

ORIGINAL ARTICLE

Burden and spectrum of paediatric respiratory diseases at a referral hospital in North-Central Nigeria - A five year review

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ABSTRACT

Introduction: Globally respiratory diseases, comprising a broad range of disease conditions due to infectious and non-infectious causes, are a major cause of childhood morbidity and mortality. Thus, identification of the burden of respiratory illness will ensure appropriate interventions towards reducing its attendant morbidity and mortality. The study was conducted to identify the burden, spectrum and outcome of respiratory diseases in hospitalized children at University of Ilorin Teaching Hospital, North-Central Nigeria.

Methods: A retrospective descriptive cross-sectional study involving children admitted through the emergency paediatric unit over five years (January 2013-December 2017) was conducted. Data on demography, diagnosis, comorbidities and complications, duration of admission, and outcome were collected and analyzed using SPSS 20.

Results: Of the total 7012 children admitted, 1939(27.7%) were due to respiratory diseases with a median age of 16 (interquartile range {IQR} 7-36) months. Males were 994(51.3%) and 945(48.7%) females. Infectious diseases were the most common cause of admission. Pneumonia (50.1%) and aspiration pneumonitis (5.1%) accounted for the highest admissions due to infective and non-infective respiratory diseases respectively. Overall, respiratory diseases accounted for 20.7% (119/574) of the overall mortality among all admissions while the all-respiratory disease mortality was 6.1% (119/1939). The major contributors to mortality were pneumonia, aspiration pneumonitis and tuberculosis accounting for 81(68.1%), 12(10.1%) and nine (7.6%) deaths respectively. The median duration of hospital stay was four days [IQR: 2 to 6 days]. A significantly higher proportion of the deaths occurred with four days of admission and 82.4% of the deaths occurred among those aged less than five years. A higher number of females (70, 58.8%) died compared to males (49, 41.2%), $p=0.05$.

Conclusion: Pneumonia and aspiration pneumonitis are major contributors to morbidity and mortality due to respiratory diseases for which interventions towards improving childhood health indices should be prioritized.

African relevance

- Respiratory disorders are a common cause of morbidity and mortality in Ilorin, North-Central Nigeria.
- It is also a common cause of morbidity and mortality across the rest of Africa
- There is an urgent need for co-ordinated interventions to address the burden of respiratory disorders across the continent.

Introduction

Respiratory diseases consist of a wide spectrum of disease conditions that may be categorized as due to either an infectious cause such

as pneumonia, bronchiolitis and croup or non-infectious cause such as asthma [1]. Respiratory tract infections are a major cause of morbidity and mortality worldwide, especially in the under-five years [2]. Pneumonia accounted for 14.9% of all death amongst under five children globally in 2013 [2]. Asthma is a major non-infectious respiratory disease in children. Globally, asthma is among the top 20 disease conditions responsible for disability-adjusted life years in children and estimated death rates of ≤ 0.7 per 100 000 [3].

A number of studies have described the pattern of respiratory illness amongst adults in Nigeria [4–7] but there is a paucity on the pattern of respiratory disease amongst children in Africa. Two studies addressed the burden of respiratory illnesses in both children and adults, [1,8] and these reviews utilized various studies on specific disease conditions to

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Fig. 1. Map of Nigeria showing Kwara State (Shaded red) [12].

identify the burden. Another study from Tanzania evaluated the respiratory disease specific mortality amongst both children and adults [9]. Available studies in Nigeria that identified the pattern of respiratory illness amongst children have emanated from the South east region [10,11]. Due to the varying climate and environmental factors in the different regions of Nigeria, the spectrum of respiratory disease may differ with locality. Thus, there is a need to identify the pattern of respiratory diseases in the North-Central region of Nigeria. This is to enable deployment of the necessary intervention needed for reducing the morbidity and mortality of respiratory illnesses as timely and appropriate treatment is a key intervention.

