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## 1.0 AUTHORITY

Varicella is not a notifiable disease in British Columbia under the Communicable Disease Regulations (B.C. Reg. 4/83). The authority for the control of varicella case and contact management would be as for non-reportable communicable diseases under the [BC Public Health Act \(2008\)](#). This is further detailed in the Communicable Disease Control Manual, Introduction, [Preamble to the BC Communicable Disease Control Manual](#).

## 2.0 GOAL

The goal of the BC varicella control program is to reduce the mortality and morbidity associated with varicella disease. This will be accomplished through routine childhood immunization, immunization of susceptible adults, and promotion of appropriate measures for high-risk susceptible individuals following exposure to varicella.

### 2.1 Targets for Immunization Coverage and Hospitalization in Children

The Canadian [targets](#) by 2025 are:

- To achieve and maintain up-to-date varicella vaccination (1 dose) in 95% of children by their 2<sup>nd</sup> birthday.
- To maintain less than 50 varicella hospitalizations annually in Canada among vaccine-eligible children under 18 years old.

## 3.0 EPIDEMIOLOGIC FEATURES OF VARICELLA ZOSTER INFECTION

**Mode of transmission:** person-to-person by direct contact, airborne spread of vesicle fluid of skin lesions of acute varicella and herpes zoster, or infected secretions of the respiratory tract of varicella cases that also might be aerosolized; indirectly by articles freshly contaminated with respiratory secretions or vesicle fluid of such cases.

**Incubation period:** 10-21 days, commonly 14-16 days. May be as long as 28 days in individuals who receive varicella zoster immune globulin post exposure, and may be shorter in immunodeficient individuals.

**Period of communicability:** generally from 1-2 days before onset of rash and until all lesions are crusted (usually 5 days following rash onset). May be prolonged in immunocompromised people. Those with zoster lesions are infectious while rash is vesico-pustular (usually 7-10 days).

## 4.0 CASE IDENTIFICATION

### 4.1 National Case Definition for Varicella

Surveillance	Definition	Reportable in BC
Confirmed Case	<p>Clinical evidence of illness and laboratory confirmation of infection:</p> <ul style="list-style-type: none"> <li>• detection of VZV DNA by real-time polymerase chain reaction (RT-PCR) from an appropriate clinical specimen</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• isolation or direct antigen detection of varicella-zoster virus (VZV) from an appropriate clinical specimen</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• molecular nucleic acid testing (NAT) for central nervous system infection from an appropriate clinical specimen (CSF or brain biopsy)</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• seroconversion or a significant rise (e.g., fourfold or greater) by any standard serologic assay in varicella-zoster IgG titre between acute and convalescent sera</li> </ul> <p><b>OR</b></p> <p>Clinical evidence of illness<sup>1</sup> in a person with an epidemiologic link to a laboratory-confirmed case of chickenpox or zoster infection</p>	No
Probable case	Clinical evidence of illness in the absence of laboratory confirmation and epidemiologic link to a laboratory-confirmed case.	No

<sup>1</sup> 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. Breakthrough disease (varicella in a previously immunized person) is usually mild with less than 50 skin lesions, and of shorter duration; the rash may contain few or no vesicles. See [section 9.1](#) for further details.



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## 5.0 CASE MANAGEMENT

Case management is conducted by the primary care/ specialty care physician, as appropriate.

### 5.1 Laboratory Testing

With the decline in incidence of varicella, and milder cases in previously immunized individuals, fewer clinicians have experience with natural infection and the clinical diagnosis is less reliable.

Testing of varicella cases: laboratory confirmation of varicella should be sought in all cases of suspect or clinically diagnosed varicella, including in previously immunized persons. This is because clinical diagnosis is now less reliable given the declining rates of varicella.

Testing should also be conducted in those with a varicella-like illness with 50 or more lesions with onset within 7 to 42 days of immunization with a varicella-containing vaccine, and suspected secondary transmission of the vaccine virus.

