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4.1 Diseases Preventable by Routine Vaccination

Introduction

This section includes the procedure required in order to complete investigation, control and reporting measures for diseases that are vaccine preventable and on the notifiable diseases list for Newfoundland and Labrador. The disease may be respiratory (e.g. influenza) and is covered here as it is primarily a disease preventable by routine immunization. The diseases discussed in this section are covered by publicly funded immunization programs for targeted groups in Newfoundland and Labrador.

For each of these diseases, immediate recognition and control measures are vital to containment. Vaccine Preventable Diseases should be rare when the immunization programs are effective.

The follow-up varies with each disease, dependant upon several disease-specific factors. The following are general guidelines and further description is provided in the specific disease section.

General procedure

- Confirm the diagnosis, and confirm whether or not the case has been informed and treated. If confirmation is delayed request immediate notification of test results from the laboratory
- Obtain required demographic information in relation to the case and the attending physician
- Contact the case to determine if this individual is in a situation where there is a high risk of transmission of the illness (childcare, health care worker etc.)
- Investigate the most probable source of infection which should include:
 - recent exposure to someone else who is sick with similar symptoms
 - travel history
 - attendance in childcare, school, daycare, healthcare settings
- Conduct contact tracing to determine if any contacts are from a high risk group
- Conduct contact tracing to inform contacts of any prophylaxis, vaccine and/or exclusion measures
- If an outbreak is identified an outbreak team is formed to complete the investigation and follow-up required
- Educate case and contacts regarding the disease
- Complete case detail investigation forms
- Report as per List A, B, C

Publicly funded treatment (antibiotics or antivirals) is indicated for many of the vaccine preventable diseases and is addressed in the specific disease section.

4.2 Diphtheria

Etiology

Diphtheria is an acute, toxin mediated disease caused by the bacteria toxigenic strains of *Corynebacterium (C.) diphtheria* of gravis, mitis or intermedius biotypes. Toxigenic strains express an exotoxin that inhibits cellular protein synthesis and is responsible for local tissue destruction and membrane formation. The toxin produced at the membrane site is absorbed into the bloodstream and then distributed to the tissues. The most severe disease is associated with the gravis biotype, but any biotype may produce the toxin. Non-toxin producing strains generally produce milder illness.

Case Definitions

Confirmed Case

Clinical illness¹ or systemic manifestations compatible with diphtheria in a person with an upper respiratory tract infection, or at another site (e.g. wound, cutaneous) PLUS at least one of the following:

Laboratory confirmation of infection:

- isolation of *Corynebacterium diphtheria* with confirmation of a toxin from an appropriate clinical specimen **OR**
- isolation of other *Corynebacterium* species (*C. ulcerans* or *C. pseudotuberculosis*) from an appropriate specimen including the exudative membrane **OR**
- histopathologic diagnosis of diphtheria **OR**
- epidemiologic link (contact within 2 weeks prior to an onset of symptoms) to a laboratory-confirmed case

Probable Case

Clinical Illness¹ in the absence of laboratory confirmation or epidemiologic link to a laboratory-confirmed case.

Suspected Case

Upper respiratory tract infection (nasopharyngitis, laryngitis, or tonsillitis) with a nasal, tonsillar, pharyngeal and/or laryngeal membrane.

¹ Clinical illness is characterized as an upper respiratory tract infection (nasopharyngitis, laryngitis, or tonsillitis) with or without an adherent nasal, tonsillar, pharyngeal and/or laryngeal membrane, plus at least one of the following:

- gradually increasing stridor
- cardiac (myocarditis) and or neurologic involvement (motor and/or sensory palsies) 1-6 weeks after onset
- death, with no known cause

Clinical Presentation

Diphtheria is an acute bacterial disease that can involve almost any mucous membrane. The characteristic lesion, caused by liberation of a specific cytotoxin, is marked by a patch or patches of an adherent grayish-white membrane with surrounding inflammation. The infection most often manifests as membranous naso-pharyngitis or obstructive laryngotracheitis. The toxin produced by some strains can cause severe damage to the throat or other tissues.

Occasionally, *C. diphtheriae* disseminates from the skin or respiratory tract and causes invasive systemic infections including bacteremia, endocarditis and arthritis. Diphtheria can be classified based on site of infection:

Pharyngeal/tonsillar: This is the most common site of infection and is associated with the absorption of toxin. The onset is insidious. Early symptoms include malaise, sore throat, anorexia and low-grade fever. Two to three days later the membrane appears in the pharyngeal/tonsillar area. The membrane initially appears white and glossy, but evolves into a dirty gray color with patches of green or black necrosis. The extent of the membrane correlates with the severity of symptoms (i.e., with posterior pharynx, soft palate and periglottal area involvement, profound malaise and obstructed breathing may occur). In cases of severe disease the individual may also develop edema of the submandibular areas and the anterior neck, along with lymphadenopathy, giving the characteristic “bullneck” appearance. The individual may recover or, depending on the amount of toxin absorbed, develop severe illness, pallor, rapid pulse, stupor and coma with death occurring in six to 10 days.

Nasal: Infection limited to the anterior nares presents with a serosanguinous or seropurulent nasal discharge often associated with a subtle whitish mucosal membrane, particularly on the septum. Signs indicating toxin effect are rare.

Laryngeal: This may be either an extension of the pharyngeal form or be the only site involved. Symptoms include fever, hoarseness and a barking cough. Development of the membrane may lead to airway obstruction, coma, and death.

Cutaneous: *C. diphtheriae* can cause clinical skin infections characterized by a scaling rash or by chronic non-healing ulcers with a dirty gray membrane and are often associated with *Staphylococcus aureus* and group A streptococci. This type of diphtheria is often associated with overcrowding, impoverished groups and homeless persons. Cutaneous sites of *C. diphtheriae* have been shown both to contaminate the inanimate environment and to induce throat infections in others. Bacterial shedding from cutaneous infections continues longer than from the respiratory tract. Because *C. diphtheriae* is usually isolated in association with other known skin pathogens, and because the ulcers do not respond to antitoxin therapy, there is debate as to whether or not the isolates are actually causing clinical illness.

Invasive Disease: Complications are predominantly attributable to the effects of the toxin. The two most common complications are myocarditis and neuritis. In most cases, the cardiac manifestations appear during the latter part of disease progression. The more extensive the local lesion and the more delayed the initiation of antitoxin therapy, the more frequently myocarditis occurs. Neuritis most often affects motor nerves and

usually resolves completely. Other complications include otitis media and respiratory insufficiency due to airway obstruction, especially in infants.

Diagnosis

Diagnosis is usually made based on history and clinical presentation as it is essential to begin therapy as soon as possible. Diagnosis is confirmed by bacteriologic examination of specimens. The laboratory should be notified as soon as the diagnosis is suspected since the successful isolation of *C. diphtheriae* depends on the rapid inoculation of special culture media.

Prior to specimen collection call the Provincial Public Health Laboratory (PHL) for guidance on specimen collection and transport recommendations at 709-777-6583.

Epidemiology

Occurrence

Diphtheria occurs worldwide and is endemic in many developing countries as well as in Albania, Russia and other countries of the former Soviet Union. In other countries, occasional cases of imported diphtheria are identified. Resurgence of diphtheria has been reported in countries with low vaccine coverage. A total of 4,187 cases of diphtheria were reported to the World Health Organization (WHO) in 2010. The potential for re-emergence of diphtheria if immunization levels decline was demonstrated during the 1990s in the Commonwealth of Independent States (former Soviet Union) when over 140,000 cases and 4,000 deaths were reported.

In Canada, immunization has resulted in a dramatic decline in diphtheria cases. A small number of toxigenic strains of diphtheria bacilli are detected each year (0 to 5 isolates), although classic diphtheria is rare. Serosurveys of healthy adult populations in Canada indicate that approximately 20% (higher in some age groups) do not have protective concentrations of antibody to diphtheria; adult booster doses are required. In recent years there have been very few cases in Canada with none reported since 2000, and a total of 12 cases seen since 1991.

In Newfoundland and Labrador there have been no cases of diphtheria reported through the surveillance system from 1990 – 2012; the last death from diphtheria was recorded in 1964.

Reservoir

Humans.

Transmission

Diphtheria is transmitted by person-to-person spread from the respiratory tract or, rarely, by contact with articles soiled with excretions of infected persons.

Incubation Period

The incubation period is about 2 to 5 days (range, 1 to 10 days).

Communicability

The infectious period in untreated persons is usually 2 weeks or less and, rarely, more than 4 weeks. Chronic carriers are asymptotically colonized with *C. diphtheria* on the skin or in the nasopharynx and may shed organisms for 6 months or more.

Control Measures

Management of Cases

Investigations

- Confirm the diagnosis and strain
- Notify the Medical Officer of Health (MOH) and the PHL
- Identify if person had recent contact with a case or carrier, or contact with articles soiled with the discharges from lesions of infected individuals
- Review the travel history
- Determine immunization history
- Identify close contacts

Treatment

- Treatment should begin as soon as possible based on clinical symptoms
 - Therapy should not be delayed until bacteriologic confirmation is obtained
- Diphtheria antitoxin (DAT) is considered the mainstay of treatment
 - The antitoxin blocks or neutralizes the effects of the toxin
 - Delayed administration increases the risk of late effects such as myocarditis and neuritis
 - Currently there is no licensed product made in Canada. An antidiphtheria serum is made available from Health Canada's Special Access Program (SAP)
 - Contact the Chief Medical Officer of Health or the MOH for assistance in obtaining the product diphtheria antitoxin accessed through the Department of Health and Community Services (DH&CS) by calling 709-729-3430 or the MOH after hours 1-866-270-7437
- Antibiotic therapy is required to eradicate the organism, to stop toxin production and prevent transmission
 - Antibiotic treatment is not a substitute for antitoxin.
 - Laboratory specimens should be collected before antibiotics are started
 - Elimination of *C. diphtheriae* should be confirmed by two negative cultures of throat and nasopharyngeal swabs taken at least 24 hours apart and a minimum of 2 weeks after antibiotic treatment is completed

Immunization

Cases should be given a complete primary course of toxoid, as indicated by age, unless serologic testing indicates protective levels of antitoxin, since diphtheria infection does not necessarily confer immunity.

Exclusion

- Hospitalized cases should be on Droplet and Contact Precautions
 - Discontinue precautions only in consult with the Infection Control Practitioner
- Non-Hospitalized (Community) Case
 - Minimal contact with other persons in the home is recommended until proof of elimination of *C. diphtheriae* organism is demonstrated

Management of Contacts

Contact tracing should be initiated promptly and should begin in the household of the suspected or confirmed case, as the risk of infection is directly related to the closeness and duration of contact and the intensity of exposure.

Definitions**Contacts**

All persons who have been in contact with a case of diphtheria caused by toxigenic *C. diphtheriae* in the previous 7 days should be considered at risk.

