with laboratory confirmation. In addition, the Reach Every District approach has been implemented in the country since 2003 to improve RI coverage. With the promulgation of the new constitution in 2010, Kenya adopted a decentralized government and replaced the eight provinces and existing districts with 47 semi-autonomous counties. In 2013, health services were fully decentralized to the counties to run the devolved functions, following the election of governors. Measles case-based surveillance therefore shifted from being district-reported to county-reported. A second dose of MCV (MCV2) was introduced in 2013 and is recommended for children aged 18 months. Kenya developed a national measles elimination strategic plan 2012-2020 as a road map for eliminating measles transmission. This analysis aims to describe measles immunization performance, the surveillance performance against WHO standards, the epidemiology of measles cases in Kenya and to track the progress towards elimination of measles (Trentini et al, 2017).

1.2 Problem Statement

Measles remains a major public health concern in Kenya. It contributes significantly to the burden of disease among children below 5 years (MOH, 2013). In May 2016, Kenyan

government introduced Measles-Rubella (MR) combined vaccine. This change came as a result of an increase in cases of rubella in Kenya with 422 cases in 2015 (CDC and Prevention Progress in Measles Control - Kenya, 2016). Rubella has serious consequences for pregnant women, like fetal death and congenital rubella syndrome. Despite Kenya having introduced measles two vaccination in the Year 2013, there has never been a good coverage of the same. The government had launched the measles vaccine immunization for all children under 5 years of age during which there was introduction of a combined measles rubella vaccine campaign. An announcement was also made that there would be introduction of the combine dose in the routine coverage by the Year 2017. (Kanyiru et al, 2019).

Mwingi central sub county has been reporting low measles-rubella second dose coverage of less than 50% since 2015 up to date leading to accumulation of susceptible children. (KHIS, 2021)

Table 1. Measles and Rubella second dose coverage.

Measles- Rubella 2 coverage at Mwingi central sub county.			Kitui Central sub county, Kitui county
Year	Percentage	MOH Reporting rate	Percentage
2021	45.1	93	76.1
2020	43.5	100	110.9
2019	38.2	100	91.8
2018	49.9	100	63
2017	39.5	66.7	52.2
2016	35.7	100	44.8
2015	32	100	48.5

Source: KHIS 2021.

1.3 Study Justification

This study was in line with the global strategy since immunization plays a key role in achievement of 14 out of the 17 sustainable development goals. By addition on knowledge and literature on measles second dose coverage, the study mirrors the sustainable development ethos “leaving no one behind”. For example, with goal two of SDGs of zero hunger, undernourished children who contract measles are more likely to die from infectious diseases such as diarrhea, and pneumonia (Torracinta et al., 2021).

The study was in line with the strategic Advisory Group of Experts recommendation of 2016 which encouraged all Governments to introduce the second measles and Rubella dose routinely in all countries. (Kanyiru et al, 2019).

The study was in consistence with big four agenda which aims at achieving Universal health coverage in Kenya since children are a very special group within the Kenya population and desperately need universal health coverage.

1.4 Significance of the Study

The study results will be of great assistance to the policy makers in Kitui County in order to scale up the immunization strategies already in place and reach more children. The study results will be of great use to the Mwingi central sub county management committee in which they will be able improve positively of the institutional factors influencing immunization of the second dose of measles two at the facility.

1.5 Study Objectives

1.5.1 Broad Objective

To assess the determinants of measles-rubella vaccine second dose uptake among children aged 19-59 months in Mwingi central sub county, Kenya.

1.5.2 Specific Objectives

- i. To find out percentage the measles-rubella second dos uptake in Mwingi Central Sub-County, Kenya.

- ii. To establish the client related factors influencing measles-rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub-County, Kenya.
- iii. To describe the institutional related factors influencing measles-rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub-County, Kenya.

1.6 Study Questions

- i. What is the measles-rubella vaccine second dose uptake in Mwingi Central Sub-County, Kenya?
- ii. What are the client related factors influencing measles-rubella second dose uptake among children aged 19-59 months at Mwingi Central Sub-County, Kenya.
- iii. What are the institutional related factors influencing measles-rubella second dose uptake among children aged 19-59 months at Mwingi Central Sub-County, Kenya.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

The chapter aimed at reviewing literature from other researchers on the same subject matter. This enabled the owner of this document to put more emphasis on the areas that were not exhaustively researched on. The literature was presented as per the laid down objectives in a logical and systematic manner.

2.2 Socio-demographic factors (confounding variables)

2.2.1 Age of the Mother

According to Pearce A. et al 2008, in their study on Factors influencing the uptake of measles, mumps, and rubella vaccine (MMR) and use of single vaccine in a contemporary UK cohort, the study showed that children of old mothers (30-35 years) were more likely to receive vaccination compared to children of young mothers. The same was supported by the findings on study on factors influencing immunization coverage among children under five years of age in Khartoum state Sudan by Maarse 2019, in which Children of older mothers were correctly vaccinated more than children of younger mothers (82.4% versus 68.6%)., this contradicted with findings of Sabahelzain et al 2022, in their study on Vaccine hesitancy among parents and its association with the uptake of measles vaccine in urban settings in Khartoum State, Sudan. Vaccines which indicated that there was no statistical significance difference among difference age groups and the uptake of measles uptake. (OR 1.055; 95% CI 1.028–1.058).

2.2.2 Care giver's Education level

Education level of the parents seemed to have significance in completion of immunization schedule. There was decrease in likelihood of being un-immunized with the parent's educational attainment. To support this, children whose mothers did not have education were six times more likely to be un-immunized (Li & Taylor, 2013).

According to KDHS (2008-2009), there was a positive correlation between education of the mother and the uptake of immunisation. According to Herliana & Douiri ,(2017) in their survey on inequity in childhood immunization between urban and rural areas of Peshawar City in North of Pakistan, the study found that immunization status higher among educated families. Immunization status for different levels of education were 93.1% in higher education families, 81.2% Secondary education families, 48.5% primary level education families and 47.7% in none educated families. Urban areas had a much higher educated population than rural areas.

According to Kanyiru (2020) in his study on factors associated with Uptake of Measles-Rubella Vaccine among Children Age 9-18 Months in Eastleigh North Ward Nairobi County, Kenya, the study indicated that there was a strong association between level of education and measles vaccine uptake, ($P=0.007$).

A lot of studies show that maternal education or literacy is a strong and consistent factor of child immunization outcome. The higher maternal education the higher immunization uptake (Magodi et al, 2019). Despite most studies associating maternal education with immunization uptake, this relationship is not so clear. However, ante-natal care follow-up and mother's knowledge about the age at which vaccination begins were significant determinants of immunization uptake (Abuya et al, 2011).

2.2.3 Place of residence

The place of residence is also an underlying factor to vaccination coverage. Children living in urban areas had higher immunization rates compared to their rural counterparts. This is attributed to the fact that immunization services are more accessible in urban areas due to higher accessibility of health facilities (Emmanuel et al, 2019).

A community-based study to investigate the determinants of immunization coverage, the study showed that the mother's area of residence was not significantly associated with full immunization among children. (Torracinta et al, 2021).

The measles and rubella second dose uptake was found to be 88.7% after overall examinations, after examining the respondent's residence as a variable, it was found that there was higher uptake among children from the East of Ireland at 91.6% compared to the children from the West with 83.8 % and a P value of 0.002. (Jessop et al, 2010).

Summary

Documented literature reveals that most of the studies compared children localities and very few concentrated on assessing the factors determining up-take at a single locality. Most of the studies have been found to have been carried out at other regions other Africa and they are either comparative or Cohort studies. The researcher found it worthy to carry out this study based on the gaps identified.

2.3 Client related factors influencing measles and rubella vaccine second dose uptake

2.3.1 Birth order

Birth order was found to be a determinant factor influencing the uptake of immunization services. It was found that the last born children were more like not to complete immunization schedule as compared to first born children. Therefore, it was concluded that birth order was a determinant in completion of the immunization. (Li & Taylor, 2013).

A study by Herliana & Douiri, 2017 found a statistical significance in the age and birth order of the children. The older children were likely to be fully immunized compared to the younger children. The odds of being fully immunized among the older children were found to be higher compared to the odds in the younger children.

2.3.2 Additional children for parents

Parents with other children to take care of or single parents with little support may find it difficult to get around to having their children immunized. (Li & Taylor, 2013). These families may need additional support from community health staff such as health visitors or practice nurses and should be particularly targeted. Making immunizations more accessible for children especially when parents seemed hesitant to bring them for the services was found to be a good method for children from parents with other children to

take care of. This could be made possible through providing opportunistic immunizations for children who had defaulted through health visitors at their homes. The approach was found to improve immunization uptake among many defaulters (Li & Taylor, 2013).

2.3.3 Knowledge on measles two schedule

According to Etana et al (2020) on factors associated with complete immunization coverage in children aged 12-33 months in Central Ethiopia, it was found that 96% had knowledge on immunizations with an immunization coverage of 79.5%. A study carried out in Ghana reported low knowledge on immunization among the caregivers according to Bosu et al (1997) on factors influencing immunization coverage. The immunization was as low as 26 % and the immunization coverage was 46% among the children. Naeem et al (2011) found out that knowledge of the mothers was positively associated with immunization (89.2% enough), 58.5% moderate, 54.5 little and 28.1 none. Knowledge on immunization in urban areas was much better than rural areas. 90.5% of parents answered yes when asked whether EPI programme was useful. Mothers who had access to TV /Radio had higher immunization rate of 68.2% than those who did not have with a rate of 45.3%. Mothers in urban areas had much better information access 93.2% than rural areas 79.3%.

