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Predictors of pneumococcal immunization uptake among caregivers of children with sickle cell disease in Lagos, Nigeria

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Pulmonary infections are still the most prevalent cause of death of children with sickle cell disease (SCD) in low and middle income countries. Pneumococcal conjugate vaccine (PCV) has been reported to reduce the incidence of pneumococcal disease by up to 90% in children under five. This study set out to report the proportion of children under five attending Lagos University Teaching Hospital (LUTH) and Massey Street Children's Hospital (MSCH) in Lagos that received PCV and the factors influencing uptake. A cross sectional study assessed the sociodemographic characteristics, knowledge and practices of 380 caregivers of children with SCD and the immunization status of the children. Proportion of children who had received routine immunization was 99.7%. However, 87 children (22.9%) had been immunized with PCV and predictors for immunization were attending LUTH, mothers' age, knowledge level of PCV and higher monthly income. The study recommends PCV being made part of the national immunization programme.

Key words: Lagos, Nigeria, sickle cell disease, pneumococcal conjugate vaccine, immunization uptake.

INTRODUCTION

Pulmonary infections are still the most prevalent cause of death of children with sickle cell disease (SCD) in low and middle income countries (Weatherall, 2010). Since sickle cell anaemia (SCA) was declared a public health priority in 2008 (United Nations, 2012), there have been 300,000 births annually of babies with the condition, 75% of them in Africa (WHO, 2012a,b). Figures are projected to rise to 6 million people with SCA (Scott et al., 2011; Makani et al., 2011) given a survival rate of half the normal expected for Africans. Children born with SCD in high income countries (HIC) have better chances of survival than their counterparts from low and middle income countries (LMIC). Pulmonary infections are still the most prevalent cause of death of children with SCA and reports have documented that the risk of early invasive bacterial disease in affected children is 53 to 600 times higher than in the general population (Overturf, 1999; Modell and Darlison, 2008; Intzes et al., 2013; Van Beneden et al., 2010; Science Daily, 2007; Battersby et al., 2010). Comprehensive care that includes parental education, penicillin prophylaxis, pneumococcal vaccination, has been shown to increase the life expectancy of people with sickle-cell disease in developed countries and the Caribbean to 45 to 55 years (WHO, 2006). The efficacy of pneumococcal vaccine has been reported to reduce the incidence of pneumococcal disease by 90% among under five sickle cell patients and 68% among sickle cell patients younger than ten years (Van Beneden et al., 2010; Halasa et al., 2007; CDC, 2012; Adamkiewicz et al., 2008; DeStefano et al., 2008). This study set out to document the proportion of under-five sickle cell patients who had received pneumococcal

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Table 1. Socio demographic characteristic of the participants.

Variables (n = 380)	Frequency (%)
Age (Years)	
18 - 30	105 (27.6)
31 - 40	185 (48.7)
41 - 50	85 (22.4)
51 - 60	5 (1.3)
Sex	
Male	39 (10.3)
Female	341 (89.7)
Marital status	
Never married	4 (1.1)
Married	352 (92.6)
Widowed	24 (6.3)
Occupation	
Housewife/Student	42 (11.1)
Manual	32 (8.4)
Clerical	35 (9.2)
Sales and services	222 (58.4)
Professional/Technical/Managerial	49 (12.9)
Educational level	
Secondary or lower	204 (53.7)
Post-secondary	176 (46.3)
Average monthly income	
<₦20,000	83 (21.8)
₦20-50,000	154 (40.5)
₦50-100,000	62 (16.3)
₦100,000 and over	50 (13.2)
Religion	
Christianity	231 (60.8)
Islam	149 (39.2)
Tribe	
Yoruba	242 (63.7)
Igbo	93 (24.5)
Others	45 (11.8)
Spouse occupation	
NA/Unemployed/Student	42 (11)
Manual	46 (61.1)
Clerical	71 (18.7)
Sales/Services	160 (42.1)
Professional/Technical /Managerial	61 (16.1)

vaccine and the factors that influence the uptake of immunization among care givers of under five children with sickle cell disease.

METHODOLOGY

This was a descriptive, cross-sectional study carried out in two tertiary hospitals purposively selected from the four which provide specialist care to sickle cell disease patients in Lagos State. Lagos University Teaching Hospital (LUTH) and Massey Street Children's Hospital (MSCH) see the highest burden of children with sickle cell disease. A previous study reported the proportion of children with sickle cell anaemia who had been vaccinated was 65.8% which was used to calculate the sample size of three hundred and eighty (Nacoulma et al., 2006). Caregivers were enrolled consecutively at the outpatient clinics of both hospitals proportionate to their patient load. One hundred and fifty one (151) and two hundred and twenty nine (229) caregivers were recruited from LUTH and MSCH, respectively. On recruitment, data was collected using an interviewer-administered, semi-structured questionnaire adapted from the WHO New Vaccine Post Introduction Evaluation Tool and previous studies in Cameroun and South Africa (Njuma, 2011; Africa, 2009; WHO, 2012).

