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Measles coverage trends at the 7th birthday in British Columbia, 2014-2022

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Background

- Measles is a highly infectious viral disease that can cause serious complications. (1)
- Measles has been eliminated in Canada, but importation can occur, leading to secondary transmission and outbreaks. (2)
- Achieving high 2 dose vaccination coverage ($\geq 95\%$) is deemed necessary for prevention of sustained transmission. (3) BC is signatory to national targets to achieve 95% 2 dose MMR (measles, mumps and rubella vaccine) coverage by the 7th birthday by 2025. (4)
- In 2019, BC introduced the Vaccination Status Reporting Regulation (VSRR), which requires a parent/guardian to provide a vaccination status record of their school-aged child, in the instance where such a record has not been voluntarily provided. (5)
- Annual provincial immunization coverage estimates show a gradual and consistent decline over the past decade in the percentage of children at the 7th birthday who are up to date for measles, mumps, and rubella (MMR) vaccine in British Columbia (BC). (6)
- This decline appears to coincide with the change in the immunization schedule for MMR second dose from 18 months to school entry (4-6 years) in 2012. (7) This change was made to optimize varicella 2nd dose for sustained protection through use of the combination MMRV vaccine, based on modeling suggesting that placement at school entry provided longer lasting protection. (8)
- Assessing the factors contributing to this decline has been complicated by changes in data sources over time and by health authority.

Objective

- To evaluate trends in measles vaccine coverage in children at the 7th birthday in BC to determine whether the MMR immunization schedule change is associated with the apparent declines.

Methods

Primary analysis

- Trends were assessed using 7th birthday childhood coverage report data from 2014-2022, which included multiple data sources that varied over time, defined below.

Health Authority	Year										
	2014	2015	2016	2017	2018	2019	2020	2021	2022		
IHA	Registry (birth cohort)				Registry (school cohort)						
FHA	Registry (birth cohort)/MoE aggregate enrollment				Registry (school cohort)						
VCHA	Registry (birth cohort)/MoE aggregate enrollment				Registry (school cohort)						
VIHA	Registry (birth cohort)/MoE aggregate enrollment				Registry (school cohort)						
NHA	Registry (birth cohort)/MoE aggregate enrollment				Registry (school cohort)						

1. Registry (birth cohort) (2014-2017; IHA only):

- Denominator:** the number of children who turned 7 years old in the year preceding the report year and with active records in the provincial immunization registry (PIR).
 - Numerator:** the number of children from the denominator who were up-to-date for measles vaccine.
- ### 2. Registry (birth cohort)/MoE aggregate enrollment (2014-2018/2019):
- Denominator:** the number of children who turned 7 years old in the year preceding the report year and were attending schools within the health authority, based on estimates derived from BC Ministry of Education enrolment statistics
 - Numerator:** the number of children who turned 7 years old in the year preceding the report year with active records in the immunization registry (PIR or VCH PARIS) who were up-to-date for measles vaccine.

Methods (cont'd)

3. Registry (school cohort):

- Denominator:** the number of children who turned 7 years old in the year preceding the report year with active records in the health authority's immunization registry (PIR or PARIS) and with immunization registry records indicating they were registered in a BC school as of June 30 of the school year.
- Numerator:** the number of children from the denominator who were up-to-date for measles vaccine.

Secondary analyses

A) As part of routine reporting, a birth cohort registry (data source #1) was produced from 2014-2021 for all HAs except for VCH. For a secondary analysis, coverage was assessed using this source only to control for the effects of data source changes.

B) Coverage for the birth cohort affected by the schedule change was also compared to estimates from the VSRR reports for 2019-2022 to assess changes in coverage as children progressed through school.

Results

Primary analysis

Measles vaccination coverage declined in 2018 in all health authorities and again in 2019 for IHA, FHA, and VIHA (Figure 1).

Most health authorities, except NHA, had an increase in coverage from 2020-2021. IHA saw a large decline in 2017, a year earlier than other health authorities.

