



Pneumonia dominance in under-five mortalities in sub-Saharan Africa- Urgency for more research and capacity improvement

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In low and middle-income countries (LMIC) the leading causes of mortality and morbidity in children younger than five years include pneumonia, acute diarrhoea, severe malnutrition, malaria and preterm birth and its complications.¹ Pneumonia is the foremost contributor to death in children younger than five years in LMIC.¹ About two-thirds of childhood pneumonia deaths are concentrated in 10 countries: India, Nigeria, Pakistan, Democratic Republic of the Congo, Ethiopia, Angola, Indonesia, China, Chad and Afghanistan.² Pneumonia accounts for 16 per cent of all deaths in sub-Saharan Africa compared to 14% for malaria and 10% for acute diarrhoeal diseases.³ In year 2015, an estimated 922,000 children younger than five years died from pneumonia worldwide.³ A conservative estimate of about 2,500 child lives lost every day, or over 100 every hour is attributable to pneumonia.⁴ Over the past two decades several interventions were introduced to help lower the incidence of pneumonia and improve case management outcomes.⁵ Strategies such as: promotion of duration of exclusive breastfeeding, introduction of pneumococcal conjugate vaccines, prevention of mother to child transmission of HIV, early initiation of anti-retroviral therapy to HIV infected children have yielded much impact.⁶

Advances in Lowering Pneumonia disease burden and Gaps in Research

The current advances in scientific knowledge about pneumonia disease entities are high yet there remains the challenge that many children continue to die from pneumonia. Between 1990 and 2015, the target of the Millennium Development Goal (MDG) 4 was to reduce the under-five mortality rate by two-thirds but this has been partially achieved. The global under-five mortality rate has declined by more than half, dropping from 90 to 43 deaths per 1,000 live births between 1990 and 2015.⁷ Although the MDG 4 was largely achieved, there is still room for improvement.⁸ Progress in the fight against pneumonia has slacked behind that of other diseases because the causes are multi factorial.⁸

As of 2011, for every dollar spent on global health only 2 cents were allocated to tackling pneumonia.⁸ The global funding to address the burden of pneumonia in children is low and this is potentially hindering the effort to reduce mortality associated with the disease.⁹ More resources particularly financial commitment is needed to tackle the high prevalence, mortality and morbidity associated with pneumonia.

Risk Factors and Aetiology of Pneumonia

The risk factors for pneumonia are multifactorial and include; poor socio economic status, overcrowding, indoor air pollution and or passive smoke exposure, lack of breastfeeding, severe acute malnutrition, lack of immunization, prematurity and HIV infection or exposure.¹⁰ In the setting of HIV infection, children develop more severe pneumonia, higher rates of mortality and more likely to develop opportunistic infection caused by *Pneumocystis jirovecii* and *Cytomegalovirus*.¹¹

Aetiological pathogen identification in pneumonia remains a major challenge because few children develop bacteraemic illness.¹²⁻¹⁴ In addition, the high prevalence of nasopharyngeal colonisation by potentially pathogenic bacteria limits the use of respiratory samples for diagnosing bacterial pneumonia.¹³

That notwithstanding, among both immunocompetent and immunocompromised children, *Streptococcus pneumoniae* is the leading cause of pneumonia in children contributing 18% of cases of pneumonia and 33% of deaths.¹³



Another important vaccine preventable organism is *Haemophilus influenzae* type “b” (Hib) estimated to contribute to 4% of pneumonia episodes and 11% pneumonia deaths in children.^{12,13} As vaccine uptake improves and the vaccine preventable pneumonia cases reduce there is the need to target the emergence of pneumonia associated with *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Mycobacterium tuberculosis*. The major contribution of viruses other than Influenza virus have also been highlighted in the pneumonia disease burden. Worldwide, there are nearly 100 million pneumonia episodes associated with viruses annually.¹⁵

Major respiratory pathogens including *Respiratory Syncytial virus (RSV)*, *Rhinovirus*, *Human metapneumo virus*, *Human bocavirus* and *para influenza virus* contributes immensely to pneumonia episodes in both developed and developing nations.¹⁵

