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Association Between Caregivers' Socio-Demographic Factors and Missed Opportunities for Measles Vaccination in Kajiado, Kenya

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Abstract: Immunization is regarded as one of the most important achievements of public health. Immunization coverage in children in Kenya is about 88%. Regional disparities however exist and these are mediated by provider, system and client related factors. The aim of this study was to investigate factors associated with missed opportunities for measles vaccination among children 9 – 23 months attending Ngong sub–County Hospital in Kajiado County. A cross sectional study was conducted between December 2019 and January 2020. Data was collected from a sampled population of 242 out of the 246 expected respondents using qualitative and quantitative methods. Factors associated with missed opportunities for vaccination were assessed through chi square tests and bivariate logistic regression methods. The proportion of completely immunized children was 73% (95% CI). At invariable levels, the factors associated with missed opportunities for vaccination included caregiver's age, marital status and relationship to the child ($p<0.05$). Economic factors and health facility factors were also associated with missed opportunities for vaccination. Of the variables investigated, health facility factors, economic factors and socio-demographic factors were associated with missed opportunities for vaccination in that order. Conclusion is therefore made that Immunization uptake in the study are central is still low compared to the national levels. Various sociodemographic characteristics, economic and health facility factors are associated with missed opportunities for vaccination. Further inquiry is required in the health facilities to fully comprehend the inextricable linkage between factors associated with missed opportunities for vaccination. Programs and policies could also target a reduction of the cases of missed opportunities for vaccination in the study area.

Keywords: Immunization, Missed Opportunities, Fully Immunized Child, Caregiver, Vaccine Coverage

1. Introduction

Immunization is one of the most cost-effective public health interventions to date, averting an estimated 2 to 3 million deaths every year, deaths from measles which is a major child killer declined by 80% worldwide between 2000 and 2017 preventing an estimated 21.1 million deaths [21]. Measles is a highly contagious disease that results from infection with measles virus and is still responsible for more than 100 000 deaths every year, down from more than 2 million deaths annually before the introduction and widespread use of measles vaccine [15]. Measles virus is transmitted by the respiratory route and illness begins with fever, cough, coryza, and conjunctivitis followed by a characteristic rash [2]. Complications of measles affect most organ systems, with pneumonia accounting for most measles-associated morbidity and mortality [19]. The management of patients with measles includes provision of vitamin A [8] while measles is best prevented through vaccination [9], the major reductions in measles incidence and mortality have renewed interest in regional elimination and global eradication [3]. Despite global progress towards the goal of 90% vaccine coverage with the first dose of diphtheria-tetanus-pertussis (DTP), childhood mortality remains significantly high from vaccine preventable diseases [6, 16]. An estimated 23 million infants remain unvaccinated, under-vaccinated and unreached, of which 2–3 million children die each year despite the availability of safe, free and efficacious

vaccines [4]. Immunization has proven the test of time as one of public health's most cost-effective interventions. In 2017, the number of children immunized – 116.2 million – was the highest ever reported. Since 2010, 113 countries have introduced new vaccines, and more than 20 million additional children have been vaccinated [2]. Nevertheless, this year starkly illustrates how easily hard-won gains are lost. Because of low coverage nationally, or pockets of low coverage, multiple WHO regions have been hit with large measles and diphtheria outbreaks causing many deaths [12].

Several factors contribute to low immunization coverage among which are missed opportunities for vaccination (MOV) in health service settings [11]. MOV refers to any contact with health services by an unvaccinated or partially vaccinated child (who is free of contraindications) which does not result in the child receiving all the recommended vaccine doses for their age according to the national schedule [1]. Recent field assessments of the magnitude of MOV in the Region of the Americas and the African Region (AFR) (2015) of WHO indicate that between 23% to 96% of eligible children who visited a health facility for vaccination or for medical care left the health facility without receiving all the vaccine doses they needed [21].

Missed opportunities for immunization (MOIs) may contribute to low coverage in diverse settings, including developing countries. Of the 45 studies, 41 involved children and 10 involved women. The pooled MOI prevalence was 32.2% (95% CI: 26.8-37.7) among children [20].