Methods

This was a retrospective descriptive cross-sectional study conducted in the Emergency Paediatric Unit (EPU) of the University of Ilorin Teaching Hospital (UITH) which is located in Ilorin-East Local Government Area (LGA) of Kwara State. Ilorin is the capital city of Kwara State, one of the six states in the North-Central geopolitical zone of Nigeria. The state shares borders with Niger State to the North, Kogi State to the East, Oyo, Ekiti and Osun States to the South and an international boundary with the Republic of Benin to the West (Fig. 1).

Ilorin is located on latitude 8°30'N and longitude 4°35'E. Based on the 2006 population census results and an annual growth rate of 2.6%, Ilorin had an estimated population of 1,049,168 in 2013. The UITH provides health care at the primary, secondary and tertiary care levels and serves as the main referral hospital in Kwara State.

The records of all children admitted into the EPU between 1st January 2013 and 31st December 2017 were retrieved from the admission registers of the doctors and nurses. The admission register contains the hospital number, name, gender, address, date of admission, initial and final diagnosis, outcome of hospital stay and date of discharge of all admitted children. Each register is updated daily by the nurses and doctors.

Diagnosis of respiratory diseases in the department is based on a combination of clinical evaluation and relevant investigations, including but not limited to chest radiographs, chest computerized tomographic scans, Mantoux test, blood/ sputum cultures, Genexpert tests, spirometry, and echocardiograms, where necessary. Children readmitted on account of the same disorder were recruited only once. For the purpose of this study, respiratory diseases were defined as any condition affecting the respiratory tract, irrespective of aetiology. The data extracted from the records included the age, sex, diagnosis, complications and co-morbidities, duration of stay and outcome. The outcome was classified as discharged, died, and discharged against medical

Table 1

Annual distribution of total and respiratory admissions/mortality

| Year | Total admissions | Respiratory diseases admissions n(%) | Total mortality n (%) | Deaths per year due to respiratory diseases n(%) |
|-------|------------------|--------------------------------------|-----------------------|--|
| 2013 | 1784 | 528(29.6) | 144 (8.1) | 31(5.9) |
| 2014 | 1230 | 320(36.0) | 110 (8.9) | 21 (6.6) |
| 2015 | 1315 | 353(26.8) | 103(7.8) | 23 (6.5) |
| 2016 | 1050 | 282(26.9) | 79 (7.5) | 21 (7.4) |
| 2017 | 1633 | 456(27.9) | 138 (8.5) | 23(5.0) |
| Total | 7012 | 1939(27.7) | 574 (8.2) | 119 (6.1) |

advice (DAMA). The duration of stay for all the patients was also obtained from the records irrespective of the disease outcome.

The data recorded on the proforma were entered into a micro-computer using numerical codes and analyzed with SPSS version-20.

The type of respiratory diseases, number of deaths, hospital discharges and DAMA were expressed as frequencies and percentages. The 95% confidence interval was calculated for proportions. Continuous variables such as the age of the subjects and the duration of hospital stay were expressed as median, interquartile range as they were not normally distributed.

The Fishers exact test was used to compare proportions of outcome between sex, age and duration of hospital categories. A p-value of less than 0.05 was considered significant.

Results

The children with respiratory illnesses comprised 994 (51.3%) males and 945 (48.7%) females. The median age of the children was 16 (IQR 7–36) months. Majority (82.6%) subjects were aged less than five years; 738 (38.1%) infants and 863 (44.5%) children aged one year to less than five years. Children aged between five years and less than ten years were 199(10.3%) while the remaining 139 (7.2%) were aged 10 years and above.

Respiratory diseases contributed 20.7% (119/574) of the overall mortality among all admissions while the all-respiratory disease mortality was 6.1% (119/1939). Table 1 shows the total number of admissions, respiratory admissions, all-cause mortality and respiratory related mortality over the five year period. Respiratory diseases have been responsible for between 26.8% and 36.0% of all admissions over the years reviewed with an overall proportion of 27.7% (95%CI 26.6–28.7).

Regarding the type of respiratory disease, 1722 (88.8%) had an infective condition while 217(11.2%) children had a non-infective condition. Table 2 shows that the most common infective respiratory illnesses were pneumonia, pharyngotonsillitis and bronchiolitis while the most common non-infective respiratory diseases were aspiration pneumonitis, asthma and acute chest syndrome.

