Invasive *Streptococcus pneumoniae* in Canada 2012*:* Serotyping, Antimicrobial Susceptibility and Virulence Assessment

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Background and Rationale:

Antibiotic resistance in *Streptococcus pneumoniae* is a global concern. Respiratory and systemic isolates of *S. pneumoniae* are commonly resistant to penicillins, macrolides, tetracyclines, sulfonamides and fluoroquinolones and are frequently multi-drug resistant. Prevnar® (PCV-7: 4, 6B, 9V, 14, 18C, 19F, 23F) is a conjugate vaccine that has been shown, both in Canada and the United States, to be effective in reducing systemic infections due to *S. pneumoniae* in children, as well as reducing the incidence of recurrent upper respiratory tract infections in children. However, an emerging issue is that PCV-7 related and PCV-7 non-related *S. pneumoniae* serotypes are on the rise in Canada. In addition, the adult vaccine, Pneumovax®, is not frequently used in Canada due to its poor immunogenicity and efficacy, especially in the elderly. Thus, a new, more immunogenic *S. pneumoniae* vaccine for adults, as well as a conjugate vaccine with enhanced coverage for children, has recently been introduced in Canada. The broader serotype coverage and critical inclusion of serotype 19A in PCV-13 (PCV-7 + 1, 3, 5, 6A, 7F and 19A) offers an important advancement in the protection of Canadian children against invasive *S. pneumoniae* infections.

The **purpose** of my summer (May 1-Aug 30, 2012) research project is to study invasive *S. pneumoniae* in Canada (Jan 1-Aug 1, 2012) and assess their serotypes and antimicrobial susceptibility patterns, as well as their virulence.

Hypotheses:

Increasingly, a greater proportion of PCV-7 and PCV-13 unrelated *S. pneumoniae* serotypes will circulate across Canada. These emerging serotypes will be antimicrobial resistant and virulent.

Experiments to be Performed (Methods):

I plan to serotype, perform antimicrobial susceptibility testing and assess ~1,000 invasive *S. pneumonia* isolates for the presence of pili (estimation based on 2011 total isolates received and tested), obtained from all geographic regions of Canada from January 1, 2012 – August 1, 2012. These isolates will be obtained as a result of a new collaboration between the Canadian Antimicrobial Resistance Alliance (CARA) and the National Streptococcus Unit at the National Microbiology Lab (Public Health Agency of Canada). Invasive *S. pneumoniae* isolated from sterile sites that are forwarded from Canadian provincial public health laboratories, regional health units and reference centres to the National Microbiology Laboratory will be tested.

The identification of *S. pneumoniae* isolates will be confirmed by bile solubility and optochin susceptibility. Serotyping will be performed by a PCR multiplex as outlined at: http://www.cdc.gov/ncidod/biotech/strep/pcr.htm. Antimicrobial susceptibility testing will be performed using custom designed antimicrobial susceptibility panels using CLSI methods. The custom designed panels will contain penicillin, amoxicillin/clavulanate, cefuroxime, ceftriaxone, clarithromycin, ertapenem, meropenem, clindamycin, vancomycin, ciprofloxacin, levofloxacin, moxifloxacin, linezolid, tigecycline, trimethoprim/sulfamethoxazole and doxycycline.

The virulence of the isolates will be studied by detecting the presence of PI-1 and PI-2 adhesion pilus-encoding islets using PCR, as has previously been done in the lab. In brief, DNA will be extracted from the isolates using the Roche High Pure PCR Template Preparation Kit and used as a template for PCR. A different PCR reaction with its own unique set of primers will be used to test each for the presence and absence of both PI-1 and PI-2 for each isolate.

Publication plans:

I hope to be able to submit my data (focus on antimicrobial resistance and infection prevention) as an abstract to the AMMI/CACMID meeting in 2013 and thereafter write a publication in the Canadian Journal of Infectious Diseases and Medical Microbiology (CJIDMM) or the Canadian Medical Association Journal (CMAJ).