



Pneumococcal vaccine uptake and its associated factors among adult patients with congestive cardiac failure seen in a tertiary facility in Lagos, Nigeria

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Abstract

Background: Patients with congestive cardiac failure (CCF) are at increased risk of morbidities and mortality associated with pneumococcal infections and thus should be vaccinated against *Streptococcus pneumoniae*. However, there is dearth of scientific data on pneumococcal vaccine uptake in this environment. This study set out to assess the vaccination status and its associated factors among CCF patients in Lagos State University Teaching Hospital (LASUTH), Lagos, Nigeria.

Methodology: A questionnaire based cross-sectional study of one hundred patients with CCF conducted at the adult cardiology out-patient clinic of LASUTH between December 2021 and March 2022. Socio-demographic and clinical characteristics were recorded as well as Pneumococcal vaccination status, source of vaccination, challenges and reasons for non-vaccination. The likelihood of recommending vaccination for others was also obtained.

Results: The mean age of the study population was 51.55±16.36 years (range 21-78 years). The male to female ratio was 56:44. Pneumococcal vaccination rate was 9% with only 4% fully vaccinated. Lack of information about vaccine was the commonest reason for non-vaccination. Healthcare providers were the source of vaccine information in only 58% of the vaccinated subjects. Majority of the vaccinated respondents (67%) had their vaccines outside the country and most of them will likely recommend vaccination to others.

Conclusion: Pneumococcal vaccination rate among CCF patients was poor. Better patients' education and prompt vaccine recommendation by the managing physicians will improve vaccination uptake. A National guideline for adult pneumococcal vaccine in Nigeria is desirable.

Keywords: Pneumococcal vaccine, vaccination rate, vaccine preventable diseases, congestive cardiac failure, immunization

Introduction

Streptococcus pneumoniae is a common cause of morbidity and mortality worldwide causing both non-invasive and serious invasive infections.¹⁻³

About 1.6 million deaths yearly are attributed to *Streptococcus pneumoniae* globally with increased mortality in low income countries, extremes of age population, immunosuppressed individuals and patients with co-morbidities like congestive cardiac failure.^{2,4-7}

Patients with congestive cardiac failure have increased susceptibility to infections.^{3,7,8} Pneumonia, septicemia and arrhythmias are known precipitants of heart failure and cause acute exacerbation and life threatening de-

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compensation.^{6,7} These exacerbations have been shown to be related to deterioration in cardiac function which may never return to baseline despite optimal guideline directed medical therapy.^{6,7} Pneumococcal pneumonia also predisposes patients with heart failure to an increased risk of cardiovascular complications like arrhythmia, myocardial ischemia, worsening heart failure and increased cardiovascular-related mortality.² This emphasizes that prevention of pneumococcal pneumonia in the at-risk population is of great importance.^{6,7,9}

Pneumococcal vaccines are vaccines against *Streptococcus pneumoniae* which help prevents diseases like sinusitis, otitis media, and community acquired pneumonia as well as other devastating infections like meningitis, empyema and bacteremia.^{1,2,10} Many international guidelines recommended routine pneumococcal vaccination for vulnerable populations.^{5-7,11} In the United Kingdom, pneumococcal vaccine is recommended to all adults with chronic heart disease.^{11,12}

There are two common types of pneumococcal vaccines which either use a polysaccharide capsular antigen alone (PPV) or conjugated to a carrier protein (PCV).^{12,13} The PCV is the commonly used pneumococcal vaccine in Nigeria.^{14,15} While these vaccines have routinely been used in the pediatric population, its use in the adult patients with organ failure has not been well documented probably as a result of the absence local guidelines and recommendations for vaccination of at-risk adult patients.^{10,14,15} Also, the rate of uptake of these vaccines and the clinical characteristics of the vaccinated subjects, especially patients with chronic co-morbidities like CCF, is unknown in our environment.¹⁰

Therefore, this study set out to determine the rate of vaccine uptake, its associated factors as well as the characteristics of the vaccinated subjects among the patients with CCF presenting to the adult cardiology Out-patient department of Lagos State University Teaching Hospital (LASUTH), Ikeja, Lagos. This will help to set the prevalence of vaccination and highlight the major challenges of adult pneumococcal vaccine uptake among these patients. This will further be useful for various policy makers in developing guidelines and policies on adult pneumococcal vaccine coverage in

Nigeria.

