DETERMINANTS OF MEASLES VACCINE UPTAKE AMONG MOTHERS OF CHILDREN BETWEEN 9 AND 24 MONTHS IN NAROK-COUNTY, KENYA

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DECLARATION

STUDENT'S DECLARATION

This research project is my original work and has not been presented in any other university for the award of a degree.

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REG NO: R50/20184/2020.

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SUPERVISORS' DECLARATION

We hereby confirm that this research project has been carried out by the student under our supervision and has been submitted with our approval as the university Supervisor(s)

1st SUPERVISOR:

Name Dr. Sarah Bett

Signature: _____ Date: _____

2nd SUPERVISOR:

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Signature: _____ Date: _____

DEDICATION

I dedicate this research project to my family and friend who supported me throughout my studies and especially my mother for praying with me and supporting me.

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My sincere gratitude goes to the Almighty God for granting me special divine enablement to complete this research project. I also want to sincerely thank my family for their prayers, support and patience as I pursued my studies. Special appreciation to my supervisors Dr Sarah Bett and Dr Jacob Masika for their valuable support and encouragement during this study.

ABSTRACT

Vaccine hesitancy is one of the major determinants of low vaccination coverage in both developed and developing countries. The measles vaccination coverage in Kenya is considered considerably low, which has contributed to sporadic measles outbreaks. The present study assessed the determinants of low uptake and hesitancy of measles vaccination among mothers or caregivers of children aged 9 – 24 months in Narok North Sub-County, Narok County, Kenya. Using an analytical cross-sectional study, a structured questionnaire was used to collect data from 100 mother and caregivers. Analyses were conducted through Pearson's chi-square, Kruskal-Wallis H, and logistic regression tests. A total of 69(69%) of the children (N =100) who had qualified for the first dose of measle vaccines (MCV1) had received the vaccines, while 31(31%) had not. Thirteen (26.5%) of the children (n = 49) who had qualified for second dose of measle vaccine (MCV2) had received the vaccine, while 36(73.5%) had not. Thus, 48(48%) of the all the children (N = 100) were considered to be fully immunized against measles, while 52(52%) were either partially or not immunized. The main maternal determinants included; maternal age (p = .019), number of antenatal clinic visits (p = .04), vaccine hesitancy (p = .001), concerns about side effects and adverse reactions of the vaccines (p = .020), and maternal level of education (p = .030). The child's determinants were; place of birth (p = .001), history of experiencing vaccine side effects (p = .004), and birth order (p = .032). The socioeconomic factors included; low socioeconomic background (p = .004) and cultural and religious issues (p = .003). The healthcare determinants included; provision of dates for vaccination to mothers or caregivers (p = .000), distance from the health facility (p = .020), availability of vaccines in the health centre (p = .000), outreaches (p = .000), and display of immunization guideline to mothers or caregivers (p = .002). The uptake of the measle vaccine was very low compared to the WHO recommended coverage rate of >95%. Thus there is need to provide health education and information to mothers or caregivers on measle vaccines uptake.

ABBREVIATIONS AND ACRONYMS

WHO:	World Health Organization
WHA:	World Health Assembly
BCG:	Bacille Calmette-Guerin
MCV1:	Measles-containing-vaccine first-dose
MCV2:	Measles-containing-vaccine second-dose
GVAP:	Global Vaccine Action Plan
KDHS:	Kenya Demographic and Health Survey
MOH:	Ministry of Health
OPV:	Oral Polio Vaccine
OPV0:	Oral Polio Vaccine at Birth
DPT:	Diphtheria, Pertussis (whooping cough), and Tetanus
DVI:	Division of Vaccine and Immunization
KEPI:	Kenya Expanded Program on Immunization
ANC:	Antenatal Clinic
SIA:	Supplemental Immunization Activity.

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CHAPTER ONE: INTRODUCTION

1.1. BACKGROUND INFORMATION

Measles is an extremely infective vaccine-preventable disease that can result in terrible complications such as diarrhoea, vomiting, middle ear infection, laryngitis, bronchitis, pneumonia, and even death (WHO, 2019). The World Health Organization (WHO) (2019), stated that in the year 2018, there were more than 140,000 measles deaths across the globe and most of the deaths were in children below the age of five years. The WHO report (2019) further stated that between the years 2000 and 2018, there was a 73% drop in global measles death due to increased measles vaccination. Accordingly, the worldwide spread of immunization against measles has forestalled an approximated 21.1 million deaths in the whole world between the years 2000 and 2017 (De Figueredo et al., 2020). The illness has been a focus for eradication in the six WHO areas and one of the aims of the Global Vaccine Action Plan (GVAP) 2015–2020 were to eradicate measles in at least 5 of its blocks by 2020. Until now, the Americas regions are the main areas that have come close to achieving this objective (Pan American Health Organization, 2018). The effort can be enhanced by eliminating factors contributing to the low uptake of measles vaccines.

In Africa, there are an estimated 28,000 deaths related to measles each year with young children being the primary victims (Phillips et al., 2017). Before the measles vaccine was introduced in Africa, an estimated 1 million measles cases mostly affecting young children were reported each year (Sarker, et al., 2019). The measles vaccine in Africa contributed to a longer inter-epidemic period and a shift of measles cases from affecting mostly younger children to occurring in older children. Even though measles vaccination led to an overall low incidence of measles across Africa, Measles outbreaks continue to occur. The African region is a central participant in the worldwide battle against measles (Desalew et al., 2020). With most instances of measles at the turn of the 21st century, Africa has put forth colossal advancement in its attempt to vaccinate children and control the infection, expanding its territorial measles immunization coverage from 56% in 2001 to 85% in 2010 (WHO, 2020).

According to (Goodson, et al., 2011), Many regions of Sub-Saharan Africa have experienced measles outbreaks and stagnancy in vaccination coverage. The interruptions came because of contentions on immunization beliefs in the region hence upsetting supplemental immunization

action (SIA) endeavours, opposition to immunization from spiritual gatherings, and the epidemiologic change in measles instances towards more seasoned age brackets. Africa could not accomplish the WHA focus in 2015 and was in danger of missing the ME 2020 objective (Nshimirimana et al., 2011). The Democratic Republic of Congo is one of the countries in Africa that has been recording escalating cases of measles, between 2018 and 2020, the country recorded 460,000 cases and nearly 8,000 fatalities of which 75% were children (MSF 2020). This was attributed to low measles vaccine uptake in the country.

In Kenya, vaccines have indeed played an important role in reducing the mortality rate of those under five (Ochieng et al., 2020). In the year 2015, the mortality rate of the under five was reported as 45 per 1,000 live births. In the year 2000, the mortality rate was 1,869 per 100,000, and in 2019 the mortality rate was 831 per 100,000 (Allah, Adetifa& Abbas, 2021; Mamuti et al., 2022). According to the KDHS between the years 2010 to 2014, the mortality rate from vaccine-preventable diseases for infants was 39 deaths per 1,000 live deaths and the mortality rate for the under-5 has been 52 deaths per 1000 live births (Kisangau et al., 2018; Mamuti et al., 2022). This implies that one in every 26 children who are born in Kenya dies before reaching the age of one year, and amongst 19 children, one dies before attaining the age of five due to vaccine-preventable diseases (Kisangau et al., 2018; Mamuti et al., 2022). Kenya Demographic and Health Survey (2020) states that Universal children immunization against whooping cough, tuberculosis, tetanus, diphtheria, polio, and measles is quite essential and is important in reducing infant and child mortality.

The uptake of MCV in Kenya has been considerably low compared to the >95% target recommended by WHO (2020). For instance, a study done in Western Kenya on coverage of vaccination in children in the year 2003 reported that 31.1% of the children between the age of 12 -23 months had received all the scheduled vaccinations by the DVI. Among these children who had received all the vaccinations only 2.2% had been timely vaccinated. The study further established that 13.9% of them were yet to be vaccinated. It is indeed a great concern to note that few children get to be vaccinated within the recommended vaccine schedule period. Failure to be fully vaccinated pose a great risk to children and this increases the mortality rate, especially from preventable diseases such as measles. From the study, it was established that just 41.0% of the

appraised children had taken their measles vaccine with less than 20% receiving it promptly (Calhoun et.al., 2014)

1.2 RESEARCH PROBLEM STATEMENT

The World Health Organization had set a target to eliminate measles in Africa by 2020. Our country, Kenya, was destined to achieve the complete elimination of measles but got off track on its 2012 pre-elimination goal in the year 2011. A study by Kisangauet al. (2018) reported that Kenya established the coverage of the first dose of MCV1 between the years 2003 and 2012 had increased from 65% to 86% but then declined to 75% in the year 2016 due to vaccine hesitancy within the community. The second dose of MCV2 has remained below 50% since its introduction in 2013.

According to KDHS results in the year 2020, only 85% of children under five in Kenya obtained the first dose and less than 50% took the second dose. Between the years 2003 and 2016, there was a total of 26,188 suspected cases of measles. About 9043 of these cases (35%), were confirmed (Kisangau et al. 2018). The measles cases incidence was highest among children aged below 1 year (Desalew et.al., 2020). Despite the importance of the measles vaccine and vaccine supplemental program in 22 counties in Kenya, among them Narok County, that are at high risk of recording measles mortality, there is still low uptake and hesitancy of the measles vaccine. This warrants the research to find out the determinants of its uptake.

1.3 JUSTIFICATION

The low uptake of measles vaccines in Kenya is a noticeable public health problem (Kisangau et al., 2018). However, its extent and associated determinant factors, particularly in a rural setting, have not been comprehensively explored. The depth of healthcare-related research evidence focuses on establishing the determinants of low measles vaccines in rural settings, especially among the historically known nomadic community is also hindering the formulation of effective policies to address the challenge. Furthermore, there is limited information to help in determining the low uptake of the measles vaccine in Narok County. Therefore, this study is believed to be very critical in providing research-based evidence that can be relied upon by policymakers and other stakeholders to focus on factors that may enhance measles vaccine uptake. The findings of

the present study are of great help to scholars as it provides the basis of literature on the factors associated with measles vaccine hesitancy.

1.4. OBJECTIVES

1.4.1 BROAD OBJECTIVES

To determine factors that contribute to low measles vaccine uptake among children between the ages of 9 and 24 months.

1.4.2 SPECIFIC OBJECTIVES

i. To determine demographic factors that influence the uptake of measles vaccine uptake among children aged 9-24 months in Narok North sub-county, Narok County.
ii. To determine the level of measles vaccine uptake among mothers of children aged 9 – 24 months in Narok North Sub-County, Narok county
iii. To determine the socio-economic factors among mothers of children aged 9 – 24 months in Narok North Sub-County, Narok county.
iv. To assess factors related to healthcare facilities among mothers of children aged between 9 – 24 months in Narok North sub-county, Narok county.
v. To establish the relationship between demographic factors, socio economic factors and health care related factors on measles vaccine uptake.

1.5 RESEARCH QUESTIONS

i. What demographic factors influence the uptake of measles vaccine uptake among children aged 9-24 months in Narok North sub-county, Narok County.
ii. What is the level of measles vaccine uptake among children aged 9 – 24 months in Narok North Sub-County, Narok county
iii. What socio-economic factors influence the uptake of measles vaccine among mothers of children aged 9 – 24 months in Narok North Sub-County, Narok county.
iv. Which factors relating to healthcare facilities influence measles vaccine uptake among mothers of children aged between 9 – 24 months in Narok North sub-county, Narok county.
v. What is the relationship between demographic factors, socio economic factors and health care related factors on measles vaccine uptake.

1.6 CONCEPTUAL FRAMEWORK

The conceptual framework that underpinned this study was founded on the comprehension of relationships between the variables of vaccine uptake derived from the information provided by existing literature. It was deciphered that uptake of measle vaccines, in terms of high or low is an outcome of the interaction of numerous factors, which were classified as socioeconomic, sociocultural, maternal and child, and healthcare facility factors (*see figure 1*). This study identified such factors and their contribution to the low uptake of measle vaccines.

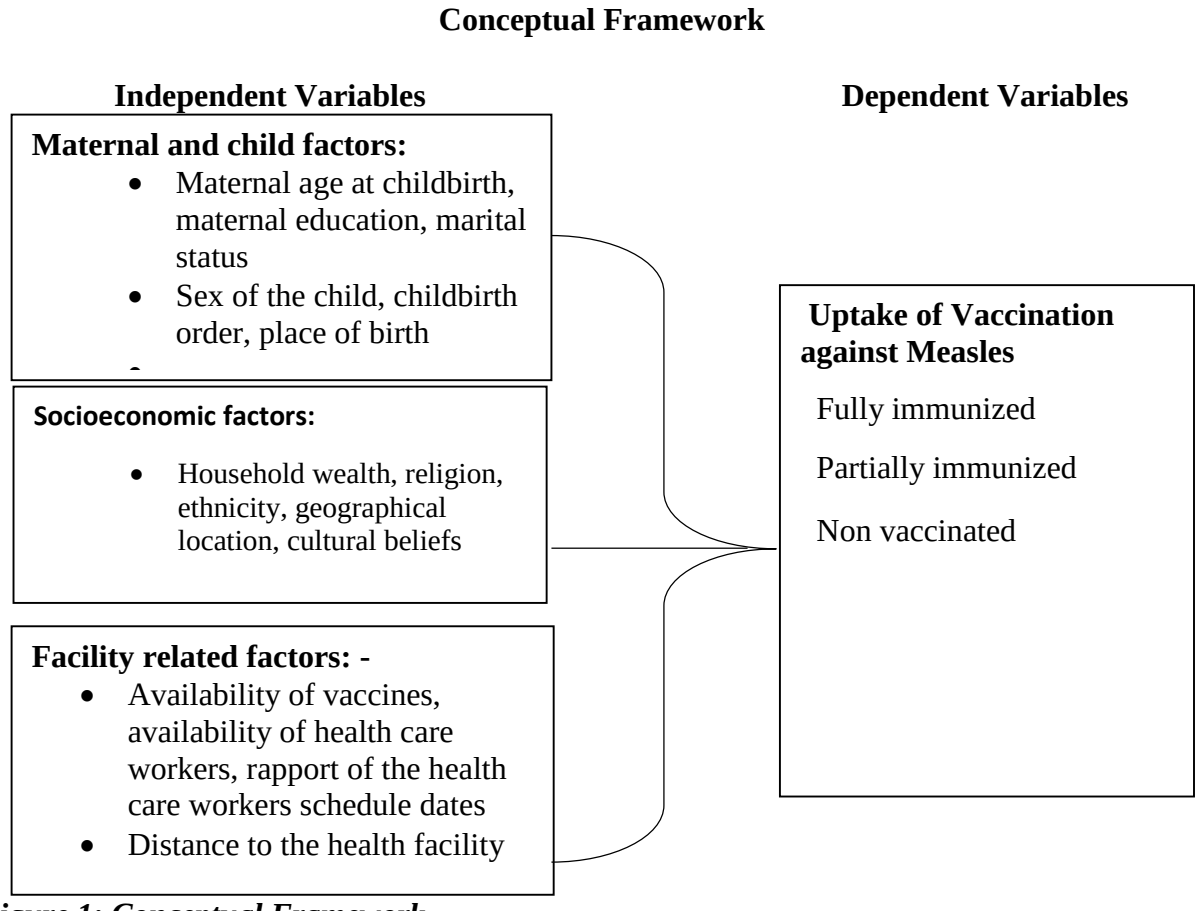

Figure 1: Conceptual Framework

CHAPTER TWO: LITERATURE REVIEW

2.1. INTRODUCTION

This chapter presents a critical integrative analysis of existing literature on determinants of measles vaccination uptake and vaccine hesitance with a focus on mothers or caregivers of children within two years. The review included research articles identified through a computerised literature search on online databases, PubMed, CINAHL, Science Direct, and google scholar and published within the past 10 years (from 2015). The key search terms and phrases used during the search included 'determinants', 'vaccine uptake', 'vaccine hesitancy', 'measle vaccine', 'mothers or caregivers, and 'children'. The search included both primary research articles and systematic reviews. The literature review was presented in themes; sociodemographic factors, mother/caregiver and child-related factors, cultural factors, and healthcare-related factors.

2.2. SOCIODEMOGRAPHIC FACTORS

Various studies have looked into numerous sociodemographic factors associated with vaccine uptake and hesitancy in general, including measles vaccination (Kalok et al., 2020; Krishnamoorthy et al., 2019; Wagner et al., 2021; Walton et al., 2022). One of the sociodemographic factors is the age of the mother/caregiver (Krishnamoorthy et al., 2019; Wagner et al., 2021). A mixed-method study conducted by Krishnamoorthy et al. (2019) investigated the prevalence and factors impacting vaccine measles-rubella hesitancy among 461 mothers with children aged between 9-15 months in rural Puducherry, India. The findings of the research identified that the mother's age was the only major determinant of vaccine hesitancy (Krishnamoorthy et al., 2019). The research had robust rigour based on its mixed-method design. However, the study did not provide reliable evidence regarding other demographic characteristics of the mothers regarding vaccine hesitancy and uptake, such as marital status or level of education.

Sabahelzani et al. (2020) conducted a community-based cross-sectional study to determine whether measles vaccine hesitancy predicted measles vaccine uptake among 495 mothers in Khartoum State, Sudan. The research measured the measles vaccine hesitancy using the Parent Attitude about Childhood Vaccines (PACV) scale (Sabahelzani et al., 2020). The result of the research indicated that the PACV scores predicted measles vaccine uptake when the sociodemographic factors, such as mothers' or caregivers' age and the number of children were controlled (Sabahelzani et al., 2020). The research had a robust and reliable methodology and yielded considerably reliable evidence confirming the important influence of mothers' or caregivers' measles vaccine hesitancy on the uptake of measles vaccines (Sabahelzani et al., 2020). However, the study, considered and controlled the sociodemographic characteristics of the participants, such as the mother's age and the number of children as confounding variables, thus their impact on the measles vaccine uptake was not determined.

Wagner et al. (2021) conducted a descriptive cross-sectional study on sociodemographic patterns of vaccine hesitancy among 305 mothers with children aged below five years in Chandigarh, India. The sociodemographic factors that influenced vaccine hesitancy included the level of education (Wagner et al., 2021). For instance, mothers who had a high school education had low odds (0.10) of vaccine hesitancy compared to those with less education (0.61) (Wagner et al., 2021). The study effectively confirmed maternal education as an important demographic factor that influences vaccine uptake, Nonetheless, the study did not focus specifically on measle vaccine, thus it is difficult to translate the findings to measles vaccine uptake.

A cross-sectional study carried out by Kalok et al. (2020) investigated childhood vaccination hesitancy and related socio-demographic factors among 1081 pregnant women in Malaysia. The findings of the research revealed that the major factors associated with childhood vaccine hesitancy included ethnic and religious background, number of children, level of education, as well as status of employment (Kalok et al., 2020). For instance, the researchers reported that low levels of education, income and strict religious adherence contributed to increased vaccination hesitance (Kalok et al., 2020). The research was considered relevant because of its focus on determinants of childhood vaccination hesitancy. The research had a very large sample size of 1081 women, thus providing considerably reliable and generalisable findings (Kalok et al., 2020). However, the focus

of the study was on general childhood vaccination hesitancy without a specific focus and emphasis on childhood measles vaccination.

A retrospective study conducted by Choudhary et al. (2019) estimated the rate of delayed vaccination among children aged 10-23 months in India and associated sociodemographic, maternal and child-related factors. The main demographic factors associated with delayed vaccination included lower maternal education as well as belonging to a household of lower wealth quintile (Choudhary et al., 2019). Additionally, Choudhary et al. (2019) also identified that maternal religion determined their vaccination hesitancy and uptake. For instance, the researchers reported that being a Muslim was associated with delayed vaccination. The research had high internal and external validity based on the use of reliable and trustworthy data derived from the National Family and Health Survey as well as having a comparison (control) group (Choudhary et al., 2019). However, the study focused on general childhood vaccination, for example, BCG, DPT, as well as measles, thus it is difficult to translate the findings to measle vaccine uptake only.

2.3. MOTHERS AND CHILD-RELATED FACTORS

Several studies have identified mother/caregiver and child-related factors that influence the measles vaccine uptake (Sabahelzani et al., 2020; Wagner et al., 2021; Wilder-Smith & Qureshi, 2020). Wilder-Smith and Qureshi (2020) conducted a systematic review to synthesise and critically assess the attitudes and beliefs of parents concerning the measles, mumps, and rubella vaccine (MMR). The review of the 20 study articles revealed that the main maternal determinants of vaccine hesitancy or refusal among parents included parental concerns about vaccine safety, efficacy, measles risk and burden perceptions, and mistrust of health experts and accessibility (Wilder-Smith & Qureshi, 2020). The review also confirmed that having a sense of responsibility towards the child, measles severity perceptions, and peer judgement among the mothers or caregivers contributed to measles vaccination hesitancy or refusal. The research provided dependable evidence on the maternal factors that influenced vaccine hesitancy (Wilder-Smith & Qureshi, 2020). However, the scope of the review was limited to vaccine hesitancy or refusal, thus did not provide an in-depth comprehension of factors influencing measles vaccine uptake.

