Research

Effects of a community volunteer-driven intervention on caregivers' knowledge and practice of childhood immunization in rural communities of Rivers state

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Abstract

Background:
Immunization is a cost-effective public health tool, preventing about three million deaths among children annually. This study was aimed at assessing the effectiveness of a community volunteer-driven intervention in improving caregivers' knowledge and practice of routine childhood immunization in rural communities of Rivers State.

Methods: A randomized controlled study was conducted among caregivers with infants between 0 to 6 weeks of age in rural communities. A total of 368 caregivers enrolled in the study through a multistage sampling technique were randomized into intervention or control groups and followed for 9 months. The intervention was a structured immunization education for caregivers in the intervention group, while the control was left out. Data were collected with a pretested, semi-structured, interviewer-administered questionnaire.

Results: There were 153 (83.2% mothers in the intervention group and 148 (80.4%) in the control group. Their mean ages were 30.2 ± 7.9 years (intervention group); 31.9 ± 10.1years (control group). There was a significantly better knowledge of immunization in the intervention group, 114 (64.9%) compared to the control group, 98 (59.0%) (X2=7.55, p=0.02), and a significantly better practice of immunization in the intervention group, 139 (80.4%) compared to the control group, 97 (58.4%) (X2=21.93, p=0.000). However, the effect size for change in knowledge was small (Cohen W=0.2) and for practice was medium (Cohen W=0.4)

Conclusion: Structured immunization education by trained community members significantly improved the knowledge and practice of childhood immunization among caregivers. And therefore, recommended for improving immunization uptake and child survival in rural communities.

Keywords
Immunization, community-volunteers, caregivers, knowledge, practices, Rivers State

Introduction

Immunization is a cost-effective public health intervention for child survival and prevents an estimated two to three million deaths in children annually from Vaccine Preventable Diseases (VPDs).[1] Globally, an increase in vaccination coverage will prevent more than 14 million deaths, 350 million cases of illness, 8 million cases of long-term disability, and 700 million disability-adjusted life years (DALYs), according to a study on the estimation of the health and economic impact of routine immunization from 2001 to 2020.[2]

Worldwide, approximately fourteen percent of incompletely immunized children live in Nigeria.[1] Not completing prescribed routine vaccines, refusal, and non-compliance to the immunization schedule, among caregivers of children in Nigeria, are a few reasons for the low immunization coverage with more than 3.2 million unimmunized children aged 12 months, resulting in the outbreaks of VPDs in the country.[1] Since the Alma-Ata Declaration, there has been a greater emphasis on the use of community volunteers such as traditional rulers, religious leaders, village health workers, and other community-oriented resources persons in the delivery of primary healthcare services,

particularly in maternal and child health services such as family planning, tuberculosis control programs, guinea worm eradication programs, general health education, malaria control programs, etc.[3]

Current community engagement programmes focus on communication activities such as the use of town announcers and community mobilizers, primarily during immunization campaigns, without actively involving communities in the planning and implementation of such activities.[4,5]

Poor parental knowledge of immunizations has been identified in several studies as the most frequent and often reported barrier to childhood immunization.[6-12]

Low parental immunization awareness and/or limited access to information regarding childhood immunization, may be a major factor in the high burden of unimmunized children in sub-Saharan Africa.[13]

Good knowledge of routine immunization among caregivers, maternal knowledge of the benefits and schedule of immunization services, caregivers' knowledge of the age a child should start and complete immunization, and access to immunization information are independent predictors of vaccination uptake.[6-8]

A systematic review to evaluate the results of community-based initiatives to raise awareness about vaccination for children under the age of six years in India and Pakistan used families, teachers, children, and local leaders in India to attend informational sessions and distribute immunization-related posters and pamphlets in the villages.[14]

In Pakistan, trusted community members reviewed the costs and advantages of childhood immunization as well as the current vaccination coverage rates in their communities.[16] Additionally, they designed local action plans, shared the knowledge they received, and continued other discussions with local households.[14]

The study reported weak evidence in both countries that the interventions would increase participants' knowledge of vaccinations or diseases that can be prevented by vaccination for the intervention group.[14]

Face-to-face interventions for informing or educating parents about early childhood vaccination reported low- to moderate-certainty evidence suggesting that face-to-face information or education may improve or slightly improve children immunization status, parents' knowledge, and parents' intention to vaccinate.[15]

A study on the effects of involving communities in decision-making and action through health education training of traditional and religious leaders to improve vaccination coverage in Cross Rivers State, Nigeria reported an up-to-date immunization coverage of 52%, although there was no evidence of an impact of the intervention on the proportion of children who were up to date with vaccination. The intervention improved the timeliness of the third dose of the pentavalent vaccine (Penta3) and measles vaccination, and the odds of completing pentavalent vaccination increased by about twofold.[16]

Informing parents about the advantages of vaccinating their children, reminding them before scheduled vaccination visits, and getting in touch with parents whose children have missed vaccination appointments all increased childhood vaccination rates.[13]

Limited information exists about the effect of a community-volunteer-driven intervention on immunization knowledge and practice in rural communities of Rivers State that are at high risk for not seeking immunization services for their children. This study was therefore aimed at assessing the effectiveness of a community volunteer-driven intervention on caregivers' knowledge and practice of basic childhood immunization in rural communities of Rivers State.

