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Full Length Research Article

RAPID ASSESSMENT OF POLIO VIRUS ANTIBODIES PREVALENCE AMONGST CHILDREN IN KANO STATE, NORTH WEST NIGERIA

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ABSTRACT
The completion of poliomyelitis eradication is a global health emergency which must be pursued with vigour. Kano state has remained one of the epicenters for polio virus outbreaks in northern Nigeria. There is paucity of information as it relates to polio antibody prevalence amongst children in the state. Periodic serologic assessment is needed to determine the quality and effectiveness of routine vaccination campaigns carried in the state to rapidly build immunity against poliovirus. Children were randomly selected throughout the state for the assessment between Sept. 2013 and Jan. 2014. Blood samples were collected from eighty children and tested for the presence of antibodies to the three poliovirus serotypes. Indirect ELISA was used to rapidly screen for the antibodies. Epi Info 3.5.4 version was used for the data analysis. Out of the samples collected, 61 (76.3%) had antibodies to all the serotypes. While 73 (91.3%), 66 (82.5%) and 72 (90%) had antibodies to virus serotypes 1, 2 and 3 respectively. Age of the children, number of doses the children had taken and educational level of the children's fathers were statistically significant risk factors on the prevalence of poliovirus antibodies. Access to immunization services must be improved in urban and rural areas so as to effectively reach a large number of children in those places. Effective and high quality campaigns are needed so that every eligible child is reached. Greater focus on good mobilization is also needed to reach children in households in rural areas as well as in households with children whose fathers' educational level was low.

Keywords: Kano, Prevalence, children and polio-antibody

INTRODUCTION
It is now almost three decades that the initiative to eradicate polioviruses by the international community was launched (WHO, 1988). Polioviruses have been known to cause paralysis especially in unimmunized or sub-optimally immunized children (Mark, 2006; Tapani, 2006). Vaccination which enable a child to develop protective antibodies is the only way to prevent him/her from coming down with paralysis (NIAID, 2008). There are three poliovirus serotypes (types 1, 2 or 3) which cause poliomyelitis. They are spread by faecal-to-oral and oral-to-oral transmission (Shibuya and Murray, 2004).Children are thought to play a dominant role in the transmission of Polioviruses within populations (Fine and Ritchie, 2006), although the effect of age alone on the prevalence and severity of poliomyelitis is difficult to specify with confidence (Moore *et al.,* 1982). Poor sanitation and hygiene is thought to contribute to the age profile of cases in developing countries (CDC, 2006).
Reduction in poliomyelitis cases was due to extensive use of two vaccines, the live attenuated oral Poliovirus vaccine (OPV) or the Sabin vaccine (Friedrich, 2000), and the inactivated Poliovirus vaccine (IPV), or the Salk vaccine, (Combiescu, 2007). Seroconversion is poor in most African countries (Mastroeni *et al.,* 1997). Immuno-surveillance is not required by the World Health Organization, but will provide insight into the protective levels of populations particularly in countries with pockets of unvaccinated persons (Van Loon *et al.,* 1998). High (Oderinde *et al.,* 2012) and low (Marta *et al.,* 2013) serum antibody prevalence levels against polioviruses had been reported.
Many scholars had studied the effects of factor association and antibody prevalence in children. Some factors had been found to have statistically significant effect on antibody prevalence, while others did not (Dashe *et al.,* 2010). Factors such as gender, water source, nature of place of residence, in most researches, had no significant relationship, except in few instances like what Mehra and Bansal (1990) reported. In one study it was observed that prevalence of polio-like paralysis was significantly higher in the urban population than in rural areas (Chaturvedi *et al.,* 1978). Likewise immunity level had been found to be correlated with the number of vaccine doses taken (Allen *et al.,* 2010).
The cornerstone of the Global Polio Eradication Initiative (GPEI) is immunization of children with multiple doses of oral poliovirus vaccine (OPV), via both routine immunization (RI) and supplementary immunization activities (SIAs) (CDC, 2010). It is customary in any country where a comprehensive program to vaccinate children against Polioviruses was undertaken; from time to time laboratory study aimed at investigating the immune status of the eligible children or even the entire population to Polioviruses is done (Pacsa *et al.,* 1994).
Kano State in northern Nigeria administers to eligible children basically two different types of Oral Polio Vaccines (bivalent and

trivalent vaccines) for the purpose of vaccinating children during campaigns and routine immunization services respectively. These vaccines were chosen probably because of their unique characteristics (Sutter *et al.,* 2008). Routine immunization and campaigns are some of the strategies for polio eradication (CDC, 2010), which enable children to react and develop antibodies to the introduced antigens. Only three countries (Nigeria, Afghanistan and Pakistan) are polio endemic as against to 125 countries in 1988 (WHO, 2014).