Various reasons have been given for the occurrence of missed opportunity for immunization in low- and middle-income countries. These include; health systems factors, services provider factors, child factors, caretaker factors and cultural factors [3].

Missed opportunities and barriers to vaccination limit progress toward achieving high immunization coverage and other global immunization goals [7]. Measles illness still remains a significant contributor of childhood morbidity and mortality in most rural and urban populations and a cause of disease outbreaks in Kenya [10]. Although much progress has been made towards achieving high immunization coverage, Kenya is yet to meet the GIVS goal of over 95% coverage for measles vaccination to achieve adequate population immunity [6]. According to UNICEF (2019) Statistics immunization global report, Kenya MCV1 coverage for 2018 was 89% whereas for MCV2 was 45%. This is evidence that the prevalence rate of missed opportunity for measles vaccine is high. A 2019 administrative data reveals the country's measles coverage as low at 84% and 46% for the 1st and 2nd dose respectively. Despite a global reduction in polio prevalence, Kenya still experiences pockets of outbreaks especially among the pastoralist communities [15]. In addition, vaccine-preventable disease burden in Kenya is still significantly high. For instance, TB prevalence rate in 2011 was 291/100,000 while the incidence rate was 288/100,000 with a mortality rate of 0.022% [22]. In 2012, 3486 cases of 5 measles were suspected with 2380 cases being confirmed [5]. The incidence rate for measles in the same year was 5.57/100,000 [22].

Immunization dropout rate refers to the number of children who enroll for vaccination but never complete [7]. In Kenya, the DPT1-Measles dropout rate for 2011 was 8.4% [22]. The WHO recommends that dropout rates remain below 10% for every country. Failure to completely immunize children within the required time can lead to disease outbreaks, resulting in death and disability [14, 18]. Repeated outbreaks of vaccine-preventable diseases have occurred in different parts of Kenya. Some of the diseases reported in the country in 2012 included polio, measles, neonatal tetanus and influenza types A (H3) and B [15].

These outbreaks are an indication that despite improved immunization coverage in the country, not all children are protected through routine immunization programs. Wider determinants of health are important in understanding variations in immunization coverage [17]. They include social, cultural, economic, political and biological factors [13]. Ngong sub county hospital also demonstrates similar trends with measles - rubella coverage dose 1 and 2 (68.3%) and (44.2%) respectively (DHIS2, 2018) which is below the recommended target of above 90%. This scenario indicates that mortalities associated with missed immunization will still be felt in the study site. The study sought to investigate the factors associated with missed vaccination opportunities among children aged 9-23 months attending Ngong sub county Hospital.

2. Methodology

The study was conducted in Ngong Sub County hospital located in Ngong Township of Kajiado County Government. Kajiado County is a county in the former Rift Valley Province of Kenya. It has a population of 687,312 and an area of 21,292.7 km². The county borders Nairobi and extends to the Tanzania border further south. Kajiado County is divided into five constituencies: Kajiado North, Kajiado Central, Kajiado South, Kajiado West and Kajiado East. The County capital is Kajiado but the largest town is Ngong. Although there are several hospitals and health centers in Kajiado County, the state of healthcare in the rural areas is in deplorable shape and residents walk for long distances to access medical facilities. However, international organizations such as AMREF are working to bring health care closer to the community. Some of the notable healthcare facilities in Kajiado include the Nairobi Women's Hospital (Kitengela), Kajiado District Hospital, Ngong Sub-District Hospital, Loitokitok District Hospital and Namanga Hospital among others.

The study employed a cross sectional descriptive design. The design is also known as cross sectional analysis, transversal or prevalence study. The design was observational and involved analysis of data that was collected from the study participants during the study period. Cross sectional regression was used to sort out the existence and magnitude of measles missed opportunities and effects of the study independent variables (factors for measles missed opportunities) among the dependent variables (prevalence of missed opportunities) during the study period. The design was instrumental in finding solutions to improve the outcomes (reducing missed opportunities for measles vaccination). Both qualitative and quantitative methods were employed in data collection.