Sociodemographic characteristics of caregivers and the index children collected were age, gender, ethnicity, marital status, level of education, occupation, monthly income, family size and number of children with sickle cell anaemia, history and duration of disease. Knowledge about pneumonia and pneumococcal vaccine was determined as low, moderate and high based on the number of correct responses. The ethical approval for the study was obtained from the Human Research and Ethical Committee of Lagos University Teaching Hospital and the Health Service Commission of Lagos State. Written informed consent was obtained from each participating respondent.

RESULTS

Sociodemographic characteristics

Three hundred and eighty participants were interviewed during the course of the study. The age of the respondents ranged between 25 and 52. The mean age of the respondents was 36.2±6.1 years.

Most of the respondents were females 89.7% (341/380), married 92.6% (352/380), Christians 60.8% (231/380), of Yoruba extraction 63.7% (242/380), and had education up to secondary school level 90% (359/380), with almost half 46% (176/380) having post-secondary school education. Majority (88% (336/380)) were employed along with 89% of the respondents' spouses. Monthly household income was well over the poverty line with 40.5% (154/380) of the respondents reporting between twenty and ₦50,000 (equivalent to $125 t0 $310), and more high income earners than low income earners (29.5 and 21.8%), respectively (Table 1). Less than 9% of respondents (34/380) had suffered the loss of a child to SCA and 14.2% were members of an SCA group. Less than a third (117/380) knew about the existence of a pneumococcal vaccine and their source of information was from a health worker/doctor. In total, 87 children (22.9%) had received the pneumococcal vaccine.

Table 2. Sociodemographic correlates of vaccination status of index child.

Characteristic	Pneumococcal vaccine		Total	χ^2	P
	Yes (%)	No (%)			
Knowledge Level (N=380)					
Poor knowledge	39 (13.4)	251 (86.6)	290		
Moderate knowledge	33 (47.1)	37 (52.9)	70	68.73	0.001
Good knowledge	15 (75)	5 (25)	25		
Average monthly household income (N=349)					
<₦ 20,000	20 (24.1)	63 (75.9)	83		
₦20-50,000	30 (19.5)	124 (80.5)	154	20.29	0.001
₦ 50-100,000	12 (19.4)	50 (80.6)	62		
₦ 100,000 and over	25 (50)	25 (50)	50		
Hospital attended (N=380)					
LUTH	74 (49)	77 (51)	151	94.34	0.0001
MSCH	13 (5.7)	216 (94.3)	229		
Educational level of respondents (N=380)					
Secondary or lower	14 (6.9)	190 (93.1)	204	63.96	<0.0001
Post-secondary	73 (41.5)	103 (58.5)	176		
Gender of caregivers (N=380)					
Female	64 (18.8)	277 (81.2)	341	32.04	0.001
Male	23 (59)	16 (41)	39		

Knowledge and attitudes to pneumococcal vaccine

More than two thirds 70.5% (268/380) of the participants knew that pneumonia could be a deadly disease in children and about half 50.5% (192/380) knew that sickle cell patients are more likely to suffer pneumonia than other children without the disease. Less than a quarter of 22.6% (86/380), the respondents knew that there is a vaccine that can protect against pneumonia. Approximately, one fifth of the participants knew that sickle cell patients are especially in need of pneumococcal vaccine [19.7% (75/380)], pneumococcal vaccine could be given to a child less than one year [15.3% (58/380)], that pneumococcal vaccine is not given as a single dose [16.3% (62/380)], that the vaccine is available in Lagos [19.2% (73/380)] and that a child who has had pneumonia should still be given a vaccine [17.9% (69/380)]. About half 54.5% (207/380) of the respondents knew that pneumococcal vaccine is not part of the routine EPI vaccines. Overall, knowledge of study participants was poor with 76.3% (290/380) getting less than 5 out of 14 possible correct responses to knowledge questions. Knowledge level was significantly positively associated with immunization status of the index child; however, less than two-thirds of the respondents [60.9% (53/87)] who had vaccinated their children were aware of the name and the name and purpose of the vaccine (Table 2). Majority of the respondents [90.8% (345/380)] had a positive attitude towards pneumococcal vaccine. Significantly more caregivers who attended LUTH and received the vaccine, paid for it compared to those that attended MSCH.

Routine and optional vaccine uptake

Majority 99.7% (379/380) had completed their child's routine immunization. Approximately a quarter had received pneumococcal 22.9% (87/380), while 10% of caregivers had taken Haemophilus influenzae type b vaccine (HIB) and Rotavirus (Figure 1).

A binary logistic regression model was used to determine the major significant predictors of vaccine uptake. The strongest significant predictor is the hospital attended by the respondent (OR=15.96, p=0.001). Other strong significant predictors of positive uptake of pneumococcal vaccine include gender (OR=6.22, p=0.001) and educational level (0R=9.61, p=0.001) (Table 3).

