

# Uptake of Second Dose of Measles-Containing Vaccine among Children in Kakamega County, Kenya

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**Abstract-** Measles is a major cause of death and complications among young children worldwide despite the availability of a safe and effective vaccine. Per annum over 158,000 cases of measles mortality are reported globally, especially in Africa and Asia. In Kenya, 59 per a million measles incidence were reported in 2011. Approximately 80.1 % of the children aged less than 5 years receive a first dose of measles-containing vaccine in Kakamega County. In 2013 a second dose of measles-containing vaccine was introduced in the routine immunization system. A cross-sectional survey was conducted to determine the coverage of second dose of measles-containing vaccine among children in Kakamega County. Thirty clusters were selected using probability proportional to size with replacement, 19 households were surveyed per cluster and data of the youngest child aged between 24-35 months collected. Among the 571 children surveyed; the coverage of second dose of measles-containing vaccine was 102 (17.9%) (95%CI = 14.9% to 21.3%). The caretaker's awareness of the second dose of measles-containing vaccine, time taken to the nearest health facility, uptake of Pentavalent 3 and uptake of at least two doses of Vitamin A was significantly associated with the uptake of the second dose of measles-containing vaccine, p-value of 0.0000, 0.0010, 0.0281 and 0.0000 respectively. The second dose of measles-containing vaccine coverage in Kakamega is very low, strategies focusing on demand creation, conducting outreach services in hard-to-reach areas and ensuring that there are no missed opportunities should be put in place to increase utilization of the second dose of measles-containing vaccine across the County.

**Index Terms-** Children in Kakamega County, Kenya, Measles-containing vaccine, uptake

## I. INTRODUCTION

Measles is a highly contagious, acute viral illness that can lead to complications such as pneumonia, encephalitis, and death (1;2). Almost all non-immune children contract measles if exposed to infection. Measles kills more children than any other vaccine-preventable disease. Measles is a worldwide major cause of death and complications among young children despite the availability of a safe and effective vaccine. Per annum over 158,000 measles mortalities are reported globally, especially in Africa and Asia (2).

An effective measles vaccine has been available since the 1960s, and all countries offer measles-containing vaccine (MCV) in tandem with immunization program (3). Since 2000, deaths

due to measles have decreased by 78 percent globally. However measles outbreaks are still common in many developing countries, particularly in parts of Africa and Asia as a result of sub-optimal implementation of immunization strategies (3). Measles remains a public health concern in Kenya. It contributes significantly to the burden of disease among children aged less than 5 years (4).

According to Kenya Demographic Health Survey (KDHS) (7, 14), 85.0% in 2009 and 87.9% in 2014 of Kenyan children aged 12–23 months had received first dose of measles-containing vaccine (MCV1). Similarly administrative coverage of MCV1 was 86% in 2010 and 87% in 2011 in Kenya (5). This was a steady increment as compared to 2003 when the coverage of MCV1 in Kenya was 46.4% (6). The MCV1 coverage in the former Western province, where Kakamega County is located was estimated at 77.7% in 2009 (7) and 80.1% in 2014 (14).

In 2009, the World Health Organization (WHO) recommended that all children under 5 years of age in countries where MCV1 coverage was more than 80% for three consecutive years should receive a second dose of measles-containing vaccine (MCV2) in their routine immunization (RI) schedule (8). The rationale for providing a second opportunity for measles vaccination is two-fold: First to immunize the primary vaccine failures among children who did not respond to MCV1 and second is to vaccinate those children who were missed out by routine services (9). In line with the WHO recommendation Kenya introduced MCV2 in RI in 2013 (4). Apart from administrative coverage that is reported routinely by all the immunization points in the county, little was known on the population coverage. Therefore, this study set out to determine the uptake and factors associated with its uptake of MCV2 in Kakamega County, Kenya.

