Health and Wellness

Prince Edward Island Guidelines for the Management and Control of Varicella

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Department of Health and Wellness

Chief Public Health Office

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Case Definition[1]

Confirmed Case

Clinical illness[a] with laboratory confirmation of infection:

- The isolation or direct antigen detection of the varicella-zoster virus (VZV) from an appropriate clinical specimen[b],

or

- The detection of VZV nucleic acid (e.g., Polymerase Chain Reaction [PCR]) in an appropriate clinical specimen[b],

or

- A positive serologic test for VZV Immunoglobulin M (IgM) antibody in the absence of recent immunization with the varicella vaccine[2],

or

- The seroconversion or significant change between acute and convalescent varicella-zoster Immunoglobulin G (IgG) titre by any standard serologic assay in the absence of a recent administration of any blood product or immunization with the varicella vaccine,

OR

Clinical illness in a person with an epidemiological link to a laboratory-confirmed case of varicella (chickenpox) or VZV (shingles) infection.

Clinical illness of less than 14 days or more than 42 days after immunization is significant and, if confirmed, is reportable.

Probable Case

[a] *Clinical illness is characterized by a rash with rapid evolution of macules to papules, vesicles and crusts; all stages are simultaneously present; lesions are superficial and may appear in crops.* *https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/varicella-chickenpox/national-case-definition.html*

[b] *Appropriate clinical specimens include swabs from a fresh lesion, cerebrospinal fluid (CSF), or eye fluid aspirate (3).*

A probable case is clinical illness in the absence of a laboratory confirmation or epidemiological link to a laboratory-confirmed case.

Reporting Requirements

1. Laboratories

The Provincial Laboratory shall, in accordance with the PEI *Public Health Act* (Prince Edward Island Legislative Council Office, 2023), report all positive laboratory results by phone, and fax, or electronic transfer, as soon as the result is known, to the Chief Public Health Officer (CPHO) (or designate) as required by the PEI Notifiable Disease and Conditions and Communicable Diseases Regulations[3].

2. Health Practitioners

Health practitioners shall, in accordance with the PEI Notifiable Diseases and Conditions and Communicable Diseases Regulations of the Prince Edward Island (PEI) *Public Health Act*, report all confirmed and probable cases by phone, fax, or electronic transfer, as soon as the result is known, to the CPHO (or designate).

Etiology

Varicella is a generalized viral disease caused by the varicella zoster virus (VZV), a deoxyribonucleic acid (DNA virus) of the Herpesvirus family. Varicella-zoster virus refers to the virus that causes varicella (chickenpox), and herpes zoster reactivation of latent VZV [4].

Clinical Presentation

Unimmunized Persons

Varicella occurs primarily in children and may or may not begin with a prodromal period. The prodromal period, when present, occurs one to two days before onset of lesions and is characterized by fever, malaise, headache, anorexia and upper respiratory tract infection. Characteristic superficial lesions or macules (small, red, flat bumps)[5] may be present in the early phase of the illness. The lesions appear in successive crops over the first 3 to 4 days of the rash, so several stages of old and new lesions will be present at the same time. The lesions rapidly progress from macules to fluid-filled vesicles to pustules and scab over within a few days. Lesions tend to develop on the trunk and face before progressing to the extremities and can occur anywhere on the body including the scalp. Ulcerated lesions may also be present on mucous

membranes, including the oropharynx and upper respiratory tract, conjunctiva, and rectal and vaginal mucosa. Subclinical infections are rare[6].

Immunized Persons (Breakthrough Varicella)

Varicella disease in individuals who have received the varicella vaccine is referred to as vaccine-modified disease (also known as breakthrough varicella). In general, vaccine-modified disease in vaccine recipients is associated with a significantly reduced number of lesions (< 50 lesions with papules but often no vesicles and a mild to absent fever)[6]. Please refer to Annex B for distinguishing characteristics of varicella (chickenpox), breakthrough varicella and herpes zoster (shingles).

Complications

Varicella is generally considered a mild disease. However, significant complications can occur and include secondary bacterial infections and soft tissue infections, including necrotizing fasciitis, toxic shock-like syndrome, otitis media, bacteremia, pneumonitis, osteomyelitis, septic arthritis, endocarditis, hepatitis, thrombocytopenia, cerebellar ataxia, and encephalitis, and Guillain-Barré syndrome. Approximately, 5 – 10% of otherwise healthy children develop complications that may be fatal.[2].

