Original Research Article

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20163935

Determinants of uptake of pentavalent vaccine in Benin city, Southern Nigeria

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Received: 01 September 2016 **Accepted:** 29 September 2016

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ABSTRACT

Background: The Nigerian government in 2012 introduced the pentavalent vaccine into her routine immunization schedule with a view to fast track reduction in child mortality. Despite the advantages of pentavalent vaccine, it has been linked to adverse effects following immunizations including clusters of infant deaths. The objective of the study was to assess knowledge, attitude and experience of care-givers whose under-fives are receiving pentavalent vaccines as determinants of uptake of the vaccine in Benin city.

Methods: A descriptive cross-sectional study design was utilized for this study. Data was analyzed using IBM SPSS version 21.0 software. The level of significance was set at p<0.05. A total of 720 care-givers with mean age (SD) of 29.02±4.8 years participated in this study.

Results: The About three-quarters 554 (76.9%) of caregivers had a good knowledge on pentavalent vaccines. Good knowledge increased with increasing level of education and being married ($p \le 0.001$ and p = 0.015 respectively). Majority, 568 (78.9%), of caregivers had a positive attitude towards the pentavalent vaccination. With increasing level of education, there was an increase in the proportion of caregivers who had a positive attitude towards the vaccine ($p \le 0.001$).

Conclusions: Two hundred (27.8%) caregivers had children who had experienced at least a side effect following pentavalent vaccination. Of these, 171 (85.5%) were willing to continue with the vaccine despite AEFIs experienced.

Keywords: Attitude, Benin city, Determinants, Knowledge, Pentavalent

INTRODUCTION

The Nigerian government in 2012 introduced the pentavalent vaccine into her routine immunization schedule with a view to improving child health and to fast track reduction in child mortality, in line with the Millennium Development Goal (MDG 4) targets. Pentavalent vaccine is a combination of five vaccines-inone that prevents diphtheria, tetanus, whooping cough, hepatitis B and Haemophilus influenza type b, all through a single dose. ^{2,3} The Global Alliance for Vaccines and Immunizations (GAVI) and the World Health

Organization (WHO) recommended its use in developing countries to replace the DPT vaccine. The underlying reason was to increase the uptake of the hepatitis B (HB) and Haemophilus influenzae type b (Hib) vaccines in these countries by piggybacking these on the DPT vaccine. Nigeria has been described as "highly strategic" in efforts to reach the final 20% of the world's children who still do not have access to routine immunization. This is because the country accounts for an estimated 1.7 million of the 19.3 million children who did not receive routine immunization and is one of the six countries that accounts for half of worldwide childhood deaths. With its introduction, nearly 400,000 cases of haemophilus

influenza type B would be prevented with about 27,000 lives saved annually in Nigeria.²

Despite the advantages the pentavalent vaccine has to offer in the attainment of MDG 4, they are creating a wide spread controversy and have been linked to Adverse Effect Following Immunization (AEFIs) including clusters of infant deaths in every South East and South Asian country where it has been introduced. Inadequate levels of immunization against childhood diseases remain a significant public health problem in resource-poor areas of Nigeria. Vaccines are generally given to healthy children and therefore the tolerance of the public towards vaccine-related adverse-reactions is low. In Nigeria, fear of AEFIs has been documented to be one of the main causes of lack of immunization. 10 Although no official documentation on AEFI exists presently, an increase in AEFI due to the introduction of the pentavalent vaccine may further reduce immunization coverage. Also, caregivers' knowledge about vaccination immunization and their attitudes towards them, are also likely to influence uptake.11 This study was thus carried out to document the knowledge, attitude towards and experience of care-givers whose under-fives are receiving pentavalent vaccines in Public and Private facilities in Benin City.

