

Prevalence and Mortality Rate of Pneumonia Infection on Under-Five Children with a Special Reference to Adamawa State, Nigeria

By

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Abstract:

Pneumonia is the most common infectious cause of death in children accounting for more than 16% of all deaths of under-fives worldwide and it is most prevalent in south Asia and sub-Saharan Africa (WHO, 2021). The leading risk factors that contribute to pneumonia incidence are lack of exclusive breastfeeding, under-nutrition, indoor air pollution, low birth weight, overcrowding, lack of immunization and comorbid conditions (Kiconco, et al. 2021). Pneumonia claimed the lives of more than 800,000 children under the age of five in 2018 globally, with one child every 39 seconds. Nigerian children made up the highest number of those who died, with an estimated 162,000 deaths in 2018 (Geoffrey, 2019). This study used Ex Post facto design with retrospective data between 2008 and 2022 obtained from Primary Health Care Development Agency in Adamawa State. The study revealed that the prevalence rates for pneumonia disease fluctuated between 2008 and 2015. However, there was a drastically and huge decreased in the prevalence rate from 6,110 to 517 cases per 100,000 childbirths in 2015 to 2016. It then sharply increased from 517 to 6,393 cases per 100,000 childbirths in 2016 to 2017. Within the timeframe, the study also revealed that pneumonia infection registered the lowest and highest child mortality in 2013 and 2022 with 1 and 17 deaths per 100,000 childbirths respectively. The results from this research will serve as a spring board for policy formulation and implementation of Government/NGOs/Community Health Programmes in Adamawa State Nigeria.

Keywords: *Pneumonia, Prevalence rate, Under-Five, Mortality rate and Childbirths.*

Introduction:

Prevalence and mortality rates are parameters use in epidemiology for charactering the diseases and deaths within a given population. Pneumonia was defined according to the 2014 WHO Integrated Management of Childhood Illness (IMCI) guidelines as children with high cough and/or difficult breathing and fast breathing for age and/or chest in-drawing were identified as non-severe pneumonia or severe pneumonia if they had any signs of severe illness (King, et al., 2022). It is the most common infectious cause of death in children accounting for more than 16% of all deaths of under-fives worldwide and it is most prevalent in south Asia and sub-Saharan Africa (WHO, 2021). The leading risk factors that contribute to pneumonia incidence are lack of exclusive breastfeeding, under-nutrition, indoor air pollution, low birth weight, overcrowding, lack of immunization and comorbid conditions (Kiconco, et al. 2021).

Geoffrey, (2019) in a related study revealed that Pneumonia claimed the lives of more than 800,000 children under the age of five in 2018 globally, with one child every 39 seconds. Nigerian children made up the highest number of those who died, with an estimated 162,000 deaths in 2018. In Nigeria, 19% of child deaths were due to pneumonia in 2018, and it was the biggest killer of children under-five in 2017. The study also explains that the biggest risk factors for child pneumonia deaths in Nigeria are malnutrition, indoor air pollution from use of solid fuels, and outdoor air pollution.

In 2017, approximately 5.4 million children under the age of 5 died worldwide. During this period the under-5 mortality rate in Nigeria was one of the highest globally, at 100 deaths per 1000 live births, and second only to India in absolute numbers (Liu et al., 2018). In Nigeria, community-acquired pneumonia is the single largest cause of under-five deaths,

accounting for 140 520 (19%) under-five deaths in 2017 (Chao, *et al.*, 2018). Considerable progress will be needed to achieve the targets in Sustainable Development Goal 3, reducing under-5 deaths to 25 per 1,000 live births by 2030 (UN, 2015).