This study is aimed at serologic assessment of the immunization activities carried out in the state, so as to determine the quality and effectiveness of the routine immunization and polio campaigns carried.

MATERIALS AND METHOD

Study Area:
Kano state is located in the north-western part of Nigeria. It is amongst the most populous states of Nigeria. It was created in May 1967 from part of the Northern region. Kano state borders Katsina state to the north-west, Jigawa state to the north-east, Bauchi state to the south-east and Kaduna state to the south-west. The capital of Kano state is Kano.

Study Design:
A health facility based cross-sectional study design involving both quantitative and qualitative approaches was employed. The study was carried out between Sept. 2013 and Jan.2014 in Kano state, northern Nigeria.

Study Population Including Inclusion and Exclusion Criteria:
Children aged between 0 – 59 months were selected in three health facilities in each of the three senatorial districts of Kano state. Children outside this age group or were not resident in the state were excluded from the study as well as children whose mothers or caregivers did not give consent for their enrollment in the study.

Sampling Techniques and Sample Size Estimation:
Mothers with eligible child/children attending one of the three clinics for services were systematically stratified into rural or urban area settlers. Children were randomly enrolled from the three selected health facilities. About 80 children were enrolled across the state. The sample size should have been larger than what was obtained for the study for meaningful interpretation of the data, but mothers were not willing to avail their children for the exercise.

Data Collection Form:
Questionnaires were administered to capture all relevant information and bio - data of participants.

Data Analysis:
All data obtained from the study were analyzed using Epi Info version 3.5.4. A *p*-value < 0.05 was considered to indicate statistical significance.

Ethical Consideration:
Consents were sought and obtained from mothers or caregivers after explaining what the study was all about, before enrolling the children in the study. Ethical clearance was sought from the State Ethical Committee before embarking on the exercise and approval was granted. The study protocol conforms to international ethical guidelines of Helsinki declaration.

Laboratory Analysis:
About 5ml of blood sample was collected from each of the enrolled children into a plain labeled tube. The tubes were transported to laboratory in cold boxes which ice-packs were earlier placed so as to preserve the samples. The tubes containing the samples were centrifuged at 3,000 revolutions per minute for 5 minutes. Serum from the centrifuged sample was collected in another labeled tube and processed immediately or was stored at -20^{o}C until processed. The polio ELISA test kit manufactured by antibodies-online GmbH was used for the detection of specific antibodies against specific polio virus in the serum of participating children.

RESULT

Out of the eighty samples collected, 61 (76.3%) had antibodies to all the serotypes. While 73 (91.3%), 66 (82.5%) and 72 (90%) had antibodies to types 1, 2 and 3 polioviruses respectively. The children in the 12-23 months age group had antibodies to all the three polio virus serotypes (Table1). The antibody prevalence difference was statistically significant between the age-groups. It turns out to be that older children had more poliovirus antibodies than younger ones. Male and female children sampled exhibited different levels of poliovirus antibody prevalence as shown in table 1. The difference however between the two groups was not statistically significant.

Table 1: Poliovirus seropositivity by age-group and sex of the children.

Variable	Sample tested	No. and % positive	DF	X^2 calculated	X^2 Tabulated	P-value	Decision
Age-group							
0 – 11	13	3 (23.1)					
12 – 23	5	5 (100)					
24 – 35	25	19 (76)					
36 – 47	20	18 (90)					
48 – 59	17	16 (94.1)	4	26.9398	9.487729	0.0000	Reject
Gender							
Male	40	32(80)					
Female	40	29(72.5)	1	0.6135	3.841459	0.9694	Accept

Table 2 shows the number of oral polio vaccine (OPV) doses each child was claimed to have received and the corresponding poliovirus antibody prevalence. It was apparent from the data that, children who had higher doses of OPV tends to show more antibody prevalence. The difference between the various groupings was found to be statistically significant ($p<0.05$). Children in the urban areas had more poliovirus antibody prevalence than those from rural areas (table 2), but the difference was not statistically significant ($p >0.05$).Fathers who had education up to tertiary level, their children had the highest poliovirus antibody prevalence (100%), while those children whose fathers' educational level stopped at primary level had the lowest poliovirus antibody prevalence (table 2).