Testing of zoster cases: Testing for suspected cases of zoster should only be undertaken when the case is:

- being considered for antiviral treatment
- under 19 years of age
- previously immunized against varicella and has no prior history of varicella disease
- a health care worker/ student
- a pregnant woman at term.

Diagnostic testing is preferably through virus identification. Specimens should be sent to the British Columbia Centre for Disease Control (BCCDC) Public Health Laboratory for testing. The medical health officer may request priority testing from the medical microbiologist at BCCDC if required at telephone: 604-661-7033 (24 hours, 7 days per week). For laboratory test results, contact the BCCDC Lab Results Line (1-877-747-2522) or access the information through PLIS (Provincial Laboratory Information System). Specimen receiving hours at BCCDC Laboratory for Central Processing & Receiving PreAnalytical 0700 - 2100 Monday to Friday and 0800 - 1700 Saturday. Specimens should be submitted with a completed [Virology Requisition](#), Herpes Viruses – skin swab for varicella-zoster. For more information regarding laboratory programs and services including the eLab Handbook, refer to [Laboratory Services](#).



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### 5.1.1 Virus Identification

PCR is the most reliable method for confirming varicella infection.

The most appropriate clinical specimen will usually be vesicular fluid, scabs or cells from the base of a lesion collected within the first 3 days of the rash.

#### Specimen collection for intact vesicles:

Collection is performed using a conventional sterile swab or 25 ga. syringe, and virus transport medium.

- a) Unroof the blister with a tuberculin syringe needle or broken edge of a sterile swab shaft.
- b) Swab the base of the broken blister firmly, applying enough pressure to collect epithelial cells without causing bleeding. Place the swab in transport media and transport to the laboratory.
- c) Alternatively the contents of the vesicular lesion may be aspirated with the syringe and transferred to the vial of transport medium

#### Other specimen types:

For some disease presentations with a suspected VZV etiology (e.g., meningitis, multi-focal organ damage), samples of cerebral spinal fluid (CSF), blood, or biopsy tissue may also be shipped. Blood or CSF can be shipped on cold packs or frozen. Biopsy tissue is preferred shipped frozen and, if available, unfixed.

Additional details are available in the [eLab Handbook](#), search for 'varicella'.

### 5.1.2 Serology

Serology is discouraged for confirmation of acute varicella unless virologic testing cannot be done e.g., because scabs have all dried and crusted.

Diagnostic testing of acute varicella by varicella IgM is not available in BC. This is because testing using commercial kits for IgM antibody lacks sensitivity and specificity; false-positive IgM results are common in the presence of high IgG levels, and results are unreliable.

If acute and convalescent sera are to be collected for varicella diagnosis by IgG rise, the acute serum should be collected within 7 to 10 days of rash onset, and the convalescent serum should be collected at least 7 to 14 days (preferably 2 to 3 weeks) later.

While serial testing of IgG antibody titres to diagnose acute infection can be done, this is not the preferred method of diagnosis for a number of reasons:

- results will not be available in a timely fashion



- serology will not allow for differentiation between wild type and vaccine virus, which may be relevant in specific clinical situations
- a 4-fold rise in IgG antibody may not be observed in vaccinated individuals.

Serology (IgG) should be used for testing for immunity, although it is most reliable for this purpose in individuals with wild type immunity, and is less sensitive in the detection of vaccine-derived immunity.

### **Interpretation of serological results:**

After a primary infection, both IgG and IgM antibodies develop within 3-7 days after rash onset. Both antibodies then increase reaching a plateau 2-3 weeks later. Antibody levels may be reported as Non-Reactive (no detectable antibody), Indeterminate (the level of antibody detected is considered borderline reactive or equivocal) or Reactive (antibody is detectable within the positive range of the assay).

Non-Reactive and indeterminate levels of IgG antibodies may be observed in the acute stage of infection rising to reactive levels in subsequent weeks. In the absence of acute infection, indeterminate levels of IgG may represent very low levels of antibody many years after initial infection or vaccination.