Close contacts include

- Household members
- Friends, relatives, and caretakers who regularly visit the home
- Kissing and/or sexual contacts
- Those who share the same room at school or work
- Healthcare workers exposed to the respiratory secretions of the infected person (staff who have taken appropriate isolation precautions need not be considered contacts)

Carrier

A carrier is defined as a person who harbors and may disseminate *C. diphtheriae* but who manifests no upper respiratory tract (pharyngitis or laryngitis) or systemic symptoms. Carriers include those with otitis media, nasal or cutaneous infections and asymptomatic pharyngeal infections due to toxigenic *C. diphtheriae*.

Immunoprophylaxis

- Close contacts of a diphtheria case should receive a dose of a diphtheria toxoid-containing vaccine as appropriate for age unless the contact is known to have been fully immunized and the last dose of diphtheria toxoid-containing vaccine was given within 10 years

- The diphtheria toxoid-containing vaccine series should be completed for previously unimmunized or incompletely immunized contacts

Chemoprophylaxis

- Antibiotic prophylaxis should be given to all contacts regardless of vaccination status
- Diphtheria antitoxin is not recommended for prophylaxis of immunized or unimmunized close contacts of diphtheria cases, given the substantial risk of allergic reaction to equine serum and lack of evidence of additional benefit of antitoxin for contacts who have received antimicrobial prophylaxis

Exclusion

- Regardless of vaccination status, all close contacts should be kept under daily surveillance for 7 days from the date of last contact with the case and assessed clinically for signs and symptoms of diphtheria, and samples for culturing should be taken from nasal and pharyngeal swabs before antibiotic treatment is started
- Contacts whose occupations involve handling food (especially milk) or involve close contact with unimmunized persons (including children, the elderly, or members of religious groups who do not accept immunizations) should be excluded from their work until bacterial examination proves them not to be carriers
- Non-hospitalized carriers should be excluded from the workplace or school until two negative cultures are obtained after completion of antibiotics. Contact with other persons in the home should be minimized when appropriate. Individuals who are carriers should be instructed to pay strict attention to personal hygiene by
 - Covering the nose and mouth with tissue when coughing
 - Placing all contaminated tissues directly into garbage containers
 - Cleaning hands with soap and water every time there is contact with respiratory secretions or infected wounds
 - Keeping all infected wounds covered

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Preventive Measures

- Education measures are important. Inform the public, particularly parents of young children, of the hazards of diphtheria and the need for vaccination
- The most effective preventive measure is widespread vaccination with diphtheria toxoid
- Maintain continual improvements in childhood and adult vaccination coverage rates
- Special efforts should be made to ensure that people at higher risk of exposure eg., health care workers, are fully vaccinated

- Travelers should be vaccinated if they have not had a booster dose of diphtheria in the last 10 years.

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network for Public Health Intelligence (CNPHI) tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs.

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4.3 *Haemophilus influenzae*, serotype B, invasive disease

Etiology

Haemophilus influenzae (*H. influenzae*) disease is caused by the bacterium *Haemophilus influenzae*. There are six identifiable types of *Haemophilus influenzae* bacteria (a through f) and other non-identifiable types (called non-typeable). *Haemophilus influenzae* type b (Hib) is the most common type and is the only type that is vaccine preventable. All laboratory confirmed invasive *Haemophilus influenzae* disease cases are reportable. The case definition for invasive non-type B is found at the following link:

http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/35s2/Haemo_non_b-eng.php

Case Definition

Confirmed Case

Clinical evidence of invasive disease² with laboratory confirmation of infection:

- isolation of *H. influenzae* (serotype b) from a normally sterile site **OR**
- isolation of *H. influenzae* (serotype b) from the epiglottis in a person with epiglottitis

Probable Case

Clinical evidence of invasive disease with laboratory evidence of infection:

- demonstration of *H. influenzae* type b antigen in cerebrospinal fluid **OR**
- demonstration of *H. influenzae* DNA in a normally sterile site **OR**
- buccal cellulitis or epiglottitis in a child < 5 years of age with no other causative organisms isolated **OR**
- demonstration of *H. influenzae* type b antigen in cerebrospinal fluid

Clinical Presentation

Haemophilus influenzae serotype b (Hib) can cause pneumonia, bacteraemia, meningitis, epiglottitis, septic arthritis, cellulitis, otitis media and purulent pericarditis. The onset of symptoms is usually sudden with development of symptoms associated with the disease presentation; for example, with Hib meningitis symptoms may include fever, vomiting, lethargy, headache and stiff neck.

² Clinical illness associated with invasive disease due to *H. influenzae* includes meningitis, bacteraemia, epiglottitis, pneumonia, pericarditis, septic arthritis and empyema.

Diagnosis

The diagnosis is made by the isolation of the *Haemophilus influenzae* organism from a normally sterile site. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Worldwide, Hib disease is estimated to cause three million cases of meningitis and severe pneumonia and approximately 386,000 deaths worldwide per year in children aged <5 years. In developed countries, the incidence of Hib disease has dramatically declined since the introduction of the Hib conjugate vaccine in 1988. In Canada the incidence rate has declined from 1.9 per 100,000 in 1989 to 0.2 per 100,000 in 2004. In Newfoundland Labrador, there have been four cases of Hib reported from 1998 to 2015. Invasive *Haemophilus influenzae* non-type B has also been identified in the elderly and is a notifiable disease.

Reservoir

Humans are the only known reservoir.

Transmission

The mode of transmission is person-to-person by inhalation of respiratory droplets or by direct contact with respiratory tract secretions.

Incubation Period

The incubation period is unknown but believed to be short, 2 – 4 days.

Communicability

It is communicable seven days prior to the onset of symptoms until the case has been on effective antibiotic therapy for 24 hours. If untreated Hib is communicable as long as organisms are present.

Control Measures

Management of Case

Investigations

- Verify the diagnosis and confirm the serotype with the laboratory
- Obtain a case history
- Estimate the period of communicability
- Review immunization status
- Identify contacts

Treatment

- Prompt treatment with an antibiotic is required

- Droplet precautions are recommended for hospitalized cases until the case has had 24 hours of effective antibiotic therapy
- Determine if the case needs chemoprophylaxis. It is not indicated in cases treated with cefotaxime or ceftriaxone as these drugs eradicate Hib from the nasopharynx.

Immunization

Complete the age appropriate vaccine schedule according to the Newfoundland and Labrador Immunization Manual available on the web site

http://www.health.gov.nl.ca/health/publichealth/cdc/S2_Routine_Imztn_Schedules_060116.pdf

Exclusion

Isolation of the case from household contacts may be of little benefit since the infection has usually spread by the time the first case is suspected.

Management of Contacts

Contact tracing needs to begin immediately after identification of a case. It is important to identify exposed, unimmunized or incompletely immunized children who are household, child care or nursery school contacts.

Definitions***Household Contact***

- An individual residing with the case or has spent 4 or more hours per day with the case for at least 5 of the 7 days preceding the day of hospital admission of the case (not school contacts). This includes people who share sleeping arrangements, such as in a dormitory setting. It is assumed that when children have spent 4 or more hours together per day, they are likely to have napped and/or eaten together, which increases transmission risk.

Childcare contact

- A contact who has attended a childcare or nursery school center where an infected individual has been identified.

Immunoprophylaxis

Post-exposure is an ideal opportunity to review and update the immunization status of contacts. Post-exposure Hib immunization is not known to decrease the risk of transmission.

Chemoprophylaxis

The aim of chemoprophylaxis is to eliminate nasopharyngeal carriage of Hib bacteria and prevent transmission.

Chemoprophylaxis is recommended for all household contacts in the following circumstances:

- Household with at least one contact younger than four years of age who is unimmunized or incompletely immunized (as per Newfoundland and Labrador Immunization Manual)
- Households with a child younger than 12 months of age who has not completed the primary Hib series (3 dose primary series)
- Households with a contact who is an immunocompromised child, regardless of that child's Hib immunization status
- Childcare and preschool contacts when two or more cases of Hib invasive disease have occurred within 60 days and unimmunized or incompletely immunized children attend the childcare facility or preschool

Chemoprophylaxis is not required for:

- Contacts of invasive *Haemophilus influenzae* (not type b) cases
- Household contacts of invasive Hib infection when the contacts have completed the Hib vaccine series
- Occupants of households with no children younger than four years of age other than the index patient
- Childcare and preschool contacts of one index case
- Pregnant women

Product

- Rifampin eradicates Hib from the pharynx in approximately 95% of carriers and decreases the risk of secondary invasive illness in exposed household contacts.
 - Rifampin is given once per day for four days
 - Weight of child is required for dosage
 - MOH provides the prescription
 - Rifampin is available for contacts of Hib disease at no charge

Exclusion

Contacts do not need to be excluded from any routine activities.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures at the discretion of the MOH.

Education and Preventive Measures

- Careful observation of exposed, unimmunized or incompletely immunized children who are household, childcare or preschool contacts of patients with invasive Hib disease is essential. Exposed children who develop symptoms should receive immediate medical evaluation.
- The early prevention of Hib disease through immunization remains the first line of defense against the disease and its circulation.
- Provide information on the disease and symptoms
 - A fact sheet is available on website
<http://www.phac-aspc.gc.ca/im/vpd-mev/hib-eng.php> OR
[http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/Haemophilus%20influenzae%20type%20b%20\(Hib\)%20May%202013.pdf](http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/Haemophilus%20influenzae%20type%20b%20(Hib)%20May%202013.pdf)

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network of Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak occurs across RHAs

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4.4 Hepatitis B

Etiology

The hepatitis B virus (HBV) is a DNA virus, composed of a nucleocapsid core (HBcAg), surrounded by an outer lipoprotein coat containing the surface antigen (HBsAg). The distribution of subtypes varies geographically. No differences in clinical features have been related to subtypes. The third hepatitis B antigen, the “e” antigen (HBeAg), has been identified as a soluble antigen, whose sequences are a subset of those in the core antigen, but without cross-reactivity. The presence of HBeAg is known to be a marker of highly replicative and infectious state for HBV.

Case Definitions

Confirmed Case

- Hepatitis B surface antigen (HBsAg) and immunoglobulin M antibody to hepatitis B core Antigen (anti-HBc- IgM) positive in the context of a compatible clinical history or probable exposure **OR**
- Clearance of HBsAg in a person who was documented to be HBsAg positive within the last six months in the context of a compatible clinical history or probable exposure

Probable Case

- An acute clinical illness in a person who is epidemiologically linked to a confirmed case

Chronic carrier confirmed case

- HBsAg positive for more than 6 months **OR**
- Detection of HBsAg in the documented absence of anti-HBc-IgM **OR**
- Detection of HBV DNA for more than 6 months.

Unspecified confirmed case

- Does not fit the criteria for either of the above **AND**
- HBsAg positive **OR**
- Detection of HBV DNA.

Clinical Presentation

Hepatitis B virus (HBV) causes a wide spectrum of manifestations ranging from asymptomatic seroconversion, sub-acute illness with non-specific symptoms (e.g., anorexia, nausea, or malaise) or extrahepatic symptoms, and clinical hepatitis with jaundice, to fulminant fatal hepatitis.

