# CONCORDANCE BETWEEN NASOPHARYNGEAL CULTURES AND PATHOGENS IN EAR DISCHARGE AND LOWER AIRWAY SPECIMENS FROM INDIGENOUS CHILDREN IN THE NORTHERN TERRITORY

**Hare Kim M[1], Cheng Allen C[1,2,3], Smith-Vaughan Heidi[1], Chang Anne C[1,4,5], Morris Peter S[1,6], Leach Amanda J[1]**

*1 Child Health Division, Menzies School of Health Research, Charles Darwin University, Darwin, NT;*
*2 Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Victoria;*
*3 Infectious Diseases Unit, Alfred Hospital, Melbourne, Victoria;*
*4 Queensland Children's Medical Research Institute, University of Queensland, Brisbane, Queensland;*
*5 Department of Respiratory Medicine, Royal Children's Hospital, Brisbane, Queensland;*
*6 Flinders Medical School, Royal Darwin Hospital, Darwin, NT.*

# Introduction

Why look at concordance?

- The nasopharynx (NP) is the [main] source of respiratory bacteria infecting the middle ear and lower airways
- Additionally, NP swabs are relatively easy to collect compared to ear discharge or lower airway specimens
- Prevalent invasive pneumococcal disease serotypes are not necessarily common carriage types
- This is less true for mucosal disease
- Surveillance of NP carriage provides important information as new pneumococcal conjugate vaccines (PCVs) are introduced

# Methods (studies)

We examined concordance between NP bacteria and bacteria found in ear discharge (ED) and broncho-alveolar lavage (BAL) fluid from Indigenous children

Data were reviewed from studies of:

(1) acute otitis media with perforation (AOMwiP), and

(2) chronic suppurative otitis media (CSOM) between 1996 and 2005;

(3) bronchiectasis in children undergoing bronchoscopy from 2007 to 2011; and

(4) OM (not here specified) from 2008 to 2011 (study ongoing)

# Methods (laboratory)

Standard published laboratory methods were used for culture and identification, except that:

- Different studies have different protocols for the number of colonies isolated per positive specimen
- This is unlikely to significantly alter the proportion of specimens found positive for each pathogen
- However it may affect the number of strains detected (e.g. pneumococcal serotypes) per positive specimen
- While ED rarely contains >1 serotype, multiple types are frequently isolated from BAL specimens

# Results

Data were obtained from:

(1) 266 ear assessments in 140 children with AOMwiP;

(2) 179 ear assessments in 133 children with CSOM;

(3) 104 Indigenous children with radiographically confirmed bronchiectasis*; and

(4) 130 children with ED from at least one ear.

* Lower airway infection was defined as $>10^4$ cfu/mL BAL fluid (for any individual pathogen) to exclude possible upper airway contamination introduced during the bronchoscopy procedure

# Isolation of respiratory pathogens in ear discharge and bronchoalveolar lavage from NT Indigenous children

| | AOMwiP (n=266) | CSOM (n=179) | Bronchiectasis (n=104) |
|---|---|---|---|
| ***Streptococcus pneumoniae*** | 32% | 22% | 16%<br>$>10^4$ cfu/mL BAL |
| ***Haemophilus influenzae*** | 42% | 46% | 31%<br>$>10^4$ cfu/mL BAL |
| ***Moraxella catarrhalis*** | 13% | 25% | 12%<br>$>10^4$ cfu/mL BAL |

# Sensitivity and specificity

Nasopharygeal swabs are sensitive but not specific for pathogens found in the middle ear (previous studies)

**What does this mean?**

If a particular bug is found in ED from a particular child, it is likely (~85-95% certainty) that the same bug will be found in the NP culture from that child

However, finding a particular bug in NP culture is no guarantee that the same bug will be found in ED from the same child

Nevertheless, at a population level NP swabs are useful indicators of strains circulating (e.g. pneumococcal serotypes) and their antibiotic resistance

# Sensitivity of NP culture for pathogens in ED and BAL fluid from NT Indigenous children

| | AOMwiP (n=266) | CSOM (n=179) | Bronchiectasis (n=104) |
|---|---|---|---|
| ***Streptococcus pneumoniae*** **(same serotype)** | 32%<br>**94%**<br>**(77%)** | 22%<br>**90%**<br>**(74%)** | 16%<br>**71%**<br>**(100%)*** |
| ***Haemophilus influenzae*** | 42%<br>**90%** | 46%<br>**83%** | 31%<br>**81%** |
| ***Moraxella catarrhalis*** | 13%<br>**85%** | 25%<br>**93%** | 12%<br>**92%** |

* BAL fluid had some additional types not found in NP swabs

# Specificity of NP culture for pathogens in ED and BAL fluid from NT Indigenous children

| | AOMwiP (n=266) | CSOM (n=179) | Bronchiectasis (n=104) |
|---|---|---|---|
| ***Streptococcus pneumoniae*** | 32%<br>**34%** | 22%<br>**30%** | 16%<br>**70%** |
| ***Haemophilus influenzae*** | 42%<br>**26%** | 46%<br>**25%** | 31%<br>**64%** |
| ***Moraxella catarrhalis*** | 13%<br>**14%** | 25%<br>**22%** | 12%<br>**76%** |

Higher specificities for BAL fluid due to azithromycin? (associated with reduced NP carriage)

# Sensitivity and specificity of NP culture for pathogens in BAL fluid from children who had or had not received azithromycin

| | Azithromycin within 2 weeks (n=39) | No recent antibiotics (n=39) |
|---|---|---|
| ***Streptococcus pneumoniae*** | Sens=56% (5/9)<br>Spec=80% | Sens=100% (6/6)<br>Spec=42% |
| ***Haemophilus influenzae*** | Sens=60% (6/10)<br>Spec=66% | Sens=92% (12/13)<br>Spec=58% |
| ***Moraxella catarrhalis*** | Sens=100% (1/1)<br>Spec=82% | Sens=80% (4/5)<br>Spec=62% |

Outlier?