Among previously healthy children the risk of severe invasive group A streptococcal infection is estimated to be 40 to 60 times higher when a Varicella infection is present. Complications such as pneumonia, encephalitis, and death are more likely to occur in adolescents, adults, or immunocompromised hosts[2]. Varicella case fatality rates are highest among adults (30 deaths/100,000 cases), followed by infants under 1 year of age (7 deaths/100,000 cases) and then those aged 1 to 19 years (1-1.5 deaths/100,000 cases). Most adults and children who die from varicella complications have no identifiable risk factor for severe disease[6].

Congenital varicella syndrome (CVS) following maternal infection with varicella is rare when infection occurs before the 13th (first trimester) or after the 20th week of gestation (mid-way through the 2nd trimester). CVS may cause defects including low birth weight, limb hypoplasia, neurologic defects, eye diseases, and skin lesions and scarring[7]. The incidence of CVS is approximately 1 – 2% when infection occurs before 20 weeks of gestation; however, case fatality is approximately 30% for infants born with signs of CVS[6].

Children exposed to varicella in utero during the second half of the pregnancy can develop inapparent varicella and subsequent shingles early in life without ever having had extrauterine varicella[6].

Maternal varicella occurring in the 5 days before to 2 days after birth may result in overwhelming infection of the neonate, with a fatality rate as high as 30%[2].

Recurrences of a varicella-like rash have been reported by 4 – 13% of people who had a previous varicella infection. Risk factors include having a first infection at a young age (less than 12 months of age) or having a mild first infection[6].

Following a varicella illness, the varicella-zoster virus establishes latency in the sensory nerve ganglia and may recur years later. Reactivation of the varicella virus results in the herpes zoster and is referred to as shingles. Exactly how the virus remains latent in the body and subsequently reactivates is not clearly understood[6]. The risk of zoster infection increases with age, especially after 50 years of age. It is characterized by a painful eruption of vesicular lesions along nerve pathways along with inflammation of the surrounding skin.

Diagnosis

The clinical diagnosis of varicella is often made by client history and physical examination. Confirmation of disease is done by taking a swab/scraping from the base of a fresh vesicular lesion. The Provincial Laboratory uses two approaches for specimen collection:

1) Varicella polymerase chain reaction (PCR) amplification and detection of the virus (either through a viral transport media swab or CSF); and

2) Varicella IgG[c] /IgM testing. Varicella IgM is performed **only** if the IgG is negative. Please note that STAT testing for IgM is only done if the person is pregnant and has had known exposure. The Medical Microbiologist or Chief Technologist must approve all other STAT requests for testing at the Provincial Laboratory.

3) Varicella-like rash following immunization should be evaluated in the context of immunization timing:

- A varicella-like rash that occurs within 2 weeks of immunization may be attributable to wild-type VZV[2].
- A varicella-like rash that occurs between 14 and 42 days after receiving the varicella vaccine is a typical adverse event.
- A varicella-like rash that occurs more than 42 days post-immunization is most likely attributable to wild-type VZV[6] (i.e., breakthrough varicella).

For more information regarding laboratory diagnoses, please refer to Annex A: *Laboratory Diagnosis of Varicella-Zoster Virus Infections (Primary or Reactivation)* for Testing and Specimen Collection.

Epidemiology

1. Reservoir

The reservoir is humans.

2. Transmission

VZV is spread by the airborne route, as well as by direct contact with virus shed from skin lesions. Transmission occurs from the skin vesicles of infected persons to the respiratory tract of susceptible person. The attack rate among susceptible contacts in household settings is estimated at 65% to 87%. The incubation period is from 10 to 21 days after exposure, usually 14 to 16 days. Infectiousness begins 1 to 2 days before onset of the rash and lasts until the last lesion has crusted. VZV infection can also occur from direct contact with skin lesions from a person infected with herpes zoster. *In utero* infection can also occur from transplacental passage of the virus during maternal varicella infection[6].

3. Incubation Period[6]

The incubation period is generally 14 to 16 days but may range from 10 to 21 days. The incubation period may be prolonged in cases with passive immunization against varicella (e.g., the varicella-zoster immune globulin) or in immunocompromised cases.

Infants born to mothers with active varicella around the time of delivery may develop varicella within 2 to 16 days after birth. Typically, the onset of the rash in the neonate occurs 9 to 15 days after the mother experiences the development of a rash[8].