Only a small proportion of acute hepatitis B cases may be clinically recognized. Less than 10% of children and 30–50% of adult acute cases will have icteric disease.

Hepatitis B in children is most often milder and often anicteric. In infants, this disease is typically asymptomatic.

In persons with clinical illness, the onset is usually insidious with anorexia, vague abdominal discomfort, nausea and vomiting, sometimes arthralgias and rash, often progressing to jaundice. Fever may be absent or mild. Severity ranges from unapparent cases detectable only by liver function tests to fulminating, fatal cases of acute hepatic necrosis. The case-fatality rate in hospitalized patients is about 1% and is higher in those over 40 years of age.

Following acute HBV infection, the risk of developing chronic infection varies inversely with age. Infants infected with HBV at birth will have a 90% chance of becoming chronic HBV carriers. Twenty-five per cent to 50% of children infected between one and five years of age and about 1–10% of persons infected as older children and adults will become chronic HBV carriers.

Chronic HBV infection is found in 0.5% of North American adults and in 0.1–20% of people from other parts of the world. Persons with chronic infection may or may not have a history of clinical hepatitis. About one-third have an elevated aminotransferase. Biopsy findings range from normal to chronic active hepatitis, with or without cirrhosis. The prognosis of the liver disease in such persons is variable.

Chronic HBV infection is also common in persons with immunodeficiency. An estimated 15–25% of persons with chronic HBV infection will die prematurely of either cirrhosis or hepatocellular carcinoma. HBV may be the cause of up to 80% of all cases of hepatocellular carcinoma worldwide, second only to tobacco among known human carcinogens.

Diagnosis

To confirm hepatitis B all suspected cases and contacts of hepatitis B should be tested. The specimen of choice for the diagnosis of HBV infection is blood. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Hepatitis B occurs worldwide and is endemic with little seasonal variation. In areas of Africa and Asia, widespread infection may occur in infancy and in childhood. In North America, infection is most common in young adults. In the United States and Canada, serologic evidence of previous infection varies depending on age and socioeconomic class. Overall, 5% of the adult population in the US has anti-HBc total and 0.5% is HBsAg positive. Among those from some areas of Asia, 10–15% may be HBsAg positive.

In developed countries, exposure to HBV may be more common in certain groups. These include injection drug users (IDUs), people with multiple sexual partners, men who have sex with men (MSM), clients and staff in institutions for the developmentally disabled, employees in hemodialysis centres and persons in certain healthcare and public safety occupations.

Percutaneous and permucosal exposure to blood or serous fluids are associated with occupationally acquired HBV infections. Surgeons, dentists, oral surgeons, pathologists, operating room and emergency room staff and clinical laboratory workers who handle blood are at highest risk of exposure, however, the majority should be immune to infection if they have received hepatitis B vaccine.

In NL chronic cases are the most common type identified with acute cases rarely identified.

Reservoir

Humans

Transmission

Hepatitis B virus is transmitted through percutaneous or mucosal contact with infectious biological fluids. Transmission of HBV occurs through close contact with infectious bodily fluids, including through sharing of injection drug equipment (such as needles), sexual contact, and from mothers who are acute cases or carriers to their newborns. The risk of transfusion-related HBV is extremely low because all blood and blood products are tested. Saliva is considered infectious in bite wounds with broken skin involving the inoculation of saliva, or when it is visibly tainted with blood. Almost one-third of people with HBV infection have no identified risk factors.

Body substances capable of transmitting HBV include: blood and blood products; saliva (although no outbreaks of HBV infection due to saliva alone have been documented); cerebrospinal fluid; peritoneal, pleural, pericardial and synovial fluid; amniotic fluid; semen and vaginal secretion; any other body fluid containing blood; and unfixed tissues and organs. Transmission from breast milk is unlikely. Feces, nasal secretions, sputum, sweat, tears, urine and vomitus are not implicated unless they are visibly contaminated with blood.

Incubation period

The incubation period is 45 to 180 days, with an average of 60 to 90 days.

Communicability

Communicability can occur while HBsAg is present in blood and is highest during the acute phase of illness. Persons in the “window period” and those rare persons who are concurrently HBsAg and anti-HBs positive should be considered infectious. In the latter case, if HBsAg disappears and anti-HBs remains, persons can be considered non-infectious. The presence of “e” antigen or high levels of viral DNA indicate high virus

titres and higher infectivity, while the presence of “e” antibody and low levels of viral DNA indicate reduced infectivity.

Control Measures

Management of Case

Investigations

- Contact the physician, if possible, before contacting the client to determine:
 - acute or chronic infection,
 - reason for the test,
 - possible source,
 - client symptoms,
 - any past negative test
 - relevant laboratory results e.g., Liver Function Tests, and
 - if testing of relevant contacts has occurred.
- Assess risk factors for acquisition of hepatitis B infection
- Determine hepatitis B immunization history
- If female, determine pregnancy status
- Identify household and other intimate/sexual contacts of the case for potential blood and/or body fluid exposure (significant contacts)
- For acute cases, this should include all current significant contacts as well as those in the previous six months
- For chronic carriers, include current contacts as well as those within the last six months. This trace-back period may be extended back if any known illness signs or symptoms indicate seroconversion, if know risk taking behaviors are reported or if previous negative tests are identified.

Treatment

- Public health personnel should contact physicians to make them aware of the usual public health follow-up
- Provide education about the modes of transmission for the purpose of reducing infection risk to others

- Promote a healthy lifestyle to minimize liver damage e.g., avoid intake of alcohol and hepatotoxic drugs, eating a well-balanced diet, and having regular medical checkups
- Provide information about community support agencies

Medical follow-up for acute cases

- Acute cases should be tested for both HBsAg and anti-HBs six months (but can be as soon as three months) after detection to assess whether a chronic carrier state has developed

- If the person is in the “**window period**” at six months, the individual should be retested at six-month intervals to determine if they have developed anti-HBs while HBsAg remains negative
- Pregnant women should be tested more frequently if they will deliver before the six-month interval to establish whether or not prophylaxis of the newborn will be required (i.e., HBIG and hepatitis B vaccine)
- Referral for specialized care (i.e., hepatologist)

Medical follow-up for chronic carriers

- Chronic carrier management should be done in consultation with a specialist.
- Further testing may be required to determine extent of liver involvement.
- Details concerning treatment should be obtained in consultation with a hepatologist.

Immunization

Cases who are eligible should be immunized with hepatitis B vaccine according to the NL Immunization Manual schedule:

<http://www.health.gov.nl.ca/health/publichealth/cdc/immunizations.html>.

Exclusion

No isolation or exclusion is required for cases of hepatitis.

Management of Contacts

Definition of contact

A contact is someone who has been exposed or potentially exposed to the blood and/or body fluids of an infected case.

Immunoprophylaxis

Contacts should be appropriately vaccinated based on their prior immunization status.

Chemoprophylaxis

- Infants born to hepatitis B infected mothers should be given hepatitis B vaccine as well as hepatitis B immune globulin (HBIG) immediately after delivery
- Children less than one year in the same household of an acute or a chronic carrier should also be given HBIG
- All sexual and household contacts of acute cases of hepatitis B or of chronic carriers should be vaccinated with hepatitis B vaccine. A single dose of HBIG (0.06ml/kg) should be given for sexual contacts of the HBV infected individual if it can be administered within 14 days of last exposure.
- Post exposure prophylaxis (HBIG and vaccine) maybe indicated for contact with blood such as occurs as a result of a needle-stick injury

Exclusion

No isolation of contacts is required.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

- Immunization is the most effective preventive measure against hepatitis B
- Immunization for HAV, if non-immune, should be offered to all cases
- Immunization for HBV, if non-immune, should be offered to all contacts
- A hepatitis B school-based immunization program has been offered since 1995 in NL. All people born in 1986 and after have been offered the vaccine. An immunization program for high risk individuals is provided and can be found at http://www.health.gov.nl.ca/health/publichealth/cdc/im_section5.pdf
- Risk factors for hepatitis B infection include:
 - Birth in a region with high rate of endemic hepatitis B infection
 - Infant of a HBsAg positive mother
 - Sexual/household contacts of a person who is HBsAg positive
 - Men who have sex with men (MSM)
 - Unprotected sexual intercourse with new or multiple partners
 - Injection/inhalation drug use with sharing of supplies.
 - Occupations that have potential exposure to blood/body fluids
 - Children/workers in child care centers in which there is a child/worker with acute hepatitis B infection or a carrier for hepatitis B
 - Residents/staff of institutions for those with developmental delays
 - Inmates/staff of correctional facilities
 - Immunocompromised persons
 - Those requiring frequent blood transfusions or undergoing dialysis.
- Harm reduction, education and counseling are critical in prevention strategies. Individuals identified at high risk for exposure to HBV should be counseled on:
 - Avoiding sharing drug needles or other drug paraphernalia including “works” for injection or bills or straws
 - Avoiding unsanitary tattoo and body piercing methods
 - Avoiding sharing personal items such as toothbrushes, razors, nail clippers, and medical devices such as glucometers that may be contaminated with blood
- Persons with known risk behavior(s) should be offered HIV and other STBBI testing and counseling
- Review and monitor prevention practices at time of diagnostic testing for HBV
- Identify barriers to prevention practices and the means to overcome them
- All donations of blood, tissues and organs are tested for HBV; only donations tested negative are used
- Infection Control Routine Practices should be in place in healthcare facilities to

- prevent exposure of health care workers to blood and body fluids
- Fact sheets are available at
http://www.phac-aspc.gc.ca/hcai-iamss/bbp-pts/hepatitis/hep_b-eng.php
and
http://www.health.gov.nl.ca/health/publichealth/cdc/Protect_your_child_against_hepatitis_B.pdf
and
http://www.health.gov.nl.ca/health/publichealth/cdc/diabetes_care_february_2010.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and infection control practitioners (ICP), in the particular region, as required, for follow-up and case investigation
- The CDCN in collaboration with the physician or nurse practitioner (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network for Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.5 Influenza

Etiology

Influenza viruses belong to the *Orthomyxoviridae* family and are classified into three distinct types: influenza A, B and C. The majority of seasonal influenza epidemics are caused by influenza A and B viruses. Influenza A is further subtyped based on the 16 different hemagglutinin and nine unique neuraminidase surface glycoproteins.

Case Definitions

Confirmed Case

Only confirmed cases of disease should be reported to the province.

Clinical illness³ with laboratory confirmation of infection:

- isolation of influenza virus from an appropriate clinical specimen **OR**
- demonstration of influenza virus antigen in an appropriate clinical specimen **OR**
- significant rise (e.g. fourfold or greater) in influenza IgG titre between acute and convalescent sera **OR**
- detection of influenza RNA.

Clinical Presentation

Influenza typically begins with an abrupt onset of fever, chills, headache, prostration, myalgia and dry cough. These symptoms are commonly followed by sore throat, nasal congestion and rhinitis. The cough can last two weeks or more with the fever and other symptoms resolving in 5 to 7 days in uncomplicated cases.

