

Microbial Interactions during Upper Respiratory Tract Infections

Melinda M. Pettigrew, Janneane F. Gent, Krystal Revai, Janak A. Patel, and Tasnee Chonmaitree

CME ACTIVITY

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Learning Objectives

Upon completion of this activity, participants will be able to:

- Identify common bacterial isolates from children with upper respiratory infection
- Specify significant interactions between colonizing bacteria during upper respiratory infections
- Identify variables associated with higher rates of colonization with *Streptococcus pneumoniae*
- Specify which bacteria is more common in the nasopharynx of children who attend day care

Editor

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CME Author

Charles P. Vega, MD, Associate Professor; Residency Director, Department of Family Medicine, University of California, Irvine, California, USA. *Disclosure: Charles P. Vega, MD, has disclosed that he has served as an advisor or consultant to Novartis, Inc.*

Authors

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Streptococcus pneumoniae, *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Staphylococcus aureus* often colonize the nasopharynx. Children are susceptible to bacterial infections during or soon after upper respiratory tract infection (URI). We describe colonization with these 4 bacteria species alone or in combination during URI. Data were from a prospective cohort of healthy children 6 to 36 months of age followed up for 1 year. Analyses of 968 swabs from 212 children indicated that *S. pneumoniae* colonization is negatively associated with colonization by *H. influenzae*. Competitive interactions shifted when *H. influenzae* and *M. catarrhalis* colonized together. In this situation, the likelihood of colonization with all 3 species is higher. Negative associations were identified between *S. pneumoniae* and *S. aureus* and between *H. influenzae* and *S. aureus*. Polymicrobial interactions differed by number and species of bacteria present. Antimicrobial therapy and vaccination strategies targeting specific bacterial species may alter the flora in unforeseen ways.

Author affiliations: Yale School of Public Health, New Haven, Connecticut, USA (M.M. Pettigrew, J.F. Gent); and University of Texas Medical Branch, Galveston, Texas, USA (K. Revai, J.A. Patel, T. Chonmaitree)

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Streptococcus pneumoniae, *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Staphylococcus aureus* often asymptotically colonize the nasopharynx of young children and are also associated with disease. *S. pneumoniae*, *H. influenzae*, and *M. catarrhalis* are the 3 most common otitis media pathogens (1,2). *S. pneumoniae* are also common causes of pneumonia, sepsis, and meningitis in young children (3). The proportion of young children colonized with any of these 3 bacteria species can be >50% in certain populations (4–6). *S. aureus* strains colonize up to 35% of young children and are associated with a wide range of diseases including soft tissue infections, sepsis, and pneumonia (7,8). Increases in the incidence of disease caused by community-acquired methicillin-resistant *S. aureus* are of great concern (9).

Host factors have been shown to influence colonization with *S. pneumoniae*, *H. influenzae*, *M. catarrhalis*, and *S. aureus*. These include host immunity, age, gender, race, out-of-home daycare, breastfeeding, and environmental exposure to tobacco smoke (10). The magnitude of host effects may differ by bacteria species.

Interactions between bacteria influence which species persist in the nasopharynx (11–13). Bacteria species may

1584

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Article Title

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CME Questions

Activity Evaluation

1. Which of the following bacteria was most commonly isolated from nasopharyngeal swabs in the current study?

- Staphylococcus aureus*
- Moraxella catarrhalis*
- Streptococcus pneumoniae*
- Haemophilus influenzae*

2. Which of the following associations between bacteria in the current study is most accurate?

- Colonization with *H. influenzae* was positively associated with *S. pneumoniae* colonization
- Colonization with *M. catarrhalis* was positively associated with *S. pneumoniae* colonization
- Colonization with *S. pneumoniae* was positively associated with *M. catarrhalis* colonization
- Colonization with *H. influenzae* and *M. catarrhalis* was positively associated with *S. pneumoniae* colonization

3. Which of the following variables was associated with a significant decrease in the rate of colonization with *S. pneumoniae*?

- Antibiotic use in the past 7 days
- Younger age
- Up-to-date vaccination with pneumococcal vaccine (PCV7)
- Breast-feeding

4. Day care promoted colonization with which of the following bacteria?

- S. aureus*
- M. catarrhalis*
- S. pneumoniae*
- H. influenzae*

1. The activity supported the learning objectives.

Strongly Disagree

1

2

3

4

Strongly Agree

5

2. The material was organized clearly for learning to occur.

Strongly Disagree

1

2

3

4

Strongly Agree

5

3. The content learned from this activity will impact my practice.

Strongly Disagree

1

2

3

4

Strongly Agree

5

4. The activity was presented objectively and free of commercial bias.

Strongly Disagree

1

2

3

4

Strongly Agree

5