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EFFECT OF PEER EDUCATION ON TIMELINESS AND COMPLETENESS OF ROUTINE IMMUNIZATION: AN ASSESSMENT IN RURAL COMMUNITIES IN NORTH-CENTRAL NIGERIA

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ABSTRACT

Most children in developing countries who start routine immunization do not complete it; this reduces the efficacy of vaccines received. This study set out to assess the effect of Peer Education on timeliness and completeness of routine immunization among children of rural communities in North-Central Nigeria. Multi-stage sampling was used to select Mother-Child pairs. A structured interviewer-administered questionnaire was used for data collection during the pre- and post peer education intervention. Chi-square test was used to determine any statistical association while Logistic Regression test was done to evaluate predictive factors for a child being fully immunized; with p-value of ≤0.05 considered significant. Pre-intervention showed that most respondents had immunized their children in a timely way (study group, 55.4%; control, 50.8%), while post-intervention indicated a statistically significant increase in timeliness of vaccination amongst the study group. However, residing at a location less than 30-minute walking distance from the immunization point was observed to be the most predictive factor for being fully immunized. It was therefore concluded, that Peer Education is an effective way of improving timeliness and completeness of routine immunization and this should be expanded by health workers.

Key words: Immunization, Intervention, Completeness, Timeliness, Peer education.

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INTRODUCTION

Immunizations are among the most successful and cost effective Public Health interventions. Their use has led to regional elimination of and substantial reduction in the mortality/morbidity associated with Vaccine Preventable Diseases (Stern and Markel, 2005; USAID, 2005). Human beings have benefited from the disease preventive ability of immunization for more than two centuries now (Stern and Markel, 2005). Perhaps the World Health Organization's (WHO) most spectacular achievement in disease prevention was the smallpox campaign of the 1960s and 1970s which culminated in the last naturally occurring case of smallpox in Somalia in 1977 (USAID, 2005).

However, the delivery and acceptance of recommended vaccinations is an ongoing challenge for health-care providers and public health systems despite the availability of safe and effective vaccines (Brown et al, 2010; Jombo et al, 2008). Many children who start the immunization schedule either do not complete it or do not keep clinic appointments; this limits the efficiency of immunization (Brown et al, 2010; Wiysonge et al, 2012; CDC, 2010).

Reasons given by mothers for not completing immunization for their children as reported by an African study included lack of knowledge about the number of immunization sessions required to complete the schedule, perception that the child didn't need particular vaccines and past history of side effects (Jombo et al, 2008). These could easily and best be addressed by health education and were found to be more common among mothers who did not attend Antenatal care where health education was provided; had no access to mass media; had more children; and/or had no formal education (Jombo et al, 2008; Wiysonge et al, 2012).

Routine immunization coverage (national average) rates for DPT3 in Nigeria for the years 2005, 2010 and 2011 were 30%, 74% and 59% respectively; comparable to the regional average but far below the globally recommended average of 90% (CDC, 2010; CDC, 2011). Immunization rates in Northern Nigeria are some of the lowest in the world despite the increased level of effort and resources devoted to the immunization program in Nigeria. Full immunization

rates range from 0.0% to 5.7% and rates for OPV-3 range from 12% to 21% despite multiple supplemental poliomyelitis vaccine campaigns each year since 2003 (CDC, 2011; Mapatano et al, 2008; Bernsen et al, 2011). One-fifth of children who begin the vaccination schedule do not complete it, limiting the effectiveness of vaccine doses that they have received and of immunization on a larger scale (Stern and Markel, 2005; USAID, 2005).

Four general problem categories preventing immunization coverage from improving are: Children who do not return for subsequent immunizations; children who need immunization and visit the health centre, but are not immunized by the health centre staff; children and women who never use the health services and lack of geographic access; and problems caused when people do not live close enough to health services (Rosenthal et al., 2004; Usman et al., 2009; Kunle-Olowu et al., 2011).This study set out to assess the effect of Peer Education on timeliness and completeness of immunization among children in a rural setting in North central Nigeria.