METHODS

This study was a cross-sectional study, carried out in University of Benin Teaching Hospital (UBTH) and St. Philomena Catholic Hospital (SPCH), both in Benin City, Edo State. Edo State is one of the thirteen states and FCT that benefited from the country's effort in implementing the first phase of the pentavalent vaccine immunization. UBTH is a tertiary hospital established in 1973 to compliment her sister institution, the University of Benin and to provide secondary and tertiary care to the State and its environs. It also provides necessary facilities for training of high and middle level manpower for health industry and also involved in research activities in the immediate locality. SPCH is a mission hospital established 62 years ago and is located in the centre of Benin City, the Edo State capital. In both hospitals, immunization services are carried out by the Public Health Nursing Department. Both hospitals run an effective cold chain system and immunizations are carried out on weekdays. Under-fives are immunized using the National Programme on Immunization protocol.

Study population comprised caregivers and their index under-fives receiving routine immunization at both hospitals. Caregivers of under- fives who have received at least one dose of the pentavalent vaccine made up the inclusion criterion. The study was carried out over a 3 month period (June – August, 2014). A minimum sample size of 247 was determined by using the Fisher's formula. Systematic sampling technique was utilized in selecting the respondents for this study. Immunizations were carried out on weekdays in both hospitals. On each

immunization day, using a sampling frame of the number of under-fives scheduled to receive immunization on each clinic day, every kth respondent was selected for the study until the minimum sample size is achieved.

A structured interviewer-administered questionnaire consisting of open and closed ended questions was used to obtain information and data relevant to the study objectives. The questions were grouped into 4 sections to gather information on the socio-demographic characteristics of the care-givers and their index under fives, their knowledge of pentavalent vaccine, their attitude towards pentavalent vaccine and also, to document their experience (if any) of AEFI in under-fives receiving the pentavalent vaccines as well as their willingness to continue with the vaccine.

Ethical clearance to conduct this research was sought and obtained from the University of Benin Teaching Hospital Research Ethics Committee. Permission was also sought from the Administrator of St Philomena Catholic Hospital and Head of Department, Public Health Nursing, U.B.T.H. Benin City. Written informed consent was obtained from respondents. In order to ensure confidentiality, serial numbers rather than names were used to identify the respondents.

The questionnaires were screened for completeness, coded, entered into the IBM SPSS version 21.0 software and analysed. A total of 24 questions were used to assess knowledge under 6 domains (composition of pentavalent vaccine, dosage, route of administration, age at which vaccine is administered, health benefits and adverse effects following pentavalent vaccine administration). A score of 1 was awarded for a correct answer and 0 for a wrong answer. Minimum and maximum scores for each domain was calculated and scores were converted to percentages and graded as poor (Scores 49.9% and below,) fair (50.0 to 74.9%) and good knowledge (75.0% and above). A total of 7 questions were used to assess the attitude of the caregivers concerning the pentavalent vaccine using a 3-point likert scale. Best responses were awarded 3 marks and worst responses 1 mark, giving a total minimum score of 3 and maximum score of 21. The total attitude score was calculated and converted to percentages and graded as negative attitude (scores 49.9% and below) and positive attitude (Scores 50.0% and above). The questions used in scoring knowledge and attitude were internally consistent and reliable with a Cronbach's alpha value of 0.897 and 0.748 respectively.

Test of associations were carried out using Chi squared tests or the Fisher's exact test where appropriate for associations between socio-demographic variables such as age, sex, religion, occupation, and socioeconomic status of caregivers and independent variables such as knowledge of and attitude towards pentavalent vaccine. The level of significance of all statistical associations was set at p<0.05.

RESULTS

A total of 720 questionnaires (comprising 430 respondents from the government facility and 290 respondents from the private facility) were analyzed for this study. Majority, 500 (69.4%), of caregivers in both health facilities were within the age group of 25-34 years. The mean age of care givers was 29.02±4.8 years. There were more females care givers, 703 (97.6%) than males in the health facilities. A higher proportion, 346 (48.1%), of caregivers had secondary level of education. Also, a higher proportion, 419 (58.2%) of spouses of caregivers had tertiary level of education. Majority, 695 (96.5%) of caregivers were Christians. There was also a higher proportion, 678 (94.2%) of married caregivers and monogamous marriages, 656 (91.1%) in both facilities. Most caregivers had between 1-3 children, 602 (83.6%) in their families and majority, 637 (87.4%), of caregivers had 1-3 children (Table 1).