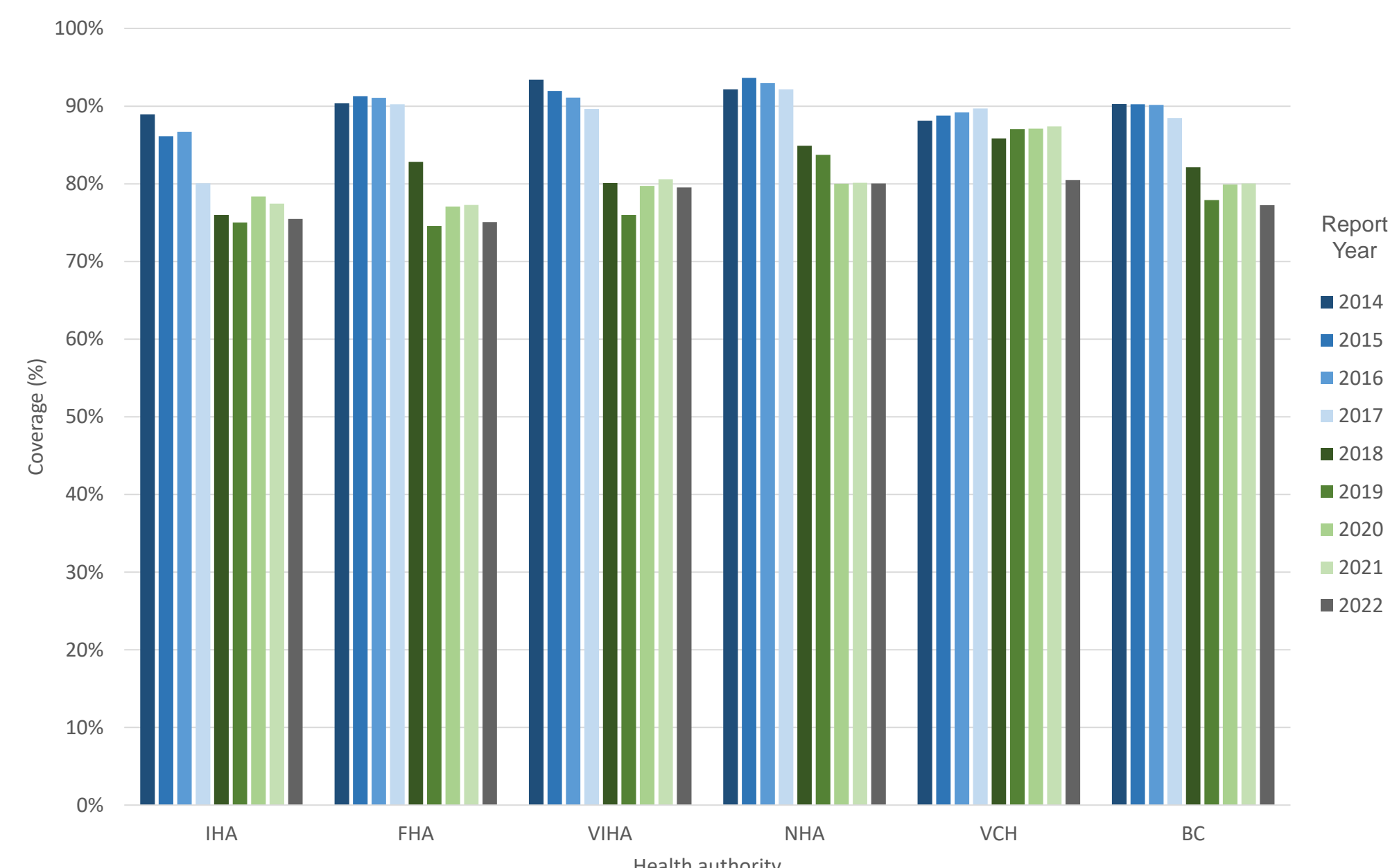


Figure 1. Percentage of second dose measles vaccine receipt by 7th birthday in BC, by health authority, 2014-2022. Calculated using historic coverage report data.