Methodology

Study Areas

The study was carried out in Emohua and Etche Local Government Areas (LGAs) of Rivers State. These LGAs are in the Rivers East senatorial district. Rivers State is one of the thirty-six (36) states of the Federal Republic of Nigeria and is in the south-south geopolitical zone of the country.

Research Design

A randomized controlled study was conducted among caregivers with infants between 0 to 6 weeks of age in rural communities.

Study Population

The study population consists of caregivers with children 0 to 6 weeks of age. The limit of 6 weeks was chosen to ensure the implementation of the intervention on or before the first dose of the pentavalent vaccine.

***Inclusion criteria*:** (A) Community Volunteers. (1) adult male or female (2) had full permission from the spouse if married (3) chosen and accepted by the community (4) understand the culture and traditional practices of the community (5) can read and write (6) have a source of income (7) willing to offer voluntary service to the community.[17] The volunteers were invited to the participating primary healthcare facilities with the assistance of the heads of facilities and screened by the research assistants.

(B) Caregivers. (1) All caregivers living in the two LGAs and having a child 0 to 6 weeks old (2) caregivers must reside within the two LGAs throughout the study (3) caregivers must have consented to participate in the study.

Exclusion criteria: (1) Caregivers with children having significant co-morbidity such as Sickle Cell Disease, or other serious illnesses such as pneumonia, measles, otitis media, etc. (2) Caregivers who are mentally retarded or physically unable to respond to the questionnaires.[17]

Sample Size Determination

The minimum sample size "n" for the study was determined using the formula for comparing two proportions.[18] Using a pre-intervention coverage of 53%,[19] to detect a change of 15% (68% of fully vaccinated children at post-intervention); at a power of 80%; 5% significant level; and a non-response rate of 10%, the minimum sample size calculated for each group was 181 but 184 was used to give a total of 368 caregivers for both groups.

Selection of Community Volunteers

The number of community volunteers selected for each study group was eight (8) to make a total number of sixteen (16) volunteers for the two groups. The eight (8) volunteers were decided upon using a study on malaria.[17]

Sampling Method

The caregivers were selected using a multi-stage sampling technique.

The first stage was the selection of the Rivers East senatorial district and the selection of Emohua and Etche LGAs by simple random sampling through balloting. The second stage was the selection of 4 Primary Health care facilities from each LGA by purposive sampling method with the assistance of the Medical Officers of Health.

The third stage was the random selection of 46 caregivers from the immunization register of each health facility as it was easier to select those children aged 0 to 6 weeks from the register. In the fourth stage, the list of caregivers was given to the trained community volunteers who approached the caregivers in their households to verify they met the inclusion criteria.

Randomization

A total of 837 caregivers were assessed for eligibility. Four (4) PHCs were selected from each LGA to give a total of 8 PHCs. 469 of these caregivers were excluded, of which 348 did not meet the inclusion criteria and 121 did not give their consent to participate. The remaining 368 caregivers were then assigned randomly to either the intervention group or the control group using a simple 1:1 allocation as shown in figure 1. The subjects were numbered from 1 to 368 and the WinPepi (Windows Programme for the Epidemiologist) version 11.65 statistic software unstratified balanced randomization function was used to generate the allocation sequence. There was allocation concealment as the caregivers were not aware of which group, they belonged to until after the allocation.

Community volunteers

Eight (8) community volunteers were selected for each study group using a study on malaria.[20] Each PHC facility screened and selected ten (10) volunteers from its catchment communities from which two (2) volunteers were selected randomly through balloting to give a total of sixteen (16) community volunteers. The sixteen community volunteers were randomly assigned to either the intervention or control group by balloting. Since the intervention was educational, there was no blinding of the caregivers and the community volunteers. However, the investigators were blinded to the exposure status of the caregivers.

Data collection instrument

The tool for data collection was a pre-tested, interviewer-administered semi-structured questionnaire with open and closed-ended questions adapted from another study.[20]

The questionnaire had four (4) sections. Section 1 was on the sociodemographic profile of the caregivers and their children. Section 2 was on the knowledge of caregivers on immunization/vaccination. There were ten questions on knowledge which included had caregivers heard about immunization/vaccination? mentioning correctly three (3) vaccine-preventable diseases, knowledge on vaccines, is immunization beneficial to children? reasons for immunization/vaccination, age a child should start immunization/vaccination, age a child should complete immunization/vaccination, and knowledge of the immunization schedule.

Section 3 was on barriers to routine immunization services and section 4 was on the practice of immunization, and included when did you start immunization/vaccination for this child? Six (6) correct responses on what the child felt after immunization/vaccination? does the child have an immunization card? did the child complete the immunization according to the schedule? and does the child have a BCG scar?

The same questionnaire was used post-intervention.

