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Determinants of Measles Vaccine Uptake among Mothers of Children between 9 and 24 Months in Narok North Subcounty

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Abstract

The low uptake of measles vaccines in Kenya is a noticeable public health problem. Therefore, the study assessed the determinants of low uptake and hesitancy of measles vaccination among mothers of children aged 9 – 24 months in Narok North Sub-County, Narok. Cross-sectional quantitative study was done. The study was conducted in four purposively selected health centers in Narok North Sub-County. A structured and pretested questionnaire was used to collect data from 100 mothers. The multistage sampling method was used in this study to select the mothers who participated in the current study. The data were analysed descriptively. Additionally, Pearson's chi-square, Kruskal-Wallis H, and logistic regression tests were conducted to determine the significance of the relationships and associations between the determinants and MCV uptake. A total of 69(69%) of the children (N =100) who had qualified for the first dose of measles vaccines (MCV1) had received the vaccines, while 31(31%) had not. Thirteen (26.5%) of the children (n = 49) who had qualified for the second dose of measles vaccine (MCV2) had received the vaccine, while 36(73.5%) did not. The significant maternal determinants of MCV uptake included; maternal age (p = .019) and maternal level of education (p = .030). The significant child's determinants were birth order (p = .032) and place of birth (p = .001). The significant socioeconomic factors included; low socioeconomic background (p = .004) and cultural and religious issues (p = .003). The significant healthcare determinants included distance from the health facility (p = .020) and availability of vaccines in the health center (p = .000). Measles vaccine uptake was very low compared to the World Health Organization (WHO) recommended coverage rate of >95%. Thus, there is a need to provide health education and information to mothers or caregivers on measles vaccine uptake.

Keywords: *Vaccine, Vaccine Uptake, Measles*

1.0 Introduction

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.[1] The World Health Organisation (WHO) stated that in 2018, there were more than 140,000 measles deaths across the globe most of which were in children below the age of five years.[1] But the worldwide spread of immunisation against measles has forestalled an approximated 21.1 million deaths in the whole world between the years 2000 and 2017.[2] The Americas regions are the main areas that have come close to achieving this objective.[1-2]

In Africa, there are an estimated 28,000 deaths related to measles each year with young children being the primary victims.[3] Many regions of Sub-Saharan Africa have experienced measles outbreaks and stagnancy in vaccination coverage.[4] The interruptions came because of contentions on immunisation beliefs in the region hence upsetting supplemental immunisation action (SIA) endeavours, opposition to immunisation from spiritual gatherings, and the epidemiologic change in measles instances towards more seasoned age brackets.[3-4] In Kenya, vaccines have played an important role in reducing the mortality rate of those under five.[6] According to the Kenya Demographic and Health Survey (KEDHIS) 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.[4,7] Nonetheless, the uptake of MCV in Kenya has been considerably low compared to the >95% target recommended by WHO.[6] 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 Division of Vaccine and Immunisation (DVI).[7] Failure to be fully vaccinated pose a great risk to children and this increases the mortality rate, especially from vaccine-preventable diseases such as measles.[6,7] Kenya has implemented a measles vaccine and vaccine supplemental programme in 22 counties in Kenya, among them Narok County, which is at high risk of recording measles mortality.[7,8] However, the low uptake and hesitancy of the measles vaccine warrant research to find out the determinants of the measles vaccine uptake.

2.0 Materials and Methods

2.1 Study design

The study employed an analytical cross-sectional quantitative research design. This was to establish the relationship between determinant variables that were contributing to low uptake of measles vaccination among mothers with children aged between 9 and 24 months.

2.2 Study Area

The study was conducted in four health centres located in Narok North Sub-County, Narok County, Kenya. They included Nkareta Health Centre, Ewaso Ngiro CMF, Entoitol Dispensary, and Olchorro Health Centre.

2.3 Study Population

The study population included the mothers of children aged between 9 and 24 months. This is because they were expected to have children who were due for or expected to have received MCV1 and or MCV2.