## II. MATERIALS AND METHODS

### Study site

Kakamega County is the second most highly populous county among the 47 counties in Kenya, with projected 2015 population was 1,929,401 of which about 4 % being children aged 24-35 months old. It is located in Western Kenya about 30km north of the Equator, at Latitude and Longitude of 0°27'5" N, 34°7'57" E respectively. The County borders Vihiga County to the South, Busia and Siaya Counties to the West, Bungoma and Trans Nzoia Counties to the North, Uasin Gishu to the North East and Nandi County to the East. The county covers an area of approximately 3050.3 km<sup>2</sup>. Administratively the County consists of sixty wards and twelve sub-Counties (10).

### Sample and Sampling Technique

A sample of 571 children was surveyed as per the WHO guidelines of conducting immunization coverage survey. Multi-stage cluster sampling technique was used by selecting 30 clusters (Villages) and then 19 children aged 24-35 selected from each village (11).

### Data Processing and Analysis

Data was entered and cleaned using MS Excel 2007 (Microsoft, Seattle, WA, USA) and analysed using EPI Info 7 (CDC, Atlanta, GA, USA) computer software. Univariate and bivariate analysis were calculated. Prevalence Odds Ratios at 95% confidence interval (CI) were used to assess measure of association between variables. P-value of  $\leq 0.05$  was considered significant. Factors with a p-value  $\leq 0.10$  were subjected to multiple logistic regression model using backward elimination, dropping the least significant independent variable until all the remaining predictor variables were significant (p-value  $\leq 0.05$ ). All biologically plausible two-way interactions between variables remaining in the model were tested and retained if significant.

### III. RESULTS

#### Coverage of MCV2 among Children

Of the 571 children surveyed, 293(51.3%) were female and 278(48.7%) were aged less than 30 months with median age of 29.0 months with inter-quartile range of 26.5 to 33.0 months, 533(93.3%) of the mothers were aged less than 40 years with median age of 27.0 years with inter-quartile range of 24.5 to 32.5 years, 157(27.4%) of the mother had at least secondary education. The corresponding vaccination coverage was 102 (17.9%) (95%CI = 14.9% to 21.3%), 480(84.1%) (95%CI = 80.7% to 86.9%), 510(89.3%) (95%CI = 86.4% to 91.7 %), 489(85.6%) (95%CI = 82.4 % to 88.4%), 438(76.7%) (95%CI = 73.0% to 80.1%), and 164(28.7%) (95%CI = 25.1- % to 32.7%) for MCV2, MCV1, OPV3, Pentavalent3, Pneumococcal3 and at least two doses of Vitamin A respectively (Table 1). 16(2.8%) (95%CI= 1.7 % to 4.6%) had not been vaccinated against any antigen.

**Table 1: Coverage for MCV2 among children aged 24-35 months by risk factors**

Variable	Categories	N= 571 n (%)	95% CI
Child sex	Male	278(48.7)	44.5-52.9
Child Age	< 30 months	293(51.3)	47.1-55.5
Number of Deliveries	> 1	473 (82.8)	79.3-85.8
Birth Order	$\geq 1$	430(75.3)	71.5-78.8
Age of mother	< 40	533(93.3)	90.9-95.2
Level of education of the mother	Secondary and above	157 (27.4)	23.8-31.3
Occupation of the mother	Business/ Farmers/Casual	533(93.3)	90.9-94.2
Marital status of the mother	Married	476(83.4)	80.0-86.3
Caretaker's awareness on MCV2	Yes	279(48.9)	44.7-53.0
Time taken to nearest health facility	< 30 minutes	99(17.3)	14.4-20.8
Received OPV 3	Yes	510(89.3)	86.4-91.7
Received Pentavalent 3	Yes	489(85.6)	82.4-88.4
Received Pneumococcal vaccine 3	Yes	438(76.7)	73.0-80.1
Received MCV1	Yes	480(84.1)	80.7-86.9
Fully immunized at 1 year	Yes	370(64.8)	60.7-68.7
Received MCV2	Yes	102(17.9)	14.9-21.3
Received $\geq 2$ doses of Vitamin A	Yes	164(28.7)	25.1-32.7

**Factors Associated With Uptake of MCV2**

Multivariate analysis showed that only caretaker’s awareness of MCV2, time taken to the nearest health facility, uptake of Pentavalent3 and two or more doses of Vitamin

A were significantly associated with uptake of MCV2 (Table 2). However factors such as uptake of MCV1, and oral polio vaccine 3 were also significant in bivariate analysis.

