Cases, Clusters, and Catch-Up Campaigns: Measles, British Columbia 2019

BC Centre for Disease Control
Provincial Health Services Authority

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Background

- Measles is a highly infectious, but vaccine-preventable, viral illness (1).
- In 1998, measles was declared eliminated in Canada (2, 3).
- Occasional imported cases related to international travel continue to occur, and these can lead to secondary transmission and outbreaks (2-5).
- MMR series completion rates amongst seven year olds have declined in recent years.
- In 2019, an increase in the number of measles cases was observed globally, and several importations occurred to BC.
- An outbreak associated with school-age children led to a province-wide immunization catch-up campaign.

Objectives

1. Describe the 2019 measles cases in BC by sex, age, immunization status, and country of acquisition.
2. Summarize the associated clusters by duration, pattern of transmission, and measles genotype.
3. Describe the results of the MMR / MMRV immunization campaign within the context of declines in series completion.

Methods

Cases with onset in 2019 were classified according to the provincial measles case definition (6). Surveillance data were obtained from the provincial measles case report form (7). Data on vaccine doses administered and student immunization records were available from two immunization registries (PARIS for Vancouver Coastal, Panorama for all other health authorities).

Descriptive epidemiology was used to summarize cases and clusters. The measles immunization campaign was assessed using BCCDC data on vaccine distribution compared to the prior year. Measles vaccine coverage rates were calculated as the percentage of students with 0, 1, or 2+ doses documented or no measles-containing vaccine over the catch-up campaign period.

References

1. Bester JC. Measles and Measles Vaccination: A Review. JAMA Pediatrics. 2016;170(12):1209-15.
2. King A, Varughese P, De Serres G, Tipples GA, Waters J, Working Group on Measles E. Measles elimination in Canada. The Journal of Infectious Diseases. 2004;189 Suppl 1:S236-42.
3. Lam P, Williams L, Gadient S, Squires S, St-Laurent M. Maintaining measles elimination in Canada: Moving forward. Canada Communicable Disease Report. 2015;41(7):175-8.
4. Gardy JL, Naus M, Amlani A, Chung W, Kim H, Tan M, et al. Whole-Genome Sequencing of Measles Virus Genotypes H1 and D8 During Outbreaks of Infection Following the 2010 Olympic Winter Games Reveals Viral Transmission Routes. The Journal of Infectious Diseases. 2015;212(10):1574-8.
5. Naus M, Puddicombe D, Murti M, Fung C, Stam R, Loadman S, et al. Outbreak of measles in an unvaccinated population, British Columbia, 2014. Canada Communicable Disease Report. 2015;41(7):169-74.
6. British Columbia Centre for Disease Control. Measles. Case definition. 2019. Available from: http://www.bccdc.ca/health-professionals/clinical-resources/case-definitions/measles.
7. British Columbia Centre for Disease Control. Surveillance Forms: Vaccine Preventable & Respiratory. 2019. Available from: http://www.bccdc.ca/health-professionals/professional-resources/surveillance-forms.

Results

There were 31 confirmed cases of measles reported in BC in 2019 (Table 1). Fifteen cases were imported and had acquired measles while travelling outside Canada (Vietnam 6, Philippines 6, Other 3). Sixteen cases were locally acquired in BC.

The majority of reported cases were male (61.3%). Cases ranged in age from 7 months to 49 years with an average of 21.7 years. Most imported cases were over 40 years of age while most locally acquired cases were aged 10 to 19 years of age. Half (50%) of locally acquired cases were fully immunized for their age with documented vaccination records. Only 13% of imported cases were similarly documented as fully immunized; however, this may be an artifact associated with age of cases, with adults generally less likely to have accessible immunization records.

Table 1. Confirmed measles case characteristics by location of disease acquisition

	Location of Disease Acquisition					
	Imported		Local		Total	
Case Characteristic	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**
Sex						
Female	5	(33.3)	7	(43.8)	12	(38.7)
Male	10	(66.7)	9	(56.3)	19	(61.3)
Age Group						
<1 year	1	(6.7)	1	(6.2)	2	(6.5)
1-9 years	1	(6.7)	1	(6.2)	2	(6.5)
10-19 years	3	(20.0)	7	(43.8)	10	(32.3)
20-29 years	4	(26.7)	5	(31.2)	9	(29.0)
30-39 years	1	(6.7)	1	(6.2)	2	(6.5)
40+ years	5	(33.3)	1	(6.2)	6	(19.4)
Immunization Status						
Fully immunized, documented	2	(13.3)	8	(50.0)	10	(32.3)
Fully immunized, undocumented	3	(20.0)	2	(12.5)	5	(16.1)
Partially immunized, documented	1	(6.7)	1	(6.2)	2	(6.5)
Partially immunized, undocumented	3	(20.0)	0	(0.0)	3	(9.7)
Unimmunized	6	(40.0)	5	(31.2)	11	(35.5)
Total	**15**	**(48.4)**	**16**	**(51.6)**	**31**	**(100.0)**

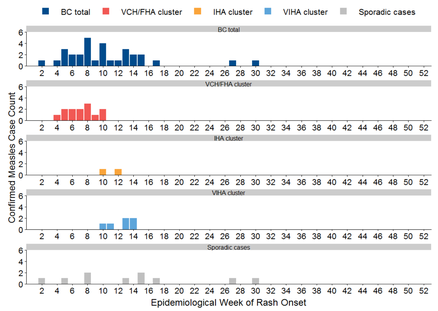

Figure 1. Confirmed measles case count by epidemiological week of rash onset for BC and by cluster, 2019

There were three clusters of measles cases in 2019 (Figure 1):

1. VCH/FHA cluster – A cluster of 13 measles cases occurred in the VCH and FHA regions, with cases having illness onset from January 21 to March 9. The cluster began with three co-primary cases returning to Vancouver following travel to Vietnam. Subsequently, there were three generations of transmission occurring in a school setting, a hospital, and amongst household contacts. Measles genotype D8 was associated with this cluster.
2. IHA cluster – IHA experienced one cluster of measles involving two cases. The first case, with illness onset of March 7, had exposure history compatible with acquisition in the United States and a known source of measles. A single secondary case with illness onset on March 19 occurred in a household contact. Measles genotype D8 was identified, albeit a different strain to the VCH/FHA cluster.
3. VIHA cluster – Six cases of measles were reported in the VIHA region with illness onset from March 20 to April 9. The two co-primary cases had travel history compatible with measles acquisition in Vietnam. Genotype D8 of the same strain as identified in the VCH/FHA cluster that also had origins in Vietnam was confirmed from one case. Four secondary cases were reported, none with recent travel. Both timing of onset and identification of the same D8 genotype in all four secondary cases were compatible with either acquisition from one of the earlier co-primary cases in VIHA despite lack of identified common settings of exposure, or from an unrecognized source.