4. Period of Communicability

The period of communicability is typically 1 to 2 days before developing a rash and continues until all lesions are crusted. Lesions generally crust after 3 to 5 days. In immunocompetent cases, most virus replication has stopped within 72 hours of rash onset. Viral replication may be prolonged in immunocompromised cases.

5. Host Susceptibility

In general, individuals of any age who have not had varicella infection or who have not been immunized are susceptible to infection. Infection confers lifelong immunity. Susceptible individuals should be considered infectious for 8 to 21 days following exposure[4].

- A susceptible individual is identified as:
    - Having no or uncertain history of chickenpox or shingles,
    - Having a negative serology test (i.e., VZV IgG negative),
    - Having no history of receiving age appropriate doses of varicella- containing vaccine, or
    - Having received a hematopoietic stem cell transplant, regardless of **pre-transplant** history of vaccination, positive serologic results, varicella, or herpes zoster disease.
        - Univalent varicella vaccines may be considered 24 months or more post-transplant provided there is no evidence of chronic GVHD, immunosuppression has been discontinued for at least 3 months, the underlying disease for which the transplant was done (if immunosuppressive), is not active, and the person is considered immunocompetent by a transplant specialist.
- Any person with one of the following is considered immune to varicella:
    - Documented evidence of immunization with 2 doses of a varicella-containing vaccine. Please refer to the PEI Childhood or Adult Immunization Schedule.
    - Laboratory evidence of immunity

A self-reported history or health care provider diagnosis is considered a reliable correlate of immunity for healthy individuals, including pregnant women without significant exposure to VZV and health care workers (HCW) who are currently or have previously been employed in a Canadian health care setting if varicella occurred before the year of a one-dose vaccine program implementation.

Healthy adults 50 years of age and older, are presumed to be immune to varicella, even if the person does not remember having had chickenpox or herpes zoster (shingles, HZ).

If varicella occurred after the year of a one-dose immunization program implementation, a self-reported history or health care provider diagnosis cannot be

considered a reliable correlate of immunity because one-dose immunization programs had a marked impact on the prevalence of wild-type varicella.

A self-reported history or diagnosis of varicella or HZ by a health care provider is not considered an acceptable evidence of immunity for:

- healthy pregnant women with significant exposure to VZV (refer to significant exposures to VZV)
- immunocompromised individuals
- HCW who are newly hired into the Canadian health care system

Persons from tropical countries are less likely to acquire immunity in childhood; thus, adults from tropical countries have a higher susceptibility rate. The lifetime risk of developing varicella is 95% in temperate climates. Infection usually confers lifelong immunity[6].

Occurrence

1. General

Varicella occurs worldwide, especially in densely populated metropolitan areas. Implementation of childhood varicella immunization programs has significantly decreased childhood infections. In the pre-vaccine era, approximately 350,000 varicella cases and 1,500 to 2,000 varicella-related hospitalizations occurred each year in Canada, primarily among healthy children up to 12 years of age.

Varicella infections display a seasonal pattern, with more varicella cases seen during the school year and a sharp decline during the summer[2].

2. Canada

The reporting of varicella across Canada is considered an underestimate of actual cases.

Most infections occur in unvaccinated children up to 12 years of age, resulting in more severe cases occurring in this age group. Data from the Canadian Institute for Health Information for 1994 to 2000 showed that over 1,550 varicella hospitalizations occur annually for all age groups. These data indicate that the majority of hospitalizations occur in previously healthy children.

Prince Edward Island

PEI was the first province in Canada to introduce the varicella vaccine as part of a universal immunization program in 2000[2,9].

Since the immunization program began in PEI, laboratory-confirmed varicella is rare, however breakthrough cases have been reported, averaging around 10 cases per year (range 2 to 22 breakthrough cases from 2018 to 2022).