**Table 2: Multivariate Analysis for most significant risk factors MCV2 uptake among children aged 24-35 months**

Term	Odds Ratio	95% C.I.	P-Value
Caretaker aware of MCV2	14.5	6.9 -30.2	0.0000
Received Pentavalent 3	3.5	1.1-10.4	0.0281
Time taken to nearest health facility < 30min	2.7	1.5-5.0	0.0010
Received ≥ 2 doses of Vitamin A	4.5	2.7-7.6	0.0000

**IV. DISCUSSION**

Global coverage estimates for the MCV2 were reported for the first time in 2013. The global coverage was 35% by the end of the second year of life and 53% when including older age groups, and in Africa it was estimated at 7% (12, 13). Therefore the MCV2 coverage of 17.9% in Kakamega County is comparable to coverage in developing world given that the MCV2 was only introduced into RI in Kenya in 2013 (4). For instance both Sudan in 2012 and Eastern Mediterranean region in 2013 had coverage of 24% (13). However in 2013, MCV2 coverage was 81% in European and 92% in Western regions. This could be partly explained by the fact that only 23% of the countries in the African region had included MCV2 in their RI system by 2013 as compared to 71% and 48% in European and Western regions respectively (13).

The low uptake of MCV2 in Kakamega County could also be attributed to poor immunization trends witnessed across the Country. According to the KDHS (7), 77% of Kenyan children aged 12–23 months had received all recommended vaccines. However, KDHS(14) shows that only 68% and 62.2% of children age 12-23 months were fully vaccinated nationally and in Kakamega County respectively (14). However, MCV1 coverage in the country remained at a high of 87% in 2014(14). This was similar with estimates of 86% in 2010 and 87% in 2011 (5, 15). This stagnation could be attributed to devolution of health services in 2013, where some health indicators declined. This low uptake of MCV2 coupled with unchanged coverage of MCV1 creates a pool of children without immunity against measles infection. This is a precondition for major measles outbreaks in the region. This also dims the prospect of eliminating measles in the region by 2020.

From bivariate analysis sex and age of the child and marital status of the mother did not influence the uptake of MCV2 in

Kakamega County. This is similar to a study conducted in Brazil that showed that there was no difference in coverage by sex and age of the child (16). Children of the caretakers who were aware of MCV2 had 15 times more chances of receiving MCV2 than those whose caretakers had no knowledge of MCV2; this is collaborated with Ibnouf, Borne *et al.* (17) and KNBS (7) that showed that knowledge on the importance of vaccination played a role in the uptake MCV.

Time taken to the nearest immunization post was associated with the uptake of MCV2. For instance children stay within 30 minutes walk to the immunization centre had 3.3 better chances of receiving MCV2 than those who walk for longer. Previous immunization history also contributed a lot in the uptake of MCV2. From multivariate analysis only four factors were significant in determining the uptake of MCV2 namely; caretaker’s awareness of MCV2, time taken to the nearest health facility, uptake of Pentavalent 3 and uptake of at least two doses of Vitamin. This agrees with many studies that have shown that time or distance taken to vaccination facility and the mother’s awareness of the purpose of vaccination play a big role in the utilization of immunization services (17, 19).

**V. CONCLUSION**

The MCV2 coverage in Kakamega is very low and given that the majority of those who missed MCV1 also missed MCV2 there is likelihood of recurrent measles outbreaks in the County. Which means the vision of measles elimination by 2020 will remain a mirage. The distance from immunizing facilities, caretakers awareness, uptake of at least two doses of vitamin A and pentavalent 3 were the main determinants of receiving MCV2.

**VI. RECOMMENDATIONS**

Kakamega County needs to put in place strategies that focus on demand creation for MCV2, outreach services in hard-to-reach areas and utilizing the missed opportunities in order to maximize uptake of MCV2 in the County.

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