The onset of influenza in children is similar to adults although calf muscle myalgia, cervical adenopathy and fever may be particularly prominent. Gastrointestinal (GI) involvement (nausea, vomiting and diarrhea) have been reported in children with influenza but GI involvement in adults is uncommon.

Complications from influenza infection include primary influenza viral pneumonia, bacterial pneumonia (e.g., *Streptococcus pneumoniae* and *Streptococcus pyogenes*), exacerbation of chronic pulmonary conditions, sinusitis, otitis media, febrile seizures, encephalitis, myositis and death. Reye syndrome has also been associated with influenza infections in children. It is typically seen in children who have been given aspirin to treat fever from influenza.

³ Clinical illness defined as influenza-like illness (ILI) is characterized as follows: acute onset of respiratory illness with fever and cough and with one or more of the following: sore throat, arthralgia, myalgia and prostration that could be due to influenza virus. In children under five, or 65 and older, fever may not be prominent. Note: Illness associated with novel influenza viruses may present with other symptoms.

Outbreaks of influenza are often associated with excess morbidity and mortality, and characterized by higher than normal rates of pneumonia and influenza-related hospitalizations and deaths

DIAGNOSIS

Clinical signs and symptoms are confirmed by laboratory findings. Kits for influenza testing are available through the Public Health Laboratory and information available at the website: <http://publichealthlab.ca/reportingname/influenza-virus-types-a-and-b/>

Information on specimen collection is available at the following web site

http://www.health.gov.nl.ca/health/publichealth/cdc/flu/specimen_collect_submit_influenza.pdf

EPIDEMIOLOGY

Occurrence

Influenza occurs in annual epidemics of varying severity depending on the strain circulating. Between three and five million severe cases, and 250,000 to 500,000 deaths occur each year worldwide. In Canada, influenza or “flu” season usually runs from November to April and an estimated 10-20% of Canadians may get the flu each year. Although most of these people recover completely, an estimated 3,500 Canadians, primarily seniors, die every year from pneumonia related to influenza and many others may die from other serious complications of influenza.

Reservoir

Humans; influenza A viruses can also circulate in birds, pigs, and horses. Influenza is usually not a zoonotic disease, although there can be exceptions. Influenza B viruses is believed to only circulate in humans. A third subtype of influenza virus exists, type C influenza, which is associated with sporadic cases and minor localized outbreaks. It does not cause nearly the significant burden of disease that influenza A and B does.

Transmission

Influenza is transmitted from person-to-person primarily via large droplet particles and droplet nuclei (i.e., aerosol) that are generated when the infected individual coughs or sneezes. These large droplets can settle on the mucosal surfaces of the upper respiratory tract of susceptible people who are within two feet of the infected individual.

Indirect transmission may also occur such as when touching surfaces contaminated with influenza virus and then touching the eyes or nose.

The virus can survive on hard surfaces (door handles, telephones, computer keyboards, light switches, countertops, etc.) for 1 – 2 days and on soft surfaces (cloth, tissues and paper) for 8 – 12 hours.

Incubation period

The incubation period for influenza is generally 1 to 3 days with an average of 2 days.

Communicability

The period of communicability is generally a day from clinical onset until 5 days after. Prolonged shedding may occur in immunocompromised individuals.

CONTROL MEASURES**Management of Case*****Investigation***

- Investigate all cases who have been hospitalized
- Obtain a case history including the immunization history

Treatment

Supportive care and treatment of symptoms is required. Treatment with antivirals is NOT generally indicated for mild to moderate illness unless the individual is at high risk for influenza-related complications. Treatment should be considered for severe cases and for clusters in a closed setting such as long term care, under the advisement of the Medical Officer of Health (MOH).

Immunization

Influenza vaccine is offered to targeted population in the fall of each year. The vaccine takes approximately two weeks to be effective. For more information on the immunization programs see:

http://www.health.gov.nl.ca/health/publichealth/cdc/im_section5.pdf

Exclusion

- People are asked to contain their illness by staying home when they are sick
- Droplet and contact precautions are recommended for patients hospitalized with influenza

Management of Contacts

Contact tracing is not required.

Immunoprophylaxis

Immunization is recommended as per NL Immunization Manual.

http://www.health.gov.nl.ca/health/publichealth/cdc/im_section5.pdf

Chemoprophylaxis

Post-exposure prophylaxis of contacts is not recommended. Antivirals are usually recommended for treatment only, generally in those individuals at high risk for influenza-related complications and in closed settings such as long term care. Use of antivirals is under the direction of the MOH.

Exclusion

There is no benefit to exclusion of contacts once the virus is circulating; people are asked to contain their illness by staying home if they become symptomatic.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures. The Outbreak summaries component of the Canadian Network for Public Health Intelligence (CNPHI) is the surveillance tool used to report outbreaks.

EDUCATION AND PREVENTIVE MEASURES

The Department of Health and Community Services provides additional information on influenza management at web site:

http://www.health.gov.nl.ca/health/publichealth/cdc/infoforpros_edu.html

Education should be provided on methods to prevent the transmission of influenza. These include:

- Clean your hands – Hand hygiene is the single most important way to prevent the transmission of infection
- Cover your cough – Tissues or the bend of the arm should be used to cover a cough
- Cover the nose and mouth when sneezing or coughing
- Clean hands after coughing, sneezing or using tissues
- Keep fingers/hands away from the eyes, nose and mouth
- Discard tissues after wiping the nose
- Contain your illness – If sick with influenza stay at home.
- Provide influenza vaccine to recommended recipients prior to the influenza season
- Provide pneumococcal vaccine to recommended recipients
 - For information on the vaccine go to the web site:
http://www.health.gov.nl.ca/health/publichealth/cdc/im_section5.pdf
- Household contacts should be instructed to:
 - Continue their normal activities but self-isolate if they develop symptoms of ILI.
 - Practice respiratory etiquette (e.g., cough into a sleeve).
 - Clean hands with soap and water frequently. Use alcohol-based hand gels (containing at least 60% alcohol) when soap and water are not available or when hands are not visibly dirty.
 - Ensure regular cleaning of high-touch objects and surfaces

A fact sheet is available at:

http://www.health.gov.nl.ca/health/publichealth/h1n1_old/understanding_influenza.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratory) report case/s to the attending physician, the Chief Medical Officer of Health and the MOH
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease

- control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network for Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.6 Measles

Etiology

Disease is caused by the measles virus, a member of the family Paramyxoviridae, genus Morbillivirus.

Case Definitions

Confirmed Case

- Laboratory confirmation of infection in the absence of recent immunization with measles containing vaccine **OR**
- Isolation of measles virus from an appropriate clinical specimen **OR**
- Detection of measles virus RNA **OR**
- Seroconversion or a significant rise (e.g. fourfold or greater) in measles IgG titre by any standard serologic assay between acute and convalescent sera **OR**
- Positive serologic test for measles IgM antibody using a recommended assay in a person who is either epidemiologically linked to a laboratory-confirmed case or has recently traveled to an area of known measles activity **OR**
- Clinical illness¹ in a person who is epidemiologically linked to a laboratory confirmed case.

Probable Case

Clinical illness⁴

- In the absence of appropriate laboratory tests **OR**
- In the absence of an epidemiological link to a laboratory -confirmed case **OR**
- In a person who has recently traveled to an area of known measles activity

Clinical Presentation

Measles causes high fever, a runny nose, cough, conjunctivitis, rash and Koplik spots. Koplik spots are a prodromic viral exanthem of measles manifesting two days before the measles rash. They are characterized as clustered, white lesions on the buccal mucosa near each Stensen's duct (on the buccal mucosa opposite the maxillary 2nd molars) usually lasting from 1-2 weeks. The red blotchy rash appears on the third to seventh day, starting on the face and then becomes more generalized. Complications may result from viral replication or bacterial infections. They can include pneumonia, otitis media, laryngotracheobronchitis, diarrhea and encephalitis. Encephalitis while rare can occur with a case fatality rate of about 10% and result in permanent disability in about 25%.

⁴ Clinical Illness is characterized by all the following features:

- ☐ fever 38.3° C or greater
- ☐ cough, coryza, or conjunctivitis
- ☐ generalized maculopapular rash for at least 3 days.

Measles infection during pregnancy leads to an increased frequency of miscarriage, premature birth, and low birth weight. Birth defects have rarely been reported.

Diagnosis

Diagnosis of measles is done by serologic testing and/or culture. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

In countries where measles vaccine has been used, there has been a marked reduction in the incidence of measles; however, cases still occur in countries where vaccination rates are low. Canada has an enhanced weekly measles reporting system; Ontario, Quebec and British Columbia have reported measles outbreaks in 2012. There have been no cases of measles in Newfoundland and Labrador since 1997.

Reservoir

Humans are the only natural hosts of measles virus.

Transmission

Measles is one of the most highly communicable infectious diseases. The virus is transmitted by the airborne route, respiratory droplets or direct contact with the nasal secretions of an infected person.

Incubation Period

The incubation period is 7-18 days, usually 10 days from exposure to fever, and 14 days from exposure until the rash appears. If immune globulin is given for passive protection later than the third day of the incubation period, the incubation period may be extended.

Communicability

Measles is communicable from one day prior to the onset of the prodromal period (about four days before rash onset) to four days after the appearance of the rash. Vaccine virus rash has not been shown to be communicable.

Control Measures

Management of Cases

Investigations

- Confirm the diagnosis
- Ensure specimens are collected from the suspect measles case as soon as possible
- Review measles immunization history

- Identify recent history of travel (8-17 days before rash onset)
- Determine if a recent contact with a confirmed or probable case of measles
- Identify contacts

Treatment

- No specific treatment, treatment should be based on the symptoms of the patient
- Hospitalization may be required if complications develop

Immunization

Defer all immunization with live and inactivated vaccine until at least four weeks after illness onset in the case.

Exclusion

- In hospitals Airborne Precautions should be taken from the onset of the catarrhal stage of the prodromal period through to the fourth day of the rash to reduce the exposure of other persons
- Immunocompromised patients should be isolated for the duration of their illness
- Cases should be excluded from childcare, school or work until four days after the onset of rash

Management of Contacts

Identify all contacts of the case and review their immunization status immediately on notification of a case. Determine if contacts are immune or susceptible to measles.

Definitions***Contact***

- A contact is someone who has shared the same airspace with the case during the infectious period

Immune contacts

- Criteria for measles immunity are included in Table 1.