Study Procedure

The study was carried out by the researcher with the assistance of eight trained research assistants who were trained for two days on interviewing techniques and record keeping enhancing the validity of the data they collect. The assistants could speak or understand the local languages. The caregivers were interviewed in the English language in their houses, and when necessary, in their native language or the Nigeria Pidgin English also called Nigeria creole for better understanding. A community guide was engaged to assist the research

team in each community. The study was conducted in three phases namely pre-intervention, intervention, and post-intervention (evaluation) phases over ten months (15th of March 2021 to the 21st of January 2022).

The Pre-intervention phase involved the selection of the community volunteers, caregivers of children 0 to 6 weeks old, the development of a research questionnaire, training of research assistants, pre-testing of the questionnaire, and a baseline survey to assess the sociodemographic characteristics of the caregivers, caregivers' knowledge, and practice of immunization. The pre-intervention phase lasted for three weeks.

The intervention involved conduct of a 3-day structured health education training on immunization for eight (8) community volunteers in the intervention arm by the research team. The trained volunteers later trained the selected caregivers. The training was in form of lectures, role-play, interactive sessions, and demonstrations. Posters on vaccine-preventable diseases and child health cards were used as teaching aids. The training sessions were for two (2) hours each day and lasted for six (6) days (3 days each for the volunteers and the caregivers).

The training for the eight (8) community volunteers and caregivers in the control group was on general health promotion such as growth monitoring and oral rehydration therapy as contained in the child health card.

The post-intervention was the evaluation of the intervention when each child attained the age of 9 months. The community volunteers assigned to the two groups had a list of the caregivers with the age of the children at baseline, and they were able to calculate when the children would be 9 months old. The evaluation was done for the intervention and control groups using the same questionnaires for the baseline survey. The outcome measures of the study were the effect of the community volunteers in improving knowledge and practice of immunization post-intervention, among caregivers of children aged 0 to 6 weeks.

Data Management

The data from the baseline and post-intervention surveys were sorted manually and validated by checking the data daily for inaccuracies and inconsistencies by the research team and asking questions in more than one way. The data were then entered into Microsoft Excel 2019 (Microsoft, Redmond, Washington, DC, USA), cleaned, and transferred to IBM SPSS Version 25.0 (IBM, Armonk, New York, USA). The data set was revalidated using the inbuilt validation functions of the IBM SPSS Version 25 and immediately backed up with an external drive.

The responses of the caregivers to questions on knowledge were scored. There were ten questions on knowledge namely heard about immunization, three vaccine-preventable diseases that are prevented by immunization, knowledge about immunization/vaccination, if immunization/vaccination is beneficial, reasons for immunization/vaccination, age a child starts primary immunization/vaccination, age a child should complete primary immunization/vaccination, and knowledge of the immunization schedule.

Each correct response received one mark while an incorrect response or "don't know" response received a zero mark. All the scores were summed up to give a maximum score of 10. The minimum score is zero (0). Scores of 0-3 were classified as poor knowledge, 4 to 6 as fair knowledge, and 7 to 10 as good knowledge.[21]The responses of the caregivers on the practice of immunization were also scored. There were also ten questions on the practice of immunization namely when did you start immunization/vaccination for this child? Six side effects after immunization/vaccination, does the child have an immunization card? did the child complete the immunization according to the schedule? does the child have a BCG scar? Each correct response received one mark while an incorrect response or "don't know" response received a zero mark. All the scores were summed up to give a maximum score of 10. The minimum score is zero (0). Scores of 0 to 3 were classified as poor practice, 4 to 6 as fair practice, and 7 to 10 as good practice.[21] The data generated from the study were analyzed with the IBM SPSS statistics Version 25 and WinPepi (Windows Programme for the Epidemiologist) version 11.65 statistic software. Univariate analysis was performed, and the data were presented as frequency tables. Categorical variables were expressed in percentages while continuous variables were expressed as mean and standard deviation. Comparisons between groups pre-and post-intervention were performed with Student t-test of independent sample means for continuous variables and Pearson Chi-square ($\chi 2$) test for statistical significance. A p-value less than or equal to 0.05 was considered statistically significant at a 95% Confidence Interval. The effect size of the intervention was determined using Cohen W.

