

Determinants of Uptake of Pneumococcal Conjugate Vaccine–10 among Infants in Rongai Sub-County Nakuru- Kenya

Lonah J. Kabutbei¹ Prof. Mary Kipmerewo¹ Mr. John Arudo¹

¹ Department of Reproductive Health, Midwifery and Child Health
Masinde Muliro University of Science and Technology

¹ Department of Nursing Education, Research and Management
Masinde Muliro University of Science and Technology

Abstract: Pneumonia contributes significantly to child deaths globally. However, the disease is preventable through pneumococcal conjugate vaccine (PCV-10) immunization. There were 613,867 documented cases of pneumonia in 2016 in Kenya and 35,851 in Nakuru County of which 2,182 were from Rongai Sub-County. The purpose of the study was to investigate the determinants of pneumococcal conjugate vaccine (PCV-10) uptake among infants in Rongai Sub-County. The study adopted a cross-sectional survey research design and targeted women of reproductive age who were residents of Rongai Sub-County. A sample size of 600 caregivers was obtained through cluster sampling. Mixed method of data collection using questionnaires and key informant interview (KII) guide were employed. The KII guide questionnaire was administered by an interviewer and used as data collection instrument. Logistic Regression was used to determine the strength of the association. A p value of ≤ 0.05 was used to reject the null hypothesis of no association between the independent variables and dependent variable. Out of 600 sampled respondents, 580 had complete questionnaires which were analyzed giving a response rate of 96.7%. In conclusion, although the results for the socio demographic factors on age, marital status, education and occupation were not statistically significant, nonetheless, it had an impact based on the proportions with children fully immunized against PCV-10. Religion, time taken, migration and knowledge had significant influence on the uptake of the PCV 10. With regard to health workers factors, staff shortage and lack of trusting relationship between staff and caregivers negatively affected the uptake of PCV-10 in the study area. In addition, information on prevalence of pneumonia, the assurance that the vaccines would not result in moderate or major reaction like seizure are factors that improve uptake of PCV – 10 in the study area. Finally, the determinants of uptake of PCV-10 in Rongai Sub-County are time taken, migration, religion, lack of trust on recommendations from nurses regarding child vaccination and knowledge of prevalence of pneumonia in the community. The study therefore recommends that the in-charges of health facilities should educate young mothers and single women on the significance of vaccinating their infants; healthcare workers should endeavor to build and maintain a trusting relationship with caregivers in order to improve on the PCV-10 uptake in areas of coverage and; the County government should facilitate public awareness on the significance and importance of uptake of PCV 10 vaccination through mass and social media campaigns.

Keywords: Uptake of Pneumococcal Conjugate Vaccine, Socio-demographic factors, Health Workers Factors

Date of Submission: 26-12-2021

Date of Acceptance: 06-01-2022

I. Introduction

Pneumonia is a form of acute infection that affects the lungs and is caused by a number of infectious agents including bacteria, viruses and fungi. Streptococcus pneumoniae is the most common cause of bacterial pneumonia in children (WHO, 2016). Pneumonia remains a major cause of morbidity and mortality in children globally despite a substantial decline in the incidence in the last decade (Liu, Oza, & Hogan, 2015). According to Campbell & Nair, (2017), globally, pneumonia still causes approximately 15% (or just under 1 million deaths) of an estimated 6.3 million deaths annually in children under five years of age.

Liu *et al.*, (2015) reported 50% of deaths occur due to pneumonia amongst the under five years. Pneumonia incidence and severity is highest in the first year of life, especially in the first six months (Rudan, *et al.*, 2013). The highest mortality rates are found in the low-income countries of Sub-Saharan Africa and South Asia. Sub-Saharan Africa not only has the highest under-five mortality rate in the world but also has the fastest population growth (Wardlaw, Newby, Anthony & Chopra, 2013).

The disease accounts for more child deaths than diarrhea, malaria and measles combined (Liu *et al.*, 2016). World Health Organization (2012) recommended the introduction of pneumococcal conjugate vaccines (PCV) in childhood immunization programs with high priority to countries with mortality rate above 50 deaths in every one thousand (1000) live births in children under 5 years of age (Rudan, *et al.*, 2012). Subduing the disease through vaccination is infinitely more effective than fighting it through treatment and case management. Viewed through the prism of national policy, vaccination is the ultimate smart investment. Most countries have endorsed the WHO's Global Vaccine Action Plan (GVAP). This aims to ensure no child is left unvaccinated by 2020. African governments also adopted, early in 2017, the African Union's Addis Declaration on Immunization (WHO, 2018).

Kenya is ranked among the 15 countries with the highest estimated number of deaths due to clinical pneumonia with mortality rate of 50 in every ten thousand (10,000) children per year. It is the second leading cause of death among children under the age of five years in the country (Onyango, 2012). In 2016, Ministry of Health (MOH) reported 613,867 cases of pneumonia accounting for 1.2% of all diseases in children under five. Almost all these deaths are highly preventable. Yet pneumonia fatalities are falling more slowly than for any other major killer of children.

In Nakuru County, 172,332 doses of PCV10 (1, 2 & 3) were administered in 2016 representing average coverage of 90.7% for all the Fully Immunized Children (FIC) in the 10 Sub-Counties. However, the FIC coverage in the entire county reduced to 83.5% when data from Rongai Sub-County was included. The reduction in coverage was attributed to low coverage in Rongai Sub-County which was 77.7% (MoH, 2016). It is as result of the poor performance in the Sub-County that researcher sought to investigate the determinants of pneumococcal conjugate vaccine (PCV 10) uptake among infants in Rongai Sub-County, Kenya.