Control

Management of a Case

- All confirmed and/or probable cases are to be reported to the CPHO as soon as the cases are known (See Reporting Requirements).
- The CPHO will inform Public Health Nursing (PHN) of cases for case investigation, contact tracing and education.
- Children and adults with varicella illness are not permitted to return to daycare, school, or work and cases should stay at home avoiding public places until all skin lesions have crusted over and there are no new lesions. Please refer to Annex C for *Common Childhood Communicable Disease Exclusion Criteria*. Please note this is a change from previous guidance based on a 2024 Addendum by the Canadian Paediatric Society.
- Air travel is not recommended until lesions have crusted due to the recirculation of the cabin air. If inadvertent exposure occurs during air travel, no follow-up of contacts will take place.
- Hospital management includes:
    - Cases will be placed on airborne and contact precautions, in addition to routine practices. This is due to the risk of severe varicella illness in susceptible immunocompromised persons.
        - The restriction of hospital entry of persons with varicella lesions, unless the individual is seeking medical care. This restriction should occur until all lesions have crusted, including visitors and healthcare workers.
        - Management of ambulatory clinic appointments and day-surgery cases. Cases should notify staff if they develop varicella and should be rescheduled to come to the hospital when their lesions have crusted.
        - CPHO will notify the hospital unit if a discharged person develops a varicella rash within 48 hours of leaving the hospital.

Treatment of a Case[6]

- Cases should be offered supportive therapy as indicated.
- In persons under the age of 18 years, the use of salicylates and salicylate-containing products (i.e., ASA, Aspirin) should be avoided due to their association with Reye's syndrome[8].
- Ibuprofen and acetaminophen are recommended to reduce fever and manage discomfort.
- The decision by a clinician to use antiviral therapy including the route and duration of treatment is determined by host factors (e.g., immunocompromise), extent of infection, and the initial response to treatment. In the immunocompetent host, most viral replication has stopped within 72 hours of rash onset and the American Academy of Pediatrics Red Book Committee does not recommend antiviral treatment in otherwise healthy children with varicella.

The following groups of individuals are considered to be at increased risk of severe varicella:

  - **Newborn infants of mothers who develop varicella** from 5 days before until 48 hours after delivery
  - **Neonates in intensive care settings** born at less than 28 weeks of gestation or weighing 1,000 g or less at birth, regardless of their mothers' evidence of immunity
  - **Susceptible pregnant women**.
  - **Susceptible immunocompromised persons, including HIV-infected persons with CD4 cell count <200 × 10^6/L or CD4 percentage <15%.**
  - **Recipients of hematopoietic stem cell transplantation (HSCT)** regardless of pre-transplant varicella immune status or post-transplant immunization history including varicella disease, vaccination or positive serologic test results

- Antivirals should be considered for those at moderately increased risk of complications including otherwise healthy but unimmunized people aged older than 12 years and for pregnant women. Treatment is recommended within 24-48 hours of rash onset.
- Intravenous acyclovir therapy is recommended for severe disease (e.g., disseminated VZV such as pneumonia, encephalitis, thrombocytopenia, severe hepatitis) and for varicella in immunocompromised patients (including patients being treated with high-dose corticosteroid therapy for >14 days).

- Cases should maintain proper personal hygiene, including bathing, astringent soaks, and closely cropping fingernails to avoid sources of secondary bacterial infections associated with scratching pruritic lesions.

- Defer all immunizations with live and inactivated vaccines until at least 4 weeks after illness onset in the case. Varicella infection is accompanied by abnormalities of cell-mediated immunity.

Management of Contacts

NOTE: Individuals with congenital varicella syndrome (CVS) are not communicable.

A contact of a case is defined as someone who has had significant exposure to the case.

Significant exposure includes one of the following:

- Continuous household contact (living in the same dwelling) with the varicella case
- Being indoors for more than 1 hour with a person with varicella
- Being in the same hospital room for more than 1 hour, or more than 15 minutes of face-to-face contact with a person with varicella
- Touching the lesions or articles freshly soiled by discharges from vesicles of a person with active varicella

For contacts with significant exposure to a case of varicella:

- Assess their disease history (varicella and/or shingles) or serological evidence of disease.

- Assess their vaccine history.

- Susceptible household contacts of confirmed and probable cases should avoid contact with the following individuals for the duration of the incubation period (range 10-21 days; average 14-16 days):

    - Immunocompromised individuals,

    - Susceptible pregnant women,

    - Hospitalized premature infants, and

    - Infants born to susceptible mothers.

The varicella-zoster immune globulin (VarIg) may be given to high-risk non-immune contacts within 96 hours of significant exposure to prevent and attenuate varicella infection. If more than 96 hours but less than 10 days have elapsed since the last exposure, VarIg may be administered to individuals for whom it is indicated; when given more than 96 hours after exposure, its primary purpose may be attenuation (reducing the severity of illness) rather than prevention of disease.

