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Socio-demographic and clinical factors predicting time to presentation for children with pneumonia in Ilorin, Nigeria[☆]

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ABSTRACT

Background: Pneumonia is a major contributor to morbidity and mortality in children, and the time to presentation is a recognized contributor towards disease severity and outcome.

Objectives: The current study aimed to explore the influence of some socio-demographic and clinical factors in children with pneumonia on the time to presentation at a health facility in Ilorin, North Central Nigeria.

Materials and method: A prospective cross-sectional study of 167 children with pneumonia was done. The duration of the various symptoms and first presentation to a health facility was obtained. Time to presentation was categorized as 0–2 days (early), 3–5 days (intermediate) and greater than five days (late). Multinomial logistic regression analysis was used to identify significant predictors of either early or intermediate presentation compared with late presentation. A *p*-value of less than 0.05 was considered significant.

Results: Fifty-one (30.5%) children with pneumonia had an early presentation, 73 (43.7%) had intermediate presentation and 43 (25.7%) were late in presentation. Predictors of early presentation were younger age (OR 0.96, 95%CI 0.93–0.99), higher respiratory rates (OR 1.03, 95%CI 1.01–1.06) and bronchopneumonia (OR 6.93, 95%CI 1.52–31.63). Predictors of intermediate presentation were families with few number of children (OR 0.73, 95%CI 0.57–0.92) and bronchopneumonia (OR 3.41, 95%CI 1.02–11.38).

Conclusion: Infancy and families with few children are socio-demographic features that are likely to determine early-to-intermediate presentation of children with pneumonia while high respiratory rates and bronchopneumonia are disease related factors that predict early presentation.

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1. Introduction

Pneumonia remains a major cause of morbidity and mortality among under-five children, especially in developing countries.¹ Globally, the median (interquartile range) incidence of pneumonia is 0.19(0.1–0.44) episodes per child year with the highest incidence occurring in Africa at 0.27(0.14–0.63) episodes per child year.² An estimated 1.3 million episodes of pneumonia resulted in mortality in 2011, and more than 50 percent of the pneumonia-related mortality occurred in Sub-Sahara Africa, with Nigeria being a major contributor to the mortality. Thus, reducing the pneumonia-

related mortality will contribute towards reducing the global childhood mortality.

Towards achieving this goal, the WHO and UNICEF are making concerted efforts with the aim of reducing the pneumonia-related incidence and mortality by 2025.³ A multipronged approach encompassing the use of simple, cheap and readily accessible methods such as improved vaccination, nutritional, social and environmental factors as well as case management have been identified as required. Improved care seeking, early recognition and timely use of antibiotics are needed in order to reduce the attendant morbidity associated with the disease.⁴ Despite this recommendation, there may still be some delays in accessing the appropriate healthcare services required. This may be a major bottleneck towards improved case management as time to presentation is a recognized contributor towards disease severity and outcome. Therefore, the current study aimed to explore the influence of some socio-demographic and clinical factors in children with pneumonia on the time to presentation at a health facility in Ilorin, North Central Nigeria.

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2. Materials and method

This was a prospective cross-sectional study, from part of a larger study, conducted in the Emergency Paediatric Unit (EPU) of the University of Ilorin Teaching Hospital (UIH) in which the subjects were children aged between two months and up to 5 years diagnosed with pneumonia. The hospital, a tertiary facility that also provides primary and secondary care, is located in Ilorin, the capital city of Kwara State, situated in North Central Nigeria.

A minimum sample size of 151 was calculated using the Fisher formula,⁵ and a prevalence of pneumonia estimated at 11.1% from a previous study,⁶ however a total of 167 subjects were enrolled over a period of one year (June 2015–May 2016).

Subjects were recruited based on the presence of clinical features comprising cough of less than 28 days duration, fever, difficult breathing, tachypnoea, and auscultatory findings of one or more of reduced breath sound intensity, bronchial breath sounds, or crepitations.⁷ The exclusion criteria included caregiver's refusal to consent, and previously recruited children representing with symptoms recrudescence. Subject recruitment was done at the initial presentation in EPU via a purposive sampling.