2.4 Sample Size Determination

A total of 100 mothers or caregivers were considered as the final sample size and were interviewed in the current study. The sample size was determined by Fisher's formula of; $N = (Z^2 \times p(1-p))/d^2$.[9] The calculation resulted in 384. However, since the population under this study was less than 10,000 sample adjustment was done using the formula; nf = n / (1+ (n/N)),[9]. N is the estimated population size from the measles vaccination monitors of Narok North sub-county, which was 120. This yielded 91.4. Then 10% non-response of the sample, which was 9, was considered. Thus, the final sample size was approximated at 100.

2.5 Sampling Procedures

A multistage 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.

2.6 Data Collection and Analysis

Data was collected using pretested structured questionnaires. This helped to gather primary data from the participants. Secondary data on measles immunisation was collected through a review of immunisation registers and other documentation within the healthcare facilities such as vaccine monitor charts. Data analysis was done using the Statistical Package for Social Sciences version 26. Descriptive data analysis, inferential statistics involving the Kruskal-Wallis H (non-parametric one-way ANOVA) test, Pearson's chi-square tests, and logistical regression analysis were conducted. The statistical significance was set at p <.05.

3.0 Ethical Consideration

Permission to carry out the study was sought from Kenyatta University Ethics Review Committee (PKU/2481/E1608) and the National Commission for Science, Technology, and Innovation (NACOSTI/P/22/19967). Regulatory approval to complete the study was sought from the research committee of Narok County (DIR/NRKCNTY/MOH/60/159) and written informed consent was obtained from the study participants.

3.0 Results

3.1 Characteristics of the Study Population

A total of 39 mothers 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 (M= 27.84, SD = 6.85) was 27.84 years with an age range of 17 to 49 years. More than half of the mothers (53%) did not have an education background, 19% secondary education level, 14% primary education level, and 13% had a tertiary education level

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(n = 100). More than half of the mothers (58%) were stay-at-home mothers, 28% were self-employed, and 14% were employed (n =100). A total of 87 mothers had an income below ten thousand Kenya shillings while the remaining 13 had income above ten thousand Kenya shillings (n = 100) (*see table 1*). Most of the children (46%) were fourth born and above, while 17% were first born (n =100).

Table 1: Sociodemographic Characteristics of the Participants

Variable	Frequency n = 100 (%)	MCV1 (n= 100)			MCV2 (n = 49)		
		Yes	**No**	**p-value**	**Yes**	**No**	**p-value**
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	.187	0	3	.000
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	.019	2	3	.470
Marital status							
Single	1(1)	0	1		0	0	
Married	97(97)	69	28		13	35	
Widowed	2(2)	0	2	.320	0	1	.853
Education level							
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	.482	3	2	.030
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	.112	4	3	.311
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	.005	0	0	.434
Ethnic group							
Maasai	98(98)	67	30		13	35	
Kikuyu	2(2)	2	0		0	1	
Kamba	1(1)	0	1	.210	0	0	.853
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	.004	1	1	.503
Employment status							

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Employed	14(14)	1	13		0	0	
Self-employed	28(28)	24	4		3	14	
Stay home mother	58(58)	44	14	.000	10	22	.002
Monthly income							
<10000	87(87)	56	31		10	33	
>10000	13(13)	13	0	.010	3	3	.390
Children							
Age							
0-12	48(48)	33	13		0	7	
13-24	52(52)	36	18	.372	13	29	.000
Gender							
Male	53(53)	35	18		5	22	
Female	47(47)	34	13	.496	8	14	.343
Place of Birth							
Health facility	63(63)	51	11		7	20	
Home (TBA)	37(37)	17	20	.001	6	17	.326
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	.122	6	18	.32
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	.25	0	0	.525