According to international health and human rights, (2009) on factors associated with complete immunization coverage in Nouna District Burkina Faso, it was found out that 59.7% of parents knew that the objective of vaccinating children was to prevent disease, while 10.29% of parents said they had no idea about the objectives of vaccination. In another study by Adediran et al 2017, on expanded program of immunization coverage and associated factors in southern Ethiopia 59.3% of children whose mothers did not know local vaccine site schedule were fully immunized as compared with 76.1% of children whose mothers knew vaccine schedule of their facility were fully immunized.

2.3.4 Fear of vaccine reaction

According to demographic health survey done by Amin et al (2006) on factors limiting immunization coverage in urban Dili, Timor- Leste, it was found out that mothers were discouraged to return for subsequent vaccinations after their children suffered from adverse

events following immunization (such as fever, crying or insomnia) or wasted a visit because the vaccine was not available where one father said in a focused group discussion that he wanted to take his child to the facility though he was afraid that his second and third born had experienced fever all day and night after receiving vaccinations.

Affordability was a major factor influencing on immunizing children among parents. The participants disclosed that they would rather miss the immunization appointments and spare the cash to travel to work. (Kanyiru et al, 2019).

Summary

Documented literature on client related factors have concentrated on knowledge, fear of vaccine reactions and the relationship between antenatal clinic attendances in relation to immunization coverage. The literature did not specify on the second dose of measles-rubella vaccine uptake. The researcher's finds it necessary carry out this research and bring out the client related factors determining the measles rubella second dose Uptake.

2.4 Institutional related factors influencing measles and rubella vaccine second dose uptake

2.4.1 Facility distance from the households

According to international health and human rights (2019) on factors associated with complete immunization coverage that the mean distance from households to vaccination site had no advantage in terms of vaccination coverage rate considering the distance between the villages of residence of the child and a health center. The mean distance was 6.8 km for vaccinated and 7.0 for not completely vaccinated. There was no significant difference between the distance from the health center and immunization uptake. (Zoma et al 2019). The correlation between the range of distance from village to health center and complete immunization coverage was no significant.

On other hand Measles and rubella vaccines were considered efficient on the recommendation by the government health care facilities that the distance to a health facility determined vaccination outcomes. In a study carried out in Khartoum State, Sudan

the study revealed that children whose mothers walked less than 30 minutes to vaccination place were more likely to have had the correct vaccinations than children whose mothers walked longer distances. The study thus found out that walking time to the nearest vaccination center had a strong influence on vaccination (Ibnouf, Borne & Jam, 2017).

In another study by Adediran et al 2017, on expanded program of immunization coverage and associated factors in southern Ethiopia, 76% of children whose mothers perceived vaccine site was accessible to their residence and were fully immunized; whereas only 41.7% of children whose mother perceived in reverse were not fully immunized. According to Naeem et al, (2010), the distance had no effect on immunization status of the children above 7km. Immunization rate for less than 1km was 64.1% 1-4 75.7%, 80.7%, 7-10km 58.2% and 10+ km 41.5%.

2.4.2 Parents past experience with healthcare workers.

According to demographic health survey done by Amin et al (2016) on factors limiting immunization coverage in urban Dili, Timor- Leste, it was found out that caregivers interviewed in a focused group discussion had un-immunized children and often did not complete their children vaccinations because of negative experience with health care services. One caregiver is quoted in a focused group discussion reporting what a health care worker told her “it is better not to bring your child here (health facility) and also better not to bring your child back again”. It was found out that those who had a bad experience with one child would not take other children for vaccination. A few mothers explained that they were shouted at when they came late or if they had lost their LISIO book (Lirrinho Saude Inan no Oan, or mother to child health book). Some mothers were afraid of taking their children if they missed an appointment and would rather avoid going back than face interrogation (Amin et al,2016). Women who had delivered at home without skilled attendant said they were scared of being shouted at by health worker for giving birth at home, so they did not seek treatment or vaccination for their children after words (Amina et al,2016). Women who recalled having a negative experience during childbirth at health facility were less likely to return to the health clinic for post-natal check-ups or for vaccinations (Amina et al,2016).

2.4.3 Vaccine waiting time

Aminauw (2018) found out that the waiting time for 38.1% was less than 15 minutes and for 26.7% the waiting time at the vaccination site was more than an hour. Majority of the caretakers were not happy with the waiting time especially when they took too long. The waiting time led to some caretakers leaving the immunization center un-attended while others went never to come back leading to missed opportunities. The members expressed concerns about the time they took waiting for vaccines indicating that the same time could be us in performing other income generating activities.

2.4.4 Health education

According to Maina (2013) on immunization coverage and its determinants among children aged 12-23 months in a peri-urban Town of Kenya, advice given to mothers at health facilities during immunization services was also assessed and participants who recalled having been advised on the next date of growth monitoring had children who were 2.94 times more likely to receive full immunization. Other form of advice that was given at the health facility was reported to be; importance of completing immunization schedules as well as date of next dose of vaccine.

Pareek & Pattison, (2000). In their study on the two-dose measles, mumps, and rubella immunization schedule, factors affecting maternal intention to vaccinate, the study found that most women whose children did not complete immunization as scheduled, had not received any health education concerning immunization during their antenatal clinic attendance.

In another study by Adediran et al 2017 on expanded program of immunization coverage and associated factors in southern Ethiopia, the mothers of study children were asked about their knowledge, perception and practice to vaccine and accessibility of vaccine to their residence. Most of the participants responded that there was accessible vaccination site to their residing area and knew vaccine schedule of the site 91.6%, 82.9% respectively. Most of participants responded that their vaccination site had never cancel schedule and their children never returned without getting vaccine 97.2% and 87.2% correspondingly.

Summary

The documented literature on institutional related factors focused more on the experience with health workers, vaccine waiting time and distance from the villages to the immunizing facility leaving out key issues as the availability of the antigens, availability of enough staffs to attend to the children and the duration for which immunization was offered.

2.5 Frameworks

2.5.1 Theoretical framework

The study borrowed health belief model. The health belief model (HBM) is a social psychological health behavior change model developed to explain and predict health-related behaviors, particularly in regard to the uptake of health services. The health belief model was developed in the 1950s by social psychologists at the U.S. Public Health Service and remains one of the best known and most widely used theories in health behavior research. The HBM suggests that people's beliefs about health problems, perceived benefits of action and barriers to action, and self-efficacy explain engagement (or lack of engagement) in health-promoting behavior.

2.5.2 Conceptual framework

The conceptual frame work indicates that independent variables through interaction of confounding variables contributes to dependent variable which is the outcome.

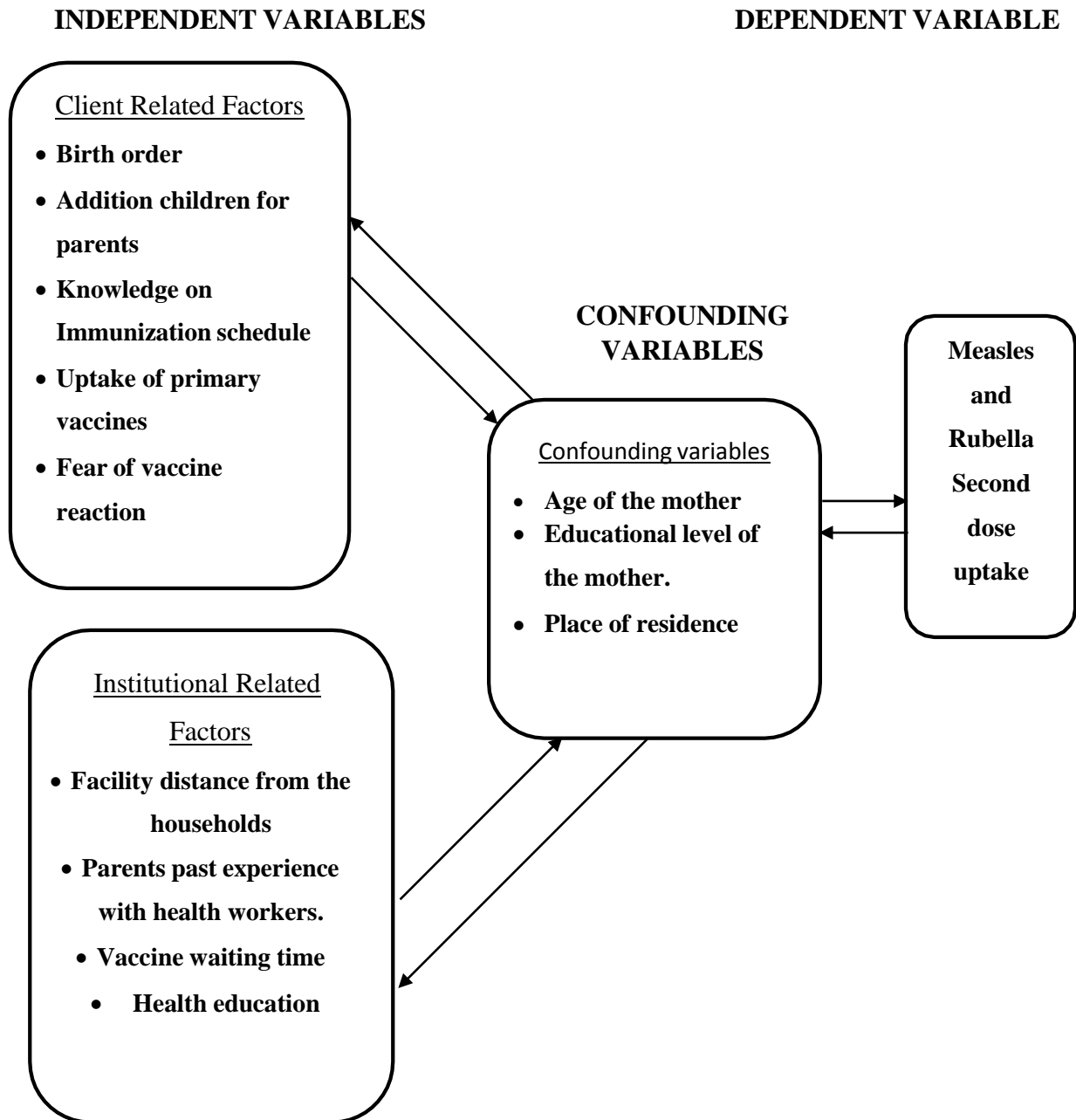


Figure 1. Conceptual Framework

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The study employed a descriptive cross-sectional design. This is because the researcher obtained information regarding both clients related and facility related factors associated with immunization uptake at Mwingi Central Sub-county at single point in time.

