

COVID-19 school cluster and transmission analysis

May 7, 2021

Purpose

Retrospective analysis of COVID-19 cases in K-12 school settings to determine clusters and transmission dynamics

Inclusion criteria

COVID-19 cases reported to Public Health between January 1 and March 7, 2021 in students and staff who attended school (K-12 public/independent)

Methods

- Identified all schools with >1 case within a 14-day period (excluding cases from the same household)
- Determined whether in-school transmission occurred based on standardized transmission/acquisition definitions
- Cases reviewed by team of epidemiologists, analysts and MHO over 6 week period
- MHO consulted for complex and ambiguous cases

Definitions

- **Suspect in-school acquisition/transmission** defined as:
 - Case attended school during acquisition period
 - Case has no known exposure to a household or community case with symptom onset two or more days earlier
- **Possible in-school acquisition/transmission event** defined as:
 - Suspect definition above AND
 - When 2 or more cases within the same classroom/admin areas/school bus/other school supervised venue or activity or with confirmed contact between cases in school based setting with similar symptom onset within 2 calendar day window without any other known acquisition
- **Likely in-school acquisition/transmission** defined as:
 - Suspect definition above AND
 - Acquisition period of case overlaps with infectious period of another case in the same classroom/admin areas/school bus/other school supervised venue or activity or with confirmed contact between cases in school based setting

*Does not include cases who were en route to school together (e.g. car-pooled or walking – excludes school bus use) as these are considered as community transmission and not issues with school based safety measures. Includes sporting events on school property and after-school programs that are operated by school or led by staff employed by school

Definitions

- **Confirmed cluster**

- At least one in-school transmission event (possible or likely) in a 14-day period

- **Declared outbreak**

- Cluster with evidence of ongoing transmission in multiple classrooms/admin areas¹

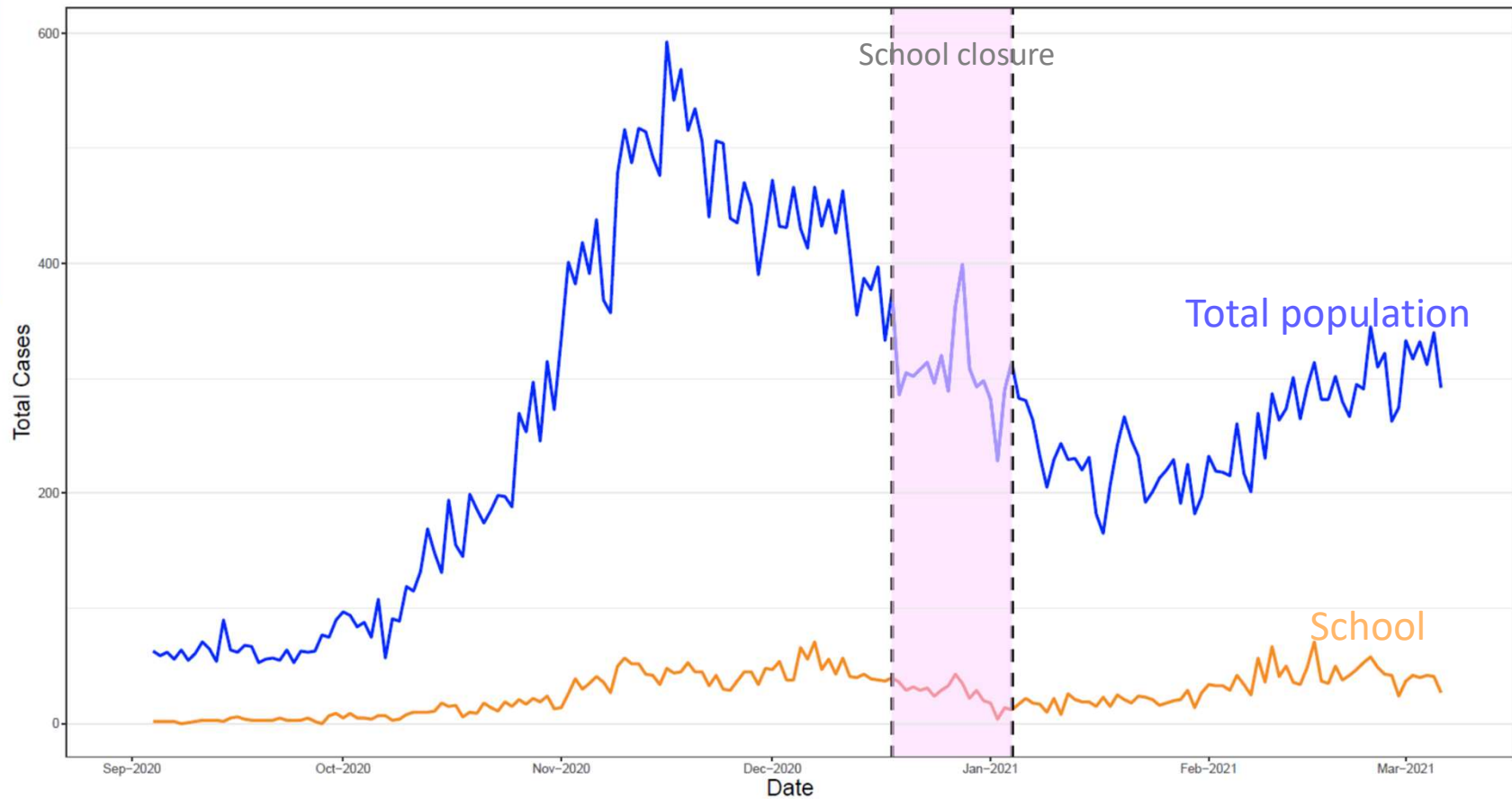
¹Outbreaks are declared at the MHO's discretion and are publicly posted when declared

Data Sources

- PARIS - clinical information system containing data collected by Public Health based on BCCDC COVID-19 Case Report Form
- Ministry of Education – school denominators