If the acute blood sample shows low reactive, indeterminate or non-reactive IgG results, then a convalescent sample should be collected. Recent infection is confirmed if a significant rise in antibody levels is observed between acute and convalescent sera.

## **5.2 Case Treatment**

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.

Antivirals should be considered, however, 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.

For information regarding communicability and symptom management, direct client to HealthLinkBC [File #44a Facts about Chickenpox](#).

Use of acetylsalicylic acid (ASA, e.g., Aspirin®) should be avoided in children and adolescents under 19 years old with chickenpox in order to avoid Reye Syndrome.



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### **5.3 Future Immunization of the Case**

Defer all immunizations with live and inactivated vaccines until at least four weeks after illness onset in the case. This is because varicella infection is accompanied by abnormalities of cell-mediated immunity (CMI).

People who have had laboratory confirmed varicella after the age of 1 year are considered immune against varicella, and should be exempt from future varicella immunization, with their infection documented in their immunization registry record and personal immunization record. Infants who develop varicella in the first year of life should be immunized against varicella with two doses, beginning as early as the first birthday, because varicella in infancy may not confer protection.

### **5.4 Case Isolation in the Community**

Cases should avoid attending new settings during their communicable period to avoid infecting new contacts. They should avoid air travel, visiting hospitalized individuals, swimming, and especially contact with infants, susceptible pregnant women, and susceptible immunocompromised individuals.

### **5.5 Exclusion of Cases in the Community**

#### **5.5.1 Exclusion from School and Child Care**

Most authorities recommend that children with varicella who are well enough to participate in regular activities may continue to attend school or day care regardless of the state of the rash. This is because varicella is infectious prior to development of the rash during the prodromal stage, and contacts are likely to have been exposed prior to the diagnosis.

When staff or health care providers become aware of a case in a school or childcare setting, notification of the school administrator is appropriate. Public health should support such institutions with development of protocols for notification of parents/guardians when such cases arise. Appropriate information in notifications includes the incubation period and signs/symptoms of varicella, immunization recommendations, and advice for susceptible high risk individuals to receive prompt medical assessment for consideration of post-exposure prophylaxis.

On a case by case basis, parents/guardians of immunocompromised susceptible children may consult their health care provider about self-exclusion from settings where an infectious case is in attendance, or where susceptible contacts have been exposed and may be incubating varicella infection.



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## 6.0 CONTACT MANAGEMENT

### 6.1 Types of Exposures Warranting Consideration

The priority for contact follow-up is identification of those **susceptible contacts at high risk for complications of varicella disease**.

See [section 3.0](#) for information about mode of transmission, incubation period, and period of communicability.

**Significant exposure:** The following types of contact are considered significant if exposure has occurred during a case's period of communicability. This includes the following type of source case: active primary varicella, or a zoster case prior to or within 24 hours of onset of antiviral treatment if disseminated or in an immunocompromised host.

- continuous household contact (living in the same dwelling)
- being indoors (e.g., classroom, doctor's waiting room) for more than 1 hour
- sharing the same hospital room for more than 1 hour or having more than 15 minutes of face-to-face contact
- touching the lesions or articles freshly soiled by discharge from vesicles of a person with active varicella or zoster (shingles).

**Note:** The following is **not** considered an exposure: contact with an immunocompetent person whose non-disseminated zoster lesions are well covered by clothing or dressings.

Dried scabs from varicella-zoster lesions are not infective.

#### **Interval to infectiousness for susceptible exposed individuals:**

Susceptible persons should be considered potentially infectious 8-21 days following exposure to a varicella case (up to 28 days if they receive Varlg).

#### **Individuals at high risk for complications of varicella disease are:**

- those who are immunocompromised due to disease or therapy
- premature infants less than 37 weeks gestation exposed during their first weeks of life
- newborns whose mothers develop varicella disease 5 days before to 48 hours after delivery, or whose mothers have active zoster lesions in an area that cannot be covered (e.g., lower buttocks) at the time of parturition
- pregnant women
- those with cystic fibrosis
- candidates or recipients of a solid organ transplant or haematopoietic stem cell transplant (HSCT)



- those undergoing hemo- or peritoneal dialysis
- those with nephrotic syndrome
- those on chronic salicylate therapy.

