



Wednesday 7 June 2023



## Modelling the potential impact of pneumococcal vaccination strategies in humanitarian crises

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### Introduction

Despite a likely high burden of disease caused by *Streptococcus pneumoniae* in humanitarian crises, pneumococcal conjugate vaccines (PCV's) are rarely used in such settings. Routine immunisation is rarely feasible in crises, and there is little evidence on alternative delivery strategies for PCV. We used modelling to evaluate the effects of different vaccination strategies within humanitarian crisis settings, aiming to identify those which could quickly reduce and sustain low transmission of vaccine serotypes.

### Methods

We conducted a nested carriage and contact survey in a camp for internally displaced people (IDP) in Somaliland to parameterise a transmission model and used it to assess the potential impact and optimal age targeting of PCV campaigns. We extrapolated this model to other representative humanitarian crisis settings: an acute-phase IDP camp, a protracted crisis in a rural setting, and an urban setting with mixed IDP and host communities. For each we explored the impact and efficiency of campaigns with different target age groups and dosing strategies.

### Ethics

This study was approved by the Ethics Review Boards of the London School of Hygiene and Tropical Medicine and the Republic of Somaliland Ministry of Health Development.

### Results

We found high prevalence of nasopharyngeal carriage of *Streptococcus pneumoniae*; 37% (95% confidence interval (CI), 32-42) in all ages, and 76% (95% CI, 70-82) in children <5 years in the Somaliland IDP camp. 53% (95% CI, 45-61) of serotypes are included in the PCV13 vaccine. People had, on average, 9 (9-10) contacts per day, with high mixing rates between children and intergenerational contacts in older age groups. Our model projects that, for the Somaliland IDP camp, a single PCV campaign including children <5 years can temporarily establish substantial herd protection, averting 37% (95% credible interval (CrI) 24-48) of invasive pneumococcal disease cases in the 2 years following the campaign. Extending age eligibility to children up to 10 or 15 years old could further increase this impact by 49% (95% CrI, 39-50) and 53% (95% CrI, 40-64) respectively. Increased migration rates and close contact with unvaccinated host populations reduces the impact. These factors might require wider age targeting and more frequent repeat campaigns until routine services could be re-established.

### Conclusion

We show that PCV campaigns could be an effective option to reduce the burden of pneumococcal disease in humanitarian crises until routine immunisation can be implemented. Our results are based on modelled estimates, intervention studies are needed to evaluate their feasibility and effectiveness in real settings.

### Conflicts of interest

None declared.