A cross-sectional study conducted by Wagner et al. (2021) on vaccine hesitancy identified that maternal factors that influence vaccine hesitancy included maternal knowledge of the vaccine and

its importance in protection against disease. According to the research, vaccine uptake is also influenced by concerns about the side effects of the vaccine (Wagner et al., 2021). Similarly, Kalok et al., (2020) also confirmed that parental concerns about the adverse side effects of vaccines, fear of vaccination pain, as well as preferences for alternative medications, contributed to vaccine hesitancy. Additionally, Krishnamoorthy et al. (2019) identified various maternal-related factors influencing measle vaccine uptake, such as limited knowledge of vaccines among the parents, as well as inadequate time to plan for vaccination. Since the study used a mixed-method design and a large sample size, it provided trustworthy and generalisable findings (Krishnamoorthy et al., 2019). Nonetheless, the study did not determine the child-related factors affecting vaccine hesitancy.

A scoping review conducted by Adamu et al. (2021) involving 23 publications provided bother maternal and child-related factors associated with vaccination uptake in Kenya, Malawi, and Ethiopia. The review identified that the mother/ caregiver-associated factors that influence vaccine uptake included personal perceptions of vaccination, distrust of immunisation, social environmental influences, negative rumours concerning the vaccines, and fear of vaccine side effects (Adamu et al., 2021). Additionally, the child-related factors included fear of injection, and low birth weight of the child (Adamu et al., 2021). The review was relevant to the present study since it provided a concise summary of diverse factors influencing vaccine uptake. However, the review had limited methodology rigour since it included studies of heterogeneous literature including studies with different designs and populations (Adamu et al., 2021). Additionally, the review looked into childhood vaccination in general with a limited focus on measle vaccines.

Nakatudde et al. (2019) conducted a mixed methods study to investigate the timeliness of vaccination, as well as associated factors among 350 preterm children of mean age of 8.4 months in Uganda. The study found that the delay in childhood vaccination was contributed to various child-related factors, such as being delivered at home or in a private health facility, preterm, low birth weight, history of vaccination delay, as well as long stay in the neonatal unit (Nakatudde et al., 2019). The study provided comprehensive details on numerous factors contributing to childhood vaccination delays. However, the study concentrated on general childhood vaccination, with a limited focus on measles vaccination.

Walton et al. (2022), conducted a retrospective analysis of National Community Child Health Database records of 1782 children in Wales to explore various child-related factors associated with delayed receipt of the childhood vaccine. The study revealed that child-related factors that contributed to delayed vaccination included having older siblings, admission in a special or intensive care setting and low birth weight, and being a male child (Walton et al., 2022). The study pertinently revealed child-related factors impacting the uptake of childhood vaccination, but it did not focus on measle vaccines. Lastly, the research conducted by Choudhary et al. (2019) also revealed that maternal and child-related factors, such as birth weight, and current or history of sickness contributed to delayed vaccination. For instance, children who were sick or had a history of chronic conditions were having high odds of delayed vaccination, especially for measle vaccination (Choudhary et al., 2019). Additionally, the study highlighted that children of mothers who received tetanus toxoid immunisation during pregnancy were not likely to delay getting childhood vaccination.

2.4. CULTURAL FACTORS

Culture is a determinant of the uptake of health services and is expected to impact measles vaccination hesitancy and uptake (Adamu et al., 2021; Olaniyan et al., 2021). One of the cultural factors associated with vaccine hesitancy and uptake is cultural practices, such as herbal treatment (Adamu et al., 2021). Walekhwa et al. (2022) carried out a descriptive qualitative study to explore factors affecting measles vaccination coverage in Uganda. The study reported that one of the factors that contributed to limited measles vaccination coverage included dependence on traditional medicine. The study was relevant since it provided an in-depth understanding of the role cultural practices play in measle vaccine coverage. However, the study population did not include mothers with children aged below two years.

Adamu et al. (2021) identified that increased maternal trust in herbal medicines contributed to vaccine hesitancy. Additionally, Adamu et al. (2021) reported that various sociocultural factors, such as reduced women's autonomy, nomadic lifestyles, as well as belonging to a minority ethnic group, and religious leaders, influenced vaccine hesitancy and uptake. Nonetheless, it should be noted that Adamu et al. (2021) focused on general childhood vaccination including measle vaccines. Thus, the findings may not be solely associated with measles vaccination hesitancy and uptake.

Olaniyan et al. (2021) conducted a qualitative study involving ten focus groups of 44 mothers or caregivers and 24 community leaders in Lagos state, Nigeria to determine factors influencing the uptake of childhood immunisation. Cultural factors, such as cultural beliefs are considerable barriers to the uptake of childhood immunisation (Olaniyan et al., 2021). Despite being relevant to the research topic, the study used a qualitative design and thus, provided low-level evidence regarding vaccine uptake. Moreso, the study did not focus mainly on the measle vaccination.

2.5. HEALTHCARE-RELATED FACTORS

There is considerable research on healthcare-related factors influencing vaccine hesitancy and uptake including the measles vaccine (Schellenberg & Crizzle, 2022; Walekhwa et al., 2022; Wong et al., 2020). Walekhwa et al. (2022), identified several healthcare-related factors associated with measles vaccination coverage in Uganda. They included the availability of vaccine supplies and vaccine stock management, health workers' attitudes, workload, and working schedules (duty rosters), as well as healthcare facility accessibility by clients (Walekhwa et al., 2020). Despite providing a wide range of healthcare-related factors and effective measle vaccine coverage, the evidence was considered not strong to be confidently generalised in a practice setting because of the qualitative design employed in the research.

Schellenberg and Crizzle (2020) conducted a systematic review to assess factors influencing vaccine hesitancy among preschoolers' parents in Canada. The review of 12 relevant research articles of diverse methodologies identified that the key determinants of vaccine hesitancy among the mothers of preschoolers in Canada were trust and access to healthcare services. (Schellenberg & Crizzle, 2020). The research provided a substantially high level of evidence supporting trust and access to healthcare services an important determinant of vaccine hesitancy based on its systematic review design (Schellenberg & Crizzle, 2020). Additionally, the research had a relevant scope of considering the mothers of preschoolers, since, they are often due to receive measle vaccine (Schellenberg & Crizzle, 2020). However, the research had a narrow focus on the determinant of measle vaccines hesitancy, hence did not provide a comprehensive insight on the determinant of measles vaccine uptake. Moreover, the review included heterogeneous studies, with diverse methods and settings, thus hindering the metanalysis and generalisability of the findings.

Krishnamoorthy et al. (2019) identified some healthcare-related factors associated with measle vaccine uptake, such as the trust parents had in doctors, the unpreparedness of the health system level, vaccination campaigns, and the level of spreading awareness concerning the importance of the vaccine. Although Krishnamoorthy et al., (2019) did not investigate other important healthcare-related factors that are likely to influence measle vaccine uptake in low- and middle-income countries, such as resources. Kalok et al. (2020) identified that health professionals' provision of vaccination information, parental trust in the pharmaceutical industry, and availability of health books and magazines were some of the factors that determine vaccination hesitancy. Kalok et al. (2020) reported that the factors were attributed to the uptake of childhood vaccination in general and not specifically to measle vaccine uptake. Lastly, Nakatudde et al. (2019) reported that the high odds of delayed vaccination, such as untimely measles vaccination was associated with vaccine stock out in the health facility. The qualitative analysis of the findings of the study conducted by Nakatudde et al. (2019) revealed that other healthcare-associated factors for childhood vaccination delay included limited knowledge, as well as poor attitudes of healthcare services providers, documentation limitations as well as insufficient communication by healthcare workers. Nonetheless, it should be noted that the factors were attributed to delayed childhood vaccination including measle vaccine.

2.6. SUMMARY OF LITERATURE GAP

From the literature review, four important gaps were identified, which informed the objectives of the current study. First, most of the available research articles focused on factors that contributed to childhood vaccination hesitancy in general, with limited focus on the measles vaccination uptake. Thus, the current study focused on providing comprehensive insight into the demographic, sociocultural, mother/caregiver and child-related and healthcare-related factors associated with measles vaccine uptake. Secondly, the reviewed research articles included mothers or caregivers with a wide range of demographic characteristics including pregnant women and those with preterm, as well as parents of sick and admitted children. Therefore, the results of the reviewed studies could not be confidently extrapolated to a population of mothers or caregivers of healthy children with children due for measle vaccination. Thus, the current study focused on determining sociodemographic determinants of measle vaccine uptake specifically among the mothers or caregivers with children aged 9-24 months. Lastly, the identified methodological gaps included

the use of mixed-method designs in some of the existing studies. This limited the flexibility and depth of the findings. The retrospective research depended on reviewing existing data and records of the immunisation status of the children. This contributed to a lack of accountability for the confounding variables and a limited understanding of the impact of the independent variables on measles vaccine hesitancy and uptake. Thus, the current study used a single consistent, and reproducible analytical cross-sectional study to bridge the gap.

CHAPTER THREE: METHODOLOGY

3.1. INTRODUCTION

This chapter describes the methods and procedures undertaken in this study. The description includes the study area, the study population, and the study designs. The chapter also describes the sample size determination procedure, the sampling technique used to select the participants, and the inclusion and exclusion criteria adopted for participation in this study. Furthermore, the chapter describes the data collection and analysis methods and the measures for the dependent variable. Lastly, the chapter describes the ethical issues considered in this study.

3.2 STUDY SETTING/AREA

The study was conducted in four health centres located in Narok North Sub-County, Narok County, Kenya. The four health centres included Nkoreta Health Centre, EwasoNgiro CMF, Entoltol Dispensary, and Olchorro Health Centre. The four centres were purposively selected by the researcher because they are eligible to provide vaccines to mothers or caregivers, thus were suitable settings to recruit the participants of this study. Narok County is located southern part of the Great Rift Valley. As per the 2019 census, Narok County has a population of 1,157,873 people and is primarily dominated by the Maasai and the Kalenjin communities.

3.3 STUDY POPULATION

The study population was the mothers or caregivers of children aged between 9 and 24 months. The population was selected for this study because they had children who were due for or expected to have received MCV1 and or MCV2. Thus, they would provide essential information regarding

the determinant factors for the uptake of measles vaccination. The mothers were considered as the biological female parents of the children within the target age bracket. The caregivers were any individual who was responsible for caring for the children within the target age bracket, such as guardians, relatives, or those who legally adopted the children.

3.4 STUDY DESIGN

The study employed analytical cross-sectional quantitative research to establish the relationship between determinant variables that were contributing to low uptake of measles vaccination among mothers or caregivers with children aged between 9 and 24 months. Why did you use this design

3.5 SAMPLE SIZE DETERMINATION

The Fisher's formula was used to determine the sample size of the participants that were interviewed for this study as follows.

$N = (Z^2 \times p(1-p))/d^2$

Where;

n = is the desired sample size (if the target population is greater than 10,000).

Z = the standard normal deviation (1.96) at a 95% confidence interval.

p = the proportion in the target populations estimated to have the desired characteristics, that is those with children between 9 months and 24 months. Since the exact figure of the participants with the desired characteristics was not known, the researcher used 50% or 0.5.

q = is the proportion of the population estimated not to have the desired characteristics whereby (q=1-p). Hence found to be 50% or 0.5

d=the desired degree of precision/accuracy was set at 5% (0.05)

p = 50%

Z = 1.96

d =0 .05

q=1-0.5=0.5

$n = (1.962(0.5)\ (0.5)/0.05^2) = 384.16$

Rounded off to the nearest whole number 384

Since the population under this study is less than 10,000 sample adjustment was done. The correction formula is;

$$nf = \frac{n}{1+ (n/N)}$$

nf =desired sample size when the population size is less than 10,000

n =Calculated sample size

N = estimated population size from the measles vaccination monitors of Narok North sub-county =120

nf=384/ (1+384/120)

nf= 91.4

Therefore, 91 mothers or caregivers were sampled, then 10% of non-response was considered, therefore 100 mothers or caregivers were considered as the final sample size and interviewed.

3.6 SAMPLING PROCEDURE

Due to difficulties in tracing the mothers or caregivers, multi stage sampling method was used in this study. The mothers or the caretakers were identified at the health facilities. Once one was identified, she assisted the researcher to trace and meet other mothers in the village to be recruited and interviewed.

3.7 INCLUSION CRITERIA & EXCLUSION CRITERIA

3.7.1. INCLUSION CRITERIA

i. Mothers or caregivers who had children aged between 9 and 24 months and were due or expected to have received MCV1, MCV2, or both.

3.7.2. EXCLUSION CRITERIA

ii. The study excluded the mothers or caregivers with children aged below or above the age bracket, children who had rare serious conditions that led to immunosuppression and those

with a history of severe anaphylactic reactions following immunization. Also, the mothers or caregivers who decline to provide consent were excluded.

3.8 DATA COLLECTION INSTRUMENTS

Data was collected using pretested questionnaires. This aided to gather primary data from the participants. Secondary data on measles immunization was collected through a review of immunization registers and other documentation within the healthcare facilities such as vaccine monitor charts.

3.9 DATA ANALYSIS

Data analysis was done using the statistical package for social science version 26. Descriptive data analysis involved the determination of frequencies, distributions, means, variance and standard deviations, where necessary. However, since most of the data were non-parametric, nominal and ordinal A Kruskal-Wallis H (non-parametric one-way ANOVA) test was conducted to determine the statistical significance of differences in uptake of MCV1 and MCV2 between the ranked categories of the determinant variables. Pearson's chi-square tests and binary regression logistics were conducted to determine the statistical significance of relationships between the determinant variables categories and the uptake of MCV1 and MCV2. The statistical significance was set at $P<.05$.

3.10. MEASURE OF DEPENDENT VARIABLE

The dependent variable was measles vaccine uptake. This was considered a binary variable, which was measured as the uptake of the measles vaccine. Both MCV1 and MCV2 were considered as measures for full immunization within the eligible proportion of the study population. For instance, the measure of uptake of MCV1 is considered as 1 or otherwise 0 for children aged above 9 months but below 18 months. On the other hand, the measure of uptake of MCV2 was considered as 1 or otherwise 0 for children aged above 18 months. Additionally, the WHO-recommended MCV coverage of more than 95% was used as a measure for MCV uptake in this study. Thus, the uptake of MCV1 and MCV2 below 95% was considered a low uptake of MCV.

3.11 ETHICAL APPROVAL

Permission to carry out the study was sought from Kenyatta University Ethics Review Committee (KUERC). A permit to conduct the study was also sought from the National Commission for Science, Technology and Innovation (NACOSTI). Regulatory approval to complete the study was sought from the research committee of Narok County. Written informed consent was obtained from the study participants. Study participation was voluntary and the participants reserved the privilege to quit the study at any stage. The study subjects were guaranteed of security and privacy of the data they provided. Namelessness was kept up by guaranteeing that the subjects did not include their names on the data collection instruments during the study and that the information they provided was held private during and after the study.

CHAPTER FOUR: RESULTS

4.1. INTRODUCTION

This chapter describes the findings generated by the current study after conducting both descriptive and inferential statistical (bivariate) analysis of the participant's responses. The chapter is organized into two main sections. The first part provides the descriptive findings presented in five main themes; sociodemographic characteristics of the participants, mothers or caregivers related determinants, child-related determinants, socioeconomic determinants, and healthcare-related determinants of low uptake of measles vaccines. The second part of presents the results of the bivariate analysis.

4.2. SOCIODEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

A total of 100 questionnaires were completed and analyzed. Thirty-nine of the participants were recruited from Entoltol Dispensary, 24 from Nkoreta Health Centre, 23 from Ewaso Ngiro CMF, and 14 from Olchorro Health Centre (see table 1) (n = 100) (*see table 1*). The mean age of the mothers or caregivers (M= 27.84, SD = 6.85) was 27.84 years with an age range of 17 to 49 years. The majority of the mothers or caregivers (97%) were married, two were widowed, and one was still single (n = 100). More than half of the mothers or caregivers (53%) did not have an education background, 19% secondary education level, 14% primary education level, and 13% had a tertiary education level (n = 100). Up to 90% of the mothers or caregivers belonged to protestants and

other Christian religions, while the remaining 10% were Roman Catholics (n =100). More than half of the mothers or caregivers (58%) were stay-at-home mothers or caregivers, 28% were self-employed, and 14% were employed (n =100). A total of 97 (n =100) mothers or caregivers belonged to Maasai, two to Kikuyu, and one to Kamba ethnic groups. A total of 87 mothers or caregivers had an income below Ksh. 10000, while the remaining 13 had income above Ksh. 10000 (n = 100) (*see table 1*).

The mean age of the children (M =, 16.27, SD = 5.85) was 16.27 months, with minimum and maximum ages of nine and 24 months respectively. The mean birth weight of the children was 3.02 kg (M=, 3.02, SD = .37), while the mean current weight of the children (M=, 11.76, SD = 6.85) was 11.76 kg. The children had a mean height (M=, 82.88, SD = 16.49) of 82.88 cm. Fifty-three of the children were males while the remaining 47 were females (n = 100). Most of the children (46%) were fourth born and above, while 17% were first born (n=100) (*see table 1*).

Table 1: Sociodemographic Characteristics of The Participants

Variable	**Frequency n = 100**	**Percentage (%)**	**MCV1 (n= 100)**		**MCV2 (n = 49)**	
			Received	**Not Received**	**Received**	**Not Received**
Healthcare facilities						
Nkoreta Health Centre	24	24	16	8	6	16
EwasoNgiro CMF	23	23	16	7	7	16
Entoltol Dispensary	39	39	24	15	0	1
Olchorro Health Centre	14	14	13	1	0	3
Mothers or Caregivers						
Age bracket						
≤20	16	16	11	5	0	6
21-30	54	54	37	17	6	17
31-40	24	24	20	4	5	10
≥41	6	6	1	5	2	3
Marital status						
Single	1	1	0	1	0	0
Married	97	97	69	28	13	35
Widowed	2	2	0	2	0	1
Education level of the mother						
None	53	53	35	18	6	22
Primary	29	29	20	9	4	8
Post Primary/Vocational	1	1	1	0	0	0
Secondary	11	11	7	4	0	4
Tertiary (College/University)	6	6	6	0	3	2
Spouse's level of education						
None	51	51	36	15	6	22
Primary	14	14	10	4	2	5
Post Primary/Vocational	3	3	2	1	0	0

Secondary	19	19	9	10	1	6
Tertiary (College/University)	13	13	12	1	4	3
Religion						
Roman Catholic	10	10	7	3	0	4
Protestants/other Christians	90	90	62	28	13	32
Muslims	0	0	0	0	0	0
No religion	0	0	0	0	0	0
Ethnic group						
Maasai	98	98	67	30	13	35
Kikuyu	2	2	2	0	0	1
Kamba	1	1	0	1	0	0
Source of income						
Livestock	39	39	29	10	8	12
Farming	37	37	18	19	2	15
Business	21	21	16	2	2	8
Others	3	3	3	0	1	1
Employment status						
Employed	14	14	1	13	0	0
Self-employed	28	28	24	4	3	14
Stay home mother	58	58	44	14	10	22
Monthly income						
<10000	87	87	56	31	10	33
>10000	13	13	13	0	3	3
Children						
Age						
0-12	48	48	33	13	0	7
13-24	52	52	36	18	13	29
Gender						
Male	53	53	35	18	5	22
Female	47	47	34	13	8	14
Place of Birth						
Health facility	63	63	51	11	7	20
Home (TBA)	37	37	17	20	6	17
Order of Birth						
1st	17	17	13	4	4	3
2nd and 3rd	37	37	29	8	3	15
4th and above	46	46	27	19	6	18
Birth weight						
<2.6	7	7	3	4	0	3
2.6 – 4.0	92	92	65	27	13	33
> 4.0	1	1	1	0	0	0

4.3. MEASLES VACCINES UPTAKE

4.3.1. UPTAKE OF FIRST AND SECOND DOSE OF MEASLE VACCINE

All the children (100%) of the mothers or caregivers qualified for or were expected to have received MCV1 since they were aged nine months and above (n = 100) (see table 2). Conversely, only 49 of the children of the mothers of caregivers were aged 18 months and above, and thus were qualified for or were expected to have received MCV2. Among the children who qualified for

MCV1, only 69 received the vaccine, while 31 did not (n=100). Among the 49 children who qualified for MCV 2, only 13 received the vaccine, while 36 did not (n= 49).

