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ORIGINAL ARTICLE

Prevalence of Pneumonia and Its Determinants among Under-five Children attending a Primary Health Care Clinic in Amuwo Odofin Local Government Area, Lagos, Nigeria

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Keywords

Pneumonia;

Under-five children;

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ABSTRACT

Background: The incorporation of Haemophilus influenza type b and pneumococcal conjugate vaccines to infant routine immunization programme in Nigeria have been reported to reduce the frequency and severity of respiratory tract infections especially bacterial pneumonia. The aim of this study was to assess the prevalence of pneumonia and its determinants among under-five children attending Primary Health Care (PHC) clinic in Amuwo Odofin Local Government Area Lagos State, Nigeria.

Methods: This was a descriptive cross sectional study. A two-stage sampling technique was used to select 330 under-five children who presented to the Festac PHC clinic. Data was collected using a pretested, structured and interviewer administered questionnaire and analyzed using EPI INFO software version 7.0. Chi-square tests and logistic regression analysis were used to identify the determinants of the development of pneumonia. The level of statistically significant was set at $p<0.05$.

Results: Of the 330 children, the median age (IQR) was 24 (10-26) months and the majority 186 (56.4%) were males. The prevalence of pneumonia was 42 (12.7%). There was no significant association between the development of pneumonia and the immunization status of children under five years of age ($p=0.05$). The odds of developing pneumonia was increased with prematurity [AOR=2.791, 95%CI (1.245 - 6.256), $p=0.013$].

Conclusion: About 1 in 8 under-five children in this study had pneumonia. Prematurity was the major determinant of pneumonia among under-five children. Health workers should create more awareness and sensitize mothers as well as the community members on the risk factors that can predispose children to pneumonia.

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INTRODUCTION

Nigeria had the second largest number of deaths globally from pneumonia in 2015. [1] In 2017, the single largest cause of under-five death was community-acquired pneumonia which accounted for 140,520 (15%) under-five deaths.[2] "Pneumonia: the forgotten killer of children", an article published by the United Nations Children's Fund (UNICEF) in 2006 was an alert to the morbidity of pneumonia globally.[3] This article led to a global response, and drastic measures were taken to control the increasing number of deaths. The death rate from pneumonia in children dropped to 51%, from 13.6 per 1000 live births in the year 2000 to 6.6 per 1000 live births by 2015. However, the numbers

of deaths are still high in Nigeria with a mortality rate of 19% and have only declined by just 8%.[4]

The risk factors for pneumonia in published articles widely differ. Several definite risk factors have contributed to the development of pneumonia, such as low socioeconomic status, poverty, and poor nutrition among children not exclusively breastfed in the first six months of life. Lack of vaccination, low birth weight, and other co-infections such as HIV/AIDS, and measles can lead to pneumonia. Living in overcrowded rooms at home and in school, exposure to indoor air pollution from domestic biomass fuel, parental smoking, and the presence of coughing sibling (s) at home are important factors that add to the risk of pneumonia and pneumonia mortalities.[5-7]

Immunization helps to protect against infectious diseases.[8] It is an important strategy in public health to reduce the morbidity and mortality among children from preventable infectious diseases.[9] About 1 in 10 infants worldwide did not receive any vaccination in a report by the World Health Organization (WHO) in 2016.[9] Over 10 million deaths occur annually in under-five children.[10] Although, efforts towards global vaccination has been made, there are still challenges to ensuring adequate coverage to children living in remote areas.[10] The Nigerian government provides free immunization to populations at risk of vaccine preventable illnesses and also recently updated its immunization schedule to include coverage of 90% of all antigens.[11] Despite these interventions, the rate of immunization is still low in the country.[12]

A scoping literature review of pneumonia morbidity and mortality among under-five children in Nigeria found a decreased prevalence of pneumonia or Acute Respiratory Infection (ARI) from 9.6% in 2011 to 2.3% in Nigeria with another rise to 4.6% in 2018 from national demographic surveys.[7] In a study done in Egypt, the most common risk factors for pneumonia were rural residence, low socioeconomic standard, over-crowding, and prematurity.[13]

These risk factors have been presumed to be more common in our environment.[14] With the high burden of childhood pneumonia deaths in the country, our study aimed to determine the prevalence of pneumonia and its determinants in children under-five years of age attending a primary health care facility in Lagos State, Nigeria. This will help in creating targeted specific interventions to tackle the burden of the disease.