Statement of the Problem

Despite the efforts undertaken, the immunization coverage trend in Kenya is worrying. Statistics indicate that in the last two decades, there has been a continuous decline in immunization coverage levels across regions in Kenya with worse trends documented in marginalized areas (KDHS, 2014). Basic vaccination coverage reduced from 77 percent in 2008 to 71 percent in 2014. Further, there is evidence that there exists weakness in the Kenyan health systems that have impeded the absorption capacity of the immunization programs, thereby preventing realization of the targeted 90% countrywide coverage by 2015 (Alliance for Health Policy and Systems Research, 2015). Despite the immunization system in Kenya being fairly well developed, an estimated 450,000 children are not fully vaccinated (Liu, 2015).

According to the KDHS (2014), there was a 10-percentage point decline in the fully immunized children between 2008 and 2014 and disparities in coverage across and within counties and wealth quintiles (Owino, 2016). With the aim to immunize all children, vaccine-preventable diseases including pneumonia have been recorded. In Kenya, there were 613,867 (1.2%) cases of pneumonia and 35,851 (5.2%) in Nakuru County while in Rongai, 2,182 (4.1%) cases recorded in 2016 (MOH 2016) which is higher than the national prevalence.

In Nakuru County, 172,332 doses of PCV10 (1, 2 & 3) were administered in 2016 representing average coverage of 90.7% for all the 10 sub-counties but the fully immunized children (FIC) coverage for the entire county is 83.5%. For the same period, Rongai Sub-County reported a PCV-10 coverage of 77.7% which was below the County's performance (MoH, 2016). Whereas Nakuru County has achieved the target of PCV 10 vaccinations uptake from the other 10 sub-counties, there is a glaring performance gap of 13% (90.7% -77.7%) between Rongai and the rest of the larger county in PCV 10 immunization. It clearly reveals that there is a variance which should be investigated. It is against this background therefore that this study sought to investigate the determinants of pneumococcal conjugate vaccine (PCV 10) uptake among infants in Rongai Sub-County, Kenya.

II. General objective

To evaluate the determinants of Pneumococcal Conjugate Vaccine (PCV-10) uptake among infants in Rongai Sub-County, Kenya.

Specific Objectives

- i. To assess the caregivers' socio-demographic factors influencing uptake of PCV 10 among infants in Rongai Sub-County.
- ii. To examine health workers factors influencing uptake of PCV-10 among infants in Rongai Sub-County.

Research Hypothesis

H0₁: There is no association between socio-demographic and uptake of PCV 10 among infants in Rongai Sub-County.

H0₂: There is no association between health worker factors and uptake of PCV 10 among infants in Rongai Sub- County.

III. Methodology

Research Design: This study applied cross-sectional survey design to guide the research process.

Study Area; The study was carried out in Rongai Sub County. Rongai Sub-County is situated north west of Nakuru County and borders Baringo County to the North, Molo Sub County to the West, Njoro and Nakuru Town West Sub Counties to the South and Bahati Sub- County to the East. Rongai Sub-County was purposively sampled for the study because it was among the least performing in vaccine uptake at 77.7% against other Nakuru Sub-Counties average of 90.7% according to health records from Ministry of Health 2016. Rongai Sub-county has five immunizing Health centres and 29 immunizing dispensaries which are run by the county government and others are run by private and faith based institutions.

Study Population: The study targeted caregivers with infants aged under one year and nurse in- charges of the facilities who offer immunizations services in Rongai Sub-county.

Inclusion and Exclusion Criteria: The inclusion criteria were caregivers with children under one year, caregivers with infants who had stayed in Rongai sub-county for six months and those who gave consent to participate in the study. The exclusion criteria were caregivers who were mentally ill.

Sampling Procedure: According to Kothari (2012) a sample is part of the target population that has been procedurally selected to represent the study population. Cluster sampling was used to divide the sample into clusters - in this case the five administrative wards of Rongai Sub County, which were Visoi, Soin, Solai, Mosop and Menengai West. Six hundred respondents were randomly selected from five (5) administrative wards. One hundred and twenty (120) respondents (caregivers) were selected from each ward. All the nurse in-charges of the government facilities were included in the study and key informants who were nurse in-charges were interviewed using key informant interview guide.

Sample Size Calculation: The researcher used the modified formula by Fisher *et al.*, (1998) to determine the sample size giving a total of 544. With additional 10% loading population, the final sample size was 598 and rounded to 600.

Research instruments: Data was collected using interviewer administered questionnaires and key informant interview guide. Qualitative data was gathered directly using key informant tool from respondents while quantitative data was mainly gathered through questionnaires which provided information that could be analyzable statistically. The two instruments were used to get both quantitative and qualitative data so that, in case of any weakness on quantitative data, it was complimented in the qualitative data. Questionnaire method was used to obtain information from caregivers.

Qualitative interviews: An interview schedule is a list containing a set of structured questions that have been prepared to serve as a guide for researchers' in collecting information or data about a specific topic or issue. Interviews enabled the researcher to acquire detailed information on health workers factors on uptake of PCV-10 among infants using Key Informant Interview (KII) guide. Most of the questions in interviews were open-ended. Such questions were flexible and this allowed for probing and the consequent production of in-depth data.

Validity of the instrument: This study used content and construct validity to ascertain the validity of its questionnaire. This was achieved by the researcher consulting with the supervisor at the university and medical professionals who gave an expert judgment on the questionnaire and moderate the test items to ensure their validity.