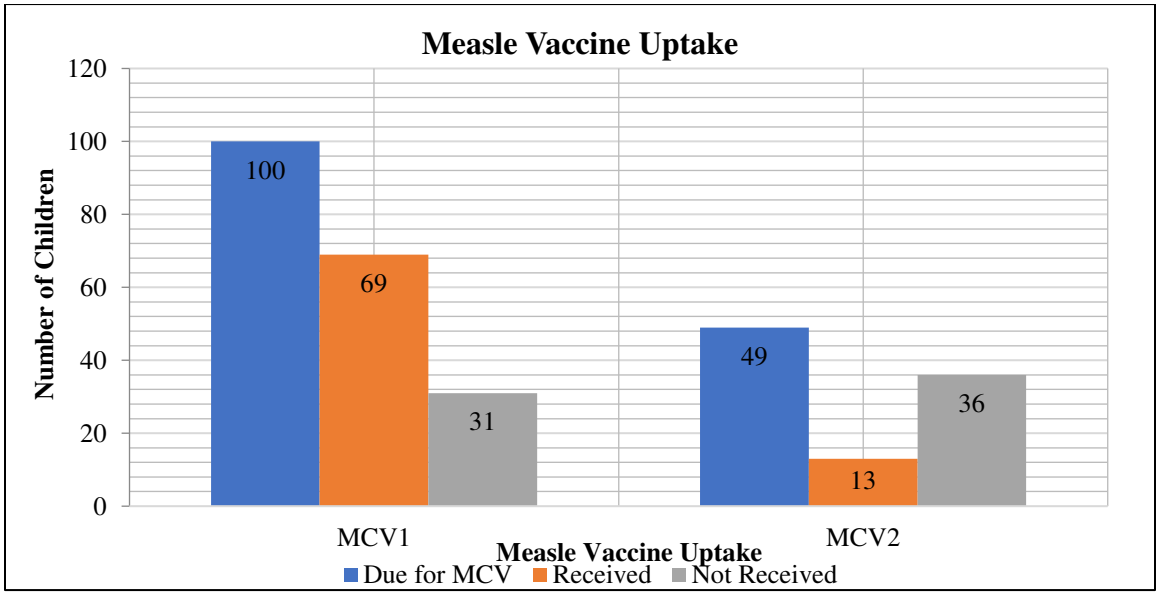

Figure 1: A Bar Graph Showing the Rate of Uptake of the Measles Vaccine (MCV1 and MCV2)