Approval was obtained from the *Ethics and Research Committee* of UIH. After obtaining an informed consent from the parent or caregiver, a semi-structured questionnaire was administered to obtain the clinical and socio-demographic data from each subject's parent/caregiver. The Oyediji socio-economic classification scheme was used to calculate the socio-economic score of each child based on the occupations and educational attainments of their parents/caregiver and thereafter categorized into low, middle or high social class.⁸ The duration of the various symptoms as well as the number of days the child was ill before first presentation at a health facility was obtained. Time to presentation was categorized as 0–2 days (early), 3–5 days (intermediate) and greater than five days (late).

The weight and height of all the subjects were taken with appropriate scales after ensuring calibration. A complete physical examination of the child was done. Chest radiographs were obtained in all subjects and radiographic features were recorded as either normal, presence of patchy opacities in one or more lobes, or lobar/segmental consolidation with or without an air bronchogram. Children were classified as having either bronchopneumonia or lobar pneumonia using a combination of clinical and radiographic features. The presence of pneumonia-related complications such as heart failure was also noted. All subjects had a blood specimen obtained for blood culture, packed cell volume (PCV), total and differential white blood cell (WBC) count. The children were managed appropriately based on the hospital's protocol for management of children with pneumonia.

Data was analyzed using the IBM® SPSS version 20.0 (IBM corporation, Virginia, U.S.A.) 2011 for windows software package. Frequency tables and simple proportions were generated while the *chi-square* (χ^2) and *Student's t-tests* were used to identify significant differences for categorical and continuous variables respectively. Also, analysis of variance (ANOVA) test was used in comparing the means when there were more than two groups for comparison. Multinomial logistic regression analysis was used to identify significant predictors of early compared with late presentation, as well as predictors of intermediate presentation compared with late presentation using models created from variables that were significant on a multivariate analysis. A *p*-value of less than 0.05 was considered significant.

3. Results

Out of 167 children with pneumonia recruited, there were 100 (59.9%) males and 67 (40.1%) females. The most frequent age

groups of the subjects were less than 12 months (101 children, 60.5%), and children aged 12 to less than 24 months (33 children, 19.8%). Children aged between 24 to less than 36 months were 17 (10.2%) and the remaining 16 (9.6%) children were aged between 36 months and 59 months.

The commonest symptoms at presentation were fever (129 children, 77.2%), cough (115 children, 68.9%) and difficult breathing (42 children, 25.1%). Others were diarrhoea (24 children, 14.4%), vomiting (6 patients, 3.6%), noisy breathing (6 patients, 3.6%), rashes, convulsions with altered consciousness and fast breathing (4 patients each, 2.4%).

Fifty-one (30.5%) of patients had an early presentation, 73 (43.7%) had intermediate presentation and 43 (25.7%) were late in presentation.

The relationship between time to presentation and selected socio-demographic features is shown in Table 1. The mean age of the children that presented early was significantly lower than the corresponding value in children with either intermediate or late presentation (*p* = 0.040). Also, the number of children in the family with early and intermediate presentation were fewer compared with the number of children in the family with late presentation (*p* = 0.006).

Regarding the relationship between clinical features of pneumonia among the patients and time to presentation, these are shown in Table 2. The mean respiratory rate and pneumonia type were the only clinical parameters significantly related to duration of illness before presentation (both *p* < 0.05).

Variables that had a *p*-value less than 0.05 were used to build a multinomial logistic regression model that compared early to late presentation as presented in Table 3. When compared to a late presentation (Table 3), predictors of early presentation include younger age (OR 0.96, 95%CI 0.93–0.99), higher respiratory rates

Table 1
Socio-demographic characteristics of study population and time to presentation.

Variable	Early (≤2 days) n (%)	Intermediate (3–5 days) n (%)	Late (>5 days) n (%)	<i>p</i>
<i>Age (months)</i>				
2–<12	39 (76.5)	41 (56.2)	21 (48.8)	0.015
≥12	12 (23.5)	32 (43.9)	22 (51.2)	
<i>Age (months) mean ± SD[#]</i>	10.16 ± 9.87 ^a	16.31 ± 19.06 ^b	17.77 ± 15.52 ^b	0.040
<i>Gender</i>				
Male	28 (54.9)	41 (56.2)	31 (72.1)	0.164
Female	23 (45.1)	32 (43.8)	12 (27.9)	
<i>Maternal education</i>				
None/Primary	5 (9.8)	11 (15.1)	5 (11.6)	0.201
Secondary	19 (37.3)	16 (21.9)	12 (27.9)	
Post secondary	27 (52.9)	46 (63.0)	26 (60.5)	
<i>Paternal education</i>				
None/Primary	8 (15.7)	10 (13.7)	3 (7.0)	0.091
Secondary	25 (49.0)	21 (28.8)	17 (39.5)	
Post secondary	18 (35.3)	42 (57.5)	23 (53.5)	
<i>Social class</i>				
Lower	10 (19.6)	12 (16.4)	8 (18.6)	0.341
Middle	13 (25.5)	32 (43.8)	15 (34.9)	
Upper	28 (54.9)	29 (39.7)	20 (46.5)	
<i>Smoker in the house</i>				
Present	7 (13.7)	10 (13.7)	5 (4.7)	0.941
Absent	44 (86.3)	63 (86.3)	38 (95.3)	
<i>Number of children mean ± SD[#]</i>	3.08 ± 1.93 ^a	2.56 ± 1.43 ^a	3.76 ± 2.54 ^b	0.006