METHODOLOGY

Description of study area

Amuwo-Odofin is a Local Government Area (LGA) in the Badagry Division of Lagos State which is divided into Oriade and Amuwo Local Council Development Area (LCDA) with seven wards each. It is one of the fifty-seven Local Governing councils that made up Lagos State. It comprises of 14 wards and 67 communities, 12 of which are urban, 8 semi-urban and 47 rural. Amuwo-Odofin LGA has a population density of approximately 300,000 people per square kilometer. Amuwo Odofin health department has four primary health center (PHC) located within the Local Government Area which include Festac primary health center, Tomaro primary health centre (outreach), Amuwo primary health centre Mile 2 and Igbologun primary health center.

This study was carried out in Festac Primary Health Care (Festac PHC) clinic which runs for twenty four hours, with daily routine clinic from Monday to Friday, starting from 8am to 4 pm. Specific immunization days are Tuesdays and Wednesdays. Other activities carried out during routine immunization include health education, weight monitoring, nutrition counseling and appropriate referral if needed. Average staff strength is estimated to be 25 and is made up of various cadres ranging from medical officer, nurses, midwives and community health workers. Routine immunization is administered by a nurse and diagnosis of pneumonia is made by a doctor who is the medical officer. On the average, about 100 children are seen monthly in the clinic, while the average number of children who receive routine immunization in the health facility on immunization days is estimated to be 40.

Study design
This was a descriptive cross sectional study from the month of August to October, 2019.

Study population
This study involved children aged four months to five years who presented to the Festac PHC clinic and their mothers were interviewed. The starting age range of four months was chosen because it was believed that the child would have completed the initial dozes of routine immunization and would have been vaccinated against pneumonia based on the Nigerian immunization schedule usually given at birth, six, ten and fourteen weeks of life.

Inclusion criteria
Children within the ages of 4 months to under-five years, who presented their immunization cards, and their mothers gave written informed consent to participate in the study.

Sample size determination
The minimum sample size required for the study was 330 using the Cochran Formula
$n=Z^2 p(1-p)/d^2$, where: p= is the prevalence of pneumonia in under-five children from a previous study in Makurdi= 0.276 [15], Z= standard normal deviate (which at 95% confidence is 1.96) , d= is the margin of error= 0.05 , n= estimated sample size for population , q= 1-p

Sampling technique
A two-stage sampling technique was used. Stage one involved selection of one out of the four PHCs in Amuwo Odofin Local council development area by simple random sampling method (balloting). Stage two involved selecting under-five children attending PHC clinic who met the inclusion criteria by systematic sampling. The study was carried out over a 10 week period, an average of 7 mothers were interviewed a day. The systematic sampling interval used was calculated as: K= total sample size / average no of patients that comes to the clinic monthly, K= 330/100 = 3.3. Therefore the sampling interval used was 3. The first child to be the starting point was chosen by simple random sampling (balloting) and sampling interval was used to determine subsequent mothers. In case the recruited child's mother did not consent, the next child was included.

Data collection method
The main instrument that was used for this study was a pretested structured interviewer administered questionnaire adapted from Integrated Management of Childhood Illness (IMCI) guideline for treating pneumonia and from National Immunization Survey of the Center for Disease Control questionnaire.[16,17] The questionnaires was administered by the lead researcher and two trained research assistants who were nurses that work in the PHC clinic. They were trained on purpose of the study and questionnaire administration ethics in order to properly fill out the questionnaire.