The study population comprised of children aged 9 - 23 months. This included children born exactly twelve months at the date of interview and any age before two years. Children aged beyond 23 months were excluded from the study as well as those whose caretakers had communication impairment, or those caregivers who did not consent to participate in the study. In this study, a caregiver was considered to be any person charged with care of or taking up responsibility of caring for a child's needs.

The appropriate sample size for the survey was determined largely by three factors:

1) The estimated prevalence of the variable of interest – percentage of fully immunized children in the district,
2) The desired level of confidence and
3) The desired width of confidence interval. Hence:

A total of 246 respondents were sampled.

Sampling Procedure: The data collection exercise took a period of 2 weeks, the potential number of children visiting the hospital on a daily basis was: 40*10 = 400. Eligible respondents were picked on a first arrival basis until all respondents were interviewed for the day. Key informant interviews were self-administered to the health workers while exit interviews were administered to eligible caregivers (those with children 9 – 23 months). This was done every day of the study period until the required sample size was attained. 12 Health workers working in preventive and curative department were interviewed using a questionnaire administered by the research assistant to understand their knowledge on current immunization schedule and determine their opinion on avoiding missed opportunities for measles vaccinations.

3. Results

3.1. Demographic Characteristics of the Respondents

Demographic factors considered in the study included age of the caregivers, age of the child, marital status of the caregiver, religion and relationship to the child.

Table 1 below presents the findings.

Table 1. *Demographic characteristics of the respondents.*

Variables	Frequency	Percentage
Age of Respondents		
≤ 19	1	0.4
20-29	154	63.6
30-39	79	32.8
≥ 40	8	3.2
Age of Child		
≤ 12 Months	90	37
>12 Months	152	63
Marital Status		
Single	6	2.4
Married	233	96.4
Separated	2	0.8
Widowed	1	0.4
Religion		
Christianity	212	87.4
Islam	27	11.4
Others	3	1.2
Relationship with the child		
Mother	202	83.4
Father	9	3.9
Aunt	20	8.2
Uncle	6	2.4
Others	5	2.1

About 63.6% of the caregivers were aged between 20-29. Those aged 40 years and above were 3.2%. Regarding age of the child, 63% of the caregivers had children aged 12 months and above. On marital status, about, 96.4% of the caregivers indicated that they were married. And concerning religion of the sampled caregivers, 87.4% were of Christian religion. As per relationship with the child, sampled mothers to the children were 83.4%.

Table 1 above presents details of the demographic factors for the respondents.

3.2. Vaccine Coverage Levels

3.2.1. Percentage Coverage of Scheduled Vaccination

All the scheduled vaccines were considered in the study.

Figure 1 below presents vaccination coverage at the study site.