## 6.2 Assessment of Susceptibility Among Exposed Contacts

Serological testing to establish immunity among exposed contacts is not practical and not necessary in most individuals. Healthy susceptible contacts who have uncertain history of prior varicella or prior immunization against varicella should be offered 2 doses of varicella vaccine without prior testing for immunity.

Serological testing for immunity may need to be conducted in exposed individuals without a history of prior varicella disease and without records of varicella vaccine receipt if they are pregnant women or health care workers.

### Consider as immune the following:

Healthy individuals who are contacts of a case:

self-reported history or physician diagnosed varicella after the age of 1 constitute 'proof of immunity' only if the episode occurred PRIOR to 2004<sup>2</sup>.

OR

laboratory proven diagnosis of prior varicella or zoster after the age of 1

OR

documented receipt of 2 doses of varicella containing vaccine

OR

serological proof of immunity<sup>3</sup> (at any time in the past).

High risk contacts of a case (pregnant women, immunocompromised):

Serological proof of immunity<sup>3</sup> (at any time in the past)

OR

documented receipt of 2 doses of varicella containing vaccine

EXCEPT

<sup>2</sup> Children and adolescents recorded in the immunization registry as exempt from varicella vaccine due to 'prior disease' should be considered immune for all practical purposes. Requirements for specific individuals may be more stringent e.g., for health care workers, and serological proof of immunity may be requested.

<sup>3</sup> Serology (IgG) should be used for testing for immunity, although it is most reliable for this purpose in individuals with wild type immunity, and is less sensitive in the detection of vaccine-derived immunity.

HSCT recipients, who should be considered susceptible even if previously immunized or had disease if they are post transplantation, unless they have been immunized post transplantation.

**Consider as susceptible the following:**

Any person with one of the following should be considered varicella susceptible:

- history of varicella illness before the 1<sup>st</sup> birthday without subsequent immunization with 2 doses of varicella-containing vaccine
- no or uncertain history of two doses of varicella vaccine given after the 1<sup>st</sup> birthday
- history of varicella or herpes zoster in/ after 2004 at the time of the disease episode without laboratory confirmation
- non-immune VZV IgG serology
- an individual within the post HSCT period regardless of a history of varicella or positive serologic test results pre-transplant

**Note:** Adults who have emigrated from tropical/subtropical areas are less likely to have acquired chickenpox in childhood and are more often susceptible to VZV than those who grew up in temperate climates. There is evidence that this may be less true for those who lived in urban settings.

## 7.0 IMMUNOPROPHYLAXIS OF SUSCEPTIBLE CONTACTS

Post-exposure immunoprophylaxis includes varicella vaccine to those without contraindications to vaccine receipt, or varicella zoster immune globulin (VarIg) to high risk susceptible individuals (as below).

See [Communicable Disease Control Manual, Chapter 2, Part 4-Biological Products: Vaccines and Immune Globulins](#), varicella vaccine and varicella zoster immune globulin pages for details of product administration.

Healthy susceptible contacts with an uncertain or incomplete history of prior varicella vaccine receipt should be offered up to 2 doses of varicella vaccine without prior testing for immunity.

Varicella vaccination has been shown to be effective in preventing or reducing the severity of varicella if given to a susceptible individual within 3 to 5 days after exposure to wild-type varicella. Post-exposure vaccination should be given as soon as possible after exposure but vaccination is still indicated 5 or more days post-exposure because it induces protection against subsequent exposures. There is no evidence that administration of varicella vaccine during the presymptomatic or prodromal stage of illness increases the risk of adverse events following immunization or more severe natural disease.

