Unmet need in controlling Invasive Pneumococcal Disease (IPD) among Canadian older adults in the context of the current and potential future pneumococcal vaccination programs

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Background and Aim

- The development of pneumococcal protein-polysaccharide conjugate vaccines and their introduction in pediatric immunization programs, has resulted in the decrease of invasive and non-invasive pneumococcal disease through direct and indirect protection. Compared to polysaccharide vaccines, conjugate vaccines elicit a more robust immune response, memory B-cells and mucosal immunity, which leads to reduction in nasopharyngeal carriage[1].
- In Canada, the 23-valent pneumococcal polysaccharide vaccine (PPV23) has been recommended and publicly funded to control invasive pneumococcal disease (IPD) in adults ≥ 65 years of age[2].
- The National Advisory Committee on Immunization (NACI) recommended the 13-valent pneumococcal conjugate vaccine (PCV13) in older adults on an individual basis (2016), based upon high quality evidence for efficacy against vaccine-type IPD and community-acquired pneumonia. Adult publicly funded program was not recommended partly based on the assumption that herd effect from the routine pediatric program (introduced in June 2010- January 2011) would reduce the PCV13-type disease, limiting utility of direct vaccination of older adults[3]. Therefore, there is no publicly funded PCV platform for older adults in Canada[4].
- Pneumococcal conjugate vaccines with broader serotype coverage, a 15- and a 20-valent pneumococcal conjugate vaccine (PCV15 and PCV20)[5, 6] are currently in phase III clinical development for use in older adults and may become available in Canada in the coming years.
- The purpose of this analysis is to assess the changes in IPD serotype distribution in older Canadian adults over time, to assess the impact of the current programs and to evaluate the potential incremental serotype coverage of future PCVs.

Methods

- Case counts of IPD by serotype for adults ≥65 were obtained from published annual National Microbiology Laboratory (NML) surveillance reports[7] that are based on passive laboratory-based surveillance and available for the period 2010 to 2017. Serotype distribution were grouped according to current and next-generation vaccines as described in figure 1.
- NML started surveillance and reference testing of *S. pneumoniae* in April 2010. Most recent reports were used when annual case counts differed across reports with overlapping periods.
- Vaccine-serotype groupings were defined as follows: PCV13-type, PPV23-non-PCV13-type, PCV15-non-PCV13-type, PCV20-non-PCV15-type, and non-PPV23-type.
- For each study year, we calculated:
  - The annual proportion of IPD cases due to PCV13, PPV23-non-PCV13 and non-PPV23-serotypes.
  - The annual proportion of IPD cases due to PCV13, PCV15-non-PCV13-type, PCV20-non-PCV15-type and PCV20-type.

Figure 1. Serotype Coverage of Pneumococcal Vaccines Available for use in Canada for Adults over 65 years of age

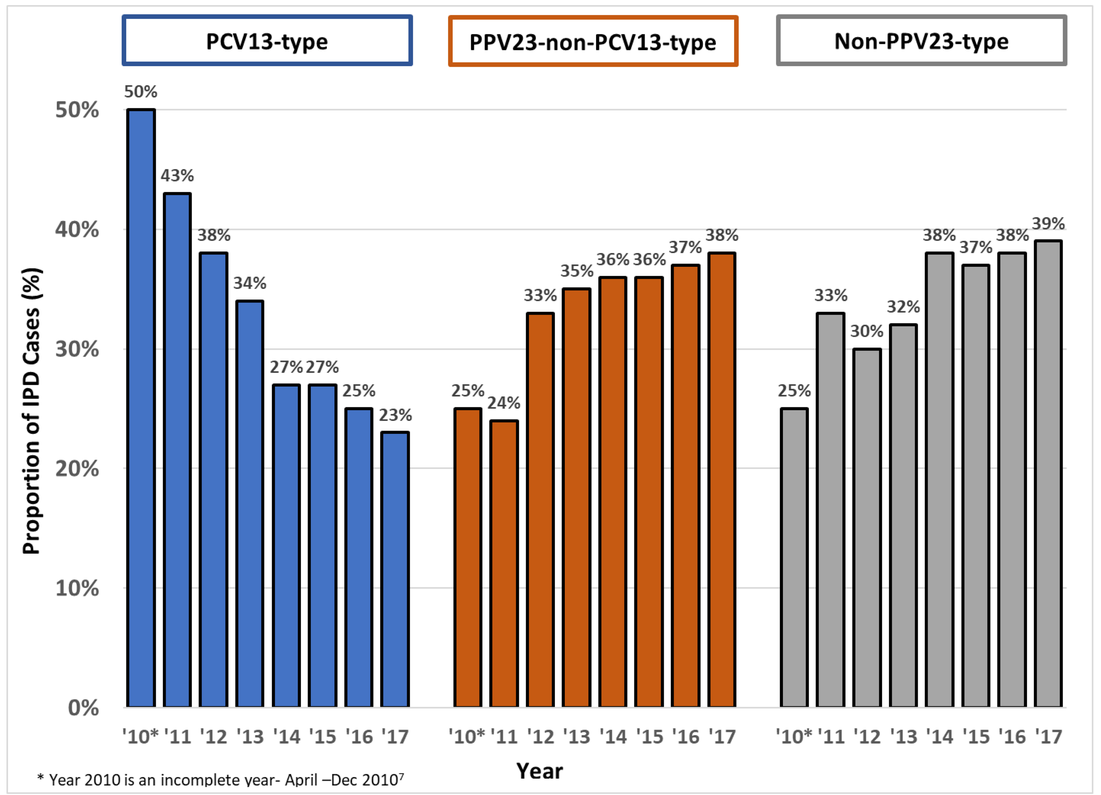
	1	3	4	5	6A	6B	7F	9V	14	18C	19A	19F	23F	22F	33F	8	10A	11A	12F	15B	2	9N	17F
PCV13	■	■	■	■	■	■	■	■	■	■	■	■	■										
PCV15	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
PCV20	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
PPV23	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Results