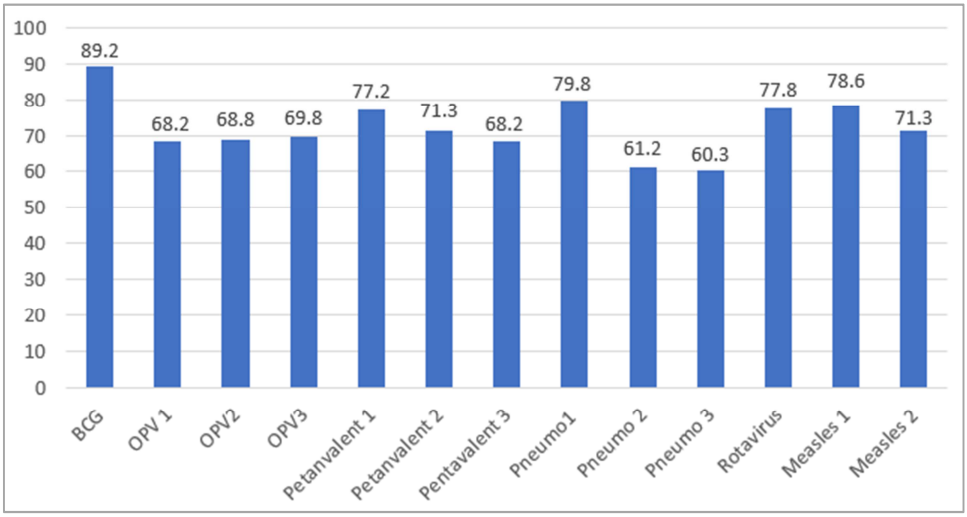

Figure 1. *Vaccination coverage.*

As indicated in Figure 1, BCG coverage was the highest at 89.2%. Children with Pneumono 3 vaccination were 60.3% and Pneumo 2, 61.2%. Those who had received Measles 1 vaccination were 78.6% and Rotavirus, 77.8%. OPV 1 vaccine coverage was at 68.2% while OPV2 and OPV3 were at 68.8% and 69.8% respectively. Figure 1 above shows a summary of the vaccine coverage.

3.2.2. Missed Vaccination

The overall immunization coverage was computed based on the number of vaccinations received against the scheduled vaccinations. Figure 2 below presents the proportion of children who had received complete vaccination and those who received partial vaccination.

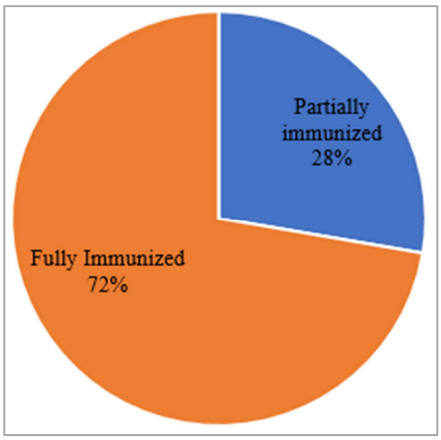

Figure 2. *Overall vaccination coverage.*

As indicated in Figure 2 above, about 72% of the children received full vaccination (Their vaccination status was on schedule). The other 28% had missed some of their scheduled vaccination.

3.3. Association Between Caregiver's Socio-Demographic Factors and Missed Opportunities for Measles Vaccination

Caregiver's demographic factors were cross tabulated with vaccine coverage and chi square tests conducted. Odds ratio was also conducted against each variable to ascertain the likelihood of occurrence. Table 2 below presents the findings.

Significant association was established between age of the caregivers, their marital status and their relationship with the baby and missed opportunities for vaccination ($p<0.05$). Children whose caregivers were between the ages 20-29 were 9.3 times more likely to be fully immunized as compared to their counterparts whose caregivers were 19 years and below. However, the likelihood of full immunization reduced with the increasing age. As such, the likelihood for children whose caregivers were 40 years and above to have full immunization was 0.3. On marital status, children whose caregivers were married were 2.8 times more likely to be fully immunized as compared to their counterparts whose caregivers were single and widowed. The likelihood of full immunization for children whose caregivers were separated to have full immunization was 0.5. The study also established that children whose caregivers were their mothers had higher likelihood of having full immunization as compared to those whose caregivers were their fathers (OR=0.1), aunt (OR=0.1), uncle (OR=0.1) and others (OR=0.1).

Table 2. *Association between caregiver's socio demographic factors and missed opportunities for vaccination.*

Variables	Frequency	Partially Immunized	Fully immunized	OR (CL=95%)	df	P-value
Age of Respondents						
≤ 19	1	0	1	1		
20-29	154	15	139	9.3 (0.55-55.1)	3	0.00
30-39	79	46	33	0.7 (0.04-11.89)		
≥ 40	8	6	2	0.3 (0.01-8.18)		
Marital Status						
Single	6	3	3	1		
Married	233	61	172	2.8 (0.55-14.34)	3	0.022374
Separated	2	2	0	0.5 (0.03-8.95)		
Widowed	1	1	0	1.0 (0.04-24.55)		
Religion						
Christianity	212	54	158	1		
Islam	27	12	15	0.5 (0.29-0.95)	2	0.33162
Others	3	1	2	0.3 (0.04-1.97)		
Relationship with the child						
Mother	202	38	164	1		
Father	9	7	2	0.1 (0.01-0.33)		
Aunt	20	14	6	0.1 (0.04-0.54)	4	0.00
Uncle	6	4	2	0.1 (0.02-0.66)		
Others	5	4	1	0.1 (0.01-0.53)		

Table 2 above presents the findings. Figure 3 below presents a graphic visualization of the missed immunization by age of the caregivers.

