BC PUBLIC HEALTH MICROBIOLOGY & REFERENCE LABORATORY

Vancouver, BC

LABORATORY TRENDS

April 16, 2014

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Bathing Beaches Testing

With the approaching summer season, beaches and other bodies of water will once again be under heavy recreational use. As part of the risk management strategies in British Columbia (BC), recreational water is routinely monitored for fecal contamination. This information is used to manage closures of beaches and other bodies of water used for recreation.

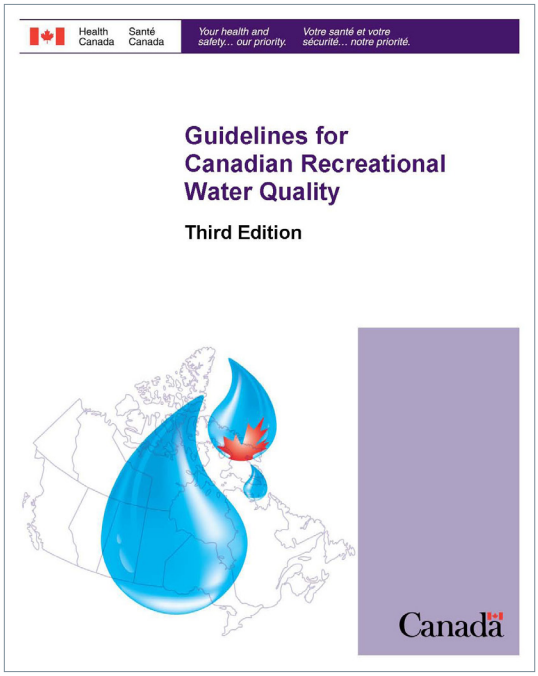
Until recently, the Fecal Coliform test has been the indicator based method for monitoring recreational water quality in BC. However, the 2012 update to the Guidelines for Canadian Recreational Water Quality by Health Canada removed the Fecal Coliform test and recommended use of *Escherichia coli* for freshwater and enterococci for marine water used for recreational purposes (1).

Guideline values for *E. coli* and enterococci have been developed based on the analysis of epidemiological evidence relating concentrations of these organisms to the incidence of swimming-associated gastrointestinal illness (1, 2, 3, 4, 5).

Both *E. coli* and enterococci satisfy the requirements of an ideal fecal contamination indicator for fresh water as they are found in high numbers in the feces of humans and warm-blooded animals (1).

Enterococci have greater resistance to environmental stresses (e.g. sunlight, salinity and chlorination) compared with other indicator organisms such as *E. coli* and fecal coliforms.

The Environmental Microbiology Program will be using *E. coli* to test freshwater samples and enterococci to test marine water samples for water quality. Please contact Brian Auk, Section Head (604-707-2608) should you have further questions related to this.



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Measles Virus Genotypes in BC, 2010 to Present

Measles is one of the most highly contagious infectious diseases. The virus is transmitted through airborne or direct contact with respiratory secretions of infected individuals. The incubation period is about 10 days with an average interval from exposure to the appearance of rash of about 14 days.

Measles is endemic in many developing countries where vaccine coverage is often low. However, sporadic outbreaks in countries with higher vaccination rates continue as a result of world-wide travel. Because of the ease of transmission, individuals who have either not been immunized, those who are non responders to vaccination or have received inadequate vaccination are at risk of infection.

