Estimates and projections of susceptibility to polio among the childhood population in British Columbia, Alberta and Ontario

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Objective

We combined data on vaccine coverage and population projections to project how childhood susceptibility to polio in 3 Canadian provinces could change in the next 10 years if current vaccination levels remain constant.

Key Messages

In British Columbia and Ontario, polio susceptibility by 2035 is projected to rise in line with population growth; in Alberta, a 43% increase in the number of potentially susceptible children is expected, driven by higher expected population growth and sub-optimal coverage in certain areas.

Characterizing future risk of vaccine-preventable diseases requires understanding of changes in population susceptibility over time, considering vaccine-induced protection and demographic changes.

Background

- Despite decades of progress towards polio eradication, wild and vaccine-derived polioviruses still circulate in numerous regions, posing ongoing risk for countries that have eliminated polio
- Recent environmental detections of circulating Vaccine-Derived Poliovirus 2 (cVDPV2) in North Ameria and Europe raise concerns regarding the potential for poliovirus transmission in settings with historically high levels of immunization with inactivated polio vaccine (IPV), including Canada (1–5)
- Three doses of inactivated polio vaccine (IPV) provide high, possibly life-long protection against polio paralysis, but IPV-vaccinated individuals can still be infected with and transmit polioviruses (6,7)
- Undetected transmission of polioviruses poses little risk to fully vaccinated individuals, but could lead to cases of polio paralysis in unvaccinated or incompletely vaccinated individuals (8)
- Characterizing immunity gaps and pockets of susceptibility is important for understanding the risks posed by potential polio transmission events in Canada

Methods

- We combined publicly available sub-provincial IPV vaccine coverage data in successive birth cohorts and age-specific projections to estimate the number and percentage of children susceptible to polio in 2024. (9–11)
- Susceptibility was defined according to provincial vaccination schedules of up-to-date for age (12–14)
- We projected the expected number of polio susceptible children in 2035, given current vaccination coverage levels using provincial government population estimates (15–17)

Findings

	Estimated susceptible children in 2024 N (%)	Projected susceptible children in 2035 N (%)	Overall % change in susceptible children, 2035 vs 2024	Median (IQR) change in susceptibility across geographic areas
Alberta (<18 years)	146,000 (14%)	207,000 (18%)	43%	37% (15% - 54%)
British Columbia (<18 years)	237,000 (26%)	270,000 (28%)	14%	11% (5% - 21%)
Ontario (7-17 years)	331,000 (18%)	335,000 (18%)	1%	2% (-5.5% - 6.8%)

Table 1: Estimates of potentially polio-susceptible children in 2024 and 2035, and relative change in size of susceptible population

- In 2024, susceptible populations were primarily concentrated in more highly-populated areas in southern BC and Ontario, large urban centres in Alberta, and certain regions in northern, central and southern Alberta (Figure 1)
- If current vaccination levels remain constant, by 2035 the greatest relative increases in susceptible children are expected in areas of southern Alberta, BC and Ontario (Figure 2), but the overall geographic distribution in all 3 provinces is expected to be similar to that in 2024 (not shown)

- In BC and Ontario, increases in polio susceptibility by 2035 are in line with projected population growth (Figure 3, panels B and C)
- In Alberta, the number of susceptible children is projected to rise by 43%; population growth accounts for ~75% of this increase, with sub-optimal vaccine coverage in certain areas having a greater influence relative to the other provinces (Figure 3, panel A)

Conclusions

- Estimates presented should not be interpreted as forecasts, but are intended to provide a picture of how polio susceptibility in Canada could change over the next 10 years if current vaccination coverage patterns remain constant
- Vaccine coverage data and serological surveys can provide useful information about population immunity to vaccine-preventable diseases, but have certain limitations:

- Coverage data are crucial indicators of immunization program performance, but provide limited information about how the size of the susceptible population changes over time
- Serological data can provide information about immunity across different age groups, but are conducted infrequently and typically have limited geographic resolution
- Characterizing the future risk from polio and other vaccine-preventable diseases requires further understanding of how the size of the susceptible population is expected to change over time, taking into consideration levels of vaccine-induced protection in successive birth cohorts, as well as changes in demographics and population size
- Spatially-stratified projections of susceptibility to polio can help inform assessments of future risk and immunization priorities, and can be incorporated into the development of mathematical models to study the potential for transmission within Canada and the role of different monitoring and control strategies

Limitations

- This analysis assumes that those who are not 'up-to-date' for age are completely susceptible, which does not account for partial protection provided by incomplete or delayed vaccination
- Differences in data availability and reporting mean that estimates are not directly comparable between provinces.
- There are limited coverage data in adult populations and certain groups are likely to be under-represented in coverage estimates (i.e., populations living on-reserve, children not actively attending school, recent immigrants)
- Coverage data likely underestimate immunity levels due to delayed vaccination, incomplete or delayed reporting.
- The influence of migration on population susceptibility estimates is unclear; our analysis assumes that vaccine uptake among in-migrants is the same as the host population, which is more likely to be the case if migration occurs at a younger age

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