As shown in Figure 2, the decline in 2018 coincided with more children only having 1 dose, with the proportion of undocumented or unimmunized children remaining consistent with previous years.

From 2019 onwards the proportion of undocumented or unimmunized children has increased, which may be due to the use of record level denominator data beginning in 2019/2020 instead of aggregate enrollment data.

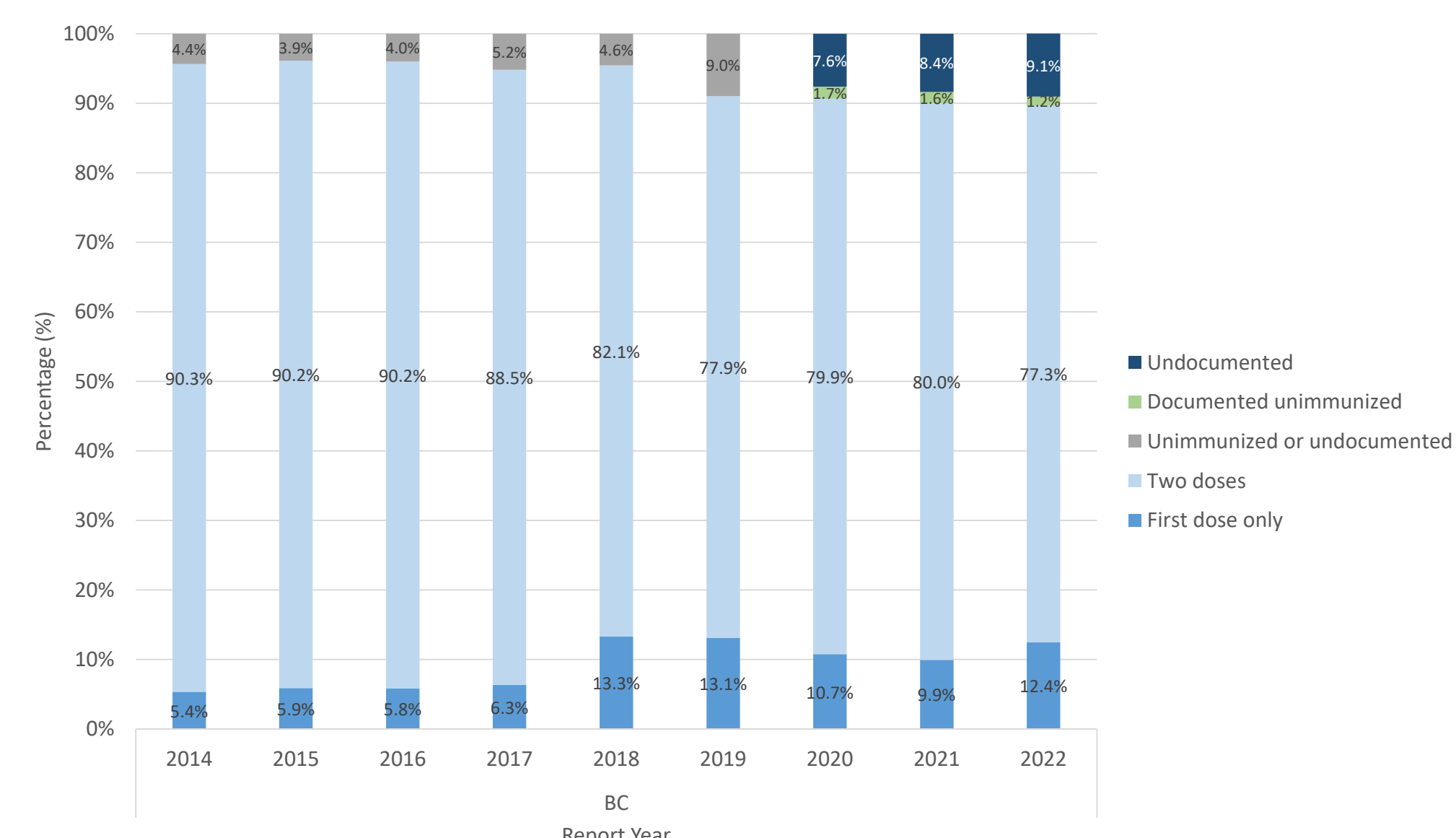


Figure 2. Measles vaccine status by 7th birthday in BC, 2014-2022 (2006-2014 birth cohorts). Calculated using historic coverage report data.

Results

Secondary analysis (part A)

Results from the secondary birth cohort analysis produced coverage estimates that were lower than the historic childhood coverage report data, but declines in coverage were still observed (Figure 3).