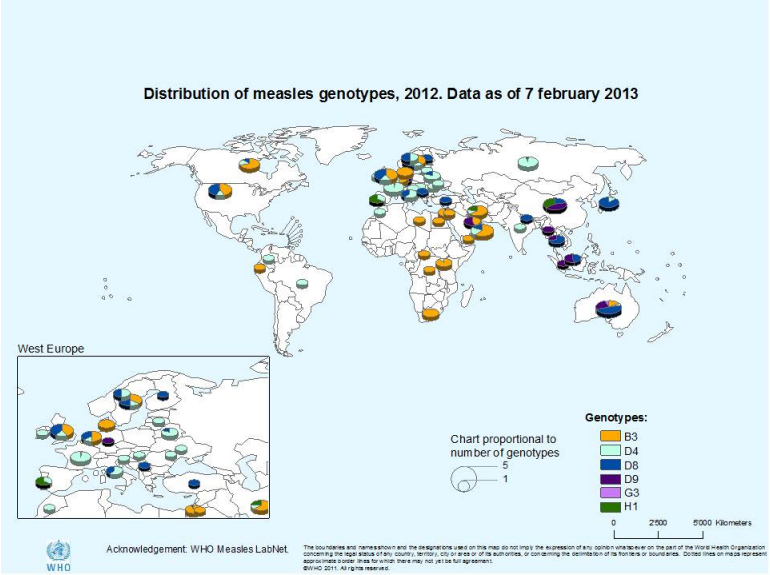

Figure 1
Map of the distribution of measles genotypes, 2012, WHO.

In the North American context those who are unimmunized and those born after 1970 are at greatest risk to acquire the disease especially if they have received only one MMR vaccination. Health care workers are at risk of being exposed to those infected and they create a risk to their co-workers and patients if they are inadequately vaccinated.

The World Health Organization (WHO) recognizes 8 clades of measles virus (A-H) with 23 genotypes based on the nucleotide sequences of their hemagglutinin (H) and nucleoprotein (N) genes: A, B1, B2, B3, C1, C2, D1, D2, D4, D5, D6, D7, D8, D9, D10, E, F, G1, G2, G3, H1 and H2. Genotype A is associated with all vaccine strains and is not associated with transmission. Global surveillance of measles strains revealed 6 circulating genotypes in 2012 (Figure 1). Genotype B3 is endemic in Africa but was also found in the Americas and parts of Europe. Genotypes D8 and D4 are consistently found in India and Nepal but these genotypes have also spread to many parts of the world. Genotype H1 circulates in China but was also found in Europe in 2012.

In BC, 4 measles genotypes have been detected in the past few years (Figure 2). In 2010, multiple importations during the Olympic Winter Games likely contributed to the largest measles outbreak in BC since 1997 at that time. Genotype D8, which was identical to the genotype detected in an outbreak in Berlin, likely originated in India, and genotype H1 likely originated from China. Multiple travel-related events in 2011 and 2013 were also due to genotype D8. Genotype B3 has been linked to travel to countries where this genotype has been circulating. Genotype D4 was linked to an outbreak in a ski resort community in 2011, although the source of introduction was unclear.

continued...

Measles Genotypes

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Thus aside from the 2010 outbreak, measles infections in BC have typically been driven by importation or introduction events with limited or no local transmission. The recent outbreak in Fraser Health Authority (larger than the 2010 outbreak) reveals what can happen in communities with low or no vaccination rates. Genotyping is ongoing but this outbreak can be attributed to genotype D8 so far, the same genotype that is circulating in the outbreak in similar communities in the Netherlands.

Molecular surveillance through genotypic analysis is therefore very useful for tracking the transmission of measles virus in areas of non-endemic spread. Genotypic surveillance can reveal the change of circulating genotypes over time as well can provide information on likely sources of acquisition when epidemiological data is unavailable.