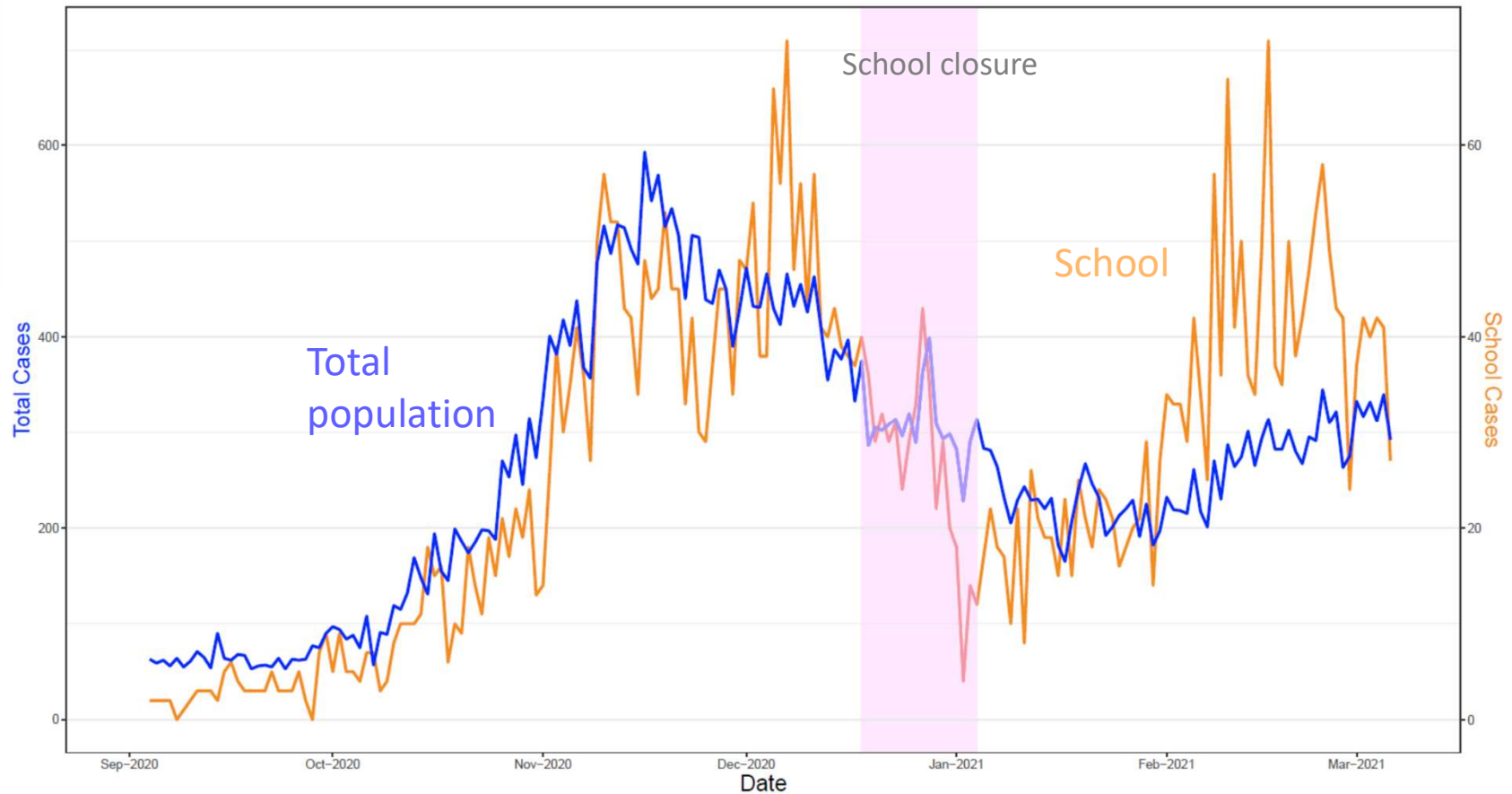
Results

Overall COVID-19 cases and school cases reported in Fraser Health between September 2020 and March 2021