A positive knowledge score was also found to be significant predictor for taking the vaccination (OR=1.528, p=0.001). This means that as their knowledge score increases by 1 (one), caregivers were 1.528 times more likely to vaccinate; and caregivers categorized as having

Table 3. Logistic regression of significant predictors of vaccine uptake.

Predictor	P-value	Odds ratio (95% CI)
Hospital attended		
LUTH	0.001	15.96 (8.38 - 30.41)
Educational level		
University	0.001	9.61 (5.17 - 17.88)
Spouse occupation		
Professional/Managers	0.000	8.495 (3.620 - 19.932)
Level of knowledge		
Good knowledge	0.001	7.76 (2.58 - 23.33)
Moderate knowledge	0.001	2.81 (1.49 - 5.26)
Gender		
Male	0.001	6.22 (3.11 - 12.4)
Income		
Over ₦100,000	0.003	3.15 (1.49 - 6.66)

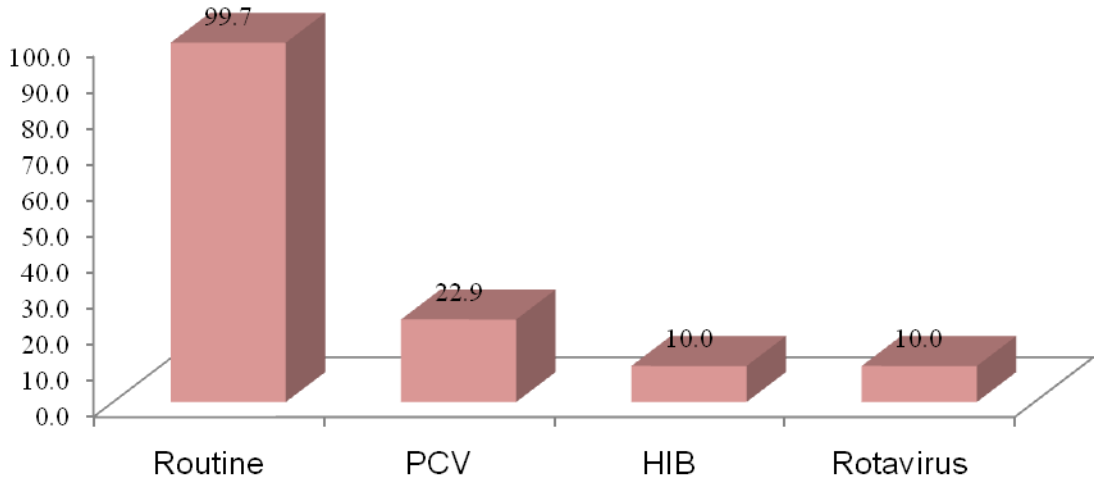

Figure 1. Routine and optional immunization uptake.

'good knowledge' were 7.7 times more likely to immunize the child than those categorized as having 'poor knowledge'. Similarly, a respondent who attended LUTH was 15.9 times more likely to be vaccinated with pneumococcal vaccine than a respondent attending Massey Street Children Hospital. With regard to income the only significant predictor was an average monthly income greater than 100,000 Naira (equivalent to $650.00), otherwise income was not a good predictor.

DISCUSSION

This study conducted over four months in two tertiary hospitals in Lagos State obtained information from three hundred and eighty caregivers of children under five years with sickle cell disease. Those who attended LUTH were more likely to have more knowledge about the dangers of pneumococcal infections in children with sickle cell disease, and vaccinated their children, even though they may not have known the name or purpose of the vaccine. As compared to another studies, the other predictors of PCV uptake were caregivers who had university education, professionals and had good household income (Mutua et al., 2011). It has been documented widely that caregivers with social power from education and high incomes are more likely to take advantage of child

survival strategies (Bosch-Capblanch et al., 2012). Morbidity and mortality from invasive pneumococcal disease has been demonstrated to reduce significantly following widespread use of PCV (Adamkiewicz et al., 2008). There is also documentation of the effect of herd immunity that is conferred on other non-vaccinated children and adults, which can be exploited with selected immunization of children at risk (Roca et al., 2011; Donnan et al., 2013). Sufficient evidence exists to warrant exploring methods of ensuring children with sickle cell disease get preferential immunization with PCV as an interim preventive measure (McGregor et al., 2004; Trotman et al., 2009; Hardie et al., 2009; Piel et al., 2013; Mackenzie et al., 2012).

Conclusion

This study finds that there are clear predictors of PCV uptake but further research is needed to examine other factors that have the potential to influence the universal adoption of PCV (Sohn et al., 2010; Mackenzie et al., 2012). Improving the knowledge of parents and care-givers needs to be more actively pursued for as long as babies are being born with SCD. The authors recommend the adoption of an active surveillance system to generate information that will serve to assist the implementation of routine PCV in national immunization programmes.

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