Reliability of the instrument: The tool adopted from Chesoli (2015) had Cronbach's Alpha of 0.84 suggesting that the items had relatively high internal consistency.

Data collection procedure: The researcher recruited ten research assistants from Rongai sub-county and trained them for four days on the objectives of the study, the administration of data collection tools and on retrieval and sorting. Pre-test was done in Nakuru West Sub-County, to ensure reliability of the tool. Data collected was subjected to screening for consistency, completeness, accuracy and verification.

Data management: The questionnaires obtained in the field were sorted, checked for completeness and cleaned. Data obtained in the questionnaires were then coded and edited. This involved carrying out screening of the data to check on consistency and accuracy of the data.

Data analysis: Statistical Package for Social Sciences (SPSS) version 25.0 was used to process the data. Descriptive statistics such as means, standard deviation and range were used to summarize the socio-demographic characteristics of the data. Inferential statistics were used to assess the strength of association between caregiver socio-demographic characteristics and practices, health care provider factors and health facility factors with the outcome which is uptake of PVC-10. Logistic Regression was used to determine the strength of the association measured as odds ratio. A p value of ≤ 0.05 was used to reject the null hypothesis of no association between the independent variables and dependent variable. Comparative content analysis was used to analyze data generated from KII. The KII field notes were marked according to the area where the interview took place. Each manuscript was analyzed looking at the concept and thereafter a comparison was done and all the concepts derived from each question were grouped together. These concepts were then grouped together to generate themes and finally the themes were categorized when applicable.

IV. Results

4.1 Socio-Demographic Characteristics of Caregivers

A total of 600 caregivers with 600 infants aged less than 12 months were visited at home and interviewed. The response rate was 96.7% after 20(3%) of the caregivers declined to proceed with the interview. However, out of the total 580 children who took part in the study 445 (76.7%) were aged below one year and who were supposed to have completed PCV 10 vaccination. Table 4.1 illustrates socio-demographic characteristics of caregivers. More than half (54.8%) were aged 25 – 34 years with more than a quarter (29%) being aged between 15 – 24 years. The mean age was 28.4 with a standard deviation of 6.2 and ranged between 19 and 44 years. Majority of respondents (caregivers) were females (96.6%) compared to 3.4% who were males. All the females interviewed were spouses to the heads of households. Three-quarters (75%) were married with nearly half (49.3%) having attained primary level of education and 40.9% having reached secondary education. Slightly more than three-quarters (75.5%) were protestants with 16.4% being Catholics. Two-thirds (67.8%) were housewives while 16.2% were engaged in business. The Ward with leading proportion of respondents was Menengai West (24.7%), Visoi (21%), Soin (19.8%), Mosop (19.6%) and with the least proportion being residents of Solai (14.8%). Majority (80.9%) were from rural communities while (10.1%) were urbanites.

Table 1: Socio-demographic characteristics of caregivers

Variables	Categories	N	%
Age group of respondents in years	15 - 24	168	29.0
	25 - 34	318	54.8
	≥ 35	94	16.2
Mean age \pm SD (Range)		28.4 \pm 6.2 (19.0 – 44.0)	
Gender	Male	20	3.4
	Female	560	96.6
Relationship to head of household	Head	20	3.4
	Spouse	560	96.6
Marital status	Single	62	10.7
	Married	435	75.0
	Separated	83	14.3
Level of education	Primary	286	49.3
	Secondary	237	40.9
	College	57	9.8
Religion	Catholic	95	16.4
	Protestant	438	75.5
	Other	47	8.1
Occupation	Housewife	393	67.8
	Farmer	36	6.2
	Employed	28	4.8
	Unemployed	2	0.3
	Business	94	16.2
	Casual worker	27	4.7
Ward	Menengai West	143	24.7
	Soin	115	19.8
	Solai	86	14.8
	Mosop	114	19.6
	Visoi	122	21.0
Residence	Rural	469	80.9
	Urban	111	19.1

Table 2: Child characteristics

Variables	Categories	n	%
Age group of respondents in months (infants)	2	135	23.3
	3	31	5.3
	4 – 5	121	20.9
	≥6	293	50.5
Median age in months (Range)		6.0 (2.0 – 11.0)	
Gender	Male	358	61.7
	Female	222	38.3

4.2 PCV 10 uptake for children aged 12 months and below(≤12 months)

Table 3 shows PCV 10 uptake among children aged 12 months and below. Out of the total 580 care givers who took part in the study 445 (76.7%) were aged 12 months and below and who were supposed to have completed PCV 10 vaccination. As illustrated in the table below, 39% (175/445) had received all the three doses. More males (56%) than females (44%) had completed PCV 10 immunization. The same trend could be seen among those who had not been fully immunized where 55.6% of males had not been fully immunized against pneumonia. Age-specific PCV 10 coverage shows late completion of vaccination with most of the children being aged 5 months or more (68.6%). The same age group also posted a higher proportion of those who had not been fully vaccinated.

Table 3: PCV 10 uptake for children aged 12 months and below

Variables	Categories	Fully Immunized		Not fully immunized	
		n	%	n	%
Gender	Male	98	56.0	150	55.6
	Female	77	44.0	120	44.4
	Total	175	100.0	270	100.0
Age group in months	3	9	5.1	22	8.1
	4	46	26.3	75	27.8
	≥5	120	68.6	173	64.1
	Total	175	100.0	270	100.0

4.2 Caregivers’ socio-demographic factors influencing uptake of PCV- 10

The first objective of the study was to assess the caregivers’ socio-demographic factors and practices of caregivers on the uptake of PCV 10 among infants in Rongai Sub-County.