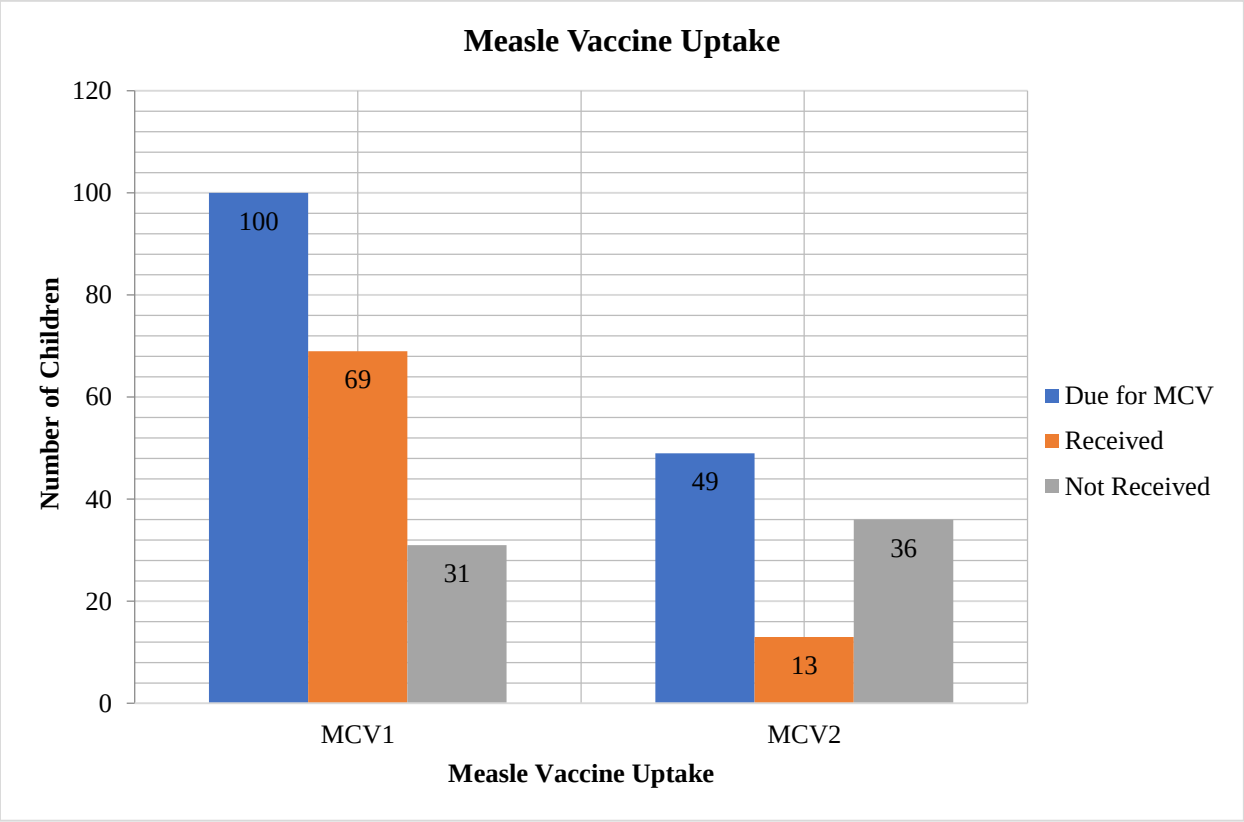

Figure 2: A bar graph showing rate of uptake of the measles vaccine (MCV1 and MCV2).

4.3.2. OVERALL MEASLES IMMUNISATION STATUS

Full measles immunization status was considered as having received both MCV1 and MCV2. Therefore, only 11% (n=100) of the children of the mothers or caregivers included in this study were considered as fully immunised. They had received both MCV1 and MCV2 at appropriate ages respectively (*see figure 3*). A total of 61% (n = 100) of the children were partially immunised, since they had only received either MCV1 or MCV2. The remaining 28% (n =100) were not immunised because they received neither MCV1 nor MCV2.

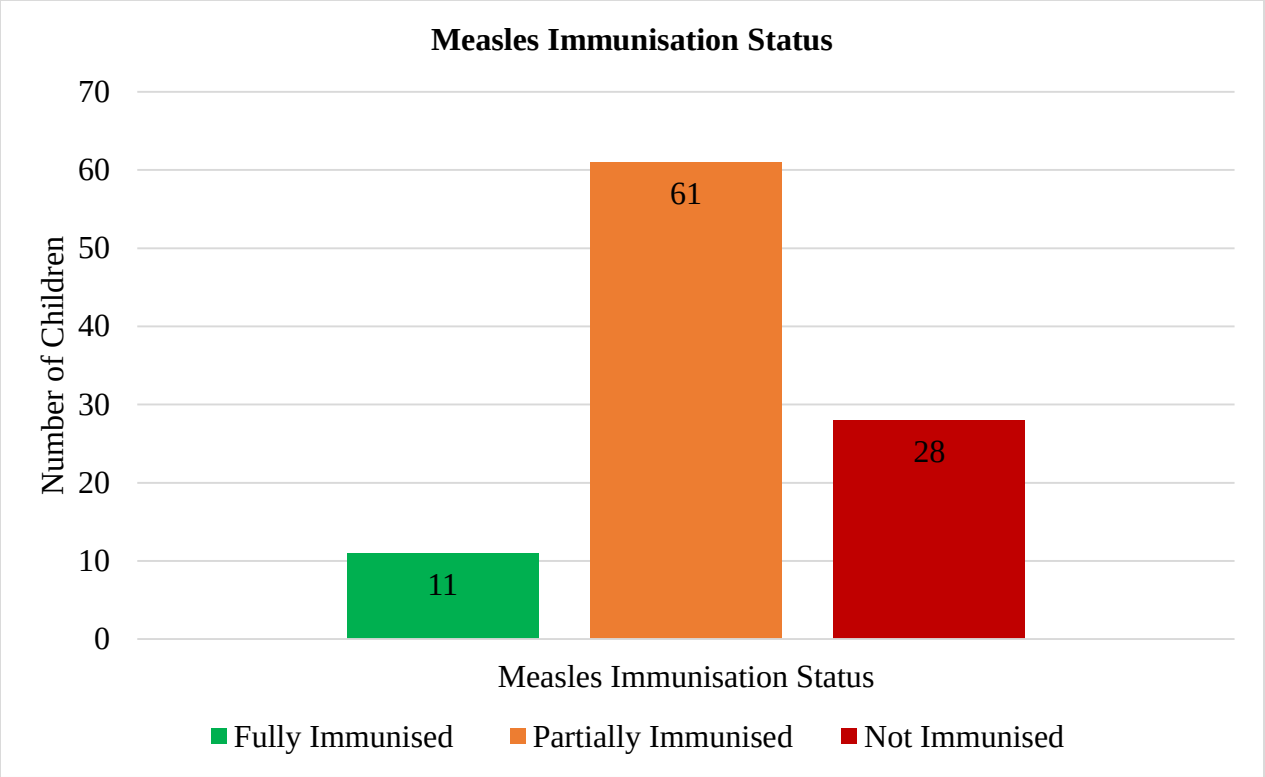

Figure 3: A bar graph showing overall immunization status

4.4. MATHERS OR CAREGIVERS' RELATED DETERMINANTS

4.4.1. AGE OF THE MOTHERS OR CAREGIVERS

The age of the mothers or caregivers was an important determinant factor in the uptake of the measles vaccine among the participants. It influenced the uptake of both MCV1 and MCV2. For instance, five out of 11 children of mothers or caregivers aged below 20 years and one out of five children of mothers or caregivers aged above 40 years received MCV1 (*see figure 3*). This indicated that mothers or caregivers aged below 20 years or above 40 years were likely to have their children miss MCV1 or MCV 2. None of the children of mothers or caregivers aged below 20 years received MCV2.

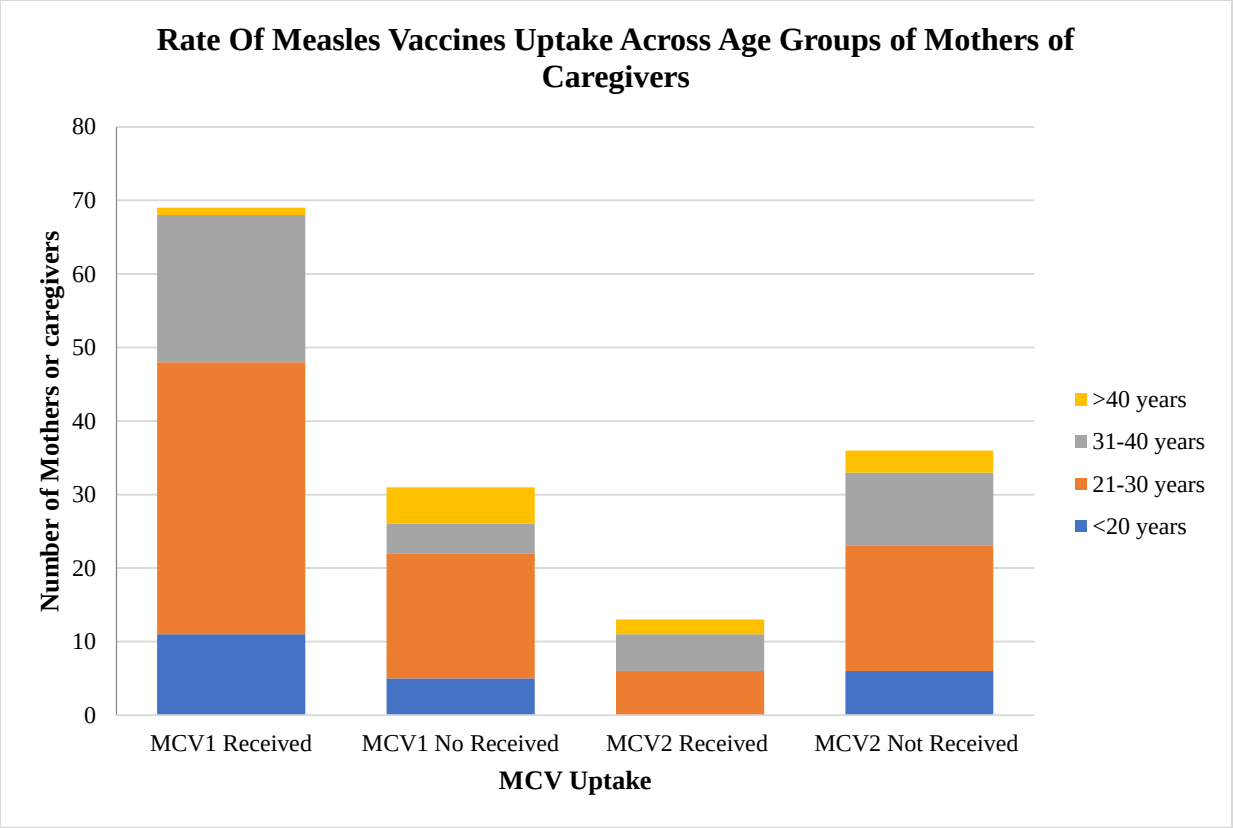

Figure 4: A bar graph of MCV uptake across the age groups of the mothers or caregivers

4.4.2. MARITAL STATUS OF THE MOTHERS OR CAREGIVERS

The maternal marital status of the mother or caregiver was identified as a significant determinant factor for the uptake of MCV. Almost all (97%) of the participants were married. A total of 69 of the 97 married mothers or caregivers received MCV1 and the remaining 28 did not. All the children of the widowed or single mothers or caregivers did not receive MCV1. Only thirteen children of 97 married mothers or caregivers received MCV2, and 35 did not. All the children of single or widowed participants did not receive MCV2. The result implied that children of single or widowed parents were likely to miss MCV.

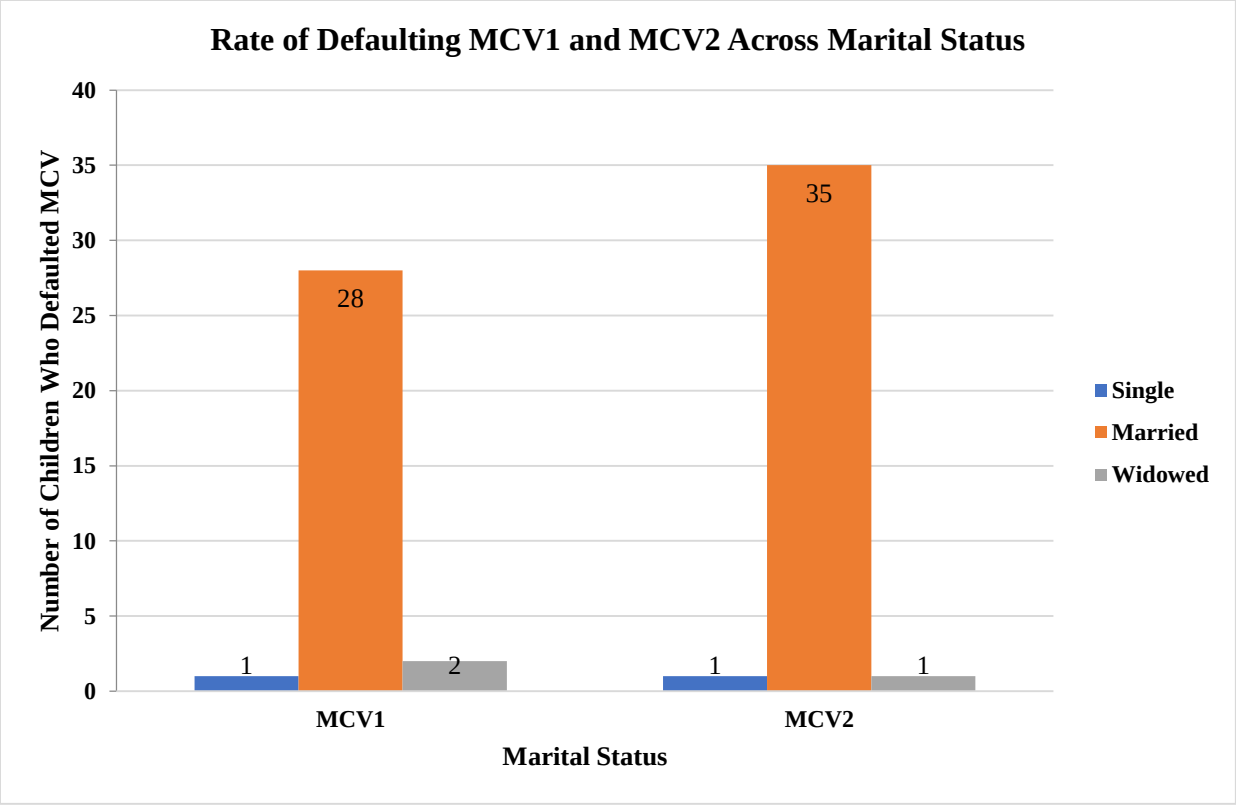

Figure 5: A bar graph of the rate of MCV1 and MCV2 default across marital status

4.4.3. EDUCATION LEVEL OF THE MOTHER OR CAREGIVER

The education level of the mothers or caregivers was found to be an important determinant of the uptake of MCV. For instance, 18 children of the 53 mothers or caregivers who had no education did not receive MCV1. Nine children of 29 mothers with primary level education and five children of mothers or caregivers with secondary level education did not receive MCV1. On the other hand, 22 children of the 49 mothers or caregivers with no education, eight children of the mothers or caregivers with a primary level of education, four children of mothers or caregivers with secondary level education, and two children of mothers with tertiary level education did not receive MCV2 despite qualifying for the vaccine (*see figure 5*). This indicated that the rate of MCV1 default was low across all maternal levels of education (*see figure 5*). There was a noticeably high rate of MCV2 default across all levels of education except tertiary education (*see figure 5*).

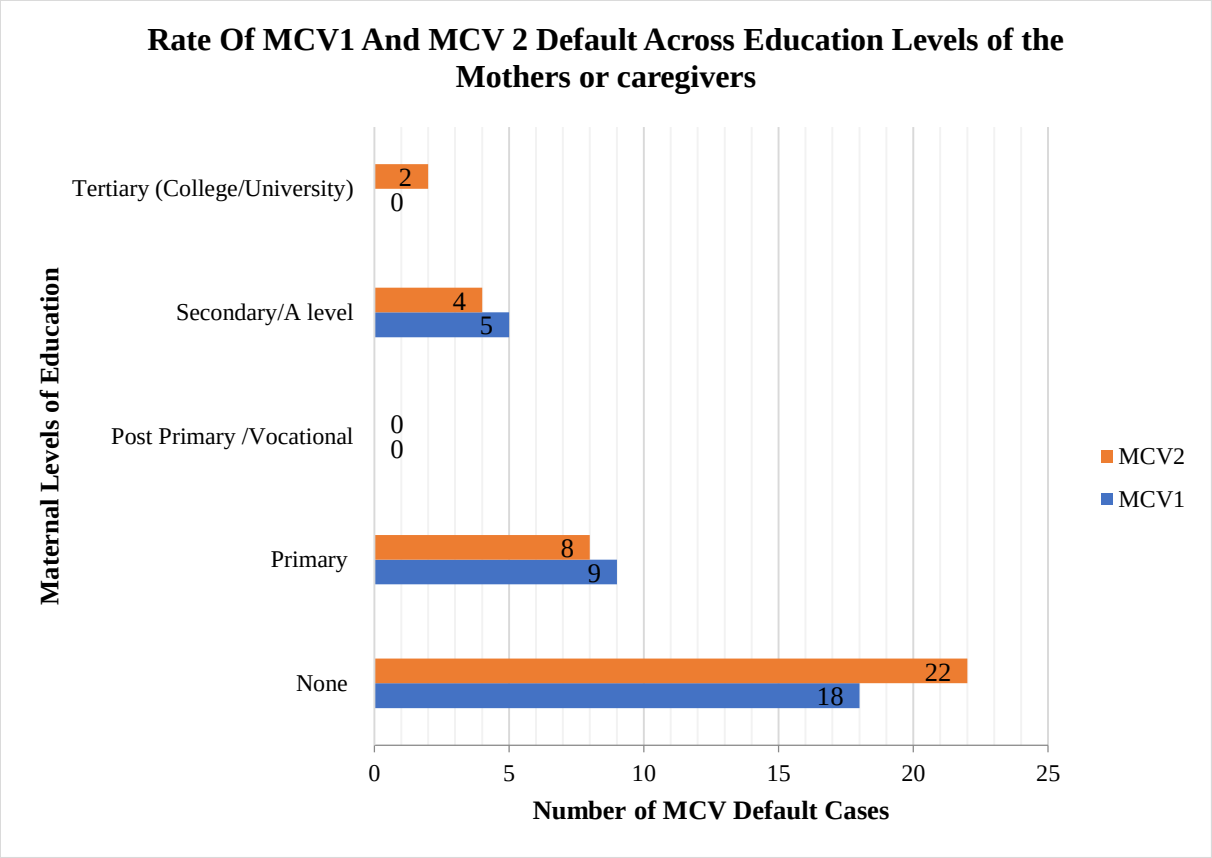

Figure 6: A bar graph of MCV1 and MCV 2 default across maternal education levels

4.4.4. RELIGION

The religion of the mothers or caregivers was analyzed as a determinant of the low uptake of both MCVs. Three children of the 10 mothers or caregivers who were Roman Catholics did not receive MCV1. On the other hand, 32 children of the 90 mothers or caregivers who were of Protestant or other Christian denominations did not receive MCV2. However, it should be noted that the religion of the mothers or caregivers was not heterogenous since about 90% of them were from one religion (Christianity).

4.4.5. NUMBER OF ANTENATAL CARE VISITS

The number of ANC visits during pregnancy was considered an important determinant of the low uptake of MCV. The study found that two children of five mothers or caregivers who did not attend ANC did not receive MCV1 representing 40%. Only 12 children of 34 mothers attended ANC 1-2 times (35%), while only 16 (28%) of the 57 mothers or caregivers who attended ANC 3-4 times did not receive MCV1. However only 1 (25%) of the 4 mothers or caregivers who attended ANC

more than 5 times did not receive MCV1. On the other hand, 80%, 32.3%, 33%, and 50% of children of mothers or caregivers who did not attend ANC, attended 1-2, 3-4, and above 5 times respectively did not receive MCV2. The findings showed that there was an increased rate of default of MCV among children of mothers who did not attend ANC.