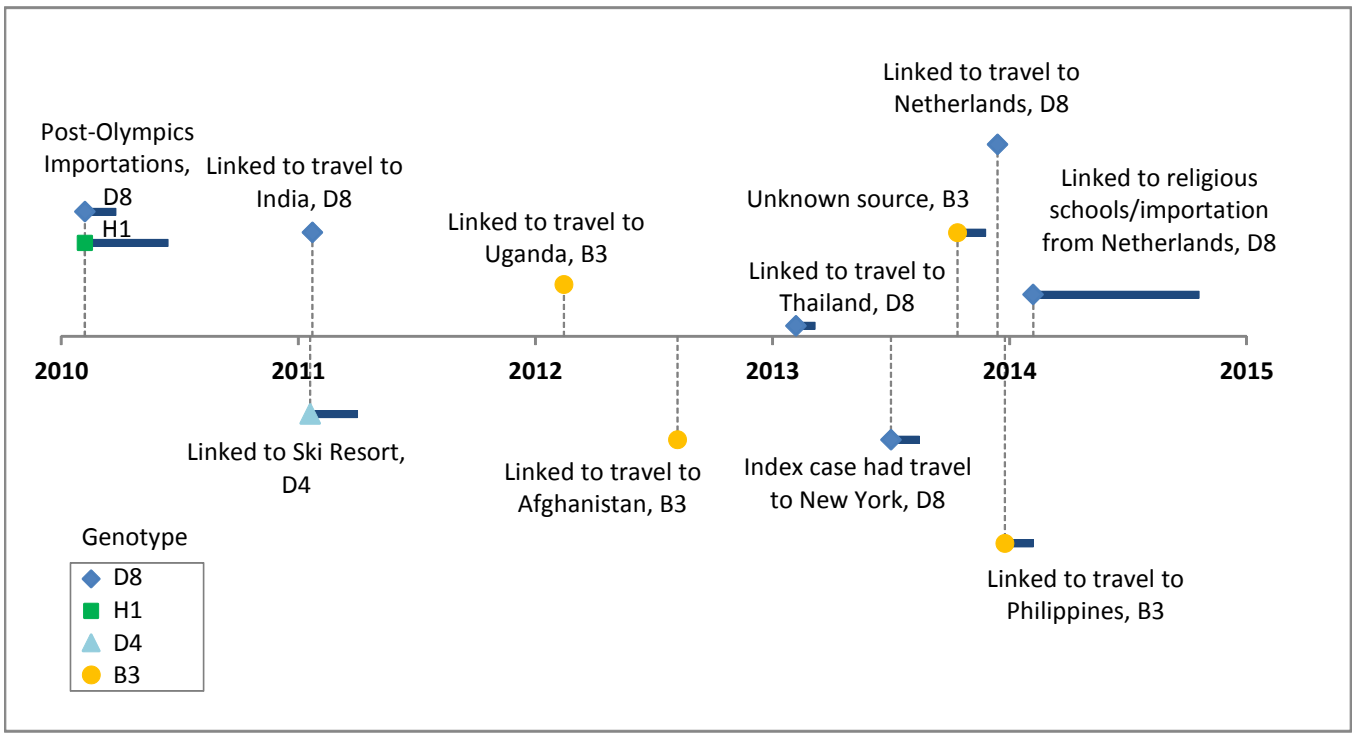

Figure 2
Genotypes associated with measles events in BC, 2010-present. Horizontal bars denote relative size of the event.

BC Carbapenemase-Producing Organism (CPO) Surveillance Program

Cases of carbapenemase-producing organisms (CPO) continue to be identified in BC, now mostly through enhanced admission screening, and detailed below. Currently, surveillance of CPO in BC is only through the laboratory network with BCPHMRL; there is a recognized need to link in clinical and epidemiological data. The Provincial Infection Control Network (PICNet), under the direction of the Ministry of Health, has struck a CPO Working Group led by Dr. Linda Hoang (BCPHMRL) and Dr. Guanghong Han (PICNet) to produce a BC CPO Surveillance Document by April 30, 2014 for implementation by acute care facilities in BC. As part of this Provincial CPO Surveillance program, we will be capturing clinical, laboratory as well as epidemiological data for this emerging pathogen to inform downstream Laboratory, Infection Control and Patient Care Practices.

