

Factors Associated with Uptake of Measles Rubella Vaccine Among Children Age 9-18 Months in Eastleigh North Ward Nairobi County

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Abstract- Globally, 535 000 children died of measles in 2000. By 2010, there was a global push to improve vaccine coverage which resulted in a 74% reduction in deaths. These efforts contributed to 23% of the overall decline in under-five deaths between 1990 and 2008. However, in several countries in African, measles is still a major public health problem. Rubella remains a threat to pregnant women and their fetus, with more than 100 000 children born each year with congenital rubella syndrome (CRS). (World Health Organization 2012). Kenya in May 2016, introduced Measles-Rubella (MR) combined vaccine in its nationwide supplementary immunization activities (SIA) campaign. However, since its introduction, the coverage has been very low especially in urban areas. (SAGE, 2016).

This study aimed at assessing factors associated with uptake of measles rubella vaccine among children age 9-18 months in Eastleigh North Ward Nairobi County.

This was a descriptive cross sectional study where data was collected from 186 caregivers of children age 9-18 months in Eastleigh North Nairobi County using semi-structured questionnaires and key interviewers guides. Analysis involved descriptive statistics such as frequencies and proportions. Test of association of study variables was done using Pearson's Chi-square test. Level of significance was fixed at 0.05 ($p < 0.05$) with a 95% Confidence interval and P value less than 0.05 was considered significant. Majority of respondents were mothers to the children 83.3%. Most were between the ages of 26 to 30 years (40.3%). Approximately 52.2% caregivers had secondary education and majority were self-employed 58.1%. About (60.8%) were muslims while (32.3%) were Christians. Of the 186 caregivers interviewed 85.5% (159) had their children vaccinated with MR1 and 27% with MR2. Awareness about MR vaccine was high 90.3% (168) among the caregivers; however, knowledge of child ever being diagnosed with measles or rubella was low 44.6%. There was a strong correlation between level of education and MR vaccine uptake, ($P=0.007$). This study also identified that there was a relationship between awareness of MR vaccine and uptake ($P=0.05$). The factors associated with uptake of MR vaccine were birth order, the level of education, lack of being attended at the health facility and awareness of existence of MR vaccine. Others included, hospital delivery, communication, health system related factors like availability of vaccine and vaccinator. Barriers identified for not receiving the vaccine,

negative attitude (66.7%) and religion (15%). Most care givers obtained information about MR vaccine from health care personnel 58.1% (108). Among the children, 18.3% (34) had been diagnosed with measles or rubella.

The uptake of MR2 is relatively low according to the findings suggesting that majority of the caregivers rarely bring their kids for the second dose (MR2). The result established a low correlation between the awareness of MR vaccine doses and implication of the results demonstrates the importance of instituting strategies that involves, aggressive awareness campaigns and education programs that focus on increasing caregiver awareness of MR vaccine dosing and risk factors for none vaccination.

The Ministry of Health and other non-state actors to come up with ways of improving immunization program, increase uptake of MR and consequently reducing the disease burden. Finally, findings of the study will benefit scholars as source of literature on the factors associated with uptake of MR vaccine.

Index Terms- measles rubella, vaccine, uptake, awareness

I. INTRODUCTION

Measles is a deadly and highly infectious virus that has affected mankind for centuries. Despite the existence of a highly effective measles vaccine since 1963, and although vaccination reduced the number of deaths from measles, it still remains one of the leading causes of vaccine preventable deaths in the world.

Globally, it's estimated that 535 000 children died of measles in 2000. By 2010, there was a global push to improve vaccine coverage which resulted in a 74% reduction in deaths. These efforts, supported by the Measles and Rubella Initiative, contributed 23% of the overall decline in under-five deaths between 1990 and 2008. However, in several countries in African, South-East Asian, European, Eastern Mediterranean and Western Pacific Regions, measles is still a major public health problem. Rubella also remains a threat to pregnant women and their fetus, with more than 100 000 children born each year with congenital rubella syndrome (CRS), like includes heart defects, blindness and deafness. (Global measles and rubella strategic plan WHO 2012)

World Health Organization (WHO) created a strategic framework for vaccination with the Measles Rubella Immunization (MRI) goals in 2008, which were achieved by most countries (UNDP, 2014). At the 2010 World Health Assembly (WHA), member states certified the plan for accelerated control of measles through national vaccination campaigns, in order to reduce mortality among children, in line with the Millennium Development Goal 4 (UNDP, 2014). In 2001, the Measles & Rubella Initiative was formed by American Red Cross, the United States' Centers for Disease Control and Prevention (CDC), the United Nations Foundation, UNICEF, and WHO, with the goal of reducing measles mortality by 90% by 2010, compared to 2000 baselines (WHO, 2015). In 2015, the global measles coverage was at around 85% and the decline in mortality from measles at around 79%, compared to the 2000 baseline estimates. Both the figures were short of the WHA targets and at risk of missing the 2020 GVAP objectives. At the 2012 World Health Assembly, the Global Vaccine Action Plan (GVAP) was adopted, with the mission of massively reducing vaccine-preventable deaths, which includes eliminating measles from 5 of the 6 WHO regions, and increasing vaccination coverage even further to 95% by 2020 (Kitamura et al. 2013). With all but one region likely to miss the GVAP target for regional measles elimination.

In 2016, the Strategic Advisory Group of Experts (SAGE) gave a recommendation for the introduction of routine second dose vaccine in all countries, regardless of their fulfillment of the 80% coverage criterion for introduction of the two-dose schedule (SAGE, 2016). In the African region, progress in immunizing children against measles has increased to 85% coverage in 2010 from 56% in 2001 (Gastañaduy, Redd, Fiebelkorn, Rota, Bellini & Seward, 2014). Despite the progress, Africa has experienced measles outbreaks and stagnation in vaccination coverage. The outbreaks came as a result of conflicts in the region disrupting the immunization activities by resistance religious groups, and from the epidemiological shift in measles cases towards older age groups (Parker et al, 2017).