MATERIALS AND METHOD

Study area: The study was conducted in two separate communities (Chanso and Zarazong) located within two different Local Government Areas (LGAs) of Plateau State, namely Mangu (study) and Jos East (control) LGAs, respectively.

Chanso is a community in Chanso ward under Gindiri district of Mangu LGA in Plateau State Nigeria, with a population of about 1548 people (National Programme on Immunization, Plateau State, 2011). The people practice mainly Christianity or Islam. They have an estimated children population of 297 who were less than one year of age (National Programme on Immunization, Plateau State, 2011). Only one government owned PHC center exists in Chanso, and it offers routine immunization services for both children and pregnant women once a month on the average. Farming and trading are the two main occupations of the people; producing and trading in food crops like Millet, Maize, yams and vegetables.

Zarazong is a rural community in Jos East LGA with an estimated total population of 1,926 and estimated 319 children less than one year of age (National Programme on Immunization, Plateau State, 2011). It is a rural community of Jarawa indigenes who were mainly farmers, producing crops like yam, millet, maize and guinea corn. There were two health care facilities within the community, both offer routine immunization services weekly, one of which was owned by the LGA Government (National Programme on Immunization, Plateau State, 2011).

Study design: This was a community-based interventional study with pre- and post-Peer Education intervention components.

Study population: This study consisted of mothers in both Chanso and Zarazong communities, who have children that are one year old (or less) and their youngest child as well.

Inclusion criteria: All mothers of children who are one year old (or less) were eligible for inclusion in both study and control populations, provided they would be resident in the locality for six months of the study. Women in their third trimester of pregnancy were also included in the study pre-intervention as they would have had their babies and commenced routine immunization during the course of the study.

Exclusion criteria: Visitors in the community who were not likely to be in the area until the end of the study, and migrant populations (Fulani herdsmen) were excluded from the study. Women who refused to consent and whose children were older than 12 months of age (pre-intervention) were also excluded.

Sample size determination: The minimum sample size (per group) was estimated using the formula for intervention studies (Araoye, 2008)

$$N = \frac{(Z_{\alpha} + Z_{\beta})^2 \times 2 \times p(1-p)}{d^2}$$

Where N= minimum sample size per group; Z_{α} =95% confidence level = 1.96; Z_{β} =20% B error (80% power) = 0.84; P= the proportion in the target population, the state coverage rate as at December 2010 was 63% (National Programme on Immunization, Plateau State, 2011); d= expected difference between experimental group and the control group post-intervention which is 15%.

$N= [(1.96 +0.84)^2 \times 2 \times 0.63 (1 – 0.63) /0.15^2] = 162$

Making adjustment for attrition of 10%, the minimum sample size was 176 mother-child pairs. The minimum sample size per group was therefore 176 mothers/child pairs.

Sampling technique: Selection of subjects was done using multistage sampling technique. This was done in three stages.

Stage I: From the list of the five (5) LGAs in Plateau state, with the least immunization coverage rates,

Mangu and Jos East were purposively selected being the LGAs with the least immunization coverage rates in the state. Mangu was selected using simple random sampling technique by balloting as the study LGA while Jos East was allotted the control LGA.

Stage II: In each of the LGAs selected, all the health wards were listed out to form the sampling frame (19 wards in Mangu LGA, 5 wards in Jos East LGA) and one ward in each LGA was selected by simple random sampling technique using the balloting system: Chanso ward in Mangu LGA and Laminga ward in Jos East LGA were selected.

Stage III: From a list of the 3 communities in Chanso ward and the 3 communities in Laminga ward, one community each was selected by simple random sampling method. This was done by balloting. Chanso community was selected as the study community while Zarazong was selected as the control community.

All the households in the study and the control communities were visited and all the mothers with children less than one year of age and pregnant women in their third trimester were recruited (pre-intervention) to form the study and control populations.

Selection and training of peer-educators: Five respected, female members of the study community whose children are fully immunized were nominated in each community to serve as Peer educators. Criteria for their nomination included: being literate in Hausa or English, ability to communicate fluently in Hausa and the local dialect, being resident in the community for at least 2 years. One each was selected to represent each of the five 'Unguwas' in the community. The Peer educators were trained regarding Routine immunization during a two-day session organized in the Community's PHC clinic by the researchers.