The mean age of under-fives was 6.09 ± 6.3 months. Majority of under-five children, 627 (87.1%) were within the age group of 0-11 months. A higher proportion 369 (51.3%) of the under-five children were males (Table 1).

Majority, 683 (94.9%), of respondents were aware of pentavalent vaccine in both facilities. A higher proportion of respondents, 673 (93.5%), picked health workers as their source of information while the source of information with the lowest number of respondents was school and neighbours 2 (0.3%) (Table 3). About a third of the respondents knew the correct composition 274 (40.1%); dosing, 555 (77.1%); route of administration, 612 (86.6%); number of doses 517 (75.7%) of pentavalent vaccine. A higher proportion, 230 (39.4%) of respondents believed that the main health benefit of the pentavalent vaccine was to boost immunity while over three-quarters, 161 (79.3%) stated fever as a major side effect of being vaccinated with the pentavalent vaccine. Overall, most 554 (76.9%) of caregivers had a good knowledge on the pentavalent vaccines (Table 2).

Majority of the caregivers 598 (87.6%), agreed pentavalent vaccine was important while approximately half of caregivers 339 (49.6%), felt that pentavalent vaccine should not be free. Some caregivers, 128 (17.8%), felt only one dose of pentavalent vaccine was enough. Only a few caregivers, 34 (4.7%) felt mothers should be encouraged to attend immunization regularly. Few, 49 (7.2%), of caregivers thought rainfall and distance were good reasons to default immunization visits and 564 (78.3%) caregivers felt that vaccination should be stopped in the case of an adverse reaction. Overall, majority, 568 (78.9%), of caregivers had a positive attitude towards the pentavalent vaccination (Table 3).

Two hundred (27.8%) caregivers had children who had experienced at least a side effect of pentavalent vaccination. Majority, 105 (52.5%), of caregivers stated their child had experienced fever and a majority, 65

(93.0%), of caregivers stated they administered paracetamol to their children as the main palliative measure. Fourteen (20.0%) had AEFIs serious enough to warrant visiting the hospital. Of the care givers who had experienced AEFIs, 171 (85.5%) were willing to continue with the vaccine despite AEFIs experienced (Table 4).

Table 1: Socio-demographic characteristics of caregivers and under-fives.

Variable	Frequency	Percentage (%)	
Age of caregiver (1 creentage (70)	
15-24	116	16.1	
25-34	500	69.4	
35-44	101	14.0	
>45	2	0.3	
Mean Age	29.02 ± 4.8		
Sex of caregiver			
Male	17	2.4	
Female	703	97.6	
Level of education	n of caregiver		
None	2	0.3	
Primary	29	4.0	
Secondary	346	48.1	
Tertiary	343	47.6	
Level of education	n of caregiver sp	oouse	
None	8	1.1	
Primary	15	2.1	
Secondary	278	38.6	
Tertiary	419	58.2	
Religion of caregi	ver		
Christianity			
Islam	695	96.5	
African	23	3.2	
Traditional	2	0.3	
Religion			
Marital status of	caregiver		
Single	40	5.6	
Married	678	94.2	
Divorced	2	0.3	
Children of the caregiver			
1-3	637	88.4	
4-6	79	11.0	
≥7	4	0.6	
Age group of U5 children (months)			
0-11	627	87.1	
12-23	72	10.0	
24-35	15	2.0	
36-47	4	0.6	
18-59	2	0.3	
	Mean Age \pm SD 6.09 ± 6.3		
Sex of U5 children			
Male	369	51.2	
Female	351	48.8	

Good knowledge of the pentavalent vaccine increased with increasing level of education and being married ($p \le 0.001$ and p = 0.015 respectively). Majority, 270

(54.0%) of caregivers within the age group of 25-34 had good knowledge on pentavalent vaccine. However, the association between age group and knowledge of pentavalent vaccine was not statistically significant. More female caregivers, 546 (77.6%) had good knowledge on pentavalent vaccine but this association was not statistically significant (Table 5).

Table 2: Knowledge of caregivers on pentavalent vaccine.

