



Full Length Research Paper

ASSESSMENT OF THE IMPACT OF SOME FACTORS ON ORAL POLIO VACCINE (OPV) SEROCONVERSION LEVELS IN SOME STATES IN NORTH WEST, NIGERIA

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ABSTRACT

About 2.5 million children less than 5 years old die annually in Africa and Asia as a result of diseases that vaccines can prevent. Various factors come into play which cumulatively prevents a child from being adequately protected. A cross-sectional study was done in three states (Kano, Kebbi and Zamfara) to enroll the children into the survey, with the sole aim of determining the proportion of the children having poliovirus antibodies that have sufficiently sero-converted following the administration of OPV. All together 240 children were drawn from different locations within the three states, with 80 children from each state. Detection of antibodies against specific poliovirus serotype in the serum was performed using ELISA test kit manufactured by antibodies-online GmbH. Generally, prevalence of poliovirus antibodies was seen to increase with age. Female children sampled in the study areas had statistically significant (Odds Ratio) ($p < 0.0095$) higher poliovirus antibody prevalence (86.0%) than the male children sampled (72.2%). The poliovirus antibodies difference between the states was statistically significant (Odds Ratio) ($p < 0.0000$). Poliovirus antibody prevalence had some level of association between it and the states where the children reside ($r = 0.16$). Children sampled in the urban areas had higher poliovirus antibody prevalence (75.2%) than their rural counterpart (48.7%). Children whose father's educational level was up to tertiary level had the highest antibody prevalence (100%) when compared with other father's educational level groups. Children whose households were within 5,000 meters away from health facilities that offer routine immunization had higher poliovirus antibody prevalence (93.3%) than those far from it. In conclusion, immunity gaps have been seen when other factors are taken into consideration. Therefore there is the need for relevant authorities or stakeholders to reach out to people and educate them so as to close the gaps.

Key words: Poliovirus, antibody prevalence, education and HF distance.

INTRODUCTION

About 2.5 million children less than 5 years old die annually in Africa and Asia as a result of diseases that vaccines can prevent (GIVS, 2005). Immunization can confer protection to infectious diseases which children are commonly prone to. Unfortunately, in middle income countries such as Nigeria, various factors come into play which cumulatively prevents a child from being adequately protected.

Certain factors play critical role in promoting or preventing a child from being vaccinated against these vaccine preventable diseases (VPDs). Previous studies have shown that uptake of vaccination services were dependent upon factors such as knowledge and attitude of mothers towards immunization (Torun and Bakirci, 2006), availability of health workers (Anand and Barnighausen, 2007) and accessibility to vaccination clinics. Equally important are socio-economic and socio-cultural factors (Chakraborty, 1987). Distance of immunization centre from household of clients, was found to have an effect as well (Mohitul-ameen and Mohammad, 2013). Supply-related factors have a sound effect on immunization status (Jegade and Owumi, 2013).

Any attempt to address these and other key factors will go a long way to improve vaccine acceptability and subsequent protection of children against childhood vaccine preventable diseases (VPDs). Therefore, this present study was carried out to assess the effect of distance of household to immunization site, educational level of household heads and place of residence (rural/urban) of the participants as it affects (oral polio vaccine) OPV seroconversion in Kano, Kebbi and Zamfara States in North West, Nigeria. Study of this nature to our understanding has not been comprehensively undertaken bearing in mind the above named factors in the study area. As the country is close to eradication of the wild poliovirus (WPV), the findings obtained may serve as a basis for an effective placement of interventional steps.

MATERIALS AND METHODS

A cross-sectional sample collecting method was carried out between February 2014 to January 2015 in three States (Kano, Kebbi and Zamfara) to enroll the children into the survey. All together 240 children were drawn from different locations within the three States, with 80 children from each State. Children whose mothers attended a selected Health Facility were randomly included in the study, provided that they were resident in the selected States and were not above 59 months of age.

The study began after the ethical committee of each state gave approval for the research to be conducted. The various approving bodies were: Kano state hospital management board, Kebbi state Ministry of health and Zamfara state hospital services management. Verbal and written consent from parents or caregivers were sought and obtained before taking blood sample. A well structured but simple questionnaire was administered to each child's mother or caregiver.

Blood sample measuring about 5ml was collected from the arm of each of the enrolled children by a trained health worker, into a plain labelled test-tube, placed immediately in an ice pack laden vaccine carrier and transported to the laboratory. The test-tubes were centrifuged at 3,000 revolutions per minute for 5 minutes. Serum was collected in another labelled test-tube and processed immediately or was stored in the freezer at -20°C until when it was convenient to be processed. Detection of antibodies against specific poliovirus serotype in the serum was performed using ELISA test kit manufactured by antibodies-online GmbH.