4.2.1 Socio-demographic factors associated with uptake of PCV 10

Table 4 presents socio-demographic factors of caregivers and children influencing uptake of PCV 10 among children aged 12 months and below in the study area. None of the socio-demographic factors of caregivers or children aged 12 months and above were statistically significantly associated with full immunization of the children under study. Despite the non-significant results, comparatively, a smaller proportion of younger caregivers aged 15–24 months (32.5%) had their children fully immunized than the older age group (67.5%). The same was true of married caregivers (40.9%) versus singles, separated or divorced (59.1%). Equally, the proportion of caregivers with none or primary education whose children had completed PCV 10 vaccination was much lower (39.9%) than those with higher level education (60.1%). The proportion of children belonging to protestant caregivers (41.5%) was less than that of those whose parents were Catholics or other religious groups (58.5%). Further analysis shows smaller proportion among children whose caregivers were housewives (38.5%), residents of Menengai West (37.6%) or urban (38%), younger children aged 4–5 months (38%) or male children (39.5%) compared to their corresponding counterparts.

Table 4: Socio-demographic factors associated with uptake of PCV 10

Variables	Categories	n	Fully immunized		OR	95% CI	P value
			Yes	No			
Age group of caregiver in years	15-24	117	32.5	67.5	0.6	0.4 – 1.0	0.08
	≥25	328	41.8	58.2			
Marital status	Married	381	40.9	59.1	1.6	0.9 – 2.9	0.09
	Others	64	29.7	70.3			
Level of education	None or primary	393	39.9	60.1	1.2	0.7 – 2.3	0.4
	Secondary and above	52	34.6	65.4			
Religion	Protestant	337	41.5	58.5	1.5	0.9 – 2.3	0.09
	Others	108	32.4	61.5			
Occupation	Housewife	312	38.5	61.5	0.9	0.6 – 1.3	0.6
	Others	133	41.4	58.6			
Place of residence	Menengai West	109	37.6	62.4	0.9	0.6 – 1.4	0.7
	Other counties	336	39.9	60.1			
Location	Urban	355	38.0	62.0	0.7	0.5 – 1.2	0.3

Child's gender	Rural	90	44.4	55.6	1.0	0.7 – 1.5	0.9
	Male	248	39.5	60.5			
	Female	197	39.1	60.9			

4.2.2 Relationship between knowledge on immunization, accessibility and uptake of PCV 10

Table 5 illustrates relationship between caregiver knowledge on immunization, accessibility and child's uptake of PCV 10. The only independent variable that was statistically significantly associated with uptake of PCV 10 was time taken to reach place of immunization (OR: 1.8; 95% CI: 1.2 – 2.8; p = 0.006). Caregivers who took less than 30 minutes to immunization site were about two times more likely to have had their children fully immunized. All the knowledge variables that were tested in the bivariate analysis resulted in non-statistically significant outcomes although a comparatively smaller proportion of those whose source of information about immunization was radio (34.5%), having knowledge on age of a baby needs to receive the first PCV 10 (39.9%), when a baby needs to receive the last PCV 10 vaccine (39.3%), where baby was taken for immunization (39.7%) or going by foot to place of immunization (37%) in contrast to the proportion of children who were not fully immunized for the same corresponding categories.

Registered Nurse confirmed the above finding by making the following remarks:

“Lack of knowledge, distance, migration, religion and shortage of staff greatly result to low level of immunization within Rongai Sub-County. (Personal communication with a registered nurse during an interview)

The Sub-County KEPI coordinator expressed the following during an interview:

“Health education, staff training and IEC materials do help before rolling out a new vaccine, so when mothers come to the clinic they are aware that there is an additional vaccine” (Personal communication with Sub-County KEPI coordinator)

Table 5: Relationship between knowledge on immunization, accessibility and uptake of PCV 10

Variables	Categories	N	Fully immunized		OR	95%CI	P value
			Yes	No			
Source of information about immunization	Radio	126	34.9	65.1	0.8	0.5 – 1.1	0.2
	Other sources	319	41.1	58.9			
Knowledge on age a baby needs to receive the first PCV 10 vaccine	6 weeks	351	39.9	60.1	1.1	0.7 – 1.8	0.6
	Other	94	37.2	62.8			
Knowledge on age a baby needs to receive the last PCV 10 vaccine	≥14 weeks	420	39.3	60.7	1.0	0.4 – 2.2	0.9
	Other	25	40.0	60.0			
Where baby is taken for immunization	Mobile clinics	189	39.7	60.3	1.0	0.7 – 1.5	0.9
	Other facilities	256	39.1	60.9			
Means of transport to place of immunization	Foot	173	37.0	63.0	0.8	0.6 – 1.3	0.4
	Other means	272	40.8	59.2			
Time take to reach place of immunization in minutes	Less than 30	109	50.5	49.5	1.8	1.2 - 2.8	0.006
	At least 30 or more	336	35.7	64.3			

4.2 Health Workers Factors on Uptake of PCV-10 among infants

4.2.1 Roles of Nurses in the Child Immunization Program

In regard to the role of the nurses in child immunization program in the sub-county, the nurses stated that their roles were mostly giving health talks to the mothers or caregivers, immunizing the children, weight monitoring, compiling and submitting of the KEPI reports to the sub county, cold chain maintenance. Other roles included defaulter tracing and follow-up, ensure that they have enough supply of vaccines throughout the months and data entry

When asked about their perspective of the programs operations from their office's perspective, the KEPI coordinator of the sub-county said their offices supported the program by ordering vaccines for all the facilities, target setting, cold chain management. The program management carried out vaccine forecasting, managing wastage, support supervision, collection of reports and supply of commodities and supplies and on job training to health workers on new updates.