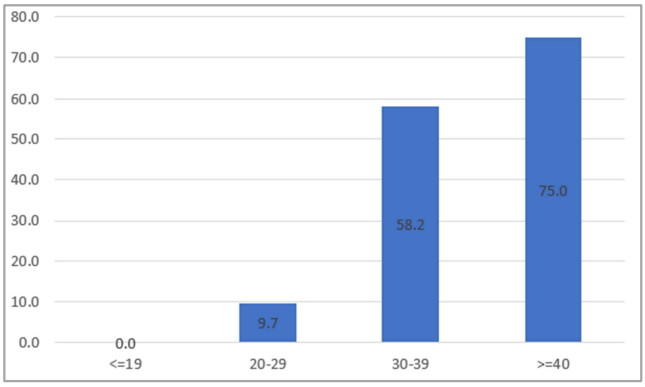

Figure 3. *Missed immunization by age of the caregivers.*

As indicated in figure 3 above, the highest percentage of missed vaccination opportunity was recorded among caregivers of ages 40 and above (75%). Only 9.7% of children whose caregivers were aged between 20-29 had missed opportunities for vaccination. Figure 4 below presents the missed vaccination opportunity by marital status of the caregivers.

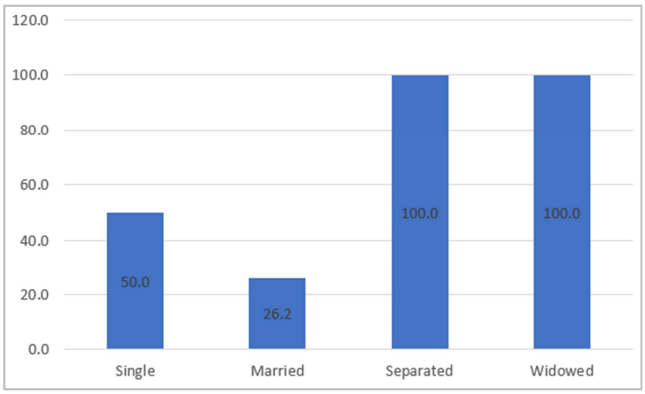

Figure 4. *Missed vaccination opportunities by marital status of the caregivers.*

As presented in Figure 4 above, all children whose caregivers were widowed and those whose caregivers were separated had impartial immunization. On the contrary, only 26.2% of the children whose caregivers were married had impartial immunization. Figure 4 above presents a summary of the findings.

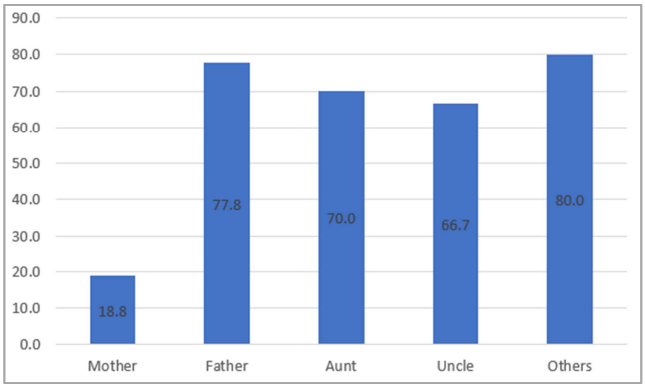

Figure 5. *Missed opportunities for vaccination against the relationship of the caregiver to the child.*

Figure 5 above presents a graphical presentation of the missed opportunities for immunization against the relationship of the caregiver to the child.

Most missed opportunities for immunization were recorded among children whose caregivers were father (77.8%), aunt (70%), uncle (66.7%) and others (80%). Only 18.8% of the children whose caregivers were their mothers had missed opportunities for vaccination.

3.4. Challenges Leading to Missed Vaccination

The respondents were further asked to indicate challenges they faced in ensuring full vaccination for their children. Figure 6 below presents the findings.