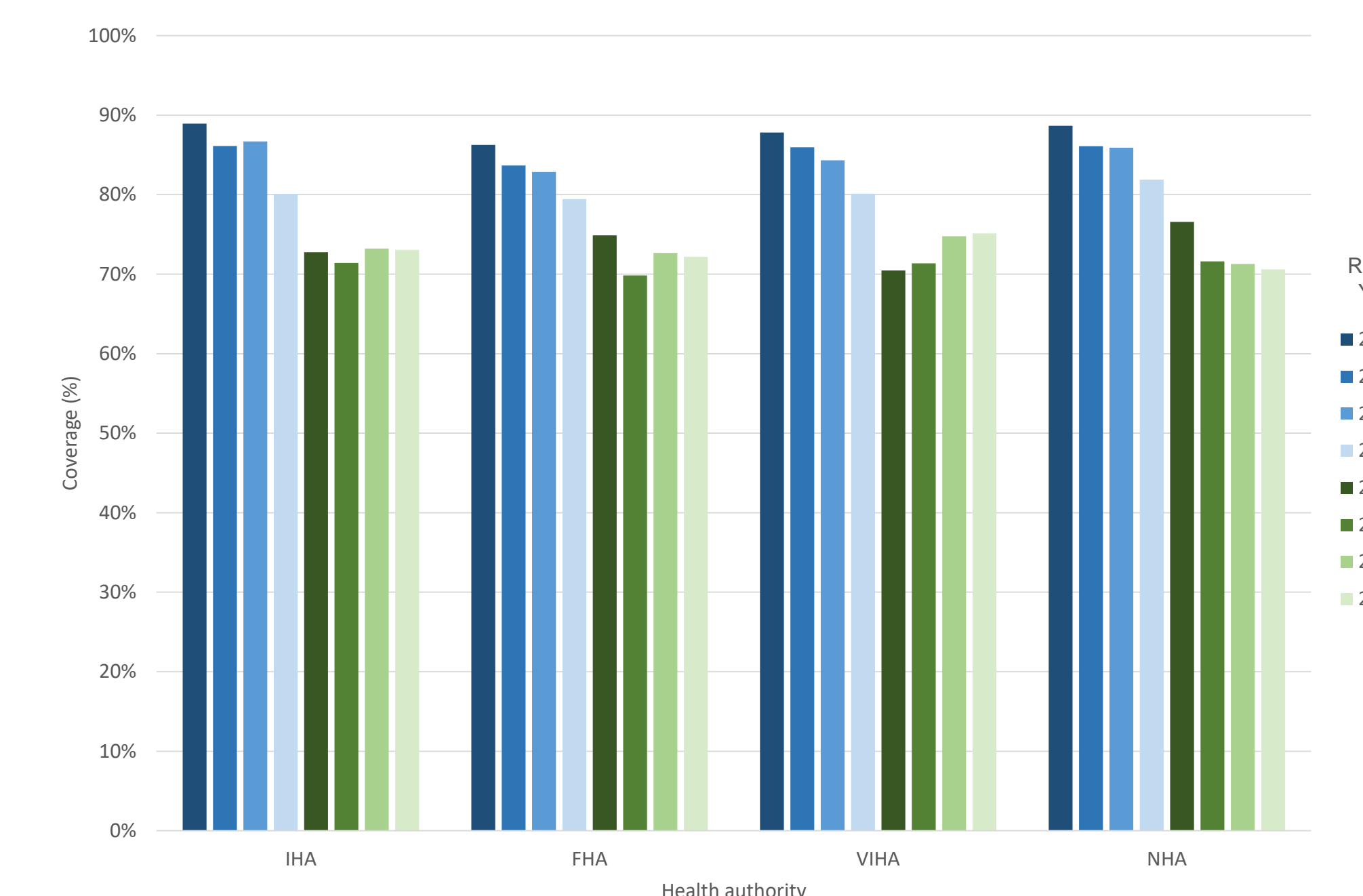


Figure 3. Percentage of second dose measles vaccine receipt by 7th birthday in BC, by health authority, 2014-2021. Secondary analysis using birth cohort data only. Note: VCH not included as birth cohort data were not available.

As shown in Figure 4, a small decline was seen in 2017, which coincided with a slightly higher proportion of children being undocumented or unimmunized.

The larger decline in 2018 coincided with a higher proportion of children with only 1 dose, with the proportion of undocumented or unimmunized children increasing slightly compared to previous years.

From 2019 onwards the proportion of undocumented or unimmunized children remained similar to 2017 and 2018.