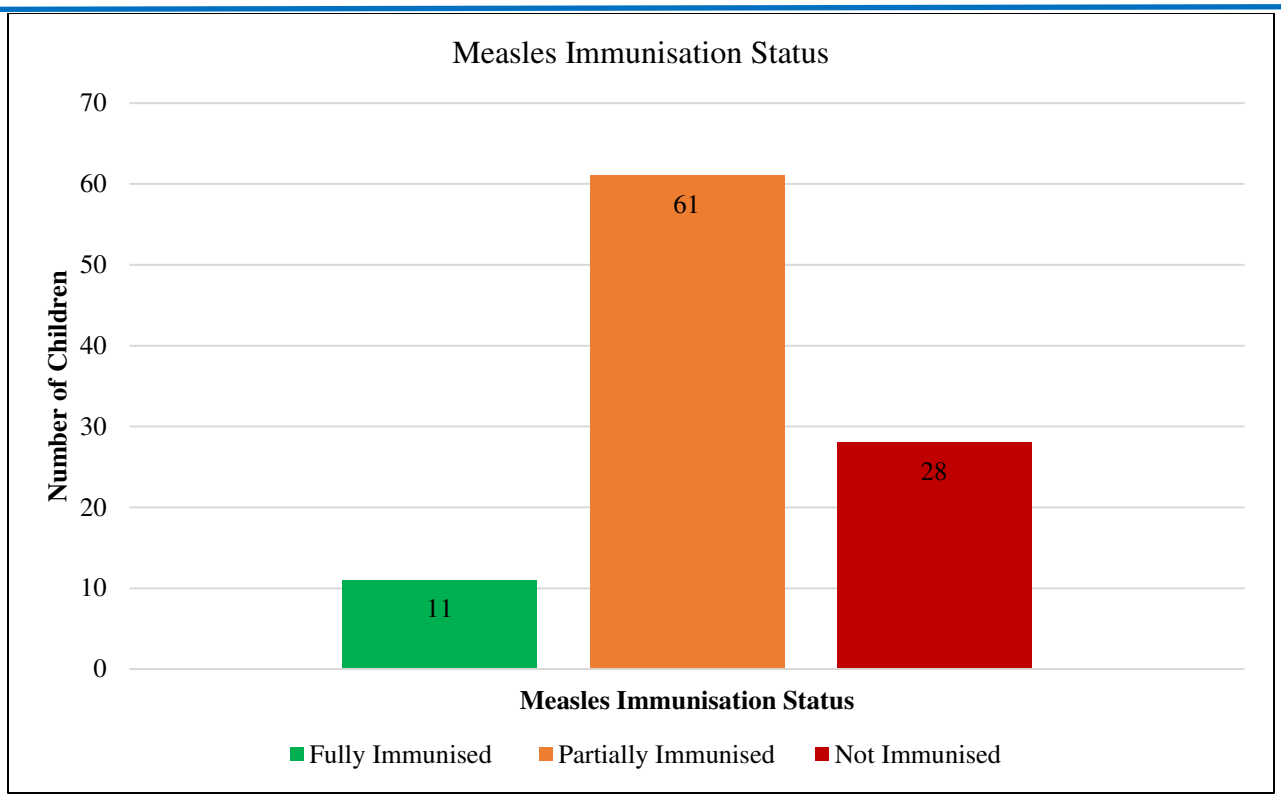

Figure 2: A Bar Graph Showing the Overall Immunisation Status

3.2 Maternal-Related Determinants of Measles Vaccination Uptake

The age of the mothers was an important determinant factor for the uptake of both MCV1 and MCV2. For instance, five out of 11 children of mothers aged below 20 years and one out of five children of mothers aged above 40 years received MCV1.None of the children of mothers aged below 20 years received MCV2. A Kruskal-Wallis H test indicated a statistically significant difference in uptake of MCV1 across the age bracket of the mothers H (3, N= 100) = 9.894, p =.019 and MCV2 H (3, N = 49) = 7.95, p = .047.

The education level of the mothers was identified as an important determinant of the uptake of MCV. There was a statistically significant association between the level of education of the mothers and uptake of MCV1, H (4, N= 49) = 7.622, p =.030, but not MCV2 (4, N= 100) = 3.475, p = .482 (*see table 1*). The mothers who had primary education had about 1.8 times the odds of having a baby who has been fully immunised with MCV (AOR= 1.78, 95% CI [2.0 - 8.56], p = .011). Education of the spouse of the mothers did not have a significant connection with the uptake of MCV1, H (4, N = 100) = 7.489, p =.112 as well as MCV2 H (4, N = 49) = 5.216, p = .266. There was no statistically significant association between any level of education of the spouse of the mothers with having a baby who was fully immunised with MCV (AOR= 1.78, 95% CI [2.0 - 8.56], p = .011).

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Table 2: Logistical Regression for Mothers or Caregivers-Related Determinants of MCV Uptake

Variables	Fully Immunized		Un Adjusted OR (95%) CI	*P* value	Adjusted OR (95% CI)	*P* Value
	Yes	**No**				
	n (%)	**n (%)**				
Age of mothers or caregivers						
≤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	
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			

