Number of Children Without 13-Valent Pneumococcal Conjugate Vaccine (PCV13) Series Completion at 2 Years of Age in Canada

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Background and Aim

- The 13-valent pneumococcal conjugate vaccine (PCV13) was introduced into routine paediatric immunization programs in Canada between 2010 and 2011, and it replaced the existing PCV7 or PCV10 program (1). With this transition, provinces that were still using a 3+1 schedule also transitioned to a 2+1 schedule (2,3).
- Substantial reductions of PCV13-type invasive pneumococcal disease (IPD) have been observed post-implementation of PCV13 through direct protection of vaccinated individuals and less prominent reduction in indirect protection via herd effect (4). Despite observed impact of PCV13 programs in Canada, PCV13-type serotypes still continue to circulate accounting for ~13%, 26%, 34% and 23% of IPD in populations aged <2, 2-4, 50-64, and ≥65 years, respectively, in 2017 (4).
- National and provincial vaccine-coverage reports in Canada showed sub-optimal on-time completion and series completion rates for PCV13 (5,6). Delays in on-time immunization and suboptimal series completion rates can impact immunization program effectiveness.
- The objective of this study is to estimate the cumulative number of children who did not complete the PCV13 series by age 2 between 2011 and 2017.

Methods

- The childhood National Immunization Coverage Survey (CNICS) from the Public Health Agency of Canada monitors childhood immunization coverage for all publicly funded routine childhood immunizations as recommended by the National Advisory Committee on Immunization (NACI) (6).
- CNICS data are obtained from-parents or guardians of sampled children through a phone interview; if parent/guardian provides written consent then CNICS also contacts children's health care providers for immunization records (6).
- Annual PCV13 series completion rates from CNICS were available for 2011, 2013, 2015 and 2017; interpolation (average from closest years) was used for 2012, 2014 and 2016 (6-9). Canadian census data were used for annual estimates of population of children aged 2 years(9).
- Annual and cumulative number of children aged 2 years who had completed PCV13 series were calculated. Then, annual and cumulative number of children aged 2 years who remained incompletely immunized were calculated by subtracting from total populations.

Results

- PCV13 series completion rate for children 2 years of age has consistently increased from 67% in 2011 to 81.4% in 2017, but increases have been modest since 2013.
- During this period, ~72,000 to ~125,000 children annually did not complete PCV13 series at age 2 years, totaling ~609,000 children between 2011-2017 (Table 1).

Table 1. Number of Children Aged 2 Years by 13-valent Conjugate Vaccine (PCV13) Series Completion in Canada, 2011-2017

	2011	2012	2013	2014	2015	2016	2017
Children aged 2 years	379,962	383,468	384,931	385,541	385,776	388,558	388,304
PCV13 series completion[a] rates	67.0%	73.1%	79.2%	79.8%	80.3%	80.9%	81.4%
Children with PCV13 series completion	254,575	280,315	304,865	307,469	309,778	314,149	316,079
Children without PCV13 series completion	125,388	103,153	80,066	78,072	75,998	74,409	72,224
Cumulative number of children without PCV13 series completion, 2011-2017				*609,309*			

[a]PCV13 series completion rates consist of 4 doses (3 primary series doses plus one booster dose) for Northwest Territories and Nunavut, and 3 doses (2 primary series doses plus one booster dose) for other provinces/territories. Rates were calculated as % of children aged 2 years that completed series.

Discussion

- During the study period (2011-2017), PCV13 series completion rates in children aged 2 years were below the national immunization coverage target of 95%, outlined in the national immunization strategy in Canada (10). None of the provinces or territories met the immunization coverage goals (6).
- Additionally, data from individual provinces point out to suboptimal timeliness of schedule completion - with up to 35% of children in some jurisdictions not receiving the booster dose on time (5,11).
- Thus, immunization coverage issues discussed above, in a setting of a 2+1 schedule, may have impeded optimal benefit from PCV13 programs by leaving un/under-immunized children vulnerable to infection, and potentially leading to suboptimal pneumococcal carriage reduction and herd protection (12,13).
- Main limitations are related to CNICS survey design, potential sampling biases, and the extrapolation of vaccine coverage done for the missing years. Due to differences in survey methodology, estimates from CNICS may not perfectly align with those from provincial and territorial vaccine registries.
- In summary, the substantial estimated number of under-immunized children over the study period, coupled with reduced-dose schedule may have undermined the optimal public health impact of the pediatric PCV13 immunization program. Potential role of these factors in PCV13 program effectiveness in Canada requires better understanding.

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