The researchers drew up an action plan to be implemented by the peer educators in the study community; it consisted of regular (at least monthly) one-on-one visits by peer educators to each caregiver/pregnant woman in their 'Unguwa' in order to enquire about their children's immunization status as well as give counseling on the benefits of routine childhood immunization and growth monitoring using the immunization cards. Regular monthly visits were paid to the Peer educators in the study community by the researchers to ensure success of the implementation of the action plan.

Study instruments: A semi-structured interviewer-administered questionnaire consisting of three sections was used in quantitative data collection for the study.

Pretesting of Questionnaire: The questionnaire was pre-tested in Langai village, a village with similar demographic characteristics with the study population.

A child was termed "Fully immunized" if he/she had had all the vaccines required for his age and vaccination was termed " Timely" if taken within 2 weeks of the required date of appointment. This was assessed from the vaccination cards for each vaccine.

Statistical Analyses: The Chi-square test was used to determine any association between certain socio-demographic variables and intervention outcomes while a student t test was used to assess difference in mean knowledge and attitudinal scores pre- and post-intervention. Logistic regression test was also done to evaluate predictive factors for a child being fully immunized. The variables used for Logistic regression were only those that had shown statistically significant association on univariate analysis (using chi-square test). A confidence interval of 95% was used in this study and a p- value of ≤ 0.05 was considered significant.

Ethical considerations: Ethical clearance was obtained from the Jos University Teaching Hospital Ethical Committee before the study commenced (Ref number: JUTH/DCS/ADM/127/XIX/4815).

A written permission was sought and obtained from the Local Government Chairmen and the village heads of both the study and control communities and the aims and objectives of the study were explained. Written informed consent was also sought and obtained from each study and control subject before enrollment into the study. The essence of the study was explained to them and they were assured of confidentiality of any information they gave.

Limitation of the study: The protracted strike of Local Government Workers as well as an on-going renovation of the Chanso PHC made access to immunization increasingly difficult for the mothers and affected the immunization coverage.

RESULTS

The mean age of the respondents was 27.25 ± 6.69 years in the study group and 29.39 ± 7.71 years in the control group; their ages ranged between 18 and 45

years in both groups. Majority of the respondents in both study (61.95) and control groups (54.1%) were aged between 20 and 29 years of age, had attained secondary level of education, lived less than 30minutes trekking distance from the PHC center offering Routine Immunization in their locality and had index children aged between 4 and 7months of age.

In Pre-intervention, most children in both study (55.4%) and control (50.8%) groups had had their last vaccination within 14days of the required vaccination appointment date. Post-intervention, there was a statistically significant difference in timeliness of vaccination in the study group; unlike the control group where majority (54.8%) had not been vaccinated timely.

In Pre-intervention also, the most common vaccination not taken on time in both study (39.4%) and control (44.9%) groups was the third doses of DPT/HBV/OPV vaccine for both study and control groups while the vaccines least likely to be missed was the first doses of the same vaccines. Post-intervention however, while the vaccine most frequently missed was still the same in the control group, it was Measles/Yellow Fever (44.3%) in the study group.

In addition, the greatest proportion of children in the Pre-intervention study group (37.5%) had missed a particular clinic appointment because the clinic staffs were either on strike or the required vaccines were not available. Post-intervention the greater proportion (40.3%) was not immunized because their mothers were busy and didn't keep the clinic appointment.

Logistic regression showed that a child is more likely to be fully immunized for age if he/she was aged between 4 and 7 months ($p = 0.016$), resides less than 30minutes ($p = 0.003$) walking distance from the PHC ($p = 0.003$) and if the mothers' most recent source of information on immunization is the media ($p = 0.027$) a peer educator ($p = 0.012$) or a health worker ($p = 0.038$). The most predictive factor for being fully immunized for age in this study was found to be residing less than 30 minutes walking distance from the immunization point.