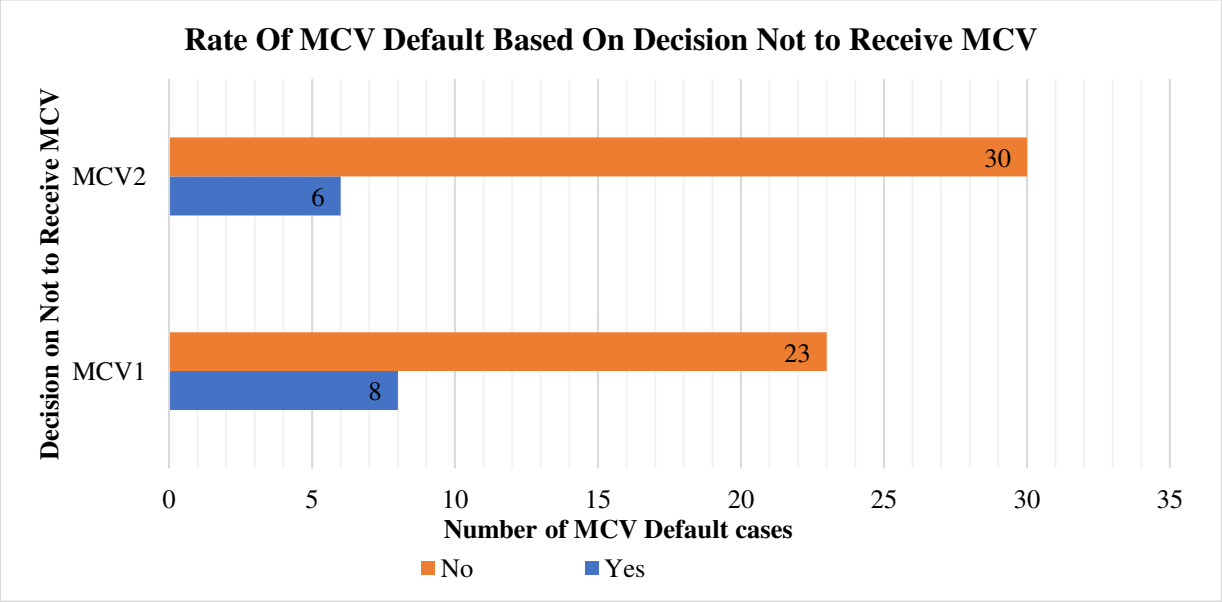

Figure 3: A Bar Graph Showing the Rate of MCV Default Based on the Decision Not to Receive MCV

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Other maternal-related determinants of measles vaccination uptake comprise mothers' marital statuses, religious affiliations, the number of ANC visits, and the knowledge of vaccines. Information about the vaccines, mothers' personal decisions not to allow their children to be vaccinated, and the concerns about the side effects impact on the uptake of measles vaccines.

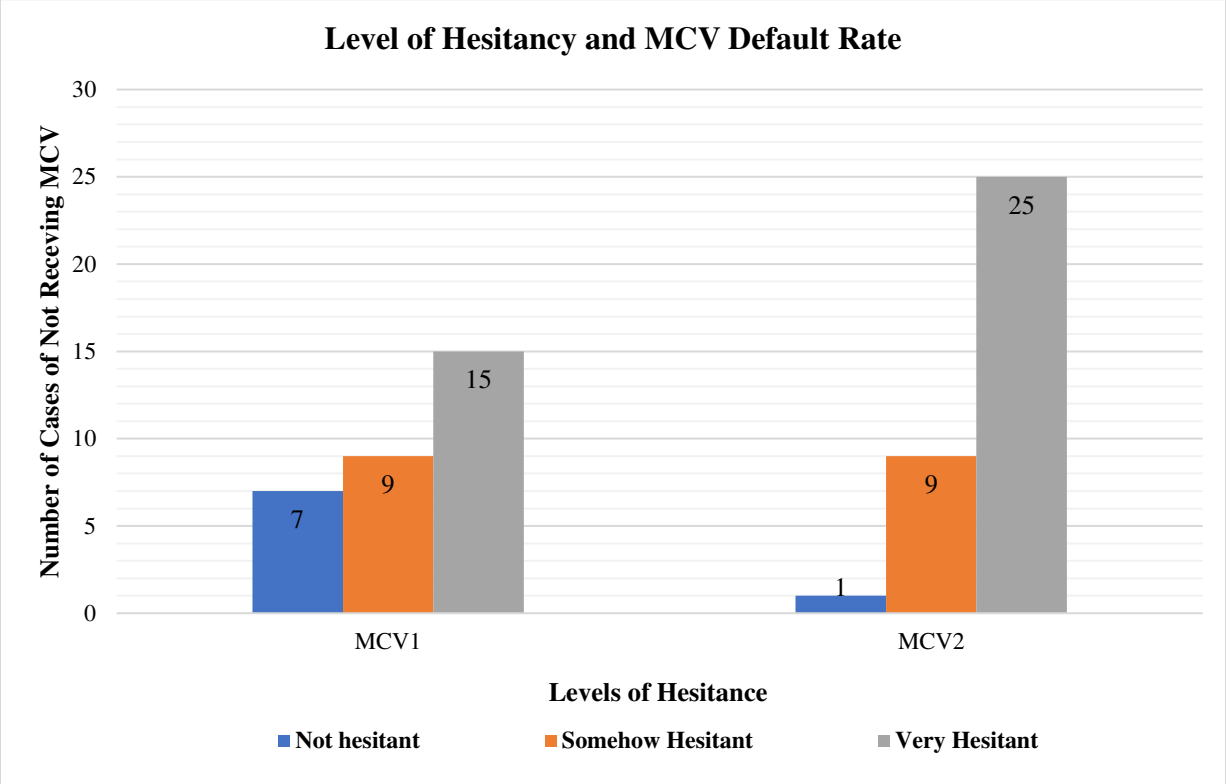

Figure 4: Levels of Hesitancies and MCV Uptake Default

Child-Related Determinants of Measles Vaccination Uptake

The child's place of birth demonstrated a statistically significant relationship between the baby's place of birth and reception of MCV1, $x^2(2, N = 100) = 14.738$, $p = .001$, but not MCV2, $x^2(2, N = 49) = 4.645$, $p = .326$ (*see table 1*). Moreover, the children who were born at the health facility were also 1.5 times more likely to be fully immunized compared to those born at home (AOR= 1.55, 95% CI [.21- 2.46], $p = .030$).