Kenya shares borders with the conflict countries of Somalia and South Sudan, leading to a large influx of refugees and immigrants, many not vaccinated against measles. This has led to several outbreaks in the past few years, either in refugee camps or in informal settlements communities and neighboring counties. (GOK, 2012).

Kenya has been a strong follower of the set protocols to ensure reduced cases of measles. However, the delay in the 2006 SIA resulted in massive outbreak of measles, which was a setback in achievement of national and international goals (GOK, 2012). In 2013, a second dose measles vaccine was introduced in routine immunization schedule, but has not had high MCV1 or MCV2 coverage in recent years (Makokha, Wanjala, Githuku & Kutima, 2014). In May 2016, the Kenyan government launched an under 15 measles and rubella campaign to increase its coverage and introduce a combined measles-rubella (MR) vaccine to the country. It was also announced that MR vaccine will be formally introduced into the routine immunization schedule in early 2017 (Mbabazi, Collins & Chemirmir, 2017). It remains to be seen whether the addition of second dose vaccine and MR vaccine into the routine schedule has led to an improvement in measles coverage and incidence decline in the country. This necessitated a study to determine the level of uptake of MR among children 9-

18months. The Nairobi county health records shows Eastleigh North Ward is leading in terms of incidences of measles rubella infections. This is despite optimal efforts to ensure adequate vaccination coverage (Anecdotes, Nairobi County Ministry of Health, 2017). Presence of an immigrant community in Eastleigh North Ward in Nairobi County has been cited as a predisposing factor owing to the failure to adhere to the vaccination regimes by the affected populations. The need to carry out the study and determine the other predisposing factors is of paramount importance.

II. METHODS

This study was a descriptive cross-sectional study carried out in Eastleigh North Ward in Nairobi County. Approval to conduct the study was granted by Kenyatta National Hospital/University of Nairobi-Scientific and Ethics Review Unit and the division of disease surveillance response unit. Permission to conduct the study was also sought from local community leaders. The study population comprised of caregivers of children age 9-18months who lived in Eastleigh North Ward in Nairobi County and consented to participate. The ward is one of the five wards of Kamkunji Constituency in Nairobi County. The area is home to immigrants Somali population. It has a total population of 21450. Population of less than 5 years is 8903, while under 24 months is 3349. Eastleigh North ward has two main boundaries National Government and political boundaries 2nd avenue from 12th street to Juja Rd, Right side Airbase left side Muratina Rd to Juja Rd is Eastleigh North. A sample size of 186 was calculated as a representative of the population. Kamkunji was purposively selected due to the fact that it had the most current and recurrent outbreaks of measles rubella outbreaks in Nairobi. Multistage sampling was done in which three (3) out of five sublocations in Eastleigh North Ward were randomly sampled. From the 3, the households were determined by sampling roads used by polio campaign 2018 method. Through purposive sampling, all the 9 health facilities in the sampled sub-locations were interviewed using the key informant guide

Data was collected using a semi-structured questionnaire that was available in both English and

Swahili languages by trained enumerators. Each questionnaire was cross-checked before the respondent left so as to ensure completeness of data. Through purposive sampling, all the 9 health facilities in the sampled sub-locations were interviewed using the key informant guide. All the analyses were done using SPSS version 19.0. Descriptive statistics were used in analysis for proportions and frequencies. Pearson's chi square (χ^2) tests were used to determine the association between uptake of MR vaccine and individual factors, awareness and health system factors. Differences were considered significant at $p < 0.05$. Qualitative data was analyzed using thematic analysis.

III. RESULTS

Individual characteristics of the caregivers of children age 9-18months in Eastleigh North Ward Nairobi County

The socio-demographic/economic characteristics of the respondents are shown in Table 1. One hundred and eighty six

caregivers from 3 sub-locations, Garage 2(33.3%), Eastleigh north 1(33.3%) and Eastleigh North 3(33.3%) were involved. Majority of the respondents were mothers to the children 83.3%. Most were between the ages of 26 to 30 years (40.3%). Approximately 52.2% caregivers had secondary education and majority were self-employed 58.1%. Most participants (60.8%) were Muslims while (32.3%) were Christians.

Uptake of measles rubella vaccine among children age 9-18months in Eastleigh North Ward Nairobi County

The overall uptake of measles rubella vaccine (Table 2) was MR1 85.5% (159/186), MR2 (32.5%) . Table 4.3 shows MR uptake by sub-location, most children who had been vaccinated with both MR one and two respectively resided in Garage2 sub-location (34.6% MR1 and MR2 33.3%).

Eastleigh North 3 had the most children who hadn't received MR1 and MR2 44.4% and 42.9% respectively.

Awareness about MR vaccine among Caregivers of Children 9-18months in Eastleigh North Nairobi County

Majority of the respondents 90.3% had heard about MR Vaccine. More than half heard from health workers (58.1%), 16.1% from religious and local leaders. A high proportion of respondents (81.7%) were aware that children received MR vaccine at 9 and 18months. A quite a number of respondents were not aware if their child had been diagnosed with measles or rubella (44.6%), while 18.3% claimed their children had been diagnosed with measles or rubella. A hundred and twenty-four of the participants reported that low uptake of MR vaccine was attributed to Myths/ negative attitudes towards many vaccines

Health System factors in Eastleigh North ward Nairobi County

Majority of the respondents 181/186 of caregivers had Mother/child booklet. More than half of the children were vaccinated in government facility (54.3%), 39.2% in faith-based organizations.