Pneumonia represents a significant public health problem in the whole world, and it is one of the leading causes of morbidity and mortality among under-five children (Nair, *et al.*, 2013). Pneumonia is the severe form of acute lower respiratory infections, which nearly kills one million children every year and accounted for 17.19% of all deaths among under-five children. The majority of pneumonia deaths (99%) occur in developing countries (Noha, Ayat & Yasmine, 2020). Pneumonia incidence among under-five children was estimated to be 0.05 and 0.29 episodes per child-year in developed and developing countries, respectively. Every year, nearly 156 million new episodes occur worldwide; 151 million episodes are in developing countries, and 7 13% of these episodes are severe enough to be life threatening and require hospitalization (Rudan, *et al.* 2011)

In Nigeria, Lukman & Umaru (2017) explained that pneumonia kills nearly 1.6 million children under five annually worldwide. An estimated 98 percent of children who die of pneumonia live in developing countries and according to 2008 estimates, about 177,000 children under the age of five died of pneumonia in Nigeria. This means that within an hour, 20 children across Nigeria will die from pneumonia. This number is the highest in Africa and second highest overall in the world.

Agnese, *et.al.* (2019) in a related study explained that the there was a national decrease in prevalence of pneumonia from 2011 to 2015 (from 9.6% to 2.3%) followed by an increase to 4.6% in 2018; the same trend was observed in Jigawa. In Lagos, however, following a decline between 2011 and 2013 (from 4.2% to 1.1%), the prevalence then increased with a 2018 estimate of 2.1% for the South West region. However, these values all have wide confidence intervals, especially in Jigawa, and were based on surveys done at a single time point and should therefore be interpreted with caution. The study also revealed that the under-five mortality rate of the pneumonia disease decreased moderately at national level between 2010 and 2017, while rates remained stable in Lagos and Jigawa. The national under-five mortality rate of the pneumonia was 136 deaths per 1,000 livebirths in 2010 and 100 deaths per 1,000 livebirths in 2017. In Jigawa, there was a slight increase in the under-five mortality rate during the same period from 187 deaths per 1,000 livebirths in 2010 to 191 deaths per 1,000 livebirths in 2017, while Lagos had a slight decrease from 106 deaths per 1,000 livebirths in 2010 to 92 deaths per 1,000 livebirths in 2017. However, in 2014 and 2016, estimated mortality rates of the pneumonia in Lagos were closer to 50 deaths per 1000 livebirths.

The prevalence rate of pneumonia infection in Adamawa state was 87 cases per thousand livebirths with a mortality rate of 14 deaths per thousand livebirths in 2021. The study also revealed that there exists a strong causal relationship between the pneumonia mortality and the total under-five mortality with $\beta = 3.233$, $p - value < 0.01$. This result shows that such a relationship was significant enough because it was associated with a relatively low level of significance (Lukman & Umaru, 2017).

Aim and Objective of the Study:

The aim and objective of this study is to determine the prevalence and mortality rates of pneumonia infection on under-five children in Adamawa State and recommend some preventive measures for reducing the infection among the vulnerable children.

Literature Review:

A scoping literature review of morbidity and mortality among under-five children found a decreased in point prevalence of pneumonia infection or Acute Respiratory Infection from 9.6% in 2011 to 2.3% in 2015 and then raised with 4.6% in 2018 from national demographic surveys (Luliano, 2020). In a study done in Egypt, the most common risk factors for pneumonia were rural residence, low socioeconomic standard, over-crowding, and prematurity (Abdel & Sakhr 2021). These risk factors have been presumed to be more common in our environment. Globally, Nigeria had the 2nd largest figure of child mortality due to pneumonia infection in 2015. In 2017 alone, community-acquired pneumonia accounted for about 140,520 deaths with a child mortality rate of 190 deaths per thousand populations which lead a global respond

(Igweonu-Nwakile, *et al.*, 2023). The child mortality rate due to pneumonia infection dropped from 13.6 in 2000 to 6.6 deaths per thousand populations in 2015 (Wonodi, *et al.*, 2020).