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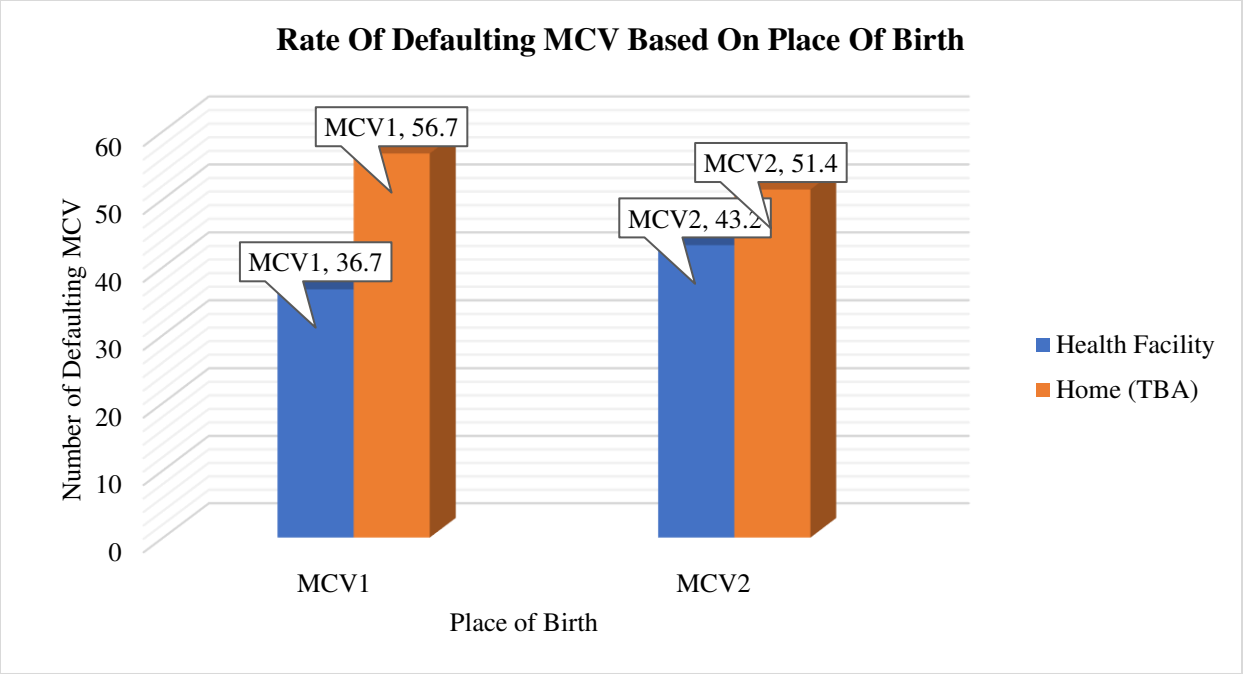

Figure 5*: A Bar Graph Comparing the Rate of MCV Default across the Place of Birth*

The birth order of the children included in this study had an impact on the uptake of MCV. Among the first-born children of the mothers, 4(15.4%), and 3(11.5%) did not receive MCV1 and MCV2 respectively (*see table 1*). 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 (*see table 1*). The first-born children had about 2.6 times chances 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 3*).

Table 3: Logistical Regression for Child-Related Determinants for MCV Uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes	**No**				
	n (%)	**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	

Child illness during the MCV period, history of experiencing adverse effects of vaccines, gender of the child, as well as birth weight, are other child-related determinants of measles vaccination uptake.