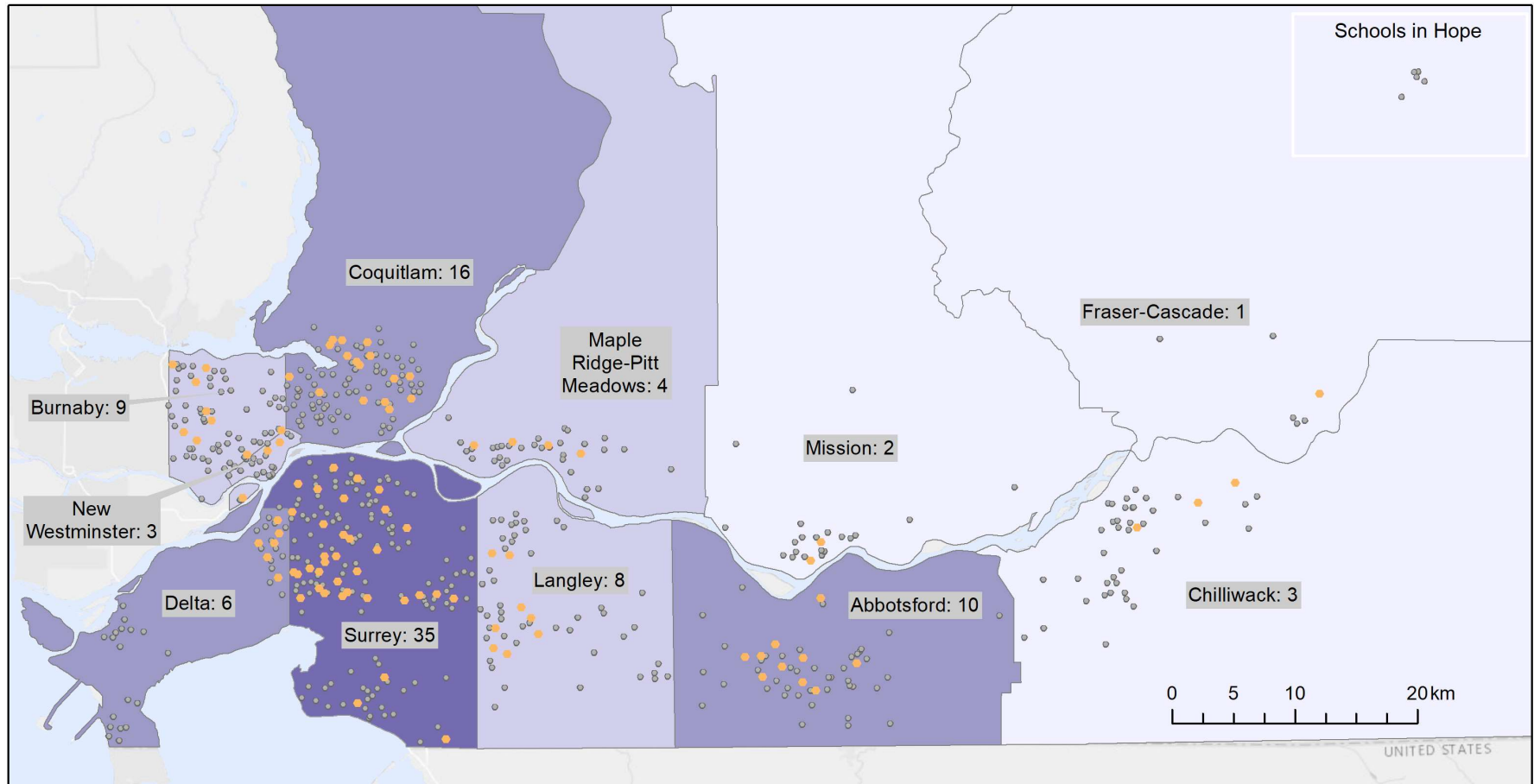
- Same scale used for total and school relationship, highlighting relative proportion of school to total population cases

Overall COVID-19 cases and school cases reported in Fraser Health between September 2020 and March 2021

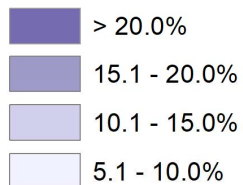


- Separate scales used for total and school relationship, highlighting similar temporal patterns in rise and fall of cases

Schools with confirmed COVID-19 clusters/outbreaks by School District Jan 1 - Mar 7, 2021



Schools with confirmed clusters/ outbreaks (%) by School District:



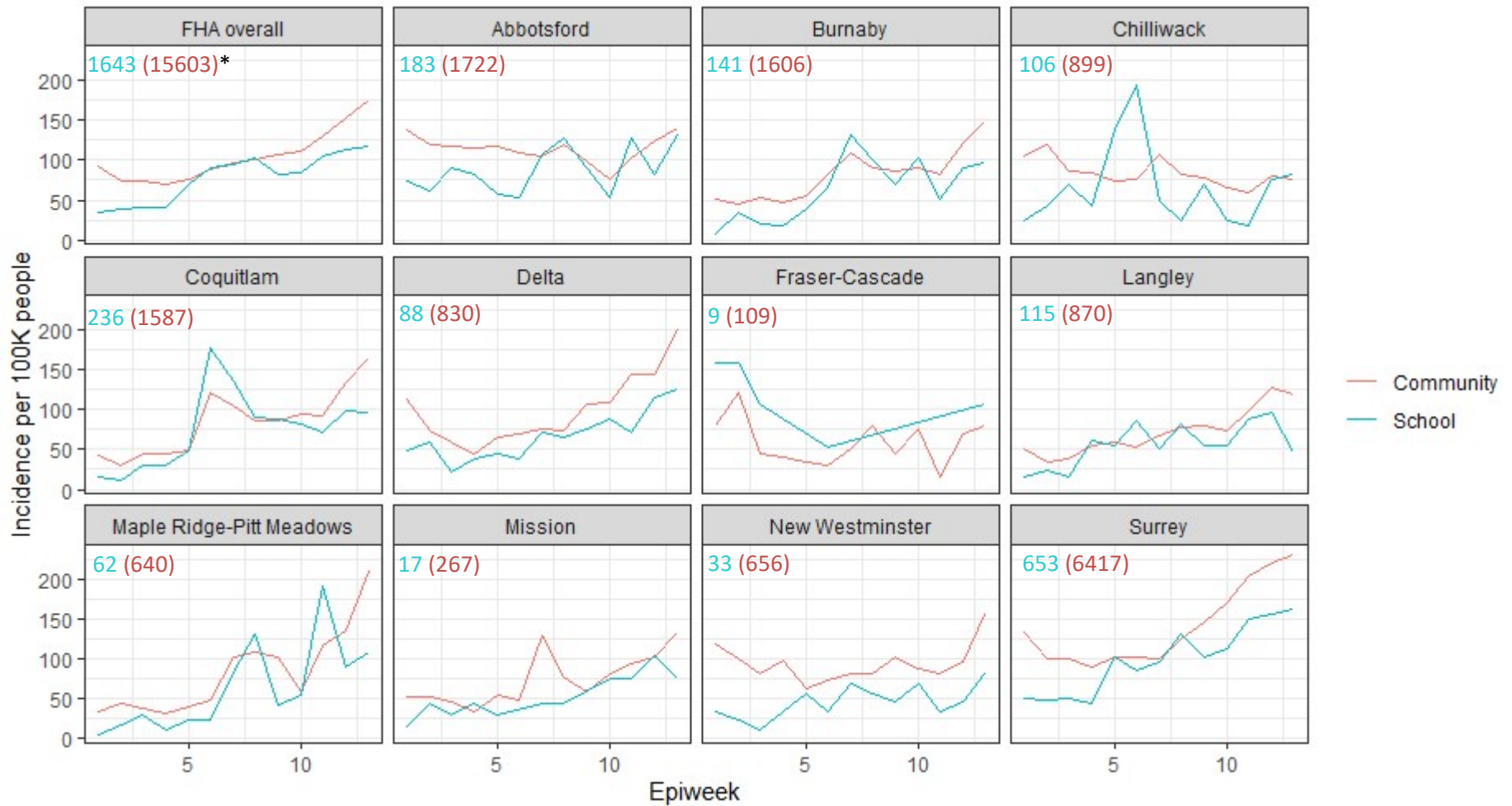
School sites

- School cluster/outbreak locations (total: 97)
- School locations (total: 639)