Statistical methods

The statistical analyses were done using Epi Info version 3.5.4. A p-value of less than 0.05 was considered statistically significant. Regression analysis was done to ascertain association or otherwise.

RESULTS

Older children had the highest poliovirus antibody prevalence, while younger children had the lowest antibody prevalence. Generally, prevalence was seen to increase with age. Antibody difference was found to be statistically significant ($p < 0.05$). However, degree of association between age and prevalence was not very strong ($r = 0.04$) as shown in Table 1. Female children sampled in the study areas had higher polio antibody prevalence than the male. The difference was statistically significant ($p < 0.05$), however, association between antibody prevalence and the sexes was very weak ($r = 0.03$) (Table 1).

Table 1: Percentage of children having poliovirus antibodies to poliovirus serotypes in the different age groups and sexes.

Age (Months)	No. Sampled	No. & % Positive	P value	Regression
0 – 11	50	33 (66.0)		
12 – 23	49	38 (76.6)		
24 – 35	48	37 (77.1)		
36 – 47	47	38 (80.9)		
48 – 59	46	43 (93.5)		
Total	240	189 (78.8)	0.0018	0.04
Gender				
Male	126	91 (72.2)		
Female	114	98 (86.0)		
Total	240	189 (78.8)	0.0095	0.023

Zamfara state children had the highest prevalence of poliovirus antibodies, while Kano state children had the lowest. The difference between the states was statistically significant ($p < 0.05$). Poliovirus antibody prevalence had some level of association between it and the States where the children reside ($r = 0.16$) (Table 2). Children sampled in the urban areas had higher poliovirus antibody prevalence than their rural counterpart. However, antibody prevalence difference amongst the children was not statically significant ($p > 0.05$) between the two areas. Prevalence was very weakly associated with location in the study areas ($r = 0.01$).

Table 2: State and urban and rural distribution of poliovirus antibodies in children.

State	No. sampled	No. positive and %	P value	Regression
Kano	80	45 (56.3)		
Kebbi	80	67 (83.8)		
Zamfara	80	77 (96.3)		
Total	240	189 (78.8)	0.0000	0.16
Location				
Urban	129	97 (75.2)		
Rural	111	92 (48.7)		
Total	240	189 (78.8)	0.1474	0.01

Children whose Father's educational level was up to tertiary level had the highest antibody prevalence (100%) when compared with other educational level groups. The lowest antibody prevalence (56.0%) was observed amongst children whose Father's highest educational attainment was at primary school level. The antibody prevalence difference between the groups was statistically significant ($p < 0.05$), while the association between poliovirus antibody prevalence and education was low ($r = 0.19$) Table 3.

Table 3: Distribution of poliovirus antibodies in children according to father's educational level.

Father's Educational Level	No. sampled	No. positive and %	P value	Regression
Primary level	91	51 (56.0)		
Secondary level	90	79 (87.8)		
Tertiary level	59	59 (100.0)		
Total	240	189 (78.8)	0.0000	0.19

Children whose households were within 5,000 meters away from Health Facilities (HFs) that offer routine immunization had higher poliovirus antibody prevalence. The lowest poliovirus antibody prevalence was found amongst the children whose households were about 1,000 meters away from immunization service point. The difference between poliovirus antibody prevalence and distance to immunization point was statistically significant ($p < 0.05$), however the association between distance and poliovirus antibody prevalence ($r = 0.03$) was very weak (Table 4).

Table 4: Poliovirus antibodies distribution according to child's household distance to nearest immunization site.

Distance in Meters	No. sampled	No. positive and %	P value	Regression
≤ 500	24	18 (75.0)		
1,000 - 1,499	21	13 (61.9)		
1,500 - 1,999	21	14 (66.7)		
2,000 - 2,499	24	21 (87.5)		
2,500 - 2,999	24	17 (70.8)		
3,000 - 3,499	24	19 (79.2)		
3,500 - 3,999	24	18 (75.0)		
4,000 - 4,499	24	19 (79.2)		
4,500 – 4,999	24	22 (91.7)		
≥5,000	30	28 (93.3)		
Total	240	189 (78.8)	0.0000	0.03

DISCUSSION

The data obtained here had affirmed that there was a relationship between age and Poliovirus antibody prevalence as had been seen elsewhere (Adewumi *et al.*, 2006). However, exceptions due to some other reasons do exist (Donbraye *et al.*, 2011). He *et al.*, (2010) are of the view that even though prevalence increases with age, it cannot continue to do so progressively. It was apparent from the result of this study that mothers were not availing their new born for immunization services, hence the low prevalence for 0 – 11 months. However, there was an increase in prevalence as the child ages.