The major contributors to mortality among the respiratory diseases were pneumonia, aspiration pneumonitis and tuberculosis accounting for 81(68.1%), 12(10.1%) and nine (7.6%) deaths respectively. (Table 2)

There were two peak periods of presentation for respiratory diseases as shown in Fig. 2. The higher peak occurred between June and July, while the smaller but broader peak occurred between November and March.

Of the total children with respiratory diseases, 119 (6.1%) died, eight (0.4%) were discharged against medical advice (DAMA) by their caregivers and 1812 (93.5%) were successfully managed and discharged. The median duration of hospital stay was four (IQR, 2–6) days. A significantly higher proportion of the deaths occurred within four days of admission and majority (82.5%) of the deaths occurred among those aged under five years. (Table 3) A higher number of females (70, 58.8%) died compared to males (49, 41.2%), $p=0.054$.

The most common complications identified were heart failure, vomiting and febrile convulsion. The highest case fatalities among the children with respiratory-related complications were due to severe anaemia, pleural effusion and pneumothorax. The most common co-

Table 2
Distribution of types of respiratory illness with contribution to morbidity and mortality.

| Variable | Age group (years) | | | Total n(%) | Deaths | |
|--------------------------|-------------------------------|------------------------|------------|---------------------|--------------------|------------|
| | <5 | 5–<10 | ≥10 | | | |
| Infective | Pneumonia | 809 | 99 | 63 | 971(50.08) | 81 (68.1) |
| | Pharyngitis/tonsillitis | 437 | 48 | 12 | 497 (25.63) | 3(2.5) |
| | Bronchiolitis | 97 | – | – | 97 (5.00) | 3(2.5) |
| | Tuberculosis | 22 | 13 | 33 | 68 (3.51) | 9 (7.6) |
| | ALTB ^a | 34 | – | – | 34 (1.76) | 2(1.7) |
| | Pertussis | 16 | – | 1 | 17 (0.88) | 1(0.8) |
| | Otitis media | 13 | 1 | 1 | 15 (0.77) | 1(0.8) |
| | Para/Retro pharyngeal abscess | 6 | 1 | – | 7 (0.36) | 1(0.8) |
| | Peritonsillar abscess | – | 4 | 1 | 5(0.26) | – |
| | Laryngeal papillomatosis | 1 | 1 | 2 | 4(0.21) | 1(0.8) |
| | Nasopharyngitis | 4 | – | – | 4(0.21) | – |
| | Diphtheria | – | 2 | – | 2(0.10) | 2(1.7) |
| | Bronchiectasis | – | 1 | – | 1(0.05) | – |
| | Non-infective | Aspiration pneumonitis | 111 | 3 | – | 114 (5.87) |
| 2° to kerosene =78 | | | | | | |
| 2° to feeds = 18 | | | | | | |
| 2° to bath water = 6 | | | | | | |
| Others = 9 | | | | | | |
| Asthma | | 40 | 10 | 11 | 61 (3.15) | – |
| Acute chest syndrome | | 1 | 11 | 14 | 26 (1.34) | 1(0.8) |
| Foreign body aspiration | | 8 | 3 | 1 | 12(0.62) | 2(1.7) |
| Epistaxis | | 1 | 1 | – | 2 (0.10) | – |
| Laryngeal web | | 1 | – | – | 1(0.05) | – |
| Nasopharyngeal carcinoma | | – | 1 | – | 1(0.05) | – |
| Total | 1601 | 199 | 139 | 1939 (100.0) | 119 (100.0) | |

^a Acute laryngotracheobronchitis.

morbid illnesses identified in these children were sickle cell disease, measles and congenital heart diseases, as shown in Table 4.

Discussion

Respiratory illnesses have been shown to be a common reason for admission in the current study accounting for 27.8% of the admissions with the infectious respiratory diseases being the predominant cause. This is similar to the report of 24.7% from Enugu [10]. There was a male preponderance, which is similar to findings from earlier reports

[10,11,13,14]. The fact that males were more affected may reflect the identified male preponderance for respiratory infectious diseases such as pneumonia, bronchiolitis [15,16].