School district:
of school clusters

Data source: PARIS COVID-19 dataset
Base map: Esri World Light Gray Canvas
Projection: UTM Zone 10N
Prepared by: Population Health Observatory
Date: March 2021

Weekly Incidence Rate in community and student population by School District



- * Cumulative number of cases with episode date between Jan 1 and March 7, 2021 for students and community overall.
- Includes students from public, Francophone and independent schools in the geographic boundary of the school district
- Smaller numbers in Fraser-Cascade may result in high variability

Geographical Distribution of Confirmed School Clusters and Outbreak

School District	Independent Schools (% of schools with confirmed clusters/ outbreaks in area)	Public Schools (% of schools with confirmed clusters/ outbreaks in area)	No. clusters/outbreaks (% of total clusters/ outbreaks)
Chilliwack	5 (100%)	-	5 (4.3%)
Abbotsford	4 (40%)	6 (60%)	10 (8.6%)
Langley	1 (11.1%)	8 (88.9%)	9 (7.8%)
Surrey	6 (13.6%)	38 (86.4%)	44 (37.9%)
Delta	-	7 (100%)	7 (6.0%)
New Westminster	-	3 (100%)	3 (2.6%)
Burnaby	3 (30%)	7 (70%)	10 (8.6%)
Maple Ridge-Pitt Meadows	-	4 (100%)	4 (3.4%)
Coquitlam	2 (9.5%)	19 (90.5%)	21 (18.1%)
Mission	-	2 (100%)	2 (1.7%)
Fraser-Cascade	1 (100%)	-	1 (0.9%)
Total clusters/ outbreaks	22 (19.0%)	94 (81.0%)	116 (100%)

Size of Confirmed School Clusters

	School Type		Total
	Public Schools	Independent	
Total number clusters	94	21	115
Size of cluster			
Min, Max	2, 11	2, 19	2, 19
Median	2	2	2
Mean	2.9	3.5	3.0
Index case role			
Student, n (VOC)	66 (8)	17 (1)	83 (9)
<i>age 5 - 12, n (VOC)</i>	36 (2)	7	43 (2)
<i>age 13 - 18, n (VOC)</i>	30 (6)	10 (1)	40 (7)
Staff, n (VOC)	24	2	26
Unknown index case*	4	2	6

*Missing data or transmission from undetected index case

- This and following slides focus on clusters. Single outbreak that occurred was excluded due to unique context of transmission.

Characteristics of Confirmed School Clusters

Role	Age group	VOC cases		Non-VOC cases		Total
		N	%	N	%	
Student						
	5-12	11	7.4	137	92.6	148
	13-18	15	12.9	101	87.1	116
Staff						
	>18	2	2.4	81	97.6	83
Total cases		28	8.1	319	91.9	347

*No VOC cases associated in schools with outbreaks

Directionality of Known In-School Transmission Events within Confirmed Clusters

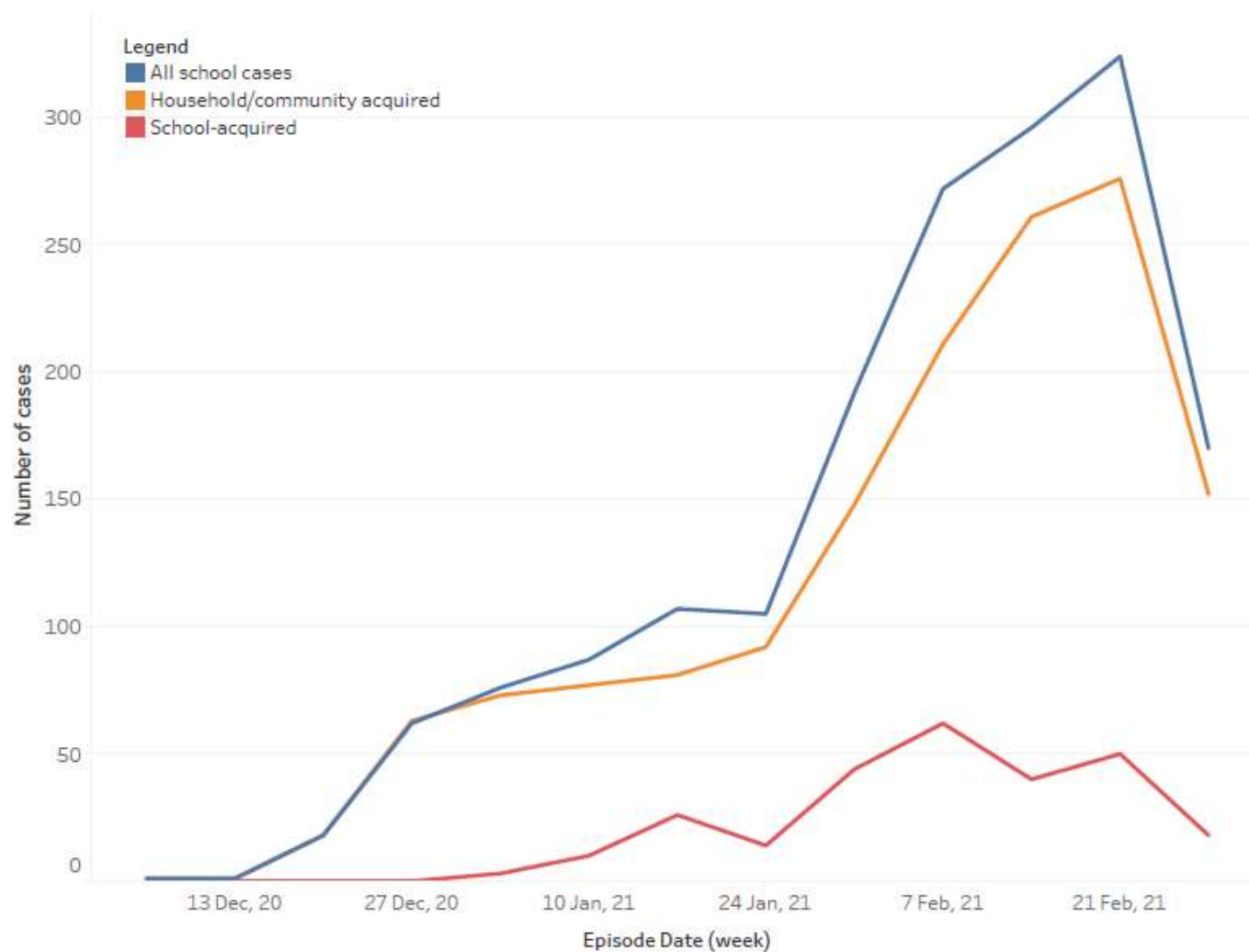
Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	108 (45.4%)	17 (7.1%)	125 (52.5%)
<i>Student-staff</i>	26 (10.9%)	1 (0.4%)	27 (11.3%)
<i>Staff-staff</i>	22 (9.2%)	1 (0.4%)	23 (9.7%)
<i>Staff-student</i>	51 (21.4%)	-	51 (21.4%)
<i>Unclear direction/ Transmission from unknown index</i>	12 (5.0%)	-	12 (5.0%)
Total	219 (92.0%)	19 (8.0%)	238 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

