

Pneumonia in Ghana—a need to raise the profile

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Despite the high mortality, pneumonia retains a relatively low profile among researchers, funders and policy-makers. Here we reflect on the problems and priorities of pneumonia in Ghana, briefly review the evidence base and reflect upon in-person discussions between Southampton-based authors MGH and JB and academic, clinical and policy colleagues in Ghana. The discussions took place in Accra in August 2017.

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Globally, there are around 1 million deaths annually due to pneumonia, and the vast majority of these occur among children younger than 5 years old who live in resource-poor settings.¹ Much of this burden is in sub-Saharan Africa (SSA), where incidence and mortality rates are high. The World Health Organization (WHO) has set a target via the Integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea (GAPPD) to reduce deaths from pneumonia to fewer than 3 children per 1000 live births by 2025.² Although estimates of lower respiratory tract infection cases and deaths are lower than in some SSA nations,³ there are still around 5000 pneumonia-related deaths annually in children younger than 5 years in Ghana (the third greatest cause of death in this age group). Lower respiratory tract infections are also responsible for more deaths than any other cause (around 20 000 annually) when considering all-age mortality in Ghana (via GBD Study data and visualizations, available at <https://vizhub.healthdata.org/gbd-compare/>). Despite the large number of attributed deaths, pneumonia may be underfunded, both for research investment and for operational funding,¹ compared with the relative level of investment and burden of other key infectious diseases such as ‘the big three’ of malaria, human immunodeficiency virus and tuberculosis.^{4,5} A 2017 Save the Children report has described pneumonia as ‘neglected for far too long’.⁶

As a country, Ghana ranks 11 out of 45 SSA nations in receiving public and philanthropic research investment related to pneumonia

(unpublished data from Michael G. Head et al., the Research Investments in Global Health study) and sixth for research and operational investments relating to malaria.⁵ The country is politically stable and has undergone several peaceful democratic changes in governments. Compared with many nations in Africa, Ghana has an attractive health infrastructure for future investments in research from the public, charitable and private sectors, but perhaps a lower international profile than countries such as Kenya, Tanzania or Uganda. Under the Ministry of Health, the Ghana Health Service (GHS) is the largest provider of health services in the country. The service is organized along a pyramid health system structure that includes regional and district hospitals and subdistrict health centres and a widely implemented community health programme (Community-Based Health Planning and Services [CHPS]). The GHS has a centralized system for ethical approval of studies conducted under its jurisdiction and maintains a research register.

Ghana has national standard treatment guidelines for the management of diseases as well as an essential drugs list.⁷ There is varied local use of national guidelines (such as the WHO Integrated Management of Childhood Illness [IMCI] guidelines), with health care practitioners often relying solely on clinical judgement and experience.

Pneumococcal vaccination (PCV) of children has been implemented across the country since 2012, and while this is a very welcome intervention, the vaccine only protects against 13 serotypes

of *Streptococcus pneumoniae* responsible for invasive disease. A cross-sectional study carried out in children in Accra and Tamale at the time of the introduction of PCV suggested that the 13-valent vaccine would cover 48–51% of pneumococcal carriage isolates in Ghana, with 45% of isolates expressing at least ‘intermediate resistance’ to penicillin.⁸ There are few data in Ghana on the extent of invasive pneumococcal disease (IPD) caused by non-vaccine serotypes, although evidence from The Gambia suggests that, although PCV introduction results in substantial reductions in IPD, there remains a significant burden from non-vaccine serotypes of *S. pneumoniae*, other bacterial species and viral and fungal pathogens.⁹ This is exemplified by a notable meningitis outbreak in northern Ghana in 2015–2016 where a high percentage of cases were caused by *S. pneumoniae*.¹⁰

There is a very limited evidence base that specifically addresses pneumonia in Ghana. Analysis assessing mortality in a children’s hospital in Accra highlights how there have been significant decreases in all-cause paediatric hospital deaths,¹¹ but there remains a large burden of mortality associated with pneumonia, with death rates possibly even rising and responsible for 18% of deaths in children younger than 5 y and 4% of deaths in children aged 5–9 y.¹² Many Ghanaians in rural settings have little access

to hospital care, so away from the district and subdistrict hospitals, the CHPS has been important in ensuring most of the population has some access to health care.¹³ Anecdotally, diagnosis and treatment of malaria have greatly improved, with most facilities having access to antimalarial combination therapies that are available without charge for patients younger than 5 y. However, there are questions about the CHPS programme,¹⁴ including the cost-effectiveness of the programme and the facts that community health care officers often receive little training, there is typically no doctor on site and there is a distinct lack of recognition when a case of pneumonia is presented.¹⁵ Often, the health care officer assumes the fever is related to malaria and prescribes accordingly. Conversations also highlight that there are local pervasive myths, especially in rural communities; for example, where a fever is thought to be ‘the blood boiling after too long spent in the sun’. Even if pneumonia is correctly diagnosed, antibiotics are usually not available in the community setting, so the drugs must be bought from drug peddlers or the nearest pharmacy, which requires travelling and paying for a prescription. Thus treatment may not always reach the patient.