Provincial MMR completion rates at age seven (documentation of 2 MMR doses) have declined from 90% in 2016 to 78% in 2019 (Figure 2). The decline coincides with the change in the MMR childhood immunization schedule in 2012, when the 2nd dose of MMR moved from 18 months to 4-6 years of age. Despite the decline in MMR series completion rates, the proportion of children who have received at least one dose of MMR has been stable.

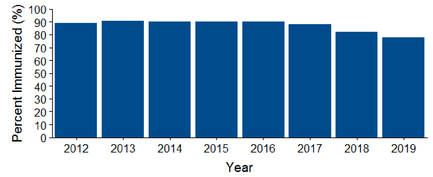

Figure 2. Percent of seven year olds with two documented doses of MMR by year, BC 2012-2019

A measles vaccine catch-up campaign was conducted in April through June. Over 25,000 MMR doses were administered to students, not including students in VCH, an increase by 14,000 over the same time period in the previous year. By the end of the campaign, the proportion of students with documentation of 2+ doses of MMR had increased by three percentage points to 82% (Figure 3). Likely the greatest contributor to this increase was submission of vaccination records by students for whom vaccine history was previously missing, as this group declined by two percentage points over the course of the campaign.

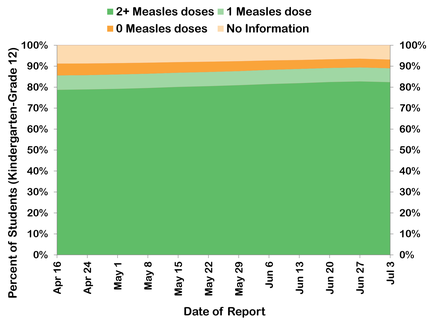

Figure 3. Measles immunization status of students by week of MMR immunization campaign, BC 2019

Conclusion

There were 31 confirmed cases of measles reported in 2019, the largest number of measles cases recorded since the Fraser Valley outbreak in 2014. Transmission was facilitated by attendance of measles cases at an elementary and high school.

There were three clusters of cases, the largest of which had 13 cases with three generations of transmission. All clusters began with an importation of measles following international travel, and measles genotype D8 was associated in each. Measles transmission was circumscribed overall, and BC maintained elimination of this disease as per Pan American Health Organization criteria.

The measles vaccine catch-up campaign was conducted over three months and resulted in a slight increase in the proportion of students who had documentation of 2+ doses of MMR vaccine received. The proportion of students with unknown measles immunization status in the public health immunization registries decreased by 2%.

Despite falling MMR vaccination series completion rates, multiple importations of measles during 2019, including within a school setting, did not result in large scale outbreaks.

Acknowledgements

We would like to acknowledge the Medical Health Officers and communicable disease teams at each of the health authorities, the BC Public Health Laboratory, and the National Microbiology Laboratory for their skilled investigative, diagnostic, and disease control efforts during the period of increased measles activity in 2019, and the immunization staff throughout the province in the delivery of and reporting of the results of the measles immunization campaign.

Immunization of Newcomer Populations:

Impact on Provincial Immunization Coverage Rates, Barriers around Immunizations, and Recommendations for Improvement

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Background

Childhood immunization rates are low in Manitoba (MB) and do not meet the National Immunization Coverage Goals. In the course of discussions with frontline workers for Manitoba's Childhood Immunization Mapping Project, it was identified that a potential factor influencing coverage rates is the newcomer populations in MB.

This project looked at what impact newcomer populations have on the provincial immunization coverage rates, what potential barriers affect this population around immunization, and identify recommendations to improve their coverage rates.

MB has the highest per capita rate of immigration in the country. In 2017, 14,700 permanent residents chose MB as their destination, which representing 5.1% of total immigration to Canada[1].

Based on MB's immunization coverage reports, those who have been in MB from birth are considered continuous residents while those who have not been in MB from birth are considered non-continuous residents; this includes those who were born in MB, moved away and then returned again to MB.

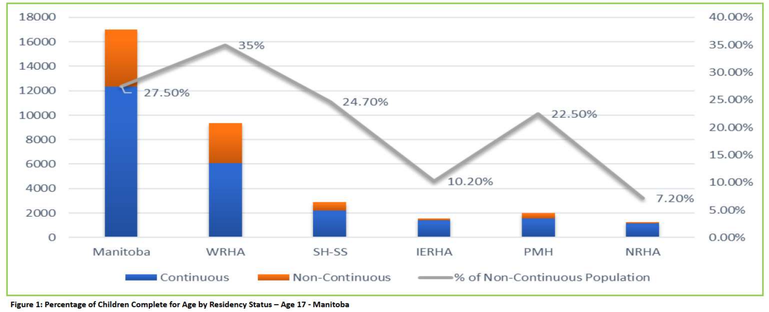

Figure 1: Percentage of Children Complete for Age by Residency Status – Age 17 - Manitoba

Methods

A project team was created consisting of various stakeholders who work with newcomer populations within the health sector. The team looked at the coverage data based on residency status (continuous vs non-continuous), a cohort analysis, the patient journey around seeking health services in MB, and frontlines experiences.

Surveys were conducted with newcomer populations, the regional health authorities, and other Canadian jurisdictions. A literature review was also conducted that looked at immunization coverage rates in newcomer populations, barriers to immunization in this population and any programs or policies to increase immunization coverage rates.

The immunization registry within the Public Health Information Management System (PHIMS) is interfaced to MB's Insured Benefits registry. This allows MB to have current population data and immunization coverage information for the entire population or broken down into residency status.

Data

When looking at the immunization coverage rates by residency status for age 17, the coverage rate for the continuous population is higher than the non-continuous population for all immunizations that are part of Manitoba`s Routine Immunization Schedule (Figure 2).

