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DETERMINANTS OF PNEUMOCOCCAL CONJUGATE VACCINE UPTAKE AMONG CHILDREN ATTENDING IMMUNISATION SERVICES AT KENYATTA NATIONAL HOSPITAL, NAIROBI, KENYA

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ABSTRACT

Objective: To establish the determinants of pneumococcal conjugate vaccine uptake among children brought to Kenyatta National Hospital.

Design: A cross-sectional hospital-based quantitative and qualitative study

Setting: Kenyatta National hospital which is the largest teaching and referral hospital in East and Central Africa situated in Nairobi, Kenya.

Subjects: The respondents were the parents/guardians of children less than two years of age attending immunisation services at KNH and those admitted in the paediatric wards with pneumonia.

Results: The study established that the determinants of uptake of Pneumococcal Conjugate Vaccine are age (OR 5.8, CI 1.4-23.4, $p=0.014$), level of education (OR 5.8, CI 1.5-22.4, $p=0.01$), parity (OR 0.2, CI 0.1-0.7, $p=0.017$), occupation (OR 6.5, CI 1.5-27.6, $p=0.011$), family income (OR 8.8, CI 1.4-55.6, $p=0.001$), knowledge (OR 6.5, CI 1.1-15.2, $p=0.011$) and attitude (OR 6.3, CI 1.9-26.8, $p=0.001$).

Conclusion: The study concluded that factors of the caregivers/parents that are statistically significant to the uptake of Pneumococcal Conjugate Vaccine uptake are Income, parity, education level, age and occupation. Also a friendly attitude from health personnel was shown to motivate parents/guardians' adherence to vaccination schedules.

INTRODUCTION

Pneumonia remains a leading killer among children in developing countries, where it accounts for up to 21% of deaths in children under the age of five years. The overall mortality rate for children aged less than five years in developing countries ranges from 60 to 100%. One fifth of this is due to pneumonia. An estimated 1.9 million children die from pneumonia yearly. Half the world's deaths due to pneumonia in children under the age of five occur in Africa. In sub-Saharan Africa, the estimated proportion of death in children aged below five years attributed to pneumonia is 17-26%.

In Kenya, Pneumonia has greatly affected children under the age of five. Currently, Kenya is ranked among the 15 countries with the highest

estimated number of deaths due to clinical pneumonia, the mortality rate being 50 / 10, 000 per year. It is the second leading cause of death among children under the age of five years and causes 16% of deaths in the age group.

Treatment of pneumococcal infection with antibiotics such as Penicillin and other drugs used to be very effective, but expensive and some strains of the disease have become resistant to these drugs. Prevention of pneumonia has therefore become important.

According to the report by the Center for Disease Control (CDC), Department of health and Human Service, released in 2009, Pneumococcal Polysaccharide Vaccine (PPV) protects against twenty three types of pneumococcal bacteria including the most likely to cause serious disease.

In February 2011, the Kenya Expanded Programme on Immunisation (KEPI), officially launched and included PCV-13 vaccine into the immunisation schedule for the under fives as a free and compulsory vaccine. When launching the vaccine, KEPI was working with an estimate that it would potentially prevent pneumococcal deaths. Initially children would get the vaccine out of the parent's initiative at a fee, usually from a private practitioner who at times charged exorbitant prices for the vaccine. This cost hindered many from accessing the vaccine. Many more were not even aware that the vaccine existed before its launch in 2011. Inclusion of PCV-13 was, therefore, a government strategy towards reducing pneumonia prevalence among the under five year old.

This study was therefore carried out with the objective of identifying the determinants of Pneumococcal Conjugate Vaccine uptake among young children attending immunisation services in Kenyatta National Hospital. This would enable health workers devise programmes that target these factors so as to increase pneumococcal conjugate vaccine uptake.

METHODS AND MATERIALS

Study Area: The study was carried in KNH; Kenyatta National Hospital is in Nairobi County. It is a metropolitan, tertiary, referral and teaching hospital situated at Upper Hill area along Hospital Road about 5km from Nairobi city centre. It is one of the two main referral hospitals in Kenya, also serving the greater East and Central African region. Apart from this, the hospital is engaged in training of many cadres of health professionals. This study aimed at establishing the determinants of Pneumococcal Conjugate Vaccine uptake among children in Maternal Child Health immunisation clinic and pediatric wards at Kenyatta National Hospital.

Study Design: This was a descriptive cross-sectional institutional-based study carried out for a period of one month.