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## 7.1 Varicella Zoster Immune Globulin (Varlg)

Varicella zoster immune globulin is only recommended for the following susceptible high risk persons following a significant exposure to varicella-zoster, and in whom receipt of varicella vaccine is contraindicated:

- Immunocompromised clients (congenital or acquired) due to treatment or disease including some clients receiving high doses of corticosteroids;
- Newborn infants whose mothers develop varicella disease 5 days before to 48 hours after delivery or have active zoster lesions to which the newborn may have been exposed;
- Infants and children in neonatal or pediatric intensive care settings, as determined by infectious disease/infection control specialist;
- Haematopoietic stem cell transplant recipients;
- Varicella-susceptible pregnant women; and
- Varicella-susceptible HIV-infected persons.

Contact the Blood Bank at the nearest hospital or Canadian Blood Services to obtain Varlg if indicated. Varlg should be administered as soon as possible following exposure, and ideally within 96 hours after first exposure for maximal benefit. Administration more than 96 hours after exposure is of uncertain benefit; at this late stage, it may attenuate but not prevent disease. It may be given if less than 10 days have elapsed since the last exposure.

If a second varicella exposure occurs more than 3 weeks after a dose of Varlg, another dose of Varlg should be given.

## 8.0 REPORTING

Varicella (chickenpox) including vaccine-modified varicella, and zoster (shingles), are not currently reportable in BC. Varicella surveillance for hospitalized cases is conducted in 12 pediatric tertiary care hospitals, including BC Children's Hospital through the Immunization Monitoring Program ACTIVE (IMPACT).

## 9.0 CLINICAL DESCRIPTION

Varicella zoster virus (VZV) is a DNA virus of the herpes virus family. It causes two diseases: varicella (chickenpox), the primary infection, and herpes zoster (shingles), a secondary infection due to a reactivation of latent varicella infection in the dorsal root ganglia.

Chickenpox typically affects children under the age of 10 years; 5-10% of the population remain susceptible to the disease in adulthood. The estimated average lifetime risk of reactivation as zoster/shingles is 28% and can occur at any time, most



often after 60 years of age.

Chickenpox is manifested as a generalized, itchy rash that progresses quickly from macules to papules to vesicular lesions before crusting. The rash usually appears first on the head, next on the trunk and then on the extremities. Successive crops of lesions appear over several days, with different stages of maturity present at the same time. Healthy children usually have 250-500 lesions. A mild prodrome including fever and malaise may precede the rash.

In shingles, vesicles with an erythematous base appear in crops in irregular fashion on the surface of the skin innervated by a specific nerve. Severe pain and paresthesia are common.

Complications are more frequent in adolescents, adults, immunocompromised persons, and pregnant women. Severe disease, disseminated varicella, and zoster are more likely to develop in immunocompromised persons. The complications of chickenpox include secondary bacterial skin and soft tissue infections, otitis media, bacteremia, pneumonia, osteomyelitis, septic arthritis, endocarditis, necrotizing fasciitis, toxic shock-like syndrome, hepatitis, thrombocytopenia, cerebellar ataxia, and encephalitis. Herpes zoster may result in permanent neurological damage such as cranial nerve palsy or visual impairment after zoster ophthalmicus. The most common debilitating complication of zoster is postherpetic neuralgia, defined as pain that persists after resolution of the zoster rash. This pain may last a year or longer after the episode of zoster. Incidence of postherpetic neuralgia increases with age.

The incidence of congenital varicella syndrome among infants born to mothers with varicella is approximately 2% when infection occurs between 13 and 19 weeks of gestation. The syndrome is rare when infection occurs before the 13<sup>th</sup> or after the 20<sup>th</sup> week. Congenital varicella syndrome results in a wide clinical spectrum, which may include low birth weight, ophthalmic abnormalities, skin scarring, limb atrophy, cerebral atrophy and other anomalies.

Infants exposed to varicella zoster virus in utero during the second 20 weeks of pregnancy can develop inapparent varicella and subsequent zoster early in life without having had extrauterine varicella.

Varicella infection can be fatal for an infant if the mother develops varicella from 5 days before to 2 days after delivery. When varicella develops in a mother more than 5 days before delivery and gestational age is 28 weeks or more, the severity of disease in the newborn is modified by transplacental transfer of VZV-specific maternal IgG antibody.