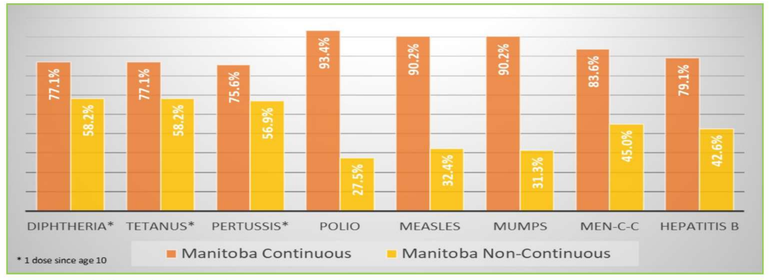

Figure 2: Percentage of Children Complete for Age by Residency Status – Age 17 - Manitoba

Data

In this seventeen-year-old cohort, Tetanus, diphtheria and pertussis vaccines have higher coverage rates in the non-continuous population than other vaccines. This could be due to being a combined vaccine, Tdap, offered as part of the school immunization program in grade 8 or 9. There would be a greater opportunity to have accessed the program come to them through the school and have the immunizations recorded into PHIMS.

The analysis of the regional differences (Figure 3) shows that the WRHA has the lowest coverage rates for this non-continuous cohort with the lowest being for polio at 13.6% (n=444). SH-SS had the highest rate for polio at 67.8% (n=484). Many of the rural RHAs conduct catch-up programs within the school immunization program which could contribute to the differences in the coverage for the other four health regions. It is unknown if WRHA was conducting catch-up activities for this cohort during the school immunization program.

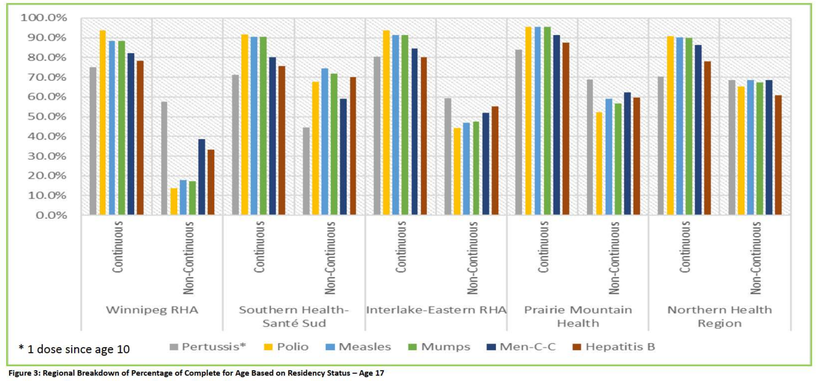

Figure 3: Regional Breakdown of Percentage of Complete for Age Based on Residency Status – Age 17

Another aspect analyzed was the contribution that the non-continuous population coverage has on MB's overall coverage rates (Figure 4). Looking at tetanus, the overall provincial coverage rate is 71.9%, of that 16% of that is from the non-continuous population. If 100% of this non-continuous cohort was immunized against tetanus, the overall coverage rate would increase to 83.4%.

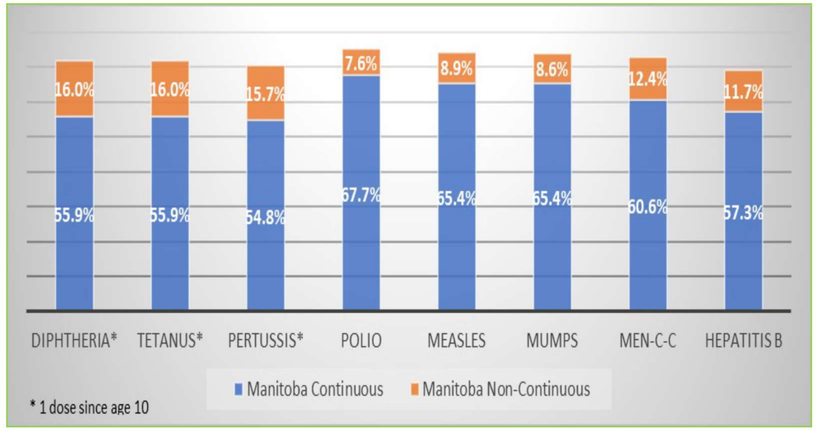

Figure 4: Contribution to Overall Population Coverage by Registry Status – Manitoba – Age 17

Cohort Analysis

A review was conducted of the 2008 birth cohort that were considered non-continuous residents (n=2,983). The analysis looked at date of registration for health services in MB and the presence of a measles vaccine either before or after registration. If dose received before registration, that meant the immunization records from their place of origin was entered into the registry by a public health office. The analysis showed:

- 26.6% (n=794) had a measles vaccine before registration in Manitoba
- 37.5% (n=1120) had a measles vaccine after registration
- 35.8% (n=1069) had no measles vaccine documented in the immunization registry

- 11.8% (n=352) were under the age of one when registered, 91.2% (n=321) of those have received a doses of measles vaccine.
- 42.2% (n=1258) were between 1 to 3 years of age when registered. 80% (n=1006) have received a dose of measles vaccine either before or after registration, 45.3% (n=456) of those received before registration.
- 46% (n=1373) were between 4 to 7 years of age when registered. 57.2% (n=786) do not have any recorded measles vaccine in the registry.

Results

Immunization rates for all Manitobans are low compared to the national immunization coverage goals regardless of residency status. However, non-continuous children do have lower immunization rates than continuous children. A couple of the key points from this project based on the data, survey results with the newcomer populations and the cohort analysis showed:

- The older a child is at registration, the less likely they are to have all of their required immunizations in the registry;
- Newcomer populations from other countries are typically very accepting of immunizations; and
- Coverage rates may be higher than they appear as many newcomers have immunization records when they arrive in MB but there is no consistent process to collect and record them into the registry.

An objective of the project team was to identify barriers that could be causing the lower coverage rates in this vulnerable population and develop recommendations

Theme: Access to Health Services

Barrier identified	Recommendation
Differences in Provider Model between rural and urban health regions.	1. Create policies and provide oversight to the RHAs on immunization programs to create consistency between the health regions on immunization services offered.
Unaware of where to seek health services	2. Look at an insert to be included with the mail out of the health card to identify where to seek health care services in MB. Any information provided should include reference to the health services being free of charge. 3. Reduce delays in matching people to physicians through the Family Doctor Finder program.