[#] ANOVA test done.

^{a,b} Duncan multiple range test shows that means with the same letter are not statistically different at *p* < 0.05.

Table 2

Clinical characteristics of children with pneumonia and time to presentation.

Variable	Early N (%)	Intermediate N (%)	Late N (%)	p
<i>Temperature (°Celsius)</i>				
mean ± SD	37.89 ± 0.71	38.09 ± 0.87	38.01 ± 1.20	0.480
<i>Respiratory rate (cycles/minute)</i>				
mean ± SD [#]	69.00 ± 12.67 ^a	61.70 ± 18.11 ^b	62.37 ± 17.83 ^b	0.042
<i>Weight for age z score</i>				
<−2	21 (41.2)	38 (52.1)	16 (37.2)	0.244
−2 to +2	30 (58.8)	35 (47.9)	27 (62.8)	
<i>Weight for age[*]</i>				
≤60%	6 (11.8)	13 (17.8)	2 (4.7)	0.166
61–80%	20 (39.2)	34 (46.6)	18 (41.9)	
>80%	25 (49.0)	26 (35.6)	23 (53.5)	
<i>Height for age[*]</i>				
<95%	24 (47.1)	43 (58.9)	27 (62.8)	0.258
≥95%	27 (52.9)	30 (41.1)	16 (37.2)	
<i>Age related tachypnea</i>				
Present	47 (92.2)	63 (86.3)	33 (76.7)	0.103
Absent	4 (7.8)	10 (13.7)	10 (23.3)	
<i>Pneumonia type</i>				
Bronchopneumonia	48 (94.1)	68 (93.2)	31 (72.1)	0.001
Lobar pneumonia	3 (5.9)	5 (6.8)	12 (27.9)	
<i>Complications</i>				
Present	16 (31.4)	24 (32.9)	20 (46.5)	0.241
Absent	35 (68.6)	49 (67.1)	23 (53.5)	

[#] ANOVA test done.^{a,b} Duncan multiple range test shows that means with the same letter are not statistically different at p < 0.05.^{*} Percentage of expected for age.**Table 3**

Multinomial regression analysis of predictors of early compared to late presentation.

Variable	B [#]	p	OR (95%CI)
Age of child (months)	−0.42	0.024	0.96 (0.93–0.99)
Number of children	−0.13	0.262	0.88 (0.71–1.01)
Respiratory rate (cycles/minute)	0.03	0.040	1.03 (1.00–1.06)
Bronchopneumonia	1.94	0.012	6.93 (1.52–31.63)
Lobar pneumonia [*]			

OR = Odds ratio.

95%CI = 95% confidence interval.

^{*} Reference category.[#] Estimated logistic co-efficient.

(OR 1.03, 95%CI 1.01–1.06) and bronchopneumonia (OR 6.93, 95% CI 1.52–31.63).

Multinomial logistic regression was used to identify predictors of intermediate presentation compared to late presentation using the variables that were significant in the multivariate analysis for the creation of the model. When compared with a late presentation (Table 4), predictors of intermediate presentation were families

Table 4

Multinomial regression analysis of predictors of intermediate compared to late presentation.

Variable	B [#]	p	OR (95% C.I.)
Age of child (months)	−0.01	0.326	0.99 (0.97–1.01)
Number of children	−0.32	0.008	0.73 (0.57–0.92)
Respiratory rate (cycles/minute)	0.01	0.892	1.00 (0.98–1.03)
Bronchopneumonia	1.23	0.046	3.41 (1.02–11.38)
Lobar pneumonia [*]			

OR = Odds ratio.