Table: 5 we find that 83.9% of the caregivers indicated that at no time had they taken their child for MR vaccine and were not vaccinated. Figure:1 Majority of the health workers interviewed were from private hospitals (34%), 22% were from the government hospitals and dispensaries and 11% were from the private clinic and health centers. Figure 4.1 shows that 67% of the health care workers who participated in the study were nurses, 22% of the health workers were clinical officers and 11% of the health workers were doctors.

MR vaccine uptake in relation to caregiver's Individual characteristics in Eastleigh North ward Nairobi County

There was a statistical significant association between measles rubella vaccine uptake and level of education of the caregivers ($P = 0.007$). Proportion of care givers who had secondary education seemed to be the majority compared to other categories. There was significantly higher proportion of children receiving MR vaccine among caregivers who had secondary education (MR1,56%;MR2, 48.1%) as the highest level of education compared to those who had tertiary level (MR1,10.7%; MR2,11.1%) .

Children who were within the birth order of first to third had a significant relationship with MR1 uptake ($P=0.01$).As compared to later births $>7^{\text{th}}$ born (MR1; 2.5%).Further on, there was no

statistically significant association among the other demographics with measles rubella vaccination uptake.

MR vaccine uptake in relation to caregiver awareness in Eastleigh North ward Nairobi County

Although the respondents were aware of availability of MR vaccine, 168(90.3%) majority did not know if their child has ever been diagnosed with measles or rubella(44.6%)

There was a relationship between caregivers who had heard about MR vaccine for children ($p=0.05$). At least 132/186 of those care givers knew the timing of two doses of the MR vaccine, a positive association to the uptake ($P=0.07$). For MR2 there was a strong relationship to MR uptake ($P=0.00$) due to the fact that majority of children who had attained the age of 18months had been vaccinated. Although the source of information had a weak relation to the uptake of MR vaccine, health workers seemed to play an important role in communicating to mothers, MR1 was 56.6% MR2 70.4%. Together this suggests that these named factors affect the uptake of the MR vaccine.

MR vaccine uptake in relation to health System factors in Eastleigh North ward Nairobi County

There was a statistically significant association between MR vaccine uptake and the place of the child's immunization ($P = 0.008$).This was attributed to the vaccinator being absent (5%) and long waiting time (2.5%) though the margin was small. The caregivers who attended government facilities were more likely to complete MR doses 63%. Large number of children received MR vaccine 88.9% in the facility without problems.

IV. DISCUSSION

Maternal education has been highlighted in most literatures as a predictor of childhood immunization owing to changes in attitudes and traditions brought about by education, In the current study, it confirms this argument as the level of education was found to influence the uptake of the MR vaccine. Thus mothers with higher education levels are more likely to have children who are fully immunized (Abuya *et al.*, 2011). Education level was found to determine immunization coverage in Nigeria (Olumuyiwa *et al.* 2008). This study established that the age of mothers was a predictor in the uptake of the MR vaccine 26-30year olds were the majority. Maternal age has been underscored to influence immunization completion with studies indicating that younger mothers are more likely to immunize children that older mothers (Fatiregun and Okoro, 2012, Bondy *et al.*, 2009 and Etana and Deressa, 2012).

The results of this study concur with the findings of W.H.O (2009) that children staying within 30 minutes' walk to the immunization center had 3.3 higher chance of receiving MCV2 than those who walk longer. The immunization facilities in this study were in close proximity to the respondents with majority of them indicating they were less than 30 minutes to their places of residence with an average of 24.3 minutes access time and this consequently affected the uptake of the MR vaccine. The same has been proven in another study which demonstrated that distance to the health facility is likely to affect the uptake of the vaccine and schedule completion (Serpell *et al.*, 2006).

Studies have been able to demonstrate a strong correlation between place of delivery and the ability of the child to complete immunization (Antai (2009). Similarly, this study was able to show that the place of delivery and uptake of the MR vaccine had a relation 100% for MR2. Children delivered in a health facility from households with higher wealth status were associated with higher uptake of the MR vaccine. Similar results have been documented in other studies done in Kenya (Egondi *et al.*, 2015; Mutua *et al.*, 2011), and India (Lauridsen *et al.*, 2011) where health outcomes are better off among the wealthier in the community compared to the less wealthy households.

Caregivers who attended ANC clinic during pregnancy had their children vaccinated with MR1 at 95% and 100% for MR2. A study by Mutua (2017) on epidemiology and impact of vaccination coverage and delays in informal settlements in Nairobi, indicated that only 67% of the children had been immunized and post-natal care; and health facility delivery were identified as the determinants of being fully immunized

The findings indicate that about 85.5% of the children had received MR1 vaccine and 14.5% of the children had received MR2 vaccine. A study done on the risk factors for non-vaccination against measles among children below five years in Eastleigh, Nairobi Kenya, found that routine measles vaccination coverage in the area had remained below 75% (Omolo 2007).

The proportion of the children who received vaccine by gender was high in female 54.3% compared to 45.7% in male. Generally, there were more girls receiving MR vaccine compared to boys. Being a female child has been shown to have a marginal positive effect on vaccination, though its effects are statistically insignificant. Sex discrimination exists in the rural areas of Bangladesh where female children are 30 % are less likely to be fully immunized compared to the male children (Jamil *et al.*, 1999; KRCS, 2011). Contrarily, this study showed that there was no relationship between the gender of the child and uptake of MR vaccine. The study however, did not clearly illustrate whether more preference was given to the female than male gender.