Theme: Data Gaps

Barrier identified	Recommendation
Immunization records not added into the Immunization Registry.	4. Create a process for newcomers to MB to provide their immunization records along with their application forms at MHSAL registration services for entry into registry. 5. Once input, a copy of their MB immunization record should be sent to the resident. This record also identifies immunizations that may be missing as part of the MB's Immunization Schedule. 6. Create a process for HCPs to send immunization records for entry into registry, if none appear in system. 7. Make PHIMS accessible for providers to be able to add in historical records.

Theme: Information Knowledge Gaps

Barrier identified	Recommendation
Lack of Information for newcomer population	8. Look at opportunities to provide information on what immunization services are available to various stakeholders and organizations such as MANSO, Immigrate Manitoba, ENTRY program (Altered Minds) monthly health information sessions, Federal orientation sessions and immigrant settlement agencies. 9. Develop an immunization website and resources that can be provided to newcomer populations (via agencies or other organizations) and possible translated services. 10. Develop a process to communicate information to the agencies working with newcomer populations.
Lack of information for HCPs	11. Update MB's Not Previously Immunized Schedule online to include whom it applies to and when to use it. 12. Develop a tool for HCPs to provide principles around assessing immunizations for newcomer populations.

Acknowledgements

We would like to acknowledge the following for their contribution with this project:

- Dr. Richard Baydack, Director of the Communicable Disease Control at Manitoba Health, Seniors and Active Living.
- The Project Team:
  - Ellen Gilbert and Deborah Hewey from Manitoba Health, Seniors and Active Living
  - Jeanette Edwards, Executive of Shared Health Services
  - Gayleen Dimond and Justine Zidona, Public Health Nurses from Winnipeg Regional Health Authority
  - Kim Hiebert, Primary Care Nurse with BridgeCare Clinic
  - Nicole Jowett, Manitoba Association of Newcomer Serving Organizations (MANSO)
  - Roselyn Advincula, Immigrant Center Coordinator
  - Erika Frey, Ting Fang, Michelle Kirkbride, and Malou Josue, Neighborhood Immigrant Settlement Workers

1. Manitoba's Clinical and Preventative Services Plan. https://sharedhealthmb.ca/wp-content/uploads/Final_PCPSP_Final-Report_2019Nov-28.pdf; November 29, 2019; 33

Manitoba Childhood Immunization Rates Mapping Project

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Dr. Joy Wei[1], Dr. Tim Hilderman[1], Kellie Navitka[1], Dr. Richard Baydack[1]

BACKGROUND:

In Manitoba, for a variety of reasons, childhood immunization rates at the provincial and regional level disguise local level variations and lead to some degree of the impression that things are not so bad. We also know that while in general people are immunized in Manitoba, there are pockets where there are high rates of under and unimmunized children. This is where we could see outbreaks of measles and other vaccine preventable diseases potentially occurring.

Moreover, national and provincial/territorial coverage surveys or data reports are not designed to accurately reflect "pockets" of unimmunized or under-immunized individuals at the provincial, regional or local level (Figure 1). The information is therefore of limited utility in identifying areas of need and for appropriately targeting resources.[2]

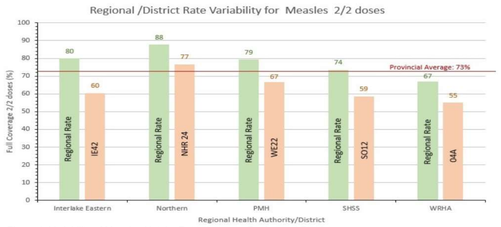


Figure 1. Variability of Measles Uptake Rates between Region and Districts

The Manitoba Childhood Immunization Rates Mapping Project mapped immunization coverage rates for pertussis, human papillomavirus (HPV), measles, and rotavirus at select ages by geographic district in the five Manitoba health regions. This also allowed:

- Assessment of immunization rates in four different age groups, based on Manitoba's Routine Immunization Schedule for these vaccines.
- Assessment of two recent changes to Manitoba's publicly funded immunization program- the addition of rotavirus vaccine in 2014, and HPV vaccine for boys September 2016.

OVERALL GOAL:

To tailor local intervention strategies to increase vaccine uptake among individuals living in unimmunized and under-immunized areas of Manitoba.

METHODS:

The approach used was to present immunization coverage data in a different way and to use this data to initiate dialogue with providers who have an understanding of the local population, to challenge providers to rethink their approaches of immunizing their populations, and put the focus on the children who are NOT fully immunized.

Using ArcGIS and data from Manitoba's immunization registry, maps were created (Figure 2) that could be used for the identification of areas with unimmunized and under immunized children at selected ages for the 4 antigens in 5 RHAs.

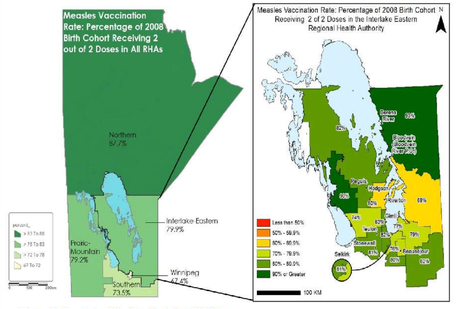


Figure 2. Example of the Provincial ArcGIS Maps

Artificial geographical areas known as Districts for the rural Health Regions or Neighborhood Clusters (NCs) in the Winnipeg Health Region were used.

* Note: Community names on data maps are geographical markers and not related to the district immunization rates.

APPROACH: Interventions

Manitoba Health, Seniors and Active Living (MHSAL) hosted Knowledge Exchange Forums in each health region with a various types of health care providers and managers in order to broadly share the data maps and analysis, identify the district specific causes of low vaccine uptake, and brainstorm potential local intervention strategies to increase immunization coverage rates in these areas.

Through the Knowledge Exchange Forums, various local level factors affecting immunization rates in specific districts were identified and several potential intervention ideas to address these were generated. Using an Intervention/Barrier Matrix, each region and MHSAL selected three to four interventions that were developed, tailored and implemented. The implementation of the interventions continues and evaluation is underway as part of the final phase of the project.

The project has also generated collaborations, pilot projects, and interventions with other service delivery organizations, MHSAL branches and provincial departments.