3.2 Study Area

The study was carried out at Mwingi Central Sub-county. The sub county had total estimated population of 166,238, total population under five years 19,291 and population 19-59 months of 13,504. It is one of eight sub counties in Kitui County. It was composed of five ward namely Central Ward, Kivou Ward, Mui Ward, Nguni Ward, Nuu Ward and Waita Ward.

Kitui County is located in the southern part of Kenya. It borders Machakos and Makueni districts to the west, Tana River district to the east and Taita Taveta district to the south. The County covers an area of approximately 20, 402 km². The altitude of the County ranges between 400m and 1800m above sea level.

3.3 Target population

The target population was all Mothers and care takers in Mwingi central sub county who had children aged under five years.

3.4 Study Population

The study population was all caretakers with children aged 19-59 months at Mwingi central Sub-county who had received the first dose of measles-rubella in the year 2020. The inclusion criteria were caretaker with children aged 19-59 at Mwingi central Sub-county who had received the first dose of Measles-rubella in the year 2020. The exclusion criteria were caretakers with children aged 19-59 months who did not receive first dose of measles-rubella vaccination or those who decline to consent for participation in the study.

3.5 Study Variables

The independent variables were the birth order of the child, additional children to mother, knowledge on measles-rubella vaccination schedule, uptake of primary vaccines, fear of vaccine side effects, distance from the health facility, past experience with health workers, vaccination waiting time and health education given to mothers. Confounding variables were: age of the mother, education level of the care taker, place of residence. On other hand the dependent variable will be the uptake of measles and rubella second dose.

3.6 Sample Size

Sample size determination.

In this study, the researcher used 95% confidence level so as to balance type one and type two errors. The researcher also used significance level of 5%. He then determined the sample size using formula designed by Fisher (1998).

$$N=19291$$

$$n= z^2 p (1-p)/ d^2$$

Z was the z value for the corresponding confidence level (1.96 for 95% confidence);

d was the significance level (i.e. 0.05= or + 5%)

P was the estimated value for the proportion of a sample that have the condition of interest

In this study P was 45.1% which was the Mwingi central sub county Measles-rubella vaccination second dose coverages for the year 2020. (DHIS ,2020)

$$n = 1.96^2 p (1-p) / 0.05^2$$

$$n= 1.96^2 \times 0.451(1-0.451) / 0.05^2$$

$$n= 380$$

3.7 Sampling Technique

In this study, the researcher employed different sampling methods. First the researcher employed stratified proportionate sampling to sample all the six wards: - namely Central Ward, Kivou Ward, Mui Ward, Nguni Ward, Nuu Ward, Waita Ward, in the sub county to ensure full representative. Two health facilities from each ward were sampled depending on population size, hence each health facility had different sample size which was

proportional to its catchment population. To select participants, simple random sampling method was applied for those children who received the first dose of measles-rubella in the year 2020 in every selected health facility, where this information was obtained in the permanent registers of each facility. By the assistance of facility in charges and the CHVs, the selected participants were called at the facility for the interview.

Table: 2 Sample Size Selection

WARD	Facility	Expected Target	MMR first dose reached (2020)	sample size
Central Ward	Kalisasi Health Centre	93	58	20
	Musukini Dispensary	36	27	9
Kivou Ward	Kanyunga Health Centre	107	95	32
	Kanzui Dispensary	34	26	9
Mui Ward	Lundi Dispensary	34	38	13
	Muyuni Dispensary	47	17	6
Nguni Ward	Nguni Health Centre	183	240	82
	Ukasi Model Health Centre	131	215	73
Nuu Ward	Kavindu Health Centre	61	36	12
	Wingemi Health Centre	60	71	24
Waita Ward	Mutwangombe Dispensary	64	91	31
	Waita Health Centre	172	203	69
Total sample size				380

3.8 Data Collection tools and Procedure

Semi Structured questionnaire was used. The questionnaire had three sections in which section one contained Socio-demographic factors, Section two client related questions while section three contained facility related factors. The questionnaire had both open and closed ended questions. The participants were called at their respective health facilities

for the interview. They were informed and explained to about the intention of the study hence requested for their consent. Once the mother/caretakers consented to participate in the study; the researcher was assisted by four research assistants who filled the questionnaire through an interview schedule.

3.9 Pre-testing

A 10 % of the sample size was involved in a pre-test. A total 38 participants were used. 19 participants were sampled from Kyoso ward, which was in Mwingi North sub county and other 19 participants in Migwani ward which was in Mwingi west sub county and which was not part of study area. Convenient sampling method was applied in selecting the facility catchment areas where the participants were sampled. This was done to determine validity and reliability of the data collection tool and make the necessary corrections before the actual data collection.

3.9.1 Reliability

Reliability refers to the measure of the degree to which a research instrument yields consistent results or data on repeated trials using the same instrument with similar conditions (Mugenda & Mugenda, 2003). To ensure reliability, pretesting of the tools was done and the research assistances were properly trained to ensure correct interpretation of the questions.

3.9.2 Validity

The validity of research instruments used in a study relies on the degree to which they measure what is intended by the researcher (Mugenda & Mugenda, 2003). The data collection tool to be used in this study was reviewed by supervisors. The research assistants were trained to ensure they have clear understanding of the tool.

3.10 Data management

3.10.1 Data Cleaning

Once data was collected, the following data processing procedures was done. These includes field editing, data coding and data entry done on an excel spreadsheet.

3.10.2 Data Analysis

Descriptive statistical analysis was done using measures of central tendencies – mean, median and frequency tabulation. Univariable, bivariable and multivariable analysis was used to determine statistical association between client and facility related factors and uptake on 2nd dose of measles-rubella vaccine. SPSS version 21 was used for data analysis

3.10.3 Data Presentation Techniques

The data was then presented in tabular form, and narratives.

3.11 Ethical Considerations

Before data was collected, permission to collect data was granted by South Eastern Kenya University. Ethical approval for this study was obtained from the University of Eastern Africa, Baraton Ethics Review Committee. (B3029052022). Finally, Research License was obtained from National Commission for science, Technology and Innovation. (998014).

The five main principles underlying scientific studies were: - scientific merit, equitable selection of subjects, seeking informed consent, confidentiality and avoidance of coercion was highly considered in the study.

Prior to the study a sensitization meeting with the health authorities in charge of the health facilities was done. Explanation of the objectives was done and finally consent was obtained from the participants.

3.12 Limitations

The study limitation was that some of the mothers and caretakers called to participate in the interview did not turn up hence the researcher was forced to others hence resulted to wastage of time.

3.13 Delimitations

Probability sampling methods were used to pick participants in the study to ensure representation in the target population.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This study was carried out at Mwingi central sub county of Kitui County. The sub county had six administrative wards namely: Central ward, Kivou ward, Mui ward, Nguni ward, Nuu ward and Waita ward. The study targeted mothers whose children had already received first dose of measles-rubella in the year 2020 and who were eligible to have received the second dose. A sample of 380 mothers were selected from the sub county. This chapter shows the findings on :- Socio-demographic characteristics of the study population, percentage Measles-rubella second dose uptake, client related factors and institutional related factors influencing the measles rubella second dose up take in Mwingi Central sub county.

4.2 Socio-demographic characteristics of the study population

Table 3.1 Sociodemographic profile of the study population, Mwingi Central Sub- County, June 2022.

Variable		Mean age	Median age	Std	Range
Age of the mother	Received 2 nd dose of measles vaccination	30.65 years (95% CI: 29.84 – 31.47)	30.00years	4.70314	21.00 – 44.00 years
	Did not receive the 2 nd dose of measles vaccination	of 30.72 years (95% CI: 28.59 – 30.41)	29.00years	7.03600	20.00 – 52.00 years

The study reviewed that the mean age of mothers sampled was 30.21 years with standard deviation of 5.89588 and a range of 15 years to 52 years. Mothers whose children had received the second dose of measles-rubella had a mean age of 30.65 years (95% CI: 29.84 – 31.47), while mothers whose children did not receive the second dose of measles had

mean age of 30.72 years (95% CI: 28.5881 – 30.4141). This indicates that this difference can be explained as due to chance hence not statistically significant and therefore comparable (Table 2.1).