Awareness of MR vaccine for children (90.3%) and timings of doses (81.7%) of the MR vaccine were positively related to the uptake of MR vaccine. These findings are in conformity with previous studies that reported that knowledge on vaccination significantly influenced vaccination coverage (Mapatano *et al.*, 2008). The children of mothers or caretakers who were aware of MCV2 were 15 times more likely of receiving MCV2 than those whose caretakers had no knowledge of MCV2 (Makhoha, 2016). These results were similar to a study conducted by Sheikh *et al.* (2014) that showed that the caretaker's knowledge of the immunization increased the uptake of OPV and IPV during immunization campaigns.

Child suffering from measles or rubella (18.3%) had no relation to the uptake of MR vaccine suggesting that previous infection of the child with measles or rubella may not affect the uptake of the MR vaccine. Similar results were obtained in the study done by Mutua (2017) that showed no significant relationship between childhood immunization patterns and hospitalization cases even though the statistical estimates direction indicated children who miss at least one of the recommended vaccines had higher hospitalization rates. However in this study, quite a significant number (44.6%) of caregivers did not know

whether their child has ever been diagnosed with measles or rubella.

Findings from this study found that sources of information for most caregivers were mainly health worker(58.1%), religious and local leaders(16.1). Contrary to Eboreime, Abimbola and Bozzani (2015) in a study done in Nigeria sources of information entailed the media, friends and social networks. However on distribution of nurses, showed no regional disparity in the human resources trained to deliver immunization services. As is in most developing countries, in Nigeria, immunization services at PHC centres are delivered mostly by mid-level health workers. In this study too, nurses were the main providers of vaccination services. Parents mentioned limited time at the health care clinics as a reason for the low uptake. They felt they do not have enough time and therefore they are not getting enough information and explanations to the questions in their minds, which seemed to shape the fear towards vaccinations. In this study, health care workers stated that they were burden with lots of other responsibilities hence not much time to explain to caregivers in details

V. CONCLUSIONS

Caregiver's level of education influences uptake of MR vaccine. This study concludes that MR1 uptake as compared to slightly low uptake of MR2 among children aged between 9 to 18 months in Eastleigh North Ward. Awareness on availability of MR vaccine for children and knowledge on double dosage of the MR vaccine influences uptake. In the face of measles rubella outbreak resurgence and increasing measles' rubella related infant and child morbidities and mortalities. The government should therefore increase its efforts in increasing awareness among the population on the importance of timely child-hood vaccination against measles and rubella through mass media, social mobilization and health education.

There is need to strengthen strategies to reach the hard-to-reach areas. Ministry of health needs to educate the community on recognition of measles rubella symptoms. Health education and sensitization on the importance of child vaccinations. Health workers need to be encouraged to use the missed opportunities in capturing children could who have missed MR2 and other vaccines. The low vaccine uptake can easily be improved through strategies such as door-to door outreach services. For scholars, consider studying factors associated with MR2 uptake in ages above 18months for those who come for late vaccination.

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REFERENCES

- [1] **Abuya, B., Onsomu, E., Kimani, J., & Moore, D. (2011).** Influence of maternal education on child immunization and stunting in Kenya. *Maternal & Child Health Journal*, 15(8), 1389-1399.
- [2] Antai, D. (2009). Inequitable childhood immunization uptake in Nigeria: a multilevel analysis of individual and contextual determinants. *BMC Infectious Diseases*, 9(1), 181.