Table 1: MHSAL Interventions

MHSAL Interventions	Customized Consents Pilot	Rotavirus Vaccine Ordering Review	School Immunization Program Letter	Vaccine Hesitancy Cascade tool	Newcomer Immunization Record collection process project	CCMB Collaboration- Target HPV immunization rates

Table 2: Selected Regional /District Interventions

Region 1 Interventions	Publication of GIS Map and article on WRHA measles coverage rates.	Enhanced Data Surveillance	Public consultation	
Region 2 Interventions	South Central District Focus-Outreach and interventions	Sub-Intervention: Medical clinic - adding child Immunization services	Sub-Intervention: Boundary Trails Health Center Childhood Immunization Rates KT	
Region 3 Interventions	Immunization Outreach	Increase HPV Vaccine uptake thru Teen Clinics	Targeted Intervention Thru A Health Equity Lens	
Region 4 Interventions	Walk-in alternative clinics. (All antigens)	Parent Reminders. (HPV, RVV, Pertussis)	Education of parents and school personnel to improve HPV uptake. Education Dept (letter to parents) Presentation to school boards	Engaging Community Leaders. (All antigens)
Region 5 Interventions	18 month vaccine catch up program	Sending "no show" letters after each missed child immunization appointment	To review immunization records of prenatal and postpartum families.	Ensure 2 month old infants are attending appointment prior to 15 weeks for Rota vaccine.

Project evaluation will include quantitative and qualitative components. Analysis of a second set of data maps will look at the impact of interventions that have been implemented on immunization rates - a quantitative perspective. Evaluation will examine knowledge translation strategies used during the initial consultations, effectiveness of engaging stakeholders, understanding the current context processes used to develop, tailor and implement local intervention strategies. Project evaluation will also look at the successes and limitations of the project.

CONCLUSIONS:

The principles, tools/data maps, and methods used in the project were effective in communicating the under immunized communities to the health regions in Manitoba.

While the tools are effective, the process by which the data and tools were shared and conversations initiated to leverage local level knowledge and expertise to identify local level factors impacting rates and generate ideas for potential interventions was just as valuable (if not more so) as the tools.

MHSAL will look at the potential of scaling up and scaling out of interventions that demonstrated positive outcomes in the evaluation phase. (Figures 8,9)

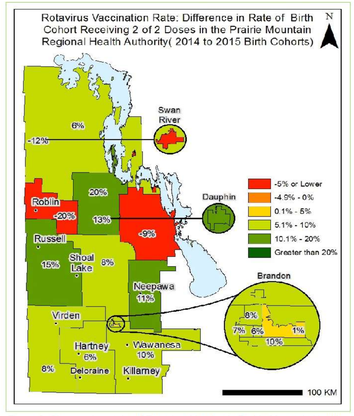


Figure 8: Changes in uptake of Rotavirus Vaccine in Prairie Mountain Health

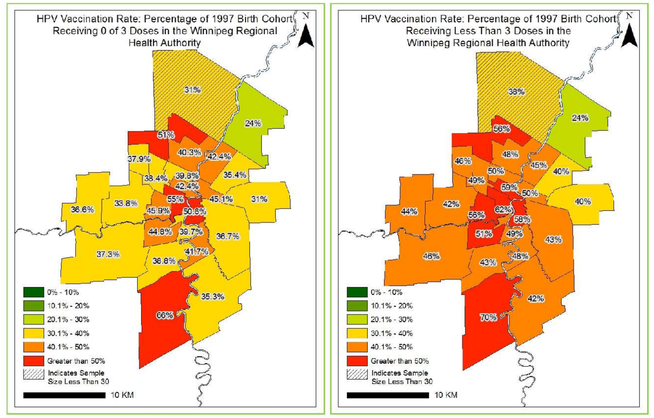


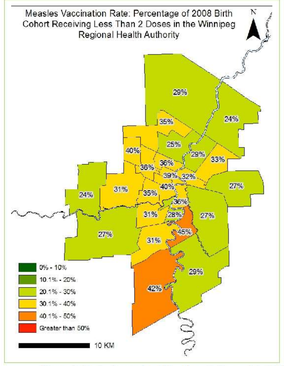
Figure 9: Unimmunized and Under immunized of HPV Vaccine in Winnipeg Health Region

The project data maps can serve as a base for comparing immunization rates in future years using data mapping to analyse year over year changes and express that analysis visually.

[1] Active Living, Population and Public Health Branch, Manitoba Health, Seniors and Active Living, Winnipeg, Manitoba, Canada;
[2] Report of the Vaccine Acceptance and Uptake Task Group

DATA MAPS

Evidence has shown that areas with lower vaccine uptake, which were not evident at the regional health authority level, could be identified by analyzing data at the geographic district (10,000 population unit) level. The following maps demonstrate how the ArcGIS data maps are useful visual tools to communicate the under immunized and unimmunized populations at the local geographic level. Immunization rates for Manitoba children at select ages for HPV, Measles, Pertussis and Rotavirus (Figures 3-7)



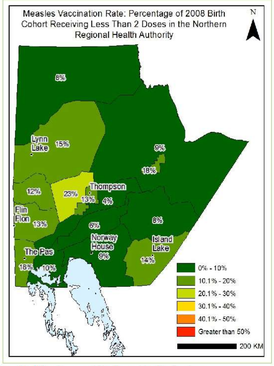


Figure 3: Under Immunized Measles <2 Doses Administered in Winnipeg and Northern Health Regions