Without antibiotics (compared to azithromycin), sensitivity of NP for BAL pathogens is increased and specificity decreased (i.e. more similar to ED)

# MARSii data (Monitoring Antibiotic Resistance and Serotypes) from NT & WA Indigenous children

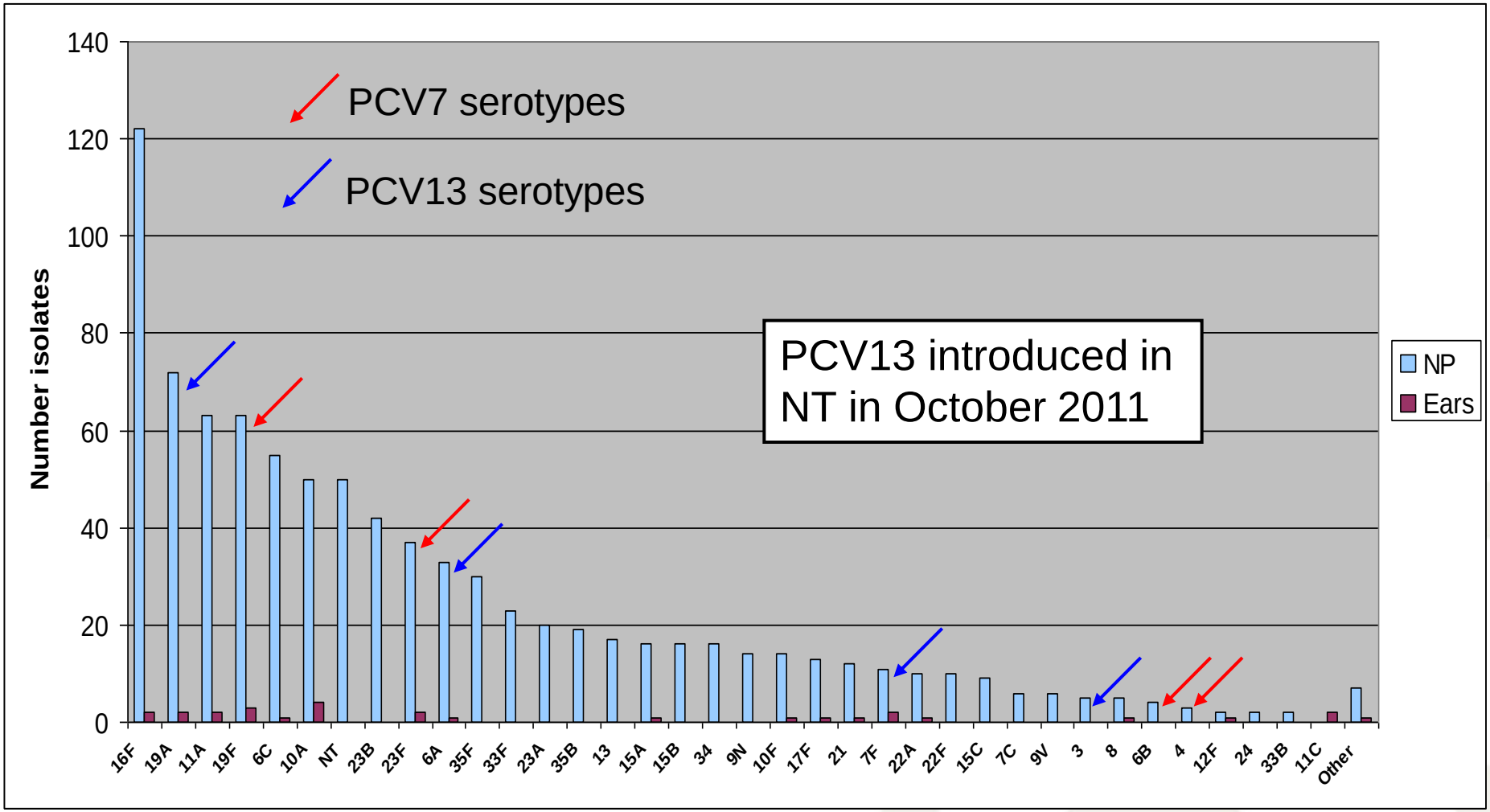
Incomplete data (study ongoing)

133 OM episodes – 3 had no matching NP swab **(n=130)**

| | NP carriage | Ears | Sensitivity | Specificity |
|---|---|---|---|---|
| ***Streptococcus pneumoniae*** | **81%** | **21%*** | **93%** | 22% |
| ***Haemophilus influenzae*** | **77%** | **47%** | **80%** | 26% |
| ***Moraxella catarrhalis*** | **48%** | **1.5%** | na | na |

* Same serotype in 90% of NP/ear pairs

# Serotype hierarchy 2008-2011 (MARSii)



# Conclusions

- Nasopharygeal (NP) swabs are sensitive but not specific for pathogens found in the middle ear
- NP swabs are also sensitive, and more specific (possibly), for lower airway pathogens
- Epidemiological surveillance for pneumococcal serotypes based on NP swabs is likely to reflect serotypes found in severe OM and lower airway infection
- Further work on multiplicity may improve concordance (e.g. NP swabs preceding bronchoscopy or ear exams to identify additional serotypes or NTHi strains)
- Interventions to reduce carriage may reduce these infections

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