Table 3.2 Socio demographic profile of study population at Mwingi Central sub-county, June 2022

Variable		Number of mothers sampled (N=380)	Proportion
Age of the mother	15 – 19 years	10	2.6 %
	20 – 24 years	47	12.4 %
	25 – 29 years	129	33.9 %
	30 – 34 years	117	30.8 %
	35 – 39 years	51	13.4 %
	Above 40 years	26	6.8 %
Education level of the mother	Primary	175	46.1 %
	Secondary	123	32.4 %
	Tertiary	68	17.9%
	None	14	3.7 %
Residence	Central Ward	29	7.6 %
	Kivou Ward	41	10.8 %
	Mui Ward	19	5.0 %
	Nguni Ward	155	40.8 %
	Nuu Ward	36	9.5 %
	Waita Ward	100	26.3 %
Employment status of the mother	Employed	70	18.4 %
	Self-employed	112	29.5 %
	Not employed	198	52.1 %
Religion	Christian	366	96.3 %
	Muslim	12	3.2 %
	None	2	0.5 %

The study showed that majority 33.9% (129) of the participants were in the age group of 25- 29 years, followed by those aged 30 – 34 years at 30.8% (117). The study also showed that minority 2.6% (10) of the participants were in age group of 15-19 years while 6.8% (26) of the participants were above 40 years) (Table 2.2). In terms of education level of the mothers, the study showed majority 46.1% (175) of the total participants sampled were primary school drop outs while those who did not attend any schooling formed the least proportion of 3.7% (14) (Table 1.2).

The study covered all the six wards in Mwingi central sub county. The finding indicated that majority of the participants sampled came from Nguni ward, with a total proportion 40.8% (155) of all mothers interviewed. The study also indicated that minority 5% (19/) of the participants sampled were from Mui ward. In term of employment status, about 52.1% (198) of the mothers sampled were not employed while 29.5% (112) of mothers sampled were self-employed and only 18.4% (70) were employed (Table 2.2).

Finally, in Mwingi central sub county, about 96.3% (366) of the mothers sampled were Christians. Those who reported to have no religion formed the least proportion of 0.5% (2). Muslim mothers were 3.2% (12) (Table 2.2).

4.1 Measles- rubella second dose uptake in Mwingi central sub county

Table 4: Measles-rubella second dose uptake in Mwingi central sub county.

Variable		Received 2 nd dose N (%)	Did not receive 2 nd dose N (%)	Total
Age	15 – 19 years	6 (60.0%)	4 (40.0%)	10 (100.0%)
	20 – 24 years	30 (63.8%)	17 (36.2%)	47(100.0%)
	25 – 29 years	95 (73.6%)	34 (26.4%)	129(100.0%)
	30 – 34 years	82 (70.1%)	35 (29.9%)	117(100.0%)
	35 – 39 years	35 (68.6%)	16 (31.45)	51(100.0%)
	Above 40 years	14 (53.8%)	12 (46.2%)	26(100.0%)
Education level of the mother	Primary	112 (64.0%)	63 (36.0%)	175 100.0%)
	Secondary	88 (71.5%)	35 (28.5%)	123 (100.0%)
	Tertiary	54 (79.4%)	14 (20.6%)	68 (100.0%)
	None	8 (57.1%)	6 (42.9%)	14 (100.0%)
Residence	Central Ward	16 (55.2%)	13 (44.8%)	29(100.0%)
	Kivou Ward	31(75.6%)	10 (24.4%)	41(100.0%)
	Mui Ward	8 (42.1%)	11 (57.9%)	19(100.0%)
	Nguni Ward	100 (64.5%)	55 (35.5%)	155(100.0%)
	Nuu Ward	18 (50.0%)	18 (50.0%)	36(100.0%)
	Waita Ward	69 (69.0%)	31(31.0%)	100(100.0%)
Employment status of the mother	Employed	58 (82.9%)	12 (17.1%)	70 (100.0%)
	Self-employed	74 (66.1%)	38 (33.9%)	112 (100.0%)
	Not employed	130 (65.7%)	68 (34.3%)	198 (100.0%)
Religion	Christian	248 (67.8%)	118 (32.2%)	366(100.0%)
	Muslim	12 (100.0%)	0 (0.0%)	12(100.0%)
	None	2 (100.0%)	0 (0.0%)	2(100.0%)
Children under 5's	One	179 (74.6%)	61 (25.4%)	240(100.0%)
	Two	83 (59.3%)	57 (40.7%)	140(100.0%)
Birth order	First borne	129 (77.2%)	38 (22.8%)	167(100.0%)
	Middle borne	67 (67.7%)	32 (32.3%)	99(100.0%)
	Last borne	66 (57.9%)	48 (42.1%)	114(100.0%)
Additional children to the mother	Yes	75 (67.0%)	37 (37.0%)	112(100.0%)
	No	187 (69.8%)	81 (30.2%)	268(100.0%)
Total		262 (68.9%)	118 (31.1%)	000.0%)

About 68.9% (95% CI 64.03%-73.57%) participants reported that their children had received the second dose of measles rubella vaccination. While 31.9% (95% CI.26.43%-35.97%) mothers indicated that their children did not receive the second dose measles-rubella vaccination. The study therefore revealed that the measles-rubella routine second dose uptake in Mwingi central sub county was 68.9% as at June, 2022 (Table 2.3).

Measles –rubella uptake in difference age groups of the participant, 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years and above 40 years were 60% (95% CI. 26.24 %-87.84%), 63.8% (95% CI 48.52%- 77.33%), 73.6% (95% CI 65.16%-81.01%), 70.1% (95% CI 60.93%-78.20%), 68.6% (95% CI 54.11%-80.89%) and 53.8% (95% CI 33.37%-73.41%) respectively. Measles-rubella uptake in Mwingi central sub county in terms of level of education was: primary level 64.0% (95% CI 56.41%-71.10%), secondary level 71.5% (95% CI 62.71%-79.31%), Tertiary level 79.4% (95% CI 67.88%-88.26%) and those did not attend any schooling 57.1% (95% CI 20.25%-66.50%). On the issue of residence of the mother, measles-rubella 2nd dose uptake was as follows: Central Ward 55.2% (95% CI 35.69%-73.55%), Kivou Ward 75.6% (95% CI 59.70%-87.64%), Mui Ward 42.1% (95% CI 20.25%-66.50%), Nguni Ward 64.5% (95% CI 56.44%-72.02%), Nuu Ward 50.0% (95% CI 32.92%-67.08%) and Waita Ward 69.0% (95% CI 58.97%-77.87%). Finally, measles-rubella uptake in terms of employment status of the mother was as follows: Employed mothers 82.9% (95% CI 71.97%-90.82%), Self-employed mothers 66.1% (95% CI 56.52%-74.75%) and Not employed mothers 65.7% (95% CI 58.59%-72.24%).

Measles-rubella second dose uptake was also analyzed in terms of the birth order other child. The study showed that: First borne children 77.2% (95% CI 70.13%-83.37%), Middle borne children 67.7% (95% CI 57.53%-76.73%) and Last borne children 57.9% (95% CI 48.29%-67.08%).

4.2 Client related factors influencing measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County.

Table 5: Bivariable analysis of the client-related factors on uptake of measles-rubella second dose among children aged 19 -59 months at Mwingi Central Sub- County, June 2022

Variable		Received 2 nd dose	Did not receive 2 nd dose	Chi-square (p-value at 95% confidence)
Age	15 – 19 years	6 (60.0%)	4 (40.0%)	5.120 (p=0.401)
	20 – 24 years	30 (63.8%)	17 (36.2%)	
	25 – 29 years	95 (73.6%)	34 (26.4%)	
	30 – 34 years	82 (70.1%)	35 (29.9%)	
	35 – 39 years	35 (68.6%)	16 (31.45)	
	Above 40 years	14 (53.8%)	12 (46.2%)	
Education level of the mother	Primary	112 (64.0%)	63 (36.0%)	6.777 (p=0.079)
	Secondary	88 (71.5%)	35 (28.5%)	
	Tertiary	54 (79.4%)	14 (20.6%)	
	None	8 (57.1%)	6 (42.9%)	
	Total	262 (68.9%)	118 (31.1%)	
Residence	Central Ward	16 (55.2%)	13 (44.8%)	36.054 (p=0.0001)
	Kivou Ward	31(75.6%)	10 (24.4%)	
	Mui Ward	8 (42.1%)	11 (57.9%)	
	Nguni Ward	100 (64.5%)	55 (35.5%)	
	Nuu Ward	18 (50.0%)	18 (50.0%)	
	Waita Ward	89 (68.9%)	11(31.1%)	
Employment status of the mother	Employed	58 (82.9%)	12 (17.1%)	7.760 (p=0.021)
	Self-employed	74 (66.1%)	38 (33.9%)	
	Not employed	130 (65.7%)	68 (34.3%)	
Religion	Christian	248 (67.8%)	118 (32.2%)	6.547 (p=0.038)
	Muslim	12 (100.0%)	0 (0.0%)	
	None	2 (100.0%)	0 (0.0%)	
Children under 5's	One	179 (74.6%)	61 (25.4%)	9.665 (p=0.002)
	Two	83 (59.3%)	57 (40.7%)	
Birth order	First borne	129 (77.2%)	38 (22.8%)	11.950 (p=0.003)
	Middle borne	67 (67.7%)	32 (32.3%)	
	Last borne	66 (57.9%)	48 (42.1%)	
Additional children to the mother	Yes	75 (67.0%)	37 (37.0%)	0.292 (p=0.589)
	No	187 (69.8%)	81 (30.2%)	
Knowledge of measles	At 9 months	6 (15.4%)	33 (84.6%)	160.998 (p=0.0001)
	At 24 months	0 (0.0%)	2 (100.0%)	
	At 18 months	246 (86.3%)	39 (13.7%)	
	I don't know	10 (18.5%)	44 (81.5%)	
Previous vaccination side effects	Yes	15 (60.0%)	10 (40.0%)	1.001 (p=0.317)
	No	247 (69.6%)	108 (30.4%)	
Perception on distance	Too long and inconvenient	82 (56.2%)	64 (43.8%)	18.095 (p=0.0001)
	Too short and convenient	180 (76.9%)	54 (23.1%)	

The study reviewed the client-related factors on the uptake of measles-rubella second dose among children aged 19-59 months at Mwingi Central Sub- County, June 2022. It revealed that age of the mother, education level of the mother, previous vaccination side effects and additional children had no statistically significant association with the uptake of the 2nd dose of measles-rubella vaccine (P-value >0.05).