The latest counts for cases of carbapenem-resistant Enterobacteriaceae (CRE) in BC can be found in Table 1 (updated from our December 2013 issue). To date, there have been 153 patients with carbapenem-resistant organisms: 90 harboured the New Delhi Metallo-β-lactamase-1-gene (NDM-1), 21 cases with OXA-48 carbapenemase and nine cases with the *Klebsiella pneumoniae* carbapenem (KPC) β-lactamase gene; some patients had multiple resistance factors including two patients with NDM-1 and OXA-48 carbapenemase, one other case with the KPC β-lactamase gene as well as a the Verona integron-encoded metallo-β-lactamase (VIM) gene and one case with NDM-1 and KPC genes. There have been 28 cases with *Serratia marcescens* enzyme (SME) resistance genes (Table 1).

Table 1
Carbapenem-resistant Enterobacteriaceae detected since 2010 until the end of March, 2014, Public Health Advanced Bacteriology & Mycology Program, BCPHMRL. Counts include one patient* with KPC and VIM in 2010, two patients^ with NDM-1 and OXA-48 in 2012 and one patient# with NDM-1 and KPC in 2013 (N=156).

	Collection Year						
Type	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
NDM-1	1	1	3	8	14^	50#	16
KPC			1*	1	1	6#	2
VIM			1*				
IMP							
OXA-48				1	9^	8	5
SME			1	4	8	13	2
Total	**1**	**1**	**6**	**14**	**32**	**77**	**25**

Tuberculosis Susceptibility Testing Trends

Antimicrobial susceptibility testing is critical in determining the most effective drug regiment for tuberculosis patients, especially in areas where the incidence of drug resistance is high. Repeat susceptibility testing is also important for detecting Mycobacterium tuberculosis that has acquired drug resistance during treatment in patients who do not completely respond to therapy. The TB/Mycobacteriology Program of the BC Public Health Microbiology & Reference Laboratory (BCPHMRL) performs *M. tuberculosis* complex (MTBC) drug susceptibility testing using the BACTEC® 960 fluorometric proportion method. Isolates are tested against critical concentration levels of first-line anti-tuberculosis drugs including isoniazid (INH, 0.1 µg/mL), rifampin (RMP, 1.0 µg/mL) and ethambutol (EMB, 5.0 µg/mL). Pyrazinamide (PZA) is not routinely performed unless isolates show resistance to isoniazid and/or rifampin or when requested. Streptomycin, a second-line anti-tuberculosis drug, is also part of this susceptibility panel.

Figure 3 demonstrates the resistance patterns of MTBC patient isolates from 2005 to 2013. From 2006 to 2011, mono-resistance has been on the rise from 5.8% in 2006 to 11.3% of isolates in 2011. Since then, the proportion of mono-resistance has decreased to 9.1% in 2012 and 8.5% in 2013. Poly-resistance has varied from 0% to 0.9% of isolates during this period. Multidrug resistance has decreased from a high of 2.0% in 2005 to levels below 1.2% of isolates between 2006-2012. In 2013, no isolates were seen to be poly- or multidrug resistant.

In the period of 2008-2011, the level of mono-resistance has been greater than that of the Canadian average as reported by the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS). In 2012, BC rates of mono-resistance fell below the Canadian average. Multidrug resistance rates in BC have either been consistent or below what CTBLSS reports for national rates from 2005-2013. For more information on national tuberculosis drug surveillance, please visit the Public Health Agency of Canada's website at: www.phac-aspc.gc.ca/tbpc-latb/pubs/tb-dr2012/index-eng.php.