- VarIg should be considered for:
    - Newborns whose mother develops varicella within 5 days prior to delivery or up to 48 hours after delivery,
    - Immunocompromised contacts, including:
        - Contacts with congenital disorders,
        - Contacts with acquired immunodeficiency syndrome,
        - Hematopoietic stem cell transplantation recipients, or
        - Those with immunosuppression due to disease or therapy (this includes contacts receiving corticosteroid therapy who are taking a high dose systemic steroid ≥ 2 mg/kg/day or ≥ 20 mg/day for more than 2 weeks),
    - Hospitalized premature infants who are exposed within the first 4 weeks of life (if less than 28 weeks gestation, give VarIg regardless of maternal status),
    - Exposed premature infants of 29 to 37 weeks gestation if the mother was not immune at the time of birth, and
    - Exposed pregnant contacts who have never had varicella disease, shingles, or varicella vaccine due to risk of complications. Titres should be completed but should not delay administration of VarIg if results cannot be received within 96 hours.

NOTE: There is no evidence that VarIg will prevent or alter disease in the fetus.

- If a second exposure occurs more than 3 weeks after the administration of VarIg in a recipient in whom varicella did not develop, another dose of VarIg should be considered.

- VarIg is not required for:

- Contacts receiving regular monthly infusions of ≥ 400 mg/kg of intravenous immunoglobulin (IVIg),
- Those whose most recent dose of IVIg was within the three weeks before exposure, or
- Healthy adults and children.

- The varicella vaccine effectively prevents or reduces disease severity if given to susceptible contacts within 72 hours and no longer than 5 days after exposure.
  - Refer to the current Canadian Immunization Guide for recommendations on post-exposure immunization.
- Airline travel is not recommended for exposed susceptible household contacts for 8 to 21 days from exposure.
- No follow-up will occur for contacts exposed to a case while travelling by airline.

Preventative Measures

General prevention measures include:

- Practicing airborne and contact precautions around infected individuals until all lesions are crusted in healthcare care settings,
- Practicing good hand hygiene,
- Cleaning frequently touched household surfaces,
- Frequently laundering clothing and linens used by the infected individual.

Immunization

The varicella vaccine was licensed for use in Canada in 1998. The Public Health Agency of Canada (PHAC) recommended, in May 1999, universal immunization for varicella. Since the vaccine's introduction, Canada's varicella disease burden has decreased.

PEI was the first province in Canada to introduce the varicella vaccine as part of a universal immunization program in 2000[2,9]. It began with a one-dose schedule, vaccinating children between grades one and six. The universal program for those at twelve months old began in April 2000 with a catch-up program for those between twelve months and grade one[9]. PEI

moved to a two-dose schedule in 2011 with a catch-up program for children aged 4-6 years in 2012.

Currently, the varicella vaccine is offered at twelve and eighteen months in combination with measles, mumps, and rubella (Please refer to the PEI Childhood Immunization Schedule).

In healthy children 12 months to 12 years of age, a single univalent varicella vaccine dose results in a seroconversion rate of 98% at 4 to 6 weeks after vaccination, with antibodies persisting in 98% at 5 years and 96% at 7 years after vaccination. A second dose of a univalent varicella vaccine in children produces an improved immunologic response that is correlated with improved protection. In adults and adolescents 13 years of age and older, 2 vaccine doses administered 4 to 8 weeks apart result in seroconversion rates of 99% at 4 to 6 weeks after the second dose, with persistence of antibodies 5 years later in 97% of vaccine recipients (2).

In healthy children, routine immunization occurs between 12 months to less than 13 years of age. Two doses should be administered before school entry to reduce the risk of breakthrough disease 3.3-fold compared to children with only one dose.

Adults under 50 years of age without varicella immunity should receive two doses of univalent varicella vaccine. In retrospective studies done in the United States, it was found that there was an overall vaccine effectiveness of 70 – 90% in preventing the varicella disease of any severity and 95% protection against severe varicella for at least seven to ten years after immunization (4).

Varicella immunization is contraindicated during pregnancy. Please refer to the Canadian Immunization Guide for further information on the varicella vaccine.