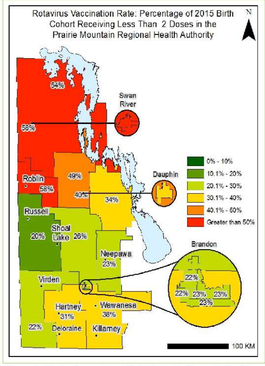


Figure 4: Under Immunized Rotavirus <2 Doses in Prairie Mountain Health Region

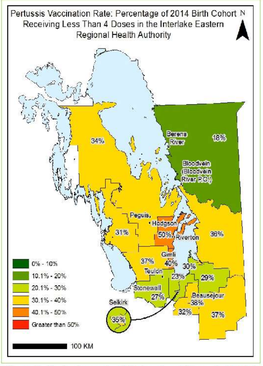


Figure 5: Under Immunized Pertussis <4 Doses in Interlake-Eastern Health Region

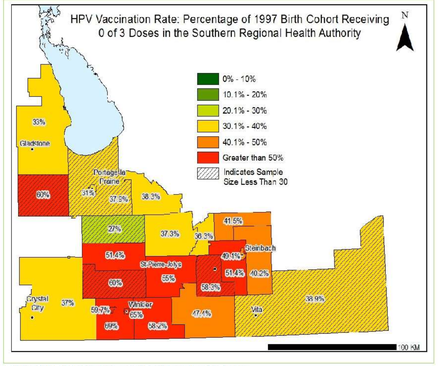


Figure 6: HPV Unimmunized in Southern Health Region

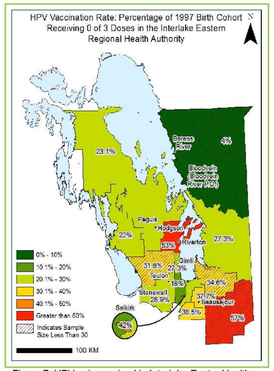


Figure 7: HPV unimmunized in Interlake-Easter Health Region

The Quadrivalent HPV Vaccine Evaluation Study (QUEST): interim analysis and future perspective

R. Donken, M. Sadarangani, K. Marty, D. Cook, S. Dobson, J. Mark, J. Bettinger, S. Liu, J. Singer, M. Naus, D. Scheifele, V. Gilca[8] C. Sauvageau[8], M. Mayrand, A. Albert, E. McClymont, D. Money, M. Krajden, G. Ogilvie

Introduction

- Based on non-inferior immunogenicity compared to 3D in adult women, a 2D schedule <15 years of age was licensed.
- Aim: To monitor the long-term effectiveness of 2D compared to 3D of the quadrivalent HPV (QHPV) vaccine against persistent HPV infections.

Methods

Figure 1. QUEST study

- Eligibility: Girls vaccinated with QHPV who have received 2D or 3D

Figure 2. Study procedures

- Interim analyses:
  - Logistic regression to compare the characteristics of participants with 2D and 3D at inclusion.
  - Immunogenicity after 2D or 3D of QHPV vaccine up to 10 years post first dose by competitive Luminex Immunoassay.

Results

- **5861** girls were enrolled in the study.
- Compared to 3D, 2D participants were younger. After adjustment for age, 2D participants were more likely to be born in Canada (OR 1.49, 95%CI 1.20-1.85) or having a First Nations background (OR 1.43, 95%CI 1.09-1.87).

Table 1. Sexual health behaviors*

	2 💉 *1580 (40.6%)*	3 💉 *2309 (59.4%)*	OR adjusted for age(+95%CI)
Had menarche (n=3798)			
Yes	1516 (98.2%)	2227 (98.8%)	1.13 (0.65-1.96)
No	27 (1.8%)	28 (1.2%)	
Ever had sex (n=3820)			
Yes	291 (18.7%)	623 (27.6%)	0.87 (0.73-1.03)
No	1269 (81.4%)	1637 (72.4%)	
Ever had sexual intercourse (n=908)			
Yes	276 (96.2%)	60 (97.8%)	0.61 (0.27-1.41)
No	11 (3.8%)	14 (2.3%)	
Sexual debut <15 years of age			
Yes	90 (33.1%)	142 (23.9%)	1.22 (0.88-1.70)
No	182 (66.9%)	453 (76.1%)	
Condom use during last sexual intercourse (n=545)			
Yes	171 (64.8%)	374 (63.8%)	0.92 (0.67-1.26)
No	93 (35.2%)	212 (36.2%)	
Ever had an STI (n=3862)			
Yes	3 (0.2%)	16 (0.7%)	0.34 (0.10-1.21)
No	1567 (99.8%)	2276 (99.3%)	
Ever had a PAP smear (n=3785)			
Yes	26 (1.7%)	71 (3.2%)	0.90 (0.56-1.45)
No	1513 (98.3%)	2175 (96.8%)	

- GMTs after 2D were non-inferior to after 3D, except for HPV18.

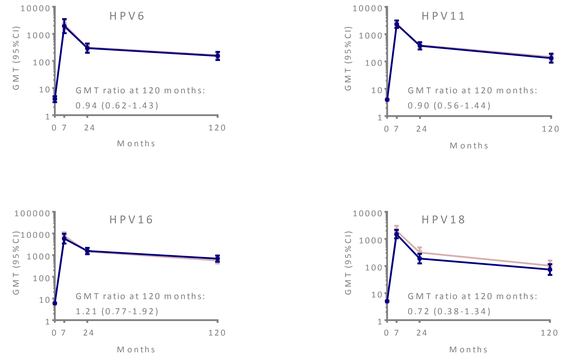


Figure 3. GMTs up to 10 years post-vaccination

- An increase in antibody titres (>assay variability) was seen among 17/73 participants (23%).

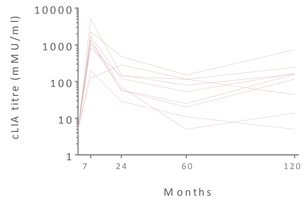


Figure 4. Participants with HPV18 boosting event

Conclusion

- Characteristics of 2D and 3D participants seem comparable.
- Study demonstrates long-term immunogenicity of the 2D QHPV vaccine schedule.
- The final results of QUEST can be expected in 2023.

QUEST Quadrivalent HPV Vaccine Evaluation Study
Global Control of HPV Related Diseases and Cancer
Vaccine Evaluation Center
CIRN
UBC THE UNIVERSITY OF BRITISH COLUMBIA

Evaluation of an Immunization Communication Tool for Health Care Providers

BC Centre for Disease Control
Provincial Health Services Authority

Chilton, K., Haines, C., Roy, N., The Professional Education Working Group

Introduction

Vaccine hesitancy has been defined by the World Health Organization (WHO) as "the reluctance or refusal to vaccinate despite the availability of vaccines" and has been identified as one of the top ten threats to global health in 2019 by the WHO[1]. Although vaccinations are one of the most successful health interventions that have contributed significantly to the decline in morbidity and mortality globally, concerns about vaccines are on the rise. Vaccine hesitancy has been linked to the decline in vaccine coverage globally and has contributed to recent measles outbreaks which the WHO has reported there has been a 30% increase in cases worldwide. Although all measles cases are not due to vaccine hesitancy, there has been a resurgence of measles in countries that were close to eliminating the disease. Unfortunately, due to this recent resurgence of measles, four European countries lost their measles eradication status in 2019.