The case fatality rates for varicella are highest among adults (30 deaths/100,000 cases), followed by infants under one year of age (7 deaths/100,000 cases.) While complications are more frequent in adolescents than in children, the case fatality rates are lowest in the 1-19 years age group (1-1.5 deaths/100,000 cases.)

## 9.1 Vaccine-Modified Disease

Vaccine modified disease is defined as a varicella infection occurring after exposure to wild-type virus, more than 42 days following vaccination.

Varicella vaccine is not 100% effective, but a single dose of the vaccine prevents 95% of severe disease. Individuals who develop varicella after vaccination usually have mild disease (“vaccine-modified infection”.) Individuals typically develop fewer than 50 skin lesions that are more commonly atypical, with papules that do not progress to vesicles.

Individuals with vaccine-modified infection experience a shorter duration of illness and lower incidence of fever than those with natural infection who were not vaccinated. Approximately 25%-30% of vaccine-modified infections are not mild, with clinical features more similar to those in unvaccinated children.

There have been varying estimates of the rate of vaccine-modified disease. In the U.S., during a ten-year surveillance period (1995-2004) the rate of vaccine-modified disease was 9.5%. The severity and incidence of vaccine-modified disease among vaccinees increased with the time since vaccination.

Both primary and secondary vaccine failures can occur. Following vaccination there is waning immunity over time, and less opportunity to boost immunity through circulating VZV because of declining chickenpox rates.

## 9.2 Differential Diagnosis of Varicella

The differential diagnosis of varicella-like illness includes other viral exanthems, disseminated herpes simplex (especially in the immunocompromised host or neonate), and atypical zoster. Enteroviral infections can cause papulovesicular lesions that occur on the palms and soles, with vesicular lesions on the buccal mucosa. Impetigo can result in erythematous macules which progress to vesiculopustular lesions that dry and crust. Exposed areas such as the face, neck, and limbs are often involved, and group A Streptococcus is usually the etiologic agent.

## 10.0 EPIDEMIOLOGY OF VARICELLA IN BRITISH COLUMBIA

The epidemiology of varicella in British Columbia has dramatically changed, with a large decrease in varicella incidence since the introduction of the publicly funded varicella vaccine. Prior to routine introduction of varicella vaccine into the childhood immunization schedule in BC, varicella-zoster virus caused up to 47,500 cases of chickenpox (varicella) each year in BC. There were 17,000 visits to a physician, 172 hospitalizations and 1-2 deaths annually in BC due to chickenpox alone. The implementation of the publicly funded program in BC saw a decrease in varicella



physician visits by 84%, and a 78% decrease in hospitalizations between 1994 and 2012. The greatest reduction was seen in children 0-9 years old, however, there has been evidence of indirect protection through reductions in the incidence of varicella in both infants and those 10 to 39 years of age.

## 11.0 VARICELLA IMMUNIZATION IN BC

Routine varicella immunization (1 dose) began in 2004 with susceptible children at school entry and Grade 6 (birth year cohorts 1993 and 1999). In 2005, routine immunization was provided for infants at 12 months of age (infants born on or after January 1, 2004). A catch-up for children 18 to 48 months of age began that same year, with an active catch-up for these children in 2006 along with a catch-up for other susceptible children, adolescents, and adults at opportune health encounters (i.e., “universal varicella program”).

In 2012, the routine varicella immunization program was changed from 1 dose to 2 doses for children. The routine immunization program for children consists of 1 dose provided at 12 months of age and a 2<sup>nd</sup> dose provided at school entry (4-6 years of age) with the second dose provided as MMRV. In addition, a 2<sup>nd</sup> dose of varicella vaccine was provided to eligible grade 6 students (beginning in the 2012-2013 school year).

Immunization coverage rates are assessed using immunization registry data or aggregate reporting from health authorities. Results of varicella vaccine coverage assessment at the 2<sup>nd</sup> birthday and at kindergarten or the 7<sup>th</sup> birthday are available on the BCCDC website ([Immunization Coverage](#)).

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