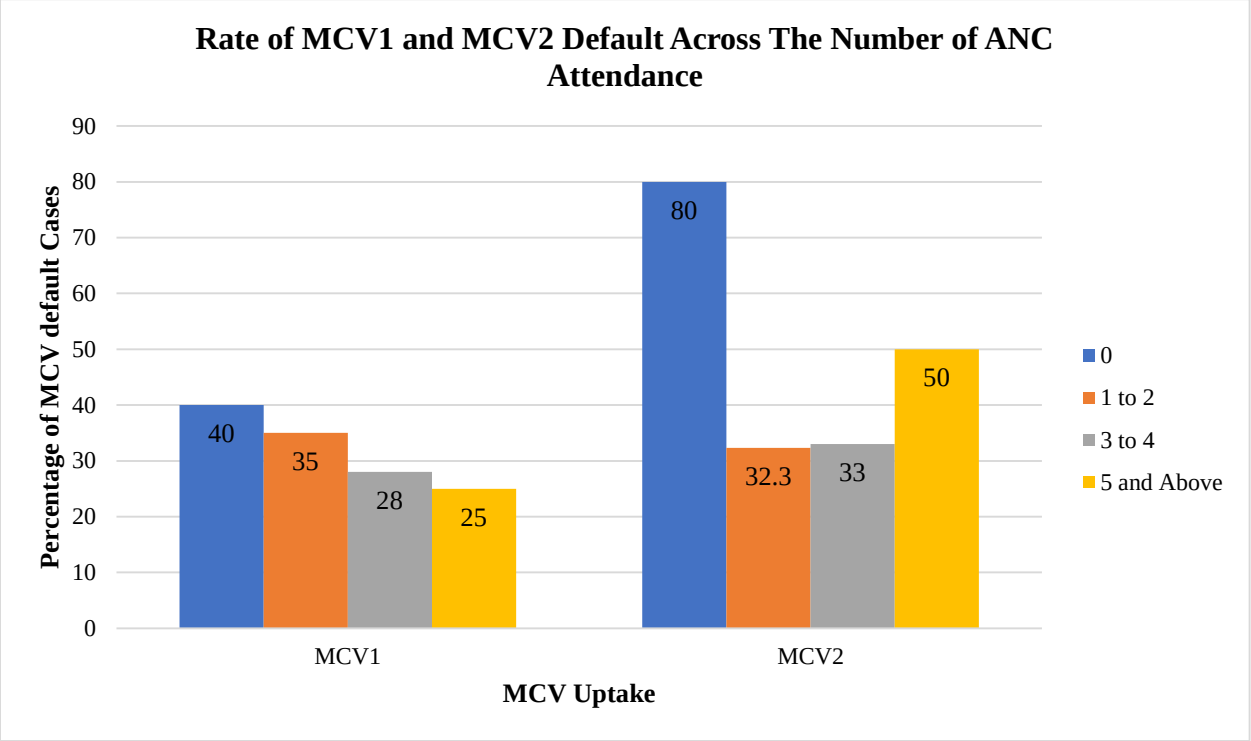

Figure 7: A bar graph comparing the rate of MCV default with ANC attendance

4.4.6. KNOWLEDGE OF VACCINES

The knowledge of vaccines among mothers or caregivers influenced the uptake of MCV. The participants were asked if they had heard about the measles vaccine. About 84% agreed, while 16% denied knowledge about MCV (n=100). Among the mothers or caregivers who agreed, 21% did not receive MCV1, compared to 81% of those who did not agree. Among the mothers or caregivers who agreed, 39.3% did not receive MCV1, while 21% of those denied did not receive MCV2. This indicated that the MCV default rate was high among mothers or caregivers who had not heard of MCV. The participants were also asked if they knew the vaccines their children were supposed to receive. Only 39% of them agreed, while 61% denied it. About 35.8% of those who agreed and 42.2% of those who denied did not receive MCV1. On the other hand, 39.4% and 47.6% of those who denied did not receive MCV2.

4.4.6. SOURCE OF INFORMATION

Descriptive analysis showed that the uptake of MCV was determined by the source of information about the vaccine among the mothers or caregivers. The most common source of information about vaccines among the mothers or caregivers was healthcare workers (92%), mainly the nurses. However, some of the mothers or caregivers received information about measle vaccine from other women (8%) (n=100). A total of, 23.4% of the children of the mothers or caregivers who received information from nurses did not receive MCV1. This was less compared to 67.9% of children of mothers who received information from other women who did not receive MCV1. About 33.6% of children of caregivers and mothers who received information from the nurses compared to 57.4% of the children of mothers or caregivers who received information from other women did not receive MCV2. The trust in the source of information about the vaccine among the mothers or caregivers influenced the MCV uptake. Most of the mothers or caregivers (94%) rated the nurses as the most trusted source of information. Among them, 36.4% and 41.2% of their children did not receive MCV1 and MCV2 respectively. The remaining 6% of the mothers or caregivers rated the villagers as the most trusted source of information. Among them, 77.9% and 82.4% of their children did not receive MCV1 and MCV2 respectively.

4.4.7. DECISION CONCERNING RECEIVING VACCINE

The mother's or caregiver's personal decision was a significant determinant of low MCV uptake. The participants were asked if they had ever decided not to allow their children receive MCV for reasons other than illness or allergy. A total of 81 denied, while 19 agreed (n=100). Among those who denied, 30 (33.7%) and 23 (25.8%) of their children did not receive MCV1 and MCV2 respectively. On the other hand, eight (42.1%) and six (31.5%) of the children of mothers who agreed did not receive MCV 1 and MCV2 respectively. This demonstrated that the rate of MCV default was comparatively high among those who agreed than those who denied it (*see figure 7*).

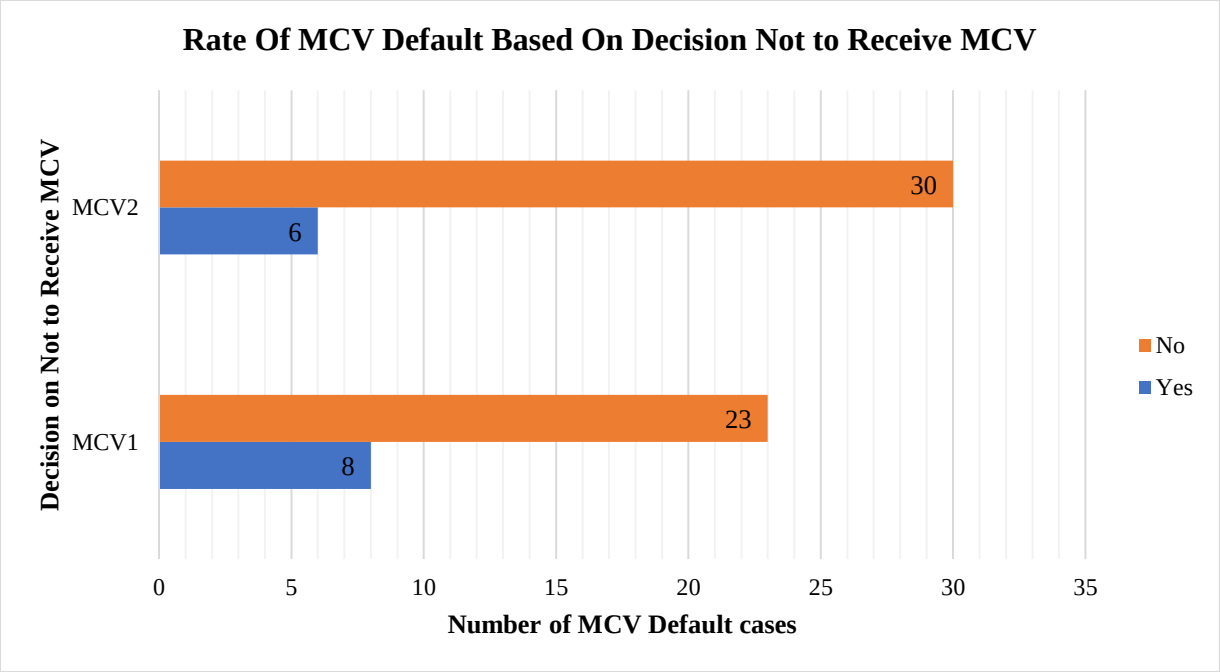

Figure 8: A bar graph showing rate of MCV default based on the decision not to receive MCV

4.4.8. CONCERNS ABOUT SIDE EFFECTS OF VACCINE

Concerns about serious side effects or adverse reactions among the mothers or caregivers influenced the uptake of MCV. About 70% of the mothers or caregivers reported that they were concerned about side effects or adverse reactions of the measle vaccine, while 30% did not. Among those who were concerned 18 (90%) and 9(75%), did not receive MCV1 and MCV2 respectively. Among those who were not concerned, only 2(10%) and 25% did not receive MCV1 and MCV2 respectively (*see figure 7*). Therefore, the findings indicated that there was a high rate of MCV default among mothers or caregivers who were concerned that their children would develop side effects or adverse reactions due to MCV (*see figure 7*)

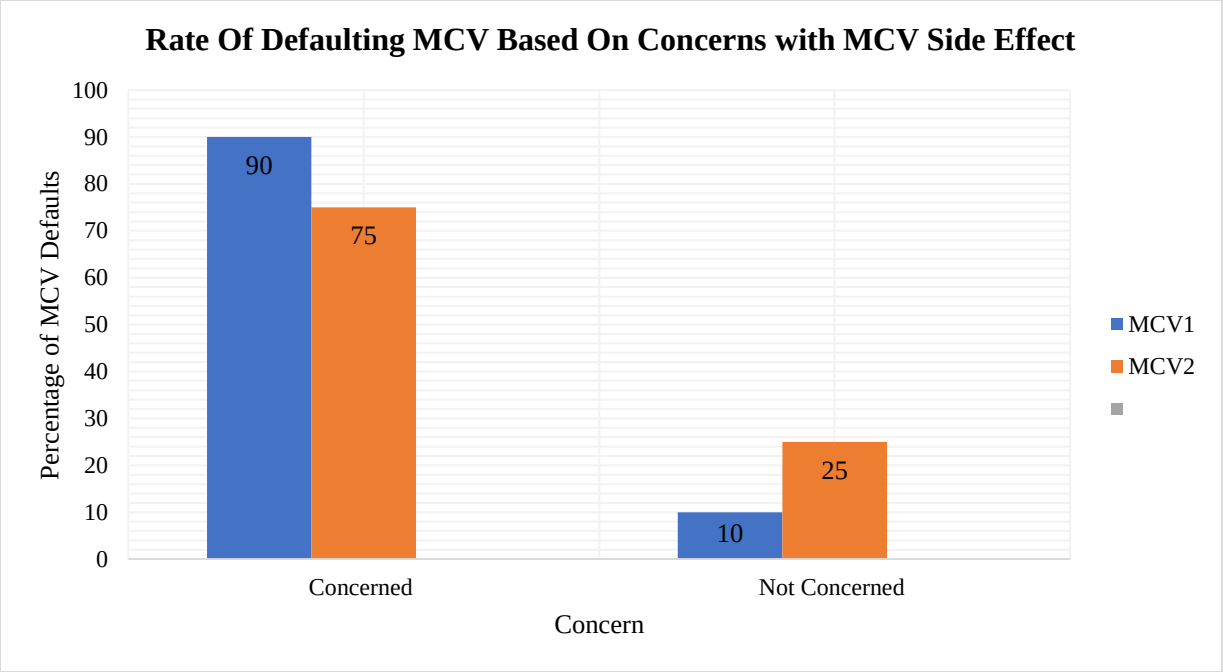

Figure 9: A bar graph of the rate of MCV default against concerns with MCV side effects

4.4.9. VACCINE UPTAKE HESITANCE

Vaccine uptake hesitancy was an important significant determinant for the low uptake of both MCV1 and MCV2. Among the mothers or caregivers, 23% were very hesitant, 39 were somehow hesitant, and 38% were not hesitant. Among those who were very hesitant, 15(48.4%) and 25(71.4%) did not receive MCV1 and MCV2 respectively (*see figure 9*). This was noticeably high compared to 7(22.5%) and 1(2.8%) of those who did not receive MCV1 and MCV2 respectively among the mothers or caregivers who were not hesitant (*see figure 9*). The results indicated that the rate of MCV default rate increased with increasing levels of hesitancy.

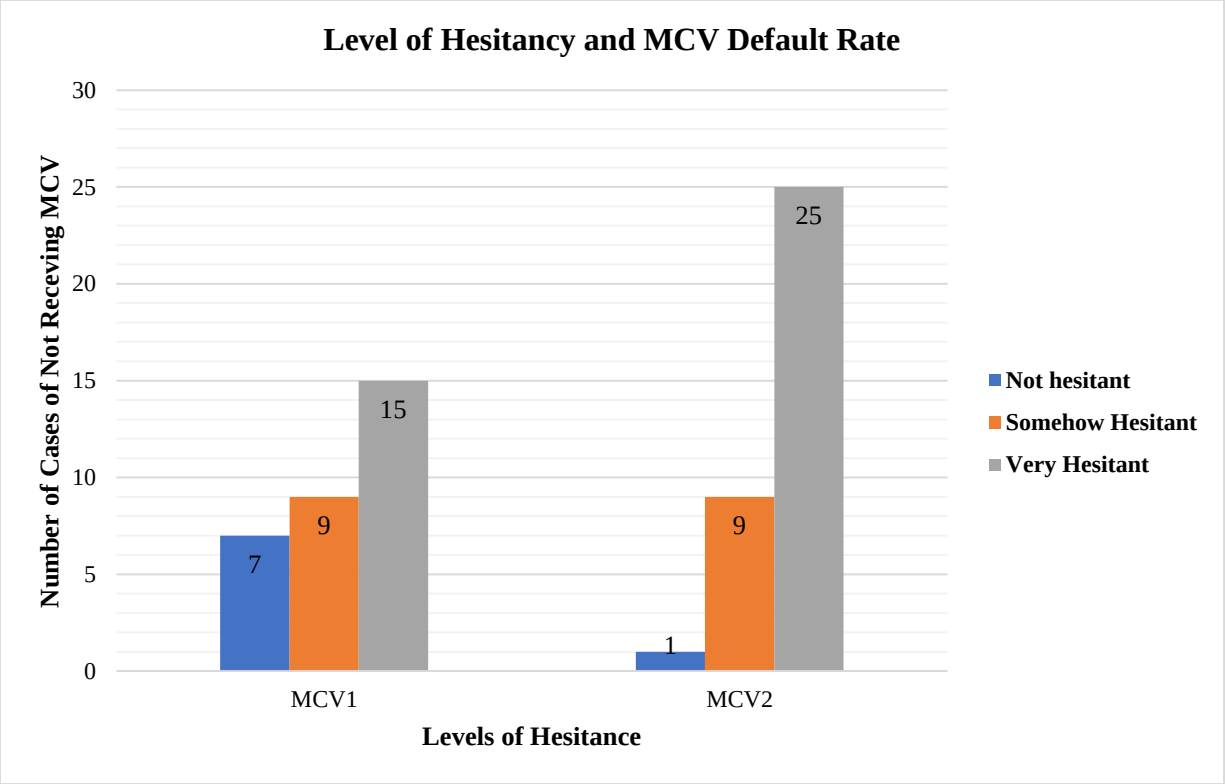

Figure 10: A bar graph comparing the rate of MCV default across levels of hesitancy

4.5. CHILD DETERMINANTS OF MEASLES VACCINE UPTAKE

4.5.1. PLACE OF BIRTH

The place of birth of the child influenced the uptake of MCV, especially MCV1 (*see figure 10*). Most of the children (63%) were delivered in a healthcare facility, while only 37% were delivered at home. Among the mothers or caregivers who delivered at the health facility, 11(36.7%) and 16(43.2%) of their children did not receive MCV1 and MCV2. On the other hand, 17(56.7%) and 19(51.4%) of the children of mothers or caregivers who delivered at home did not receive MCV1 and MCV2. The result showed that children delivered at home were likely to default from receiving MCV.

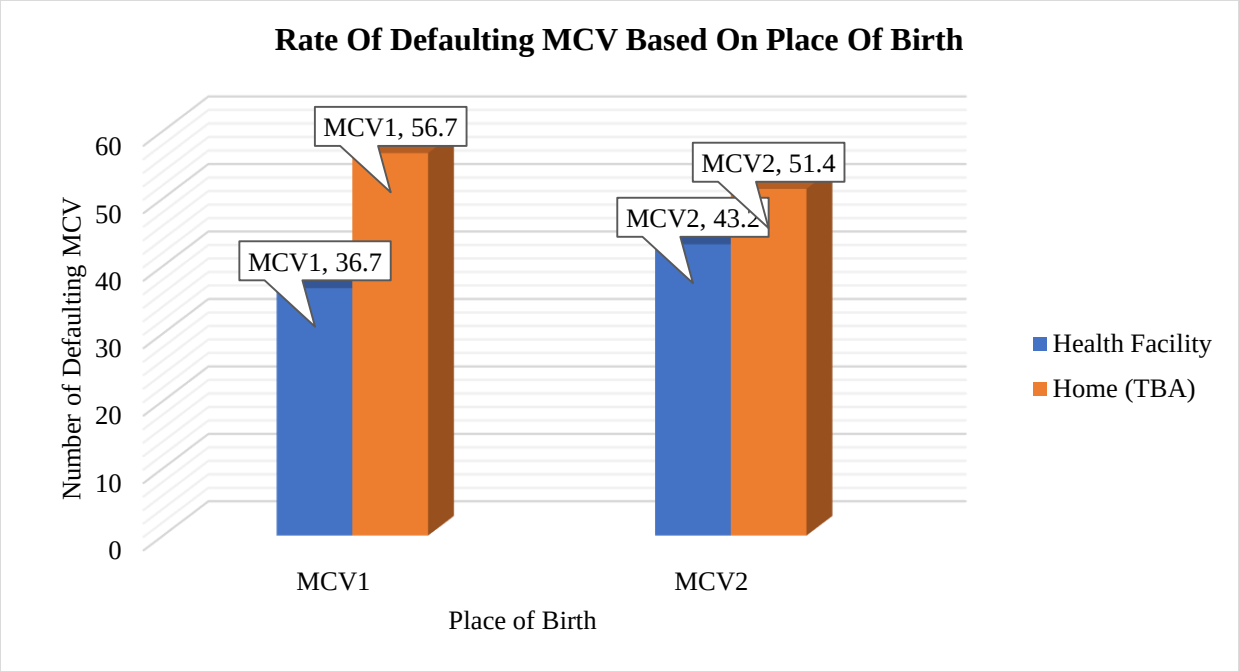

Figure 11: A bar graph comparing the Rate of MCV default across the place of birth

4.5.2. CHILD'S BIRTH ORDER

The birth order of the children of the mothers or caregivers included in this study had an impact on the uptake of MCV. Most of the children (46%) were the fourth born and above in their families. About 37% of the children of the participant were second or third-born, while 17% were first-born in their families. Among the first-born children of the mothers or caregivers, 4(15.4%), and 3(11.5%) did not receive MCV1 and MCV2 respectively. However, cases of default were high among the children who were of birth order four and above (*see figure 10*). For instance, 19(47.5%) and 18(45%) of children who were fourth born in their families did not receive MCV1 and MCV2 respectively (*see figure 10*). This showed that the default rate of MCV 1 and MCV 2 increased with the increasing birth order of the child (*see figure 10*).

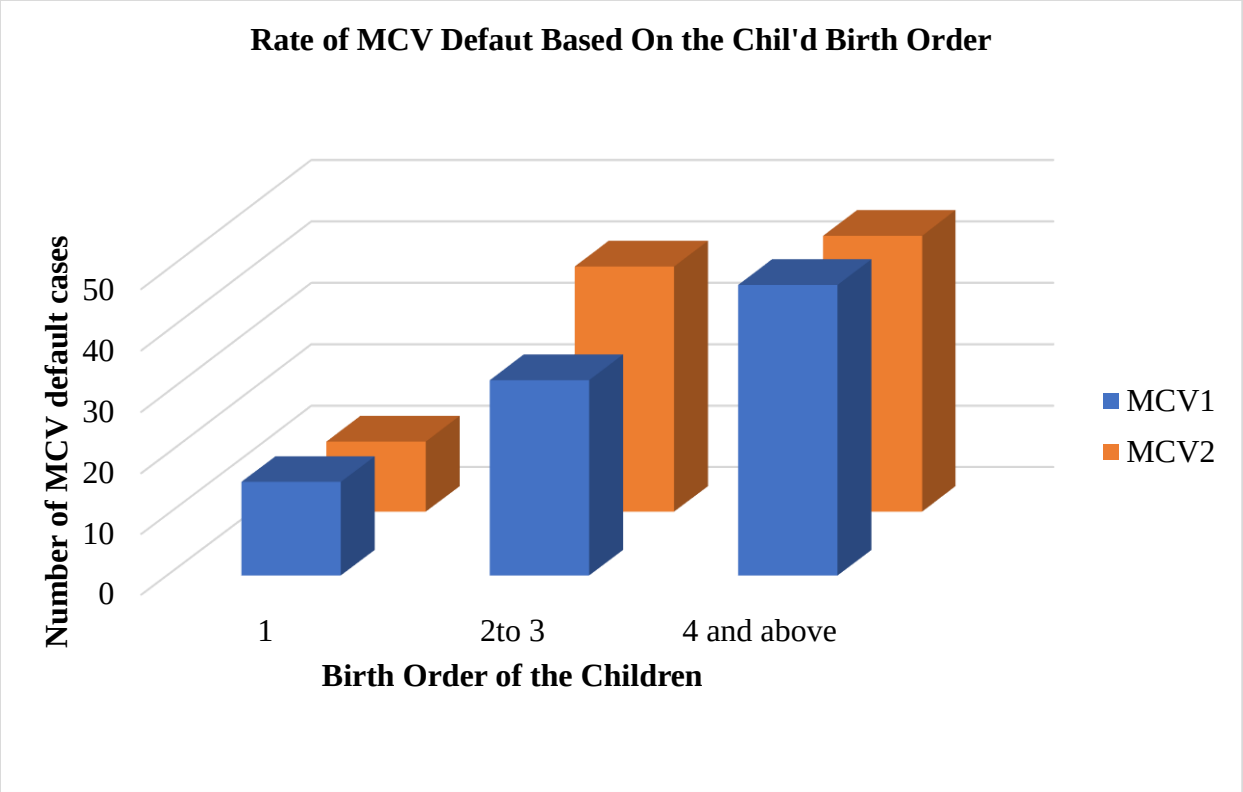

Figure 12: Bar graph of the rate of default based on the birth order of the children

4.5.3. ILLNESS AND ALLERGY

Child illness during the MCV period was a major important determinant of MCV. This was mainly observed in the MCV1 uptake rate. Nonetheless, children who were reported to be ill during the vaccination period, having an allergy, or being sick in the past three months were likely not to receive MCV1 or MCV2. For instance, 29% of mothers or caregivers reported that their children were sick or had an allergy during the vaccination period or in the past three months, while 71% reported not. Among the children whose mothers or caregivers reported illness or allergy, 21(79%) and 13 (64%) did not receive MCV1 and MCV2 respectively. On the other hand, among the mothers or caregivers who did not report any illness or allergy during or in the past three months of vaccination, 10(14%) and 6(28%) did not receive MCV1 and MCV2 respectively. Some of the illnesses reported included the common cold, respiratory tract infection, diarrhoea, and cerebral palsy.