The absence of an appropriate diagnosis means that eventually many of these patients will end up in a district or teaching

Table 1. Research priorities to address pneumonia sustainably in Ghana

Hospital-based research topics

Highest priority

- What low-cost diagnostics can provide greater specificity for rapidly identifying the causative pathogen?
- What are the key risk factors that increase mortality risk of patients who are hospitalized due to pneumonia?
- What changes to clinical practice (e.g. routine early referral to specialist respiratory physician) can feasibly be introduced that would impact upon patient mortality and recovery?
- What microbiology can feasibly be implemented to allow routine identification of both the pathogen and resistance profile?

Other priority areas

- Can widely available technology, such as apps and the use of smartphones, be helpful in providing digital clinical datasets that are easier to analyse and will inform improved clinical practice?
- How can radiologists and clinicians work more effectively in managing a child with a persistently abnormal radiograph?

Community-based research topics

Highest priority

- What is the epidemiology and key risk factors of community-acquired pneumonia and how do these differ between urban and rural settings and between wealth quintiles?
- To what extent, and why, do mortality rates due to pneumonia differ between regions?
- How can recognition of the clinical presentation of pneumonia be increased by community health care workers?
- What approaches would be most effective in educating parents on the signs and symptoms of pneumonia and how these can be distinguished from malaria?

Other priority areas

- How can technology (e.g. smartphones) be most appropriately used in the community to provide digital datasets for epidemiological analysis?
- How can first- and second-line antibiotics be made safely and routinely available and accessible in the community?
- Would a tailored clinical scoring system be helpful in recognizing pneumonia cases at first contact with a health care setting?
- What is the spatial distribution and temporal trend of childhood pneumonia deaths in Ghana?

Other

- What are the nationwide resistance patterns of *S. pneumoniae*?
- Develop multidisciplinary and multi-institutional networks to share knowledge and assist in developing an evidence base to underpin policy and practice.
- Develop improved surveillance data on the prevalence of resistance to pneumonia-causing pathogens.
- How can accurate surveillance of pneumonia be conducted in the country?

hospital with a worsening infection of the lower respiratory tract. Here, the challenge is the subjective diagnosis of pneumonia from one clinician to another. They may be constrained by a lack of routine access to basic radiological and microbiological investigations that could highlight whether the pathogen is bacterial, viral or fungal, as well as a lack of facilities that can assess the resistance profile of the pathogen and thus allow for a more appropriate antibiotic to be prescribed.

The patient will usually be sick enough to be admitted and is prescribed amoxicillin, despite not knowing the likely patterns of resistance and whether it will be effective. In a teaching hospital, there may be specialist respiratory physicians available, but they are not routinely called to assess cases of pneumonia upon admission and typically only see the patient up to 10 d later. The patient may have remained on amoxicillin all this time and not improved, and many children at this point die. District hospitals rarely have respiratory specialists.

There is little knowledge of the prevalence of resistance among pneumonia-causing pathogens.¹⁶ There are certainly no rapid point-of-care diagnostics that might assess biomarkers of infection such as C-reactive protein, procalcitonin or specific pneumococcal antigens in the urine. The added clinical value of these tests in these settings is unknown and warrants consideration. There is limited use of mobile technology in the current management and monitoring of pneumonia, and exploration of such approaches may have merit.¹⁷

There are therefore opportunities to diagnose and treat cases of pneumonia correctly in vulnerable patients at their first contact with a health care facility in the community and further opportunities to improve care and reduce mortality in the hospital setting. Conversations between Ghanaian colleagues revealed some key priority areas for future research (Table 1). Apart from implementation of the pneumococcal vaccine, arguably little has changed since a 2008 effort at highlighting priority areas globally for pneumonia.¹⁸

Interventions that take into account the local context, allow local ownership of the research and forge close links with the Ministry of Health (and other policy stakeholders) are important in maximizing the uptake and use of research findings. Improvements in policy and practice, underpinned by high-quality data, epidemiology and a renewed focus from national and international stakeholders are overdue and vital. Until this happens, there will be limited progress in efforts to reduce the incidence and mortality of pneumonia in Ghana.

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