Table 1: This table provides a summary of criteria for measles immunity

Routine	Health Care Workers	Travelers to destination outside North America	Students in post-secondary educational settings	Military personnel
<ul style="list-style-type: none"> Documentation of vaccination: <ul style="list-style-type: none"> Children 12 months to 17 years of age: 2 doses* Adults 18 years of age and older born in 1970 or later: 1 dose* OR History of laboratory confirmed infection OR Laboratory evidence of immunity OR Born before 1970 	<ul style="list-style-type: none"> Documentation of vaccination with 2 doses (regardless of year of birth) OR History of laboratory confirmed infection OR Laboratory evidence of immunity 	<ul style="list-style-type: none"> Documentation of vaccination: <ul style="list-style-type: none"> If born in 1970 or later: 2 doses* If born before 1970: 1 dose* OR History of laboratory confirmed infection OR Laboratory evidence of immunity 	<ul style="list-style-type: none"> Documentation of vaccination: <ul style="list-style-type: none"> If born in 1970 or later: 2 doses* If born before 1970: consider 1 dose if no documentation of receipt of measles containing vaccine* OR History of laboratory confirmed infection OR Laboratory evidence of immunity 	<ul style="list-style-type: none"> Documentation of vaccination with 2 doses (regardless of year of birth) OR History of laboratory confirmed infection OR Laboratory evidence of immunity
<p>* Measles containing vaccine For additional information go to the Canadian Immunization Guide.</p>				

Immunoprophylaxis

- Susceptible contacts should be offered the measles vaccine within 72 hours of exposure
- Susceptible contacts with a contraindication to MMR vaccine (e.g. immunocompromised, HIV+, pregnant) may be offered Immune globulin (IG)
- IG must be provided within six days of exposure

Exclusion

- Susceptible contacts that refuse or cannot receive measles containing vaccine or immune globulin may be excluded from childcare, school or work at the direction of the MOH
- The period of exclusion would be between day five (post first exposure) and day 21 (post last exposure)

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

- Provide written or oral information on measles
- The prevention of measles is maintained by high coverage rates of vaccination
- Remind the public about the importance of measles vaccination
- Consider scheduling extra immunization clinics for those at risk without up to date measles immunization status
- Additional information on measles is available at web site
<http://www.phac-aspc.gc.ca/im/vpd-mev/measles-rougeole-eng.php#res>
- A fact sheet is available at the web site
<http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/Measles%20May%202013.pdf>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and use the Canadian Network for Public Health Information (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada via the Measles, Rubella and CRS/CRI Surveillance (MARS).
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>

- Coordinates the response if an outbreak occurs across RHAs

Measles IG is obtained by calling 709-729-3430 during working hours or the MOH after hours 1-866-270-7437.

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4.7 Mumps

Etiology

Mumps is caused by the mumps virus (family Paramyxoviridae; genus *Paramyxovirus*). It is antigenically related to the parainfluenza viruses.

Case Definitions

Confirmed Case

Clinical illness¹ and laboratory confirmation of infection in the absence of recent immunization with a mumps-containing vaccine:

- isolation of the mumps virus from an appropriate clinical specimen
- OR**
- detection of mumps virus RNA
- OR**
- seroconversion or a significant rise (e.g. fourfold or greater) in mumps IgG titre by any standard serologic assay between acute and convalescent sera
- OR**
- positive serologic test for mumps IgM antibody

Clinical illness in a person who is epidemiologically linked to a laboratory- confirmed case.

Probable Case

Clinical illness⁵ in the absence of appropriate laboratory tests OR in the absence of an epidemiologic link to a laboratory-confirmed case.

Clinical Presentation

An acute viral disease characterized by fever, swelling and tenderness of one or more salivary glands, usually the parotid, with possibility of orchitis in 20% - 30% of post-pubertal males. Subclinical infection is common. The prodromal period tends to be rather nonspecific and may include a low grade fever, anorexia, malaise and headache. Parotitis (unilateral or bilateral) is the most common manifestation occurring in 30% - 40% of infected persons. Pain on chewing or swallowing is one of the earliest symptoms. Sublingual or submandibular glands may also be affected. The virus may be found in the saliva for one to six days before the glands swell and for the duration of glandular enlargement (5-9 days). Up to 30% of cases are asymptomatic. Complications may include CNS involvement, orchitis, oophoritis, and deafness. Encephalitis is rare, occurring in 1% - 10% of patients manifested by a headache and stiff neck. Mumps during the first trimester of pregnancy may increase the rate of spontaneous abortion.

⁵ Clinical illness is characterized by acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland lasting > two days and without other apparent cause.

There is no firm evidence that mumps during pregnancy causes congenital malformations.

Diagnosis

During an outbreak, the clinical diagnosis of mumps is easy, however when cases are sporadic the clinical diagnosis is less reliable. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

The incidence has declined in countries where there are universal immunization programs; however, cases still occur in countries where vaccination rates are low.

Reservoir

Humans.

Transmission

Mumps is spread by respiratory droplets, as well as direct contact with the saliva of an infected person.

Incubation period

The incubation period is typically 15-18 days, ranging from 12-25 days.

Communicability

The range of communicability is from seven days before onset of parotitis to nine days after onset. However, the most infectious period is 1-2 days before onset of parotitis to 5 days after onset.

Control Measures

Management of Cases

Investigations

- Confirm the diagnosis and ensure appropriate clinical specimens have been collected
- Determine immunization history.
- Determine history of recent travel.
- Determine source of infection.

Treatment

- No specific treatment, treatment should be based on the symptoms of the patient.

Immunization

If a case has not been immunized or if immunization status is uncertain, immunize according to the Newfoundland and Labrador Immunization Manual

<http://www.health.gov.nl.ca/health/publichealth/cdc/immunizations.html>.

Exclusion

Exclude the case from childcare, school, or work until five days from the date of parotitis onset. If hospitalized the case must be on droplet precautions.

Management of Contacts**Definitions***Contact*

A close contact is someone who has direct contact within the two meters of a case.

Susceptible contact

A susceptible contact include the following

- Those born in Canada in 1970 or later who did not receive two doses of mumps-containing vaccine (first dose given on or after the first birthday)
- Those who have not had laboratory confirmed mumps; and
- Those who do not have document immunity to mumps.

Immunoprophylaxis

Prompt identification of contacts will allow for administration of mumps containing vaccine to prevent further infection. Special attention must be given to those who are increased risk such as those who are immunocompromised. Immunization post exposure may not prevent infection. Known susceptible contacts should be immunized according to the Newfoundland and Labrador Immunization Manual.

Exclusion

Isolation of mumps-susceptible contacts is not required. Refer HCWs who are contacts to occupational health for assessment.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Preventive Measures

- The most effective preventive measure against mumps is vaccination. The NACI statement recommends two doses of MMR vaccine be given for measles prevention after the first birthday, at least one month apart, and this vaccine also contains mumps

- Ensure high vaccination rates are maintained in the population
- Additional information on mumps is available at web site
<http://www.phac-aspc.gc.ca/im/iyc-vve/faq-dis-mal/mumps-oreillons-eng.php>
- A fact sheet is available on the web site
<http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/Mumps%20May%202013.pdf>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network for Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.8 Pertussis (Whooping Cough)

Etiology

Pertussis is an acute bacterial infection of the respiratory tract caused by *Bordetella pertussis*. *B. pertussis* is a small, gram-negative rod.

Case definition

Confirmed Case

- Laboratory confirmation of infection:
 - isolation of *Bordetella pertussis* from an appropriate clinical specimen

OR

- detection of *B. pertussis* DNA from an appropriate clinical specimen **AND** one or more of the following:
 - cough lasting two weeks or longer
 - paroxysmal cough of any duration
 - cough with inspiratory “whoop”
 - cough ending in vomiting or gagging, or associated with apnea

OR

- epidemiologic link to a laboratory-confirmed case **AND** one or more of the following for which there is no other known cause:
 - paroxysmal cough of any duration
 - cough with inspiratory “whoop”
 - cough ending in vomiting or gagging, or associated with apnea

Probable Case

Cough lasting two weeks or longer in the absence of appropriate laboratory tests and not epidemiologically linked to a laboratory-confirmed case **AND** one or more of the following, with no other known cause:

- paroxysmal cough of any duration
- cough with inspiratory “whoop”
- cough ending in vomiting or gagging, or associated with apnea

Suspect Case

One or more of the following, with no other known cause:

- paroxysmal cough of any duration
- cough with inspiratory “whoop”
- cough ending in vomiting or gagging, or associated with apnea

Clinical Presentation

The course of illness is typically divided into three stages. The first stage (catarrhal stage), is characterized by the insidious onset of coryza, sneezing, low-grade fever, and

a mild occasional cough. The cough gradually becomes more severe. After one to two weeks the second (paroxysmal) stage begins. This is when the diagnosis is most often suspected. The cough increases in severity with repetitive coughing spells followed by an inspiratory whoop or posttussive vomiting or both. In the final (convalescent) stage, symptoms gradually wane over weeks to months. Older children and adults, especially those who have been vaccinated, can have atypical manifestations of pertussis with prolonged cough with or without paroxysms and no whoop. Pertussis is an often unrecognized cause of chronic cough or respiratory illness in this population. These infected individuals are able to transmit the disease to others who may be susceptible including unimmunized and partially immunized infants. The most serious pertussis disease occurs in young infants, who may experience complications such as apnea, bacterial pneumonia, seizures (febrile and afebrile) and encephalitis, and who are at the greatest risk of dying from these complications.

Diagnosis

Diagnosis is made by testing the nasopharyngeal specimens (nasopharyngeal swab) obtained during the catarrhal and early paroxysmal stages of illness. Bronchoscopy specimens are also acceptable. The organisms do not have to be viable. The organism can be recovered from the case during the first 3-4 weeks of illness. It is particularly difficult to isolate in individuals who have been previously immunized. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Pertussis occurs worldwide. There is no distinct seasonal pattern although there is evidence to suggest an increase in the summer and early fall. Outbreaks occur every two to five years. In Canada the introduction of pertussis vaccine in the 1940s dramatically decreased the prevalence of the disease in Canada by 99%. In the last two decades there has been an increase in pertussis incidence mainly in the adolescent and adult population. While infants over six months of age are well protected by acellular vaccines, young infants who are unimmunized or partially immunized are at highest risk of severe disease and death. Newfoundland and Labrador experienced outbreaks of pertussis in 1994-1996, 1999, and 2003. Prior to 2000, these outbreaks primarily involved those individuals aged one to nine years. The outbreak in 2003 mainly affected individuals aged 10 to 14 years. In 2014 and 2015, there have been 7 and 10 reported cases of pertussis, respectively.

Reservoir

Humans

Transmission

Transmission most commonly occurs by the respiratory route through contact with respiratory droplets or via airborne droplets of respiratory secretions.

Incubation Period

The incubation is usually 7 to 10 days with a range of 5 to 21 days.

Communicability

Infected individuals are most contagious during the catarrhal stage and the first two weeks after cough onset. Factors affecting the length of communicability include age, immunization status, previous episode of pertussis, and appropriate antimicrobial therapy. The person is no longer infectious after five days of appropriate antibiotic treatment.