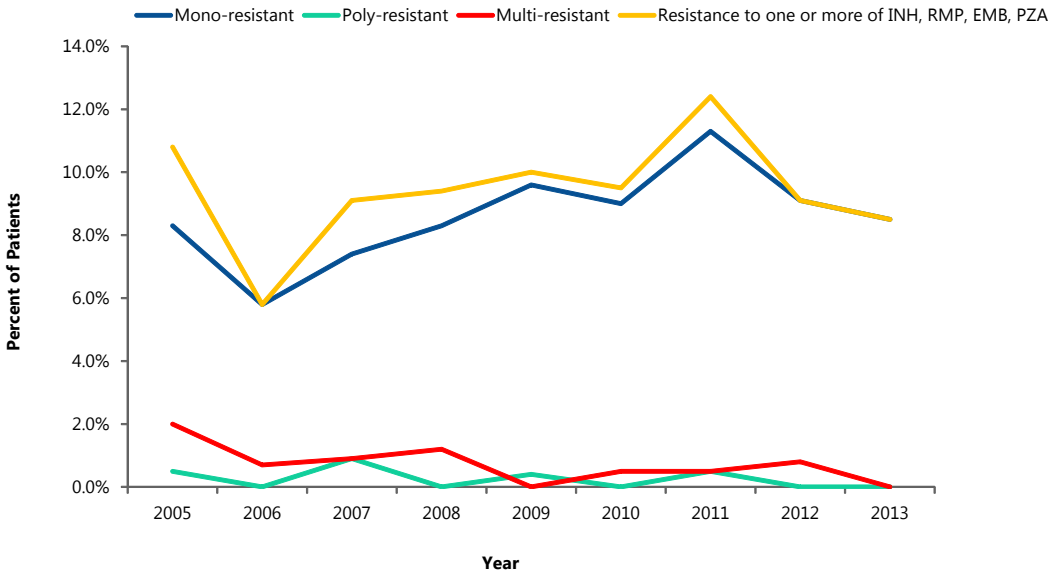

Figure 3
Percent of *M. tuberculosis* Complex patients that are mono-resistant, poly-resistant and multi-resistant to first-line TB drugs in British Columbia, 2005-2013. Resistance profiles are defined as: mono-resistance, resistance to one of the first-line drugs (INH, RMP, EMB or PZA); poly-resistance, resistance to two or more first-line drugs not including the combination of isoniazid and rifampin; and, multidrug-resistance (MDR-TB), resistance to at least the two best first-line anti-tuberculosis drugs, isoniazid and rifampin, but which does not meet the definition of extensively drug-resistant TB.

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Influenza Surveillance

Influenza testing volumes continued to decrease in March from 368 tests in the first week to 285 in the last week of the month. Influenza A rates decreased to 7-11% positivity. Influenza A(H1N1)pdm09 continued to be the dominant subtype constituting about 70-78% of all influenza A detected while influenza A(H3) made up the remaining subtype. Rates of influenza B detection increased from the previous month to 7-9% positivity over the weeks in March (Figure 4).

Nationally, rates of influenza A decreased in the month of March. BC had slightly higher influenza A detection rates in the first weeks of March compared to the other provinces with the exception of the Atlantic Province; influenza A detection rates then stablized to rates consistent with the rest of the country in the latter half of the month (Figure 5). Influenza B rates have steadily increased in all provinces over the weeks in March with BC having detection rates consistent with the other provinces from 3-17% positivity at the end of the month (Figure 6).

Figure 4
Respiratory testing volumes and influenza detection rates, Virology Program, BCPHMRL.