The age preponderance for the under-five years in the current study is similar to earlier reports [10,11]. The increased vulnerability of the under-five age group to respiratory illness is most likely related to less compliant lungs, increased propensity for blockage of the airway by secretions, inflammation and foreign objects due to the smaller airway dimensions, and the immature immune systems [16,17].

The two identified peak periods of presentation for respiratory

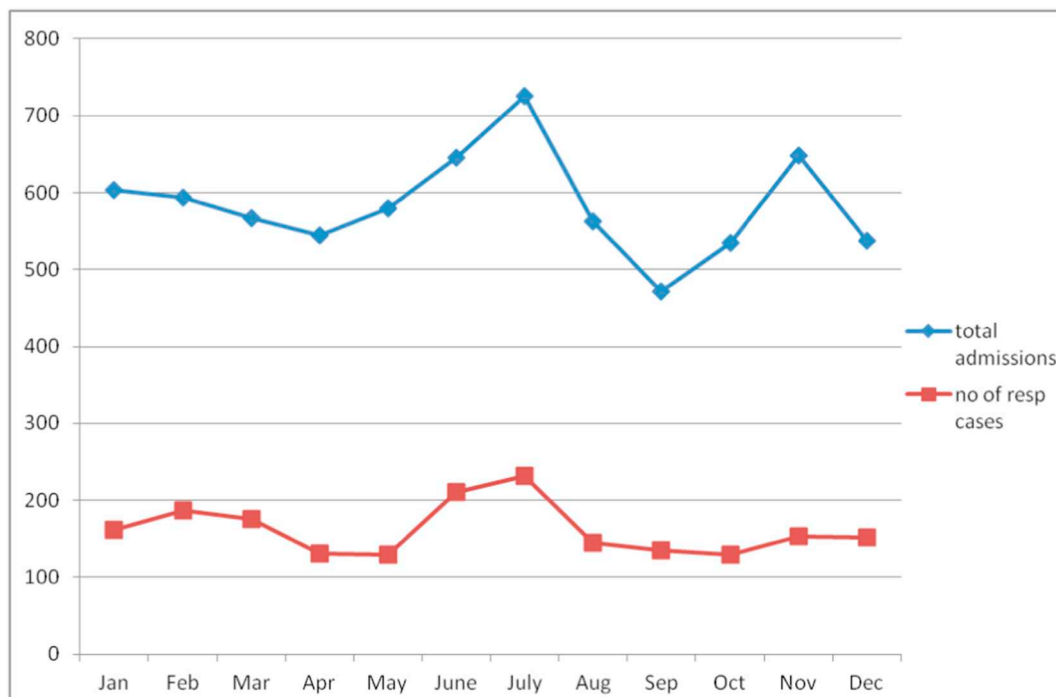


Fig. 2. The seasonal pattern of admissions of respiratory illnesses.

Table 3
Outcome of admission for respiratory diseases.

| Variable | Outcome of hospital admission | | | Fisher exact derived p-value |
|----------------------------------|-------------------------------|--------------------------------|-----------------------|------------------------------|
| | Died N = 119 n(%) | Discharged N = 1812 n(%) | DAMA N = 8 n(%) | |
| Gender | | | | |
| Male | 49(4.9) | 940(94.9) | 5(0.5) | 0.0634 |
| Female | 70(7.4) | 872(92.3) | 3(0.3) | |
| Age group (years) | | | | |
| < 5 | 98(6.1) | 1498(93.6) | 5(0.3) | 0.591 |
| 5–< 10 | 11(5.5) | 186(93.5) | 2(1.0) | |
| ≥ 10 | 10(7.2) | 128(92.1) | 1(0.7) | |
| Duration of hospital stay (days) | | | | |
| ≤ 4 | 100 (8.6) | 1061(91.1) | 4(0.3) | < 0.001 |
| > 4 | 19(2.5) | 751(97.0) | 4(0.5) | |

diseases corresponds with the peak of the rainy season and dry season in Nigeria. During the rainy season, the weather is cold and humid while the months of January till March are associated with hot, dry and dusty weather. The cold humid period has been identified to be a risk factor for pneumonia and other respiratory infectious diseases [17,18]. Furthermore, during this period there is a high preponderance of pollens and frequent upper respiratory infections which results in an increase in asthma flare-ups. The dry dusty weather also predisposes to asthma flare-ups. The current seasonal variation in the pattern of admissions was similarly reported amongst children from the South East region [10,11].