The questionnaire was divided into four sections: Section A: Socio demographic information of the respondents; Section B: Prevalence of pneumonia - This was assessed by the qualified pediatrician based on the WHO criteria for pneumonia. Pneumonia was diagnosed in children under 5 years of age with coughing, difficulty breathing, with or without fever, as well as fast breathing or contraction of the lower chest wall during inhalation.[18] Section C: Immunization status of child - The immunization status of the child was assessed from the information on child's immunization card and each child was categorized as completely immunized, partially immunized or not immunized at all; Section D: Predisposing factors for pneumonia such as the nutritional and environmental predisposing factors.

Data analysis
Data was analyzed using EPI INFO software version 7.0. The mean ± standard deviation (SD) as well as the median age was computed for the age of the children. The frequencies of clinical symptoms of pneumonia and immunization status were analyzed. Chi-square tests (or Fisher's exact) analysis were carried out to determine the association between the development of pneumonia and socio-demographic characteristics and other predisposing factors. Logistic regression was done to identify the predictors of the development of pneumonia. The level of significance was set at 5% ($p<0.05$).

Ethical consideration

Ethical approval (HREC 3021) for the study was obtained from the Health Research and Ethics Committee of the College of Medicine Lagos University Teaching Hospital (LUTH). A letter of introduction from the Department of Community Health and Primary Care to Medical Officer of Health (MOH) in charge of the PHC was obtained for easy access to the study center. The highest degree of ethical standard was maintained throughout the duration of the study and afterwards. Voluntary and informed consent was obtained from the mothers who meet up with the inclusion criteria.

RESULTS

During the study period, a total of 330 children were included in the study. The median age was 24 months with the interquartile range of 10 -26 months, and there were more males 186 (56.4%) than females. The most predominant religion was Christianity 220 (66.7%) and most of the respondents were of Igbo tribes 98 (29.7%). Most of the mothers of these children 284 (86.1%) were married and in monogamous family type 272 (82.4%). Half of the mothers of these children had secondary education as their highest level of education while a few 19 (5.8%) had no form of formal education. (Table 1).

The prevalence of pneumonia during the time of survey was estimated to 42 (12.7%) (Table 2). Only 39 (11.8%) of the children were delivered as preterm delivery. The proportion of people who lived in a well-ventilated house was 290 (87.9%). History of indoor smoking was found in 76 (23.0%) of the respondents and 26 (7.9%) of children attended day care center. Majority of the children 325 (98.5%) had received one form of vaccination since birth. The most common place of vaccination was at the primary health care center 250 (75.8%). Out of the 330 children, 269 (81.5%) were fully immunized while the rest, 61 (18.5%) were partially or not immunized.

Socio-demographic characteristics like child's age (p=0.307), sex (p=0.373), mother's educational level (p=0.399) and ethnicity (p=0.779) did not show statistically significant association with development of pneumonia (Table 3). There was no statistically significant association between immunization status of a child and pneumonia (p= 0.05). Other factors such as gender, age, immunization status, mother's and father's levels of education, ethnicity, breast feeding patterns and environmental factors such as the type of cooking fuel and the presence of indoor smoking were not significantly associated with the development of pneumonia in this study. However, prematurity was significantly associated with the development of pneumonia. A higher proportion of the children delivered as a preterm 10 (25.6%) developed pneumonia compared to the children born as term babies 32 (11%) p=0.010. (Table 4) The odds of developing pneumonia also increased with prematurity (AOR=2.791, 95%CI (1.245 - 6.256), p=0.013. (Table 5).

Table 1: Socio-demographic characteristics of the children

Variables	Frequency (n=330)	Percent
Age-group (months)		
4-24	244	73.9
25-48	78	23.6
49-60	8	2.5
Sex		
Male	186	56.4
Female	144	43.6
Religion		
Christianity	220	66.7
Muslim	102	30.9
Traditional	2	0.6
Others	6	1.8
Ethnicity		
Igbo	98	29.7
Hausa	76	23.0
Yoruba	67	20.3
Others	89	27.0
Parents' marital status		
Married	284	86.1
Separated/divorced	11	3.3
Single /cohabiting	33	10.0
Widower	2	0.6
Family type		
Monogamous	272	82.4
Polygamous	58	17.6
Mother's level of education		
None	19	5.8
Primary	29	8.8
Secondary	165	50.0
Tertiary	117	35.4
Mother's occupation		
Unemployed	129	39.1
Employed	201	60.9
Father's occupation		
Unemployed	21	6.4
Employed	309	93.6