- Offer immunization to children according to the PEI Childhood Immunization Schedule
- Offer vaccines to susceptible individuals, including:
    - Persons whose occupation exposes them to varicella (e.g. teachers of young children),
    - Women of childbearing age (See Annex E: Management of Varicella Immunization in Post-Partum Women),
    - Household contacts of immunocompromised persons,
    - Immigrants and refugees from tropical regions,

- Persons with cystic fibrosis or receiving chronic salicylate therapy, and
- Persons exposed to a case of varicella.

  (See PEI Adult Immunization Schedule)

- Susceptibility will be based on the above definition of a susceptible individual.
- Healthcare workers should demonstrate proof of immunity upon hire.
  - Proof of immunity may include laboratory-confirmed history of disease, serological evidence of disease, or documented age-appropriate doses of varicella vaccine.
- Immunize non-immune persons according to the PEI Immunization Schedule and CIG Guidance for age and contraindications .

References

1. Canada, P. H. A. of. (2023, July 11). Varicella (Chickenpox) [Education and awareness]. https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/varicella-chickenpox.html

2. Canada, P. H. A. of. (2023, December 14). Varicella (chickenpox) vaccine: Canadian Immunization Guide [Guidance]. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-24-varicella-chickenpox-vaccine.html

3. Toolkit, W. E. (2016, July 21). Reporting Notifiable Diseases and Conditions and Communicable Diseases. https://www.princeedwardisland.ca/en/information/health-and-wellness/reporting-notifiable-diseases-and-conditions-and-communicable

4. Heyman, D.L. (2022) Control of Communicable Diseases Manual 21st Ed. American Public Health Association. pp 696-702.

5. Marin, M., & Bialek, S. R. (2015). Varicella/herpes zoster. In Control of Communicable Diseases Manual. American Public Health Association. https://doi.org/10.2105/CCDM.2745.151

6. Chickenpox / Varicella. (n.d.). Retrieved May 27, 2023, from http://www.bccdc.ca/health-info/diseases-conditions/chickenpox-varicella

7. Alberta public health disease management guidelines: Varicella (chickenpox)—Open Government. (n.d.). Retrieved May 27, 2023, from https://open.alberta.ca/publications/varicella-chickenpox

8. Sauerbrei, A., & Wutzler, P. (2000). The congenital varicella syndrome. Journal of Perinatology: Official Journal of the California Perinatal Association, 20(8 Pt 1), 548–554. https://doi.org/10.1038/sj.jp.7200457

9. Health, C. D. C., Manitoba. (n.d.). Varicella (Chickenpox) | Health. Province of Manitoba - Health. Retrieved May 27, 2023, from https://www.gov.mb.ca/health/publichealth/diseases/varicella.html

10. Sweet, L., Gallant, P., Morris, M., & Halperin, S. A. (2003). Canada's first universal varicella immunization program: Lessons from Prince Edward Island. The Canadian Journal of Infectious Diseases, 14(1), 41–44.

11. Communicable Diseases—Chickenpox (Varicella) | novascotia.ca. (n.d.). Retrieved May 27, 2023, from https://novascotia.ca/dhw/CDPC/chicken-pox.asp

12. Chickenpox for HCPs. (2023, December 15). Centers for Disease Control and Prevention. https://www.cdc.gov/chickenpox/hcp/index.html

13. Rinaldi, C. (2010). Well Beings: A Guide to Health in Child Care (Third Edition). Canadian Journal of Public Health = Revue Canadienne de Santé Publique, 101(2), 142. https://doi.org/10.1007/BF03404360

14. Canada, P. H. A. of. (2012, April 30). Varicella Zoster Virus [Education, Safety and Data]. https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/varicella-zoster-virus.html

15. American Academy of Pediatrics. Varicella-Zoster Virus Infections. In: Red Book: Report of the Committee on Infectious Diseases. 30th Edition. Elk Grove Village, IL. 2015. p. 846-860

16. Canadian Paediatric Society, Immunization and Infectious Disease Committee. School, child care and camp exclusion policies for chickenpox: A rational approach. https://cps.ca/en/documents/position/exclusion-policies-for-chickenpox

Annex A: Laboratory Diagnosis of Varicella-Zoster Virus Infections (Primary or Reactivation)

Acute Presentation of a Vesicular Rash

The rash may be generalized (primary chickenpox), dermatomal (herpes zoster or shingles) or sometimes "atypical" (limited lesions in a partially immune or immunocompromised individual). For optimal laboratory diagnosis of varicella-zoster virus (VZV) infection, lesion swab(s) and serology, as described below, are necessary:

1) **Swab/scraping from the base of a new vesicular lesion (blister).**

Unroof the larger blister and, using the appropriate swab, press and rub over the base of the blister vigorously (the goal is to collect abundant cellular matter). The swab should be placed into Viral Transport Medium and transferred to the laboratory for the polymerase chain reaction (PCR) amplification approach and detection of the virus.