The finding of pneumonia and bronchiolitis as the first and third highest infective causes of hospitalization due to respiratory illness in this study is similar to the reports from Abakaliki and Enugu [10,11]. However, the second highest cause of admission in the present study was pharyngotonsillitis which differed from the report of rhinosinusitis in Enugu and pulmonary tuberculosis in Abakaliki.

Amongst the non-infective causes, aspiration pneumonitis was the leading cause in the present study which was also the commonest non-infective cause reported in Abakaliki. In Enugu [10], kerosene aspiration was the third common cause of non-infective respiratory disease in their study. Oguonu et al in Enugu reported asthma as the leading non-

infective respiratory disorder which contrasts with the current study finding of asthma as the third non-infective respiratory condition requiring admission. A substantial proportion of the aspiration pneumonitis cases in the current study were due to accidental kerosene ingestion with inhalation. Kerosene is a source of cooking fuel in most Nigerian household which is often stored in easily accessible containers that the toddler is familiar with such as plastic water bottles and soft drink bottles [19,20]. Kerosene has a high volatility which enables it to diffuse readily to children's airway upon ingestion causing irritation of the airways [21]. Further harmful home intervention, such as inducing vomiting and palm oil ingestion as an antidote with resultant vomiting, aggravates the risk of aspiration [21]. There is a need to educate caregivers on the importance of proper storage of kerosene in areas inaccessible by the toddler. Furthermore increased awareness through health education and behavioural change communication is needed to ensure the discontinuation/avoidance of force feeding which is a cultural technique of feeding toddlers in Nigeria [22].

Acute chest syndrome, a respiratory complication of sickle cell anaemia that manifests with worsening respiratory distress, fever and hypoxaemia [23], accounted for 1.8% of the respiratory diseases seen in the present study which is almost similar to the proportion of 1.3% reported in Enugu. It is a common cause of respiratory admissions among sickle cell disease patients which if not timely managed with adequate hydration, analgesia and cardiopulmonary support in the intensive care unit is likely to be fatal. It behoves the clinician to have a very high index of suspicion for this clinical entity in the child with sickle cell disease so as to ensure early identification and management.

Sickle cell disease was the most common co-morbid illness identified in the children with respiratory disease in the current study. With a prevalence of sickle cell anaemia of 3.0% in Nigeria, a high predisposition to infections by encapsulated organisms such as pneumococcus, and the lungs being one of the major organs affected in sickle cell disease [23], frequent respiratory illnesses with significant morbidity and mortality are likely to occur. Thus prevention of infections through immunization, ensuring adequate hydration as well as appropriate and timely management of vaso-occlusive crises in children with sickle cell disease is plausible to reduce the incidence of respiratory illnesses.

Measles, a major co-morbid illness in the current study, is a vaccine preventable disease which has been identified to be a risk factor for

Table 4
Complications and co-morbidities of the respiratory diseases.