- [3] Atkinson, W. (2011). Epidemiology and Prevention of Vaccine-Preventable Diseases (12th Ed.). Public Health Foundation, 301–323.
- [4] Bbaale, E. (2013). Factors influencing childhood immunization in Uganda, *Journal of Health Population Nutrition*, 31(1), 118-129.
- [5] Belachew, E., & Wakgari, D. (2012). Factors associated with complete immunization coverage in children aged 12-23 months in Ambo Woreda, Central Ethiopia. *BMC Public Health*, 12, 566.
- [6] Best, J. & Kahn, J. (1989). *Research in Education* (6th Ed.). New Jersey: Prentice Hall.
- [7] Bondy, J. N., Thind, A., Koval, J. J., & Speechley, K. N. (2009). Identifying the determinants of childhood immunization in the Philippines. *Vaccine*, 27(1), 169- 175.
- [8] Calhoun, A. et al. (2014). Determinants and coverage of vaccination in children in western Kenya from a 2003 Cross-Sectional Survey. *The American Journal of Tropical Medicine and Hygiene*, 90(2), 234-241.
- [9] Canavati S.E. (2013). Community knowledge, attitudes and practices (KAP) on behaviour change communication (BCC) interventions for the control, prevention, diagnosis, and treatment of malaria among mobile and malaria populations (MMPs) in Pailin province, Western Cambodia: a quantitative and qualitative study. Mahidol University.
- [10] Cole, N., & McNulty, Y. (2011). Why do female expatriates “fit-in” better than males? An analysis of self-transcendence and socio-cultural adjustment. *Cross Cultural Management: An International Journal*, 18 (2), 144-164.
- [11] Cooper, D., & Schindler, P. (2013). *Business research methods* (12th Ed.). McGraw-Hill.
- [12] Datar, A., Mukherji, A., & Sood, N. (2007). Health infrastructure & immunization coverage in rural India. *Indian J Med Res*, 125, 31-42.
- [13] Devasenapathy, N., Jerath, S., & Sharma, S. (2016). Determinants of childhood immunisation coverage in urban poor settlements of Delhi, India: a cross-sectional study. *BMJ Open*, 6, 13-15.
- [14] Eboime, E., Abimbola, S., & Bozzani, F. (2015). Access to Routine Immunization: A Comparative Analysis of Supply-Side Disparities between Northern and Southern Nigeria. *Plos One*, 10 (12), 14.
- [15] Esmail, L., Cohen-Kohler, J., & Djibuti, M. (2007). Human resource management in the Georgian National Immunization Program: a baseline assessment. *Human Resource Health*, 5, 20.
- [16] Etana, B., & Deressa, W. (2012). Factors associated with complete immunization coverage in children aged 12-23 months in Ambo Woreda, Central Ethiopia. *BMC Public Health*, 12(1), 566.
- [17] Fatiregun, A. A., & Okoro, A. O. (2012). Maternal determinants of complete child immunization among children aged 12–23 months in a southern district of Nigeria. *Vaccine*, 30(4), 730-736.
- [18] Godi, R. & Kusuma, Y. (2008). Immunization Coverage in Tribal and Rural Areas of Visakhapatnam District of Andhra Pradesh. *India Journal of Public Health*, 16 (6), 389-397.
- [19] GoK (2014). Kenya health policy paper 2014 - 2030. Government of Kenya. Accessed on May 6, 2018 Retrieved from:
- [20] Gap_in_NCD_Policy_Brief_May_30D-Final.pdf
- [21] Henry, V., Bairagi, R., Findley, S., Hellingranger, S., & Dahir, T. (2011). Northern Nigeria Maternal, Newborn and Child Health programme: selected analyses from population-based baseline survey. *The Open Demography Journal*, 4, 11 21.
- [22] Ibnouf, A. H., Borne, V.D., & Jam, M. (2007). Factors influencing immunization coverage among children under five years of age in Khartoum State. Sudan.
- [23] Jackson, S.L. (2011). *Research Methods and Statistics: A Critical Approach*. (4th ed.). Cengage Learning.
- [24] Kasomo, D. (2007). *Research Methods in Humanities and Education*. Eldoret: Zapf Chancery.
- [25] Kenya Red Cross Society (2011). Kenya Measles Outbreak, *International Federation of Red Cross and Red Crescent Societies*, 29, April, 2011. Nairobi: Kenya.
- [26] Kitamura, T., et al. (2013). World Health Assembly Agendas and trends of international health issues for the last 43 years: *Analysis of World Health Assembly Agendas between 1970 and 2012*. *Health Policy*, 110 (2–3), 198-206.
- [27] Kowal, S., Jardine, C., & Bubela, T. (2015). If they tell me to get it, I'll get it. If they don't...: Immunization decision-making processes of immigrant mothers. *Can J Public Health*, 106(4), 230-5.
- [28] Lyimo, J. (2012). Uptake of Measles Vaccination Services and Associated Factors Among Under Fives In Temeke District, Dar Es Salaam Region, Tanzania. Tanzania. MA. Thesis, Muhimbili University: Tanzania.
- [29] Makokha, F.M., Wanjala, P.M., Githuku, J., & Kutima, H.L. (2015). Uptake of Second Dose of Measles-Containing Vaccine among Children in Kakamega County, Kenya. *International Journal of Scientific and Research Publications*, 5(7), 1-4.
- [30] Mariara, J.K, Karienyeh, M., & Kabubo, F.M. (2012). Child Survival and Policy Options in Kenya: Evidence from Demographic and Health Surveys. *Journal of Reviews on Global Economics*, 1, 13-26.
- [31] Mbabazi, W.B., Collins, T.W., & Chemirmir, C. (2015). Innovations in communication technologies for measles supplemental immunization activities: lessons from Kenya measles vaccination campaign, November 2012. *Health Policy Plan*, 30(5), 638-44.
- [32] Mugenda, M. & Mugenda, O. (2003). *Research Methods: Quantitative and Qualitative Approaches*. Nairobi: African Centre for Technology Studies.
- [33] Mutua, K.M, Murage, K.E, & Ettarh, R. (2011), Childhood Vaccination in Informal Urban Settlements in Nairobi, Kenya: Who gets vaccinated? *BMC Public Health*, 11(6), 2-11.
- [34] Olumuyiwa, O., Ewan, F., Francois, P., Vincent, I., (2008). Determinants of vaccination in rural Nigeria. *BMC Public Health*, 208 (8), 381.
- [35] Omolo, J. (2007). Risk factors for non-vaccination against measles among children under five years in Eastleigh, Nairobi Kenya, 2006. Master's Thesis. Jomo Kenyatta University of Agriculture and Technology, Kenya.
- [36] Oyefolu, A., Nwaeke, A., Audu, R., Akinyemi, K., Salu, O., Muller, C., & Omilabu, S. (2007). Evaluation of Measles Vaccine Cold Chain in Lagos State, Nigeria. *African Journal of Clinical and Experimental Microbiology*, 8(1):17.
- [37] Parker, A., Fiebelkorn, S., Redd, P. Gastañaduy, A., Clemmons, N., Rota, P., Rota, S., William, J., & Wallace, G. (2017). A Comparison of Postelimination Measles Epidemiology in the United States, 2009–2014 Versus 2001–2008 . *Journal of the Pediatric Infectious Diseases Society*, 6 (1), 40–48,
- [38] Republic of Kenya (2013). Measles Vaccine Second Dose Introduction in Routine Immunization: A Guide for Health Worker. Nairobi: Government Printers.
- [39] Smith, P., Humiston, S., Marcuse, E., Zhao, Z., Doreli, C., Howes, C., & Hibbs, B. (2011), 'Parental Delay or Refusal of Vaccine Doses, Childhood Vaccination Coverage at 24 Months of Age, and the Health Belief Model', *Public Healthy Reports* 12(126), 135-146.
- [40] Uddin, J., Adhikary, G., Ali, W., Ahmed, S., Shamsuzzaman, M, Odell, C., Hashiguchi, L., & Lim, S., & Alam, N. (2016). Evaluation of impact of measles rubella campaign on vaccination coverage and routine immunization services in Bangladesh. *BMC Infect Dis*, 16, 411.
- [41] UNDP (2015). Assessment of development results Kenya: evaluation of UNDP contribution. UNDP. Available on July 7, 2018 from: <http://www.ke.undp.org/content/kenya/en/home/library/undp-reports/assessment-of-development-results-kenya-2014.html>
- [42] WHO (2014). WHO/UNICEF estimates of national immunization coverage. WHO, Geneva, 2014.
- [43] WHO (2015). Regional Office for Africa. African Regional Guidelines for Measles and Rubella Surveillance. Harare: WHO AFRO.
- [44] World Health Organization 2012, *Global measles and rubella strategic plan* : World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland .

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Table: 1 Individual Characteristics of the Caregiver of Children aged 9-18 months in Eastleigh North Ward Nairobi County

Variable	N	%
Sub-location of caregivers		
Eastleigh North 1	62	33.3
Eastleigh North 3	62	33.3
Garage 2	62	33.3
Interviewee Relationship		
Mother	155	83.3
Father	15	8.1
Grandparents	5	2.7
Aunt/Uncle	9	4.8
Siblings>18yrs	2	1.1
Care giver's Age (Years)		
15-20	11	5.9
21-25	60	32.3
26-30	75	40.3
31-35	27	14.5
36-40	9	4.8
>40	4	2.2
Level of Education		
No formal education	31	16.7
Primary	32	17.2
Secondary	97	52.2
Tertiary and above	26	14
Caregiver's Religion		
Christian	60	32.3
Muslim	113	60.8
Others	13	7

Caregiver's occupation

Employed	24	12.9
Self-employed	108	58.1
Unemployed	54	29

Caregiver's monthly income (KSH)

1,000-5,000	25	13.4
5,001-10,000	64	34.4
10,001-20,000	68	36.6
20,001-50,000	29	15.6

Marital Status of the caregiver

Married	143	76.9
Single	34	18.3
Separated	1	0.5
Divorced	6	3.2
Widowed	2	1.1

Children born by the caregiver

1-3	119	64
4-6	56	30.1
>7	11	5.9

No. of Children alive

1-3	119	64
4-6	56	30.1
>7	11	5.9

ANC attendance during pregnancy

Yes	178	95.7
No	8	4.3

Place of Delivery

Home by skilled birth attendant	9	4.8
Health facility	177	95.2

Child's age in Months		
9-17	103	55.4
18 months	83	44.6
Child's birth order		
1-3	133	71.5
4-6	45	24.2
>7	8	4.3
Child's gender		
Male	85	45.7
Female	101	54.3
Time Taken to reach nearest immunizing facility (Min)		
0-10	39	21
11-20	62	33.3
21-30	50	26.9
31-40	21	11.3
>40	14	7.5

Table 2: Uptake of measles rubella Vaccine among Children 9-18months in Eastleigh North Ward Nairobi County (N=186)

Vaccine	Vaccinated		Not Vaccinated	
	No.	%	No.	%
MR1	159	85.5	27	32.5
MR2	27	14.5	56	67.5

Table 3: Uptake of measles rubella Vaccine by Sub -location among Children 9-18months in Eastleigh North Ward Nairobi County (N=186)

Sub-location	MR1		MR2	
	Given	Not Given	Given	Not Given
	No.(%)	No. (%)	No. (%)	No.(%)
Eastleigh North-1	54 (34)	8 (29.6)	7 (25.9)	16 (28.6)
Eastleigh North-3	50 (31.4)	12 (44.4)	11 (40.7)	24 (42.9)
Garage2	55 (34.6)	7 (25.9)	9 (33.3)	16 (28.6)

Table: 4 Awareness about measles rubella vaccine among caregivers of children age 9-18 months Eastleigh North Ward Nairobi County

Variable	N=186	%
Ever heard of Measles-Rubella Vaccine for children		
Yes	168	90.3
No	18	9.7
If yes, source of information		
Health workers	108	58.1
Religious and local leaders	30	16.1
Neighbors	7	3.8
Other sources (Radio, T.V, Megaphone)	23	12.4
Knowledge of the doses of Measles-Rubella Vaccine		
Yes	152	81.7
No	34	18.3
Knowledge of the timing for the Measles-Rubella Vaccination		
At 9 months	68	36.6
At 18 Months	31	16.7
Both at 9 and 18 months	53	28.5
Has your child ever been diagnosed with measles or rubella		
Yes	34	18.3

No	69	37.1
Don't Know	83	44.6
If Yes, What Age		
<18 months	28	14
18 months	6	3.2
Reasons for mothers/caregivers' low uptake of Measles-Rubella vaccination for their children in your neighborhood		
Religion not encouraging vaccination	28	15
Myths/Negative attitude towards many vaccines	124	66.7
Unavailability of mothers to take children for vaccination	24	12.9
Some of their friends' children have not been vaccinated and were not sick	10	5.4

Table: 5 Health system factors in Eastleigh North ward Nairobi County

Variable	N=186	%
Mother/Child Booklet available		
Yes	181	97.3
No	5	2.7
Facility for Immunization (Type)		
Government	101	54.3
Faith Based organization	73	39.2
Private	11	5.9
Other	1	0.5
Ever experienced lack of attendance for Measles-Rubella Vaccine in a facility		
Yes	30	16.1
No	156	83.9
If yes, Reason for non-attendance*		
Long waiting time	4 (2.5)	1 (3.7)
Vaccinator absent	8 (5)	-

Vaccines not available	-	-
Child ill	5 (3.1)	1 (3.7)
Health facility closed	-	-
Other	1 (0.6)	-

Table: 6 MR Vaccine uptakes in relation to Caregiver’s Individual Factors with in Eastleigh North ward Nairobi County(N=186)