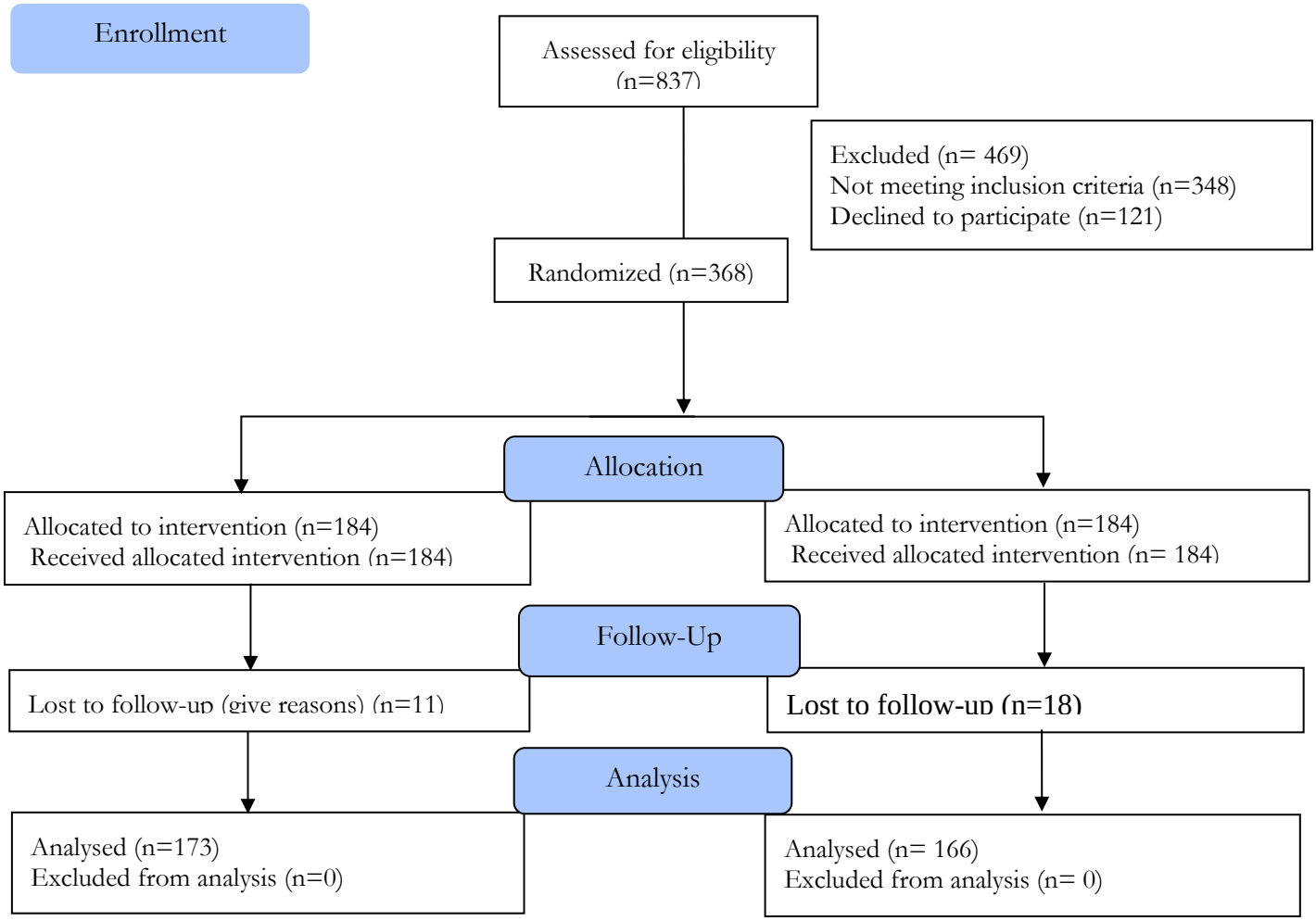

Figure 1. Flow Diagram of Caregivers Screening, Allocation, Follow-up, and Analysis

Results

A total of 368 caregivers were recruited for the study, 184 each for the intervention group and the control group. A total of 339 caregivers completed the study: 173 (94.0%) in the intervention group and 166 (90.2%) in the control group giving an attrition rate of 6.0% for the intervention group and 9.8 % for the control group. All the community volunteers completed the study.

Sociodemographic characteristics of the respondents and their children at pre-intervention

Table 1 shows the sociodemographic characteristics of the caregivers and their children pre-intervention. Most caregivers were mothers (83.2% intervention group: 80.4% control group) with a mean age of 30.2±7.9 years (intervention group) and 31.9±10.1 years (control group).

Most of the children were males (72.3% intervention group: 65.8% control group) with a mean age of 22.6± 9.3 days (intervention group) and 22.2± 8.6 days (control group). Most caregivers were Christians (83.7% intervention group: 87.0% control group) and were married (54.9% intervention group: 37.0% control group).

Knowledge of caregivers on immunization at pre- and post-intervention

Tables 2 and 3 show the knowledge of caregivers on immunization in pre-intervention and post-interventions. All the caregivers in the intervention and control groups have heard about immunization.

Table 1. Socio-demographic characteristics of caregivers and children 0 to 6 weeks old

Characteristics	Intervention group n_1=184		Control group n_2=184		χ^2 (p-value)
	Freq (n)	Percent (%)	Freq (n)	Percent (%)	
Relationship of respondent to child					0.46 (0.499)
Father	31	16.85	36	19.57	
Mother	153	83.15	148	80.43	
Age of caregiver (years)					8.03 (0.091) α
≤20	13	7.07	16	8.70	
21-30	100	54.35	95	51.63	
31-40	54	29.35	42	22.83	
41-50	13	7.07	17	9.24	
≥51	4	2.17	14	7.61	
Mean (SD)	30.20 ± 7.90		31.92 ± 10.10		1.82 (0.072) µ
Sex of caregiver					0.29 (0.589)
Female	153	83.15	148	80.43	
Male	31	16.85	36	19.57	
Age of child (days)					4.21 (0.379) α
0-10	12	6.52	12	6.52	
11-20	72	39.13	69	37.50	
21-30	61	33.15	71	38.59	
31-40	35	19.02	24	13.04	
41-50	4	2.17	8	4.35	
Mean (SD)	22.62 ± 9.27		22.23 ± 8.61		0.42 (0.675) µ
Sex of child					1.54 (0.215)
Female	51	27.72	63	34.24	
Male	133	72.28	121	65.76	
Religion					1.91 (0.384)
Christian	154	83.70	160	86.96	
Muslim	17	9.24	17	9.24	
Traditional	13	7.07	7	3.80	
Marital status					9.82 (0.080) α
Married	101	54.89	80	43.48	
Single	38	20.65	41	22.28	
Co-Habiting	26	14.13	32	17.39	
Separated	10	5.43	19	10.33	
Widowed	4	2.17	10	5.43	
Divorced	5	2.72	2	1.09	