This was also confirmed by the following remarks, which was made by a registered nurse:

“Some of the activities that I am involved include; giving health talks to the caregivers on immunizations, immunizing the children, ensuring that all the vaccines are available, , defaulter tracing and weight monitoring” (Personal communication with a registered nurse during an interview).

This was also in concurrence with The Sub-County KEPI coordinator who expressed the following statements during interview:

“I am actively and personally involved in coordination and supervision of vaccination, I am also involved in collecting report and supply of vaccination materials He also stated that “My office is involved in ordering vaccines, setting targets, supervising the vaccination processing, collecting reports and training to health workers on new update” (Personal communication with a The Sub-County KEPI coordinator).

4.2.2 Challenges faced by the nurses in the child immunization program

The study also sought to establish the challenges faced by the nurses in child immunization in the sub-county. The key challenges cited by the nurses when carrying out child immunization in the sub-county included weak facility community linkage, lack of KEPI targeted supervision, staff shortage, no outreaches to support immunization, lack of KEPI data review and performance review and no sharing of reports at facility level. It was also important to establish how these challenges affected immunization coverage in the sub-county. According to the nurses, staff shortage contributed to delays in vaccination and increase in the number of defaulters. For example, one registered nurse (RN1) said,

‘Shortage of staff leads to vaccines not offered on daily basis and long waiting hours.’

Similar sentiments were shared by RN10 who observed that,

“Staff shortage may cause longer waiting hours or closure of the facility if the staff is away e.g. when he or she takes reports or go for official meetings or official functions. We also see increasing number of defaulters due to such delays as those who bring their children and do not get their children vaccinated may not report when given another appointment date”.

Distance to the facility was also mentioned as being among the major impediments to the realization of the immunization program by the area residents. The effect of distance from facility was articulated by RN13 who stated that,

“Some miss or come late due to distance from the facility. Transportation is also a challenge due to long distance to the KEPI store. Sometimes there are no means of communication”.

Similarly, RN5 indicated that, “The distance to KEPI store may affect supply of vaccines. It could be better if vaccines are distributed to the facility.” RN11 had a similar view stating that, “The immunizing facility should ensure that when vaccines are picked, it should arrive at the receiving facility at the right time.”

However, this view was contradicted by some, especially RN9 who claimed that,

Transportation of vaccines is good for we do ordering monthly when we submit our reports and in case of any antigen missing, we do order anytime. We use motorbikes for transportation.

RN 12 also said that,

“If possible, vaccines should be supplied to the facility because of the distance. Further, lack of nurses to do follow-up and linkage and also a weak defaulter tracing system affects uptake of the child vaccines. Equally, lack of data review leads to poor forecasting and planning and poor data quality may lead to poor performance due to poor data entry.

The study also sought to establish whether resourcing/staffing of the nurses had an impact on acceptance of the program. Most nurses indicated that staff shortage leads to poor performance and could also affect uptake of PCV-10 as the facility may be closed when staff attends meetings, seminars and trainings which makes client reluctant to go for immunization. Further, lack of adequate data tools meant that they might not enter all the work done which leads to more workload. However, despite the resourcing challenges, majority of the nurses claimed that they had improved coverage from 50-74% in the last 8 years.

Further, when asked whether there were Adverse Events Following Immunization (AEFI) that may impact acceptance, the nurses said that they rarely get AEFI reported from the facility children. Usually, children experience minor adverse effects after immunization like fever and pain.

The Sub-County KEPI coordinator made the following remarks during the interview:

Some of the major challenges facing child immunization include; Weak facility community linkage, staff shortage, inadequate outreach to support immunization, lack of EPI data review and performance review

He also made the following proclamation;

“Lack of data review leads to poor forecasting and planning and poor data quality which may lead to poor performance due to poor data entry” He explained that “There is no one to do defaulter tracing and weak facility community linkage” He further insisted that “We rarely get AEFI reported from the facility, children usually get the normal effects after immunization e.g. fevers, pain and health education gives the mother assurance of what to expect after immunization”.

4.2.3 Communication in child immunization program

Regarding communications, the study sought to establish whether communication programs put in place ahead of time or during the campaign on PCV-10 had an impact on acceptance. The nurses pointed out that, “health education staff training and IEC materials do help before rolling out new vaccines. When materials come to the clinic, caregivers are aware that there is an additional vaccine”. However, there were challenges in communicating the importance of the vaccines to the community as certain members of the community especially members of religious sects such as the Akorino refused to accept the vaccines due to their religious beliefs.

The Akorino Church does not allow members to take any medication or treatment. However, the Public Health Officer and the local administration are used to force them to bring their children for immunization mobilization. Besides, health education is used to overcome the resistance (Sub-County EPI Co-ordinator).