Current evidence for severe pneumonia also suggests that polymicrobial infections such as bacterial-viral, viral-viral and bacterial-mycobacterial infection also contributes to pneumonia severity. Nearly a third of bacterial pneumonias may have viral co-infection.¹³

Treatment and Prevention of Pneumonia

Known public health interventions such as exclusive breastfeeding and community case management (CCM) for pneumonia should be encouraged. The most definitive preventive measure for pneumonia is the roll-out of vaccines.¹⁶

Identifying pneumonia cases and instituting appropriate antibiotic therapy is the main strategy to minimize morbidity and mortality in pneumonia. The treatment for most types of severe pneumonia infection is usually antibiotics, which typically cost less than 50 cents for a full treatment.^{5,17} The WHO defines children who present with difficulty in breathing or cough and have seizures as “very severe pneumonia.” The current WHO recommendation for treatment of severe infection in young infants is hospitalization and parenteral antibiotic therapy.³ The use of antibiotics in severe pneumonia reduced mortality by 24% in children younger than five years.⁷

Managing severe pneumonia remains a challenge in many LMIC.¹⁴ The mortality from severe pneumonia could be attributed to late detection of pneumonia, antibiotic resistance and the unavailability of critical care facilities to provide intermittent positive airway pressure (mechanical ventilation) or continuous positive airway pressure (CPAP)

and monitors to support continual monitoring of children in many communities in sub Saharan Africa. Hypoxemia is associated with a two to five-fold increase in mortality from pneumonia it has been documented as an independent risk for pneumonia mortality.^{18,19} Other common causes of death in severe pneumonia include cardiac failure, septic shock and multi organ failure.¹⁸ Although oxygen therapy is well established as a treatment for hypoxic pneumonia and reduces mortality by approximately 20%, oxygen supplies are often unavailable, expensive, and inappropriately utilized in LMIC. Use of CPAP in the management of severe hypoxic is helpful to provide positive end expiratory pressure that prevents collapse of inflamed conducting and respiratory units in the lungs, improves gas exchange and allows enough time for antimicrobial treatment to take effect for recovery to occur.^{19,20}

The utility of simple clinical signs like rapid breathing and chest in-drawing to diagnose pneumonia in infants and young children has been well established.^{20,21} Simple diagnostic solutions such as the use of counting beads to monitor respiratory rate in children with fever, cough and breathing difficulties, or mobile phones to facilitate communication between patients and healthcare providers have improved diagnosis of pneumonia.²⁰

Promoting exclusive breastfeeding, vitamin A supplementation, sickle cell disease detection, prompt identification of congenital heart disease and providing safe drinking water and good sanitation are the keystones for keeping children healthy and free of illnesses such as pneumonia.

Opportunities for future research and capacity improvement

The contribution of radiological services toward pneumonia case detection and management should be explored further. Simple imaging techniques such as chest x-ray and point of care ultrasound should be made accessible in a lot more facilities and should be affordable for children.²²⁻²⁴ Clinicians involved in the care of children should be trained on standardised case definition for pneumonia in children using chest x-ray and point of care ultrasound particularly for cases of severe and complicated pneumonia.^{22,23} In many centres in LMIC radiological services are very expensive or not always readily available.

Establishing diagnosis early in the pneumonia disease process is required for prompt treatment and improved outcomes.

Basic training for community health workers trained on the how to pick early signs of pneumonia should continue.²⁵

The introduction of other vaccine preventable causes of pneumonia particularly RSV pneumonia is a vast field and more research in this area should be encouraged. Careful documentation of vaccination status of children presenting with pneumonia and the presence of antibiotic resistance should be encouraged at the local level to assist in the identification of communities left behind in the pneumonia prevention process.

Circulating pneumonia pathogens and serotypes should be monitored and compared against vaccine serotypes to ensure

that vaccine in use is targeting the strains prevalent in a particular region. The administration of the vaccines should be monitored to ensure that cold chain is not broken to ensure vaccine efficacy.

Health personnel should also be trained and encouraged to standardize the documentation of pneumonia.

Advocacy and awareness should be intensified at the global level to further accelerate the introduction of new vaccines and vaccine uptake. Other barriers that hinder the elimination of the pneumonia should be highlighted.

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