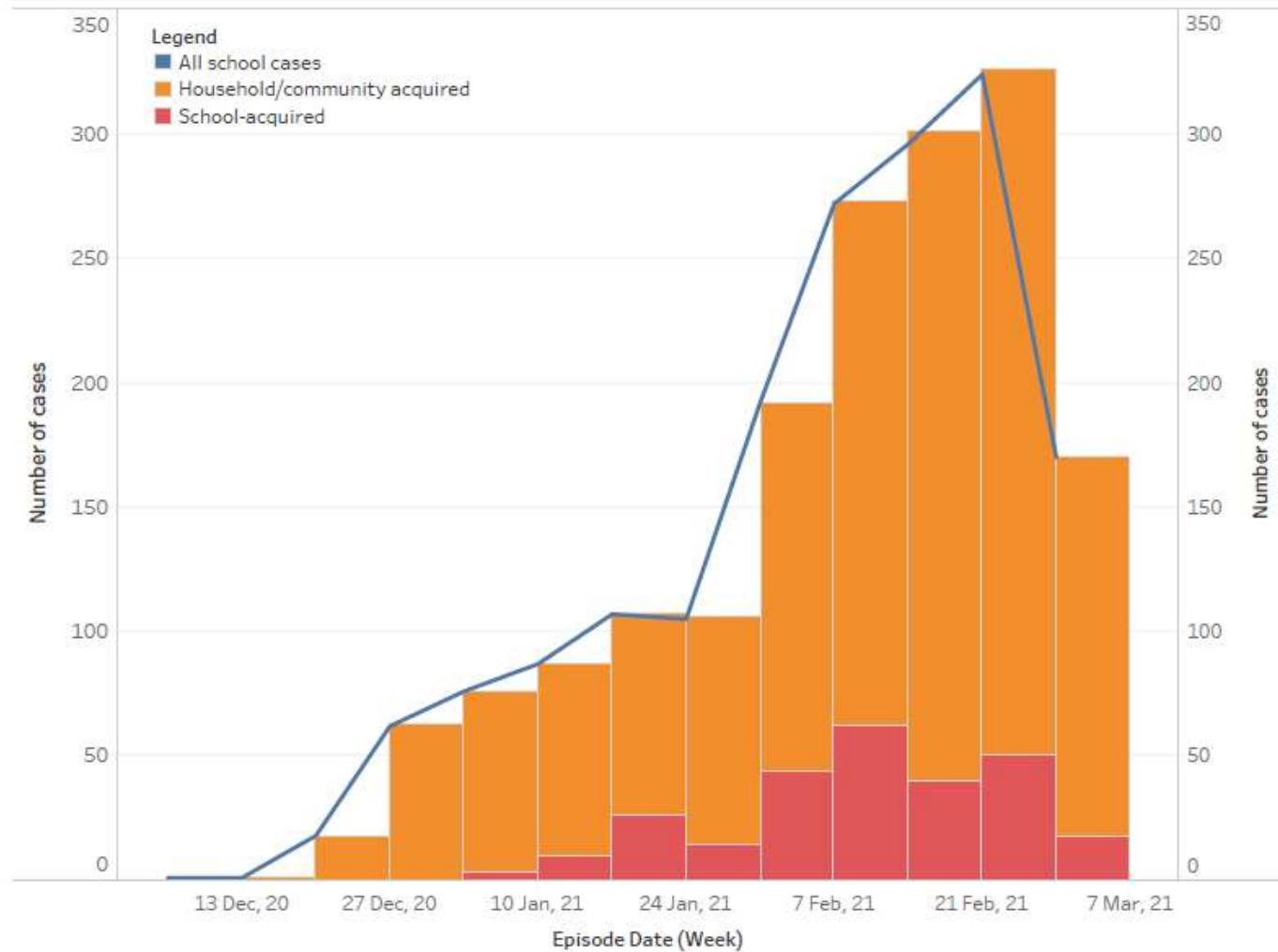
*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- There were an additional 333 cases with suspect acquisition in school that were not included in confirmed clusters as additional analysis is warranted to determine if linked or not to in-school acquisition