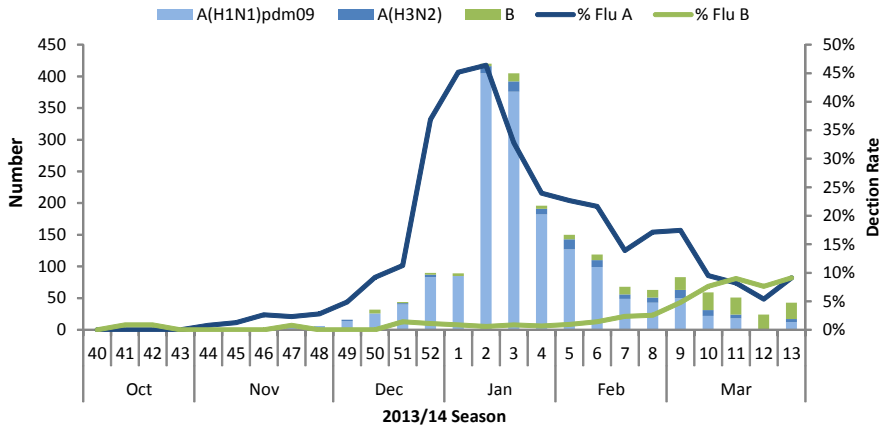


Figure 5
Influenza A detection rates across Canada, October 2013 to present. Data derived from FluWatch reports.

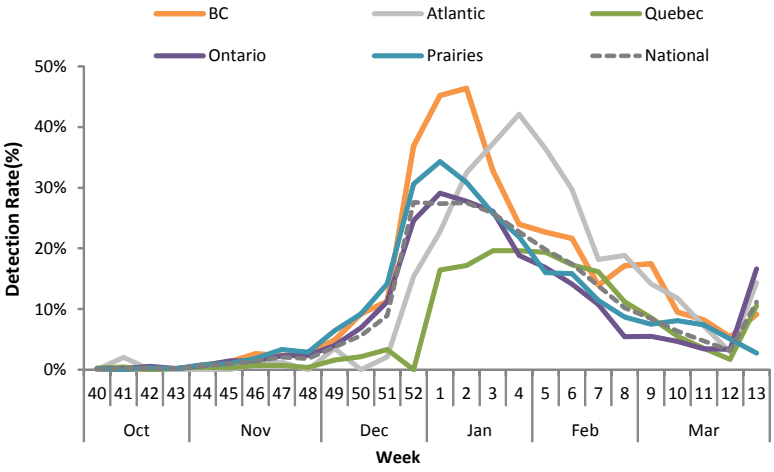
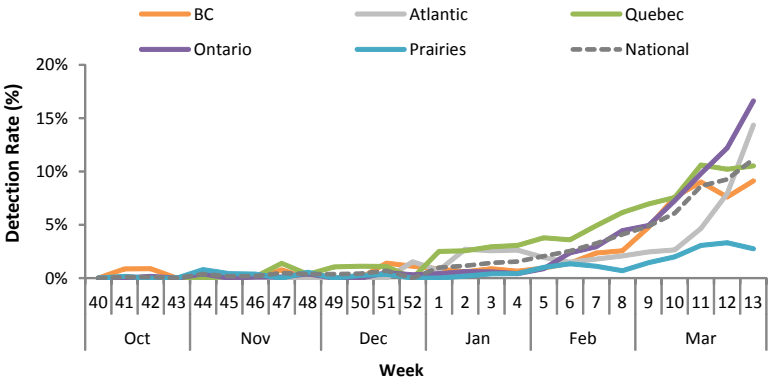


Figure 6
Influenza B detection rates across Canada, October 2013 to present. Data derived from FluWatch reports.