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Socio-economic Determinants of Measle Vaccination Uptake

There was 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 significant difference in odds of being fully immunised or not for the mothers who were self-employed (AOR= .74, 95% CI [.30-1.79], $p = .499$) (*see table 4*).

Table 4: Logistical Regression for Sociocultural Determinants for MCV Uptake

Variables	Fully Immunised		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes (%)	**No (%)**				
Employment status						
Formal employment						
Self-Employment	21(43.8)	18(34.6)	1.47(.66-3.29)	.349	.74(.30-1.79)	.499
	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	

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 1*). The socioeconomic determinants of MCV uptake that showed statistically significant association with being fully immunised in terms of odd ratio included having an average monthly income below ten thousand Kenya Shillings (AOR= 7.89, 95% CI [1.47-42.44], $p = .016$) (*see table 4*).

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3.3 Healthcare-Related Determinants of Measles Vaccination Uptake

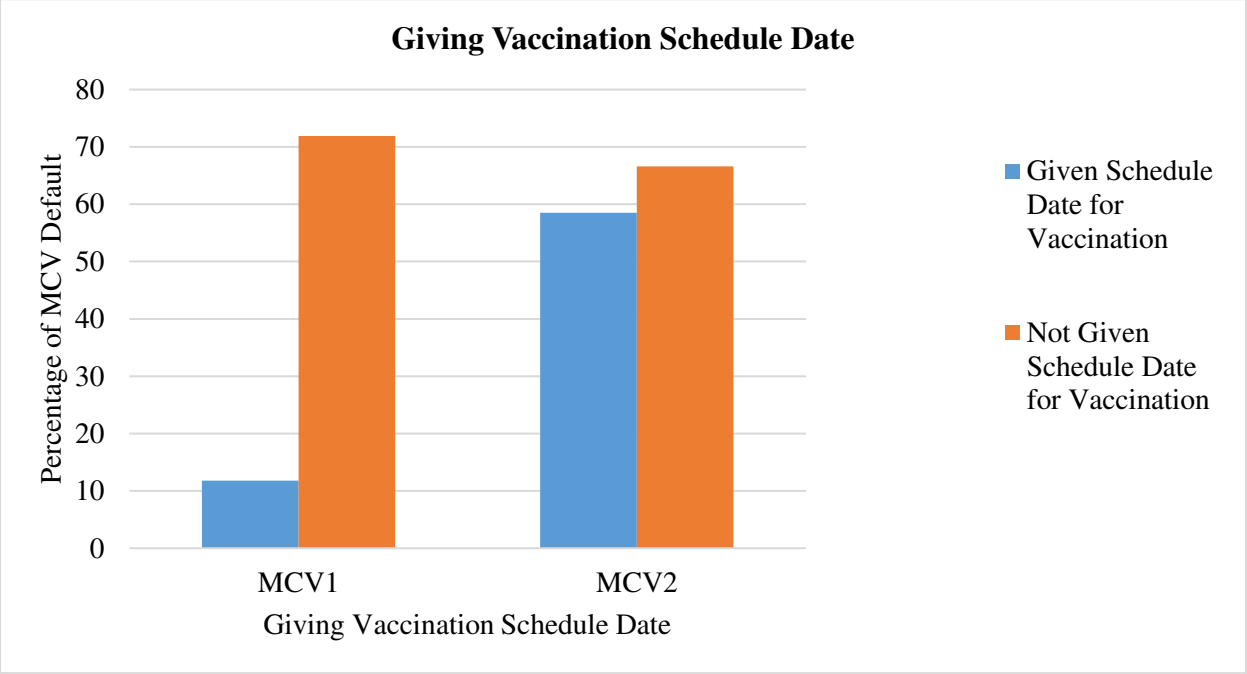

Figure 6: Giving Vaccination Schedule Date to the mother or Caregiver

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 $(2, N = 49) = 41.722$, $p = .000$. Nonetheless, there was no statistically significant association in terms of odds with being fully immunized against measles and the distances from the healthcare facility within 5 km (AOR= 1.38, 95% CI [.400 - 4.80], $p = .612$) (*see table 5)*.