Methods

Study design and study population

This was a descriptive cross-sectional study conducted at the adult cardiology out-patient department of Lagos State University Teaching Hospital (LASUTH), Ikeja, Lagos. Lagos is a metropolitan city with about 25 million inhabitants and LASUTH is the only Lagos state government - owned tertiary health institution attending to this population.¹⁶ All patients with a diagnosis of Congestive cardiac failure were eligible and a convenient sampling method with consecutive recruitment of patients was used.

Sample size determination

The minimum sample size of 100 for this study was calculated using the formula for finite population size. A standard normal deviation of 1.96 with a confidence level of 95% and a precision of 5% was used. We also used a prevalence of 7% obtained from a previous study on vaccination rate of vaccine preventable diseases.¹⁷ The targeted sample size was achieved between December 2021 and March 2022.

Data collection and analysis

A structured questionnaire was provided to all consecutive patients with congestive cardiac failure attending the adult cardiology outpatient clinic of LASUTH. The survey included parameters concerning patients' socio-demographics as well as clinical profiles, information and knowledge on pneumococcal vaccine, source of information, vaccination status, reasons for non-vaccination, duration of vaccination, source of vaccination, challenges of getting the vaccine, reservation about vaccine prior to vaccination, side-effects of vaccine, reservation about vaccine post vaccination and likelihood of recommending vaccine post vaccination.

Data analysis

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 21.0 (Chicago IL. USA). Quantitative data were summarized as means \pm standard deviation, while qualitative data were summarized in frequencies and percentages. The association between variables

was assessed with chisquare. $P < 0.05$ was assumed as the level of significance at a 95% confidence interval. All results were presented in tables.

Ethical considerations

Ethical approval was sought and obtained from the Lagos State University Teaching Hospital Ethics

and Research Committee.

Results

The mean age of the study population was 51.55 ± 16.36 years with a range of 21-78 years. Majority of the respondents were above 40years. The commonest etiology of heart failure was

Table 1: Socio-demographic and clinical characteristics of respondents

Variables	Male N (%)	Female N (%)	Total	p-value
Age	56	44	100	0.67
<40	8	16	24	0.41
40-60	20	12	32	0.54
>60	28	16	44	0.36
Marital status				
Single	8	1	9	0.21
Married	44	34	78	0.59
Separated/Divorced	2	2	4	0.89
Widowed	2	7	9	0.42
Level of Education				
Uneducated	6	10	16	0.60
Primary	10	5	15	0.45
Secondary	20	15	35	0.67
Tertiary	20	14	34	0.64
Employment Status				
Unemployed	10	20	30	0.58
Employed	42	9	51	0.23
Retired	4	15	19	0.48
Monthly Income (Naira)				
<100,000	45	34	79	0.61
100,000-200,000	5	7	12	0.67
>200,000	6	3	9	0.48
Duration of Illness (Years)				
0-1	10	14	24	0.74
1-3	11	16	27	0.70
>3	35	14	49	0.58
Etiology of CCF				
HHD	36	14	50	0.57
DCM	4	12	16	0.42
RVHD	5	7	12	0.67
IHD	6	1	7	0.32
CHD	6	2	8	0.39
PPCM	0	7	7	0.08
Functional Class (NYHA)				
I	7	8	15	0.82
II	32	25	57	0.65
III	10	8	18	0.77
IV	7	3	10	0.58

KEY: CCF: Congestive Cardiac Failure. HHD: Hypertensive Heart Disease, DCM: Dilated Cardiomyopathy, RVHD: Rheumatic Valvular Heart Disease, IHD: Ischemic Heart Disease, CHD: Congenital Heart Disease, PPCM: Peripartal Cardiomyopathy, NYHA: New York Heart Association

Table 2: Vaccination profile of the respondents

Variables	Frequency	Percentage
Have you heard of pneumococcal vaccine		
Yes	19	19
No	81	81
Source of information		
Media	2	10
Peers	3	16
Family	3	16
Physician	11	58
Vaccination Status		
Full	4	4
Partial	5	5
None	91	91
Time since vaccinated		
Within last 1 year	6	67
More than 1 year	3	33
Challenges of getting vaccination		
No knowledge about vaccine	81	81
Cost	1	1
Unavailability	2	2
Lack of information on vaccination centers	7	7
Not motivated enough	9	9
Reservations about vaccine		
Dangerous	5	5
Ineffective	21	21
Religion contradiction	4	4
I have no knowledge of vaccine	70	70
Source of vaccination		
Primary healthcare	0	0
Secondary healthcare	0	0
Tertiary healthcare	3	33
Overseas	6	67
Side effects of the vaccine		
Pain	1	11
Swelling	1	11
Fever	1	11
Fatigue	1	11
Non specific	1	11
None	4	45
Will you recommend vaccine for others		
Yes	9	100
No	0	0

hypertension while most of the respondents were in New York Heart Association (NYHA) functional class I and II. The socio-demographic and clinical characteristics are shown in table 1.

