

WHY ARE CHILDREN AROUND THE
WORLD STILL DYING FROM
PNEUMONIA – A PREVENTABLE
AND TREATABLE CONDITION? THE
CASE FOR EVALUATING HEALTH
INTERVENTIONS WITHIN SOCIETAL
CONTEXTS

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Globally, pneumonia is the single largest infectious killer of children. Each year, pneumonia is estimated to be responsible for 900,000 child deaths (1). Yet effective tools and knowledge currently exist to both prevent and treat this condition. So why are children still suffering from and dying of pneumonia?

The typical victim is a malnourished child from a poor family in a community that is not well served by government agencies. Factors such as air pollution, household crowding, and malnutrition all increase a child's risk of developing pneumonia. Limited access to affordable healthcare results in children dying of this disease. While many children across the world get pneumonia, the majority of deaths occur in low- and middle-income countries (1).

An important tool at our disposal is a vaccine that protects children against pneumonia (known as the pneumococcal vaccine). This is a relatively simple intervention that effectively reduces the risk of severe pneumonia in children. Vaccination is an especially important way to save the lives of children who are unable to access or afford healthcare. For this reason, vaccines can reduce disparities in pneumonia outcomes within and between countries (2).

While there is clear evidence from controlled experiments that the pneumonia vaccine works well in children, we also need to evaluate the vaccine in 'real world' settings. Such evaluations take into account important societal factors that influence the success of a vaccine program. For example, in the US, the introduction of this vaccine in children resulted in unexpectedly large reductions in disease among adults and elderly (3). This is because a vaccine program that appropriately targets the individuals who are spreading a particular illness within a community will result in widespread reductions in disease beyond those who were vaccinated, a phenomenon known as herd immunity. From the introduction of the pneumonia vaccine in the US, we learned that children were primarily responsible for spreading the bacteria that causes pneumonia. However, this pattern is likely to vary between countries due to considerable differences in how society is structured and how people interact. Another important societal factor influencing the success of the vaccine program is the strength of the health system delivering this intervention. A vaccine program that fails to reach those children who are most at risk of pneumonia will only exacerbate the existing inequities in the burden of pneumonia described above.

To facilitate this type of evaluation, I am part of an international team that is measuring how well the pneumococcal vaccine is performing as it is introduced to three countries within the Asia Pacific region with a high burden of pneumonia: Laos, Mongolia and Papua New Guinea.

Evaluations of pneumococcal vaccine impact in low- and middle-income countries are rare because conducting this research can be challenging. The existing surveillance system for evaluating pneumococcal vaccine impacts, established by the World Health Organization (WHO), has so far yielded limited results. It uses methods derived from high-income countries, requiring the collection of large numbers of blood samples, which are not currently a part of routine care for pneumonia in many low-income settings. The failure of this system highlights the importance of integrating local expertise

in adapting both interventions and disease surveillance methods. In 2017, the WHO surveillance system reported just 55 cases of pneumococcal disease in the Southeast Asian region. Such a small sample is unlikely to be well representative of the millions of cases in the region or to be able to describe national or sub-national changes in disease patterns following vaccine introduction (4).

One of the key things we want to measure is how well the vaccine protects children and adults who have not been vaccinated (herd immunity). The presence and degree of herd immunity has two important policy implications. Firstly, it radically improves the cost-effectiveness of the vaccine, helping policy makers to justify the public funding of the vaccine (5). Secondly, understanding this phenomenon can help policy makers design vaccine programs in a way that takes advantage of this effect. In the UK, in response to this type of research demonstrating strong herd effects, public health officials have switched from giving children three doses to two doses of the vaccine, a move which represents a significant cost-saving measure for a relatively expensive vaccine (6). By conducting this study in three very different countries which have contrasting vaccine programs and disease patterns, we can determine what factors maximise this herd effect (7).

Furthermore, by studying the vaccine in ‘real world’ settings, we can monitor which children are and are not accessing and benefiting from vaccination programs. Indeed, our initial findings indicate high variability in vaccination coverage across communities, especially in Papua New Guinea. Our final results will also tell us how this impacts disease transmission. Hence, we can use this data to improve health and as well as highlight issues of equity and social inclusion.

RECOMMENDATIONS:

- There is a need for evaluations of vaccine programs in order to:
 - 1) Quantify benefits of the intervention to justify ongoing funding
 - 2) Understand how the intervention is working in order to design programs that can maximise vaccine impacts, while minimising costs
 - 3) Identify who in the population is benefiting from the program in order to examine equity and facilitate social inclusion
- Methods of evaluation also need to be tailored to settings and require local expertise
- Vaccine policy needs to be flexible and responsive to findings from vaccine evaluations

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