Residual nasopharyngeal carriage of vaccine type pneumococci in a mature PCV10 immunisation programme in Kenya

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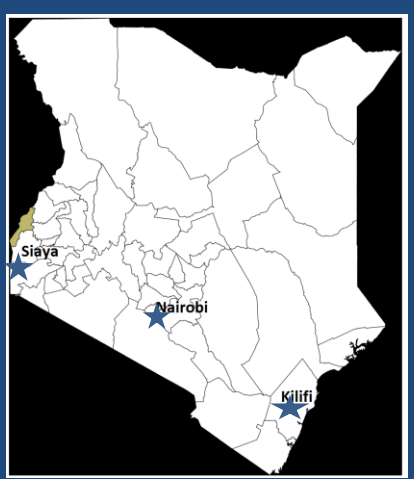
Introduction

- In countries like the US and the UK with mature PCV programmes, good vaccine coverage, high efficacy against acquisition of vaccine-type (VT) pneumococci and durable herd protection have all resulted in reduced community transmission of VT pneumococci and near elimination of VT carriage in the population[1,2,3].
- Consequently, using fewer doses of the expensive PCV to maintain herd protection/immunity has become an attractive prospect. In the UK, mathematical models suggest this is possible without a negative impact on VT-IPD and a recent clinical trial of PCV13 delivered as 1+1 schedule induced immunity equivalent or superior to those seen for the standard 2+1 schedule[4,5].
- In developing countries in Africa, PCVs have reduced VT-carriage prevalence in both vaccinated and unvaccinated populations[6]. However, in Kilifi Kenya 5 years following PCV10 introduction with a catch-up campaign for all children <5 years, there is residual VT-carriage in approximately 10% of children <5 years old [7].
- We conducted carriage surveys in multiple sites across Kenya to obtain data that would aid in modelling and policy experiments to achieve near elimination of VT-carriage and high levels of herd protection.

Methods

- Pneumococcal carriage surveys were conducted in June-October 2017 in representative settings across Kenya - Nairobi (urban slum) located centrally, Siaya (rural and peri-urban) located in the west and Kilifi (rural) located in the east as shown in figure 1- targeting a randomly selected population of 500 stratified into 10 age groups (<1, 1-2, 3-4, 5-9, 10-14, 15-19, 20-39, 40-49, 50-59, ≥60 years).
- We collected data on demographic characteristics, clinical history, and risk factors.
- Nasopharyngeal swabs were obtained from each consenting participant, stored, transported, cultured and serotyped (by latex agglutination and Quellung) according to WHO guidelines.
- We calculated crude and age-standardised carriage prevalence (against the INDEPTH 2013 network's standard population) and used log-binomial regression models to determine carriage risk factors.

Figure 1: Map showing the three study locations



Nairobi is located south to the central part of Kenya

Siaya HDSS is located in the southwest part of Kenya

The Kilifi HDSS is located on the Indian Ocean Coast of Kenya, to the east

Results

- We recruited 514 participants in Nairobi and 499 both in Siaya and Kilifi. This was 70% (N=730), 99% (N=500) and 77% (N=649) of the target respectively.
- The prevalence of VT carriage was highest in children aged 1-4 years but was also very high in older children (5-17 years), especially in rural areas as shown in figure 2.
- The most commonly seen pneumococci across all the sites were serotypes 3 and 35. The top 5 serotypes by site were:
  - Nairobi – 3 (11%), 35B (5%), 6A (5%), 23B (5%) and Non-typeable (5%).
  - Siaya – 3 (14%), 35B (11%), 19A (7%), 11A (6%) and 19F (5%).
  - Kilifi – 35B (8%), 19A (6%), 23B (6%), 11A (6%) and 15A (5%).

Figure 2: Vaccine and non-vaccine type pneumococcal carriage by age category and by study location

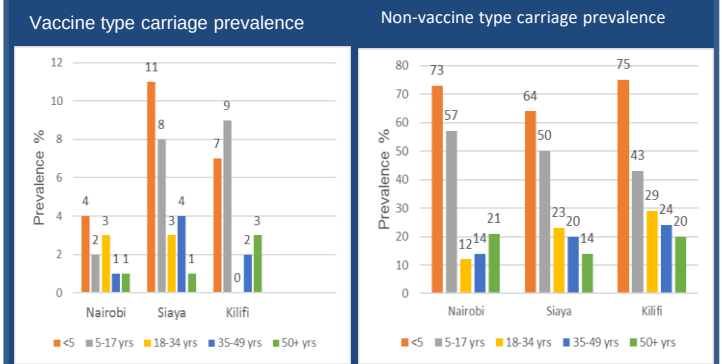


Table 1: Prevalence ratios for risk factors for pneumococcal carriage

		Prevalence ratio	95% CI	p-value
Sex				
	Female	1.0		
	Male	1.2	(1.1, 1.3)	<0.0001
Age group				
	≥50 years	1.0		
	35-49 years	1.0	(0.7, 1.5)	0.9
	18-34 years	1.2	(0.9, 1.7)	0.3
	5-17 years	2.6	(2.1, 3.3)	<0.0001
	0-4 years	3.6	(2.9, 4.5)	<0.0001
Runny nose in the preceding 2 weeks				
	No	1.0		
	Yes	1.3	(1.2, 1.4)	<0.0001
Antibiotic use in the preceding 2 weeks				
	No	1.0		
	Yes	1.2	(1.0, 1.3)	0.01
Cough in the preceding 2 weeks				
	No	1		
	Yes	1.2	(1.1, 1.3)	0.001
Number of under 5's in the household				
	0	1		
	1	1.8	(1.4, 2.2)	<0.0001
	≥2	2.0	(1.7, 2.4)	<0.0001
Number sharing bed with the participant				
	0/1	1		
	2	1.6	(1.4, 1.8)	<0.0001
	≥3	1.8	(1.5, 2.0)	<0.0001

Conclusions

- There is high residual VT-pneumococcal carriage across Kenya 6 years post-PCV10 introduction among the under 5 years and older children (5-17 years) especially in the rural areas.
- This is in contrast to developed countries, such as the USA and UK that have reported a near elimination of the nasopharyngeal carriage of vaccine serotypes (VT).
- There is evidence of substantial exposure to VT pneumococci and therefore we cannot rely on indirect effects to protect unvaccinated or partially vaccinate infants. This suggests that reducing the number of vaccine doses given in infancy would render infants vulnerable to VT-IPD.

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