Knowledge	Frequency	Percentage		
domains	(n = 683)			
Awareness				
Yes	683	94.9		
No	37	5.1		
*Source of inform	ation			
Health workers	673	93.5		
Television	227	31.5		
Internet	163	22.6		
Radio	138	19.2		
Newspaper	86	11.9		
Relatives/Friends	6	0.8		
Neighbours	2	0.3		
School	2	0.3		
Composition				
Poor	196	28.7		
Fair	213	31.2		
Good	274	40.1		
Dosing				
Correct	555	77.1		
Incorrect	165	22.9		
Route of administ	ration			
Poor	12	1.8		
Fair	59	8.6		
Good	612	86.6		
Number of doses				
Poor	104	15.2		
Fair	62	9.1		
Good	517	75.7		
*Health benefits	n = 584			
Immunity	230	39.4		
Protection against	196	33.6		
disease				
Promotes growth	179	30.7		
*Adverse effects	n = 203			
Fever	161	79.3		
Abscess	25	12.3		
Discomfort	15	7.4		
Rash	11	5.4		
Pain	5	2.5		
Overall knowledge	e score			
Poor	104	14.4		
Fair	62	8.7		
Good	554	76.9		
* Multiple response question				

^{*} Multiple response question.

Table 3: Attitude of caregivers towards pentavalent vaccine.

Variable	Frequency	Percentage
Pentavalent is important	598	87.6
Pentavalent should not be free	339	49.6
One dose is enough	128	17.8
Mothers should be encouraged to attend immunization regularly	34	4.7
Rainfall and distance are good reasons to default immunization	49	7.2
Vaccine should be stopped in case of an adverse effect	564	78.3
Side effect experienced is a good reason to stop vaccination	594	82.5
Total attitude score		
Negative	152	21.1
Positive	568	78.9

Table 4: Experiences of side effects of Pentavalent Vaccine and palliative measures taken by caregivers.

Variable	Frequency	Percentage	
Experienced side effects			
Yes	200	27.8	
No	520	72.2	
*Side Effects			
Fever	105	52.5	
Pain	60	30.0	
Swelling	34	17.0	
Rash	11	5.5	
Palliative measures n = 70			
Administration of	65	93.0	
Paracetamol	20	28.5	
Tepid sponging			
Visited a doctor/hospital	14	20.0	
Willingness to continue vaccination			
Yes	171	85.5	
No	29	14.5	

Majority, 389 (77.8%), of caregivers with a positive attitude towards pentavalent vaccine were within the age group of 25-34 years. The association between the age of the caregiver and the attitude towards pentavalent vaccine was not statistically significant (p=0.153). Female caregivers constituted a higher proportion, 557 (79.2%) of those with positive attitude towards pentavalent vaccine, however, this association was not statistically significant (p=0.147) Majority, 554 (79.7%), of those with positive attitude were Christians and religion significantly affected the attitude towards the vaccine. (p=0.005).

Table 5: Socio-demographic Characteristics of caregivers and Total Knowledge of Pentavalent vaccine.

¥7	Total know	wledge score	T	
Variable	Good	Poor	Test statistic	
Age group (years)			
15-24 25-34 35-44	56 (48.3) 270 (54.0) 52 (51.5)	55 (46.0) 49 (48.5)	X = 6.053 p=0.735	
≥45 Sex	0 (0.0)	2 (100.0)	p=0.733	
Male Female	8 (47.0) 546 (77.6)	9 (53.0) 157 (22.4)	X = 1.250 p=0.742	
Religion				
Christianity Islam ATR	540 (77.7) 12 (52.2) 2 (100.0)	155 (22.3) 11 (47.8) 0 (0.0)	X = 3.058 p=0.802	
Level of education				
Primary Secondary Tertiary	7 (24.1) 184 (53.2) 318 (92.7)		X = 32.348 p≤0.001	
Marital status				
Single Married Divorced	22 (55.0) 360 (51.8) 0 (0.0)	18 (45.0) 335 (48.2) 2 (100.0)	X = 15.784 p=0.015	

With increasing level of education, there was an increase in the proportion of caregivers who had a positive attitude towards the vaccine with the highest being among those with tertiary level of education, 287 (83.7%). The association between these two variables was statistically significant (p \leq 0.001). Married caregivers constituted a high proportion, 537 (79.2%) of caregivers with a positive attitude. The association between marital status and attitude toward the pentavalent vaccine was not statistically significant (p=0.459) (Table 6).