- If vesicles are absent, as seen in atypical lesions in immunized patients, swabs of papules/ulcers may also be submitted for PCR. Swabs should be collected and submitted in viral transport media.

2) **Blood sample (serum separator tube) for VZV IgM and IgG tests.**

An IgM positive result may indicate an acute VZV infection (usually primary).

- The assay may lack sensitivity early in acute infection and in partially immune patients (i.e., immunized).
- A false positive VZV IgM result can occur (i.e., due to rheumatoid factor).
- VZV IgM may be detectable in recurrent VZV infection (herpes zoster).

Seroconversion for VZV IgG may indicate a recent acute VZV infection.

- Immunocompromised individuals may not develop a detectable antibody response.
- Immunized individuals may not develop VZV IgG that is detectable by the standard laboratory assays, making IgG detection an unreliable measure of immunity or protection in this population.
- Seroconversion is retrospective and not immediately useful for patient and contact management, or for deciding infection control measures.

Atypical Rash Presentation after Vaccination

Samples should be taken as described above. If there are no fresh vesicular lesions, swabs of papules/ulcers and serum for IgM/IgG testing should be collected. Lesion samples will be tested using PCR (which provides maximum sensitivity).

Neurological Symptoms in the Context of Possible Primary or Recurrent VZV

If a lumbar puncture is undertaken because of neurological symptoms and VZV is suspected, cerebrospinal fluid (CSF) should be collected and submitted for PCR testing alongside blood for serological testing and analysis of lesions, as appropriate.

Disseminated Infections of the Immunocompromised (Notably Stem Cell Transplant Patients)

Donor-derived VZV infections are rare, and more frequently, reactivation of latent virus can result in disseminated disease, presenting as abdominal pain and/or hepatitis prior to rash onset. Collection of plasma (EDTA whole blood) for molecular detection is the method of choice and requires consultation with virologist-on-call.

Differentiation between Wild-Type and Vaccine VZV (and Strain Characterization)

If a sample contains detectable VZV by PCR or culture, it may be important to know if the causative virus is wild-type or related to vaccination. Such analysis can be undertaken by nucleic acid sequencing, which may provide sufficient detail to confirm whether cases are linked in an outbreak setting. If considered necessary, or in the case of linked (outbreak) cases, samples will be forwarded to the National Microbiology Laboratory (NML) for sequence-based analysis.

Annex B: Distinguishing Characteristics of Varicella (Chickenpox), Breakthrough Varicella and Herpes Zoster (Shingles)[1,6,10,11]

	Varicella	**Breakthrough Varicella**	**Shingles**
Definition	Primary infection with VZV.	Typically, a mild infection with wild-type VZV more than 42 days after varicella immunization.	Develops after reactivation of latent VZV after a primary episode of varicella.
Distinguishing Characteristics	▪ Vesicular (fluid-filled) rash that progresses to scabs. ▪ Maculopapular rash (reddened areas with small, solid bumps), vesicles, and scabs in varying stages of evolution.	▪ Maculopapular rash occurring more than 42 days after varicella immunization. ▪ Usually mild with less than 50 lesions.	▪ Grouped vesicular eruptions mostly unilaterally in the distribution of a sensory nerve (dermatome). ▪ Thoracic dermatome is affected in 50% of cases. ▪ Can occasionally become disseminated with lesions occurring outside the primary dermatomes, causing visceral complications.
Clinical Manifestations	▪ May be mild or severe. ▪ A mild prodrome (fever, malaise, and upper respiratory tract infection) may precede rash by 1 or 2 days. Prodrome may not occur in all cases, particularly children.	▪ A mild illness often with <50 lesions (usually maculopapular rather than vesicular). ▪ Systemic symptoms such as fever occur less frequently. ▪ Shorter duration.	▪ Prodromal neuropathic within dermatome may precede lesions by days to weeks. ▪ Grouped vesicular lesions appear in 1 to 3 sensory dermatomes (often unilateral but can be bilateral).