95%CI = 95% confidence interval.

^{*} Reference category.[#] Estimated logistic co-efficient.**Table 5**

Comparison of time to presentation and outcome.

Time to presentation	Recovered n (%)	Died n (%)	p
Early and intermediate	123 (78.8)	1 (9.1)	<0.001
Late	33 (21.2)	10 (90.9)	
Total	156 (100.0)	11 (100.0)	

with fewer number of children (OR 0.73, 95%CI 0.57–0.92) and bronchopneumonia (OR 3.41, 95%CI 1.02–11.38).

Eleven (6.7%) of the children with pneumonia died; 10(90.9%) deaths occurred in children who had a late presentation which was significantly higher than the single death recorded among the children with early-to-intermediate presentation as shown in Table 5.

4. Discussion

The percentage of children with pneumonia who had an early presentation of 30.5% recorded in the current study is low, and shows a significant delay in presentation as more than two-thirds of the children presented at least three days after onset of illness. This current study finding of delayed presentation beyond three days after onset of illness in almost 70% of the children is similar to the report from Kenya,⁹ and Uganda.¹⁰ There is a need to increase caregivers awareness about the importance of timely and appropriate health care seeking for children via education as delays in seeking treatment would probably lead to progression of the disease with increase in disease severity and risk of mortality. This is evident from the current study finding of greater than 90% mortality recorded in the children with late presentation, a finding which had also been reported by some authors.^{11,12} Delays in seeking appropriate medical care is a major obstacle that needs to be overcome in order to reduce the morbidity and mortality associated with pneumonia.¹³ Strategies to encourage appropriate and timely health care seeking such as media campaigns and intensification of the integrated case management of pneumonia via capacity building of the different cadres of health workers could be adopted.

The findings of a significantly higher mean respiratory rate among the early presenters when compared with either the intermediate or late presenters could be adduced to fast breathing being a sign that is readily recognized by the parent/caregiver,¹⁴ and perceived as evidence of pneumonia,^{15–17} therefore ensuring a prompt health care seeking behaviour. This finding of high respiratory rate as a predictor of early disease presentation is in keeping with some earlier works^{18–20} which had found children with fast breathing were more likely to have early hospital presentation.

The current study identified age to be a significant predictor of early presentation, with a younger aged child having an early presentation. The preponderance of infants and toddlers aged less than two years amongst the children with pneumonia is in accord with earlier observations that identified this age group at increased risk of having pneumonia.^{6,21–25} Indeed, it has been found that 81% of pneumonia-related deaths occurs in the first two years of life.² The fact that infants are unable to express themselves may partly explain why the parents of children in this age group present them early at the health facility.

The current study finding of few number of children in a family as a predictor of intermediate presentation, rather than early presentation, is surprising as it is expected that families with few children would hasten to seek health care for the ill child. Gombojav et al. had earlier reported that families with a single child had a delay in medical seeking.²⁶ Maternal educational level was not significantly associated with time of presentation in the present

study, however, a higher proportion of children whose mothers had post-secondary education had early-to-intermediate presentation. This finding is similar to the reports from Pakistan which identified maternal education as a predictor of early health seeking behaviour.²⁷

Children with bronchopneumonia had a sevenfold increased odd compared with lobar pneumonia of having an early presentation, and a threefold increased odd of intermediate presentation when compared to late presentation. Children with lobar pneumonia have been reported to have a higher frequency of pneumonia related complications and mortality when compared with children with bronchopneumonia.^{28,29} Therefore, it is expected that children with lobar pneumonia should be brought earlier than children with bronchopneumonia to seek appropriate health care. However, this is contrary to the current study finding which found that children with bronchopneumonia had a sevenfold increased odd compared with lobar pneumonia of having an early presentation, and a threefold increased odd of intermediate presentation when compared to late presentation. This finding may be partly explained by the fact that bronchopneumonia is more commonly seen in the younger aged child compared to lobar pneumonia, and accounted for the majority of the cases recruited which is similar to the earlier report of Johnson et al.²⁸

In conclusion, Infancy and families with few children are socio-demographic features that are determinants of early-to-intermediate presentation of children with pneumonia while high respiratory rates and bronchopneumonia are disease related factors that predicts early presentation.

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Conflict of interests

None.

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