The WHO's Strategic Advisory Group of Experts on Immunization (SAGE) stated that the reasons for choosing not to vaccinate are complex and identified complacency, inconvenience in accessing vaccines, and lack of confidence as key reasons underlying hesitancy[2]. According to the WHO, "Health workers, especially those in communities, remain the most trusted advisor and influencer of vaccination decisions, and they must be supported to provide trusted, credible information on vaccines". Research has shown that the recommendation to vaccinate by a health care provider is an important step in moving clients from vaccine hesitancy to vaccine acceptance.

In British Columbia (BC), the Immunization Communication Tool for Immunizers (ICT) is available to support health care providers (HCPs) address common immunization questions and concerns from the public. The ICT was first developed in 2008 by the Professional Education Working Group (PEWG) and was last updated in 2014. Since the update, more literature has become available that emphasizes *how* HCPs communicate about vaccines can significantly impact an individual's decision to vaccinate.

With the aim of better supporting HCPs in BC with a current evidence-based resource on effective immunization communication, the PEWG developed and distributed a survey to gain a greater understanding of the HCPs needs.

Objectives

The objectives of the Immunization Communication Tool for Immunizers survey were to:

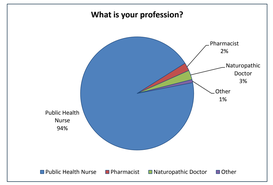
1) Determine the needs of HCPs in addressing vaccine hesitancy.
2) Obtain feedback to assist the improvement of the current ICT.
3) Identify additional content to be included.

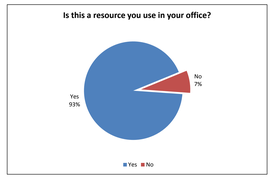
Methods

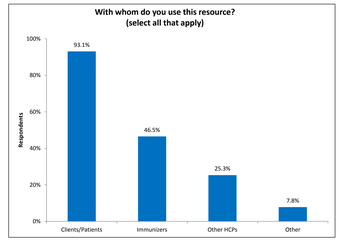
The ICT survey was conducted using RedCap®, an online survey tool. The survey was held from July 26 to September 13, 2019 (7 weeks). Participation in the online survey was voluntary, and 219 participants completed the survey. 6 of the participants failed to complete all of the questions in the survey. The online survey consisted of 11 questions, with a combination of open/closed-ended questions as well as questions using a Likert-type scale. Feedback was also sought on suggested improvements to the ICT. The survey was distributed though the Provincial CD Nurses group and through the PEWG members which include: public health nurses, physicians, medical health officers, nurse practitioners, pharmacists, naturopathic physicians and midwives.

Survey Results

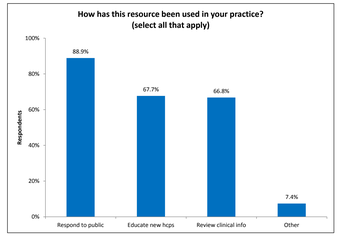
The survey findings supported the relevance of the ICT which was reinforced by 93% of the respondents reporting that the ICT is used in their practice. The survey findings also indicated the overall content in the ICT is good, however further comments emphasized the need for more current content. Comments from respondents suggested that updated research, current immunization guidelines, figures and more images/graphics would be helpful to support HCPs to address immunization questions and concerns from the public. Survey results also indicated that HCPs wanted content on how to address concerns and questions specifically related to HPV vaccine. Another theme which emerged from the survey was the need to provide an up-to-date communication framework to support immunizers in responding to questions from vaccine hesitant clients.







Other (7.8%):
- Self-learning
- Family and friends
- Students



Other (7.4%):
- Competency exam
- Resource for immunization certificate
- Educate high-school, nursing and medical students

References

1) Ten threats to global health, World Health Organization, available at https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019 (Accessed Feb. 25, 2020)
2) Improving vaccination demand and addressing hesitancy, World Health Organization, available at https://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/ (Accessed Feb. 26, 2020)
3) Dubé E, Bettinger JA, Fisher WA, Naus M, Mahmud SM, Hilderman T. Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches. Can Comm Dis Rep 2016;42(12):246-51. https://doi.org/10.14745/ccdr.v42i12a02
4) Scherer LD, Shaffer V, Patel N, Zikmund-Fisher BJ. Can the vaccine adverse event reporting system be used to increase vaccine acceptance and trust? Vaccine. 2016;34(21):2424–2429. doi:10.1016/j.vaccine.2016.03.087

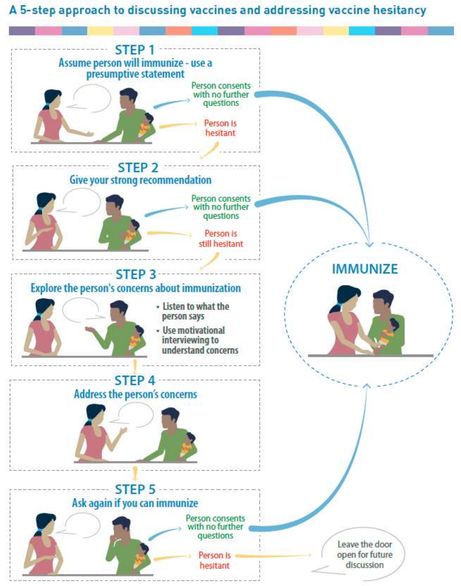
Acknowledgements

We would like to acknowledge the ICT project team and the BC Centre for Disease Control Communicable Diseases and Immunization Service. We would also like to acknowledge the Professional Education Working Group for their support with the ICT survey, review of the ICT content and the continued promotion of the working group's immunization resources.

Discussion

While most Canadian parents ensure their children receive all routine immunizations, a recent Canadian study showed 19% of parents consider themselves to be vaccine-hesitant[3]. Traditionally, it was thought that a person's reason for vaccine hesitancy was simply that they lacked the knowledge to make informed decisions about vaccines. However, it has been found that just providing facts is not enough and that this approach does not eliminate hesitancy and, in some cases, can actually generate hesitancy[4]. The updates to the ICT include a focus on key messages about current vaccine concerns. The updated ICT will include:

1. Evidenced-based strategies to address vaccine hesitancy.
2. An updated immunization communication framework.
3. A brief introduction to Motivational Interviewing with examples of how this approach can be applied.