Cases with In-School vs Household/Community Acquisition



Cases with In-School vs Household/Community Acquisition



Summary the number of household/ community transmissions that resulted from cases that acquired from school

2049

cases examined



267 (13.0%)

likely or possibly acquired from school among confirmed clusters
(333 suspect unable to rule out in-school acquisition)



179 (67.0%) led to no household or community transmission

88 (33.0%) led to household and/or community transmission

- Any household: N = 86 (32.2%)
- Any community: N = 8 (3.0%)

Summary of the number of household/ community transmissions that resulted from cases that acquired from school – FHA overall

Household transmission

Household transmission (N)	School-acquired case (N)	School-acquired case (%)
0	181	67.8%
1	43	16.1%
2	25	9.4%
3	12	4.5%
4	3	1.1%
5	3	1.1%
Grand Total	267	100.0%

Household transmission events per school-acquired case:

Mean: 0.58

Median: 0

Community transmission

Community transmission (N)	School-acquired case (N)	School-acquired case (%)
0	259	97.0%
1	8	3.0%
Grand Total	267	100.0%

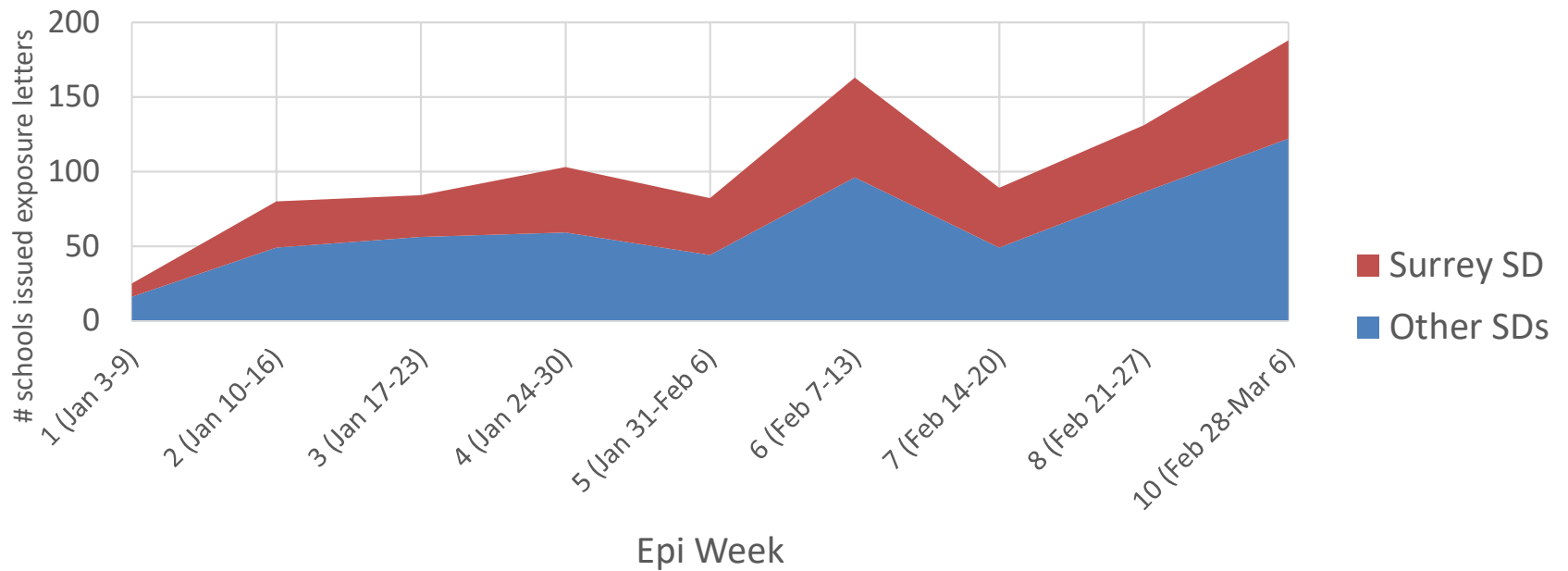
Community transmission events per school-acquired case:

Mean: 0.03

Median: 0

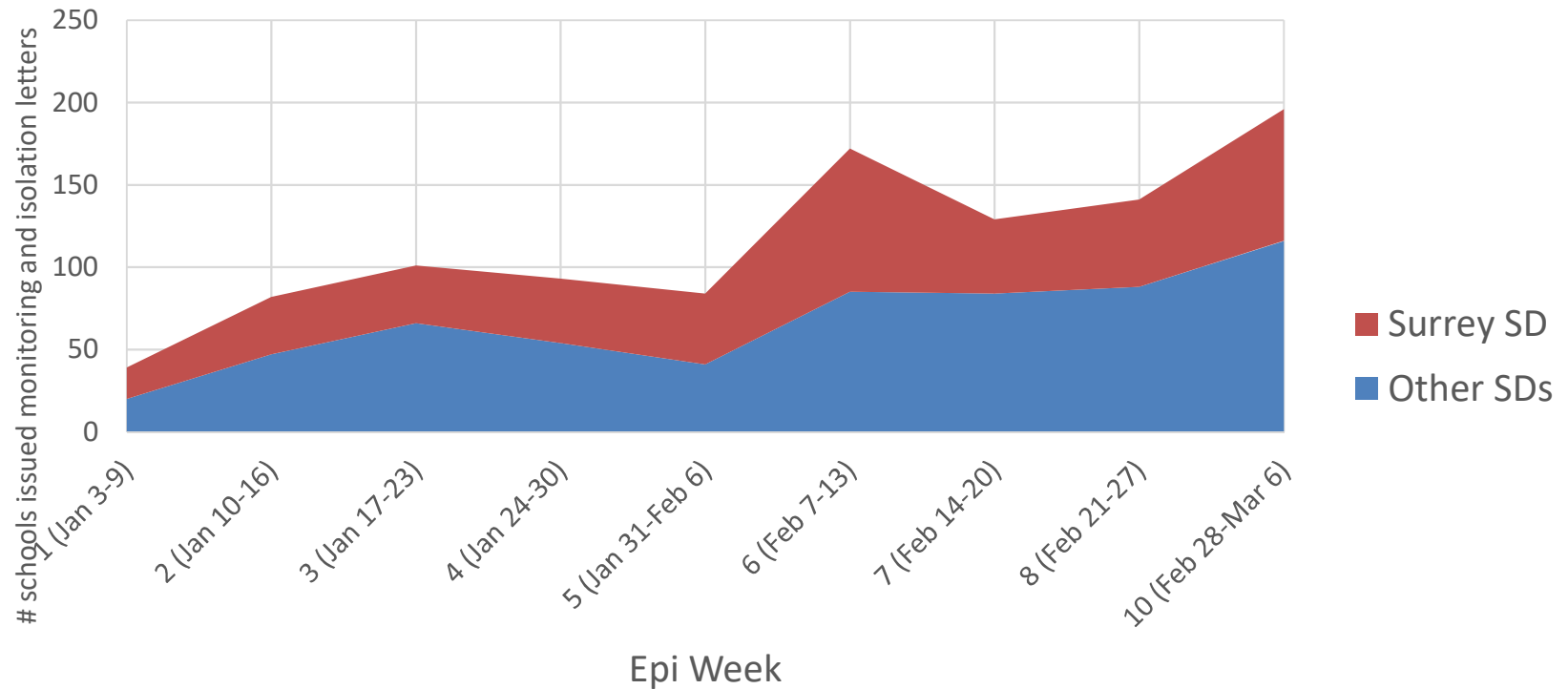
Burden of exposure notifications and isolation orders over time that are issued by FH