Table 5: Logistical Regression for Healthcare-Related Determinants of MCV Uptake

Variables	Fully Immunized		Un Adjusted OR (95%) CI	P value	Adjusted OR (95% CI)	P Value
	Yes (%)	**No (%)**				
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	

There was a statistically significant association between the availability of vaccines and reception of both MCV1, $x^2(1, N = 100) = 15.222$, $p = .000$, and MCV2 x^2 $(2, N = 49) = 9.099$, $p = .11$. Mothers who attended health care facilities that had all basic vaccines available all the time were about 1-2 times likely to be fully immunized (AOR= 1.24, 95% CI [.28 -3.41], $p = .007$) (*see table 5*).

Additional healthcare-related determinants of measles vaccination uptake consist of the healthcare practice of giving a scheduled date for vaccination to the mothers, training of staff on vaccination, availability of vaccine equipment, occurrences of vaccine stockouts in the facilities, and the availability of vaccination outreaches.

4.0 Discussion

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., [10] identified a trend of low uptake of measles vaccination in Europe, although the vaccine is not a mandatory childhood vaccine as it is in Most African countries including Kenya. A study conducted in Kenya by Ochieng et al. revealed a low uptake of measles vaccines in Kenya.[6]

The first objective was to find out the mothers' related determinants of measles vaccination uptake. The significant determinant factors that affected the uptake of measles vaccine included maternal age, such as young or old maternal age, and no or low level of education. Pacenti et al., [11] confirmed that young maternal age is associated with parental inexperience and limited childcare abilities, which reduced the uptake of measles vaccination. This study confirms the findings of the study conducted by Ongas which found that health education of mothers on immunisation is a critical strategy for enhancing vaccine uptake in Kenya.[8] 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.[12] 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.[13-14.] The current study also confirmed that personal decision not to take the children for vaccination is another important factor contributing to low uptake of measles vaccines[10, 16]. As established by Hill et al., [17], the study established that information sources played a key role in influencing decisions regarding vaccine uptake.

The second objective of the study 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 employment status and level of monthly income. This study confirmed that those who were employed were having a considerably high level of low uptake of measles vaccines. This is true because Toll and Li, [18] explained that those who are in full-time employment have increased commitment at work and may not keep the vaccination appointment for their children. This study identified that those who had a low level of income of less than ten thousand Kenya shillings per month had increased cases of defaulting from taking measles vaccines. Machado et al., [19] noted that parents from low socioeconomic households tended not to have their children fully vaccinated owing to a lack of finance for transportation to the vaccination facilities. The

study's findings confirm the observation made by Darnal et al., [20] that there is low uptake of measles vaccination among the nomadic communities.

The third objective was to assess healthcare-related factors that influenced 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 and the availability of vaccines as the most vital determinants. 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., [21] stated that access to immunisation, especially in rural areas in Kenya, is impaired by limited access to healthcare services. The availability of vaccines was identified as another key factor that hindered the uptake of measles vaccines. Studies by Majekodunmi et al. [22] and Ongas [8] 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. This study highlighted the contribution of continuous healthcare staff training and education on the low uptake of measles vaccines, as reported by Joseph et al.,[21] that healthcare workers should continuously update their knowledge on immunisation. The findings agreed with those of Wilder-Smith and Qureshi[23]. They showed 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 study revealed that vaccine outreaches can increase measles uptake to more than 65.5%.[16, 24].

Strengths 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 measles vaccination in general but also on each measles vaccine dose (MCV1 and MCV2).

Despite the mentioned successes, this study was limited by issues that included focusing 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. Also, the population included in this study was not adequately heterogeneous in terms of sociodemographic diversity such as ethnicity, religion, marital status, and income level.

5.0 Conclusion

The rate of measles vaccine (MCV1 and MCV2) uptake is low among the study participants. The study revealed the maternal, child, socioeconomic, and healthcare-related factors as the leading measles vaccine uptake determinants. The maternal determinants of low uptake of measles vaccines were majorly maternal age and level of education. The child-related determinants of low uptake of measles vaccines largely included birth order and place of birth. The socioeconomic determinants of low uptake of measles vaccines were employment status and monthly income level. The main healthcare-related determinants were the healthcare facility location in terms of distances from the participants and the availability of vaccines.

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Availability of the Data Statement

The primary data that supports this research is not publicly available but can be availed by the corresponding author through the given email on request. Secondary data is available in immunisation registers and other documentation within the four healthcare facilities in the Narok-North sub-county, Narok County.

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