χ^2=Chi-Square; µ=Student t-test; α=Fisher's Exact p

Knowledge of caregivers on immunization at pre- and post-intervention

Tables 2 and 3 show the knowledge of caregivers on immunization in pre-intervention and post-interventions. All the caregivers in the intervention and control groups have heard about immunization.

During pre-intervention, only a few caregivers correctly mentioned vaccine-preventable diseases. Neonatal tetanus was mentioned by 95 (17.2%) in the intervention group and 62 (13.5%) in the control group; tuberculosis by 71 (12.8%) in the intervention group and 52 (11.3%) in the control group; whooping cough 43 (7.8%) in the intervention group and 58 (12.6%) in the control group. There was no statistically significant difference in knowledge of the vaccine-preventable diseases between the two groups (X2=12.40, p= 0.05).

62 (33.7%) in the intervention group and 43 (23.4%) in the control group said a vaccine is to prevent diseases while 52 (28.3%) in the intervention group and 69 (37.5%) in the control group said it is a drug given to children. There was no statistically significant difference in knowledge of vaccines between the two groups (X2=8.90, p= 0.064). The majority of caregivers, 157

(85.3%) in the intervention group and 145 (78.8%) in the control group stated that immunization was beneficial even though the response was not statistically significant (X2=2.66, p= 0.103). Many caregivers in both groups responded that the reason for immunization was because it is good for health and this was statistically significant (X2=16.4, p=0.001). Knowledge of the age a child should start primary vaccination was not statistically significant (X2=3.59, p=0.47), as well as when a child would complete primary vaccination (X2=8.94, p=0.06). A total of 172 (93.5%) of caregivers in the intervention group and 162 (88.0%) in the control group did not know the immunization schedule and this was not statistically significant (X2=3.24, p=0.07).

When the total scores on knowledge were analyzed, good knowledge of caregivers on immunization/vaccination for the intervention group was not statistically significantly higher, 74 (40.2%) in the intervention group compared to the control group, 69 (37.5%) (X2=0.95, p=0.62) and Cohen W showed no effect (0.1). At post-intervention, more caregivers in the intervention group mentioned neonatal tetanus, tuberculosis, and whooping cough as vaccine-preventable diseases than caregivers in the control group. There was a statistically significant difference in knowledge of vaccine-preventable diseases between the two groups (X2=92.98, p= 0.001) and in the knowledge of vaccines (X2=71.17, p= 0.000). 92 (53.2%) in the intervention group and 59 (35.5%) in the control group said a vaccine is to prevent diseases. The response on the benefits of immunization was statistically significant (X2= 8.35, p=0.004) with 162 (93.6%) in the intervention group compared to 139 (83.7%%) in the control group stating that immunization is beneficial. The majority of caregivers in both groups responded that immunization is good for health, 102(59.0%) in the intervention group compared to 86 (57.8%) in the control group and this was statistically significant (X2=11.68, p=0.01). There was a statistically significant improvement in knowledge of when a child should start primary vaccination in the intervention group, 148 (85.6%) compared to 48 (28.7%) in the control group (X2=124.42, p=0.000). Most of the caregivers, 158 (91.3%) in the intervention group; 24 (14.5%) in the control group had significant knowledge of when the child should complete primary vaccination.

Knowledge of immunization schedule was statistically significantly higher, with 159 (91.9%) in the intervention group compared to 67 (40.4%) in the control group (X2=101.29, p=0.000).

Analysis of the total scores on knowledge showed statistically significant good knowledge of caregivers on immunization with 114 (65.9%) caregivers in the intervention group and 98 (59.0%) in the control group (X2=7.55, p=0.021). Cohen W = 0.213 and by Cohen's criteria, this is a small effect size.