| Variable | Frequency | Percentage | Deaths | Case fatality |
|--|-----------|------------|--------|---------------|
| Type of complication | | | | |
| Heart failure | 237 | 41.1 | 31 | 13.1 |
| Vomiting | 164 | 28.5 | 4 | 2.4 |
| Febrile convulsion | 94 | 16.3 | 0 | – |
| Pleural effusion | 33 | 5.7 | 10 | 30.3 |
| Severe anaemia | 17 | 3.0 | 6 | 35.3 |
| Empyema thoracis | 12 | 2.1 | 2 | 16.7 |
| Pneumothorax | 5 | 0.9 | 1 | 20.0 |
| Heart failure + pleural effusion | 5 | 0.9 | 0 | – |
| Disseminated Intravascular Coagulation | 2 | 0.3 | 2 | 100.0 |
| Hypoglycaemia | 2 | 0.3 | 0 | – |
| Lung collapse | 2 | 0.3 | 0 | – |
| Acute Kidney Injury | 1 | 0.2 | 0 | – |
| Hydropneumothorax | 1 | 0.2 | 0 | – |
| Subcutaneous emphysema | 1 | 0.2 | 0 | – |
| Total | 576 | 100.0 | 56 | 9.7 |
| Co-morbid illness | | | | |
| Sickle cell disease | 158 | 38.6 | 2 | 1.3 |
| Congenital heart disease | 66 | 16.1 | 11 | 16.7 |
| Human immunodeficiency virus infection | 61 | 14.9 | 8 | 13.1 |
| Measles | 73 | 17.8 | 5 | 6.8 |
| Protein energy malnutrition | 7 | 4.2 | 2 | 28.6 |
| Down Syndrome | 14 | 3.4 | 4 | 28.6 |
| Rickets | 6 | 1.5 | 0 | – |
| Seizure disorder | 6 | 1.5 | 0 | – |
| Cerebral palsy | 4 | 1.0 | 0 | – |
| Laryngomalacia | 2 | 0.5 | 0 | – |
| Cleft lip and palate | 2 | 0.5 | 0 | – |
| Total | 409 | 100.0 | 32 | 7.8 |

respiration infections like pneumonia, bronchiolitis, otitis media, and acute laryngotracheobronchitis [16,17]. Unfortunately, measles remains a common condition in Nigerian children often associated with low vaccination uptake. In Nigeria, the percentage of children age 12–23 months who had received measles vaccine by their first birthday was 41.7% overall and 66.9% in Kwara state, with only 15.0% and 6.6% of these children respectively receiving the vaccine at the appropriate time [24]. Increased advocacy on ensuring children receive all vaccines appropriately is imperative. Supplemental immunization activities and reminders/recall strategies are other options to be explored.

Majority of the respiratory related deaths occurred in the under-five age group as identified in earlier reports [9–11]. Amongst the respiratory related mortality causes, pneumonia was the major contributor as documented in some reports in Nigeria and Tanzania [9–11]. This finding is also in keeping with global reports that pneumonia is a major cause of mortality amongst under-fives [2]. Concerted efforts at reducing the burden of pneumonia through strategies as hand washing, exclusive breastfeeding, immunization, reducing exposure to biomass pollutants, early identification and treatment would reduce the mortality in this age group.

Heart failure was the most common complication identified associated with the highest mortality. In children with pneumonia, heart failure occurs due to the significant inflammation-driven reduction in the lung compliance and subsequent right ventricular strain [16]. Intrathoracic complications of pleural effusion, empyema thoracis and pneumothorax were major contributors to complication related fatality with the respiratory illness. These are all complications that are associated with worsening respiratory distress and a rapid progression to a fatal disease in children with pneumonia [16]. There is a need to facilitate early presentation of children with these complications so as to reduce the mortality associated with the disease.

This was a retrospective study using the admission records so there is a high possibility that some of the complications and co-morbid conditions of the children may have been underestimated. Furthermore, the immunization status of the children could not be ascertained. In conclusion, respiratory disorders are a common cause of morbidity and mortality in Ilorin, North-Central Nigeria. Majority of these conditions are infections and easily preventable. There is an urgent need for co-ordinated interventions to address the burden of these conditions in Nigeria.

Dissemination of results

Results of the study was shared at the 50th annual Paediatric Association of Nigeria conference (PANCONF) that held in Ibadan, Nigeria on January 23rd, 2019 via an oral presentation during one of the scientific sessions. The abstract was printed in the book of abstracts of the conference. The results were also presented at the weekly paediatrics departmental grand round of the hospital where the data was collected.

Author contribution

Authors contributed as follows to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: RMI contributed 40%; JAA 30%; MBA 25% and WBRJ contributed 5%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare no conflict of interest.

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