Conclusion

Vaccine hesitancy continues to be an ongoing threat to global health. The importance of effective immunization communication by a HCP is crucial in supporting individuals who are vaccine hesitant to move to vaccine acceptance. All immunization providers should be fully supported with easily accessible up-to-date resources to be able to provide their clients with clear evidence-based information about vaccines. Promoting credible immunization communication resources to immunization providers continues to be an important step in addressing vaccine hesitancy.

Assessment of Serious and 'Other' Reports of Adverse Events Following Immunization in British Columbia

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BC Centre for Disease Control
An agency of the Provincial Health Services Authority

SFU SIMON FRASER UNIVERSITY

Background

❖ Adverse events following immunization (AEFI) are any untoward medical occurrences which follow immunization, but do not necessarily have a causal relationship with the usage of the vaccine[1].

❖ Post-marketing surveillance of AEFI is an important component of all immunization programs and is conducted at all levels of the public health system in Canada.

❖ Most adverse events are reported using categorical event codes which are grouped into four major categories. The information system used in BC since 2013 is based on the national surveillance system including event categories.

❖ This review focuses on the two categories:

- "Neurologic Event", and
- "Other Defined Events of Interest"

❖ Neurological events are typically most concerning for the public and health care professionals; 'other' events may include serious events and cannot be readily identified.

❖ Serious events are AEFI that are life threatening or result in death, require hospitalization, result in a residual disability, or are associated with congenital malformation[2].

Goals

❖ Use surveillance data to assess quality of reporting and make recommendations for surveillance improvement such as identification of new categorical event codes.

❖ Evaluate whether routine processes at regional levels include causality assessment and whether these can be strengthened using standardized tools and assessment results.

❖ Enhance BC's vaccine adverse event monitoring system to improve reporting of potentially serious events.

Methods

❖ Review the events reported in BC in the 'other' fields of both "Neurologic events" and "Other defined events of interest" categories, and assess their reportability. Consider whether these can be re-categorized using existing events codes, or if they warrant the creation of new event codes based on the frequency and seriousness of the events.

❖ Review select AEFI reports that meet seriousness criteria for causality assessment and categorize the public health recommendation(s) made (both categorical and text responses) to determine whether a conclusion about the causal relationship of the event to immunization or vaccine was made.

Methods (cont'd)

❖ Each AEFI report was examined to extract relevant information.

❖ Descriptive analysis of AEFI from five regional Health Authorities was conducted; these include Fraser (FHA), Interior (IHA), Vancouver Coastal (VCHA), Vancouver Island (VIHA) and Northern (NHA).

❖ Reports were reviewed to assess public health recommendations made and evidence of a determination of the causal relationship of the event to vaccine or immunization.

❖ Descriptive analysis was conducted with respect to age of immunization, health authority, and type of AEFI..

❖ Categorical recommendation check boxes as well as text comments were used to identify the public health recommendations in each report.

❖ All descriptive analyses were conducted using Microsoft® Excel 2010.

Conclusion

❖ The quality of reporting by BC health authorities was high, with appropriate use of 'other' when a corresponding categorical event code was not available in the surveillance system.

❖ The new categorical events in the 2019 version of the AEFI information system will result in an estimated 42% reduction in reporting of events as 'other' and associated text, based on AEFI reports received in 2017 and 2018.

❖ Opportunities exist for adoption of a standardized approach to causality assessment for serious events.

Acknowledgements

I would like to thank Dr. Naus for always taking the time to guide me throughout the practicum. I would also like to thank Chelsea Treloar, the lead epidemiologist, who spent countless hours helping me develop this project, along with the entire CDIS team at BCCDC. Lastly, I wish to express my gratitude to Dr. Malcolm Steinberg for his incredible support throughout the project.

References

1. WHO. (2014). Adverse events following immunization (AEFI). Retrieved from World Health Organization: https://www.who.int/vaccine_safety/initiative/detection/AEFI/en/
2. BCCDC. (2019). Communicable Disease Control Manual Chapter 2: Immunization Part 5 - Adverse Events Following Immunization.

Results

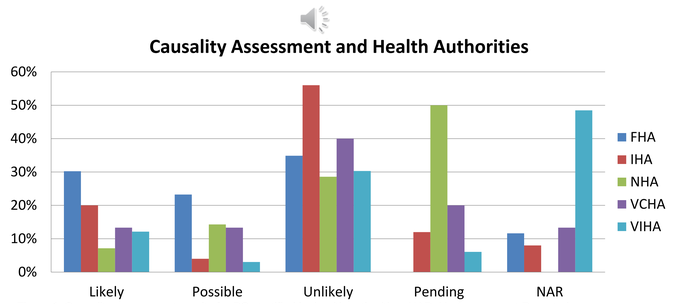

Figure 1: Causality assessment results for BC stratified by health authorities. NAR: No Assessment Reported.

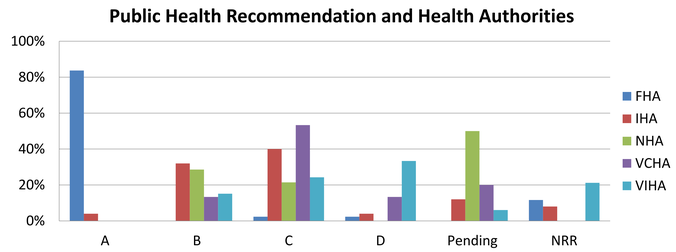

Figure 2: Public health recommendation quality in BC stratified by health authorities. (A) Gold standard; (B) Public health recommendation described in detail; (C) Minimal amount of information; (D) No information is given; (NRR) No Recommendation Reported.

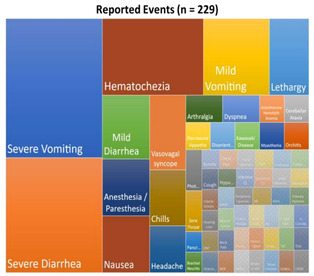

Figure 3: Frequency of reported 'other' AEFI classified into MEDRA codes (January 2017 – December 2018).

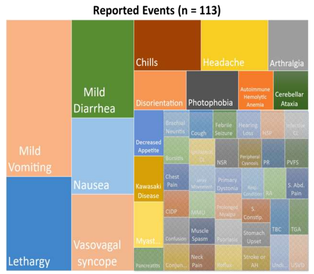

Figure 4: Frequency of the same reported 'other' AEFI once 61% of these events were classified into event codes available in Panorama 3.2.