Table 2: Knowledge of caregivers on childhood immunization at pre-and post-intervention

Characteristics	Pre-intervention					Post-intervention				
	Intervention group		Control group		χ2 (p-value)	Intervention group		Control group		χ2 (p-value)
	N1= 184	%	N2= 184	%		N1= 173	%	N2= 166	%	
Heard about Immunization?					-					-
Yes	184	100	184	100		173	100	166	100	
No	0	0.00	0	0.00		0	0.00	0	0.00	
Three most mentioned VPDs [Multiple responses] (n1=553; n2=461 (Pre-Intervention); n1=519; n2=498 (post-intervention)					12.398 (0.054)					92.983 (0.001) α*
Tetanus	95	17.18	62	13.45		144	27.75	88	17.67	
Tuberculosis	71	12.84	52	11.28		121	23.31	62	12.45	
Whooping cough	43	7.78	58	12.58		113	21.77	75	15.06	
Malaria	154	27.85	114	24.73		82	15.80	115	23.09	
Typhoid fever	119	21.52	103	22.34		37	7.13	93	18.67	
Diarrhoea	59	10.67	54	11.71		22	4.24	57	11.45	
Hypertension	12	2.17	18	3.90		0	0.00	8	1.61	

Characteristics	Pre-intervention					Post-intervention				
	Intervention group		Control group		χ2 (p-value)	Intervention group		Control group		χ2 (p-value)
	N1= 184	%	N2= 184	%		N1= 173	%	N2= 166	%	
Knowledge of vaccine					8.903 (0.064)					71.17(0.000)*
To prevent disease	62	33.70	43	23.37		92	53.18	59	35.54	
A drug for children	52	28.26	69	37.50		7	4.05	39	23.49	
Improve child immunity	15	8.15	20	10.87		69	39.88	30	18.07	
Is an injection	50	27.17	42	22.83		5	2.89	24	14.46	
Don't know	5	2.72	10	5.43		0	0.00	14	8.43	
Think immunization is beneficial?					2.659(0.103)					8.35 (0.004)*
Yes	157	85.33	145	78.80		162	93.64	139	83.73	
No	27	14.67	39	21.20		11	6.36	27	16.27	
Reasons for vaccination					16.36(0.001*					11.679(0.009*
For good health	117	63.59	112	60.87		102	58.96	86	51.81	
For child development	30	16.30	29	15.76		22	12.72	27	16.27	
Prevent childhood diseases	12	6.52	33	17.93		43	24.86	32	19.28	
Don't know	25	13.59	10	5.43		6	3.47	21	12.65	
Age child starts vaccination					3.586 (0.465) α					124.417 (0.000) α*
At birth	55	28.26	51	27.72		148	85.55	48	28.74	
24 hours after birth	101	54.89	97	52.72		25	14.45	57	34.13	
Age 21 days	13	27.72	16	8.70		0	0.00	32	19.16	
Age 30 days	3	1.63	9	4.89		0	0.00	0	0.00	
0-1 years	12	6.52	11	5.98		0	0.00	29	17.47	

***Statistically significant (p<0.05); χ^2=Chi-Square; α=Fishers Exact p.**

Table 3: Knowledge of caregivers on childhood immunization at pre-and post-intervention

Characteristics	Pre-intervention					Post-intervention				
	Intervention group		Control group		χ2 (p-value)	Intervention group		Control group		χ2 (p-value)
	N1= 184	%	N2= 184	%		N1= 173	%	N2= 166	%	
Age child completes vaccination					8.935 (0.063)					125.441 (0.000) α*
4months	13	7.07	17	9.24		2	1.16	23	13.86	
6months	18	9.78	20	10.87		13	7.51	35	21.08	
9months	17	9.24	16	8.70		158	91.33	24	14.46	
2years	102	55.43	116	63.04		0	0.00	60	36.14	
Don't know	34	18.48	15	8.15		0	0.00	24	14.46	

Know the immunization schedule?					3.241(0.072)					101.288 (0.000) *
Yes	12	6.52	22	11.96		159	91.91	67	40.36	
No	172	93.48	162	88.04		14	8.09	99	59.64	
Overall Knowledge					0.953(0.621)					7.547 (0.021)*
Good (7-10)	74	40.22	69	37.50		114	65.90	98	59.04	
Fair (4-6)	63	34.24	72	39.13		48	27.75	42	25.30	
Poor (0-3)	47	25.54	43	23.37		11	6.36	26	16.66	
Effect size determined by Cohen W		**Cohen W=0.072**					**Cohen W=0.213**			

*****Statistically significant (p<0.05); χ^2=Chi-Square; **α**=Fishers Exact p. Cohen Effect size: 0.2= small; 0.5= medium; 0.8=large.

The practice of childhood immunization among caregivers at pre-and post-interventions

Table 4 is on the practice of immunization among caregivers pre-and post-intervention. Most of the caregivers started immunization at the birth of the child, 153 (83.2%) in the intervention group and 142 (77.2%) in the control group. The age at which the child commenced the immunization was not statistically significant (X2=2.13, p=0.55).

At pre-intervention, fever was the commonest adverse event following immunization as reported by the caregivers, with 72 (26.9%) in the intervention group and 67 (25.7%) in the control group while 128 (47.8%) in the intervention group and 134 (51.3%) in the control group reported no adverse event. There was no statistically significant difference in the adverse events following immunization between the two groups (X2=7.26, p=0.30). All the caregivers in both groups had immunization (child health) cards.

The majority of caregivers, 103 (56.0%) in the intervention group; 112 (60.9%) in the control group did not complete the immunization of the children according to the national immunization schedule and this was not statistically significant (X2=0.91, p=0.34) at pre-intervention. BCG scar was reported in 79 (42.9%) of children in the intervention group and 86 (46.7%) in the control group although there was no statistically significant difference between the two groups (X2=0.54, p=0.46) at pre-intervention.