The age of the mothers sampled ranged from 15 to 52 years. This was categorized into six classes of the five years' class interval. The study showed that different classes of the age of the mother reported difference coverage of measles-rubella second dose for their children. Participants of 15-19, 20-24, 25-29, 30-34, 35-39 and above 40 years reported the following measles-rubella second dose coverage of their children 60% ,63.8%,73.6% 70,1%, 68.6% and 46.2% respectively (Table 3.1).

The variable level of education of the mother, the study showed that those who reported their education level to primary school, their children vaccination coverage was 64% (112). Those reported secondary level of education, their children measles- rubella coverage of 71.5% (88). Those with tertiary education level reported their children measles-rubella coverage of 79.4% (54). And finally those who never when to school reported a measles-rubella coverage of 57.1 of their children. At 95% confidence level, a chi-square value was 6.777 and P value of 0.079. (Table 3.1).

However, the study showed there was statistically significant association between residence of the mother, employment status, religion, knowledge of measles and perception of distance on the uptake of the 2nd dose of measles-rubella vaccine (P-value < 0.05) (Table 3.1).

The study showed that different residence of the mother reported different measles-rubella uptake. Residence of the mother was classified in terms of administrative wards in Mwingi central sub county. Mothers residing from Central ward, kivou ward, Mui ward, Nguni ward, Nuu ward and Waita ward reported the following measles-rubella second dose vaccination 55.2%, 75.6%, 42.1%, 64.5%, 50.0% and 68.9% respectively. A chi-square

value at 95% confidence level was 36.054 and P value of 0.0001, this showed that children coming from some wards were more likely to be vaccinated compared to others from wards. This was because there was statistical significance difference in various ward in relation to uptake of Measles-rubella vaccination, hence the differences cannot be explained as due to chance. See table 3.1.

Children whose mother were employed (82.9 %) (58) Were more likely to received second dose of measles-rubella compare to children whose mothers were not employed (65.7%) (130) see table 2.1. A chi-square value was 7.760 and P value of 0.021, this showed that the difference in employment status was statistically significant. See table 3.1

Table 6. Logistic regression analysis of the client-related factors on uptake of measles-rubella second dose among children aged 19 -49 months at Mwingi Central Sub- County, June 2022

Variable		Received 2 nd dose	Did not receive 2 nd dose	Logistic regression (95% CI)	P-value
Residence	Central Ward	16 (55.2%)	13 (44.8%)	1.0	
	Kivou Ward	31(75.6%)	10 (24.4%)	6.574 (2.509 – 17.226)	0.0001
	Mui Ward	8 (42.1%)	11 (57.9%)	2.610 (1.010 – 6.741)	0.05
	Nguni Ward	100 (64.5%)	55 (35.5%)	11.125 (3.683 – 33.601)	0.0001
	Nuu Ward	18 (50.0%)	18 (50.0%)	4.450 (2.193 – 9.029)	0.0001
	Waita Ward	89 (68.9%)	11(31.1%)	8.091 (3.273 – 20.002)	0.0001
Employment status of the mother	Employed	58 (82.9%)	12 (17.1%)	1.0	
	Self-employed	74 (66.1%)	38 (33.9%)	0.396 (0.199 -0.786)	0.008
	Not employed	130 (65.7%)	68 (34.3%)	0.982 (0.602 – 1.601)	0.941
Children under 5's	One	179 (74.6%)	61 (25.4%)	1.0	
	Two	83 (59.3%)	57 (40.7%)	0.496 (0.318 – 0.774)	0.002
Birth order	First borne	129 (77.2%)	38 (22.8%)	1.0	
	Middle borne	67 (67.7%)	32 (32.3%)	0.405 (0.241 – 0.680)	0.001
	Last borne	66 (57.9%)	48 (42.1%)	0.657 (0.374 – 1.152)	0.142
Perception on distance	Too long and inconvenient	82 (56.2%)	64 (43.8%)	1.0	
	Too short and convenient	180 (76.9%)	54 (23.1%)	2.602 (1.665 – 4.066)	0.001

Participants from Mwingi central ward were less likely to receive the 2nd dose of measles rubella as compared to other wards and these were statistically significant with the exception of Mui ward (Table 3.2). Mwingi Central and Nui Ward had comparable uptake of 2nd dose of measles -rubella among children aged 19 – 59 months.

With regards to employment status, children of mothers who were self-employed were about 60.4% less likely to receive the 2nd dose of measles -rubella vaccine compared to those children whose mothers were employed and this was statistically significant (OR: 0.396 (95% CI: 0.199 -0.786). Children of unemployed and self-employed women had comparable uptake of 2nd dose of measles-rubella vaccine (Table 3.2).

Participants with two children under 5 years were about 50.4% less likely to receive the 2nd dose of measles -rubella vaccine compared to mothers who had one child under 5 years of age and this was statistically significant (OR: 0.496 (95% CI: 0.318 – 0.774) (Table 3.2).

The study showed that children who are middle borne were 59.5% less likely to receive the 2nd dose of measles -rubella vaccine compared to children who were first borne and this was statistically significant (OR: 0.405 95% CI: 0.241 – 0.680) (Table 3.2).

The study also revealed that participants who perceived the distance to health facility as being short and convenient were about 2.602 times more likely to receive the 2nd dose of measles -rubella vaccine compared to children whose mothers perceived the distance to be too long and inconvenient (OR: 2.602; 95% CI:1.665 – 4.066) (Table 3.2).

4.3 Institutional related factors affecting measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County.

Table 7: Bi-variable analysis of the facility-related factors on uptake of measles-rubella second dose among children aged 19 -59 months at Mwingi Central Sub- County, June 2022

Variable		Received 2 nd dose	Did not receive 2 nd dose	Chi-square (p-value at 95% confidence)
Is facility always open	Yes	245 (73.1%)	90 (26.9%)	26.948 (p=0.0001)
	No	15 (34.9%)	28 (65.1%)	
Facility has specific days of immunization	Yes	174 (68.0%)	82 (32.0%)	0.351 (p=0.554)
	No	88 (71.0%)	36 (29.0%)	
Child missed vaccination	Yes	32 (61.5%)	20 (38.5%)	1.545 (p=0.214)
	No	230 (70.1%)	98 (29.9%)	
Bad experience with health workers	Yes	8 (72.7%)	3 (27.3%)	0.076 (p=0.783)
	No	254 (68.9%)	115 (31.1%)	
Delays at vaccination sites	Yes	50 (64.1%)	28 (35.9%)	1.076 (p=0.300)
	No	212 (70.2%)	90 (29.8%)	

The study also sought to review the facility related factors on uptake of measles-rubella second dose among children aged 19 -59 months at Mwingi Central sub-county. It revealed that there was statistically significant association between facility always being open and the uptake of the 2nd dose of measles-rubella vaccine for children between 19 -59 months (p-value = 0.0001). However, other facility related factors such as facility having specific days of immunization, bad experience with health workers, delays at vaccination sites did not seem to influence the uptake of 2nd dose of measles-rubella vaccine in Mwingi central sub-county (P-value > 0.05) (table 4.1).

CHAPTER FIVE

5.0 DISCUSSION

5.1 Instruction

This chapter tries to interpret and describe the significance of the study findings in relation to what was already known about the research problem being investigated and to explain any new understanding or insights that emerged as a result of this research.

5.2 Measles- rubella second dose uptake in Mwingi Central Sub County

According to WHO (2022), Measles is a vaccine-preventable disease whose elimination depends on the measles-containing vaccine (MCV) coverage of $\geq 95\%$. To achieve measles elimination, two doses of measles-containing vaccine (MCV) are provided through routine immunization services or vaccination campaigns. At the end of 2021, the global measles-containing vaccine second dose had coverage of 71%.

According to ministry of health Kenya, through their routine reporting in District Health Information Software, at the end of 2021, the measles-rubella second dose was 57.2%. in the National level.

In this study, Mwingi Central Sub County had measles- rubella second dose uptake (68.9 %) which was more compared to national coverage (57.2%) but lower compared to global coverage (71%) (WHO 2021). 68.9% measles-rubella second dose uptake in Mwingi central sub county is lower compared to WHO recommendations of $\geq 95\%$ for community to had herd immunity.

Majority of the participants sampled are in age group of 25-29 years and had highest vaccination coverage of 73.6%. The study reviewed that measles –rubella second dose uptake was higher in children whose mothers were more educated as compared to low educated mothers, this agreed with Naeem et al (2017) in their survey on inequity in childhood immunization between urban and rural areas of Peshawar City in North of Pakistan which found out that immunization status was higher among educated families

compared to less educated families.

Measles-rubella second dose uptake in the sub county was not the same in all the wards, Kivou ward reporting the highest coverage 75.6% and Mui ward reporting the lowest measles-rubella second coverage of 42.1%, this could be because some wards have populations which are hard to reach compared to others. In this case Mui wards has catchment population which are hard to reach and no outreach services available. This disagreed with study by Torracinta et al., 2021 which showed that the mother's area of residence was not statistically significantly associated with full immunization among children.

The study also indicated that measles-rubella second dose uptake was 82.9% in employed families and 65.7% in unemployed participants. This indicated that children from employed mothers were more likely to be immunized as compared to children whose mothers were not employed. This study agrees with study by Li & Taylor, 2013 which indicated that children whose mothers were employed were more likely to be immunized than children whose mothers were not employed.