	Varicella	Breakthrough Varicella	Shingles
Clinical Manifestations Cont'd	▪ Generalized, pruritic (itchy) vesicular (fluid-filled) rash typically consisting of 200-500 lesions, mild fever, and general malaise. ▪ Lesions tend to develop on the trunk and face, progressing to extremities. ▪ Ulcerated lesions may be present on mucous membranes (e.g. mouth, throat, conjunctiva, rectum, and vagina). **10-20 times more severe in adolescents and adults.		▪ Symptoms and lesions tend to resolve over 10-15 days. ▪ Is usually benign and not associated with pain in children but tingling may be present. ▪ Approximately 30% of elderly will have post herpetic neuralgia.
Mode of Transmission	▪ Person-to-person by direct contact, droplet, or airborne spread of vesicle fluid or secretions of the respiratory tract of cases. ▪ Direct contact with vesicle fluid of persons with shingles. ▪ Indirectly by touching articles soiled by discharges from vesicles and mucous membranes of cases.	▪ Person-to-person by direct contact, droplet, or airborne spread of vesicle fluid or secretions of the respiratory tract of cases. ▪ Contact can be months or years post-immunization.	▪ Direct contact with fluid in vesicle or respiratory droplets can cause varicella (not shingles) in susceptible persons. ▪ Respiratory droplet transmission is more likely to occur in patients with disseminated shingles and/or who are immunocompromised. ▪ The lifetime risk of having at least one reactivation of varicella zoster is 15%-20%, occurring predominantly in older

			adults and rarely in children.
	Varicella	**Breakthrough Varicella**	**Shingles**
Incubation Period	▪ 10 – 21 days (typically 14 – 16 days)	▪ 10 – 21 days (typically 14 – 16 days)	▪ VZV remains latent for a few to many years before reactivating.
Period of Communicability	▪ Usually 1-2 days and up to 5 days before the onset of the rash until all lesions are crusted over (3-5 days). ▪ May be longer in immunocompromised persons.	▪ Usually 1-2 days and up to 5 days before the onset of the rash until all lesions are crusted over (3-5 days). ▪ May be longer in immunocompromised persons.	▪ While lesions are present until they are crusted (usually 7 – 10 days)
Host Susceptibility	▪ Infants ▪ Adolescents ▪ Adults ▪ Pregnant women ▪ Immunocompromised individuals		▪ Individuals over 50 years of age ▪ Immunocompromised individuals ▪ Children with a history of intrauterine varicella or varicella during the first year of life
Occurrence or Reoccurrence after Natural Varicella Infection	▪ Recovery from primary varicella infection usually results in lifetime immunity. ▪ Clinical re-infections have been reported usually in children who were less than one year of age at first infection and/or had a milder first infection.		▪ Occurs in individuals after primary varicella infection at a rate of 68 per 100,000 person-years. ▪ The lifetime risk of having reactivation to herpes zoster is 15%-20%. ▪ Approximately 4% of people will experience a second episode of shingles.

	Varicella	Breakthrough Varicella	Shingles
Incidence	In nations without immunization programs, varicella develops in about 50% of children before age five years and 90% before age 12. In the pre-vaccine era, approximately 350,000 varicella cases and 1,500 to 2,000 varicella-related hospitalizations occurred each year in Canada. Since the introduction of immunization programs in Canada, there has been a decrease in the burden of varicella.	Breakthrough varicella occurs in about 7.2% of individuals within 10 years of receiving one dose of univalent varicella vaccine.	Lifetime risk of shingles is about 30% in the general population. Approximately 130,000 new cases of herpes zoster (shingles), 17,000 cases of postherpetic neuralgia (PHN), and 20 deaths occur in Canada per year.

Annex C: Common Childhood Communicable Disease Exclusion Criteria[4,12]

Disease **NOTE: Diseases that are notifiable to the CPHO are in bold**	**Primary Reporting Responsibility**	**Period of Communicability**	**Exclusion from Daycare/School**
Shingles		Once rash appears and until blisters have crusted.	No exclusion period.
Varicella	**MD/NP/lab**	Most contagious period is 1-2 days before onset of rash. Contagious for up to 5 days after rash appears or until blisters have formed crusts.	Exclusion until all skin lesions have crusted over and there are no new lesions.

Annex D: Management of Varicella Immunization in Post-Partum Women