Study Population and Sampling: The study population was parents/guardians of children less than two years of age attending immunisation services at KNH and those admitted in the paediatric wards with pneumonia. 95% Confidence Interval was used assuming 16% mortality rate of children with pneumonia.

A sample size of 104 parents or guardians was obtained using Fisher's formula.

Data collection tools: A pretested structured questionnaire was administered to the mothers or care-givers to collect quantitative data such as demographic, socio-economic, cultural, knowledge

attitude and practice of the study group, while key-informant interview guide was used to interview nurse-in-charges to collect qualitative data. Child health cards of the individual children were used to assess the validity of information by the respondent and child's immunisation status.

Methods of data analysis and presentation: All information was entered into computer software for analysis, using statistical package for social sciences (SPSS) version 18 computer package and analysed using descriptive and inferential statistics.

Descriptive data were presented using tables, graphs, charts, pie charts, frequency diagrams while inferential data was presented using p-values, t-test, odds ratios and degree of freedom.

Data collected by questionnaire was coded to enable analysis by statistical package for social scientist (SPSS). Descriptive statistics were calculated including measures of central tendencies (means and medians) and measures of variability (standard deviation and range), while frequency distribution were organized into tables, graphs, charts and other descriptive modes. Tabulation of data involved arranging data in concise and logical order. Inferential statistics were also calculated using chi square, and t-test for comparing categorical and continuous variables, respectively. Qualitative data from key informant's interview data were organized into themes and then subjected to further thematic analysis. The results were used to validate the results from quantitative data.

Ethical considerations: Ethical clearance was obtained from the University of Nairobi / Kenyatta National Hospital Ethics and research Committee. Informed and written consent was sought, obtained from all participants after explaining the nature and aim of the study and before administering the questionnaire.

RESULTS

Demographic characteristics: A total of 66 mothers with infants attending the MCH clinic and 37 mothers with infants admitted in the paediatric wards at Kenyatta National Hospital were enrolled into the study. There was no interviewee who declined from the study. The mean age of the mothers was 28.6 years (SD=4.7). Most participants in the study were female representing 96.2.8% (n=100) while male participants represented 3.8% (n=4). 98.1% (n=102) of the participants in the study reported that they were married. 37.5% (n=39) reported that they had one child.

The association between demographic characteristics and the uptake of the PCV

a) **Age:** On average the odds of uptake of PCV is 5.8 times higher in the caregivers with 25-29 years

age group compared with those of 20-24 years age group(OR 5.8, CI 1.4-23.4, p=0.014). When the uptake of PCV is compared between ages 20-24 years(Reference group) and other age groups, none was statistically significant as demonstrated in Table 1.

b) *Parity*: Immunisation uptake was statistically significantly associated with parity. The odds of uptake of PCV are 70% lower for caregivers with

two children compared with those with one child(OR 0.3, CI 0.1-0.8, p=0.023). The odds of uptake of PCV are 80% lower for caregivers with at least three children compared with those with one child (OR 0.2, CI 0.1-0.7, p=0.017).

c) *Marital status and sex*: There was no correlation between marital status and sex with vaccine uptake as demonstrated in Table 1.

Table 1
Demographic characteristics of the participants versus vaccine uptake

Characteristic		PCV uptake		OR (95% CI)	Chi	P-value
		Uptake	No uptake			
Age	20 - 24 years	18(60.0)	12(40.0)	1.0		-
	25 - 29 years	26(89.7)	3(10.3)	5.8(1.4-23.4)	6.8	0.014
	30 - 34 years	23(69.7)	10(30.3)	1.5(0.5-4.3)	0.7	0.420
	35 - 40 years	10(83.3)	2(16.7)	3.3(0.6-18.0)	2.1	0.160
Sex	Male	3(75.0)	1(25.0)	1.0		-
	Female	74(74.0)	26(26.0)	0.9(0.1-9.5)	0.002	0.960
Marital	Single	2(100.0)	0(0.0)	NA	-	-
	Married	75(73.5)	27(26.5)	NA		

Association of Socioeconomic characteristics of respondents with vaccine uptake

a) *Level of education*: On average the odds of uptake of PCV is 5.8 times higher in the caregivers with at least secondary education compared with those with primary education and below(OR 5.8, CI 1.5-22.4, p=0.01).

b) *Occupation*: On average the odds of uptake of PCV is 6.5 times higher in the caregivers with salaried occupation compared with the non-salaried occupation(OR 6.5, CI 1.5-27.6, p=0.011).

c) *Family's income*: On average the odds of uptake of

PCV is 8.8 times higher in the caregivers with an income of over KSh. 21,000 compared with those with an income of less than KSh. 21,000 (OR 8.8, CI 1.4-55.6, p=0.001).