Finally, measles-rubella second dose uptake in Mwingi Central Sub County in term of birth order of child was that: first born 77.2%, middle born children 67.7% and last born 57.9%. This clearly indicates that first born children in Mwingi Central Sub County were more likely to receive second dose of measles-rubella as compared to last born children. This study supports the findings of Herliana & Douiri, 2017 which found a significance in the birth order of the children and immunization coverage hence order children were likely to be fully immunized compared to the younger children.

5.3 Client related factors influencing measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County

According to a research done by Maarse, (2019) on factors influencing immunization coverage among children under five years of age in Khartoum state Sudan, children of older mothers were correctly vaccinated more than children of younger mothers (82.4% versus

68.6%). This contradicts this study that revealed no statistically significant difference in the mean ages for mothers who's in this study, children received or did not receive the second dose of measles-rubella vaccine at 30.65 years (95% CI: 29.84 – 31.47) and 30.73 years (95% CI: 28.59 – 30.41) respectively. This indicates that the difference in immunization coverage in different age groups can be explained as due to chance hence not statistically significant hence this study disagrees with study by Maarse (2019) which found that Children of older mothers were more likely to be vaccinated than children of younger mothers.

Educational level of the mother was another factor studied, according to Li & Taylor (2013) and Naeem et al (2017) in their studies, it showed that children whose mothers were educated were more likely to receive immunization as compare to less children from less educated mothers. This compares favorably with the finding of this study that there was a statistical significant difference between the levels of education with those with higher education level having a higher uptake of second dose of measles – rubella vaccine than those with lower education level. This means education level was associated with the uptake of measles-rubella second dose in Mwingi central sub county. And therefore this study supports the findings studies of Li & Taylor (2013) and Naeem et al (2017).

In Mwingi Central Sub County, different wards reported different uptake of measles-rubella second dose. Kivou ward reporting the highest percentage uptake 75.6% and Muui lowest uptake of 42.1%. This could be because some wards like Muui have hard to reach populations and no outreach services are provided. Mothers from Mwingi Central Ward were less likely to receive the 2nd dose of measles rubella as compared to other wards and these were statistically significant with the exception of Mui ward. Mwingi Central and Mui Ward had comparable uptake of 2nd dose of measles -rubella among children aged 19 – 59 months. ($P < 0.05$). This indicates that differences in the uptake of measles-rubella second dose was statistically significant.

Birth order was found to be a determinant cause of failure to be fully immunized. It was found that the higher the birth order, the lower the odds in completion of immunization

schedule. Therefore, it was concluded that birth order was a determinant in completion of the immunization. (Li & Taylor, 2013), In this study it showed that children who are middle borne were 59.5% less likely to receive the 2nd dose of measles -rubella vaccine compared to children who were first born and this was statistically significant. It also showed that showed that children who are last born were 34.3% less likely to receive the 2nd dose of measles -rubella vaccine compared to children who were first born and this was statistically significant. This means that difference cannot explained as due chance and therefore there was association between the uptake of measles-rubella second dose and birth order of the child. The study done by Torracinta et al 2021, indicated that parents with additional children to take care, found it difficult to take their other children for immunization. This study supports the findings of Torracinta et al 2021, and it reviews that Mothers with two children under 5 years were about 50.4% less likely to receive the 2nd dose of measles -rubella vaccine compared to mothers who had one child under 5 years of age and this was statistically significant, meaning there was association between the uptake of measles-rubella second dose and additional number of under five children in the family.

With regards to employment status, this study showed that children of mothers who were self-employed were about 60.4% less likely to receive the 2nd dose of measles -rubella vaccine compared to those children whose mothers were not employed. This study was supported by study finding of Mohamed et al (2020) on their study on factors contributing to the uptake of childhood vaccination in Somalia, which found statistically significant in different employment status and therefore employment status was a factor associated with uptake of the second dose of measles-rubella.

Knowledge of the mother on measles-rubella second dose schedule was studied, in this study, it was found that those mothers who correctly knew when measles-rubella second dose have uptake of 86.3% and this was statistically significant. This study finding was supported by findings of Etana et al (2020) on their study on factors associated with complete immunization coverage in children aged 12-33 months in Central Ethiopia that revealed that knowledge on vaccination schedule was a factor contributing to vaccination uptake in a community.

Amina et al (2006) in their study on factors limiting immunization coverage in urban Dili, Timor- Leste, it was found out that mothers were discouraged to return for subsequent vaccinations after their children suffered from adverse events following immunization. In this study it revealed that those mothers who reported that their children had experienced side effects on immunization reported an uptake of 60.0% while those who reported as their children had no side effects had uptake of 69.9%. However, this was not statistically significant and therefore contradicts the findings of Amina et al (2006).

In summary this study, it indicated that age of the mother, previous vaccination side effects and additional children had no statistically significant association with the uptake of the 2nd dose of measles-rubella vaccine. However, the study also showed there was statistically significant association between educational level of the mother, residence of the mother, employment status, religion and knowledge of measles schedule and the uptake of the 2nd dose of measles-rubella vaccine.

5.4 Institutional related factors affecting measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County

The study also revealed that mothers who perceived the distance to health facility as being short and convenient were about 2.6 times more likely to receive the 2nd dose of measles -rubella vaccine compared to children whose mothers perceived the distance to be too long and inconvenient and this was statistically significant. This indicates that distance from health facility to the households was factor associated with the uptake of measles rubella second dose in Mwingi Central Sub County. This study finding contradicted with the findings of international health and human rights (2019) on their finding on factors associated with complete immunization coverage that the mean distance from households to vaccination site had no advantage in terms of vaccination coverage rate. However, the study findings were supported by the findings of by Adediran et al 2017 in her study on expanded program of immunization coverage and associated factors in southern Ethiopia, 76% of children whose mothers perceived vaccine site was accessible to their residence and were fully immunized.

The variable whether the health facility was always open when clients visited the facility for vaccination, it revealed that there was statistically significant association between facility always being open and the uptake of the 2nd dose of measles-rubella vaccine for children between 19 -59 months. This study was supported by Sato (2020) in his study on association between access to a health facility and continuum of vaccination behaviors among Nigerian children, which revealed that mothers were discouraged not to revisit a health facility if the health facility was always closed hence limiting the uptake of health services. This study therefore concludes that, health facility opening on daily basis was one of the factor influencing measles-rubella second dose in Mwingi Central Sub County.

Participants having bad experience with health workers was another facility related factor investigated. It was revealed that mothers who reported to have experienced bad relationship with the health facility staffs when they visited for services had measles-rubella second dose uptake of 72.7% while those mothers who had no issues with health facility staffs, had measles-rubella second dose uptake of 68.9%. However, this was not statistically significant. This study finding contradicts with findings of Amina et al (2016) in their study on factors limiting immunization coverage in urban Dili, Timor- Leste, which found out that caregivers interviewed in a focused group discussion had un-immunized children and often did not complete their children vaccinations because of negative experience with health care services.

Vaccine waiting time was another facility related variable investigated. According to Adediran et al 2017 in his study found out that majority of the caretakers were not happy with the waiting time especially when they took too long. The waiting time led to some caretakers leaving the immunization center un-attended while others went never to come back leading to missed opportunities. In this study it was found that those mothers who reported delays in the vaccination sites had measles-rubella second dose uptake of 64.1 while those mothers who reported no delays in vaccination sites had uptake of 70.2%, but this was not statistically significant.

Lastly variable whether the health Facility had specific days of immunization was investigated. According to Malande et al (2019) in their study on barriers to effective uptake and provision of immunization in a rural district in Uganda, children missed opportunities when they were brought to health facility in days without vaccination. This contradicts this study that revealed that, those mother who reported their health facility having specific days for vaccination had uptake of 68.0% while those reported their health facility not having specific days for vaccination had measles-rubella second dose of 71.0%. However, this was not statistically significant.

In summary institutional related factors, it revealed that there was statistically significant association between distance from health facility, facility always being open and the uptake of the 2nd dose of measles-rubella vaccine for children between 19 -59 months. However, other facility related factors such as facility having specific days of immunization, bad experience with health workers, delays at vaccination sites did not seem to influence the uptake of 2nd dose of measles-rubella vaccine in Mwingi Central Sub-County.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

The objective of this study was to assess the determinants influencing measles-rubella second dose uptake in Mwingi Central Sub County. In this study, the level of uptake of measles-rubella second dose, client related factors and the institutional related factors influencing measles-rubella second dose uptake among children aged 19-59 months at Mwingi central sub county was assessed.

6.2. Conclusions

6.2.1 Measles- rubella second dose uptake in Mwingi Central Sub County

The overall uptake of measles-rubella in Mwingi central sub county was 68.9%. The measles –rubella uptake in difference age groups of the mothers, 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years and above 40 years were 60%, 63.8%, 73.6%, 70.1%, 68.6% and 53.8% respectively. The measles-rubella uptake in Mwingi central sub county in terms of level of education of the mother was: primary level 64.0%, secondary level 71.5%, Tertiary level 79.4% and those did not attend any schooling 57.1%. On the issue of residence of the mother, the measles-rubella uptake was as follows: Central Ward 55.2%, Kivou Ward 75.6%, Mui Ward 42.1%, Nguni Ward 64.5%, Nuu Ward 50.0% and Waita Ward 69.0%. The measles-rubella second dose uptake in terms of employment status of the mother was as follows: Employed mothers 82.9%, Self-employed mothers 66.1% and Not employed mothers 65.7%. Finally, measles-rubella second dose uptake in terms of the birth order of the child was: First borne children 77.2%, Middle borne children 67.7% and Last borne children 57.9%.