Variables	Measles-Rubella1		P	Measles-Rubella2		P
	Given	Not Given		Given	Not Given	
	<i>n=159</i> (%) <i>No. (%)</i>	<i>n=27</i> (%) <i>No. (%)</i>		<i>n=27</i> (%) <i>No. (%)</i>	<i>n=56</i> (%) <i>No. (%)</i>	
Interviewee Relationship						
Mother	133 (83.6)	22 (81.5)	0.69	23 (85.2)	47 (83.9)	0.88
Father	13 (8.2)	2 (7.4)		2 (7.4)	5 (8.9)	
Grandparents	4 (2.5)	1 (3.7)		-	1 (1.8)	
Aunt/Uncle	8 (5)	1 (3.7)		2 (7.4)	3 (5.4)	
Siblings>18yrs	1 (0.6)	1 (3.7)		-	-	
Mother/ Care giver’s Age (Years)						
15-20	9 (5.7)	2 (7.4)	0.46	-	3 (5.4)	0.3
21-25	51 (32.1)	9 (33.3)		10 (37)	14 (25)	
26-30	67 (42.1)	8 (29.6)		8 (29.6)	25 (44.6)	
31-35	20 (12.6)	7 (25.9)		8 (29.6)	10 (17.9)	
36-40	8 (5)	1 (3.7)		1 (3.7)	4 (7.1)	
>40	4 (2.5)	-				
Level of Education						
No formal education	25 (15.7)	6 (22.2)	0.007	5 (18.5)	8 (14.3)	0.71
Primary	28 (17.6)	4 (14.8)		6 (22.2)	8 (14.3)	
Secondary	89 (56)	8 (29.6)		13 (48.1)	31 (55.4)	
Tertiary and above	17 (10.7)	9 (33.3)		3 (11.1)	9 (16.1)	
Mother/Caregiver’s Religion						

Christian	49 (30.8)	11 (40.7)	0.45	9 (33.3)	14 (25)	0.78
Muslim	99 (62.3)	14 (51.9)		17 (63)	38 (67.9)	
Others	11 (6.9)	2 (7.4)		1 (3.7)	4 (7.2)	
Mother's/Caregiver's occupation						
Employed	22 (13.8)	2 (7.4)	0.79	6 (22.2)	4 (7.1)	0.1
Self-employed	93 (58.5)	15 (55.6)		17 (63)	37 (66.1)	
Unemployed	44 (27.7)	10 (37)		4 (14.8)	15 (26.8)	
Mother/Caregiver's monthly income (KSH)						
1,000-5,000	20 (12.6)	5 (18.5)	0.7	2 (7.4)	3 (5.4)	0.49
5,001-10,000	57 (35.8)	7 (25.9)		9 (33.3)	18 (32.1)	
10,001-20,000	58 (36.5)	10 (37.0)		9 (33.3)	27 (48.2)	
20,001-50,000	24 (15.1)	5 (18.5)		7 (25.9)	8 (14.3)	
Marital Status of the mother						
Married	125 (78.6)	18 (66.7)	0.79	18 (66.7)	47 (83.9)	0.04
Single	26 (16.4)	8 (29.6)		6 (22.2)	8 (14.3)	
Separated	1 (0.6)	-		-	-	
Divorced	5 (3.1)	1 (3.7)		3 (11.1)	-	
Widowed	2 (1.3)	-		-	-	
Children born by the mother						
1 -3	100 (62.9)	19 (70.4)	0.1	18 (66.7)	33 (58.9)	0.35
4 -6	51 (32.1)	5 (18.5)		9 (33.3)	19 (33.9)	
>7	8 (5)	3 (11.1)		-	4 (7.1)	
No. of Children alive						
1-3	100 (62.9)	19 (70.4)	0.1	18 (66.7)	33 (58.9)	0.35
4-6	51 (32.1)	5 (18.5)		9 (33.3)	19 (33.9)	
>7	8 (5)	3 (11.1)		-	4 (7.1)	
ANC attendance during pregnancy						
Yes	151 (95)	-	0.61	27 (100)	52 (92.9)	0.3

No	8 (5)	27 (100)	-	4 (7.1)		
Place of Delivery						
Home	9 (5.7)	-	0.36	-	5 (8.9)	0.17
Hospital	150 (94.3)	27 (100)		27 (100)	51 (91.1)	
Child's age in Months						
9-17	84 (52.8)	19 (70.4)	0.1	-	-	
18 months	75 (47.2)	8 (29.6)		27 (100)	56 (100)	
Child's Birth order						
1 st -3rd	115 (72.3)	18 (66.7)	0.01	20 (74.1)	36 (64.3)	0.4
4 th -6th	40 (25.2)	5 (18.5)		7 (25.9)	17 (30.4)	
>7th	4 (2.5)	4 (14.8)		-	3 (5.4)	
Child's gender						
Male	72 (45.3)	13 (48.1)	0.27	16 (59.3)	25 (44.6)	0.25
Female	87 (54.7)	14 (51.9)		11 (40.7)	31 (55.4)	
Time Taken to reach nearest immunizing facility (Min)						
0-10	34 (21.4)	5 (18.5)	0.87	4 (14.8)	9 (16.1)	0.31
11-20	51 (32.1)	11 (40.7)		13 (48.1)	17 (30.4)	
31-35	43 (27)	7 (25.9)		5 (18.5)	16 (28.6)	
36-40	18 (11.3)	3 (11.1)		5 (18.5)	9 (16.1)	
>40	13 (8.2)	1 (3.7)		-	5 (8.9)	

Table: 6 MR vaccine uptake in relation to caregiver awareness in Eastleigh North ward Nairobi County(N=186)