The association between cultural and religious factors of participants versus the vaccine uptake: Two caretakers reported that cultural practices prohibited immunisation and both of these respondents did not take up PCV but there was no statistical association between the uptake of PCV with cultural (p=0.54) or religious values (p=0.53) and PCV uptake as shown in the following Table 2.

Table 2
Cultural and religious beliefs versus the vaccine uptake

	Uptake		No uptake		OR(95% CI)	P value
	N	%	N	%		
Religious beliefs prohibit immunisation						
Yes	3	25	9	75	0.6(0.1-2.5)	0.530
No	30	37	51	63		
Cultural practices prohibit immunisation						
Yes	0	0	2	100	NA	0.540
No	33	36.7	57	63.3		

The association between knowledge of participants on PCV versus vaccine uptake : On average the odds of uptake of PCV is 4.1 times higher in the caregivers with adequate knowledge compared with inadequate knowledge of vaccines (OR 6.5, CI 1.1-15.2, $p=0.011$).

The association between attitude of participants versus the vaccine uptake: The odds of uptake of PCV is 6.3 times higher in the caregivers with positive attitude towards the vaccine compared with negative attitudes towards the vaccine (OR 6.3, CI 1.9-26.8, $p=0.001$).

DISCUSSION

The recruited caretakers mainly comprised married (98%) females and (2%) single and never married. These respondents commonly reported having other children in addition to the index child involved in the study. Out of one hundred and four caretakers interviewed for this study, there were only four men implying that mothers are the primary caregivers in this setting as reported in other studies among Kenyan infants. There however remains the need to incorporate fathers in the care of infants as advocated in family centered care model for healthcare (Pamela, 2006). Furthermore, fathers' involvement in childcare has been shown to have a positive influence on child social behavior, psychological outcome and general wellbeing (Ball, Mossele & Pedersen 2007). In the current study there appeared to have been minimal involvement of fathers or other male caregivers in caring for children during infancy. It is also noteworthy that while most females in the study were housewives their spouses were commonly engaged in occupational activities that required them to be away from home either as salaried employees or business persons further explaining their limited involvement in seeking healthcare services for the infant.

Conversely, the finding that majority of the respondent were mothers (mothers were the primary caregiver) is explained by the fact that infants in this study were still breastfeeding, hence totally dependent on the mothers (the high numbers of maternal primary caregivers). While emphasizing the need to incorporate male caregivers in providing care for infants, it is important to reinforce maternal caregiver role in order to improve child health.

Maternal Parity showed a significant with vaccine uptake $p=0.003$, with three times more likelihood of parents with two children, and two times likelihood of parents with three children showing poor vaccine uptake compared with mothers who had one child. The mothers with one child were more likely to accept vaccine in this study. This study's finding is similar to study by Antai (2009) in Nigeria which showed that, children of birth order 5+ had a 49% lower likelihood of receiving full immunisation compared with the reference group. It is also supported by study

done by Mutua (2011) in Nairobi urban settlements which demonstrates that higher maternal parity was associated with a lower likelihood of full vaccination among children.

The uptake of PCV was inversely proportional to maternal age and showed statistical significance with vaccine uptake (25-29 years) (OR 5.8, CI 1.4-23.4, $p=0.014$) and (30-34) years of age (OR 1.5, CI 0.5-4.3, $p=0.420$). This age group was more likely to accept their children to be immunised. This group comprised of the mothers in middle adulthood, the difference can be explained by the fact that, the younger mothers are more educated and hence their knowledge on immunisation is consequently more than the older mothers. This agrees with study by Mutua (2011) that maternal age strongly influences the likelihood of child immunisation with older mothers (25-34 years) more likely to have children vaccinated compared with mothers aged less than 20 years. It also agrees with study by Kamau (2001) which describes that mothers in middle adulthood had their children immunised than younger mothers. This finding was in contrast with that of Charles et al (2011) which state that children of older mothers (above 35 years) were more likely to be immunized unlike children of young mothers.