Table 2 showed the Vaccination profile of the respondents. Only 9% of respondents had pneumococcal vaccine while 19% had any form of

knowledge about vaccine.

Table 3 showed the socio-demographic and clinical profile of the vaccinated and the unvaccinated patients. All the vaccinated patients were above 40 years and had at least secondary level education, with monthly income more than #200,000.

Table 3: Socio-demographic and clinical profile of the vaccinated and unvaccinated patients

Variables	Vaccinated Patients			Unvaccinated patients			p-value
	Male	Female	Total	Male	Female	Total	
Age							0.12
<40	0	0	0	8	16	24	
40-60	1	2	3	19	10	29	
>60	4	2	6	24	14	38	
Marital status							0.26
Single	0	0	0	8	1	9	
Married	4	2	6	40	32	72	
Divorced	0	0	0	2	2	4	
Widowed	1	2	3	1	5	6	
Level of education							0.49
Uneducated	0	0	0	6	10	16	
Primary	0	0	0	10	5	15	
Secondary	2	3	5	18	12	30	
Tertiary	3	1	4	17	13	30	
Employment status							0.32
Unemployed	0	0	0	10	20	30	
Employed	1	0	1	41	9	50	
Retired	4	4	8	0	11	11	
Monthly income							0.12
<100,000	0	0	0	45	34	79	
100,000-200,000	0	0	0	5	7	12	
>200,000	6	3	9	0	0	0	
Duration of illness (years)							0.56
<1	0	0	0	10	14	24	
2-3	1	1	2	10	15	25	
>3	4	3	7	31	11	42	
Etiology of heart failure							0.34
DCM	2	2	4	2	10	12	
HHD	3	2	5	33	12	45	
RVHD	0	0	0	5	7	12	
IHD	0	0	0	6	1	7	
CHD	0	0	0	6	2	8	
PPCM	0	0	0	0	7	7	
Functional class (NYHA)							0.49
I	2	3	5	5	5	10	
II	3	1	4	29	24	53	
III	0	0	0	10	8	18	
IV	0	0	0	7	3	10	

KEY: CCF: Congestive Cardiac Failure. HHD: Hypertensive Heart Disease, DCM: Dilated Cardiomyopathy, RVHD: Rheumatic Valvular Heart Disease, IHD: Ischemic Heart Disease, CHD: Congenital Heart Disease, PPCM: Peripartal Cardiomyopathy, NYHA: New York Heart Association

Discussion

This study set out to assess the vaccination rate as well as the associated factors affecting the rate of vaccination among patients with congestive cardiac failure (CCF) patients in the adult cardiology outpatient clinic of Lagos State University Teaching Hospital (LASUTH) in Lagos, Nigeria. The mean age of the study population was 51.55±16.36 years

(range 21-78 years), with a slight male predominance, which was in keeping with previous study done among CCF patients in Nigeria which showed CCF to be more prevalent among older population.^{1,4,6,8} This study also showed that hypertensive heart failure is the commonest cause of heart failure. This has also been established in previous studies.^{1,3,5}

Pneumococcal vaccination rate among the study population in this index study was noted to be poor. To the best of our knowledge, there is no previous study documenting pneumococcal vaccination rate among CCF patients in this environment. Adejumo et al in a study of hepatitis B virus (HBV) vaccination rate among chronic kidney disease (CKD) patient on hemodialysis reported an abysmally poor vaccination rate.¹⁸ None of the 202 CKD subjects studied were vaccinated against HBV.¹⁸ Akinbodewa also documented a poor influenza and HBV vaccination rate among CKD patients.¹⁷ This poor rate of vaccination may probably be related to the fact that there are presently no locally available guidelines for vaccination of adults and at-risk population in Nigeria.^{10,14} However, this may not entirely be the sole reason, as poor vaccination rate has also been documented in developed countries with pneumococcal vaccination guidelines.¹⁹⁻²⁴