Variable	Measles-Rubella 1		<i>P</i>	Measles-Rubella 2		<i>P</i>
	Given	Not Given		Given	Not Given	
	<i>n=159</i> (<i>No. (%)</i>)	<i>n=27</i> <i>No. (%)</i>	<i>n=27</i> <i>No. (%)</i>	<i>n=56</i> <i>No. (%)</i>		
Ever heard of Measles-Rubella Vaccine for children						
Yes	142 (89.3)	26 (96.3)	0.48	27 (100)	48 (85.7)	0.05

No	17 (10.7)	1 (3.7)	-	8 (14.3)		
If yes, source of information						
Health workers	90 (56.6)	18 (66.7)	0.8	19 (70.4)	29 (51.8)	0.2
Religious and local leaders	26 (16.4)	4 (14.8)		4 (14.8)	10 (17.9)	
Neighbors	6 (3.8)	1 (3.7)		2 (7.4)	2 (3.6)	
Other sources (Radio, T.V, Megaphone)	20 (12.6)	3 (11.1)		2 (7.4)	7 (12.5)	
Knowledge of two doses of Measles-Rubella at 9 and 18 months						
Yes	132 (83)	20 (74.1)	0.11	27 (100)	44 (78.6)	0.007
No	27 (17)	7 (25.9)		-	12 (21.4)	
Timing of doses for Measles Rubella Vaccine						
At 9 months	55 (34.6)	13 (48.1)	0.03	2 (7.4)	31 (55.4)	0.00
At 18 months	31 (19.5)	-		11 (40.7)	-	
At 9-18 months	47 (29.6)	6 (22.2)		14 (51.9)	13 (23.2)	
Has your child ever been diagnosed of measles						
Yes	31 (19.5)	3 (11.1)	0.27	9 (33.3)	13 (23.2)	0.62
No	57 (35.8)	12 (44.4)		7 (25.9)	17 (30.4)	
Don't Know	71 (44.7)	12 (44.4)		11 (40.7)	26 (46.4)	
If Yes, What Age						
<18 months	25 (15.7)	1 (3.7)	1	8 (29.6)	11 (19.6)	1
18 months	6 (3.8)	-		1 (3.7)	2 (3.6)	
Reasons for mothers/caregivers' low uptake of Measles-Rubella vaccination for their children in your neighborhood						
Religion not encouraging vaccination	22 (13.8)	6 (22.2)	0.61	5 (18.5)	9 (16.1)	0.24
Myths/Negative attitude towards many vaccines	108 (67.9)	16 (59.3)		16 (59.3)	35 (62.5)	

Unavailability of mothers to take children for vaccination	20 (12.6)	4 (14.8)	3 (11.1)	11 (19.6)
Some of their friends' children have not been vaccinated and are not sick	9 (5.7)	1 (3.7)	3 (11.1)	1 (1.8)

Table: 7 Association between MR vaccine uptake and health System factors

Variables	Measles Rubella-1		P	Measles Rubella-2		P
	Given	Not Given		Given	Not Given	
	<i>n=159 No.(%)</i>	<i>n=27 No.(%)</i>		<i>n=27 No.(%)</i>	<i>n=56 No.(%)</i>	
Mother/Child available						
Yes	157 (98.7)	24 (88.9)	0.1	26 (96.3)	56 (100)	0.33
No	2 (1.3)	3 (11.1)		1 (3.7)	-	
Facility for Immunization (Type)						
Government	86 (54)	15 (55.6)	0.59	17 (63.0)	26 (46.4)	0.11
Faith Based organization	64 (40.3)	9 (33.3)		9 (33.3)	25 (44.6)	
Private	8 (5)	3 (11.1)		-	5 (8.9)	
Other	1 (0.6)	-		1 (3.7)		
Ever experienced lack of attendance for Measles-Rubella Vaccine in a facility						
Yes	23 (14.5)	7 (25.9)	0.008	3 (11.1)	11 (19.7)	0.49
No	136 (85.5)	20 (74.1)		24 (88.9)	45 (80.4)	
If yes, Reason for intendance						
Long waiting time	4 (2.5)	1 (3.7)	0.79	-		0.2
Vaccinator absent	8 (5)	-		3 (11.1)	2 (3.6)	
Vaccines not available	-	-		-	-	
Child ill	5 (3.1)	1 (3.7)		-	5 (8.9)	
Health facility closed	-	-		-	-	
Other	1 (0.6)	-		-	1 (1.8)	

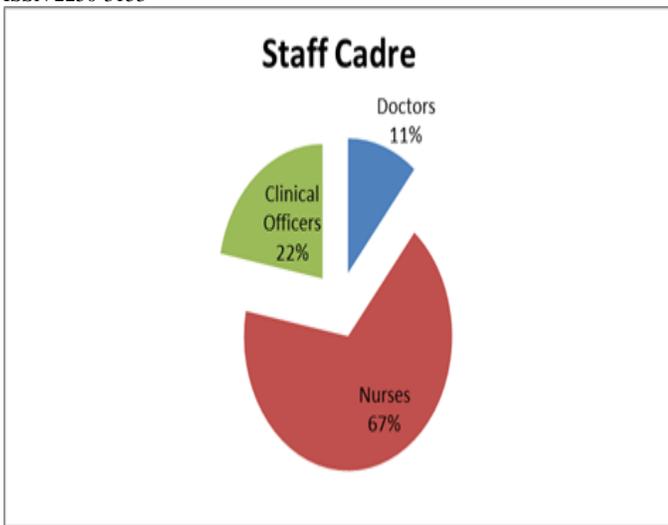


Figure: 1 Health System factors in Eastleigh North ward Nairobi County (N=9)