Weekly school exposure notifications issued by FH



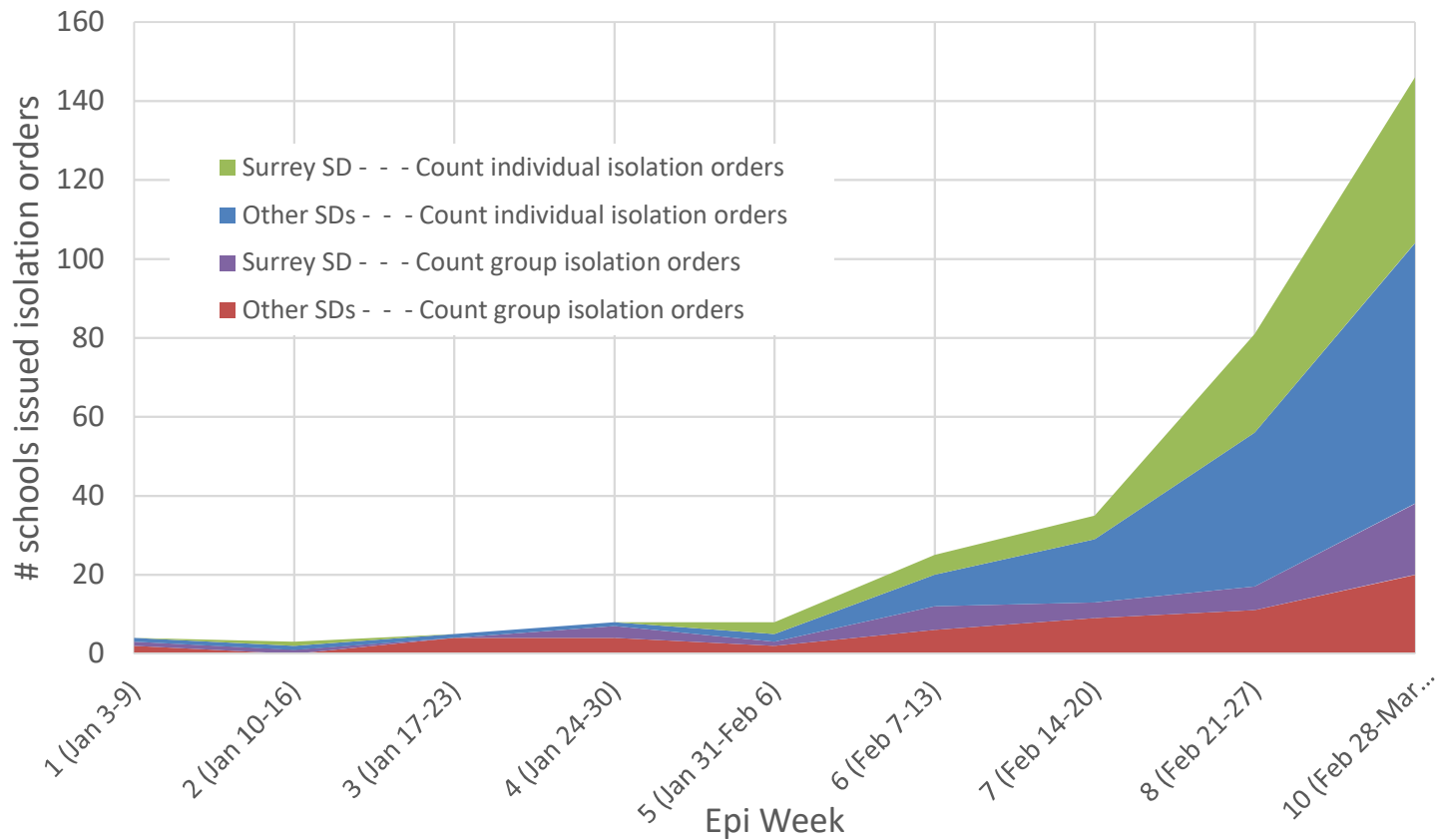
Burden of exposure notifications and isolation orders over time that are issued by FH

Weekly monitoring and isolation recommendations issued by FH



Burden of exposure notifications and isolation orders over time that are issued by FH

Isolation recommendations issued by FH



Key Findings (1)