The practice of adult vaccination against vaccine preventable diseases (VPDs) in Nigeria has been very poor even though the knowledge and awareness of vaccine preventable diseases among adult physicians have been found to be above average in many local studies.^{17, 25} Adekanle et al, Akinbodewa et al and Ojo et al found different levels of awareness among Doctors about different VPDs, but these knowledge and awareness have not been shown to translate into practice.^{14,17,25} However, lack of proper awareness of the disease by health care providers, failure to assume responsibility for vaccination by the managing physicians, competing priorities, incomplete or inaccessible records of previous vaccines, and various health care system challenges were also reported by Rehm et al as possible barriers to vaccination.²³ The low level of pneumococcal vaccine uptake is a cause of concern as streptococcus pneumonia has been established to be a major cause of heart failure exacerbation, heart failure progression, morbidity and mortality.^{1,3,4,10-12}

Conversely, studies have shown good VPDs vaccine coverage and uptake among pediatrics population.^{9,15}

Many factors have been shown to predict pneumococcal vaccination rate among CCF patients.^{10,20,22,24,26} Olanipeken et al in a large study of African American patients with heart failure, found that patients who received vaccination information

and recommendation from their physician, especially cardiologists, were significantly more likely to be vaccinated.²² In a clinical audit of pneumococcal vaccination in Greece, the decision for patient to get vaccinated was significantly influenced by patient's age >65 years and the adequacy of vaccination information provided by the physician.¹⁹ In this study, though logistic regression could not be done on the factors predicting vaccine uptake due to the low number of vaccinated patients, we could postulate that many of the unvaccinated patients had no information of pneumococcal vaccination and neither were they aware of the benefit of vaccination. Only 58% of our vaccinated population got vaccine information from their physician. This may be related to the knowledge – practice mismatch earlier mentioned.^{11,17}

Other factors that may be postulated to affect non-vaccination in this study include competing priorities and cost as well as health care challenges.^{3,20,21} Most of our patients have no health insurance and thus resort to out-of-pocket payment and their competing needs will include the cost of anti-failure drugs with its own high costs. Also, the challenges of healthcare in Nigeria may be the reason why a large percentage (67%) of the vaccinated patients got their vaccination outside the shores of the country. Marital status, level of education, employment status, monthly income, duration of illness, etiology of heart failure and functional class seems not to be different between the vaccinated male and female population. This was also shown not to be statistically significant in previous studies.^{8,20-22,24,26} Hebert et al found no difference in age, race, ethnicity, and gender as predictors of Vaccination Rates among 549 patients with Systolic Heart Failure.⁸

This study like previous studies also showed that there were no major side effects reported by the vaccinated population and thus unsurprisingly, all the vaccinated patients were willing to recommend vaccination to others.^{10,12,23} This may be an inroad to improve vaccination rate among patients by forming vaccination support group through which these patients may encourage one another. Support groups have been shown to be an effective patient educative medium.^{20,26} Reminder letters and follow-up telephone calls have also been used to increase

influenza vaccination acceptance by the elderly population in Canada.^{20,26} This method may also be deployed to increase vaccination rate in Nigeria. Finally, the managing physicians and other health workers should be encouraged to adequately counsel their patients on the benefit and efficacy of pneumococcal vaccine.

Limitations

The study was limited by the small population of the vaccinated patients and thus regression analysis to test for association of the predictors of vaccination uptakes among this population could not be conclusively determined. Further studies on the predictors of vaccination will be desirable.

Conclusion

In conclusion, awareness and practice of pneumococcal vaccination among CCF patients in Nigeria is poor. Physicians and healthcare providers should be kept abreast of the current international guidelines on pneumococcal vaccines and other vaccine preventable diseases (VPDs). Vaccination of CCF patients as well as at-risk individuals against VPDs should be incorporated into the national Heart failure treatment guideline currently being used in Nigeria. Meanwhile, various hospitals should develop standard protocols for pneumococcal vaccination of their CCF patients pending the development of a National guideline so that CCF patient can have an overall and holistic care.

Ethical considerations

The study proposal was reviewed by the ethical board of Lagos State University Teaching Hospital. All the recruited patients gave their consent to participate in the study and their confidentiality was maintained throughout.

Authors' contributions

AOA and OTO designed the study. AOA, AOD, AOA, ASO and AA collected data, performed statistical analysis, and were involved in the final drafting of the manuscript.

Conflict of interest

There is no potential competing or conflicting interest. The authors received no support or grant from any funding agency in the public, commercial,

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