6.2.2 Client related factors influencing measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County

Age of the mother, previous vaccination side effects and additional children to the mother had no statistically significant association with the uptake of the 2nd dose of measles-rubella vaccine, hence their difference were just due chance. (P-value >0.05). And

therefore these variables were not influencing the uptake measles-rubella second dose in Mwingi Central Sub County. However, the study also showed there was statistically significant association between educational level of the mother, residence of the mother, employment status, religion and knowledge of measles schedule and the uptake of the 2nd dose of measles-rubella vaccine (P-value < 0.05). And these were actual the client related determinants influencing the uptake in Mwingi Central Sub County.

6.2.3 Institutional related factors affecting measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central Sub County

Distance from health facility to the households and facility always being opened were the Institutional related determinants influencing measles-rubella uptake in Mwingi Central Sub County for children between 19 -59 months (p-value < 0.05).However, other facility related determinants such as facility having specific days of immunization, bad experience with health workers, delays at vaccination sites did not seem to influence the uptake of 2nd dose of measles-rubella vaccine in Mwingi central sub-county (P-value > 0.05).

6.3 Recommendations

The uptake of measles-rubella second dose in Mwingi Central Sub County is low (68.9%) compared to WHO required uptake of 95% for community to have herd immunity. The study recommends the Mwingi Central Sub County health management team should ensure that its catchment population is educated on measles-rubella second dose schedule, ensure all immunizing health facilities are always open and ensure they provide outreach service for hard to reach community. Finally, more studies should be conducted to investigate why different wards in Mwingi Central Sub County have different uptake of measles-rubella second dose.

REFERENCES

- Abuya, B. A., Onsomu, E. O., Kimani, J. K., & Moore, D. (2011). *Influence of maternal education on child immunization and stunting in Kenya*. *Maternal and child health journal*, 15, 1389-1399.
- Adediran, A. S., Onyire, N. B., Guvuoke, V. O., Obum, E., & Anyanwu, O. U. (2017). *Immunization status of under-5 children in a rural community in Nigeria*. *mortality*, 4, 5.
- Amin, R., De Oliveira, T. J. C. R., Da Cunha, M., Brown, T. W., Favin, M., & Cappelier, K. (2013). *Factors limiting immunization coverage in urban Dili, Timor-Leste*. *Global health: science and practice*, 1(3), 417-427.
- Bosu, W. K., Ahelegbe, D., Edum-Fotwe, E., Bainsong, K. A., & Turkson, P. K. (1997). *Factors influencing attendance to immunization sessions for children in a rural district of Ghana*. *Acta tropica*, 68(3), 259-267.
- Emmanuel Rudatsikira, M. D., & Moono Silitongo, B. V. M. (2019). *First-ever measles-rubella vaccination coverage in a campaign in 2016, Zambia*. *International Journal of Child and Adolescent Health*, 12(3), 243-252.
- Etana, B., & Deressa, W. (2020). *Factors associated with complete immunization coverage in children aged 12–23 months in Ambo Woreda, Central Ethiopia*. *BMC public health*, 12, 1-9.
- Gastañaduy, P. A., Goodson, J. L., Panagiotakopoulos, L., Rota, P. A., Orenstein, W. A., & Patel, M. (2021). *Measles in the 21st century: progress toward achieving and sustaining elimination*. *The Journal of infectious diseases*, 224(Supplement_4), S420-S428
- Herliana, P., & Douiri, A. (2017). *Determinants of immunisation coverage of children aged 12-59 months in Indonesia: A cross-sectional study*. *BMJ Open*, 7(12), 1–14. <https://doi.org/10.1136/bmjopen-2016-015790>
- Jessop, L. J., Murrin, C., Lotya, J., Clarke, A. T., O'Mahony, D., Fallon, U. B., Johnson, H., Bury, G., Kelleher, C. C., & Murphy, A. W. (2010). *Socio-demographic and health-related predictors of uptake of first MMR immunisation in the Lifeways Cohort Study*. *Vaccine*, 28(38), 6338–6343. <https://doi.org/10.1016/j.vaccine.2010.06.092>
- Kanyiru, R. W., Kikuyi, G., . J., & Jomo, D. M. (2019). *Factors Associated with Uptake of Measles Rubella Vaccine Among Children Age 9-18 Months in Eastleigh North Ward Nairobi County*. *International Journal of Scientific and Research Publications (IJSRP)*, 9(5), p8905. <https://doi.org/10.29322/ijsrp.9.05.2019.p8905>

- KHIS. 2021 Kenya Health Information system.
<https://hiskenya.org/dhis-web-data-visualizer/index.html#/>
- Kisangau, N., Serگون, K., Ibrahim, Y., Yonga, F., Langat, D., Nzunza, R., ... & Lowther, S. A. (2018). *Progress towards elimination of measles in Kenya, 2003-2016*. Pan African Medical Journal, 31(1).
- Liu, J., Hull, V., Godfray, H. C. J., Tilman, D., Gleick, P., Hoff, H., ... & Li, S. (2018). *Nexus approaches to global sustainable development*. Nature Sustainability, 1(9), 466-476.
- Li, J., & Taylor, B. (2013). *Factors affecting uptake of measles, mumps, and rubella immunisation*. British Medical Journal, 307(6897), 168–171.
<https://doi.org/10.1136/bmj.307.6897.168>
- Maina, L. C., Karanja, S., & Kombich, J. (2013). *Immunization coverage and its determinants among children aged 12-23 months in a peri-urban area of Kenya*. Pan African Medical Journal, 14(1).
- Maina, N.M, (2016). *immunization coverage and its determinants. Kenya. English press.*
- Maarse JAM, AH Ibnouf & HW Van den Borne (2007) *Factors influencing immunisation coverage among children under five years of age in Khartoum State, Sudan, South African Family Practice*, 49:8, 14-14f, DOI: [10.1080/20786204.2007.10873611](https://doi.org/10.1080/20786204.2007.10873611)
- Naeem et al, (2017). *Inequity in childhood immunization between urban and rural areas*. Peshawar.
- Magodi, R., Mmbaga, E. J., Massaga, J., Lyimo, D., Mphuru, A., & Abade, A. (2019). *Factors associated with non-uptake of measles-rubella vaccine second dose among children under five years in Mtwara district council, Tanzania, 2017*. The Pan African Medical Journal, 33.
- Malande OO, Munube D, Afaayo RN, Annet K, Bodo B, Bakainaga A, Ayebare E, Njunwamukama S, Mworozzi EA, Musyoki AM. *Barriers to effective uptake and provision of immunization in a rural district in Uganda*. PLoS One. 2019 Feb 14;14(2):e0212270. doi: 10.1371/journal.pone.0212270. PMID: 30763355; PMCID: PMC6375600.
- Masresha, B., Shibeshi, M., Kaiser, R., Luce, R., Katsande, R., & Mihigo, R. (2018). *Congenital Rubella Syndrome in The African Region - Data from Sentinel Surveillance*. Journal of Immunological Sciences, 2(SI1), 145–149.
<https://doi.org/10.29245/2578-3009/2018/si.1122>
- Mkopi, A., Mtenga, S., Festo, C., Mhalu, G., Shabani, J., Tillya, R., ... & Masanja, H. (2021). *Factors affecting non-coverage of measles-rubella vaccination among children aged 9–59 months in Tanzania*. Vaccine, 39(41), 6041-6049.

- Mohamed Farah Abdullahi, Jennifer Stewart Williams, Klas-Göran Sahlèn, Khalif Bile & John Kinsman (2020) *Factors contributing to the uptake of childhood vaccination in Galkayo District, Puntland, Somalia*, *Global Health Action*, 13:1, DOI: 10.1080/16549716.2020.1803543
- Mutua, M. K., Kimani-Murage, E., Ngomi, N., Ravn, H., Mwaniki, P., & Echoka, E. (2016). Fully immunized child: *coverage, timing and sequencing of routine immunization in an urban poor settlement in Nairobi, Kenya*. *Tropical medicine and health*, 44(1), 1-12.
- Orenstein, W. A., Samuel, K. L., & Hinman, A. R. (Eds.). (2004). *Summary and conclusions: measles elimination meeting, 16–17 March 2000*. *The Journal of infectious diseases*, 189(Supplement_1), S43-S47.
- Pearce, A., Law, C., Elliman, D., Cole, T. J., & Bedford, H. (2008). *Factors associated with uptake of measles, mumps, and rubella vaccine (MMR) and use of single antigen vaccines in a contemporary UK cohort: prospective cohort study*. *Bmj*, 336(7647), 754-757.
- Panda, B. K., Mishra, S., & Awofeso, N. (2020). *Socio-demographic correlates of first dose of measles (MCV1) vaccination coverage in India*. *BMC Public Health*, 20(1), 1–13. <https://doi.org/10.1186/s12889-020-09321-0>
- Pareek, M., & Pattison, H. M. (2000). *The two-dose measles, mumps, and rubella (MMR) immunisation schedule: factors affecting maternal intention to vaccinate*. *British Journal of General Practice*, 50(461), 969-971.
- Restivo, V., Napoli, G., Marsala, M. G. L., Bonanno, V., Sciuto, V., Amodio, E., Calamusa, G., Vitale, F., & Firenze, A. (2015). *Factors associated with poor adherence to MMR vaccination in parents who follow vaccination schedule*. *Human Vaccines and Immunotherapeutics*, 11(1), 140–145. <https://doi.org/10.4161/hv.34416>
- Ruhul, A.M. (2016). *Factors limiting immunization coverage in Urban dilli*. Timor leste.
- UNICEF. (2019). *The progress of nations, 2019*. New York, N.Y: UNICEF
- Sabahelzain, M. M., Moukhyer, M., van den Borne, B., & Bosma, H. (2022). *Vaccine hesitancy among parents and its association with the uptake of measles vaccine in urban settings in Khartoum State, Sudan*. *Vaccines*, 10(2), 205.
- Sato R. *Association between access to a health facility and continuum of vaccination behaviors among Nigerian children*. *Hum Vaccin Immunother*. 2020 May 3;16(5):1215-1220. doi: 10.1080/21645515.2019.1678360. Epub 2019 Nov 5. PMID: 31634047; PMCID: PMC7227619