4.5.4 HISTORY OF EXPERIENCING SIDE EFFECTS OF VACCINATION

The history of experiencing a side effect or adverse reaction from any other vaccines was a determinant factor for the uptake of MCV, especially the uptake of MCV1. For instance, out of the 14 children who had previous experience of side effects or adverse effects, nine of them did not receive the vaccine (n=100). On the other hand, 22 out of the 89 children who did not receive the measle vaccine had no experience of side effects or adverse reactions. Among the children due for MCV2, six had previous experience with the side effects of vaccination, and all of them did not receive the vaccination (n=49). Among the 43 children who had no experience with side effects, 30 did not receive MCV2 (n=49).

4.5.5. GENDER

The gender of the baby was conjectured to have a potential impact on MCV uptake among the participants. The descriptive statistical analysis showed that there was a high proportion of males who did not receive MCV1 and MCV2. For instance, 18 males and 13 females (n = 100) did not receive MCV1, compared to 22 males and 14 (n = 49) females who did not receive MCV2 (*see figure 11*).

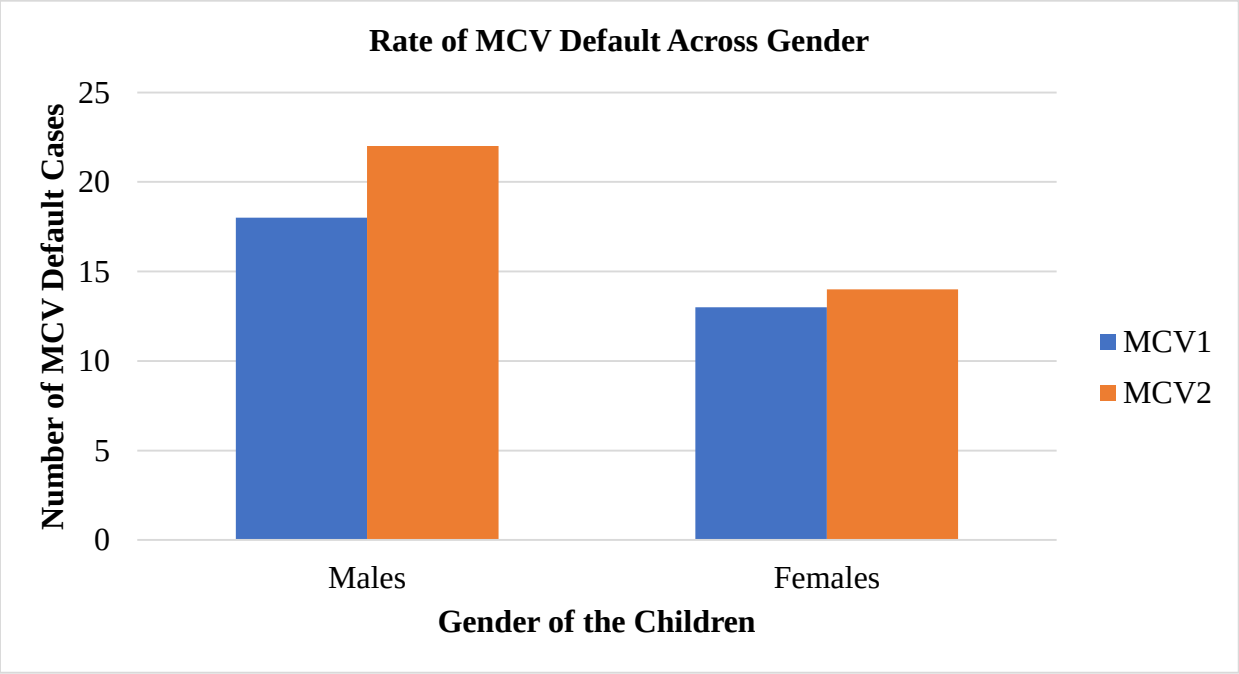

Figure 13: A bar graph of the rate of MCV default based on gender

4.5.6. BIRTH WEIGHT

The child's birth weight was presumed as a determinant factor for MCV uptake. The descriptive analysis indicated that there was a proportionately high rate of defaulting MCV among those who had a birth weight of below 2.5 kg. For instance, four out of seven children who weighed below 2.5 kg did not receive MCV1 (n = 100). All three children who weighed less than 2.5 kg and were due for MCV2 did not receive the vaccine (n = 49).

4.6. SOCIOECONOMIC DETERMINANT OF MEASLES VACCINE UPTAKE

4.6.1. SOURCES O F INCOME

The source was identified as an important determinant of MCV uptake. A high number of default cases were registered among those who had livestock and farming as a source of income compared to business. For instance, 10 out of 39 children of mothers or caregivers who engaged in livestock and 19 out of 37 children of mothers or caregivers who engaged in farming did not receive MCV1 (n=100). On the other hand, only 2 out of 21 children of mothers or caregivers who engaged in business did not receive MCV1 (n = 100). Although, there was a high default rate for MCV2 among children of mothers or caregivers who engaged in farming compared to business.

4.6.2. EMPLOYMENT STATUS

The employment status of the mothers or caregivers determined the uptake of MCV. Among the 14 children of the employed mothers or caregivers, 13 did not receive MCV1. On the other hand, only 4 among the 28 children of mothers or caregivers who were self-employed and 14 out of 58 children of stay-at-home mothers or caregivers did not receive MCV1 (n = 100) (*see table 2*). For the MCV2, none of the participants was employed. A total of 14 out of 28 children of mothers or caregivers who were self-employed and 22 out of 32 children of stay-at-home mothers or caregivers did not receive the MCV2 (n = 49) (*see table 2*).

Table 2: MCV Uptake Across Employment Status

Employment Status	**MCV1**		**MCV2**	
	Received	Not Received	Received	Not Received
Employed	1	13	0	0
Self-Employed	24	4	14	14
Stay-at-Home mothers or Care Givers	44	14	10	22

4.6.3. MONTHLY INCOME

The monthly income was a significant determinant of the low uptake of MCV. However, the descriptive statistics indicated a high rate of MCV default among children from a household with an average monthly income of less than Ksh. 10000. It should be noted that most of the participants (87%) had an income of less than Ksh. 10000. A total of 31 out of 87 children of mothers or caregivers with an income of less than Ksh. 10000 and nine out of 13 children of mothers or caregivers with an income of more than Ksh. 10000 did not receive MCV1 (n = 100). On the other hand, 33 out of 43 children of mothers or caregivers with an income of less than Ksh. 10000 and three out of six of the children of mothers or caregivers with an income of more than Ksh. 10000 defaulted MCV2.

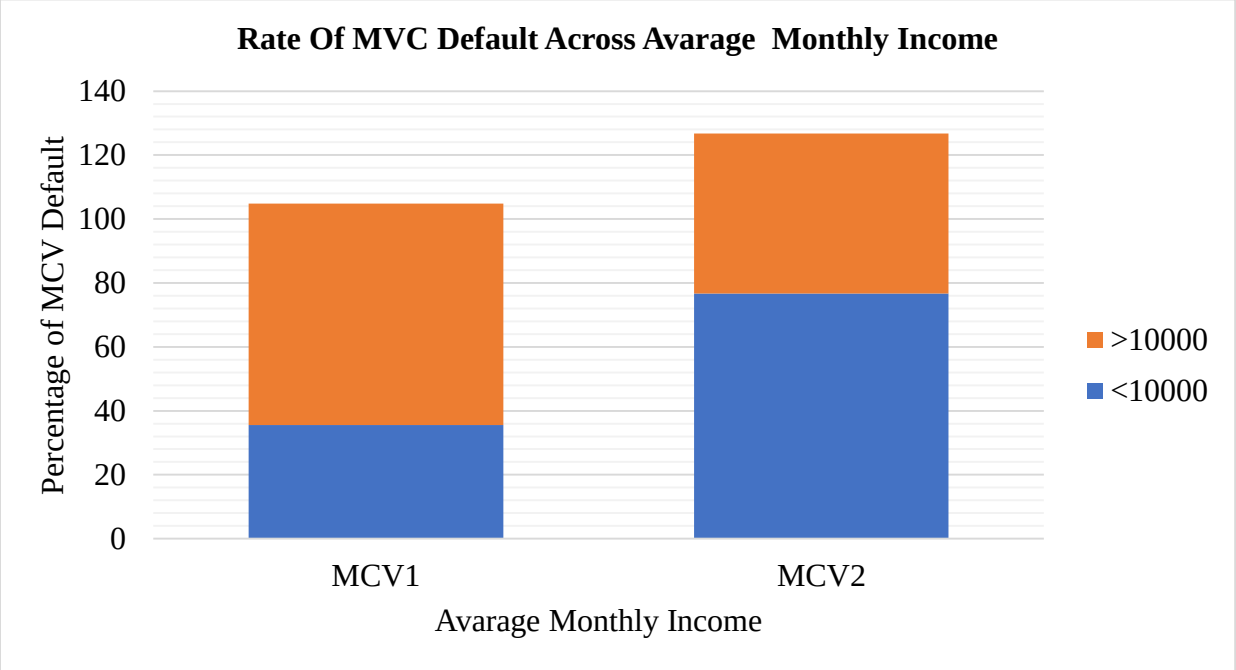

Figure 14: Rate of MVC Default Across Average Monthly Income

4.6.4. ETHNIC GROUP

Ethnicity was projected as a socioeconomic determinant for the low uptake of MCV. However, the ethnic grouping of the participant was largely homogenous. The majority (97%) of the participants were from the Maasai tribe. This limited the identification of any relevant differences across the ethnic groups. A total of 30 and 35 children of the 97 mothers or caregivers belonging to the Maasai tribe did not receive MCV1 and MCV2 respectively. All two children of mothers or

caregivers of Kikuyu ethnicity received MCV1, while the only child of the mother or caregiver of Kamba background did not receive MCV1.

4.6.5. CULTURAL AND RELIGIOUS FACTORS

Culture and religion were significant determinants for the low uptake of MCV1. Among the 16 children of mothers or caregivers who knew someone who refused MCV due to cultural and religious practices, 10 defaulted MCVI (n = 100). On the other hand, six out of 10 children of mothers or caregivers who knew someone who refused MCV due to cultural and religious practices defaulted MCV2 (n = 49). Three out of four children of mothers or caregivers who knew a leader who do not agree with MCV defaulted MCV1 (n = 100). One out of four children of mothers or caregivers who knew a leader who does not agree with MCV defaulted MCV2 (n = 49)

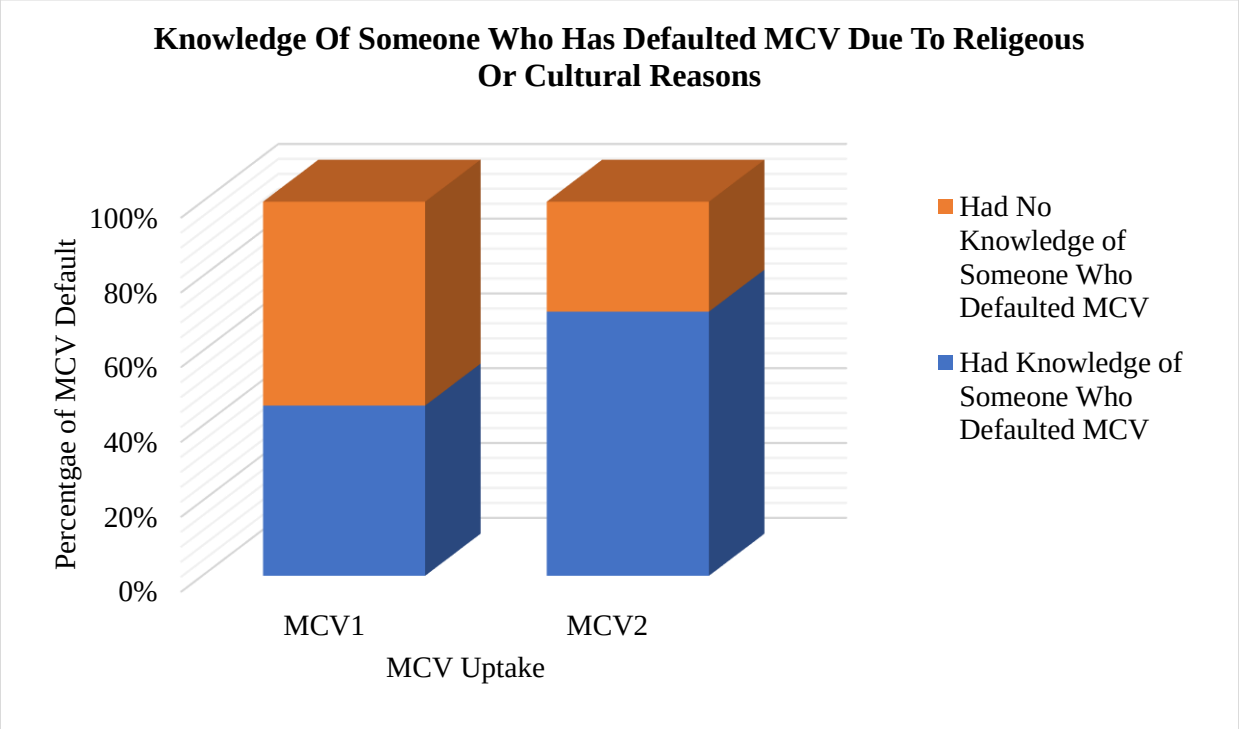

Figure 15: Rate of MCV Default Due to Religious or Cultural Reasons

4.7. HEALTHCARE-RELATED FACTORS

4.7.1. THE HEALTH CARE FACILITY

Sixteen babies of the 24 mothers or caregivers who visited Nkoreta Health Centre received MCV1, while eight did not. Sixteen babies of the 23 mothers or caregivers who visited Ewaso

ngiro CMF received MCV1, while seven did not. A total of 24 babies of the 39 mothers or caregivers who visited Ontoltol Dispensary received MCV1 while 15 did not. Thirteen babies of the 14 mothers or caregivers who visited Olchorro Health Centre received MCV1, while one did not. On the other hand, six babies of the mothers or caregivers who attended Nkoreta Health Centre received MCV2, while 16 did not. Seven of the babies of the mothers or caregivers who attended Ewaso ngiro CMF received MCV2, while 16 did not. There were no babies of the mothers or caregivers who attended Entoltol Dispensary and Olchorro Health Centre received MCV2.

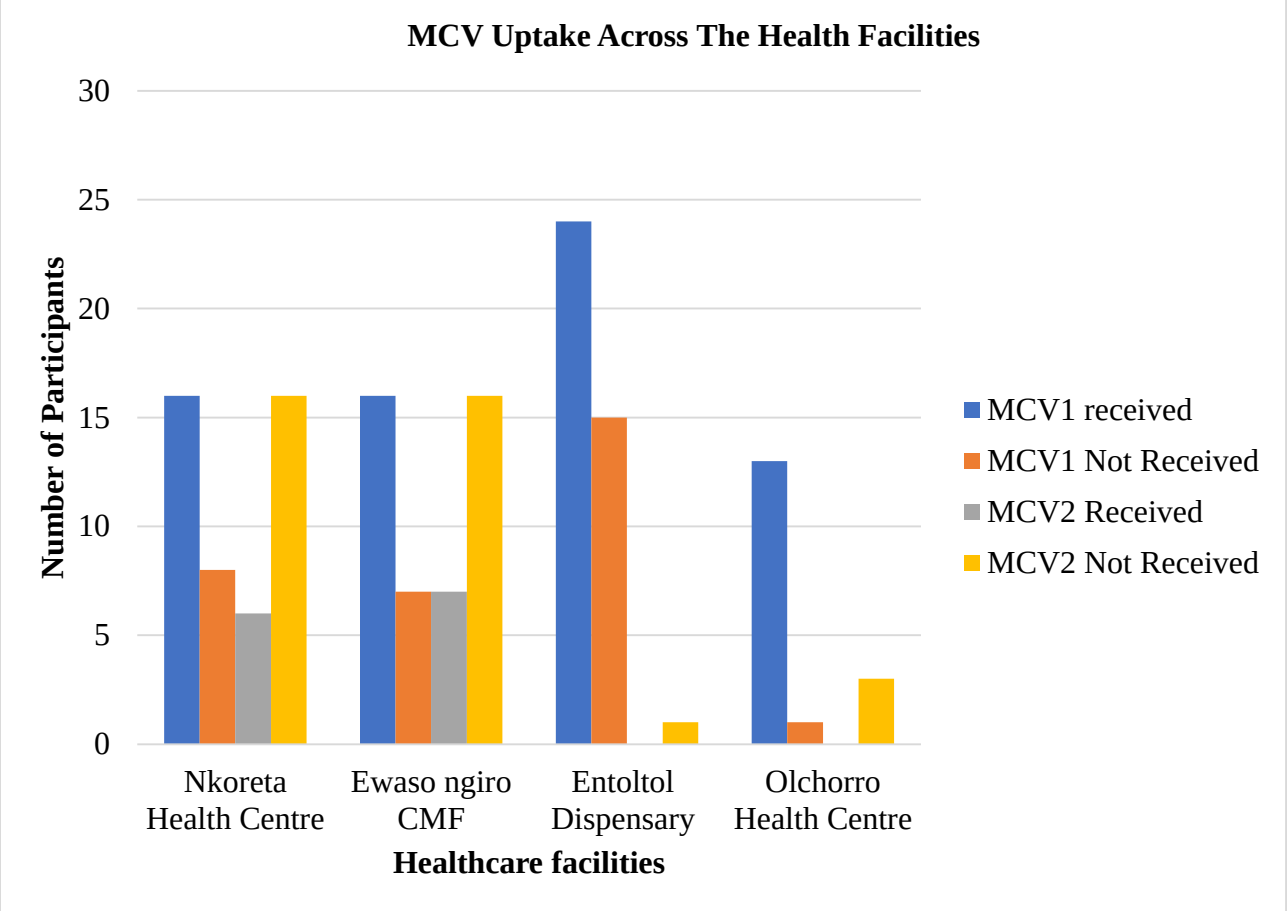

Figure 16: A bar graph of the MCV uptake across the health facilities

4.7.2. GIVING VACCINE SCHEDULE DATE TO THE PARTICIPANTS

The healthcare practice of giving a scheduled date for vaccination to the mothers or caregivers determined the uptake of MCV. Descriptive statistics indicated that only eight out of 68 children of the mothers or caregivers who were given a scheduled date for vaccine defaulted MCV1 (n =

100). On the other hand, 23 out of 32 children of mothers or caregivers who did not receive the scheduled dates for measle vaccination defaulted MCV1. However, 28 out of 41 children of mothers or caregivers who were provided with scheduled dates defaulted MCV2 (n=49). Eight children of mothers or caregivers who did not receive the scheduled date for vaccination defaulted MCV2 (n = 46).