A majority, 111 (81.6%) of caregivers willing to continue with the pentavalent vaccine despite an AEFI were within the age group of 25-34 years. The association between willingness to continue with vaccination and the age of caregivers was not statistically significant (p = 0.323). More female caregivers, 166 (82.6%) were willing to continue with the vaccine despite the experience of an AEFI. This association was statistically significant (p=0.041).

More married caregivers, 152 (79.6%), were willing to continue with pentavalent vaccine in spite of an AEFI and this association was statistically significant (p=0.029). Level of education and religion of caregivers did not affect the willingness to continue with the pentavalent vaccine. (p=0.244, 0.958) A higher proportion of caregivers who were Christians, 165 (82.1%) and those who had tertiary level of education, 101 (80.8%) were also willing to continue despite an AEFI.

Table 6: Socio-demographic characteristics of caregivers and total attitude score.

Vanishla	Total attitude score		Test	
Variable	Positive	Negative	statistic	
Age group (years)			
15-24	100 (86.2)	16 (13.8)	2	
25-34	389 (77.8)	111 (22.2)	$X^{2} = 5.271$	
35-44	78 (77.2)	23 (22.8)	p = 0.153	
≥45	1 (50.0)	1 (50.0)	1	
Sex				
Male	11 (64.7)	6 (35.3)	$X^{2} = 2.103$	
Female	557 (79.2)	146 (20.8)	p = 0.147	
Religion				
Christianity	554 (79.7)	141 (20.3)	2	
Islam	12 (52.2)	11 (47.8)	X = 10.674	
ATR	2 (100.0)	0 (0.0)	p = 0.005	
Level of edu	Level of education			
Primary	18 (58.1)	13 (41.9)	2	
Secondary	263 (76.0)	83 (24.0)	X = 46.097	
Tertiary	287 (83.7)	56 (16.3)	p ≤0.001	
Marital status				
Single	29 (72.5)	11 (27.5)	2	
Married	537 (79.2)	141 (20.8)	X = 16.477	
Divorced	2 (100.0)	0 (0.0)	p = 0.459	

Table 7: Socio-demographic characteristics of caregivers and willingness to continue pentavalent vaccine despite experiencing a side effect.

¥7 • 11	Willingness to continue		Test
Variable	Yes	No	statistic
Age group (y	vears)		
15-24	21 (72.4)	8 (27.6)	2
25-34	111 (81.6)	25 (18.4)	X = 2.261
35-44	38 (86.4)	6 (13.6)	p = 0.323
Sex			
Male	5 (55.6)	4 (44.4)	$X^{2} = 4.162$
Female	166 (82.6)	35 (17.4)	p = 0.041
Religion			
Christianity	165 (82.1)	36 (17.9)	$X^{2} = 1.355$
Islam	6 (66.7)	3 (33.3)	p = 0.244
Level of education			
Primary	5 (83.3)	1 (16.7)	2
Secondary	65 (82.3)	14 (17.7)	X = 0.085
Tertiary	101 (80.8)	24 (19.2)	p = 0.941
Marital status			
Single	19 (100.0)	0 (0.0)	$X^{2} = 4.764$
Married	152 (79.6)	39 (20.4)	p = 0.029

DISCUSSION

It is widely accepted that immunization is of great importance in the prevention of childhood diseases, hence vaccination uptake is an indirect way to assess child health. The mean age of caregivers in this study was 29.02±4.8 years. This is similar to the mean ages found among mothers in other studies. 11,14,15 The fact that most of the care givers were females may be because females are directly involved in the nurturing of their young and this is seen as a gender role. The male presence at the immunization clinic may be due to ill-health of the mother or the fact that the mother may be involved in white collar jobs where getting time off for routine immunization may be difficult. Perhaps, it may also be a pointer to the notion that males are increasingly becoming actively involved in the grooming of their children. Of the total number of caregivers involved in the study, most respondents had secondary and tertiary levels of education. This finding is in contrast to a study conducted in 2013 which revealed that half of the respondents had no formal education.¹⁶ This difference may be due to the nature of the study, which analysed data from children aged between 12-23 months using the 2008 Nigeria Demographic and Health Survey, and thus had nationwide distribution.