Table 1: Socio-Demographic characteristics of Mothers (Pre-intervention)

Variable	Study (n= 176) Freq	%	Control (n=181) Freq	%	χ^2	P-Value
Age group (years)						
<19	19	10.8	10	5.5	12.36	0.0062
20 – 29	109	61.9	98	54.1		
30 – 39	40	22.7	69	38.1		
40 – 49	8	4.6	4	2.3		
Highest educational status attained						
None	27	15.4	22	12.2	3.19	0.3626
Primary	59	33.5	59	32.6		
Secondary	65	36.9	62	34.2		
Tertiary	25	14.2	38	21.0		
Tribe						
Pyem/ Jarawa	77	43.8	88	48.6		
Others*	65	36.9	52	28.7	2.76	0.2514
Hausa/Fulani	34	19.3	41	22.7		
Distance of residence from phc						
< 30 minutes trek	106	60.2	98	54.1	17.36	0.0001
30 – 60 minutes trek	35	19.9	67	37.0		
>60 minutes trek	35	19.9	16	8.9		
Age of youngest child (months)						
0 - 3	46	25.6	50	27.6	2.19	0.5334
4 – 7	48	27.4	51	28.2		
8 – 11	34	18.6	42	23.2		
12 – 15	48	27.4	38	21.0		

Others* = Igbo, Mwaghavul, Mupun, Berom, Rukuba.

TABLE 2: Timeliness of Last Vaccine taken

Timeliness	Study group				Control Group			
	Pre-Intervention (n=176)		Post-intervention (n=163)		Beginning of study (n=181)		End of study (n=177)	
	Freq	%	Freq	%	Freq	%	Freq	%
Yes	98	55.4	111	68.1	92	50.8	80	45.2
No	78	44.6	52	31.9	89	49.2	97	54.8
	χ^2 = 5.518; df = 1; p = 0.019				χ^2 = 1.137; df = 2; p = 0.2860			

Table 3: Vaccine not taken timely

Vaccine	Study group				Control Group			
	Pre-Intervention (n=78)		Post-intervention (n=52)		Beginning of study (n=89)		End of study (n=97)	
	Freq	%	Freq	%	Freq	%	Freq	%
BCG/HBV1/OPV0	18	22.3	6	11.5	23	25.8	29	29.9
DPT1/HBV2/OPV1	4	7.4	3	5.8	2	2.2	6	6.2
DPT2/OPV2	5	8.6	6	11.5	12	13.5	21	21.6
DPT3/HBV3/OPV3	34	39.4	14	26.9	40	44.9	35	36.1
Measles/YF	17	22.3	23	44.3	12	13.6	6	6.2
	χ^2 = 12.94; df = 4; p = 0.012				χ^2 = 8.26; df = 4; p = 0.083			

Key: BCG = Baccille Calmette Guerin Vaccine ; HBV = Hepatitis B Vaccine, OPV= Oral Poliomyelitis Vaccine; DPT = Diphtheria, Pertusis, Tetanus Vaccine; YF = Yellow Fever Vaccine.

Table 4: Major reason for not taking last vaccine on time

Reason	Study group				Control group			
	Pre-Intervention (n=78)		Post-intervention (n=52)		Beginning of study (n=89)		End of study (n=97)	
	Freq	%	Freq	%	Freq	%	Freq	%
No vaccines/strikes	30	37.5	11	21.0	21	23.6	27	27.8
Attitude of staff	15	18.8	4	8.5	23	25.8	25	25.8
Too busy	12	16.2	22	40.3	16	18.0	13	13.2
Fear of side effects	12	16.2	3	7.4	6	6.8	7	4.4
Child was ill	9	11.3	12	22.8	23	25.8	25	25.8
	χ^2 = 26.51; df = 4; p < 0.0001				χ^2 = 2.07; df = 4; p= 0.7230			

DISCUSSION

Only 10% of children studied in a national immunization survey in USA received their routine childhood vaccines on time (Gust et al., 2004). That finding was lower than findings in this study where above 40% of studied children (pre- and post-intervention and in both groups) took their last vaccine on time. This difference can be explained by the fact that while in this study, a vaccination was termed late if taken 2 weeks after the expected date, the USA study defined a late vaccine as being 7 days overdue.