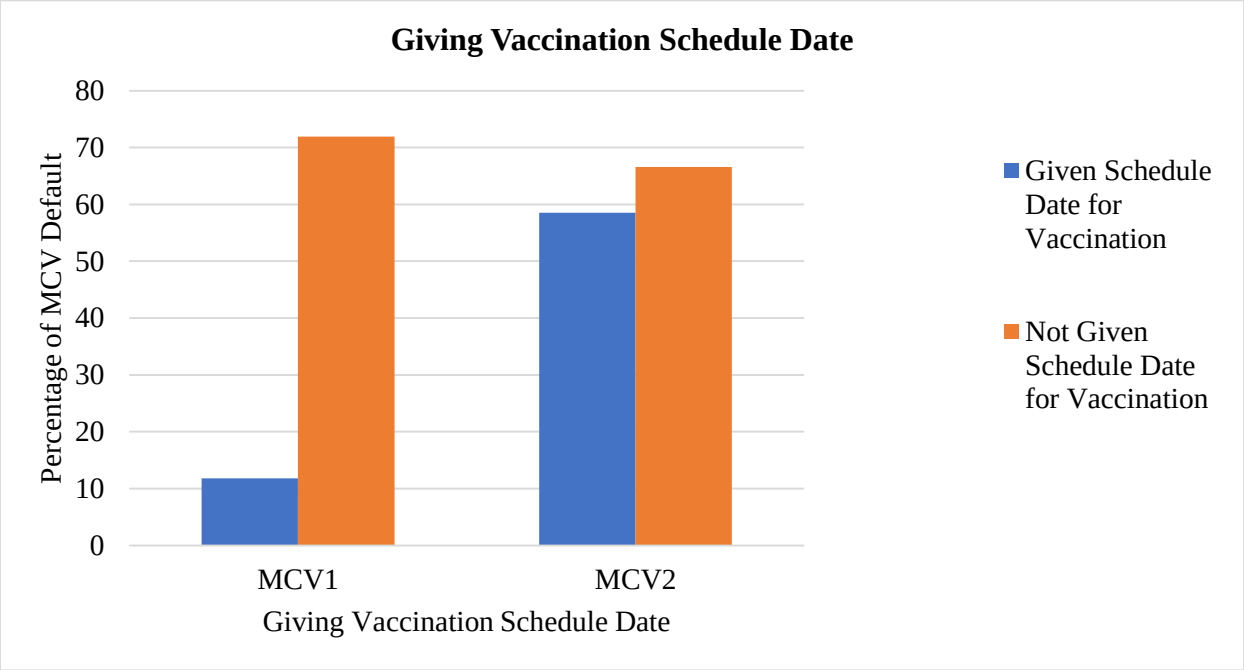

Figure 17: A bar graph showing rate of MCV default against giving vaccination schedule date

4.7.3. DISTANCE FROM THE HEALTH FACILITY

The accessibility of the healthcare facility in terms of participants' distance from the health facility was an important healthcare-related factor that influenced the uptake of MCV. The participants who were more than 5 km away from the healthcare facility were having a notable tendency of defaulting to MVC1, MCV1, or both. For instance, 14 out of 62 (n = 100) participants who lived within 5 km and 17 out of 38 participants who were more than 5 km away from health facilities defaulted MCV1. On the other hand, 33 out of 46 (n = 49) participants who lived within 5 km and three who lived more than 5 km from the health facility defaulted MCV2.

Table 3: Distance from The Health Facility

Distance From the Health facility	MCV1		MCV2	
	Received	Not Received	Received	Not Received
Within 5 km	48	14	13	33
More than 5 km	38	17	5	3

4.7.4. AVAILABILITY OF VACCINES

The availability of all basic vaccines in the healthcare facility determined the low uptake of measle vaccination. There was a reduced number of MCV defaults among the participants who attended the healthcare facilities with a constant supply of basic vaccines. However, the absence of vaccines in healthcare facilities contributed to more MCV default cases. The mothers or caregivers who visited facilities that missed basic vaccines were likely to have their children default from receiving MCV1 and MCV2. For instance, 20 out of 88 (22.7%) children of mothers or caregivers who attended a facility with all basic vaccines did not receive MCV1. Seven out of eight (87.5%) children of the mothers or caregivers who visited facilities with no basic vaccines did not receive MCV1. A total of 36 out of 88 (40.9%) children of the mothers or caregivers who attended facilities with all basic vaccines did not receive MCV2. However, 66.7 % of the children of mothers or care givers who attended facilities with no basic vaccines did not receive MCV2.

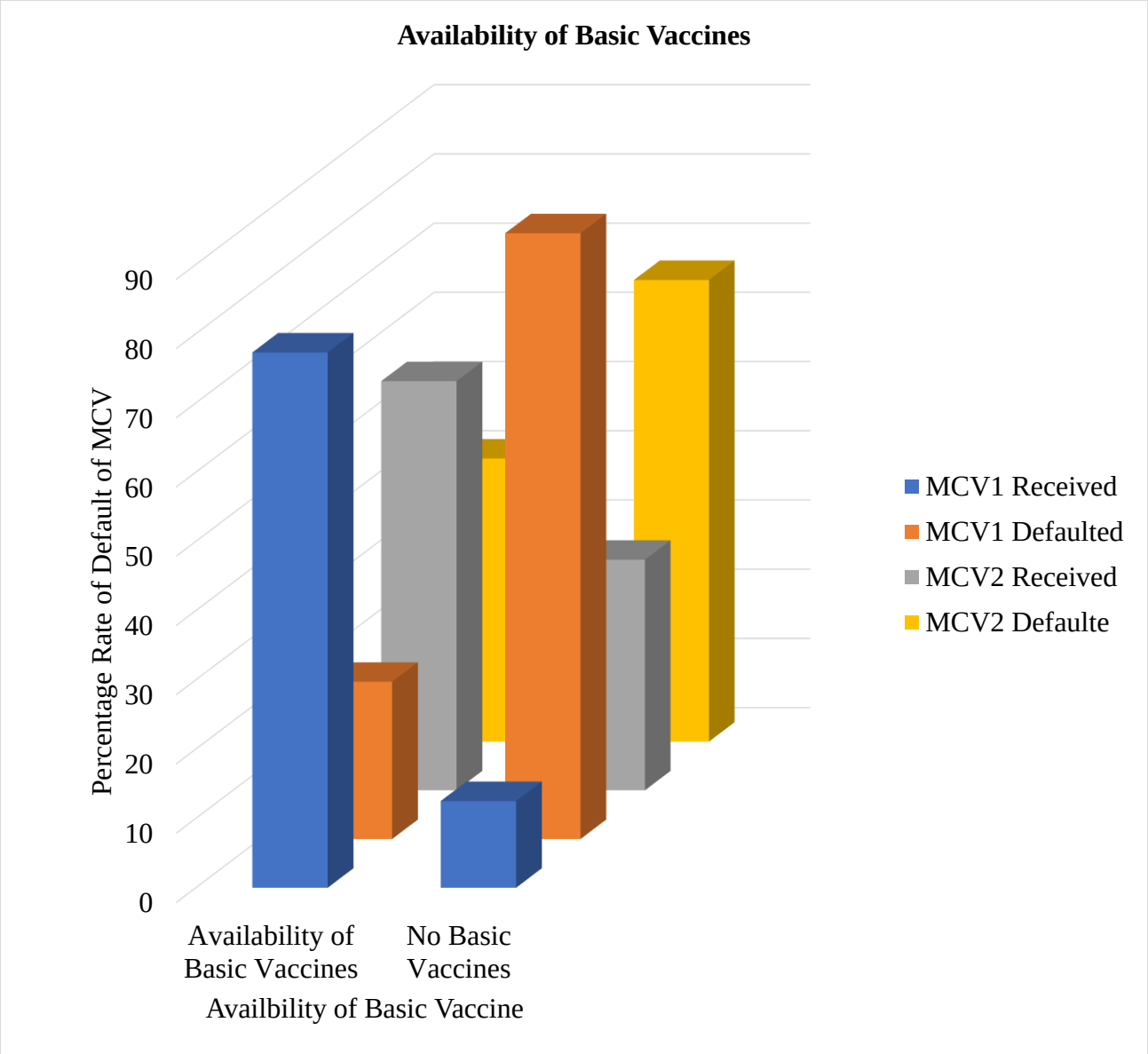

Figure 18: Rate of MCV uptake against the availability of basic vaccines in the facility

4.7.5. STAFF TRAINING ON VACCINATION

Attending clinics at a health facility that had their staff trained on vaccination influenced the uptake of MCV. The descriptive analysis indicated that there was a proportionately high rate of default of MCV among children of mothers or caregivers who were visiting health facilities with staff not trained on vaccination. For instance, 41% of the mothers or caregivers attended healthcare facilities with staff trained in vaccination through immunization seminars, while 59% attended health facilities with staff not trained in vaccination. Among the mothers who attended healthcare facilities with staff trained on vaccination, 20(48.8%) and 8 (19.5%) had children who did not

receive MCV1 and MCV2 respectively. On the other hand, Among the mothers or caregivers who attended health facilities with staff trained on vaccination, 11(18.6%) and 6(9.6%) had children who defaulted MCV1 and MCV2 respectively.

4.7.6. AVAILABILITY OF VACCINATION EQUIPMENT

Availability of vaccination equipment, such as cold box, vaccine carrier, refrigerator, continuous temperature monitoring, energy source, and immunization determined the uptake of MCV. For instance, 81% of the mothers attended healthcare facilities with the availability of vaccination equipment, while 18% did not. Among the mothers or caregivers who attended health facilities with the availability of vaccination equipment, 20(24.7%) and 36(44.4%) had children who defaulted to MCV1 and MCV2. On the other hand, among the mothers or caregivers who attended health facilities without vaccination equipment, 11(61.1%) had children who did not receive MCV1. This showed that mothers and caregivers who visited healthcare facilities with limited vaccination equipment were likely not to receive MCV1 and MCV2.

4.7.7. VACCINE STOCK-OUTS

The occurrence of vaccine stock-outs in a health facility contributed to the low uptake of MCV. A total of 83% of the mothers or caregivers attended healthcare facilities that had experienced vaccine stockout in the past three months. Among them, 30 (36.1%) and 33(41.3%) had children who did not receive MCV1 and MCV2 respectively. On the other hand, 17% of the mothers or caregivers who attended the healthcare facilities that had not experienced vaccine stock out in the past three months. Among them, only 1(5.9%) and 11(17.6%) had children who did not receive MCV1 and MCV2 respectively. This indicated that mothers or caregivers who visited health facilities that had experienced vaccine stock-outs, such as in the previous three months were likely to have their children default from receiving MCV.

4.7.8. IMMUNIZATION OUTREACHES

The availability of vaccination outreaches determined the uptake of MCV among the participants. About 78% of the mothers or caregivers attended clinics at healthcare facilities that organized immunization outreaches. Among them, 10(12.8%) and 30(38.5%) had children who defaulted MCV1 and MCV2 respectively. On the other hand, 22% of the mothers or caregivers attended clinics at healthcare facilities that organized immunization outreaches. Among them, 21(95.4%) and 12(54.5%) had children who defaulted MCV1 and MCV2 respectively. The result showed that

healthcare facilities that organized outreaches were associated with a reduction of low uptake of MCV. This implied that mothers or caregivers who were attached to facilities that organized outreaches were unlikely to have their children default MCV compared to those attached to facilities without immunization outreaches.

4.7.9. DISPLAY OF GUIDELINES FOR MOTHERS OR CAREGIVERS

Displaying the vaccination guidelines to the mothers or caregivers in the healthcare facilities determined the MCV uptake. About 86% of the mothers or caregivers visited healthcare facilities that displayed the vaccination guidelines. Among them, 20(23.3%) and 36(41.9%) had children who defaulted MCV1 and MCV2 respectively. Conversely, 12% of the mothers or caregivers attended healthcare facilities that did not display the vaccination guideline. Among them, 7(70%) had children who defaulted MCV1. This denoted that mothers or caregivers who attended the healthcare facilities that displayed the EPI guidelines to clients had a reduced likelihood of defaulting the MCV.

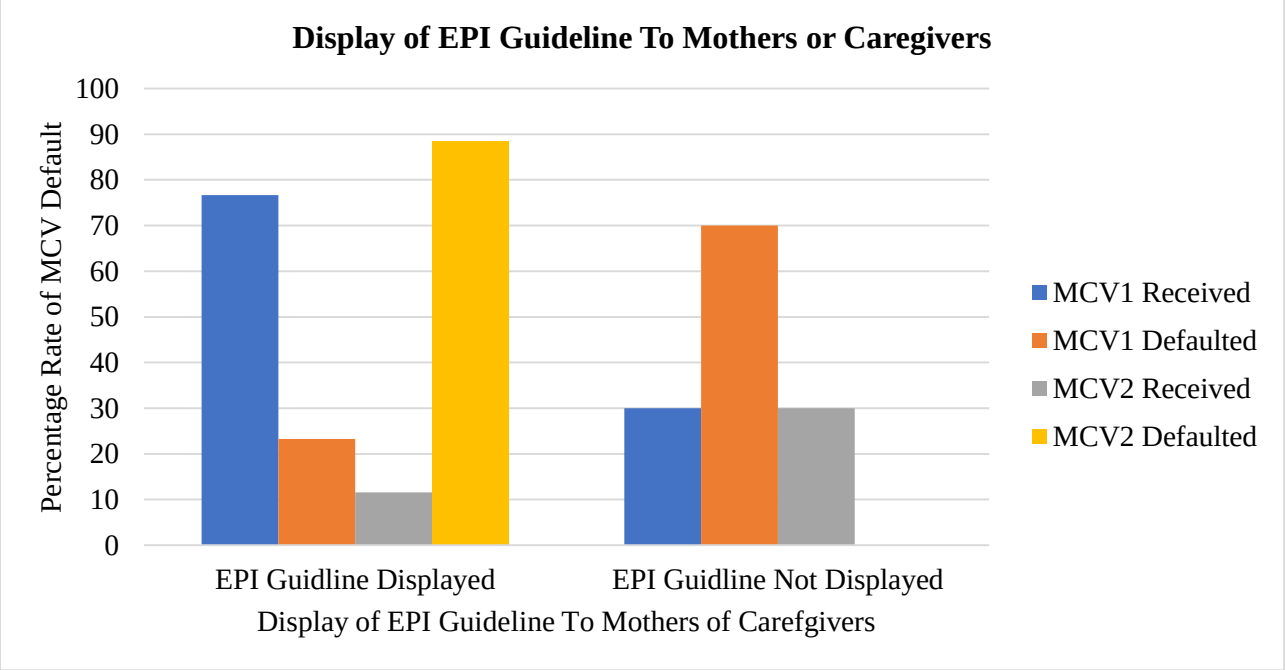

Figure 19: Display of EPI Guideline to Mothers or Caregivers

4.8. BIVARIATE ANALYSIS FOR DETERMINANTS OF MCV1 AND MV2 UPTAKE

4.8.1. MOTHERS' CHARACTERISTICS AND MCV UPTAKE

The mothers' or caregivers' related factors that had a statistically significant association with both MCV1 and MCV2 included mothers' or caregivers' age, knowledge of vaccines, personal decision not to receive the vaccination, and vaccine uptake hesitance. A Kruskal-Wallis H test indicated a statistically significant difference in uptake of MCV1 across the age bracket of the mothers or caregivers' groups, H (3, N= 100) = 9.894, p =.019 with a mean rank of 50.63 for <20 years, 50.74 for 21-30 years, and 43.33 for 31-40 years, and 76.67 for >40 years (*see table 4*). Similarly, there was a statistically significant difference in uptake of MCV2 across the age groups of the mothers or caregivers, H (3, N = 49) = 7.95, p = .047 with a mean rank of 58.69 for <20 years, 53.75 for 21-30 years, 42.71 for 31-40, and 30.58 for >40 years. Children of young mothers or caregivers below 20 years and those older than 40 years were unlikely to receive both MCV1 and MCV2.

There were statistically significant associations between having heard about the measles vaccines with MCV1, x^2(1, N = 100) = 22.485, p= .000 and MCV2 x^2(2, N = 49) = 7.468, p= .024. There were statistically significant relationships between knowing the vaccine a child was supposed to receive and uptake of both MCV1, x^2(1, N= 100) = 9.691, p= .02 and MCV2 $x2$(2, N = 49) = 22.796, p= .000 (*see table 4*). The decision not to receive the MCV demonstrated a statistically significant association with the uptake of both MCV1 x^2(1, N = 100) = 17.240, p = .000 and MCV2 x^2(2, N = 49) = 10.374, p = .006. Moreover, hesitancy among the mothers produced a statistically significant effect on the MCV1 uptake, x^2(3, N = 100) = 16.708, p = .001, and MCV2 x^2(3, N = 49) = 31.800, p = .002. Therefore, the children of mothers or caregivers who had not heard about measles vaccines or the mothers or caregivers who decided not to have their children receive MCV were likely to default from receiving measles vaccination.

The mothers or caregivers related factors that had a statistically significant association with only MCV1 uptake included marital status, x^2(2, N = 100) = 6.884, p = .32; the number of ANC visits by the mothers or caregivers during pregnancy, H(3, N = 100) = .771, p = .04; and concerns of the mothers or caregivers about serious side effects or adverse reactions on the uptake of MCV1 H(1, N = 100) = 5.447, p = .020. On the other hand, the mothers' or caregivers' related factors that had a statistically significant association with only MCV2 uptake included the education level of the mothers or caregivers, H (4, N= 49) = 7.622, p=.030.

The mothers' or caregivers' related factors that had a statistically significant association with both MCV1 and MCV2 included source of information and level of trust in the sources of information on measle vaccine among the mothers or caregivers. The chi-square test revealed no statistically significant association between the source of information and uptake of MCV1 $x^2(2, N = 92) = 1.391$, $p = .238$, and MCV2 $x^2(2, N = 49) = 2.523$, $p = .283$. There was no statistically significant connection between the level of trust of the mothers or caregivers on the uptake of MCV1 $x^2(2, N = 100) = .613$, $p = .434$ and MCV2 $x^2(2, N = 49) = 1.036$, $p = .596$.

The mothers or caregivers related factors that had no statistically significant association with only MCV1 uptake included the level of education of the mothers or caregivers $H(4, N = 100) = 3.475$, $p = .482$, education of the spouses of the mothers or caregivers, $H(4, N = 100) = 7.489$, $p = .112$; and religion of the mothers or caregivers, $x^2(1, N = 100) = .005$, $p = .943$. The mothers or caregivers related factors that had no statistically significant association with only MCV2 uptake included marital status, $x^2(4, N = 49) = 1.347$, $p = .853$; education level of the mothers or caregivers, $H(4, N = 49) = 5.216$, $p = .266$; the religion of the mothers or caregivers $x^2(2, N = 49) = 1.670$, $p = .434$; the numbers of ANC attendances by the mothers or caregivers $H(3, N = 49) = 6.260$, $p = .100$; and concerns of the mothers or caregivers about the side effects of adverse reaction of the vaccine $H(2, N = 49) = 1.470$, $p = .225$.

Table 4: Relationship Between Maternal Or Caregivers Determinants And MCV Uptake

Variable	MCV1					MCV2				
	Yes	**No**	**X^2**	**df**	**p-value**	**Yes**	**No**	**X^2**	**df**	**p-value**
Age of the mother or caregiver										
≤20	11	5				0	6			
21-30	37	17				6	17			
31-40	20	4				5	10			
≥41	1	5	9.894	3	.019	2	3	7.954	3	.470
Marital Status of the mother or caregiver										
Single	0	1				0	0			
Married	69	28				13	35			
Widowed	0	2	6.884	2	.320	0	1	1.347	4	.853
Education level of the mother or caregiver										
None	35	18				6	22			
Primary	20	9				4	8			
Post Primary	1	0				0	0			
Secondary	7	4				0	4			
Tertiary	6	0	3.475	4	.482	3	2	7.622	4	.030

Education level of the spouses										
None	36	15				6	22			
Primary	10	4				2	5			
Post Primary	2	1				0	0			
Secondary	9	10				1	6			
Tertiary	12	1	7.489	4	.112	4	3	9.382	8	.311
The religion of the mother or the caregivers										
Roman Catholic	7	3				0	4			
Protestants	62	28				13	32			
Muslims	0	0				0	0			
No religion	0	0	.005	1	.943	0	0	1.670	2	.434
Number of ANC visits										
0	3	2				0	4			
1-2	22	12				1	11			
3-4	41	16				11	19			
5 and above	3	1	.771	3	0.04	1	2	6.260	3	.100
Concerns about serious side effects or adverse reactions										
Yes	47	23				6	28			
No	22	2	5.447	1	.020	7	6	1.470	2	.225
Have heard about measles vaccines										
Yes	66	18				13	33			
No	3	13	22.48	1	.000	0	3	7.468	2	.024
Knowing the vaccine, the child is supposed to receive										
Yes	53	14				11	33			
No	16	17	9.691	1	.02	2	3	22.796	2	.000
The decision not to receive MCV										
Yes	4	12				0	2			
No	65	19	17.240	1	0.000	13	34	10.374	2	0.006
Hesitancy about MCV										
Very hesitant	8	6				3	1			
Somehow hesitant	30	9				7	9			
Not Hesitant	31	16	16.708	3	.001	3	26	31.800	3	.002
Source of Information										
Nurse	62	30				11	35			
Other women	7	1	1.391	2	.238	2	1	2.523	2	.283
The most trusted source of information										
Nurse	64	30				12	35			
Villagers	5	1	.613	2	.434	1	1	1.036	2	.596

4.8.2. CHILD-RELATED CHARACTEIRISTICS AND MCV UPTAKE

The main child-related determinant factor was the child's birth order, which demonstrated a statistically significant relationship between the baby's place of birth and reception of MCV1, $x^2(2, N = 100) = 14.738$, $p = .001$. However, there was no significant association between place of birth and MCV2 $x^2(2, N = 49) = 4.645$, p= .326 (*see table 5*). The child's birth order was a significant factor in MCV1 but not MCV2 uptakes. Kruskal-Wallis H test confirmed a significant connection between the birth order of the child with the uptake of MCV2 H(2, N = 49) = 2.44, p = .032, but not MCV1 H(2, N = 100) = 4.206, p = .122. There was a statistically significant association between the reports of the baby having any illness or allergy with the uptake of MCV1, $x^2(2, N = 100) = 32.751$, $p = .000$. However, the statistical test did not show any important association with MCV2 uptake $x2(2) = 3.334$, $p = .189$.