Median age (IQR) = 24 (10-26) months

Table 2: Clinical features at presentation and prevalence of pneumonia

Variables	Frequency (n = 330)	Percent
Clinical symptoms		
Fever	145	43.9
Cough	129	39.1
Loss of appetite	78	23.6
Vomiting	52	15.8
Fast breathing	43	13.0
Difficulty in breathing	38	11.5
Clinical signs		
Fever (>37.5)	115	34.8
Tachycardia	65	19.7
Tachypnea	61	18.5
Presence of crepitation	46	13.9
Diagnosis of Pneumonia		
Yes	42	12.7
No	288	87.3

Table 3: Association between socio-demographic characteristics of the respondents and development of pneumonia

Variables	Development of pneumonia		Chi square (χ^2)	p-value
	Present n=42) n (%)	Absent n=288 n (%)		
Age (months)	35 (14.3)	209 (85.4)	2.730**	0.307
4-24	7 (9.0)	71 (91.0)		
25-48	0 (0.0)	8 (100.0)		
49-60				
Sex				
Male	21 (14.6)	123 (85.4)	0.792	0.373
Female	21 (11.3)	165 (88.7)		
Mother's Level of Education				
None	2 (10.5)	17 (89.5)	3.812**	0.311
Primary	7 (24.1)	22 (75.9)		
Secondary	20 (12.1)	145 87.9)		
Tertiary	13 (11.1)	104 (88.9)		
Mother's occupation				
Unemployed	22 (17.1)	107 (82.9)	3.494**	0.045
Employed	20 (10.0)	181 (90.0)		
Ethnicity				
Igbo	15 (15.3)	83 (84.7)	1.091	0.779
Hausa	10 (13.2)	83 (86.8)		
Yoruba	7 (10.5)	60 (89.5)		
Others	10 (11.2)	79 (88.8)		

****Fisher's exact test*

Table 4: Association between predisposing factors of pneumonia and development of pneumonia

Variable	Development of pneumonia		Chi square (χ^2)	p-value
	Present n = 42 n (%)	Absent n = 288 n (%)		
Immunization status				
Fully immunized	31 (11.5)	238 (88.5)	5.834	0.050
Partially immunized	9 (15.8) 2	48 (84.2) 2		
Not immunized	(50.0)	(50.0)		
Breast feeding pattern				
Exclusively breast fed	25 (12.5)	175 (87.5)	0.023	0.878
Not exclusively breast fed	17 (13.1)	113 (86.9)		
Premature delivery				
Yes	10 (25.6)	29 (74.4)	6.640	**0.010**
No	32 (11.0)	259 (89.0)		
Type of cooking fuel				
Cooking gas	28 (10.9)	230 (89.1)	5.691**	0.091
Kerosene	9 (18.4)	40 (81.6)		
Wood /charcoal	2 (14.3)	12 (85.7)		
Electric gas	3 (3.3)	6 (66.7)		
Place of cooking				
Main house kitchen	29 (11.2)	231(88.8)	2.740	0.254
Separate kitchen	7 (18.9)	30 (81.1)		
Inside the room	6 (18.2)	27 (81.8)		
Place of child while cooking				
Backed by mother	3 (12.0)	22 (88.0)	1.157**	0.573
Beside mother	6 (18.8)	26 (81.2)		
In another room	33 (12.1)	240 (87.9)		
Indoor smoking				
Yes	8 (10.5)	68 (89.5)	0.431	0.512
No	34 (13.4)	220 (86.6)		

****Fisher's exact test*

Table 5: Logistic regression analysis for predictors of pneumonia

Variables	Adjusted Odd ratio	95% Confidence interval	p-value
Immunization status			
Complete	0.591	0.279 - 1.254	0.171
Incomplete (Ref)	1		
Preterm delivery			
Yes	2.791	1.245 - 6.256	**0.013**
No (Ref)	1		