Historically, pneumonia was the main cause of under-five mortality in developed countries, and in the United States in 1900, it is estimated that pneumonia killed 47 of every 1,000 children before the age of 5 years. Improvements in nutrition and living standards in the United States in the first 40 years of the 20th century led to a substantial reduction in pneumonia mortality before antibiotics became available. However, in the low-income countries of Asia and Africa, pneumonia is still the main cause of under-five mortality. In developing countries, over one-quarter of children have an episode of clinical pneumonia each year throughout the first 5 years of their lives (UN IGME, 2022). Liu *et al.* (2012) updated total numbers of deaths in children aged 0–27 days and 1–59 months were applied to the corresponding country-specific distribution of deaths by cause. They applied the multinomial logistic regression model to vital registration data for low-mortality countries without adequate vital registration. The results of their study indicate that between 2000 and 2010, the global burden of deaths in children younger than 5 years decreased by 2 million, of which pneumonia contributed the most to the overall reduction.

In 2020, out of a total of 330 children investigated in Lagos State Nigeria, their median age was 24 months with the interquartile range of 10 -26 months and there were more males 186 (56.4%) than females. The point prevalence of pneumonia during the time of survey was estimated to be 12.7% (42/330) with no significant association between the pneumonia infection and the immunization status of the under five children with P-value = 0.171. 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 centre. 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 centre 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 (Igweonu-Nwakile, *et al.*, 2023).

Adequate period of exclusive breast feeding followed by continued breast feeding and an appropriate complementary feeding has been shown to protect young children against respiratory tract infections, while lack of breast feeding predisposing the young children to pneumonia diseases. Hence, Pneumonia has been highlighted as a common cause of childhood morbidity and mortality encountered in several children emergency care setting. In a related study, the point prevalence of pneumonia in 2020 was 13.3% among children investigated in Ilorin, Nigeria (Igweonu-Nwakile, *et al.*, 2023), while the point prevalence of pneumonia was 13.2% among under-five children admitted to Children Emergency Ward in Port-Harcourt with a highest prevalence of 27.1% seen among children under-one year of age (Gabriel-Job & Azubogu, 2020).

Based on investigation on “empirical analysis of five child-killer diseases and under-five mortality in Adamawa State, Nigeria”, Pneumonia had its highest mortality rate with 17 deaths per thousand livebirths in 2013 within the period under review. The study also shows that there exists a positively strong causal relationship between mortality arising from Pneumonia and overall child mortality in the study area with $\beta = 6.468$ and P-value > 0.05. This result shows that such a relationship is insignificant enough since it associated with a relatively high level of significant (Dalatu *et al.*, 2024).

Methods and Materials:

This investigation used Ex post facto design with quantitative approach. A retrospective data of under-five diseases and deaths were obtained from Adamawa State Primary Health Care Development Agency Yola, for the period of 2008 to 2022. The data obtained consist of the number of under-five children immunised and number of under-five children that were infected and later died due to the pneumonia diseases within the time frame.

The method used to determine the prevalence rate of the pneumonia diseases in the study area is given by equation (1):

$$\text{Prevalence Rate} = \frac{\text{No. of persons infected by pneumonia disease at time } t}{\text{Number of persons at risk at time } t} \times 100,000.. (1)$$

While the method used to determine the mortality rate due to pneumonia infection in the study area is given by equation (2):

$$\text{Child Mortality Rate} = \frac{\text{No. of deaths due to pneumonia disease at time } t}{\text{Number of persons at risk at time } t} \times 100,000 \dots (2)$$

Results:

This section of the study analysed the prevalence rate of the diseases for the period under review. Using equation (1), the Prevalence rate of the pneumonia diseases in the study area was determined as shown below:

Table 1: Prevalence Rate of the Pneumonia Disease in the Study Area

Years	Children Immunized	Pneumonia Diseases	Prevalence Rate
2008	155,123	10,112	6,519
2009	155,703	10,034	6,444
2010	156,962	8,779	5,593
2011	158,021	10,096	6,389
2012	158,888	9,792	6,163
2013	159,936	10,222	6,391
2014	166,872	11,345	6,799
2015	168,953	10,323	6,110
2016	169,887	879	517
2017	177,879	11,371	6,393
2018	189,963	1,007	530
2019	197,773	10,090	5,102
2020	209,996	13,144	6,259
2021	216,985	13,192	6,080
2022	224,940	11,716	5,209

Source: Researcher's Results, 2025

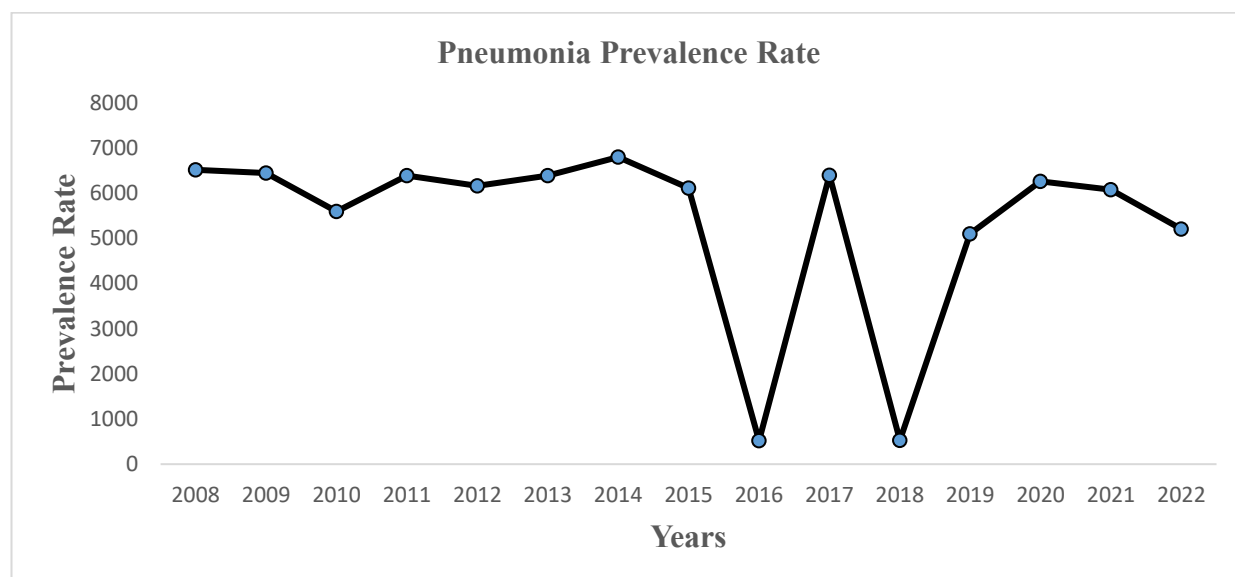


Figure 1: Pneumonia Prevalence Rate

Source: Researcher's Results, 2025

The results in table 1 and figure 1 show that, the prevalence rates for pneumonia disease fluctuated between 2008 and 2015. However, there was a drastically and huge decreased in the prevalence rate from 6,110 to 517 cases per 100,000 childbirths in 2015 to 2016. It then sharply increased from 517 to 6,393 cases per 100,000 childbirths in 2016 to 2017. The study also shows that the prevalence rate decreased again in 2018 with 530 cases per 100,000 childbirths before a relatively sustained rate was maintained from 2019 up to the rest of the study period. The study also confirmed that the

pneumonia infection had its lowest and highest prevalence rate with 517 cases and 6,799 cases per 100,000 livebirths in 2016 and 2014 respectively

This section of the study analysed the pneumonia mortality rate for the period under review. Using equation (2), the pneumonia mortality rate in the Study Area was determined as shown below:

Table 2: Mortality Rate due to Pneumonia Diseases in the Study Area

Years	Children Immunized	Pneumonia Mortality	Mortality Rate
2008	155,123	23	15
2009	155,703	14	9
2010	156,962	15	10
2011	158,021	20	13
2012	158,888	23	14
2013	159,936	27	17
2014	166,872	12	7
2015	168,953	12	7
2016	169,887	5	3
2017	177,879	10	6
2018	189,963	17	9
2019	197,773	5	3
2020	209,996	15	7
2021	216,985	11	5
2022	224,940	3	1

Source: Researcher's Results, 2025

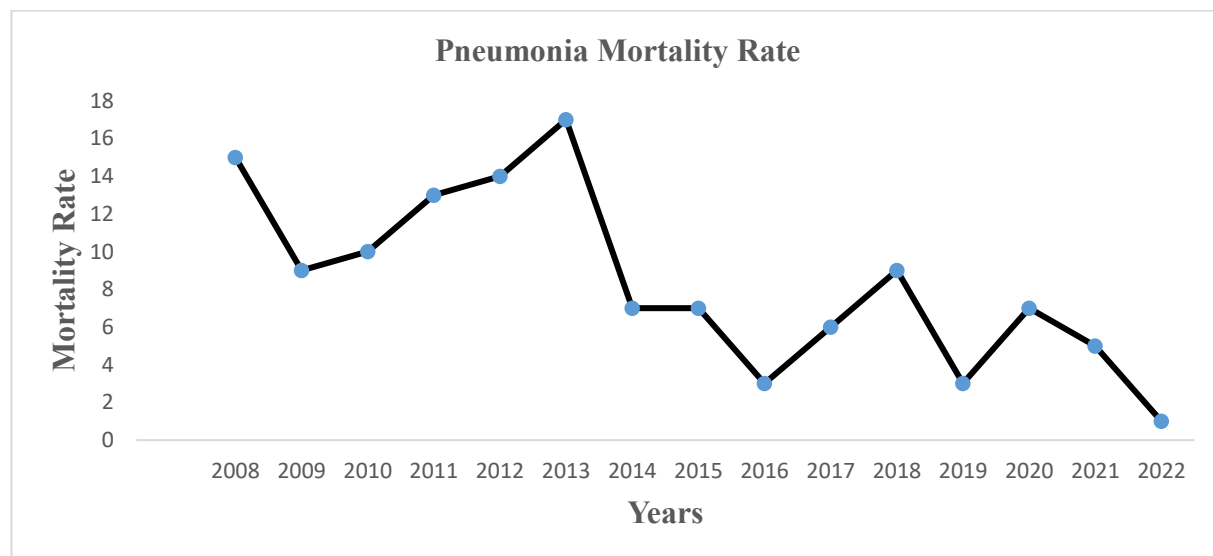


Figure 2: Pneumonia Mortality Rate

Source: Researcher's Results, 2025

Table 2 and Figure 2 revealed that, the child mortality rate due to pneumonia disease in 2008 was 15 before it decreased to 9 deaths per 100,000 livebirths in 2009. However, the child mortality rate gradually increases from 2010 until it reached its highest peak in 2013 with 17 deaths per 100,000 livebirths. The result also revealed that the child mortality rate started to decline from 2013 until it reached a rate of 3 deaths per 100,000 livebirths in 2016. In 2017 and 2018, the child mortality rate then raised again before it finally dropped with 1 death per 100,000 livebirths in 2022.

Discussion of Findings:

Luliano, 2020 in a scoping literature review of morbidity and mortality among under-five children in Nigeria found a decreased in point prevalence of Pneumonia Acute Respiratory Infection from 9.6% in 2011 to 2.3% in 2015 and then

raised with 4.6% in 2018 from national demographic surveys. This study is partially in agreement with Luliano, 2020 since it confirmed a decline in point prevalence of 6.389% (prevalence rate of 6,389 cases per 100,000 livebirths) in 2011 to 6.110% (prevalence rate of 6,110 cases per 100,000 livebirths) in 2015, while this study is not in agreement with Luliano, 2020 since it recorded a continues decline of 0.530% (prevalence rate of 530 cases per 100,000 livebirths) in 2018.