When the total scores on the practice of immunization were analyzed at pre-intervention, the good practice of caregivers on immunization/vaccination in the intervention group was not statistically significantly higher, 56 (30.4%) compared to the control group, 47 (25.5%) (X2=1.12, p=0.57) and there is no effect according to Cohen W (0.078).

Post-intervention, fever was also the commonest adverse event following immunization as reported by the caregivers, 133 (51.4%) in the intervention group and 115 (33.8%) in the control group. 16 (6.2%) in the intervention group and 9 (2.7%) in the control group reported no adverse event. There was a statistically significant difference in the adverse events following immunization between the intervention and the control group (X2= 30.96, p=0.000). All the caregivers in both groups kept immunization (child health) cards.

The majority of caregivers, 113 (65.3%) in the intervention group and 77 (46.4%) in the control group completed the children's immunization according to the national immunization schedule post-intervention, and there was a statistically significant difference between the two groups (X2=12.33, p=0.000).

BCG scar formation was seen in 161 (93.1%) of children in the intervention group and 156 (94.0%) in the control group at post-intervention although there was no statistically significant difference between the two groups (X2=0.12, p=0.73). When the total scores on the practice of immunization were analyzed post-intervention, good practice of caregivers on immunization/vaccination in the intervention group was statistically significantly higher, 139 (80.4%) compared to the control group, 97 (58.4%) (X2=21.93, p=0.000) but the effect of the intervention on knowledge is medium by Cohen's criteria (Cohen W =0.372).

Table 4. Practice of childhood immunization by caregivers at pre-and-post-intervention

Characteristics	Pre-intervention					Post-intervention				
	Intervention group		Control group		χ2 (p-value)	Intervention group		Control group		χ2 (p-value)
	N1= 184	%	N2= 184	%		N1= 173	%	N2= 166	%	
When did you start vaccination for this child? (n1=184; n2=184)					2.126 (0.0547)					2.126 (0.0547)
At birth	153	83.15	142	77.17		153	83.15	142	77.17	
2 weeks of age	20	10.87	26	14.13		20	10.87	26	14.13	
1 Month of age	5	2.72	7	3.80		5	2.72	7	3.80	
Don't know	6	3.26	9	4.89		6	3.26	9	4.89	
What did the child feel after vaccination? [*Multiple responses*] n1=268; n2=261(pre-intervention); n1=259; n2=340 (post-intervention)					3.033 (0.220)					30.958 (0.000) *
Fever	72	26.87	67	25.67		133	51.35	115	33.82	
Body pain	18	6.72	15	5.75		21	8.11	37	10.88	
Rash	9	3.36	7	2.68		12	4.63	27	7.94	
Body weakness	23	8.58	19	7.28		19	7.34	32	9.41	
Body Swelling	5	1.87	13	4.98		52	20.08	94	27.65	
Diarrhoea	13	4.85	6	2.30		6	2.32	26	7.65	
Nothing	128	47.76	134	51.34		16	6.18	9	2.65	
Does the child have an immunization card?					-					-
Yes	184	100	184	100		173	100.00	166	100.00	
No	0	0.00	0	0.00		0	0.00	0	0.00	
Completed immunization on schedule?					0.906(0.341)					12.326 (0.000) *
Yes	81	44.02	72	39.13		113	65.32	77	46.39	
No	103	55.98	112	60.87		60	34.68	89	53.61	
Does the child have BCG scar?					0.538(0.463)					0.116(0.733)
Yes	79	42.93	86	46.74		161	93.06	156	93.98	
No	105	57.07	98	53.26		12	6.94	10	6.02	
Overall practice					1.123(0.570)					21.927(0.000) *
Good (7-10)	56	30.43	47	25.54		139	80.35	97	58.43	
Fair (4-6)	49	26.63	51	27.72		20	11.56	28	16.87	
Poor (0-3)	79	42.93	86	46.74		14	8.09	41	24.70	
Effect size determined by Cohen W		**Cohen W=0.078**					**Cohen W=0.372**			

*****Statistically significant ($p<0.05$); χ^2=Chi-Square. Cohen Effect size: 0.2= small; 0.5= medium; 0.8=large**.**

Discussion

All the caregivers in both groups have heard about immunization. This finding is expected because of the increase in awareness of immunization in health facilities through health talks by health workers, and communities through town announcers, mass media, immunization campaigns, and recently the Covid-19 pandemic awareness creation as was also reported in a similar study.[20]

The study showed that structured immunization education by trained community members significantly improved parental knowledge and practice of immunization as was reported in similar studies.[15,22-25] A study, however, reported the little effect of an immunization education intervention on knowledge and practice of immunization.[26]

There was a significant improvement in the knowledge of VPDs as caregivers in the intervention group correctly mentioned three VPDs namely neonatal tetanus, tuberculosis, and whooping cough post-intervention. Another similar study reported that the majority of mothers had a good awareness of vaccine-preventable diseases such as poliomyelitis, tuberculosis, and measles.[27]

The understanding of what a vaccine is, significantly improved in the intervention group, (53.2%) compared to the control group (35.5%) as reported in another study.[20]

Knowledge of vaccines is very important for the effective acceptance of vaccines and utilization by parents. Low vaccination coverage in children is largely due to the lack of knowledge of vaccines by healthcare providers and parents.[9,12]

Most of the caregivers in both groups stated that immunization is beneficial. Similar findings on the benefits of immunization and vaccine uptake were reported by other studies.[13,20] When caregivers are knowledgeable about immunization, there will be an increase in vaccine uptakes thereby reducing vaccine hesitancy and increasing immunization coverage.[13]

The majority of caregivers in both groups said that immunization is good for health as was reported in another study.[20] This response is expected to increase immunization coverage.