Control Measures**Management of Case*****Investigations***

- Obtain a case history
- Estimate the dates for period of communicability
- Determine immunization history
- Identify the possible source of infection
- Identify contacts
- Collaborate with MOH regarding the follow-up plan

Treatment

- Young infants and older individuals with underlying medical conditions commonly require hospitalization
- Droplet Precautions are recommended for hospitalized cases until five days of antibiotics have been administered
- Antibiotics should be administered as soon as possible after the onset of illness.
 - Treatment eradicates *B. pertussis* from the nasopharynx but has little effect on the clinical symptoms or course of pertussis unless given in the early (incubation period, catarrhal or early paroxysmal) stages of infection.

Immunization

Immunize with pertussis containing vaccine as per age appropriate schedule as outlined in the Newfoundland and Labrador Immunization Manual available on web site http://www.health.gov.nl.ca/health/publichealth/cdc/health_pro_info.html#immunization

Exclusion

- The case should be excluded from child care, school or work until five days after the start of antibiotic therapy
- If there is no treatment or treatment is incomplete, the case should be excluded for three weeks (21 days) from onset of the paroxysmal cough or until the end of the cough

Management of Contacts

Contact tracing needs to begin immediately after identification of a case.

Definition Actions

Contact

- An individual who has the following type of unprotected contact during the period of communicability:
 - face to face contact for > 5 minutes;

OR

- sharing the same confined air space for a prolonged period (e.g., 1 hours);

OR

- direct contact with the respiratory secretions of the infected person (e.g., an explosive cough or sneeze in the face, sharing food or eating utensils, mouth-to-mouth resuscitation, or conducting a medical exam which includes the nose and throat examination)

High risk Contacts

- Infants less than one year of age regardless of immunization status (due to the increased rate of mortality from pertussis in this age group)
- Pregnant woman in the third trimester (because of the risk of disease transmission from infected mother to neonate).

Immunoprophylaxis

- Review the immunization history of all contacts
- Provide pertussis containing vaccine as appropriate for age and immunization history

Chemoprophylaxis

- Post exposure prophylaxis is provided to prevent the development of disease (if given early in the incubation period) and to limit secondary transmission to vulnerable individuals
- Chemoprophylaxis is offered to **high risk contacts**, as soon as possible, and within 21 days of onset of cough in the case regardless of immunization status
- If the case is the **only** high risk person in the household, chemoprophylaxis is not required for household contacts
- The management of pregnant contacts must be individualized and should be discussed with the MOH (or designate) or the contact's physician
- Infants born to mothers who have had confirmed pertussis in the 2-3 weeks prior to delivery have an extremely high risk of disease, therefore treatment for the mother and chemoprophylaxis for the newborn should be reviewed by the MOH (or designate)

Exclusion

No exclusion of contacts from routine activities. A contact with symptoms must be followed as a possible case.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Preventive Measures

- Contacts and parents of contacts should be instructed about disease transmission as well as signs and symptoms of pertussis so that early diagnosis and treatment can be initiated when needed.
- Educate the public, especially parents, that the primary strategy to prevent pertussis is immunization:
 - Immunization of pregnant women during the 27th to 32nd week of each pregnancy
 - Five doses of acellular pertussis before the 7th birthday
 - A pertussis containing vaccine booster in adolescence (14-16 years of age)
- Provide information on respiratory hygiene/cough etiquette, a fact sheet is available at:
http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/pertussis_october_2012.pdf
OR
<http://www.phac-aspc.gc.ca/im/vpd-mev/pertussis/professionals-professionnels-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratory) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network of Public Health Intelligence (CNPHI) tool for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website

<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>

- Coordinates the response if an outbreak occurs across RHAs

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4.9 Pneumococcal Invasive Disease

Etiology

Invasive pneumococcal disease (IPD) is an acute bacterial disease caused by *Streptococcus (S.) pneumoniae*. *S. pneumoniae* is gram-positive encapsulated diplococci. Although the bacteria are typically observed in pairs (diplococci) they may also occur singularly or in short chains. There are approximately 90 known pneumococcal capsular serotypes.

Case Definition

Confirmed Case

Clinical evidence of invasive disease⁶ with laboratory confirmation of infection:

- isolation of *S. pneumoniae* from a normally sterile site (excluding the middle ear and pleural cavity)

OR

- demonstration of *S. pneumoniae* DNA from a normally sterile site (excluding the middle ear and pleural cavity)

Probable Case

Clinical evidence of invasive disease¹ with no other apparent cause and with non-confirmatory laboratory evidence:

- demonstration of isolation of *S. pneumoniae* antigen from a normally sterile site (excluding the middle ear and pleural cavity)

Clinical Presentation

Pneumococcal disease is caused by the bacteria, *S. pneumonia*, and there are about 90 strains. Two types of infection caused by pneumococci are local infections and invasive infections. Pneumococci are common inhabitants of the respiratory tract. The bacteria may be isolated from the nasopharynx. The rate of asymptomatic carriage varies with age and the presence of upper respiratory infections. The duration of carriage varies but is generally longer in adults than children.

The symptoms of IPD depend on the clinical presentation. Manifestations include pneumonia, meningitis, bacteremia (septicemia), endocarditis, arthritis, and peritonitis. Bacteremia without a focus is the most common manifestation in children less than five years (50–60% of all cases). Otitis media is frequently caused by *S. pneumoniae* but isolation of *S. pneumoniae* from the middle ear is not reportable.

⁶ Invasive disease manifests itself mainly as pneumonia with bacteremia, bacteremia without a known site of infection, and meningitis.

Pneumococcal pneumonia is the most common clinical presentation among older children and adults. Symptoms generally include a rapid onset of fever and shaking, chills or rigors. The individual may also experience chest pain, productive cough, dyspnea, tachypnea, hypoxia, tachycardia, malaise, and weakness. The case fatality rate is between 5 and 7% but is typically higher in elderly persons.

It may be very difficult to distinguish pneumococcal infections from other infections, as fever may be the only initial symptom, especially in children. Most often the colonization starts in the nose or throat. It is a common bacterial complication of influenza and measles.

Pneumococcal infections can be a cause of bacterial meningitis. Clinical symptoms may include headache, lethargy, vomiting, irritability, fever, seizures, and coma. The case fatality rate is about 30% and tends to be much higher in elderly persons. Neurologic sequelae are common among survivors.

Diagnosis

The diagnosis is made by the isolation of *S. pneumoniae* from a normally sterile site excluding the middle ear. Blood cultures should be obtained, and cultures of other appropriate fluids (e.g., CSF, pleural fluid) may also be indicated. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

The rate of invasive pneumococcal disease in the Canadian population was 6.8 or 1295 cases seen in 2000. There were no cases reported in NL for that year. The cases of invasive pneumococcal diseases reported in NL for the years 2001 – 2010 is available on the web site

http://www.health.gov.nl.ca/health/publichealth/cdc/mdr/cdr_v28n2_sept2011_vpd.pdf

Reservoir

The reservoir is humans. This bacterium is frequently colonizing the upper respiratory tract of healthy people (carriers).

Transmission

Transmission is person to person via respiratory droplets and by autoinoculation in persons carrying the bacteria in their upper respiratory tract. It has been estimated that 40% of individuals become carriers of the bacteria by age one. The spread of disease most often involves carriers. Children who attend daycares or day homes have a higher carrier rate due to the increased frequency and level of contact with other children.

Incubation Period

The incubation period varies by the type of infection but may be as short as 1-3 days.

Communicability

The period of communicability is variable, but persists as long as the organism is present in the respiratory tract. Individuals are no longer infectious 24 hours following initiation of antibiotics.

Control measures**Management of Case*****Investigations***

- Determine immunization status
- Identify underlying medical conditions
- Identify outcome following infection

Treatment

- Routine practices for hospitalized individuals
- Treatment with antibiotics as per the recommendation of the attending physician
 - The route, dosage, schedule, and duration depend on the severity of the illness
- Antibiotic resistant pneumococci strains have become more common

Immunization

- Promote immunization with pneumococcal vaccine as per the current Newfoundland and Labrador Immunization Manual available at web site:
http://www.health.gov.nl.ca/health/publichealth/cdc/health_pro_info.html#immunization

Exclusion

- There is no exclusion from work, school or child care recommended for the case

Management of Contacts

- Follow up of contacts is not required.

Management of Outbreaks

In areas where outbreaks may take place such as in an institution, an outbreak management team should be established to address infection prevention and control measures.

Education and Preventive measures

Certain risk factors or chronic conditions put children and adults at an increased risk of acquiring invasive pneumococcal disease. Individuals with risk factors should be assessed for eligibility for both pneumococcal conjugate and/or pneumococcal polysaccharide vaccine as per the current Newfoundland and Labrador Immunization

Manual available at web site

http://www.health.gov.nl.ca/health/publichealth/cdc/health_pro_info.html#immunization

- Educate the public about the risks of disease transmission
 - Educate healthcare professionals about the risks of pneumococcal disease for individuals with specified underlying medical conditions and others identified as at risk
 - Promote good hygiene
- A fact sheet is available at the following web site:
<http://www.phac-aspc.gc.ca/im/vpd-mev/pneumococcal-pneumococcie/professionals-professionnels-eng.php>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratory) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network of Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
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<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.10 Poliomyelitis

Etiology

Polio is caused by poliovirus, a member of the enterovirus subgroup of the *Picornaviridae* family. There are three types: type 1, 2, and 3. The virus is extremely stable and can remain viable in the environment for a long period of time. It is rapidly inactivated by heat, formaldehyde, chlorine and ultraviolet light.

Case Definitions

Confirmed Case

Clinical illness⁷ with laboratory confirmation of infection:

- isolation of polio virus (vaccine or wild-type) from an appropriate clinical specimen
- OR**
- detection of polio virus RNA
- OR**
- clinical illness in a person epidemiologically linked to a laboratory-confirmed case

Probable Case

Clinical illness without detection of polio virus from an appropriate clinical specimen and without evidence of infection with other neurotropic viruses but with one of the following laboratory confirmations of infection:

- Significant rise (e.g., fourfold or greater) in polio IgG titre by any standard serologic assay between acute and convalescent sera **OR**
- Positive serologic test for polio IgM antibody in the absence of recent immunization with polio virus-containing vaccine

Suspected Case

Clinical illness and no laboratory confirmation of infection (no polio virus detection or serologic evidence), including negative test results and inadequate or no investigation.