Ref- Reference category

DISCUSSION

Pneumonia has been highlighted as a common cause of childhood morbidity and mortality encountered in several children emergency care setting.[19] From this study, the prevalence of pneumonia among under-five children attending PHC clinic in Amuwo Odofin LGA was 12.7%. This is slightly lower than the prevalence of pneumonia (13.3%) among children in Ilorin, Nigeria [20]and the prevalence of pneumonia (13.2%) among children admitted to Children Emergency Ward (CHEW) in Port-Harcourt with highest prevalence (27.1%) seen among children under-one year of age. [21] The lower prevalence could be as a result of the high vaccination rates against pneumonia among children included in this study. However, the prevalence of pneumonia in this study is higher than the report of national surveys as found by a scoping review of literature. [7]

This study showed that 200 (60.6%) children were exclusively breast fed for six months and 56.4% had breastfeeding duration of up to a year. There was no significant association between breastfeeding pattern, and the development of pneumonia. This was in contrast to a study which showed that non-exclusive breastfeeding had a statistically significant association with pneumonia.[4] An adequate period of exclusive breast feeding followed by continued breast feeding and an appropriate complementary feeding has been shown to protect young infants against respiratory tract infections, while lack of breast feeding predisposing young infants to pneumonia and diarrheoa diseases.[22] Also compared with breastfed infants, formula-fed infants have been shown to face higher risks of infectious morbidity in the first year of life, because they lack specific and innate immune factors provided in human milk which protect against infection, particularly against the common respiratory pathogens, such as Haemophilus influenza and Streptococcus pneumonia [22]Although evidence has shown that breastfeeding protect infants against infection and has protective factor for reducing risk of respiratory illness among infants,[22-24] in this study there was no statistically significant association between breastfeeding and pneumonia.

Prematurity was significantly associated with the development of pneumonia and the odds of developing pneumonia significantly increased with prematurity. This is similar to the findings of a study that examined the risk factors of pneumonia among under-five children in Alexandria, Egypt. [25] Lower immunity and defects in lung functions were the possible mechanisms that put premature and low birth weight children at the risk of developing respiratory infections including pneumonia.[26]

Several factors including age, gender, immunization status, breast feeding patterns and environmental factors such as the type of cooking fuel and the presence of indoor smoking were not significantly associated with the development of pneumonia in this study in contrast to what has been found in other studies. [25] Children who live in homes where there is indoor smoking are more likely to develop pneumonia, as well as families who use firewood and charcoal as cooking fuel,

which is common in rural households.[26] Our study location was in an urban center, which most likely explains the lack of association between the type of cooking fuel, and the development of pneumonia. Identifying the risk factors for the development of pneumonia, and the level of association is important for strategically developing interventions to reduce pneumonia burden among under-five children in Nigeria.

Limitations of the study: Certain limitations of this study should be recognized. Based on limited resources, the diagnosis of pneumonia was based on clinical findings. Further studies in this area can include chest X-ray and laboratory investigation in the assessment of pneumonia. This study assessed the frequency of the development of pneumonia and its' determinants but not the severity; the determinants of the severity of pneumonia could be different. This can be an area of research for further studies. The cross-sectional design of this study does not permit causal conclusion to be drawn. However, this study provided useful information that can be used as a baseline for other studies.

Conclusion: About 1 in 8 children of under-five children attending primary health care clinic in Amuwo Odofin Local Government Area Lagos State, Nigeria had pneumonia. There was no significant association between the development of pneumonia and the immunization status of these children. However, prematurity was associated with the development of pneumonia in these children and children born as premature babies were twice more susceptibility to the development pneumonia.

Recommendations: Governments should make skilled health care services more available and accessible to all pregnant mothers to ensure that they deliver termed children in order to reduce the prevalence and burden associated with childhood preventable disease like pneumonia. Health workers should create more awareness and sensitize mothers as well as the community members on the risk factors that can predispose a child to pneumonia such as lack of immunization, prematurity, lack of exclusive breast feeding, poorly ventilated housing conditions, and indoor smoking to prevent under-five pneumonia.

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