

Prevalence and serotype distribution of *Streptococcus pneumoniae* colonization in infants too young to be immunized in Nepal

Brian Wahl¹, Jyoti Kumari Yadhav², Rashmila Deshar², Madhav Chandra Gautam², Meeru Gurung², Sarah Kelly^{3,4}, Stephen Thorson², Imran Ansari², David Murdoch⁵, Bradford Gessner⁶, Michael J Carter^{3,4}, Rama Kandasamy^{3,4}, Dominic Kelly^{3,4}, Andrew J Pollard^{3,4}, Katherine L O'Brien¹, Shrijana Shrestha²

¹ International Vaccine Access Center (IVAC), Department of International Health, Johns Hopkins Bloomberg School of Public Health; ² Patan Academy of Health Sciences (PAHS); ³ Oxford Vaccine Group, Department of Paediatrics, University of Oxford; ⁴ NIHR Biomedical Research Centre, Oxford; ⁵ Department of Pathology, University of Otago; ⁶ Agence de Médecine Préventive (AMP)

INTRODUCTION

- In August 2015, Nepal introduced 10-valent pneumococcal conjugate vaccine (PCV10) using a 2+1 schedule as follows: 6 weeks, 10 weeks, and 9 months. Children less than 1 year were eligible for catch-up immunization at the time of introduction.
- Several studies have demonstrated the impact of PCV on vaccine-type nasopharyngeal carriage in unvaccinated individuals (i.e. indirect effects). However, such data are lacking in Asia and there is little evidence available in **children too young to be immunized**.
- To establish a comparator for assessing PCV10 indirect effects in this populations, we measured **prevalence and serotype distribution of pneumococcal colonization in young infants** prior to the introduction of PCV in Nepal.

METHODS

- **Participants:** Asymptomatic children or children with minor upper respiratory tract infections less than 8 weeks who were attending the outpatient clinic Patan Hospital for routine immunizations or accompanying a family member were recruited to the study.
- **Nasopharyngeal swabs** were obtained using updated World Health Organization methods.¹
- **Pneumococci** were cultured and identified phenotypically; serotyping was by the Quellung reaction.

RESULTS

- **600 infants** were recruited from July to December 2014. The median age was **6.4 weeks** (IQR: 6.3-6.7). Of these children, 55.7% (334/600) were male and 44.3% (266/600) were female.
- **Overall pneumococcal colonization** prevalence in this population was **18.8%** (113/600).
- We identified 38 different serotypes—see Figure 1.
- Most common serotypes among the 79 (69.9%) typeable pneumococci:
 - 19F (n=9, 8.0%)
 - 10A (n=7, 6.2%)
 - 6A (n=4, 3.5%)
- PCV10 and PCV13 serotypes accounted for **26.5%** (30/113) and **29.2%** (33/113) of isolates, respectively.

CONCLUSIONS

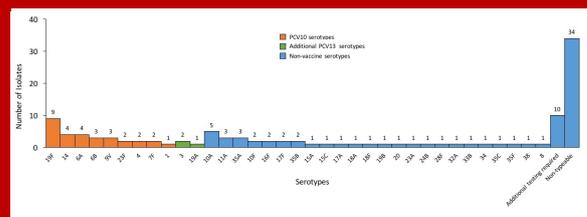
- Pneumococcal colonization among very young infants in Kathmandu is **somewhat less common** compared with that of similarly aged children in other Asian settings—see Table 1.
- Vaccine-type pneumococci accounts for a **minority** of colonizing strains in this age group.
- The data we present will form the **baseline** for an assessment of **indirect effects** on carriage among infants too young to be vaccinated in Nepal.

References:

- Satzke, Catherine, et al. "Standard method for detecting upper respiratory carriage of *Streptococcus pneumoniae*: updated recommendations from the World Health Organization Pneumococcal Carriage Working Group." *Vaccine* 32.1 (2013): 165-179.
- Granat, Simo M., et al. "Longitudinal study on pneumococcal carriage during the first year of life in Bangladesh." *The Pediatric infectious disease journal* 26.4 (2007): 319-324.Df
- Saha, Samir K., et al. "Comparison of antibiotic resistance and serotype composition of carriage and invasive pneumococci among Bangladeshi children: implications for treatment policy and vaccine formulation." *Journal of clinical microbiology* 41.12 (2003): 5582-5587.Df
- Rupa, V., et al. "Risk factors for upper respiratory infection in the first year of life in a birth cohort." *International journal of pediatric otitis rhinitis* 7.12 (2012): 1835-1839.Df
- van den Biggelaar, Anita H., et al. "Effect of early carriage of *Streptococcus pneumoniae* on the development of pneumococcal protein-specific cellular immune responses in infancy." *The Pediatric infectious disease journal* 31.3 (2012): 243-248.
- Holmlund, Emma, et al. "Development of natural antibodies to pneumococcal surface protein A, pneumococcal surface adhesion A and pneumolysin in Filipino pregnant women and their infants in relation to pneumococcal carriage." *Vaccine* 24.1 (2006): 57-65.
- Turner, Paul, et al. "A longitudinal study of *Streptococcus pneumoniae* carriage in a cohort of infants and their mothers on the Thailand-Myanmar border." *PLoS one* 7.5 (2012): e38271.

FIGURE 1

Serotype distribution in children too young to be immunized from Patan Hospital



We considered 6A to be vaccine type due to cross-reactivity of the 6B component of PCV10 against 6A.

Table 1

Estimates of colonization prevalence and serotype distribution in children less than or equal to 6 weeks of age in Asia

Country	Setting	Age group	Colonization prevalence	PCV serotype coverage	Reference
Nepal	Urban	6 weeks	18.8% (113/600)	PCV10:23.9% (27/113) PCV13:29.2% (33/113)	Current study
Bangladesh	Rural	0-1 week	6.7%	Not provided*	[2]
Bangladesh	Rural	2-3 weeks	22%	Not provided*	[2]
Bangladesh	Rural	4-5 weeks	29%	Not provided*	[2]
Bangladesh	Rural	0-4 weeks	29.4% (10/34)	Not provided*	[3]
Bangladesh	Urban	0-4 weeks	18.8% (3/16)	Not provided*	[3]
India	Rural	4 weeks	3.8% (8/210)	Not provided	[4]
Papua New Guinea	Rural	0-2 weeks	39.8% (111/279)	Not provided	[5]
Philippines	Urban	6 weeks	27.7%	Not provided	[6]
Thailand	Rural	0 weeks	0.0%	N/A	[7]
Thailand	Rural	4 weeks	39.5% (93/234)	PCV13:46.2% (43/93)	[7]

* Serotype distribution data provided, but not for children less than 6 weeks of age.

Funding Statement:

The project is supported by the Gavi Alliance.