⁷ Clinical illness is characterized by all of the following:

- Acute flaccid paralysis of one or more limbs
- Decreased or absent deep tendon reflexes in the affected limbs
- No sensory or cognitive loss
- No other apparent cause (including laboratory investigation to rule out other causes of a similar syndrome) of neurologic deficit present 60 days after onset of initial symptoms, unless the patient has died

Confirmed Case Categories

Confirmed cases of poliomyelitis can be further subdivided into the following two categories:

1) *Wild virus*

Laboratory investigation implicates wildtype virus. This group is further subdivided as follows:

- Imported: travel in or residence in a polio-endemic area 30 days or less before onset of symptoms
- Import-related: epidemiologic link to someone who has travelled in or resided in a polio-endemic area within 30 days of onset of symptoms
- Indigenous: no travel or contact as described above

2) *Vaccine-associated virus*

Laboratory investigation implicates vaccine-type virus. This group is further subdivided as follows:

- Recipient: the illness began 7-30 days after the patient received oral polio vaccine (OPV)
- Contact: the patient was shown to have been in contact with an OPV-recipient and became ill 7-60 days after the contact was vaccinated
- Possible contact: the patient had no known direct contact with an OPV-recipient and no history of receiving OPV, but the paralysis occurred in an area in which a mass vaccination campaign using OPV had been in progress 7-60 days before the onset of paralysis
- No known contact: the patient had no known contact with an OPV-recipient and no history of receiving OPV, and the paralysis occurred in an area where no routine or intensive OPV vaccination had been in progress. In Canada, this would include all provinces and territories.

Clinical Presentation

Poliomyelitis is a highly infectious disease. The clinical presentation of poliovirus infection is variable and is typically categorized based on the severity of symptoms. Manifestations range from inapparent or asymptomatic infections to severe paralysis and death. Asymptomatic infections occur in up to 95% of cases. The virus enters through the mouth and begins to multiply at the site of implantation (pharynx and gastrointestinal tract). The virus is commonly present in the throat and stool before symptoms are apparent. One week after onset the virus is rarely found in the throat but continues to be excreted in the stool for 3-6 weeks. The virus infects lymph tissue and enters the blood stream. It may then invade cells of the central nervous system (CNS). The replication of the virus occurs in motor neurons of the anterior horn and brain stem resulting in cell destruction. This is the cause of the typical manifestations of poliomyelitis.

A minor or nonspecific illness occurs in 4-8% of cases. Symptoms may include fever, malaise, headache, nausea, and vomiting. There is little or no evidence of CNS invasion. Three syndromes are associated with this type of infection: upper respiratory infection, gastrointestinal upset and influenza-like illness. Aseptic meningitis (occasionally with parenthesis) occurs in a small number of individuals after the minor illness has resolved. A more severe form of infection is characterized by the onset of acute flaccid paralysis (AFP). This occurs in about 1% of infections. Severe muscle pain and stiffness of the neck and back with paralysis may occur.

Paralytic polio is classified into three types depending on the level of involvement. Spinal polio is the most common (79% of paralytic polio cases) and is characterized by asymmetric paralysis usually of the legs. Bulbar polio occurs in about 2% of paralytic polio cases and is manifested by weakness of muscles innervated by cranial nerves. Bulbospinal polio accounts for about 19% of cases and is a combination of spinal and bulbar polio. The duration of the paralysis is usually short, lasting 3-4 days. Rarely will the paralysis remain but if it extends beyond 60 days it is usually permanent. Cranial nerve involvement and paralysis of respiratory muscles can occur.

Post-polio syndrome (PPS) affects polio survivors 10-40 years after recovery from an initial paralytic polio attack. PPS is not thought to be caused by persistence of the virus but rather by the death of nerve terminals in the motor units that remain after the initial attack of polio. It is characterized by further weakening of muscles that were previously affected by the polio infection. Individuals may experience fatigue, slowly progressive muscle weakness, joint pain and increasing skeletal deformities. Some individuals experience only minor symptoms and others have more severe symptoms. The extent to which individuals will suffer PPS depends on how seriously they were affected by the original polio attack; it is usually not life threatening.

Diagnosis

To confirm polio in suspected cases consultation should be made with the MOH and the Public Health Laboratory (PHL) to determine the appropriate specimens required. The PHL can be accessed through the web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

In 2007, poliomyelitis was limited to just four countries (Afghanistan, India, Nigeria, and Pakistan) that had not yet been successful in achieving complete eradication. Canada was declared polio-free as of 1994. However, detection of the virus and recording of cases has been ongoing. Since 1994, there have been twelve cases of polio reported in Canada; eleven were caused by vaccine-associated polio-virus due to the administration of OPV. The use of OPV was discontinued in 1995/1996 in Canada, and since that time there have not been any cases of vaccine-associated paralytic poliomyelitis. However, OPV is still used in many parts of the world. There is a constant threat of poliomyelitis acquisition due to travel.

Reservoir

Humans. No long-term carriers of wild type polio virus have been detected.

Transmission

Poliomyelitis is highly infectious with seroconversion rates among household contacts nearing 100% and is transmitted person-to-person mainly via the fecal-oral route. It can also be transmitted via throat secretions. Food and water contaminated with feces may also be vehicles for transmission.

Incubation Period

The incubation period is 3 - 35 days. It is typically 7-14 days for paralytic cases.

Communicability

Communicability is present as long as the virus can be excreted. The virus can remain in the throat for one week, and it can remain in feces between three to six weeks.

Control Measures**Management of Case**

A single case constitutes a public health emergency.

Investigations

- Obtain a case history
- Estimate the dates for period of communicability
- Verify immunization history
- Identify the possible source of infection
- Identify contacts
- Collaborate with the MOH regarding a follow-up plan

Treatment

- No specific treatment, treatment should be based on the symptoms of the patient
- Contact Precautions for hospitalized patients
- Special handling of contaminated articles in the home setting
- In areas where there is modern sewage disposal, feces and urine can be discharged directly into the sewers

Immunization

- If a case has not been immunized with inactivate polio vaccine (IPV) or if the immunization status is uncertain he/she should be immunized according to the Newfoundland and Labrador Immunization Manual available on website

http://www.health.gov.nl.ca/health/publichealth/cdc/health_pro_info.html#immunization

Exclusion

Cases should be excluded from childcare, school or work as directed by the MOH.

Management of Contacts

Definition

An individual who has direct or indirect contact with fecal or oral secretions of a case of poliomyelitis.

Immunoprophylaxis

All contacts should be appropriately updated with the age appropriate polio schedule.

Chemoprophylaxis

Not recommended.

Exclusion

Isolation of household contacts maybe of little benefit since the infection has usually spread by the time the first case is suspected. The exclusion of susceptible contacts from childcare, school and work will be directed by the MOH.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

- Routine immunization of eligible populations is crucial in preventing the emergence of polio cases.
- The general public needs to be educated on the risks and benefits of polio immunization.
- Travelers should be immunized against polio
- All cases and contacts should be made aware of the disease and the possible outcomes
- Additional information on polio is available at the following web site
<http://travel.gc.ca/travelling/health-safety/diseases/polio>
- A fact sheet is available at this web site
<http://www.who.int/mediacentre/factsheets/fs114/en/index.html>

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratory) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officer of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation

- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN enters the case details into the electronic reporting system and uses the Canadian Network for Public Health Intelligence (CNPHI) tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.11 Rubella and Congenital Rubella Syndrome

Etiology

Rubella is caused by the rubella virus (family *Togaviridae*; genus *Rubivirus*).

Case Definitions

Rubella

Confirmed Case

Laboratory confirmation of infection in the absence of recent immunization with rubella-containing vaccine:

- isolation of rubella virus from an appropriate clinical specimen **OR**
- detection of rubella virus RNA **OR**
- seroconversion or significant rise (e.g. fourfold or greater) in rubella IgG titre by any standard serologic assay between acute and convalescent sera **OR**
- positive serologic test for rubella IgM antibody using a recommended assay in a person with an epidemiological link to a laboratory-confirmed case or a person who has recently traveled to an area of unknown rubella activity **OR**
- clinical illness⁸ in a person with an epidemiological link to a laboratory-confirmed case

Probable Case

Clinical Illness

- in the absence of appropriate laboratory tests

OR

- in the absence of an epidemiological link to a laboratory-confirmed case

OR

- in a person who has recently travelled to an area of known rubella activity

Congenital Rubella Syndrome (CRS)

Confirmed Case

Live birth: two clinically compatible manifestations (any combination from Table 1, Columns A and B) with laboratory confirmation of infection:

- isolation of rubella virus from an appropriate clinical specimen **OR**
- detection of rubella virus RNA **OR**

⁸ Clinical illness is characterized by fever and rash, and at least one of the following: arthralgia/arthritis, lymphadenopathy, conjunctivitis

- positive serologic test for IgM antibody in the absence of recent immunization with rubella-containing vaccine **OR**
- rubella IgG persisting for longer than would be expected (approximately six months after birth) from passive transfer of maternal antibody, or in the absence of recent immunization

Still Birth: two clinically compatible manifestations with isolation of rubella virus from appropriate clinical specimen

Probable Case

In the absence of appropriate laboratory tests, a case that has at least

- any two compatible manifestations listed in Table 1, column A

OR

- one manifestation listed in Table 1, column A, plus one listed in Table 1, column B

NOTE: The following cannot be classified as a CRS case:

- rubella antibody titre absent in the infant

OR

- rubella titre absent in the mother

OR

- rubella antibody titre declining in the infant consistent with the normal decline after birth of passively transferred maternal antibody

Congenital Rubella Infection (CRI)

Confirmed Case

Laboratory confirmation of infection but with no clinically compatible manifestations:

- isolation of rubella virus from an appropriate clinical specimen

OR

- detection of rubella virus RNA

OR

- positive serologic test for rubella IgM antibody in the absence of recent immunization with rubella-containing vaccine

OR

- rubella IgG persisting for longer than would be expected (approximately six months after birth) from passive transfer of maternal antibody, or in the absence of recent immunization

Table 1. Congenital Rubella Syndrome: Clinically Compatible Manifestations.

Column A	Column B
1. Cataracts or congenital glaucoma (either one or both count as one) 2. Congenital heart defects 3. Sensorineural hearing loss 4. Pigmentary retinopathy	1. Purpura 2. Hepatosplenomegaly 3. Microencephaly 4. Microphthalmia 5. Mental retardation 6. Meningoencephalitis 7. Radiolucent bone disease 8. Developmental or late onset conditions such as diabetes & progressive panencephalitis & any other conditions possibly caused by rubella virus

Clinical Presentation

RUBELLA

Rubella is generally a mild febrile viral illness characterized by a mild rash in about 50% of cases. While children are usually asymptomatic adults have a low grade fever, headache, mild coryza, malaise and conjunctivitis may appear 1-5 days before the onset of rash. The most characteristic sign is lymphadenopathy and it can begin 5-10 days prior to the appearance of the rash and involves occipital, post auricular and posterior cervical nodes. Transient arthralgia and less often arthritis can occur in up to 50% of women and adolescents. The maculopapular rash last about 3-5 days, begins on the face and can spread to the chest arms and trunk. One in every 6000 cases develops encephalopathy.

CONGENITAL RUBELLA SYNDROME (CRS)

Fetal infections with rubella, especially in the first 20 weeks of pregnancy, may be associated with spontaneous abortion, intrauterine death and a variety of other problems collectively known as CRS.

Congenital rubella infection (CRI) occurs when the rubella virus is passed from an infected pregnant mother to her baby. Infants born with CRI have laboratory confirmation of infection but no visible defects. The virus may be shed in the infant's urine or nasopharyngeal secretions for a year or more. Infants infected at 20 weeks of pregnancy or beyond may still present later in life (sometimes several years later) with deafness, chorioretinopathy, developmental delay or other problems.