Table 2: Prevalence of poliovirus antibodies by number of doses taken, location and educational level of the father.

Variable	Sample tested	No. and % positive	DF	X^2 calculated	X^2 Tabulated	P-value	Decision
Doses taken							
0	9	2 (22.2)					
1	9	7 (77.8)					
2	15	9 (60)					
3	9	8 (88.9)					
4	22	21 (9 5.5)					
>4	16	14 (87.5)	5	23.0983	11.0705	0.0003	Reject
Location							
Urban	54	44(81.5)					
Rural	26	17(65.4)	1	0.4534	3.841459	0.1153	Accept
Educational level							
Primary	31	20(64.5)					
Secondary	33	25(75.8)					
Tertiary	16	16(100)	2	7.3449	5.991465	0.0254	Reject

DISCUSSION

The 73.6% of the children sampled who had antibodies to all the 3 poliovirus serotypes appeared to be lower than what a country that had eradicated poliovirus reported in a similar survey (Jee *et al.,* 2004). Antibodies to poliovirus types 1 and 3 appeared to be higher than against serotype 2, though other researchers had different results (Simonetta *et al.,* 2004). What was seen in this study could be as a result of children being reached more through campaigns than through routine immunization. Campaigns vaccines are mainly bivalent oral polio vaccines (bOPV), while trivalent vaccine (tOPV) is used during routine immunization. Therefore the number of campaigns the state had could have had a significant effect on the prevalence of poliovirus antibodies. The vaccine type used during vaccination programme actually had an effect on the overall antibody type developed (Richardson *et al.,* 1995).

We found out that age naturally determined the number of doses taken either through routine immunization or during campaigns. That might be the reason why older children had more antibody prevalence than younger ones. Increase of immunity level with age had earlier been associated with age (Adewumi *et al.,* 2006).

We were able to find out that gender had no effect on the overall prevalence of poliovirus antibody, meaning to say that both male and female children had equal chances of being immunized during routine immunization sessions or through campaigns. This agrees well with what had been observed (Adewumi *et al.,* 2006).

This study was able to support previous findings (Chen *et al.,* 1996) that Vaccine doses taken by children affect poliovirus antibody prevalence in the population. However children who were reported to have had more doses of vaccines in some instances had lower poliovirus antibody prevalence. This might be as a result of some mothers' inability to recall the actual vaccine doses taken as in most cases no card was presented to support what the mothers reported.

The state over the years, had built many health facilities especially in urban areas which offer immunization services to clients. While in rural areas, attention had been given to increasing the number of out-reaches conducted by immunization personnel. We found out that, this had resulted in almost closing the gap in terms of poliovirus antibody prevalence between urban and rural areas. This may explain why the difference between the two locations was not statistically significant.

We found out that education as in most other studies (Swartz *et al.,* 1972) had a positive effect on the poliovirus antibody prevalence in the state. The higher the educational level of the father, the higher the prevalence of poliovirus antibody in the children sampled.

Despite the overall progress recorded in the fight against poliomyelitis in Nigeria, a lot needs to be done particularly in Kano state, as the overall result has shown.

More samples should have been taken if not for financial limitation which the study faced. This will provide basis for meaningful interpretation of results. Therefore further studies in this and neighbouring states are recommended involving larger samples to comprehensively evaluate the progress made so far, not only for poliomyelitis but all vaccine preventable diseases.

CONCLUSION

We can reasonably conclude that the age of the children, number of vaccine doses the children had taken and educational level of the fathers were positively associated with the prevalence of poliovirus antibodies. Therefore immunization authorities should study carefully the situation and find possible ways and methods to make good use of these findings, so as to ensure every eligible child is reached and vaccinated. Access to immunization services must be increased, scheduled sessions in urban and rural areas must be adhered to and high quality campaigns should be ensured so as to quickly increase immunity level in the state overall. Greater focus on good mobilization is needed to reach children in households in rural areas as well as in households with children whose fathers' educational level is low.

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