The Pearson Chi-square test demonstrated a statistically significant correlation between having a history of side effects and uptake of MCVI, $x^2(1, N= 100) = 8.432$, $p = .004$, but not MCV2 $x^2(2, n = 49) = 2.449$, $p = .294$. Similarly, the Chi-square test showed that there was no statistically significant association between the baby's gender and uptake of MCV1, $x^2(1, N = 100) = .463$, $p = .496$, and MCV2 $x^2(2, N = 49) = 2.137$, $p = .343$ (*see table 5*). Lastly, A Kruskal-Wallis H test showed no statistically significant difference in MCV uptake between the birth weight categories of the babies, $H(2, N = 100) = 2.775$, $p = .250$ for MCV1, and $H(2, N = 49) = 1.287$, $p = .525$ for MCV2.

Table 5: Relationships Between Child-Related Determinants and MCV Uptake

Variable	MCV1 Received					MCV2 Received				
	Yes	**No**	**X^2**	**df**	**p-value**	**Yes**	**No**	**X^2**	**df**	**p-value**
Gender of the baby										
Male	35	18				5	22			
Female	34	13	.463	1	.496	8	14	2.137	2	.343
Place of birth										
Health facility	51	11				7	20			
Home (TBA)	17	20	14.738	2	.001	6	17	4.645	2	.326
Order of Birth										
1st	13	4				4	3			
2nd -3rd	29	8				3	15			
4th and above	27	19	4.206	2	.122	6	18	2.44	2	.32
Birth weight										
<2.6	3	4				0	3			
2.6 – 4.0	65	27				13	33			
> 4.0	1	0	2.775	2	.25	0	0	1.287	2	.525
Illness or allergy										

Yes	8	21				1	12			
No	61	10	32.751	2	.000	12	24	3.334	2	.189
History of vaccine side effects										
Yes	5	9				0	6			
No	64	22	8.432	1	.004	13	30	2.449	2	.294

4.8.3. SOCIOECONOMIC DETERMINANTS AND MCV UPTAKE

Concerning the socioeconomic factors among the mothers or caregivers, the Chi-square test demonstrated a statistically significant association between the source of income of the mothers or caregivers and uptake of MCV1, $x^2(3, N = 100) = 13.564$, $p = .004$ (*see table 6*). However, a chi test on the result revealed no statistically significant association between source of income and uptake of MCV2 $x^2(6, N = 49) = 5.323$, $p = .503$. Again, the Pearson Chi-square test revealed a statistically significant association between the employment status and uptake of both MCV1, $x^2(2, N = 100) = 29.977$, $p = .000$, and MCV2 $x^2(4, N = 49) = 17.137$, $p = .002$. There was a statistically significant association between monthly income and uptake of MCV1, $x^2(1, N = 100) = 6.713$, p= .010, but not MCV2 x^2 $(3, N = 49) = 1.884$, p= .390 (*see table 6*).

The Chi-square test showed no statistically significant association between ethnic groups of the participant and uptake of both MCV1, $x^2(2, N = 100) = 3.125$, $p = .210$ and MCV2 $x^2(4, N = 49) = 1.347$, $p = .853$ (*see table 6*). Knowing someone who refused MCV due to religious and cultural practices produced a statistically significant association with the uptake of both MCV1, $x^2(1, N = 100) = 8.836$, $p = .003$, but not MCV2 x^2 (2, N = 49) = 2.982, $p = .225$. Additionally, knowing leaders who did not agree with the vaccine did not have a statistically significant connection with the uptake of MCV1, $x^2(1, N = 100) = 3.771$, $p = .052$, and MCV2 $x^2(2, N = 49) = 1.152$, $p = .562$.

Table 6: Relationship Between Socioeconomic Determinants and MCV Uptake

Variable	**MCV1 Received**					**MCV2 Received**				
	Yes	**No**	**X^2**	**df**	**p-value**	**Yes**	**No**	**X^2**	**df**	**p-value**
Source of income of the mother or the caregiver										
Livestock Farming	29	10				8	12			
Business	18	19				2	15			
Others	16	2				2	8			
	3	0	13.564	3	.004	1	1	5.323	6	.503
Employment status of the mother or the caregiver										

Employed										
Self-employed	1	13				0	0			
Stay home	24	4				3	14			
	44	14	29.997	2	.000	10	22	17.137	4	.002
Average monthly income of the mother or the caregiver										
<10000	56	31				10	33			
>10000	13	0	6.71	1	0.10	3	3	1.884	3	.390
Ethnicity of the mother or the caregiver										
Maasai										
Kikuyu	67	30				13	35			
Kamba	2	0				0	1			
	0	1	3.125	2	.210	0	0	1.347	4	.853
Knowing someone who refused MCV due to religious and cultural practices										
Yes	6	10				0	6			
No	63	21	8.836	1	.003	13	30	2.982	2	.225
Knowing leaders who did not agree with the vaccine										
Yes										
No	1	3				0	1			
	68	28	3.771	1	.052	13	35	1.152	2	.562

4.8.4. HEALTHCARE-RELATED FACTORS AND MCV UPTAKE

The bivariate test on the healthcare-related factors demonstrated giving mothers or caregivers a scheduled date for vaccination significantly influenced the uptake of MCV. The Pearson Chi-square test showed a statistically significant relationship between giving the mothers scheduled dates for measles vaccination with the uptake of MCV1, $x^2(1, N = 100) = 36.757$, $p = .000$, and MCV2, x^2 $(2, N = 49) = 13.014$, $p = .01$ (*see table 7*). There was a statistically significant relationship between the participant's distance from the healthcare facility with the uptake of MCV1 $x^2(1, N = 100) = 5.407$, $p = .020$, and MCV2 x^2 $(2, N = 49) = 41.722$, p= .000. Moreover, the Pearson Chi-square test showed a statistically significant association between the availability of vaccines and reception of MCV1, $x^2(1, N = 100) = 15.222$, $p = .000$, and MCV2 x^2 $(2, N = 49) = 9.099$, $p = .11$ (*see table 7*).

Healthcare staff training on vaccination and the availability of vaccination equipment in the health facility were significant determinants for MCV uptake. Pearson Chi-square test indicated that there was a statistically significant association between staff attendance of immunization seminars and

the uptake of both MCV1, $x^2(1, N = 100) = 10.271$, $p = .001$ and MCV2 $x^2(2, N = 49) = 12.537$, $p = .002$. The Pearson Chi-square test indicated a statistically significant association between the availability of vaccination equipment in the health facility and the uptake of the MCV1, $x^2(2, N = 100) = 9.586$, $p = .008$, and MCV2 x^2 $(4, N = 49) = 22.537$, $p = .000$ (*see table 7*).

There was a statistically significant connection between experiencing vaccine stock-outs in the facility and the uptake of MCV1, $x^2(1, N = 100) = 6.041$, p= .014, but not MCV2 $x^2(2, N = 49) = 3.011$, p = .222. There was a statistically significant connection between outreaches organized by the health facilities and the uptake of MCV1, $x^2(1, N = 54.780) = 54.780$, $p = .000$ and MCV2 $x^2(2, N = 49) = 6.874$, p = .032. The Pearson Chi-square test confirmed a statistically significant association between displaying vaccination guidelines to mothers or caregivers on uptake of the MCV1, $x^2(1, N = 100) = 9.683$, $p = .002$, and MCV2 $x^2(2, N = 49) = 7.428$, $p = .024$.

Table 7: Relationship Between Healthcare-Related Determinants and MCV Uptake

Variable	MCV1 Received					MCV2 Received				
	Yes	**No**	**X^2**	**df**	**p-value**	**Yes**	**No**	**X^2**	**df**	**p-value**
Giving mothers or caregivers a scheduled date for vaccination										
Yes										
No	60	8				13	28			
	9	23	36.757	1	.000	0	8	13.014	2	.001
Distance from the healthcare facility										
Within 5 km	48	14				13	33			
More than 5 km	21	17	5.407	1	.020	0	3	41.722	2	.000
Availability of all routine vaccines										
Yes	68	20				13	36			
No	1	7	15.22	1	.000	0	0	9.099	2	.110
Availability of vaccination equipment in the facility										
Yes										
No	61	20				13	36			
	7	11	9.589	2	.008	0	0	22.537	4	.000
Training on staff training on vaccination										
Yes										
No	21	20				10	8			
	48	11	10.271	1	.001	3	28	12.537	2	.002
Vaccine stock-outs in the health facility										

Yes	53	30				10	33			
No	16	1	6.041	1	0.14	3	3	3.011	2	.222
Vaccination outreaches										
Yes										
No	68	10				13	30			
	1	21	54.780	1	.000	0	6	6.874	2	.032
Displaying vaccination guidelines to the mothers or caregivers										
Yes										
No	66	20				10	36			
	3	7	9.683	1	.002	3	0	7.428	2	.024

4.9 LOGISTIC REGRESSION FOR DETERMINANTS OF MCV UPTAKE

Maternal Related Factors for MCV uptake

A logistic regression test for the determinants of MCV uptake was conducted and indicated that the mothers age who aged between 21-29 years had about three times odd having children who were fully immunized with MCV in comparison to those aged above 30 years (AOR= 2.95, 95% CI [1.78 -11.56], p = .046) (*see table 8*). The marital status of the mothers or the caregivers did not demonstrate significant difference in terms of odds of having babies who were fully immunized (AOR= .919, 95% CI [.524-.885], p = .111). The mothers who had primary education had 1.8 times odds of having a baby who have been fully immunized with MCV (AOR= 1.78, 95% CI [2.0 - 8.56], p = .011). However, there was no statistically significant association between the level of education of the spouse of the mothers with having a baby who was fully immunized with MCV (AOR= 1.78, 95% CI [2.0 - 8.56], p = .011). Similarly, there was no significant association between the religion of the mothers or caregivers with uptake of MCV (AOR= .99, 95% CI [.17 – 5.64], p = .992) (*see table 8*).

The number of ANC visits by the mothers or the caregivers influenced the uptake of MCV among their children. For instance, the mothers who had more than three ANC visits were five times likely to have a baby who had received full MCV immunization (AOR= 4.56, 95% CI [1.66 – 14. 43], p = .020). Similarly, the mother who reported that they have heard about the MCV were 2.3 times more likely to have their babies fully immunized against measles than those who had not heard about the MCV (AOR= 2.36, 95% CI [1.44-9.06], p = .004). Moreover, there was also statistically significant difference of having a fully immunized child between mothers who knew the vaccines their children were to receive and the those who did not (AOR= 33.33, 95% CI [2.05-541.91], p =

.014). The mothers who were not hesitant to allow their children receive MCV had two-time high odds of having their children fully vaccinated compared to those who were not. However, the mothers who were somehow hesitant were not likely to have their children be immunized against measles. Concerns about the serious side effects and adverse outcome of MCV vaccines had statistically significant association with MCV uptake (AOR= 1.35 95% CI [5.85-8.06], p = .001).

There was no statistically significant different in odds of MCV uptake between the woman who received information about MCV from nurses and those who got information from others women (AOR= .52, 95% CI [.51-.54], p = .585) (*see table 8*). Concerning the trust of the source of their information about MCV, there was no statistically significant association between the mothers or caregivers who trusted the nurses the most and the villagers the most (AOR= .99, 95% CI [.17 – 5.64], p = .992). Moreover, mothers or caregivers who trusted the nurses the least did not have any sufficiently different odds of having children who were fully immunized against MCV compared to women who trusted the villagers (AOR= .98, 95% CI [.54 – .77], p = .612) (*see table 8*).

Table 8: Logistical Regression for Maternal Related Factors for MCV uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	*P* value	Adjusted OR (95% CI)	*P* Value
	Yes n (%)	No n (%)				
Age of mothers or care giver						
≤20 years	9(18.8)	8(15.4)	.89(.34-2.30)	.206	1.21(.20-7.54)	.202
21-29 years	23(47.9)	28(55.8)	1.26(.73-2.18)	.041	2.95(1.78-11.56	.046
≥ 30 years	16(33.3)	15(28.8)	1		1	
Marital Status						
Married	48(100)	49(94.2)	1.021(.67-1.52)	.919	0.96(.524-.885)	.111
Not married	0(0.0)	3(5.8)	1		1	
Education level of the mother or the caregiver						
None	24(50.0)	29(55.8)	1.21(.70-2.08)	.493	.90(.139-5.80)	.654
Primary	14(29.2)	15(28.8)	1.07(.52-2.22)	.023	1.78(2.07-8.56)	.011
Post Primary	10(20.8)	8(15.4)	1		1	
Education level of the spouse of the mother or the caregiver						
None	23(47.9)	28(53.8)	1.22(.70-.46)	.485	3.61(.604-21.58)	.160
Primary	6(12.5)	8(15.4)	1.33(.46-3.84)	.594	4.32(.581-32.12)	.153
Post Primary	19(39.6)	16(30.8)	1			
Religion of the mother or the caregiver						
Roman Catholic	5(10.4)	5(9.6)	1.09(.30-4.04)	.894	.99(.17-5.64)	.992
Protestants	43(89.6)	47(90.4)	1		1	
Number of ANC visit						
≥ 3	17(35.4)	22(42.3)	1.78(.33-1.68)	.048	4.56(1.66 – 14.43)	.020
≤2	31(64.6)	30(57.7)	1		1	
Having heard about the measles vaccines						

Yes	46(95.8)	38(73.1)	8.48(1.8-39.63)	.006	2.36(1.44-9.06)	.004
No	2(4.2)	14(26.9)	1		1	
Knowing the vaccines, the child is supposed to receive						
Yes	35(72.9)	32(61.5)	1.68(.72-3.93)	.227	33.33(2.05-541.91)	.014
No	13(27.9)	20(38.5)	1			
Decision not to receive the MCVs						
No	1(2.1)	15(28.8)	1.05(.007-.42)	.001	2.18(.047-9.69)	0.043
Yes	47(97.9)	37(71.2)	1		1	
Hesitancy concerning vaccines						
Not Hesitant	7(14.6)	7(13.5)	.47(.14-1.58)	.007	2.17(.47-1.69)	.030
Somehow Hesitant	26(54.2)	13(25.0)	.23(.10-.58)	.166	.27(.080 - .83)	1.61
Very Hesitant	15(31.3)	32(61.5)	1		1	
Concerns about serious side effects and adverse reactions						
No	21(64.6)	39(84.8)	.37(.12-.89)	0.025	1.35(5.85-8.06)	.001
Yes	17(35.4)	7(15.2)	1		1	
Source of information						
Nurse	43(89.6)	49(94.2)	.53(.12-2.33)	.392	.54(.51-.54)	.585
Other women	5(10.4)	3(5.8)	1		1	
Most trusted source of information						
Nurse	43(89.6)	51(98.1)	.17(0.2-1.50)	.074	.25(2.31-2.36)	.129
Villagers	5(5)	1(1.9)	1		1	
Least trusted source of information						
Nurses	1(2.1)	0(0.0)	2.11(1.71-2.60)	.296	.98(.54 - .77)	.612
Villagers	47(97.9)	52(100)	1		1	

Child Related Factors for MCV uptake

The child's birth order had significant association with the uptake of MCV. For instance, the first-born children had 2.6-time odds of being fully immunized compared to those who were second born and above (AOR= 2.61, 95% CI [.18 – 4.02], p = .014) (*see table 9*). Moreover, the children who were born at the health facility were also 1.5 time likely to be fully immunized compared to those born at home (AOR= 1.55, 95% CI [.21- 2.46], p = .030). Having any illness or allergy within the past three months to the date of MCV was also statistically significantly associated with being fully immunized (AOR= 3.93, 95% CI [1.30 – 11.81], p = .015). Additionally, children who had no history of side effect or reacting to the any vaccine were had increased odds of being fully vaccinated (AOR= 2.64, 95% CI [1.25-5.36], p = .038). Nonetheless the child related determinants that had no significant association with MCV uptake were the gender of the baby (AOR= .25, 95% CI [.87-.99], p = .637), low birth weight of below 2.5 kg (AOR= .47, 95% CI [.52- .64], p = .251), and normal birth weight of 2.60-4.00 kg (AOR= .21, 95% CI [.41- .82], p = .314).

Table 9: Logistical Regression for Child Related Factors for MCV uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes n (%)	No N (%)				
Child's birth order						
1st Born	11(22.9)	6(11.5)	2.28(.77-6.74)	.030	2.61(.18-4.02)	.014
2 and above	37(77.1)	46(88.5)	1		1	
Place of birth						
Health Facility	36(75.0)	27(51.9)	2.78(1.19-1.89)	.017	1.55(.21-.46)	.030
Home (TBA)	12(25.0)	25(48.1)	1		1	
Illness or allergy				.000	3.93(1.30-11.81)	.015
Yes	6(12.5)	23(44.2)	.180(.07-.50)		1	
No	42(87.5)	29(55.8)	1			
History of side effects						
No	3(6.3)	11(21.2)	.25(.05-.95)	.032	2.64(1.25-5.36)	.038
Yes	45(93.8)	41(78.8)	1		1	
Gender of the baby						
Male	23(47.9)	30(57.7)	.68(.31-1.49)	.328	.25(.87-.99)	.637
Female	25(52.1)	22(42.3)	1		1	
Birth weight					.	
<2.50 kg	2(4.2)	5(9.6)	.42(.08-2.26)	.311	.47(.52-.64)	.251
2.60 – 4.00 kg	45(63.8)	47(90.4)	.35(.56-.84)		.21(.41-.82)	.314
> 4.00 kg	1(2.1)	0(0.0)	1		1	

Socioeconomic characteristics on mcv uptake

The socioeconomic determinants of MCV uptake that showed statistically significant association with being fully immunized in terms of odd ration included having average monthly income below Kshs. 10000 (AOR= 7.89, 95% CI [1.47-42.44], p = .016); belonging to Maasai ethnic (AOR= 5.24, 95% CI [.04-12.16], p = .001); and knowing a leader who did not agree with vaccines (AOR= 2.38, 95% CI [.28-9.23], p = .006) (*see table 10*). However, the socioeconomic determinants of MCV uptake that did not demonstrate statically significant association with being fully immunized in terms of odd ration were self-employment status (AOR= .74, 95% CI [.30-1.79], p = ..499); belonging to a kikuyu ethnicity (AOR= .11, 95% CI [.87 - .99], p = .26); knowing someone who had refused MCV because of cultural and religious factors (AOR= 5.12, 95% CI [2.48 – 11.84], p = .999) (*see table 10*).