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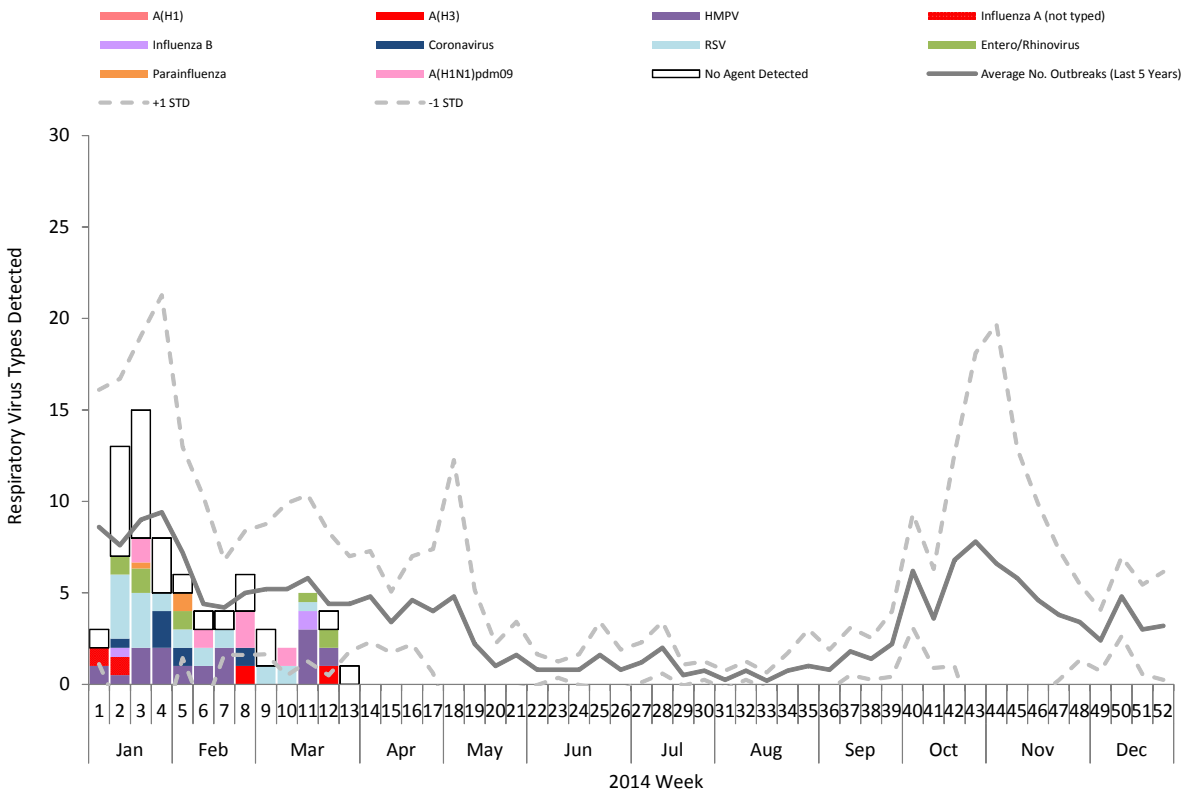
Respiratory Outbreaks

The number of respiratory outbreaks for the month of March were below the expected average levels early in the month based on previous years' investigations and then increased in weeks 11-12 (Figure 7). Samples were submitted to the BCPHMRL for 15 respiratory outbreak investigations from 13 (87%) longterm care facilities, 1 (7%) hospital and 1 (7%) community outbreak. From the longterm care facility outbreaks, human metapneumovirus (HMPV) was detected at 4 (31%) sites and respiratory syncytial virus (RSV) at 3 (23%) sites; influenza A(H1N1)pdm09, influenza A(H3) and entero/rhinovirus were each detected at three separate facilities. Influenza B was detected in samples from the community outbreak while HMPV was detected at the hospital outbreak.

Figure 7
Respiratory outbreaks investigated* in 2014, Virology Program, BCPHMRL.



* Figure 7 reflects respiratory sample results submitted for investigation to the BCPHMRL and may not be representative of respiratory outbreaks in the entire BC community.