Igweonu-Nwakile, *et al.*, 2023 in related study revealed that out of a total of 330 children investigated in Lagos State Nigeria in 2020, the prevalence of pneumonia was estimated to be 12.7% with no significant association between the pneumonia infection and the immunization status, while this study confirmed a point prevalence of 6.259% (prevalence rate of 6,389 cases per 100,000 livebirths).

The point prevalence of pneumonia was 13.2% among under-five children admitted to Children Emergency Ward in Port-Harcourt with a highest prevalence of 27.1% seen among children under-one year of age in 2020 (Gabriel-Job & Azubogu, 2020). As confirmed above, this study revealed a point prevalence of 6.259% (prevalence rate of 6,389 cases per 100,000 livebirths).

Agnese, *et al.*, 2019 in a related study explained that in Jigawa state, there was a slight increase in the child mortality rate from 187 deaths in 2010 to 191 deaths per 1,000 livebirths in 2017, while Lagos state had a slight decrease from 106 deaths in 2010 to 92 deaths per 1,000 livebirths in 2017. However, in 2014 and 2016, estimated mortality rates of the pneumonia in Lagos were 50 deaths per 1000 livebirths. This study is not in line with Jigawa state mortality rate since it revealed a decrease in child mortality from 10 deaths in 2010 to 6 deaths per 100,000 livebirths in 2017, even though their methodologies differ. This study used the ratio of deaths to children immunization level per 100,000 livebirths, while Agnese, *et al.*, 2019 used ratio of deaths to children with the disease per 1,000 livebirths. However, this study is in line with Lagos state mortality rate since it also revealed a decrease from 10 deaths in 2010 to 6 deaths per 100,000 livebirths in 2017 but their methodologies also differ as explained above.

Furthermore, an investigation carried by Wonodi, *et al.*, 2020 reported that the death rate due to pneumonia infection in children dropped from 13.6 deaths in 2008 to 6.6 deaths per 1000 livebirths in 2015. Meanwhile, this study is in agreement with Wonodi, *et al.*, 2020; that there was a decrease in Pneumonia child mortality rate from 15 deaths in 2008 to 7 deaths per 100,000 livebirths in 2015, however their methodologies also differ. This study used the ratio of deaths to children immunization level per 100,000 livebirths, while Wonodi, *et al.*, 2020 used a ratio of deaths to children with the disease per 1,000 livebirths.

Conclusion:

The study concludes that; while the number of immunization levels are increasing on yearly basis, the pneumonia infection had its lowest and highest prevalence rate with 517 cases and 6,799 cases per 100,000 livebirths in 2016 and 2014 respectively. However, the child mortality rate gradually increases from 2010 until it reached its highest peak in 2013 with 17 deaths per 100,000 livebirths before it finally dropped with 1 death per 100,000 livebirths in 2022.

Recommendation:

Since the study has discovered that; pneumonia associated significantly with deaths compared to other diseases Adamawa State Government need to implement the Global Action Plan for Pneumonia and Diarrhoea (GAPPD) with immediate effect as campaigned by WHO and UNICEF.

Both government and individual should promote adequate nutrition as a key factor to improve children's natural defences against the pneumonia diseases, starting with exclusive breastfeeding for the first 6 months of life.

Adamawa State Primary Health Care Development Agency (PHCDA), Yola whose primary responsibility among orders is to curb and reduce the spread of the pneumonia diseases among vulnerable children of age needs to revise and strategies their act plans.

Addressing environmental factors such as air pollution, encouraging sanitation and good hygiene in crowded area would be an ideal solution to reduce the prevalence of the pneumonia diseases.

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