RN made the following remarks regarding the acceptability of PCV-10 among caregivers during an interview: “Majority of caregivers are willing to take their children for immunization except some few cases of religious beliefs eg Akorinos and the Israeli church” (Personal communication with a registered nurse during an interview)

A Sub-County KEPI Co-ordinator expressed the following during an interview schedule: “Health education. Staff training and IEC materials do help before rolling out a new vaccine, so when mothers come to the clinic, they are aware that there is an additional vaccine” (Personal communication with Sub-County KEPI co-ordinator during an interview)

4.2.4 Relationship between trust on health care workers and PCV 10 uptake

Table 7 presents relationship between trust on recommendations of key persons and uptake of PCV 10. Results show that the children whose caregivers did not trust recommendations from nurses regarding child vaccination were 40% less likely to have had full immunization (OR: 0.6; 95%CI: 0.4 – 0.9; p = 0.01), the findings being statistically significant. Although not statistically significant, a higher proportion of children whose caregivers trusted recommendations from church or mosque regarding child vaccination (60%) were up to 14 times more likely to have completed PCV 10 immunization. Likewise, though not statistically significant, children of caregivers who stated that it was not at all important to consult CHVs were up to 11 times more likely to have fully been immunized, results being non-significant.

Table 6: Relationship between trust on health care workers and uptake of PCV 10

Variables	Categories	n	Fully immunized		OR	95% CI	P value
			Yes	No			
Trusts recommendations from nurses regarding child vaccination	Not at all	142	31.0	69.0	0.6	0.4–0.9	0.01
	Trusted	303	43.2	56.8			
Trusts recommendations from church or mosque regarding child vaccination	Not at all	5	60.0	40.0	2.3	0.4–14.1	0.4
	Trusted	440	39.1	60.9			
Importance of consulting parents or spouse	Not at all	26	34.6	65.4	0.8	0.3–1.8	0.6
	Important	419	39.6	60.4			
Importance of consulting CHV	Not at all	8	62.5	37.5	2.6	0.6–11.1	0.3
	Important	437	38.9	61.1			

V. Discussion

Caregivers’ socio-demographic factors influencing uptake of PCV 10 among infants in Rongai Sub-County

Key results like age, education and occupation are discussed though they were were not statistically significant but had an effect on uptake of PCV 10 among infants. On age, younger women were less likely to have had their children fully immunized compared to older women (p = 0.08). This was contrary to previous findings by Mukungwa (2015) who found that maternal age was an important determinant of full immunization. Mothers aged 25-34, and 35-44 were more likely to fully immunize their children than younger mothers.

Abdirisak, *et al.*, (2016) also found that relatively younger caregivers had higher odds of having children who were fully immunized than those in upper age-brackets.

The findings on maternal education and uptake of PCV 10 revealed non-significant association. In spite of that, results indicate that a higher proportion of mothers with none or primary education were more likely to have had their children fully immunized with the likelihood being up to two times compared with those with secondary and above education. Caregivers' occupation was not statistically associated with uptake of PCV-10 ($p = 0.6$). That notwithstanding, fewer housewives (38.5%) compared to their working counterparts (41.4%) had their children fully immunized which is contrary to the findings of Mutisya (2012) who associated low uptake of pneumococcal vaccination among children below one year with the caregiver's occupation. Mothers who are employed usually do not have time to vaccinate their children compared to mothers who are not working.

Concerning religion, the study area had members of the Akorino sect, a small number that discourages adherents from seeking vaccination and other Western healthcare services due to their faith. This finding was consistent with Mukunga (2015) who found that the caregiver's religious doctrine, beliefs, practices and sanctions were some of the reasons for vaccine refusal and hesitancy. The negative perceptions of modern medicines and health services are embedded in the religious views that ascribe drug use to lack of faith in God, ignoring the spiritual dimensions of health and child diseases. Besides, the nurses reported that the public health officers and the local administration were used to force members of the sect to take their children for immunization. In addition, health education was used to overcome the resistance.

Time taken to reach place of immunization was positively associated with the children being fully immunized. Mothers who were taking less than 30 minutes to reach immunization place were about twice as likely to have had the children fully immunized. A 30 minutes' walk is within 5 km radius making facilities easily accessible to caregivers. The results on distance from health facility support those of Lakew, *et al.*, (2015) who found that distance and geographical location were statistically significantly associated with completion of childhood immunization. According to Shelles, *et al.*, (2014) the factors associated with having a fully immunized child in Mozambique included their knowledge about where to seek immunization and distance to the health facility. Most of the caregivers accessed the immunization sites by foot (36.2%) and by *Boda Boda* taxis (motorbikes and bicycles). For majority (84.7%) of the caregivers, the time to reach the vaccination facilities ranged from 30 minutes to 59 minutes further suggesting close proximity of health facilities to places of residence of caregivers.

From KII results, migration was found to be one of the factors influencing vaccine uptake. Children whose parents had ever migrated out of the study area during immunization period were less likely to get complete doses of PCV 10. This was supported by RN5 and RN 6 who said that if the caregivers travel to another place, they would miss immunizations. The study findings are consistent with previous studies that have shown low uptake of vaccinations among migrants compared to non-migrants (Gyan, 2016).

Regarding knowledge, all the variables that were tested in the bivariate analysis resulted in non-statistically significant outcomes. Nonetheless, although a comparatively smaller proportion of those whose source of information about immunization was radio and having knowledge on age of a baby needs to receive the first and last PCV 10 doses and where to take the baby for immunization had a higher uptake of immunization (37%) in contrast to the proportion of children who were not fully immunized for the same corresponding categories.

