Background

- Measles is a highly infectious, but vaccine-preventable, viral illness.
- In 1918, 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 (4-6).
- 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-aged 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 impact of the MMR 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 reports file and from student immunizations 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 administration compared to the prior year. Measles vaccine coverage rates were calculated as the percentage of students with 1, or 2 doses documented and no measles-containing vaccine over the catch-up campaign period.

Results

There were 31 confirmed cases of measles reported in 2019 in Table 1. Eighteen were imported and 13 were locally acquired.

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 26 to March 9. The cluster began with three primary cases returning to Vancouver following travel in 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. HVA cluster – Eighteen cases of measles involving two families. The first case, with illness onset of March 7, had exposure history compatible with acquisition in the United States and a known source of infection. A single secondary case with illness onset on March 19 occurred in a household contact. Measles genotype D8 was identified, what a slight difference to the VCH/FHA cluster.
3. VIHA cluster – Six cases of measles were reported in the VIHA region with three, sick from March 26 to April 2. Two of the three 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 origin in Vietnam was confirmed from one case. Four secondary cases were imported, and identified 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.

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 with all cases. Measles transmission was circumvented overall, and BC maintained elimination of the disease as per Pan American Health Organization (PAHO) criteria (3). The measles vaccine catch-up campaign was conducted over three months and resulted in a slight increase in the proportion of students who had documented 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.

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We would like to acknowledge the Medical Health Officers and communicable disease teams at each of the health authorities, the BC Centre for Disease Control’s communicable disease teams and epidemiologists, and the BC Centre for Disease Control’s communicable disease control teams who engaged in active investigation, diagnostic, and disease control efforts during the period of increased measles activity in 2019, and the immunization programs that contributed to the campaign 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 (93%) 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 barriers offset 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, 3.9% permanent residents chose MB as their destination, which represents 5.1% of total immigration to Canada.

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.

Data

In this seventeen-year-old cohort, ‘Continuous, dual-language and perinatal vaccine have higher coverage rates in the non-continuous populations than other vaccine.

This could be due to being a combined vaccine,@yahoo, as opposed to the school immunization program in grade 8 or 9. There would be a greater opportunity to have assessed the program come in to have their vaccine and have the immunizations recorded in the HIAP.

The analysis of the regional differences (figure 4) shows that the NMB has the lowest coverage rates for this non-continuous cohort with the lowest being for at 30.9% (9/294). 50.9% of the highest rates for polio at 93.0% (46/50). Some of the non-MB programs conduct catch-up programs within the school immunization program which could contribute to the differences in the coverage for the other African health regions. It is unknown if MB was conducting catch-up activities for this cohort during the school immunization program.

Another aspect analyzed was the contribution of the non-continuous population coverage has on MB’s overall coverage rates (figure 4). Scouting at vaccination, one can observe overall provincial coverage rate is 71.3% of that 40% of those have the non-continuous population. 100% of this non-continuous cohort was immunized against measles, so the overall coverage rate would increase to 81.4%

Coahlt Analysis

A review was conducted of the 2050 birth cohort that were considered non-continuous residents (n=2050). The analysis looked at dates of registration for Health services and the presence of a measles vaccine either before or after registration. If dates retrieved before registration, then we record the immunization rates from their place of entry into the registry by a public health office. The analysis showed:

- 26.6% (9/294) had a measles vaccine before registration in NMB.
- 37.5% (112/300) had a measles vaccine after registration.
- 42.6% (42/99) had a measles vaccine documented in the immunization registry

11.0% (107/972) were under the age of one when registered, 91.4% (293/320) of those have received a dose of measles vaccine. 42.2% (24/57) were between 1 to 3 years of age when registered. 60.9% (98/161) have received a dose of measles vaccine before after registration. 37.5% (112/300) of those received before registration.

- 69% (213/300) were between 1 to 7 years of age when registered. 57.2% (70/123) do not have any recorded measles vaccine in the registry.

Methods

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

The project team was made up of newcomers, the regional health authorities, and other Canadian practitioners. A literature review was also conducted that looked at immigration 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 Immunization Information System (HIAP) is focused on 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

By analyzing 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 Basic Immunization Schedule (Figure 1).

Theme: Access to Health Services

Barriers Identified

Recommendations

- Enhance access to health services
- Increase knowledge awareness
- Streamline measures and protocols

Theme: Data Gaps

Barriers Identified

Recommendations

- Address data that impedes timely decision-making
- Implement quality assurance

Theme: Information Knowledge Gaps

Barriers Identified

Recommendations

- Increase access to health services
- Address data that impedes timely decision-making

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

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- Janet McClenahan, Executive Director of Global Health Services.

- Nabil Ahmed, Nurse Manager at St. Boniface Health, Seniors and Active Living.

- Dr. Richard Botto, Director of the Community Research Centre at St. Boniface Health, Seniors and Active Living.
Manitoba Childhood Immunization Rates Mapping Project

**BACKGROUND:** In Manitoba, for a variety of reasons, childhood immunization rates of the provincial and regional level degrade local level variables and lead to some degree of the impression that things are not as bad. We also know that while in general people are immunized in Manitoba, there are pockets where there are higher rates of under and unimmunized children. This is where we see such outbreaks of measles and other vaccine-preventable diseases potentially occurring. Moreover, national and provincially-level 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.

**APPROACH: Interventions**

- Manitoba Health, Seniors and Active Living (MHSAL)’s Knowledge Exchange Forum in each health region with a variety of local factors influencing immunization rates, specific districts were identified and several potential intervention ideas to address these were generated.
- Using an Intervention Barometer, 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 collaboratives, pilot projects, and interventions with other service delivery organizations, MHSAL branches and provincial departments.