Table 10: Logistical Regression for Maternal Socio-Economic Related Factors for MCV uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes (%)	No (%)				
Sources of income of the mothers of the caregivers						
Formal employment	21(43.8)	18(34.6)	1.47(.66-3.29)	.349	.74(.30-1.79)	.499
Self-Employment	27(56.3)	34(65.4)	1		1	
Average monthly income						
< 10000	37(77.1)	50(96.2)	.14(.03-.64)	.005	7.89(1.47-42.44)	.016
>10000	11(22.9)	2(3.8)	1		1	
Ethnicity						
Maasai	46(95.8)	51(98.1)	1(.00-.00)	.00	5.24(.04-12.16)	.001
Kikuyu	2(4.2)	0(0.0)	1(.00-.00)		.11(.87-.99)	.26
Kamba	0(0.0)	1(1.9)	1		1	
Knowing someone who refused MCV due to cultural or religious factors						
Yes	3(6.3)	13(25.0)	.20(.05-.75)	0.011	5.12(2.48-11.84)	.999
No	45(93.8)	39(75.0)	1		1	
Knowing a leader who did not agree with the vaccines						
Yes	0(0.0)	4(7.7)	2.00(1.64-2.44)	0.050	2.38(.28-9.23)	.006
No	48(100.0)	48(92.3)	1		1	

Health care related factors on MCV uptake

There were various health care determinants that had significant association with the MCV uptake. For instance, giving mothers or caregivers a scheduled date for MCV demonstrated a statistically significant association in terms of odds with being fully immunized against measles (AOR= 3.27, 95% CI [.04-5.78], p = .001) (*see table 11*). Mothers or caregivers who attended health care facilities that had all basic vaccines available all the time were 1-2 times likely to be fully immunized (AOR= 1.24, 95% CI [.28 -3.41], p = .007) (*see table 11*). Displaying vaccination guidelines to the mothers or caregivers at the health facility increased the odds of being fully immunized against measles (AOR= 1.98, 95% CI [5.75-9.65], p = .004). Additionally, mothers who visited healthcare facilities that had not experienced vaccines stock-outs were 5.7 times more likely to have children who were fully immunized against measles (AOR= 5.69, 95% CI [2.38 -

14.52], p = .006). Organization of vaccination outreaches by the health facilities increased the odds having a child who is fully immunized against measles (AOR= 12.25, 95% CI [.96 – 11.45], p = .008). On the other hand, the healthcare related factors that had no statistically significant association in terms of odds with being fully immunized against measles included the distances from the healthcare facility within 5 km (AOR= 1.38, 95% CI [.400 - 4.80], p = .612); availability of vaccine equipment in the facility (AOR= .33, 95% CI [.10 – 1.06], p = .069); and training of staff on vaccination (AOR= .02, 95% CI [.56 - .61], p = .123) (*see table 11*).

Table 11 Logistical Regression for Healthcare Related Factors for MCV uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes (%)	No (%)				
Giving mothers or caregivers a scheduled date for vaccination						
Yes	40(83.3)	28(53.8)	4.29(1.68-10.81)	.002	3.27(.04-5.78)	.001
No	8(16.7)	24(46.2)	1		1	
Distance from the healthcare facility						
Within 5 km	32(66.7)	30(57.7)	1.47(.65-3.31)	.356	1.38(.400-4.80)	.612
More than 5 km	16(33.3)	22(42.3)	1		1	
Availability of all routine vaccines						
Yes	47(97.9)	41(85.4)	8.02(.947-67.99)	.027	1.24(.28-2.341)	.007
No	1(2.1)	14.6)			1	
Availability of vaccination equipment in the facility						
Yes	40(83.3)	41(78.8)	1.34(.49-3.69)	.568	.33(.10-1.09)	.069
No	8(16.7	11(21.2)	1		1	
Training on staff training on vaccination						
Yes	15(37.5)	23(44.2)	.76(.34-1.69)	.494	.02(.56-.61)	.123
No	30(62.5)	29(55.8)	1		1	
Vaccine stock-outs in the health facility						
No	35(72.9)	48(92.3)	.22(.07-.75)	.010	5.69(2.38-14.52)	.006
Yes	13(27.1)	4(7.7)	1		1	
Vaccination outreaches						
Yes	47(97.9)	31(59.6)	31.84(4.07-248.98)	.000	12.25(.96-11.45)	.008
No	1(2.1)	21(40.4)	1		1	
Displaying vaccination guidelines to the mothers or caregivers						
Yes	45(93.8)	41(85.4)	2.56(.62-10.57)	.096	1.98(5.75 – 9.65)	.004
No	3(6.3)	7(14.6)	1		1	

CHAPTER FIVE: DISCUSSION

5.2. DISCUSSION

The main objective of this study was to determine factors that contribute to low measles vaccine uptake among children between the ages of 9 and 24 months in Narok North Sub-County, Narok county. This study identified that low uptake of MCV is a serious problem among children aged 9-24 months in Narok county. The findings indicated that about 31% of the children in the age group failed to receive MCV1 in time, while about 73% of those due for MCV2 did not receive the vaccine. This observation confirms the findings of various studies globally, in Africa, and Kenya. For instance, Crawshaw et.al., (2022) identified a trend of low uptake of measle vaccination in Europe, although the vaccine is not a mandatory childhood vaccine as it is in Most African countries including Kenya. Malande et al. (2019) confirmed low uptake of measle vaccines in Uganda. A similar observation was made in Sudan by Sabahelzain et al. (2022). A study conducted in Kenya by Ochieng et al. (2020) revealed a low uptake of measle vaccines in Kenya. Although the study focused on measle vaccination among the HIV exposed children. Thus, the low uptake of the measles vaccine is a significant problem that should not be ignored in countries with a high vulnerability to measle outbreak, such as Kenya.

Maternal and Child determinants

The first specific objective was to determine the maternal and child determinants that affect the uptake of the measles vaccine among children aged 9 – 24 months in Narok North Sub-County, Narok county. Some of the significant determinant factors that affected the uptake of measle vaccine included maternal age, such as young or old maternal age, marital status, such as being single and widowed, and no or low level of education. These factors agreeably contributed to the low level of measle vaccine uptake. Pacenti et al. (2019) confirmed that younger maternal age is associated with parental inexperience and limited childcare abilities, which reduced the uptake of measles vaccination. Pacenti et al. (2019) also explained that older women tend to ignore the importance of child vaccination, especially if their previous vaccine defaulting did not contribute to any noteworthy. A study conducted by Wilder-Smith and Qureshi (2020) identified that no or

low level of education hinders the uptake of measles vaccination because they contribute to high hesitancy on vaccine uptake.

Another significant maternal determinant of low uptake of measle vaccine was no or absent ANC absent. The ANC visits are important in keeping the mothers on track to ensure the proper outcome of the baby and facilitate health education on various baby care strategies including vaccination. Research conducted by Demissie et al. (2020) also revealed that women who had few numbers of ANC visits recorded a poor rate of vaccine uptake. Owuor (2020) explained that low clinical visits limit mothers' contact with healthcare during the measle vaccination period, which contributes to measle vaccine default. Additionally, Wilder-Smith and Qureshi (2020) added that a low rate of healthcare facility visits is associated with limited information on measle vaccination, which can hinder the measle vaccine uptake.

This study also identified that lack of knowledge on vaccines and the vaccine the child is to receive, and source of information also contributed to low uptake of vaccines. Ongas (2021) explained that health education of mothers on immunization is a critical strategy for enhancing vaccine uptake in Kenya. Ongas (2021) reported low levels of knowledge and awareness of vaccines, such as immunization schedules contribute to reduced uptake of immunization. This occurs because the baby's parents and caregivers with limited knowledge of the vaccine may consider vaccination as a routine procedure, with limited health benefits for the child (Nabatanzi, 2018). Thus, may default to taking their children for vaccination.

This study confirmed that personal decision not to take the children for vaccination is another important factor contributing to low uptake of measle vaccines. This finding has corroborated the result identified by Crawshaw et al. (2022) that there is an increasing number of parents who decide not to have their children vaccinated around in Europe. Additionally, Zhang et al., (2019) reported that a significant number of women are increasingly deciding not to have their children vaccinated in China despite understanding the importance of vaccines. The decision regarding vaccine acceptance is a complex process influenced by numerous factors including misinformation, previous undesirable experiences, or limited knowledge of the importance of the vaccine (Malande et al., 2019). This, strategy to improve measle vaccine uptake must address all such factors and focus on making the mothers or caregivers make an informed decision regarding measle vaccination for their children.

This study did not find a significant impact of religion and culture on the low uptake of measles vaccines. This finding was contributed by the homogeneity of the participants in terms of religion. However, other studies have confidently and strongly identified religion and culture as key factors contributing to the low uptake of vaccination. Harapan et al. (2021) identified that religion and cultural beliefs and practices contributed to a low probability of vaccine uptake. This is because some religious practices and beliefs outrightly oppose vaccination (De Figueiredo et al. 2020). Additionally, some religious and cultural practices hindered the acceptability of vaccines in the community (De Figueiredo et al. 2020; Harapan et al., 2021). Therefore, religious and cultural beliefs and practices can strongly hinder measle vaccine uptake and must be addressed by strategies targeting improving measle vaccination uptake in Kenya.

The findings of this study also identified that the sources of information regarding vaccines that mothers or caregivers have may contribute to low uptake of measle vaccination, although this was not statistically significant. Hill et al. (2019) reported that information sources played a key role in influencing decisions regarding vaccine uptake. Individuals who do not have a trustworthy source of information on vaccination are likely to decline vaccination. De Figueiredo et al. (2020) identified that the source of information can erode individual confidence in the vaccines, especially if the information propagates the wrong idea about the vaccines. This may contribute to the low uptake of measle vaccines.

Socioeconomic factors

The second objective was to determine the socioeconomic factors that affect the uptake of the measles vaccine among children aged 9 – 24 months in Narok North sub-county, Narok-county. The key socioeconomic factors that affect the uptake of measles vaccines identified by this study included the source of income, employment status, monthly income, as well as cultural and religious factors. This study identified that unstructured and unstable sources of income, such as having livestock attributed to low uptake of measle vaccine compared to a more organised stable source of income, such as business. The findings confirm the observation made by Darnal et al. (2018) that there is low uptake of measle vaccination among the nomadic communities. This is because their engagements in livestock keeping hinder their adherence to immunisation schedules and are likely to default from taking their children for the vaccination.

This study confirmed that those who were employed were having a considerably high level of low uptake of measle vaccines. This is true because Toll and Li (2021) explained that those who are in full-time employment have increased commitment at work and may not keep the vaccination appointment for their children. Thus, they tend to default to the vaccination schedule.

This study identified that those who had a low level of income of less than Ksh. 10000 per month had increased cases of defaulting from taking measle vaccines. Machado et al. (2021) identified that parents from low socioeconomic households tended not to have their children fully vaccinated. This is because, low income is associated with various factors that contribute to low uptake of measles vaccination, such as lack of finance for transportation, which contributes to defaulting from receiving the vaccine. A study by Sabahelzain et al., (2021) also made a similar observation that those who are not employed, such as stay home mothers may have a significantly low level of income, which contribute to their poor health outcome including vaccination for their children.

Healthcare related factors

The third objective was to assess factors related to healthcare facilities that influence the uptake of the measles vaccine among children aged between 9 – 24 months in Narok North sub-county, Narok county. This study identified healthcare facility-related factors, such as location in terms of distances of the facility, availability of vaccines, and vaccination resources, staff training on vaccination, immunisation outreaches, and display of immunisation schedule to the clients.

This study found that a considerable number of participants had healthcare facilities located more than 5 km from their homes, which significantly influenced their uptake of measles vaccines. Joseph et al. (2020) stated that access to immunisation, especially in rural areas in Kenya is impaired by limited access to healthcare services. Clients located more than 5 km from the healthcare facility must travel for more than one hour to access basic healthcare services including immunisation. This consequently contributes to low uptake of immunisation including measles vaccines.

Availability of vaccine and vaccination equipment was identified as another key factor that hindered the uptake of measles vaccines. Studies by Majekodunmi et al. (2022) and Ongas (2021) reported that Kenya frequently experiences a shortage of vaccines, although this is most often temporary. This sometimes causes a delay in receiving the measles vaccination among the targeted

children. Rural areas, such as the setting of this study, are also more prone to experience a lack of vaccination equipment, to ensure effective management of cold chain systems. This can interrupt the availability of vaccines in a healthcare facility and thus hinder measle vaccine uptake.

This study highlighted the contribution of continuous healthcare staff training and education on the low uptake of measles vaccines. Joseph et al. (2020) also reported that healthcare staff should continuously update their knowledge on immunization, such as through seminars, to boost the uptake of targeted vaccines. However, such training should focus on enhancing the healthcare staff's capacities to address the cultural, religious, and informational issues that hinder them from measles vaccination.

This study found that the lack of displaying immunization guidelines for mothers or caregivers in the healthcare facility has a significant effect on the uptake of measles vaccines. Similarly, Wilder-Smith and Qureshi (2020) identified that providing clients with informational resources, such as wall charts, and brochures, and displaying educational materials to clients increases their measles vaccines uptake

Lastly, the organization of outreaches was also another key factor that contributed to the low uptake of measles vaccines. This finding corroborates the outcome of a study conducted by Malande et al. (2019) that identified that vaccine outreaches increase measles uptake to more than 65.5%. Outreach ensures that most children within the targeted age group received vaccines. Moreover, it enhances access to vaccines for missed opportunities for children. Furthermore, the organization of immunization outreaches enhances awareness of the public of the vaccination, which can promote the uptake of the measles vaccine.

5.3. STRENGTH AND LIMITATIONS

The main strength of the current study is that it provided reliable evidence on determinants of low vaccine uptake in a community with a pastoralism and nomadism background in remote rural areas. Moreover, the study has highlighted the relationships and significances of the determinants not only on measle vaccination in general but also on each measle vaccine dose (MCV1 and MCV2). This provides a unique perspective and understanding of how the determinants impact the uptake of MCV1 and MCV2 differently. Secondly, the study has considerable consistency in terms of the methodology. The research adhered to the descriptive correctional study

methodologies, such as sample size determination, participant recruitment, and data collection and analysis. This makes the current study reliable and reproducible, hence significantly strong internal validity. Thirdly, the cross-sectional study design enabled the identification of various variables, which provided a comprehensive understanding of the determinants of the low rate of measles vaccine uptake.

Despite the successes of the current study, such as revealing the crisis of low uptake of measle vaccines among children aged between 9 – 24 months in Narok Subcounty, this study was limited by several issues. First, this study focused on children aged 9-24 months, thus other important population groups, such as those who are to receive measles vaccines at six months, and those who are aged above two years were not considered, although they are also an important target group for measle vaccines. Secondly, the population included in this study was not adequately heterogeneous in terms of sociodemographic diversity such as ethnicity, religion, marital status, and income level. Thus, this limits the generalizability of the findings to the target group. Thirdly, in terms of methodological limitations, this study could not confirm the incidence rate of low measle vaccine uptake in the target population due to its cross-sectional methodology. Additionally, it just identified the association between the factors that hindered measles vaccine uptake, without determining the cause-effect relationship. This study relied on snowballing sampling procedure, which contributed to a lack of randomization and participant inclusion biases, thus limiting to generalization of the findings in similar settings.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1. CONCLUSION

The current study aimed at determining factors that contribute to low measles vaccine uptake among children aged 9 -24 months in Narok North Sub-County, Narok county. The current study confirmed that the rate of measle vaccine (MCV1 and MCV2) uptake is low among the study participants. The study revealed four categories of determinants of low uptake of measle vaccine. They included the maternal, child, socioeconomic, and healthcare-related determinants. The maternal determinants of low uptake of measles vaccines included maternal age, level of education, marital status, personal decisions on vaccination, knowledge of vaccines, source of information, and concerns about side effects and adverse reactions. The child-related determinants of low uptake of measles vaccines included birth order, place of birth, illnesses and allergy, gender, and birth weight. The socioeconomic determinants of low uptake of measles vaccines included sources of income, employment status, monthly income level, ethnic group, and cultural and religious factors. The healthcare-related determinants included giving schedule dates for vaccination, healthcare facility location in terms of distances from the participants, availability of vaccines and vaccination equipment, staff training on vaccination, availability of vaccination equipment, vaccination stock out, immunization outreaches, and display of guidelines for the mothers or caregivers.

6.2. RECOMMENDATIONS

Four key recommendations were derived from the findings generated by the current study. First, there should be the provision of comprehensive health education to the mothers or caregivers of children aged 9-12 months on measle vaccination. This is to address the maternal determinants of low uptake of measle vaccine. Health education should focus on addressing the measle vaccine

hesitancy among mothers or caregivers and improving their knowledge on childhood immunization, its impotence in improving a child's health, and keeping the vaccination schedule date. The rationale for the recommendation is to make the mothers or caregivers aware of the necessary child's measles vaccination and promote adherence to the measles vaccine schedule.

Secondly, there should be integrated child-targeted services to promote measles vaccine uptake. For instance, there should be a promotion of effective family planning to properly space births and reduce the number of children to the number and order that the mothers can effectively take care of and ensure they receive a vaccination. Mothers should be encouraged to engage in regular and frequent ANC visits to promote delivery in a health facility, improve the child's birth weight, as well as prevent childhood illnesses that may hinder measles vaccine uptake. The recommendation target addressing the child-related determinants of low uptake of measles vaccines, such as birth order, place of birth, and childhood illnesses.

Thirdly, the number of primary healthcare facilities in remote rural areas should be increased. This is to ensure the accessibility of immunization services in the community. For instance, there should be at least one healthcare facility within a five-kilometres radius to provide vaccination services. Additionally, healthcare facilities should be adequately equipped with vaccination equipment, such as cold-chain processes to maintain the constant availability of vaccines. Moreover, healthcare workers should be advised to continually display immunization guidelines to mothers or caregivers and provide them with vaccination scheduled dates to ensure that the mothers do not default immunizations. Moreover, healthcare facilities should engage in outreaches, vaccination campaigns, follow-ups, and home visits. This is to ensure that all the vaccine default cases are traced and immunized.

Lastly, to address some of the socioeconomic determinants of low uptake of measle vaccine, there should be a promotion of multisectoral collaboration. There should be advocacy to bring together various government sectors, nongovernmental organizations, and private institutions to work towards improving the average monthly income and establishing a stable source of income among mothers or caregivers. The multisectoral collaboration and advocacy should also address infrastructural issues, such as improving road conditions. Moreover, churches, schools, cultural institutions, and political leaders should be engaged in addressing sociocultural determinants of low uptake of measles vaccines.

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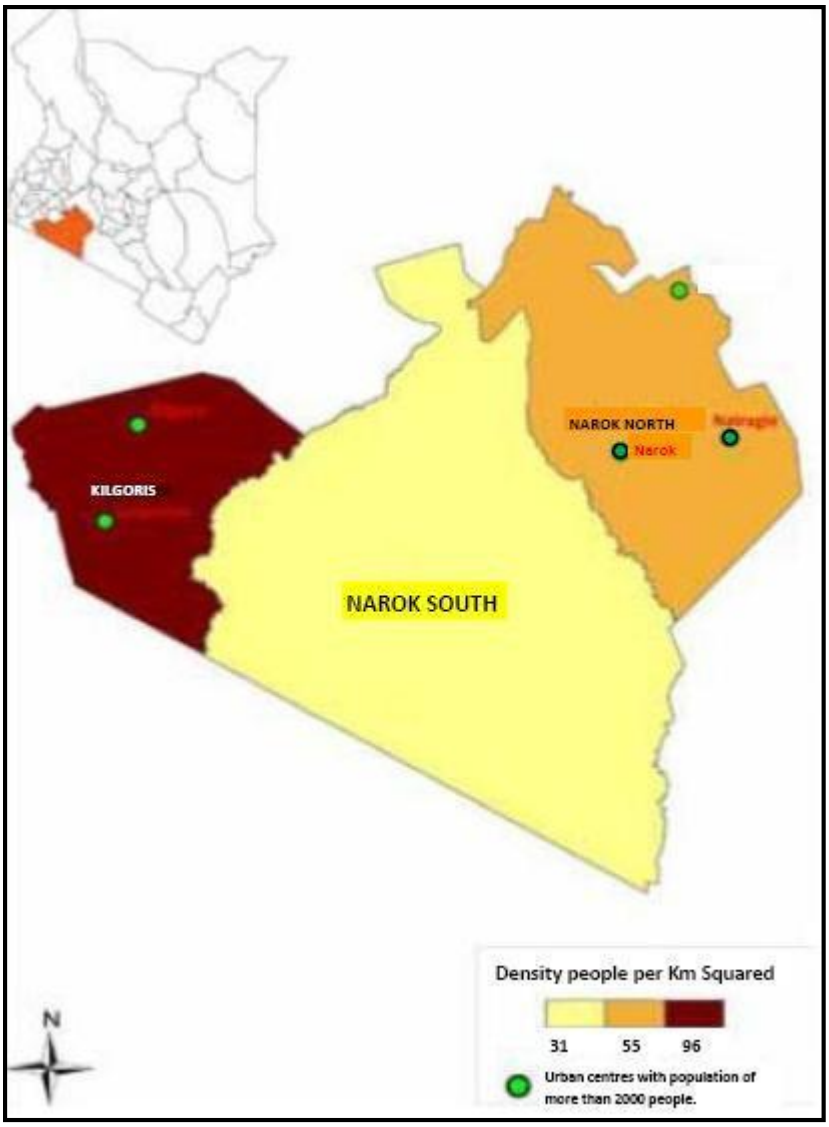
APPENDICES

APPENDIX V. STUDY AREA MAP


NAROK NORTH
Narok
KILGORIS
NAROK SOUTH
Density people per Km Squared
31
55
96
Urban centres with population of more than 2000 people.
N