Health workers factors on uptake of PCV-10 among infants in Rongai Sub- County

Key informant responses on the role of the nurses in child immunization program in the sub-county revealed that the nurses were charged with the responsibility of giving health talks to the mothers or caregivers, immunizing the children and informing them of return dates to the clinic. The key challenges cited by the nurses when carrying out child immunization that could influence uptake of PCV-10 among children in the study area included weak facility community linkage, lack of KEPI targeted supervision, staff shortage, lack of outreaches to support immunization, lack of EPI data review and performance review and failure to share reports at facility level. The issue of staff shortage in particular had been cited by Bwire (2016) who observed that staff shortage was a common problem in most health facilities in Kenya.

Elizabeth, *et al.*, (2016) had recommended increasing the number of health facilities and number of staff to boost the low uptake of immunization. In the present study, the impact of staff shortage was being felt as it reportedly led to immunizing delays and consequently increases in defaulters. Also noted were challenges in communicating the importance of the vaccines to the community as certain members of the community especially members of religious sects such as the Akorino refused to allow their children to be vaccinated due to their religious beliefs and is consistent according to a study by MOHCC (2017).

VI. Conclusions And Recommendations

Socio-demographic factors such as age, marital status, education and occupation were not statistically significant but it had a bearing on uptake of PCV 10. The younger caregivers are less likely to fully vaccinate their children than older ones. The majority of older women in the community accept health information faster than relatively youthful women. The married couples had more percentage of their infants vaccinated than the single while a higher proportion of house wives had their children immunized than those engaged in employment, mainly as casual labour and in flower farms.

Religion, time taken, migration and knowledge were found to significantly affect the uptake of the PCV 10. The negative perceptions of modern medicines and health services by the members of the *Akorino* sect on their religious doctrine, beliefs, practices and sanctions were some of the reasons for vaccine refusal and hesitancy. Time taken to reach place of immunization was positively associated with the children being fully immunized. Caregivers who were taking less than 30 minutes to reach immunization place were about twice as likely to have had the children fully immunized. Migration was found to be one of the factors influencing vaccine uptake. Children whose parents had ever migrated out of the study area during immunization period were less likely to get complete doses of PCV 10. The caregivers who received information on radio and knew the place and schedule of the doses had a higher proportion of their infants fully vaccinated than those who were less knowledgeable.

Concerning the second objective on the association between health workers factors and uptake of PCV-10 among infants in Rongai Sub- County the study concluded that nurses are responsible for giving health talks to the mothers or caregivers, immunizing the children and informing them of return dates to the clinic, weight monitoring, compiling and submitting of the KEPI reports to the Sub-County and cold chain maintenance. However, among the crucial roles which were a challenge to nurses were defaulter tracing and follow-up. Some of the key challenges cited by the nurses when carrying out child immunization in the sub-county included weak facility community linkage, lack of KEPI targeted supervision, staff shortage, lack of outreaches to support immunization, lack of EPI data review and performance review and failure to share reports at facility level.

Regarding the influence of caregivers' socio-demographic factors on the uptake of PCV 10 among infants in Rongai Sub- County, the study recommends that the in-charges of health facilities should educate young mothers and single women on the significance of vaccinating their infants. They should also be made aware of the implications of failure to vaccinate their children.

In addition, the study recommends that church leaders of non-protestants should be enlightened on the need and importance of vaccination. This will go a long way in increasing the uptake of vaccination since such leaders have a great influence on their followers. County government, Ministry of Health Department should facilitate public awareness on the significance and importance of uptake of PCV 10 vaccination through meetings, seminars, mass media and social media campaigns.

References

- [1]. Abdirisak, M., & Karanja, S. (2016) Barriers to Full Immunization Coverage of Under Five Years Children in Benadir Region, Somalia. *Journal of Chemical, Biological and Physical Sciences.1* (6), 234–
- [2]. Alliance for Health Policy and Systems Research, (2015). Immunization coverage in Mathare Valley, Nairobi. Ministry of Health, Kenya
- [3]. Awino, J., & Ouko, H. (2016) *Determinants of Immunization coverage among children aged 12-23 Months in Kenya*: Unpublished Master's thesis submitted to University of Nairobi
- [4]. Bwire, A., & Vera, R. (2016). *Government Communication Strategies on Routine Immunization Uptake in Kangemi Informal Settlement*; Unpublished Master of Arts thesis
- [5]. Campbell, H., & Nair, H. (2017) *Child pneumonia at a time of epidemio- logical transition*. *Lancet Glob Health* 2015; 3: e65–6.
- [6]. Chesoli, P. (2015). *Factors influencing implementation of immunization programs in primary health care facilities in Kakamega County*". Unpublished Master of Arts thesis in Project Planning and Management of University of Nairobi.
- [7]. Chisti, J., Graham, M., & Duke, T. (2014) *Post-discharge mortality in children with severe malnutrition and pneumonia in Bangladesh*. *PloS one*. 9(9), 107-663
- [8]. Elizabeth, K., George, K., Raphael, N., & Moses, E. (2016). Factors Influencing Low Immunization Coverage among Children between 12 - 23 Months in East Pokot, Baringo Country, Kenya. *International Journal of Vaccines* 44(6), 531-539
- [9]. Fisher, C. D. (1998). *Affective events-emotions matrix: A classification of work events and associated emotions* (pp. 1-20). Bond University.
- [10]. Gyan, P. (2016). Individual and Contextual Factors Associated with Low Childhood Immunization Coverage in Sub-Saharan Africa, *a multilevel analysis*, 7(5), 37905.
- [11]. KDHS, (2014). Makindu District Health Records and Information database, 2014.
- [12]. Kothari, C.R. (2004). *Research Methodology: Methods and Techniques* : New Age International; New York
- [13]. Lakew, Y., Bekele, A., & Biadgilign, S. (2015) *Factors influencing full immunization coverage among 12–23 months of age children in Ethiopia*: Evidence from the national demographic and health survey in 2011. *BMC Public Health BMC Public Health*. 15(1):728.
- [14]. Liu, L., Johnson, L., & Cousens, S. (2012) *Global, regional, and national causes of child mortality: An updated systematic analysis for 2010 with time trends since 2000*. *The Lancet* 379, 2151–2161.
- [15]. Liu, L., Oza, S. & Hogan D. (2016). *Global, regional, and national causes of child mortality in 2000-, with projections to inform post-2015 priorities*: An updated systematic analysis. *Lancet*. 385(6), 430–440.