Marital status did not show any statistical significance with vaccine uptake in this study. Out of 104 parents only two mothers were single and 102 were married. This finding agrees with study done in Nairobi urban settlement by Mutua (2011). which stated that marital status of the mother was not significantly associated with full child vaccination, but the finding in this study is in contrast with other studies of Pickering et al (2009) that described that, risk factors associated with under immunisation at 3 months were unmarried respondents. It is also in contrast with study by Charles (2011) done in sub Saharan Africa, which explains that children of single mothers were less likely to be unimmunised.

Level of education was significantly associated with the vaccine uptake. The higher the level of education the more advanced the reasoning and better decision making. Majority of the participants 41.4% attained primary level, while 34.6% completed tertiary education. Caretakers with at least secondary education had higher odds of uptake (OR 5.8, CI 1.5-22.4, $p=0.01$). The higher the level of formal education the better the vaccine uptake as elicited in the study. This finding agreed with earlier findings by Nankabirwa et al (2010) and Masaharu et al (2007) indicating that higher caretaker's education was associated with increased knowledge and opportunity to get children vaccinated. This result is expected since more years of schooling means more rounded knowledge that includes immunisation and its advantage kamau et al (2001).

Income level has a highly significant impact on

vaccine uptake as elicited in this study ($p=0.001$). Children from the poorest households were more likely to be unimmunized than their counterparts from the richest households. Similar findings have been reported in previous study by Antai (2009) on inequitable immunisation uptake in Nigeria, that mothers' household wealth was significantly and proportionally associated with the likelihood of full immunisation. With higher position in the wealth index being associated with increased likelihood of full immunisation.

Mother's occupation was significantly associated with vaccine uptake ($p=0.011$) with mothers who were employed, having higher likelihood to accept vaccine than the house wives and casual laborers. The result findings in this study is supported by that of Mathews *et al* (1997), parental occupation was shown to have statistically significant association with acceptance of immunisation. It further agrees with study by Charles (2011) that Children whose mothers were unemployed were more likely to be unimmunised than those whose mothers were employed.

Client's awareness of vaccine in this study implied to the knowledge on vaccine and access to information. Client's awareness showed a statistical significance with vaccine uptake ($p = 0.011$). These findings are in agreement with other study by Bhuiya (1995) which revealed that, low parental and community knowledge of immunisation and/or, lack of access to information on childhood immunisation could be an important contributor to the high burden of unimmunised children in sub-Saharan Africa (Bhuiya, 1995). This finding also support the study done by Mutua (2011) which showed significant reductions in the number of unimmunized children among parents and communities with access to mass media. Maternal access to media improves the knowledge of the caretaker on the availability of Health interventions and vaccine is not an exception. This study finding also agrees with study done by Charles (2011) that revealed that maternal access to media reduced the odds of a child being unimmunized by 6%. The mothers who access media easily get updated with the current affairs and are more likely to have their children receive immunisation.

There was no significant association of vaccine uptake in this study (in relation to cultural practices, religious beliefs, norms). Despite the fact that cultural practices still influence health seeking behaviour in Kenya, it is not a predominant factor among the respondents at KNH and it did not interfere with vaccination of the children against the killer diseases for instance pneumonia. This was affected by the fact that majority of the participants are from within the urban area (Nairobi county) hence the cultural practice is fading off, for instance use of herbal medicine to cure diseases. The Muslims were the minority in the study (1%). This does not mean that their children are

not immunised. They may be residing far from the health facility and it could also be a sampling error. There is a high level of awareness regarding the PCV availability, with majority of parents/caregivers getting information on pneumococcal conjugate vaccine from the health workers. The main source of information was from health care providers (86.4%). This showed that health care providers are a vital source of information on pneumococcal conjugate vaccine and vaccines in general, majority of the respondents were of the opinion that immunisation ensures adequate health protection to the child. A greater number of these parents were impressed with the attitude of nurses (health personnel) during immunisation process of their children. This also agrees with study by Pickering *et al* (2009) which claimed that for an optimal uptake of PCV, it would be vital for health personnel to adopt an approach which is effective and empathetic as it will reduce the vaccine risk, communication and misinformation while assisting parents in understanding the ultimate need of immunisation.

The positive attitude of the parents can be explained by the fact that the immunisation services of the under five years has been made affordable and accessible to the respondent in the study area and (Chege *et al*. 2002).

In conclusion, the study concluded that factors of the caregivers/parents that are highly statistically significant to the uptake of Pneumococcal Conjugate Vaccine uptake are family and caregivers attitude toward the vaccine. Other determinants the are statistically significant are parity, education level, age and occupation. Also a friendly attitude from health personnel was shown to motivate parents/guardians' adherence to vaccination schedules.

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