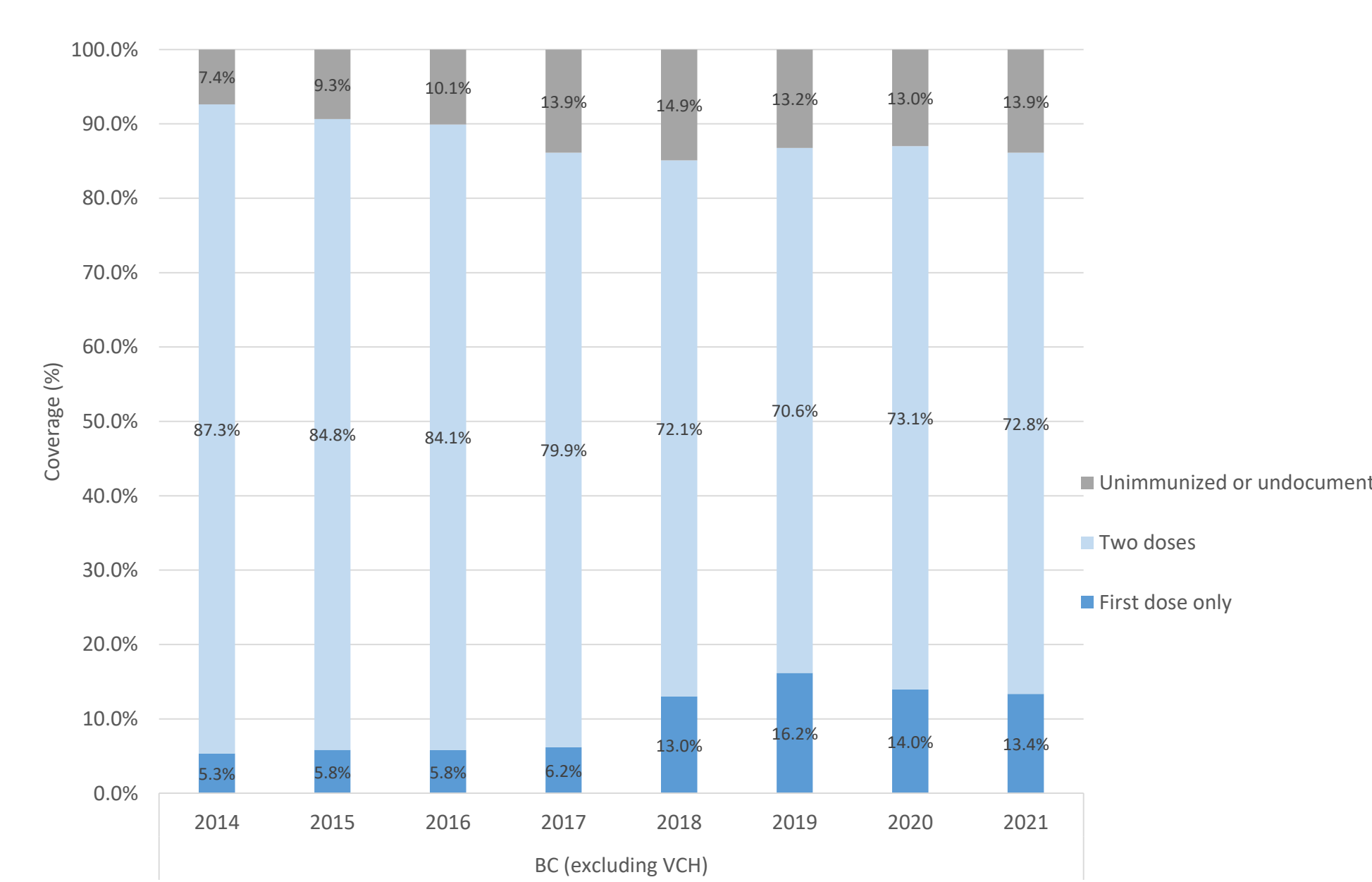


Figure 4. Measles vaccine status by 7th birthday in BC, 2014-2021 (2006-2013 birth cohorts). Secondary analysis using birth cohort data only. Note: VCH not included as birth cohort data were not available.

Overall, this analysis likely underestimates coverage due to the inclusion of children based on birth year without confirmed active enrollment in school.

However, the consistent decline in coverage provides support for the conclusion that declines in measles vaccination coverage may have resulted from a change in program schedule rather than data sources.

Secondary analysis (part B)

For this analysis, we assumed the 2010 birth cohort corresponded to Grade 2 in the 2017-2018 school year. This cohort had a two-dose measles coverage of 82.1% by age 7.

VSRR report data for the 2019-2020, 2020-2021, and 2021-2022 school years shows a 2-dose coverage of 90.1% by end of grade 6 in 2021-2022 (Figure 5), with the greatest improvement between Grades 5 and Grade 6. This suggests that catch-up may be occurring for some children as they progress through school, and that grades with existing school-based immunization programs might be useful for promoting completion of other vaccine series.

Results (cont'd)