Table 5: Logistic regression of factors associated with being fully immunized

Exposure variables	Odds Ratio	95% CI	p – value
Age of child (months)			
4 – 7	0.202	0.545	0.016
8 – 11	0.386	1.118	0.079
12 - 15	0.395	1.040	0.060
Sex of child			
Male/Female	1.873	3.715	0.072
Highest educational status of Mother			
Primary	1.940	10.651	0.445
Secondary	4.514	23.936	0.076
Tertiary	6.013	47.214	0.088
History of side effects			
Yes/No	0.507	0.225	0.100
Trekking time to PHC (mins)			
<30	0.227	0.604	0.003
30 - 60	0.449	1.080	0.074
Most recent source of immunization information			
Media /Friend	6.193	31.348	0.027
Peer educator/Friend	11.251	74.812	0.012
Health worker/Friend	7.251	47.452	0.038

Furthermore, while the USA study studied four (4) specific vaccines, this study accessed timeliness of the last vaccine only. Results of this study were lower than that of 3 setting in South Africa where timeliness was a little below 90%; however, like the findings in this study, the least timely administered vaccine was the DPT3 or the third dose of the penta-valent vaccine ; (Luman et al, 2002). Akmatov and Mikolaicyzk (2012), a review of studies on the timeliness of vaccination in 31 low and middle income countries, concluded that most countries achieved high up-to-date vaccination coverage. However, there were substantial vaccination delays (as seen in this study) resulting from forgetfulness by mother, misunderstanding of contraindications to immunization as well as health care system delivery problems like strikes and lack of vaccines due to the 'Out-of Stock' syndrome (Akmatov and Mikolajczyk, 2012).

A study in India found that 28.8% of studied children were partially or not immunized because of a past history or the belief of parents that vaccination has 'serious' side effects (Kumar et al, 2010). The NDHS of Nigeria in 2008 recorded that in the North-Central zone of Nigeria, 24.5% of surveyed subjects did not or delayed immunization because of the fear of side effects (National Population Commission, 2008). There was also a statistically significant association between history of side effects and immunization status of children in the control group. The presence of side effects and adverse effects to immunization has resulted in reduction in uptake of vaccination. Researchers have suggested the need for education on the side effects of vaccine to mothers to improve the uptake of immunization and teach mothers how to treat these side effects and report Adverse Events Following Immunization (like convulsions) to relevant health authorities (Page, 2008; Taylor et al., 2002; Smith et al, 2011).

Logistic regression analysis showed the most predictive factor for being fully immunized for age in this study to be getting immunization information from Health workers; other factors included lower age and living closer to the health facility. Other studies also noted a statistically significant association between the age of the child and immunization status (Adeyinka et al., 2009). Getting immunization information from health workers reduces the risk of getting wrong information and also increases the chances of getting explanations for side effects of immunization which are a major concern to parents and affect immunization uptake (Falagas and Zarkadoulia, 2008; Adebayo et al., 2012). Living closer to a health facility ensures both

geographical and financial access to immunization and treatment of complications of immunization when and if they arise; these tend to improve chances of a child being fully immunized for age (Adeyinka et al, 2009; Adebayo et al., 2012).

CONCLUSION/ RECOMMENDATION

This study set out to assess the effect of peer education on timeliness of immunization coverage among children less than one year of age in Chanso community and concludes that: Most respondents immunized their children in a timely manner but the main reasons for missing vaccines were strikes by health workers and fear/experience of side effects. The commonest vaccines not taken in time were DPT3, HBV3 and OPV3. A child was also found to be most likely to be fully and timely immunized if he/she lived within 30 minutes walking distance from the health facility. It is recommended that the use of Peer educators should be expanded by rural health workers in areas with poor immunization uptake, lateness of immunization and low immunization coverage in the country.

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AUTHORS' CONTRIBUTION

Banwat, M.E.: Wrote the manuscript, data entry, data analysis; Bupwatda, P.W.: Data collection; Lar, L.A.: Critique of manuscript; Apagu, A.A., Zoakah, A.I.: Data analysis