Most caregivers knew the age a child should start and complete the primary immunization in the intervention group. Knowledge of the age a child should start, and complete primary immunization is an important factor for full immunization of the child. [20,28,29]

The knowledge of the immunization schedule significantly improved in the intervention group (91.9%) compared to the control group (40. 4%) post-intervention. Knowledge of the immunization schedule is necessary for improving immunization coverage.[7,29,30]

Several studies on caregivers' knowledge of immunization identified poor knowledge of parents on immunization as the most occurring and consistently reported hindrance to childhood immunization.[6-13]

Overall, there was a statistically significant good knowledge of caregivers on immunization with 114 (65.9%) caregivers in the intervention group and 98 (59.0%) in the control group similar to other studies.[16,22,23]

Most of the children who were recruited into the study were vaccinated at birth. 83.2% in the intervention group and 77.2% in the control group although this number was higher than the 41.3% observed in a similar study.[20]

Fever was the most frequently reported adverse event in both groups, but pain was the most frequently reported side effect after immunization in another study.[20]

There was a significant good practice of caregivers on immunization in the intervention group, 139 (80.4%) compared to 97 (58.4%) in the control group similar to the findings of other studies.[20,31]

All the caregivers in both groups retained the child's health card. This was expected as the caregivers were enrolled using the immunization records of the primary health care facilities and were told to retain the immunization cards for subsequent visits and for school enrollment. The finding is similar to a study that reported that mothers in the intervention group were 17% more likely to save the card and provide proof of vaccination for outcome assessment.[23]

There was a significant difference in the completion of immunization according to the national schedule between the two groups. 65.3% in the intervention group and 46.4% in the control group completed the primary immunization according to the schedule. A study reported 57.3% completion of immunization according to the national schedule in rural areas.[20] The completion of the immunization according to the schedules is further evidence of the effectiveness of the intervention.

Most of the children developed the BCG scar, 93.1% in the intervention group and 94.0% in the control group. The absence of the BCG scar is an indication of poor injection technique by the health workers as scar formation from BCG is a proxy measure of injection technique.

The success of the community-based volunteer-driven educational intervention in improving health-seeking behaviour may be due to the focused nature of the intervention and the fact that it was given by trained community members who understood the sociocultural characteristics of the caregivers.

The intervention group receiving the focused education on immunization is more likely to understand and retain its content and modify its behaviour, compared to the control group who did not receive any education on immunization.

Implications of the study

The findings from this study support the Federal Government initiative on the Community Health Influencers, Promoters, and Services (CHIPS) programme designed to improve on the Village Health worker (VHW) concept to provide integrated health services including health education on immunization in rural communities of the country.

In practice, community volunteers are useful in immunization services especially in health education, community mobilization during immunization campaigns, and the administration of the oral polio vaccines. There is limited information on their effects on improving knowledge and practice of childhood immunization. However, there is the issue of sustenance if adequate funding from Government and Partners (World Health Organization, UNICEF, etc.) is not provided for their training, logistics, and supervision.

Future research should be on the economic evaluation of the community volunteer-driven intervention in improving the knowledge and practice of caregivers on childhood immunization in rural communities of Rivers State.

Limitations of the study

The limitation of the study is that though it is a randomized control trial, there was no blinding of the community volunteers and the caregivers as the intervention was educational. This however did not significantly affect the outcome of the study as the investigators assessing the outcome post-intervention were blinded to the exposure status of the caregivers

Conclusion

Structured immunization education administered by community members to caregivers, significantly improved the knowledge and practice of routine childhood immunization among caregivers. Although the effect on the knowledge of caregivers on immunization is small and medium for the practice of immunization, the findings are important for improving immunization coverage in rural communities of Rivers State.

The government should consider the training of community volunteers and engage them in the provision of essential health services including immunization in rural communities to bridge the gap in the shortage of healthcare workers.

Ethical approval

Ethical approval was obtained from the Ethics Committee of the University of Port Harcourt. Permission was obtained from the Medical Officers of Health in charge of Emohua and Etche local government areas. Informed consent was obtained from heads of households, community volunteers, and caregivers with children 0 to 6 weeks old. Verbal consent was obtained where written consent was not possible.

Authors' contributions

Nduye C.T.Briggs conceptualized, planned, collected the data for the study, and prepared the manuscript. Charles I. Tobin-West also conceptualized, planned the study, interpreted the results, and proofread the manuscript. Oluseye Babatunde also interpreted the results and made useful inputs to the manuscript. All the authors read and approved the final version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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