**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 influence decisions with providers who have an understanding of the local population, to challenge providers to rethink their approaches of immunizing their population, 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 6 antigens in 5 regions:

1. **Inactivated Diphtheria, Tetanus, Pertussis (DTP) (data sourced from the Manitoba Immunization Information System (MIIIS) database (data from 2014-2017))
2. **Inactivated Polio (IPV) (data sourced from the MIIIS database (data from 2014-2017))
3. **Pneumococcal Vaccine (PCV13) (data sourced from MIIIS database (data from 2015-2017))
4. **Haemophilus influenzae type B (Hib) vaccine (data sourced from the MIIIS database (data from 2015-2017))
5. **Inactivated Meningococcal C Vaccine (MACV) (data sourced from the MIIIS database (data from 2015-2017))

**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 selected ages by HPY, Measles, Pertussis and Rickets (Figure 5-9).

**CONCLUSIONS:** The principles, tools, 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 processes by which the data and tools were shared and communications related to leverage local level knowledge and expertise to identify local level factors impacting rates and generate ideas for potential interventions were not as valuable (if not more so) as the tools. BMI-AF will look at the potential of scaling up and scaling out of interventions that demonstrated positive outcomes in the evaluation phase. (Figure 6-9)

Figure 1: Variability of Measles Update Rates between Region and Districts

Figure 2: Example of the Provincial ArcGIS Maps

Figure 3: Under Immunized Measles - 12 dose Schedule Districts in Winnipeg and Northern Health Regions

Figure 4: Under Immunized Rotavirus - 12 Doses in Middle & Prairie Mountains Health Region

Figure 5: Under Immunized Pertussis - 12 Doses in Central Eastern Health Region

Figure 6: HPY Vaccination Rate Percentage of 1997 Birth Cohort Receiving 6 or 7 Doses in the Southern Regional Health Authority

Figure 7: HPY Vaccination Rate Percentage of 1997 Birth Cohort Receiving 6 or 7 Doses in the Northern Regional Health Authority

Figure 8: Changes in uptake of Polio Vaccine in Prairie Mountains Health Region

Figure 9: Unimmunized and Under immunized HPY Vaccine in Winnipeg Health Region
The Quadrivalent HPV Vaccine Evaluation Study (QUEST): interim analysis and future perspective


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

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

- 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

<table>
<thead>
<tr>
<th></th>
<th>2D/vaccinated (n=3798)</th>
<th>3D/vaccinated (n=3862)</th>
<th>OR adjusted for age (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had menarche</td>
<td>1516 (98.2%)</td>
<td>2227 (98.8%)</td>
<td>1.13 (0.65-1.96)</td>
</tr>
<tr>
<td>Eever had sex</td>
<td>291 (18.7%)</td>
<td>623 (27.6%)</td>
<td>0.87 (0.73-1.03)</td>
</tr>
<tr>
<td>Ever had sexual intercourse (n=908)</td>
<td>1269 (81.4%)</td>
<td>1637 (72.4%)</td>
<td>0.61 (0.27-1.41)</td>
</tr>
<tr>
<td>Sexual debut &lt;15 years of age</td>
<td>90 (33.1%)</td>
<td>142 (23.9%)</td>
<td>1.22 (0.88-1.70)</td>
</tr>
<tr>
<td>Condom use during last sexual intercourse (n=545)</td>
<td>182 (66.9%)</td>
<td>453 (76.1%)</td>
<td>1.01 (0.72-1.41)</td>
</tr>
</tbody>
</table>

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

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

**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.
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. 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. 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 healthcare provider is an important step in moving clients from vaccine hesitancy to vaccine acceptance. In British Columbia (BC), the Immunization Communication Tool for Immunizations (ICT) is available in support health care providers (HCPs) address common immunization questions and concerns from the public. The ICT survey was conducted using RedCap®, an online survey tool.

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 2165 participants completed the survey. Of the participants, 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 through the Provincial CD Nurse group and the FENGs 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 indicated the need for evidence based information in the ICT to help support HCPs in addressing immunisation questions and concerns from the public. Survey results also indicated that HCP’s want current content 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.

Discussion

While most Canadian parents ensure their children receive all routine vaccinations, a recent Canadian study showed 16% of parents consider themselves to be vaccine hesitant. 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 contribute to individuals' 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 contribute to individuals' knowledge to make informed decisions about vaccines. 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. HCPs should have readily accessible up-to-date resources to be able to provide their clients with clear evidence-based information about vaccines. Promoting available immunization communication resources to immunization providers continues to be an important step in addressing vaccine hesitancy.

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. HCPs should have readily accessible up-to-date resources to be able to provide their clients with clear evidence-based information about vaccines. Promoting available immunization communication resources to immunization providers continues to be an important step in addressing vaccine hesitancy.
**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.
- 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: a) Neurologic Events; and b) 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.

**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 (VCH/VA), 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 2016.
- Opportunities exist for adoption of a standardized approach to causality assessment for serious events.

**Results**

- **Causality Assessment and Health Authorities:**

  ![Causality Assessment and Health Authorities](image)

  - **Likely:** 60%
  - **Possible:** 20%
  - **Unlikely:** 10%
  - **Pending:** 20%
  - **NRI:** 0%

- **Public Health Recommendation and Health Authorities:**

  ![Public Health Recommendation and Health Authorities](image)

  - **A:** 9%
  - **B:** 30%
  - **C:** 45%
  - **D:** 20%
  - **Pending:** 0%
  - **NRI:** 0%

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**References**