- [16]. Lynch, K. (2014). Do parents understand immunizations a national telephone survey?, *Pediatrics*, 106, 1097-1102.
- [17]. Ministry of Health (2013): *The Kenya Health Sector Strategic and Investment Plan – KHSSP* Published by: Ministry of Health, Kenya
- [18]. Ministry of Health and Child Care (2015). *Zimbabwe National Program on Immunization. Vaccination Acceptability Assessment in Zimbabwe*. Draft Report, Harare: MoHCC
- [19]. Ministry of Health and Child Care (2017) “*Factor Influencing Vaccine Hesitancy and Immunization Coverage in Zimbabwe: A Rapid Assessment (2017)*”; Harare: MOHCC
- [20]. Mukungwa, T. (2015) Factors Associated with full Immunization Coverage amongst children aged 12 – 23 months in Zimbabwe”. *Zimbabwe Open University Faculty of Applied Social Sciences: African Population Studies* 29(2), 17-61.
- [21]. Mutisya, F., & Mbithe, Y. (2012) “*Determinants of pneumococcal conjugate vaccine (PCV-10) uptake at Makindu district, Kenya*” Unpublished Master’s thesis of school of public health- Kenyatta University
- [22]. Mutua, K., Kimani-Murage, E., & Ettarh, R. (2011) *Childhood vaccination in informal urban settlements in Nairobi, Kenya: who gets vaccinated?* BMC Public Health 11-6.
- [23]. Mvula, H., Heinsbroek, E., Chihana, M., Crampin, C., Kabuluzi, S. & Chirwa, G. (2016). Predictors of Uptake and Timeliness of Newly Introduced Pneumococcal and Rotavirus Vaccines, and of Measles Vaccine in Rural Malawi: A Population Cohort Study. *PLoS ONE* 11(5)15-49.
- [24]. Odotola, A., Afolabi, M., Ogundare, O., Lowe-Jallow, N., Worwui, A., & Okebe, J. (2015). *Risk factors for delay in age-appropriate vaccinations among Gambian children*. BMC Health Serv Res. 15(3)4-6.
- [25]. Odotola, A., Afolabi, M., Ogundare, O., Lowe-Jallow, N., Worwui, A., & Okebe, J. (2015). *Risk factors for delay in age-appropriate vaccinations among Gambian children*. BMC Health Serv Res. 15(3)4-6.
- [26]. Onyango, H. (2012). Child immunization in Ghana, the effects of family location and disparity. *Journal Bio Social Science*, 29(3):327-43.
- [27]. Owino, H. (2016). Cognitive Processes and the Decisions of Some Parents to forgo pertussis Vaccination for their Children. *Journal of Clinical Epidemiology*, 49, 699-703
- [28]. Rudan, I., O’Brien, L., & Nair, H. (2013) *Epidemiology and etiology of childhood pneumonia in 2010: estimates of incidence, severe morbidity, mortality, underlying risk factors and causative pathogens for 192 countries*.
- [29]. Russo, K. (2015). Vaccine coverage and determinants of incomplete vaccination in children aged 12–23 months in Dschang, West Region, Cameroon: A cross-sectional survey during a polio outbreak. *BMC Public Health* (15)3-6.
- [30]. Shelles H., (2014). Risk factors of severe pneumonia among children aged 2- 59 months in western Kenya: a case control study. *The Pan African Medical Journal*, 13,45
- [31]. Shellese, A., Meridith, B., Peratikos, L., González-Calvo, M., Charlotte, B., & Troy, D. (2017). Determinants of full vaccination status in children aged 12–23 months in Gurùé and Milange districts, Mozambique: results of a population-based cross-sectional survey, *Journal on International Health*, 9(41) 234–242
- [32]. Sunguti, F., Joram, S., Neave, U., Penny, L., & Taylor, P. (2016). Immunogenicity, Efficacy, Safety and Effectiveness of Pneumococcal Conjugate Vaccines, *Vaccines*, 25, 21-25
- [33]. Wardlaw, T., You, D., Newby, H., & Anthony, D., & Chopra, M. (2013) *Child survival: a message of hope but a call for renewed commitment in UNICEF report*. *Reprod Health*.10-64.
- [34]. WHO, (2012). *World health statistics 2018: Monitoring health for the SDGs, sustainable development goals*. Geneva: World Health Organization; 2018. License: CC BY-NC-SA 3.0 IGO.
- [35]. WHO, (2018). *The Work of WHO in the African Region - Report of the Regional Director: Executive Summary & Illustrative Report: 2017-2018*

Lonah J. Kabutbei, et. al. “Determinants of Uptake of Pneumococcal Conjugate Vaccine–10 among Infants in Rongai Sub-County Nakuru- Kenya.” *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 11(01), 2022, pp. 01-11.