**Pneumonia in Ghana – a need to raise the profile**

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**Abstract**

Despite the high mortality, pneumonia retains a relatively low profile among researchers, funders and policymakers. 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 Head and Batchelor, and academic, clinical and policy colleagues in Ghana. The discussions took place in Accra in August 2017.

**Keywords -** pneumonia; health policy; Ghana; west Africa; lower-respiratory tract infection

Globally, there are around 1 million deaths annually due to pneumonia, and the vast majority of these occur among children under 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 Organisation (WHO) have 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 some SSA nations,3 there are still around 5000 pneumonia-related deaths annually in children under 5 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 20000 annually) when considering all-age mortality in Ghana (via GBD Study data and visualisations at <https://vizhub.healthdata.org/gbd-compare/>). Despite the large number of attributed deaths, pneumonia may be underfunded, both for research investment and operational funding,1 compared to relative level of investment and burden of other key infectious diseases such as ‘the big three’ of malaria, HIV 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Ghana ranks 11 out of 45 SSA nations for receiving public and philanthropic research investment related to pneumonia (unpublished data from Head et al, the Research Investments in Global Health study), and 6th for research and operational investments relating to malaria.5 The country is politically stable and has undergone several peaceful democratic change in governments. Compared to 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 service in the country. The service is organised along a pyramid health system structure which includes regional, district and sub-district hospitals and a widely-implemented community health programme (Community-Based Health Planning and Services, CHPS). The GHS has a centralised system for ethical approvals for studies conducted under its jurisdiction and maintains a research register.

Ghana has a national standard treatment guidelines for the management of diseases as well as an essentials drugs list.7 Anecdotal evidence suggests there are varied local use of national guidelines (such as the the WHO Integrated Management of Childhood Illness (IMCI) guidance) with healthcare practitioners often relying solely on clinical judgement and experience.

Pneumococcal vaccination of children has been implemented across the country since 2012, and whilst 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 the 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 is little data in Ghana on the extent of invasive pneumococcal disease (IPD) caused by non-vaccine serotypes, though evidence from The Gambia suggests that, although the 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 has 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 under 5s and 4% of deaths in children aged 5-9 years.12 Many Ghanaians in rural settings have little easy access to hospital care, and so away from the district and sub-district hospitals, CHPS has been important in ensuring most of the population has some access to healthcare.13 Anecdotally, diagnosis and treatment of malaria has greatly improved with most facilities having access to anti-malarial combination therapies that are available without charge for the under-5 patient. However, there are questions around the cost-effectiveness of CHPS,14 community healthcare officers have often received little training, there will typically be no doctor on site, and there is a distinct lack of recognition when a case of pneumonia is presented.15 Often, the officer will assume the fever is related to malaria, and prescribe accordingly. Conversations also highlighted that there are also 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 also usually not available in the community setting, and the patient/parents will need to buy from drug peddlers or travel to the nearest pharmacy and pay for a prescription. Thus, treatment may not always reach the patient.

Absence of appropriate diagnosis means that eventually many of these patients will end up in a district or teaching 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, and also 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 prescribed amoxycillin, 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 days 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 current management and monitoring of pneumonia, and exploration such approaches may have merit.17

There are therefore opportunities to correctly diagnose and treat cases of pneumonia invulnerable patients at their first contact with a healthcare 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 the 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 maximising 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 all both overdue and vital. Until this happens, there will be limited progress in the efforts to reduce incidence and mortality of pneumonia in Ghana.

**Author contributions**

MGH wrote the first draft. All authors contributed revisions, and read and approved the final version. MGH Is guarantor of this manuscript. All authors agree to be considered equally on this manuscript as part of as the Ghana Southampton Pneumonia Partnership.

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**Ethical approval**

Not required

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*Table 1. Research priorities to sustainably address pneumonia in Ghana*

*Hospital-based research topics*

* *What low-cost diagnostics can provide greater specificity for rapidly identifying the causative pathogen?*
* *What are the nationwide resistance patterns of S. pneumoniae?*
* *What microbiology can be implemented to allow routine identification of both the pathogen and resistance profile?*
* *What are the key risk factors that increase mortality risk of patients who are hospitalised 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?*
* *Can widely-available technology, such as apps and use of smart phones, be helpful in providing digital clinical datasets that are easier to analyse and will inform improved clinical practice?*
* *How radiologists and clinicians can work more effectively in managing a child with a persistently abnormal radiograph?*

*Community-based research topics*

* *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 do mortality rates due to pneumonia differ between regions?*
* *How can recognition of clinical presentation of pneumonia be increased by community healthcare workers?*
* *Would a tailored clinical scoring system be helpful in recognising pneumonia cases at first contact with a healthcare setting?*
* *What approaches would be most effective at educating parents on i) the signs and symptoms of pneumonia, and ii) how these can be distinguished from malaria?*
* *How can technology (e.g. smart phones) be most appropriately used in the community to provide digital datasets for epidemiological analysis?*
* *How can first- and second-line antibiotics be safely and routinely available and accessible in the community?*
* *What is the spatial distribution and temporal trend of childhood pneumonia deaths in Ghana?*

*Other*

* *Multi-disciplinary and multi-institutional networks to share knowledge and assist in developing an evidence base to underpin policy and practice*
* *Improved surveillance data on prevalence of resistance to pneumonia-causing pathogens*
* *How can accurate surveillance of pneumonia be conducted in the country?*