- Trentini, F., Poletti, P., Merler, S., & Melegaro, A. (2017). *Measles immunity gaps and the progress towards elimination: a multi-country modelling analysis*. *The Lancet Infectious Diseases*, 17(10), 1089-1097.
- Torracinta, L., Tanner, R., & Vanderslott, S. (2021). *Mmr vaccine attitude and uptake research in the united kingdom: A critical review*. *Vaccines*, 9(4), 1–21. <https://doi.org/10.3390/vaccines9040402>
- WHO. (2015). *WHO African Regional Guidelines For Measles and Rubella Surveillance WHO Regional Office for Africa*. Who, April, 1–82.
- World Health Organization (WHO). (2017). *Plan of action for the sustainability of measles, rubella, and congenital rubella syndrome elimination in the Americas 2018-2023*. September 2017, 1–5.
- Wilder-Smith, A., Hombach, J., Ferguson, N., Selgelid, M., O'Brien, K., Vannice, K., ... & Nolan, T. M. (2019). *Deliberations of the Strategic Advisory Group of Experts on Immunization on the use of CYD-TDV dengue vaccine*. *The Lancet infectious diseases*, 19(1), e31-e38.
- Zoma, R. L., Walldorf, J. A., Tarbangdo, F., Patel, J. C., Diallo, A. O., Nkwenkeu, S. F., & Soeters, H. M. (2019). *Evaluation of the impact of meningococcal serogroup A conjugate vaccine introduction on second-year-of-life vaccination coverage in Burkina Faso*. *The Journal of infectious diseases*, 220(Supplement_4), S233-S243.

APPENDICES

Appendix I: Introduction Letter

JAMES MULWA

P.O BOX 149

Kitui

Email: mulwa2chalbi@gmail.com

Dear Respondent,

My name is James Mulwa. I am a student from South Eastern Kenya University and pursuing a Master's degree in Epidemiology. I am conducting a research on factors influencing measles-rubella second dose coverage at Mwingi Central Sub County.

You have been selected to participate in this research. Kindly assist by answering this questionnaire. Your answers will be handled with confidentiality and will be used for the purpose of this research only.

Thanks

Yours faithfully,

James Mulwa

Appendix II: Consent

Instructions

The purpose of this survey is to determine the factors influencing measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central sub County. Do not write your name on the questionnaire and responses you give will not be linked to you. The information generated from this survey will be used for academic purpose only. The participation is voluntary and non- participation will not be used against you. There are no monetary inducements for participating in the study.

Consent

Having understood the above information and knowledge that the survey is voluntary, confidentiality and anonymity are guaranteed, I do hereby accept to participate in the survey.

Participant's Signature_____

Date_____

Kindly answer the following questions.

Appendix III: Questionnaire

QUESTIONNAIRE FOR MOTHERS/CARETAKERS PARTICIPATING IN THE STUDY AT MWINGI CENTRAL SUB-COUNTY.

This research is meant for academic purpose. It will try to find out the factors influencing measles- rubella vaccine second dose uptake among children aged 19-59 months at Mwingi Central sub County. Please do not write your name on this questionnaire. Please tick or fill the required information only if you give consent to do so at your will.

Unique Number. _____

(start with MFL Code then Serialize)

Section One: Socio-demographic Factors

1. How old are you _____(Years)?
2. What is your education level?
 - a) Primary level
 - b) Secondary school
 - c) Tertiary level
 - d) Never went to school
3. Which is your residence?
 - a) Central Ward
 - b) Kivou Ward
 - c) Mui Ward
 - d) Nguni Ward
 - e) Nuu Ward
 - f) Waita Ward

Specify_____

4. What is your educational level?
 - a) None
 - b) Primary
 - c) Secondary
 - d) College/ University

5. What is your occupation?
- a) Employed
 - b) self – employed
 - c) Not employed
6. What is your average monthly income?
7. What is your religion?
8. How many children less than 5 years are there in the family?
- a) One
 - b) Two

SECTION TWO: CLIENT RELATED FACTORS

9. What is the birth order of your child aged 19-49 months?
- a) First Born
 - b) Middle born
 - c) Last Born
10. Do you have other children who stays with you who are under five years.
- a) Yes
 - b) No
11. When measles-rubella second dose administered?
- a) At 9 months
 - b) At 24 months
 - c) At 18 months
 - d) I don't know
12. Was your child vaccinated against BCG, OPV, Pentavalent, PCV 10 and measles one? (Refer from the mother child booklet.
- a) Yes
 - b) No

13. From the previous vaccination, has your child had any vaccine related side effects?

Yes

No

If yes specify _____

SECTION THREE: INSTITUTIONAL RELATED FACTORS

14. How far is the health facility that you take your child for immunization _____

(kilometers)

15. What do you think about the distance from your home to the facility?

a) Too long and inconvenient

b) Very short and convenient

16. Is the facility always open when you go for immunization?

a) Yes

b) No

17. Does the health facility have specific days for immunization?

a) Yes

b) No

18. Have you ever missed vaccinations for the child?

a) Yes

b) No

If yes specify _____

19. Have you ever had a bad experience with health workers that you felt you should not come back for immunization?

a) Yes

b) No

If yes which one?.....

20. Are there any delays at immunization clinic?

a) Yes

b) No

If yes what is your feeling about it.....

21. Were you given the next date for measles -rubella second dose from the health facility.

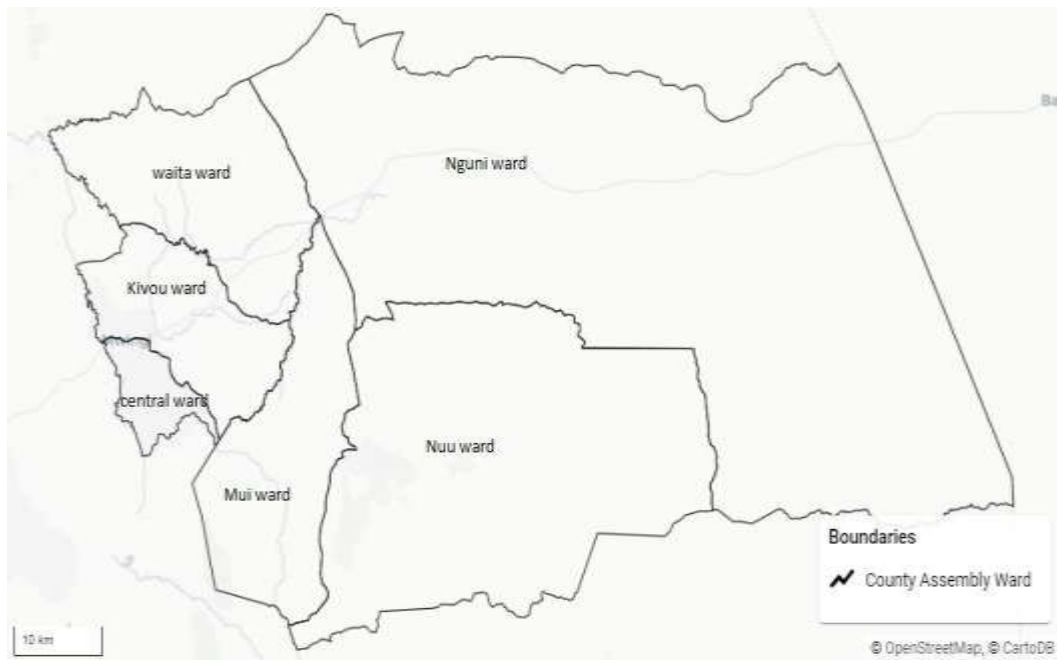
- a) Yes by card
- b) Yes by recall
- c) No
- d) Don't know

SECTION FOUR: MEASLES -RUBELLA SECOND DOSE UPTAKE

22. Has your child received second dose of measles and rubella?

- a) Yes
- b) No

Appendix IV: Mwingi Central Sub County Map



Appendix V: Ethical Approval Letter



OFFICE OF THE CHAIRPERSON
INSTITUTIONAL SCIENTIFIC ETHICS REVIEW COMMITTEE
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2506-30100, Eldoret, Kenya, East Africa

B3029052022

May 26, 2022

TO: James Mulwa Munyithya
Department of Public Health (Epidemiology)
South Eastern Kenya University

Dear James,

RE: Determinants Influencing Measles-Rubella Vaccine Second Dose Uptake Among Children Aged 19-49 Months at Mwingi Central Sub-County

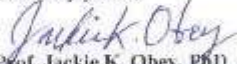
This is to inform you that the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/ISERC/30/5/2022. The approval period is 29th June, 2022 – 29th June, 2023.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.

Sincerely yours,


Prof. Jackie K. Obey, PhD
Chairperson, Institutional Scientific Ethics Review Committee



A SEVENTH-DAY ADVENTIST INSTITUTION OF HIGHER LEARNING
CHARTERED 1991

Appendix VI: Research License

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 998014	Date of Issue: 13/July/2022
RESEARCH LICENSE	
	
<p>This is to Certify that Mr. JAMES MULWA MUNYITHYA of South Eastern Kenya University, has been licensed to conduct research in Kitui on the topic: DETERMINANTS INFLUENCING MEASLES - RUBELLA VACCINE SECOND DOSE UPTAKE AMONG CHILDREN AGED 19- 49 MONTHS AT MWINGI CENTRAL SUB- COUNTY for the period ending : 13/July/2023.</p>	
License No: NACOSTI/P/22/18806	
998014 Applicant Identification Number	 Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code 
<p>NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.</p>	