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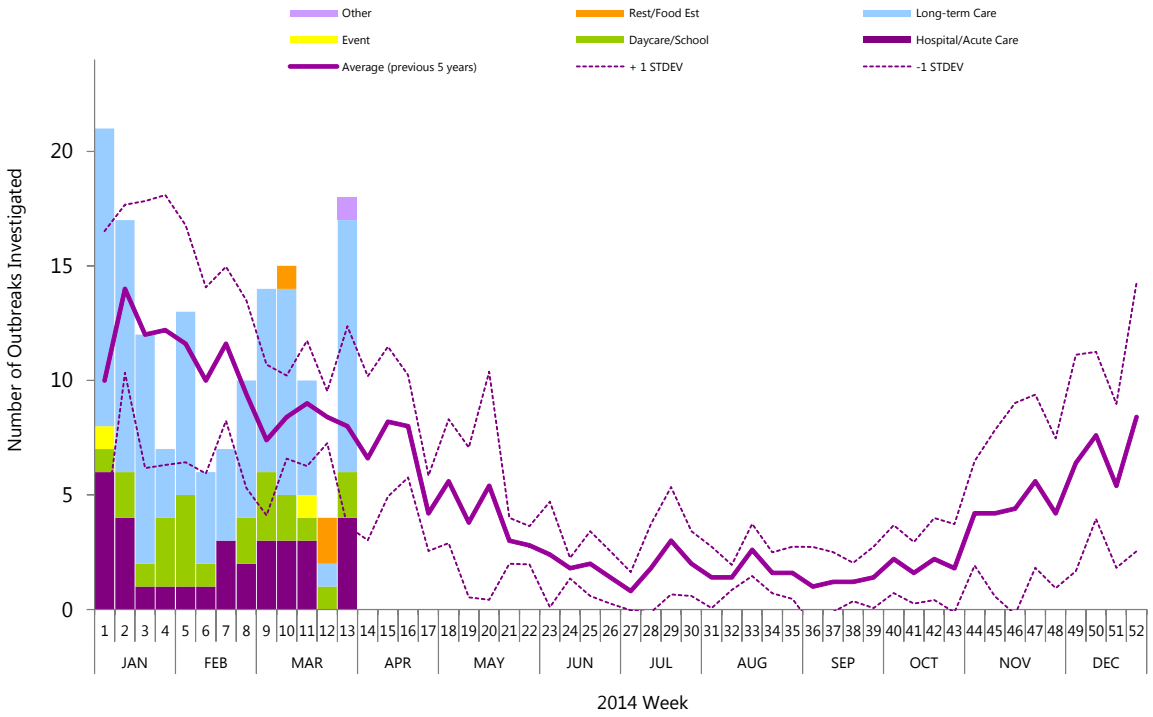
Gastrointestinal Outbreaks

In March, the BCPHMRL investigated 46 gastrointestinal (GI) outbreaks; a significant increase beyond the number of investigations performed in previous years (Figure 8). Outbreaks were identified from 25 (54%) longterm care facilities, 10 (22%) hospitals and 6 (13%) daycares/schools, 3 (7%) restaurants/food service establishments and 2 (4%) other event types. Samples for laboratory testing were submitted for 30 (65%) of these outbreaks with norovirus confirmed in 26 (87%) from 19 (73%) longterm care facilities and 7 (27%) hospitals. *Salmonella* Enteritidis was identified in 2 (7%) separate restaurants/food service establishments and sapovirus was also detected at another event.

Figure 8
Gastrointestinal outbreaks investigated* in 2014, Environmental Microbiology, Public Health Advanced Bacteriology & Mycology, Parasitology and Virology Programs, BCPHMRL.



* The data available are from outbreaks in which the BCPHMRL has been notified. Some acute care microbiology laboratories are also testing for norovirus in the province and these data may not include outbreaks from all Health Authorities. Given the nature of GI outbreaks, samples are not always available for testing.

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A Report of the BC Public Health Microbiology & Reference Laboratory, Vancouver, BC

The BC Public Health Microbiology Reference Laboratory (BCPHMRL) at the BCCDC site provides consultative, interpretative testing and analyses for clinical and environmental infectious diseases in partnership with other microbiology labs and public health workers across the province and nationally. The PHMRL is the provincial communicable disease detection, fingerprinting and molecular epidemiology centre providing advanced and specialized services along with international defined laboratory core functions province-wide.

This report may be freely distributed to your colleagues. If you would like more specific information or would like to include any figures for other reporting purposes, please contact us.

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