Females in this study had higher prevalence of Poliovirus antibody when compared with males, this finding was in agreement with what Donbraye *et al.* (2011) found. The difference in prevalence was statistically significant. However other studies done, disagree with what was found in this study (Adewumi *et al.*, 2006; Oladejo *et al.*, 2013). Ordinarily, both sexes had equal chances of exposure to either natural infection or the vaccine, as such any difference between the two sexes should not have arisen. Furthermore, vaccination in the country was not gender based. Certain cultural or religious peculiarities might possibly have an effect on the observed outcome. This could be a temporary issue which may possibly be resolved through intense mobilization and sensitization of the concerned authorities and populace. Further investigation is suggested to find out the real cause of the disparity between them.

There was polio antibody prevalence differential in the three States from the data obtained. Refusal levels of OPV amongst the three States even though data was skeletal might have played a significant role as was observed in Pakistan (Mukarami *et al.*, 2014). State's differential in poliovirus antibody prevalence might alternatively be linked to a determined and committed leadership, which many scholars had acknowledged its contributions in reaching a lot more

children in their respective areas of jurisdiction (Lashkevich, 2013), and in most cases influence how immunization programme is being delivered at different service levels.

Even though no statistically significant difference was observed in poliovirus antibody prevalence between the children in urban areas and those in rural areas in this study, as in other studies (Schoub *et al.* 2005). However in places where socio-economic factors come into play, a substantial variation between urban and rural areas had been observed (Sabine *et al.*, 2002). Children in the urban areas were seen to have higher prevalence than those in the rural areas, this might be as a result of inadequacy of services in the rural areas or poor attitude to work by the health workers in those areas.

This study had reaffirmed what was already known, that Father's educational level positively affects child's antibody prevalence (Habib *et al.*, 2013). Result from the study has shown that illiteracy of fathers was an important risk factor for polio eradication activities in the study area. The study, as one of its priorities seeks to find out to what extent does Father's educational level affects child antibody's prevalence. The emphasis on Father's education as against that of mother's educational level was because in the area, where this study was carried out, men predominate in the affairs of the family. Educational and cultural differences in communities had been found to play a significant role in transforming attitudes and behaviours towards vaccination (Vincelik *et al.*, 2007). For example noncompliant (to immunization) heads of households compared to compliant heads of households in Sokoto State, Nigeria had low level of education (Mohammed *et al.*, 2014). Equally observed was that low level of parents' education was found to be associated with non-vaccination during mass campaign in India (Singh *et al.*, 1997). Only in few instances in developed countries, had it been seen that advanced educational status was a major factor in vaccine refusals (Omer *et al.*, 2009). Therefore authorities should consider this issue with all the seriousness it deserves by encouraging parents to enroll their children in schools.

Benefits of short distance from child's household to immunization point have been fully studied in different countries (Cui and Gofin, 2007). The data obtained here seem to support the conclusion that the present strategies to vaccinating children are sufficient to maintain high levels of serological immunity within the study area in respective of distance. This could be that an incentive or other policies had been instituted to attract clients. Bishai *et al.* (2002) reported that outreach services offered to clients by health workers in rural areas, who were far away from HFs rendering routine immunization services, had reduce socioeconomic differentials amongst the clients. The result obtained did not show any significant difference in terms of poliovirus antibody prevalence amongst children ($p = 0.0066$). The reasons are complex and multifaceted, but in general insufficient understanding of the services may account for greater part of the reasons. Studies have shown that children would be vaccinated irrespective of the distance if services were convenient, reliable, friendly, and informative (Ruhul *et al.*, 2013).

This present study showed that appreciating immunization services and presenting children for immunization services was linked to educational level of the father who in most cases instructs the mother to take the child for immunization. Equally important, is the fact that this study has exposed us to the fact that there is an immunity gap in the rural areas in the study area, which could be extended to cover the rest of the rural areas in other Northern States.

The study has also shown that gap exists in rural areas in terms of reaching eligible children with relevant vaccines of parents with little or no education. In conclusion, immunity gaps have been seen when certain factors are taken into consideration. Therefore there is the need for relevant authorities or stakeholders to reach out to people and educate them so as to close the gaps observed.

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