- A total of 2049 school-associated cases were reported
 - This represents 0.65% of the total estimated staff and school population in Fraser region (approximately 315,000 staff and students)
- 19.6% were associated with a confirmed cluster or outbreak
 - 115 confirmed clusters in 96 schools involving 347 cases, with cluster size tending to be limited to 2 cases
 - 1 outbreak in one school involving 54 cases
 - There are approximately 640 K-12 schools in the Fraser region

Key Findings (2)

- 72.8% of clusters were attributed to introduction of COVID into schools by students
 - This was expected as students proportionately make up the majority of the school population
 - Staff are known to be involved in 42.4% of transmission events
 - Approximately 8% of in school transmission in confirmed clusters were associated with VOC cases
- Of the 267 cases (13% of all school-associated cases) who were likely/possibly acquired from school, 88 (4.3% of all school-associated cases) led to household/community transmission, and mostly within the household
 - Put another way, 87% of school-associated cases were acquired in the household/community

Limitations

- Study period reflects only the early stages of COVID-19 variant introduction into and spread within Fraser region communities and therefore their impact is not fully assessed in this study.
- Suspect in-school acquisitions (333 cases) are pending whole genome sequencing to determine if school-acquired. Current results reflect possible/likely in-school acquisition.

Directionality of Known In-School Transmission Events within Confirmed Clusters: Surrey School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	25 (31.3%)	14 (7.5%)	39 (48.8%)
<i>Student-staff</i>	11 (13.8%)	1 (1.3%)	12 (15%)
<i>Staff-staff</i>	7 (8.75%)	1 (1.3%)	8 (10%)
<i>Staff-student</i>	17 (21.3%)	-	17 (21.3%)
<i>Unclear direction/ Transmission from unknown index</i>	4 (5%)	-	4 (5%)
Total	64 (80%)	16 (20%)	80 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Coquitlam School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	23 (50%)	-	23 (50%)
<i>Student-staff</i>	5 (10.9%)	-	5 (10.9%)
<i>Staff-staff</i>	3 (6.5%)	-	3 (6.5%)
<i>Staff-student</i>	13 (28.3%)	-	13 (28.3%)
<i>Unclear direction/ Transmission from unknown index</i>	2 (4.4%)	-	2 (4.4%)
Total	46 (100%)	-	46 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Abbotsford School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	23 (59.0%)	-	23 (59.0%)
<i>Student-staff</i>	3 (7.7%)	-	3 (7.7%)
<i>Staff-staff</i>	2 (5.1%)	-	2 (5.1%)
<i>Staff-student</i>	9 (23.1%)	-	9 (23.1%)
<i>Unclear direction/ Transmission from unknown index</i>	2 (5.1%)	-	2 (5.1%)
Total	39 (100%)	-	39 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Langley School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	10 (71.4%)	-	10 (71.4%)
<i>Student-staff</i>	-	-	-
<i>Staff-staff</i>	2 (14.3%)	-	2 (14.3%)
<i>Staff-student</i>	-	-	-
<i>Unclear direction/ Transmission from unknown index</i>	2 (14.3%)	-	2 (14.3%)
Total	14 (100%)	-	14 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Burnaby School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	10 (38.5%)	2 (7.7%)	12 (46.2%)
<i>Student-staff</i>	3 (11.5%)	-	3 (11.5%)
<i>Staff-staff</i>	4 (15.4%)	-	4 (15.4%)
<i>Staff-student</i>	7 (26.9%)	-	7 (26.9%)
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	24 (92.3%)	2 (7.7%)	26 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Chilliwack School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	5 (55.6%)	-	5 (55.6%)
<i>Student-staff</i>	1 (11.1%)	-	1 (11.1%)
<i>Staff-staff</i>	-	-	-
<i>Staff-student</i>	1 (11.1%)	-	1 (11.1%)
<i>Unclear direction/ Transmission from unknown index</i>	2 (22.2%)	-	2 (22.2%)
Total	9 (100%)	-	9 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Delta School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	6 (75%)	1 (12.5%)	7 (87.5%)
<i>Student-staff</i>	-	-	-
<i>Staff-staff</i>	1 (12.5%)	-	1 (12.5%)
<i>Staff-student</i>	-	-	-
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	7 (87.5%)	1 (12.5%)	8 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: New Westminster School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	2 (50%)	-	2 (50%)
<i>Student-staff</i>	1 (25%)	-	1 (25%)
<i>Staff-staff</i>	-	-	-
<i>Staff-student</i>	1 (25%)	-	1 (25%)
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	4 (100%)	-	4 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Maple Ridge – Pitt Meadows School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	2 (25%)	-	2 (25%)
<i>Student-staff</i>	1 (12.5%)	-	1 (12.5%)
<i>Staff-staff</i>	3 (37.5%)	-	3 (37.5%)
<i>Staff-student</i>	2 (25%)	-	2 (25%)
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	8 (100%)	-	8 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Mission School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	-	-	-
<i>Student-staff</i>	1 (50%)	-	1 (50%)
<i>Staff-staff</i>	-	-	-
<i>Staff-student</i>	1 (50%)	-	1 (50%)
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	2 (100%)	-	2 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries

Directionality of Known In-School Transmission Events within Confirmed Clusters: Fraser-Cascade School District only

Direction of transmission	Non-VoC cases	VoC cases ¹	Total
<i>Student-student</i>	2 (100%)	-	2 (100%)
<i>Student-staff</i>	-	-	-
<i>Staff-staff</i>	-	-	-
<i>Staff-student</i>	-	-	-
<i>Unclear direction/ Transmission from unknown index</i>	-	-	-
Total	2 (100%)	-	2 (100%)

¹ Refers to the VoC status of the recipient for each transmission event

*Note that VOC testing strategy in BC has evolved between January and March where it began as targeted testing of returning travellers and random background sampling to now include VOC screening of all COVID positive results processed at BCCDC.

- Includes public and independent schools within school district boundaries