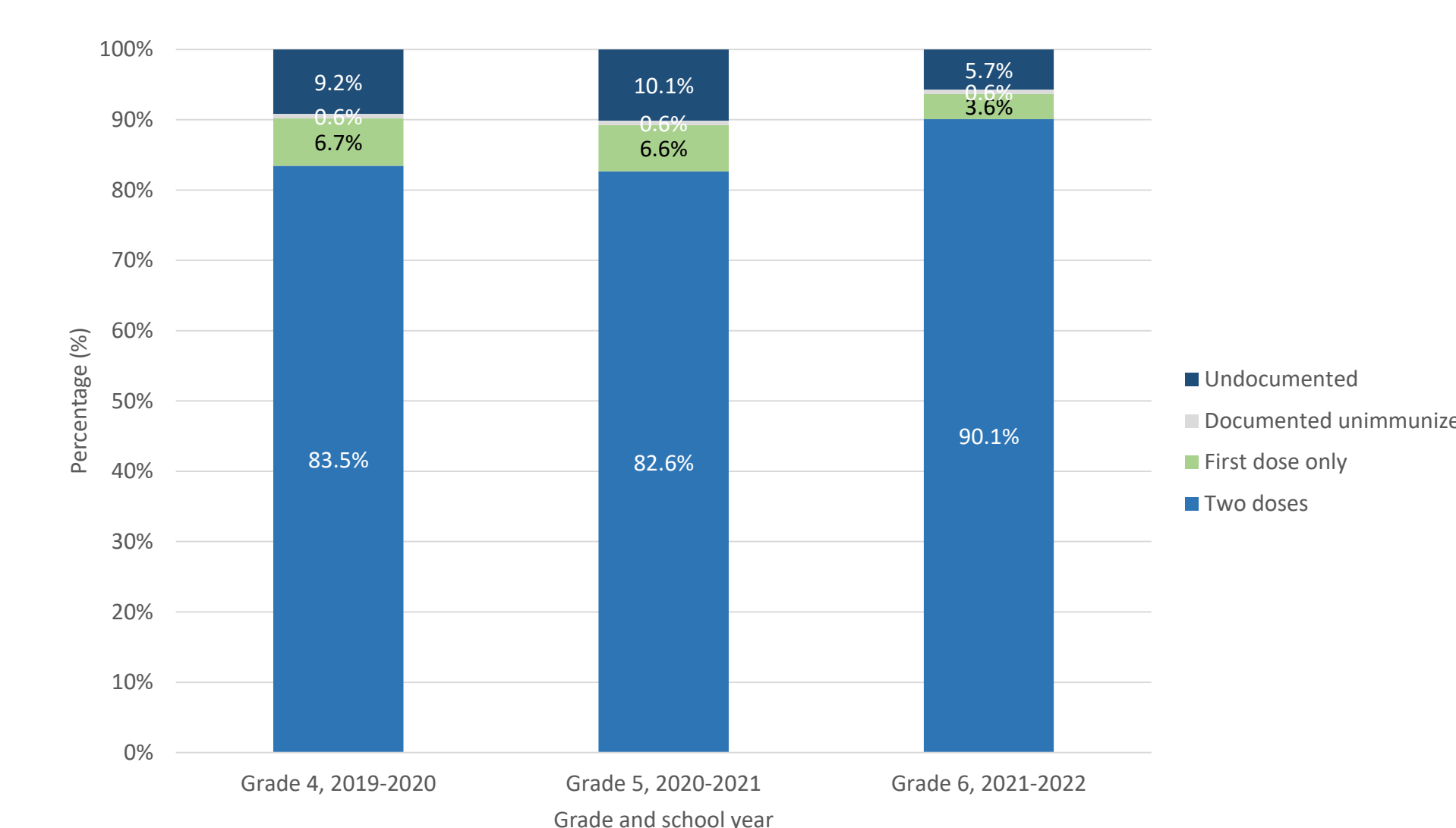


Figure 5. Secondary analysis of measles vaccine status for the 2010 birth cohort (coverage report year 2018) using VSRR report data for the 2019-2020, 2020-2021, and 2021-2022 school years.

Conclusion

- Measles vaccination coverage by the 7th birthday has declined gradually and consistently since 2018, which was the first birth cohort affected by the change in 2nd dose schedule from 18 months of age to school entry.
- Direct comparison of historic coverage data is not possible due to changes in data sources for the numerator and denominator, but a secondary analysis using birth cohort data from a single source (PIR) for both numerator and denominator showed that the decline in second dose receipt was still observed.
- Comparison of a cohort of children who were assessed for vaccine receipt by 7th birthday in 2018 to VSRR coverage data from 2019-2022 shows that measles coverage improved as this cohort reached later grades (i.e., grades 4, 5, and 6). However, coverage assessed at grade 6 is still short of the 95% national target (4).
- BC could consider advancing the age of second dose to 18 months (as per other Canadian jurisdictions) or use a mixed schedule similar to the United States (9) where the second dose can be administered at either 18 months or 4-6 years. This may help in targeting younger children for completion of their MMR series prior to school entry.

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