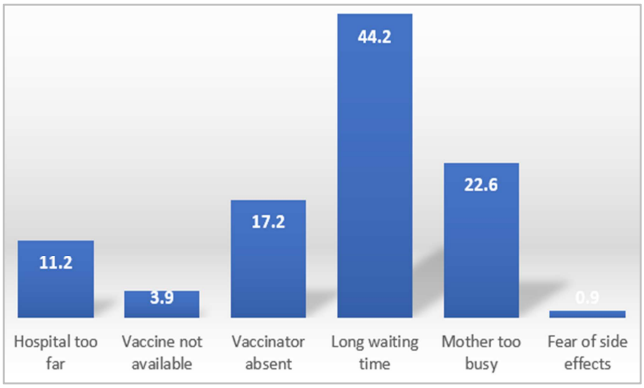

Figure 6. *Reasons for Missed vaccinations.*

As indicated in Figure 6 above, 44.2% of the caregivers reported that there was long waiting time. About 22.6% also indicated that the mothers were too busy. About 17.2% of the caregivers indicated that the reason was that the vaccinator was absent. Another 11.2% of the caregivers also indicated that the hospital was too far.

In order to ascertain the association between caregivers' socio-demographic factors and missed opportunities for immunization, binary regression analysis was conducted. Tables 3, 4 and 5 below presents the findings.

Table 3. *Summary of regression analysis.*

Regression Statistics	
Multiple R	0.859592
R Square	0.738899
Adjusted R Square	0.720249
Standard Error	42.20375
Observations	16

As indicated in Table 3, Multiple R of 0.859592 indicates a positive relationship between immunization and socio-demographic characteristics of the caregivers. This shows that demographic factors are indeed associated with missed immunization opportunities in the study area. The coefficient of multiple determination for the regression equation (R Square=0.738899) reveal a 73.9% fit in the regression equation. ANOVA output for the regression analysis was as presented in Table 4 below.

Table 4. *ANOVA output for the regression equation on demographic factors and missed opportunities for vaccination.*

ANOVA					
	df	***SS***	***MS***	***F***	***Significance F***
Regression	1	70567.8	70567.8	39.61909	1.97E-05
Residual	14	24936.2	1781.157		
Total	15	95504			

As indicated in Table 4 above, the significant F coefficient in the study was 0.00 While the F statistics was 39.61909. This implies existence of a relationship between some variables in the equation.

Table 5 below presents the test statistics.

Table 5. *Test statistics for the relationship between socio-demographic factors and missed opportunities for vaccination.*

	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**	**Lower 95.0%**	**Upper 95.0%**
Intercept	1.066637	14.1591	0.07533	0.941016	-29.3016	31.43484	-29.3016	31.43484
X Variable 1	3.54826	0.56372	6.2944	1.97E-05	2.339202	4.757319	2.339202	4.757319

As indicated in Table 5 above, the regression analysis revealed an insignificant p=0.941016 with a t stat of 0.07533for the intercept. The findings reveal an insignificant relationship between demographic factors and missed opportunities for vaccination among caregivers in the study area.

4. Conclusions

Based on the findings as presented in chapter four above, conclusions are made to the effect that specific caregiver demographic factors including age of the caregiver, their marital status and their relationship to the child influenced missed opportunities for vaccination. Specifically, missed opportunities are minimal among caregivers of middle age (20-30). Also, children whose caregivers were outside marriage arrangements were more likely to present with missed opportunities for vaccination. When children are taken care of by persons who are not their mothers, their chances of presenting with missed opportunities for vaccination also increased.

5. Recommendations

The study established that close to 30% of the children whose caregivers were sampled in the study had missed opportunities for vaccination. Based on this finding, the study recommends programs aimed at sensitization targeting both the providers and the caregivers on the importance of complete immunization. Programs should also be organized in such a way that it ensures Continual Medical Education (CMEs) for the healthcare providers on immunization.

With an understanding of existence of policies for vaccination in Kenya, given that the study established healthcare facility factors such as lack of adequate financial and human resource exists, Policies could target sufficient funding and adequate human resource for immunization services in the study area. Such policies could be put into place by the county governments given the devolved healthcare services in Kenya. Such policies could also aim at ensuring consistent monitoring mechanisms to ensure accurate forecast on vaccination services in the study area.

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