Overall knowledge of pentavalent vaccine was good in the studied population. This is different from the findings in of a study conducted in India.¹⁴ This is encouraging, considering that the vaccine had been introduced into Nigerias' National Programme on Immunization for just over one years prior to the study. It may also imply proper health education by health workers since they made up majority of the respondents source of information. However, the results were similar to the findings of a study conducted in UAE in 2011 and Saudi Arabia in 2013. Knowledge was particularly high among respondents within the age group of 25-34 years. Most caregivers at this age had probably attended antenatal clinic services where a general health education on childhood immunizations is given or had immunized a child before. This is similar to a study conducted in Saudi Arabia which showed that older mothers were less likely to have knowledge and positive attitude towards child vaccination¹⁸. More females than males had good knowledge of pentavalent vaccine. This finding is expected and similar to the result of a study nationwide study conducted in 2013. This is not surprising as women were most involved in the ante-natal care and immunization services. In addition, knowledge was seen to be highest amongst Christians. This may be due to the more successful uptake of immunization programs in the South, which is largely a Christian community, than in the Northern part of Nigeria. Also, most caregivers with good knowledge on pentavalent vaccine had higher levels of education. This is in consonance with other studies. 15,17 This shows a strong association between maternal education and full immunization, thus education helps to improve health seeking behaviour of an individual. Therefore, highly educated mothers would be able to understand and appreciate the importance ofimmunization. The role of maternal education in the immunization status of a child cannot overemphasized.19

There was a positive attitude towards pentavalent vaccine in a majority of respondents. This is different from findings of a study conducted in Saudi Arabia in 2013 which showed that parents attitudes towards immunization was positive expect in some aspects related to vaccination side effects. Less than half of the caregivers stated that pentavalent vaccine was more efficient than DPT vaccine. Studies have shown that there's no significant difference in the immunogenicity of the DPT and the pentavalent vaccine and that both are well tolerated. Less than the pentavalent vaccine and that both are well tolerated.

Majority of caregivers with a positive attitude towards the pentavalent vaccine were Christians. This result is the same with that found in the Nigerian study carried out in 2013 to assess the determinants of child's immunization where it was shown that children from the Northern part of the country were less likely to receive full immunization. With increasing level of education, there was increase in caregivers with positive attitude towards the pentavalent vaccine. This is not surprising as education helps to improve health seeking behaviour of caregivers.

Majority of caregivers that were willing to continue pentavalent vaccine despite experiencing a side effect were in the age group 25-34 years. This is because older mothers have experienced a side effect in an older child and has seen the sequelae or lack of it. This result is in keeping with the results of a Nigerian study carried out in 2013 which stated that mothers between the ages of 25-34 years were twice more likely to fully immunize their child than mothers in the age group 15-24 years. Majority of caregivers with a positive attitude towards the pentavalent vaccine were females.

Immunization programs depend on public confidence to be effective. These caregivers may have understood the importance of immunization and the health benefits that would accrue to their children. This is encouraging especially in a developing country like Nigeria where high immunization uptake is sacrosanct to achieving the Sustainable Development Goals. This is in contrast to observations in developed countries where caregivers are beginning to reject immunization because of the misconception that it causes autism. ²⁴⁻²⁶

CONCLUSION

In conclusion, this study has revealed that mothers in Benin City had good knowledge and positive attitude towards the newly introduced pentavalent vaccine. They also were willing to continue to take their children for future vaccinations, despite experiencing AEFIs. This is good and encouraging and health care providers should take advantage of this by using these mothers as peer educators to improve on immunization coverage.

ACKNOWLEDGEMENTS

Authors wish to acknowledge the research assistants and the mothers of Under-five children who participated in this study.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Ogboghodo EO, Esene HA, Okojie OH. Determinants of uptake of pentavalent vaccine in Benin city, Southern Nigeria. Int J Community Med Public Health 2016;3:3195-201.