- Between 2010-2017, the proportion of IPD due to PCV13-serotypes in adults 65 of age and older declined from 50% (487/967) to 23% (287/1,238); the proportion of IPD due to the PPV23-non-PCV13-type increased from 25% (240/967) to 38% (469/1,238), and almost the same increase in the proportion of IPD was observed for non-PPV23-type from 25% (240/967) to 39% (482/1238). (Fig 2)
- The decline in the proportion of PCV13-type IPD was more prominent between 2010 and 2014 and then leveled off in the 3 following years.
- In 2017, the total proportion of IPD due to PCV15- and PCV20-types were 36% (447/1,238) and 52% (628/1,238), respectively. The proportion of IPD due to the PCV15-non-PCV13-type and PCV20-non-PCV15-type accounted for 13% (160/1238) and 16% (181/1238), respectively. (Fig 3)

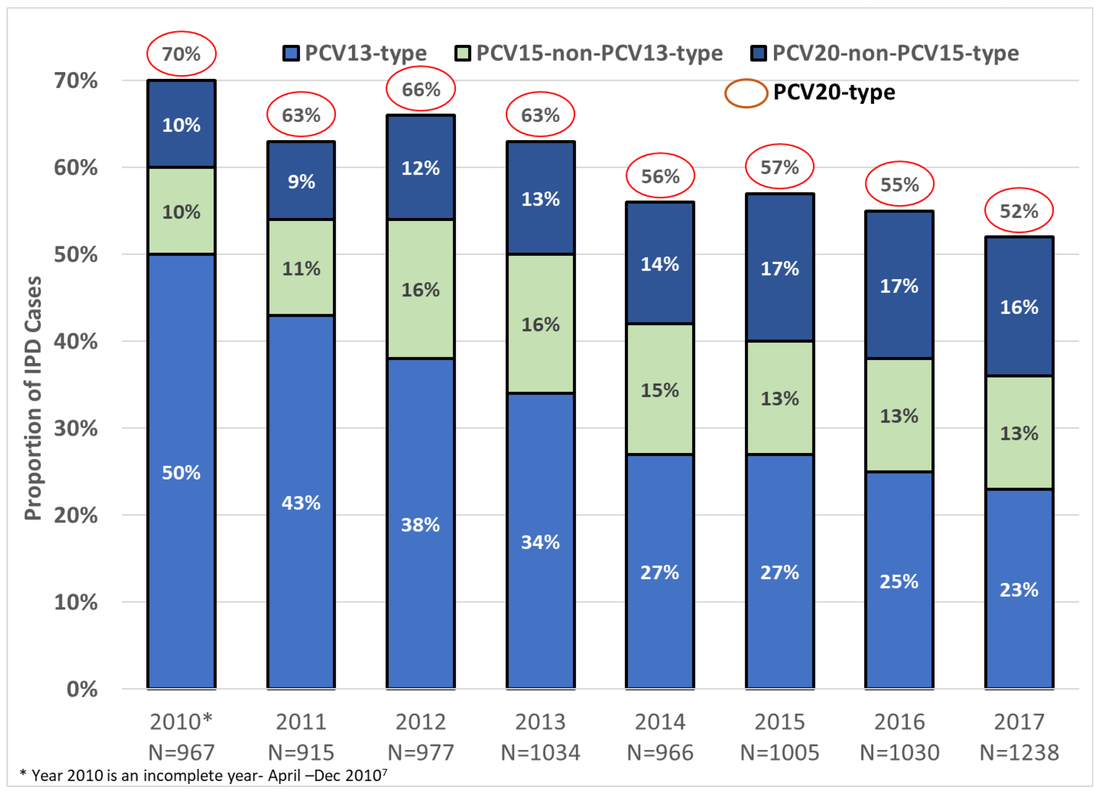
Results (Cont.)

Figure 2. Proportion of IPD in Canadian Adults ≥ 65 by Vaccine-Type(2010-2017)



* Year 2010 is an incomplete year- April –Dec 2010[7]

Figure 3. Proportion of IPD in Canadian Adults ≥ 65 years by Groups of Serotypes Related to Next Generation Vaccines (2010-2017)



* Year 2010 is an incomplete year- April –Dec 2010[7]

Discussion/Conclusions

- Most of the observed reductions in the proportion of PCV13-type IPD among older adults in Canada occurred between 2010 and 2014, with one in four annual IPD cases remaining of PCV13-type since then.
- The increasing trend in PPSV23-nonPCV13-type IPD and the remaining proportion of PCV13-serotype IPD among older adults suggests that the existing publicly funded PPSV23 programs and/or herd effect from the routine pediatric PCV13 immunization have provided suboptimal protection. These findings may warrant revaluation of health economic assessments for PCV programs for older adults.
- IPD isolates are submitted to the NML on a voluntary basis, which limits robust statistical analyses of trends or calculation of age-standardized incidence rates. However, directional trends observed within this assessment were consistent with published reports of vaccine-type IPD incidence trends in older adults over the same time period from public health surveillance in Ontario, Manitoba and Alberta (8, 9, 10).
- New conjugate vaccines have the potential to cover higher proportion of the unresolved IPD compared to PCV13 and potentially address the limitations of the currently funded PPV23 in older adults, provided public health vaccine policy shifted to support the use of conjugate vaccines in older adults in Canada.

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