Moderate and severe cases of CRS are typically recognized at birth. In mild forms of the disease, however, the anomalies may not be obvious at birth but become apparent within the first year of life. The risk of infection producing damage to the fetus is as high as 90% if infection occurs in the first trimester, falling to 10–20% by the 16th week, and

becoming very low by the 20th week of pregnancy and beyond. Diabetes mellitus has been recognized as a frequent late manifestation of CRS.

Diagnosis

Information on appropriate laboratory specimens is available on public health laboratory website site www.publichealthlab.ca or call 709-777-6583.

- Laboratory personnel should be notified that rubella is suspected because specialized testing is required to detect the virus
- Recent immunization with rubella-containing vaccine can cause false positive results
- Rubella-specific IgG persisting for longer than would be expected (approximately six months following birth) from passive transfer of maternal antibody, or in the absence of recent immunization.

Epidemiology

Occurrence

In Canada, in 2000, there were 29 cases of rubella compared to 704 cases in 1991. In Newfoundland and Labrador (NL) there have been no cases of rubella since 1991.

Reservoir

Humans

Transmission

Transmission occurs through droplets from the respiratory secretions of an infected individual. Transplacental transmission from an infected mother to her fetus during pregnancy may result in CRS in the infant.

Incubation period

The incubation period is 14-17 days with a range of 14-21 days.

Communicability

Rubella is highly contagious for those who are non-immune. It can be transmitted one week before and for one week after the onset of the rash. Infants with CRI/CRS can shed the virus in their urine and nasopharyngeal secretions for a year or more.

Control Measures

Management of Cases

Investigations

- Confirm the diagnosis

- Determine the immunization history
- Identify the possible sources of infection e.g., recent history of travel (30 days prior to onset of symptoms), contact with others who have recently traveled or recent contact with a case of rubella, or recent immigration
- Determine the occupation and place of employment, if applicable
- Identify contacts. Determine if any contact with pregnant women

Congenital Rubella Syndrome (CRS)

- Determine the mother's immunization and antenatal serologic status
- Determine if the mother recalls being exposed to rubella status during the pregnancy

Treatment

- There is no specific treatment, treatment should be based on the symptoms of the patient

Immunization

If a case has not been immunized or if immunization status is uncertain they should be immunized according to the NL Immunization schedule:

<http://www.health.gov.nl.ca/health/publichealth/cdc/immunizations.html>

Exclusion

- In hospital, rubella cases must be placed on Droplet Precautions for seven days after the onset of the rash
- Rubella cases should be excluded from childcare, school or work for seven days after the onset of the rash
- Droplet and Contact Precautions are indicated for hospitalized children with proven or suspected congenital rubella until they are at least one year age, unless cultures of clinical specimens obtained one month apart after three months of age are negative for rubella virus
- Once discharged from hospital, only persons that are immune to rubella should have contact with and care for child with CRS

Management of Contacts

Contact tracing needs to begin immediately after identification of a case.

Definition

A susceptible contact is someone who has shared the same airspace during the infectious period.

Immunoprophylaxis

All contacts should be fully immunized against rubella. Although live-virus rubella vaccine administered after exposure has not been demonstrated to prevent illness, vaccine theoretically could prevent illness if administered within three days of exposure.

If a person has not been immunized or if immunization status is uncertain he/she should be immunized according to the Newfoundland and Labrador Immunization Manual schedule at web site:

<http://www.health.gov.nl.ca/health/publichealth/cdc/immunizations.html>

Exclusion

Exclusion of contacts from childcare, school or work is not indicated.

Management of Outbreaks

- An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

In countries, such as Canada, immunization rates are high and rubella is seen very rarely.

- The most effective preventive measure against rubella is vaccination
 - In NL rubella vaccination is routinely given at 12 and 18 months of age
 - Vaccine is given as measles, mumps and rubella (MMR)
- Part of the pre-natal screen in Canada includes screening for immunity to rubella
 - Use every opportunity to review the rubella vaccination history with women of childbearing age
 - Immunize non-pregnant women of childbearing age who have no proof of immunity
 - Pregnant women found to be susceptible should be vaccinated with a rubella-containing vaccine in the immediate postpartum period, preferably in hospital prior to discharge
 - Advise rubella-susceptible pregnant women to avoid individuals with rubella and report any contacts with cases to their physician immediately
 - Women who are exposed to rubella during pregnancy should have serology done as soon as possible after the contact to determine susceptibility if this information is not readily available. Consult with MOH.
- Use every opportunity to immunize adolescents and women who immigrate from countries where rubella vaccine is not routinely used (e.g., the majority of Asian, African, and many Caribbean and South and Central American countries) or regions with poor vaccination coverage, as soon as possible
- Healthcare workers who have no documented immunity should be immunized with a single dose of rubella-containing vaccine
- All staff of daycare facilities shall ensure they are immunized against rubella
- Additional information on rubella is available at the Public Health Agency of Canada's web site
<http://www.phac-aspc.gc.ca/im/vpd-mev/rubella-eng.php>

- A fact sheet is available at Department of Health and Community Services' web site <http://www.health.gov.nl.ca/health/publichealth/cdc/infectioncontrol/Rubella%20May%202013.pdf>

REPORTING REQUIREMENTS AND PROCEDURES

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network of Public Health Intelligence (CNPHI) tool for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website <http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs

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4.12 Tetanus

Etiology

Tetanus (lockjaw) is caused by a neurotoxin produced by the tetanus bacillus, *Clostridium tetani*. It exists in two forms, as an anaerobic bacterium which lives in the bowels of humans and animals and in spores which are produced by the bacteria in the intestines and are excreted in feces. The spores are in a protective pod and they do not multiply outside of the body but are hardy and may survive for many years in soil and dust.

Case Definitions

Reporting is required for confirmed cases.

Confirmed Case

Clinical illness⁹ without other apparent medical cause with or without laboratory evidence of *Clostridium (C.) tetani* or its toxin and with or without history of injury

Clinical Presentation

Tetanus is an acute neurologic disease induced by an exotoxin of the tetanus bacillus which grows anaerobically at the site of an injury. The process begins with the introduction of spores into the tissue. The spores change into bacteria in the absence of oxygen. As the bacteria multiply and die they produce a toxin that is released into the tissue. The toxin may enter the central nervous system (CNS) along peripheral motor nerves or may be bloodborne traveling to the nervous tissue. History of an injury or apparent portal of entry is not always present. The clinical manifestations of tetanus are divided into four clinical types: generalized, localized, cephalic, and neonatal. The type reflects host factors and site of inoculation.

1. Generalized type

Generalized disease is characterized by painful trismus (the most characteristic sign) and severe muscle spasms primary of the masseter and neck muscles, and secondarily of the trunk muscles. Abdominal rigidity may be present. The individual experiences severe pain during spasms which are often triggered by sensory stimuli. Typical features of generalized tetanus include the position of opisthotonos and the facial expression known as “risus sardonicus” (fixed smile and elevated eyebrows)

⁹ Clinical Illness is characterized by acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw and neck), and generalized muscle spasms without other apparent medical cause.

2. Localized type

Localized tetanus involves spasticity or rigidity of muscles associated with the site of spore inoculation. It may be mild and persistent, lasting for weeks and often resolving spontaneously.

This type is often the prodrome of generalized tetanus which occurs when sufficient toxin gains entry to the CNS.

3. Cephalic type

Cephalic tetanus is a rare and unique form of localized disease that affects the cranial nerve musculature.

4. Neonatal type

Neonatal tetanus, arising from contamination of the umbilical cord, is a common cause of infant mortality in developing countries. This generally results from a lack of passive immunity, that is, mother being inadequately immunized and the non-aseptic umbilical cord-care practices. Clinical manifestations include generalized weakness and failure to nurse. Apnea is the most prominent cause of death in the first week of life and sepsis in the second week. Rigidity and spasms occur later in survivors.

Diagnosis

History of injury or portal of entry may not be apparent. Case confirmation is based on symptoms with or without laboratory results. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

There is worldwide occurrence with approximately 50,000 deaths annually but disease is relatively uncommon in industrialized countries. An average of 50 cases per year is reported in the United States.

The disease is more common in agricultural regions and in underdeveloped areas where immunization may not be adequate and there may be contact with animal feces. Tetanus is an important cause of death in rural and tropical areas in countries of Asia, Africa, and South America. Neonatal tetanus accounts for approximately 50% of all tetanus deaths in developing countries. The worldwide tetanus mortality rate is 50% with the highest rates in young and old patients, and in persons using intravenous drug.

Tetanus is rare in Canada. The number of cases reported annually ranged from 1–7 (average five) from the years 1990 to 2000. The immunization status of most cases was unknown. Males over the age of 50 years accounted for the majority of reported cases. In Newfoundland and Labrador, one case of tetanus has been reported in the past 10 years.

Reservoir

C. tetani spores are widely distributed in soil worldwide and have also been detected in the intestines of animals and humans.

Transmission

C. tetani spores are usually introduced into the body through a wound that is contaminated with dust, soil or animal/human feces. *C. tetani* spores will germinate into bacilli in an anaerobic environment, such as necrotic tissue. The bacilli release a potent neurotoxin.

Incubation period

The incubation period is generally 3 to 21 days (range, 1 day to several months). Shorter incubation periods have been associated with heavily contaminated wounds, more severe disease, and a worse prognosis. In neonatal tetanus, symptoms usually appear from 4 to 14 days after birth, averaging 7 days.

Communicability

Since tetanus is caused by the neurotoxin, it is not transmitted person-to-person.

Control Measures**Management of Case*****Investigations***

- Assess immunization history
- Identify and recent injury i.e., puncture wound or laceration

Treatment

- All wounds should be cleaned and debrided
- Hospitalization is required to control the muscle spasms and pain
- Routine Practices are recommended for hospitalized patients
- Antibiotic therapy
- Human tetanus immune globulin (TIG), given intramuscularly, is recommended as it may shorten the course and lessen the severity of the disease

Immunization

The case should receive tetanus vaccine to prevent tetanus in the future. For persons with incomplete or absence of immunization, a primary series or booster dose of tetanus-containing vaccine should be offered.

Exclusion

Routine practices for hospitalized patients should be followed however; exclusion from childcare, work or school is not required.

Management of Contacts

Follow-up is not required as tetanus is not transmitted from person to person.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

The most effective preventive measure against tetanus is immunization. High vaccination coverage in the childhood programs and opportunistic vaccination of those with histories of incomplete vaccination are required to ensure high levels of tetanus immunity in the whole population. In Canada, and other developed countries tetanus immunization is included in our routine vaccination programs. It is estimated that those not protected in Canada are mostly among those who are elderly, those who are born outside of Canada and those with no records.

Strategies to increase vaccination for tetanus include:

- Educate the public about the hazards of tetanus infection
- Educate the public regarding proper wound care and the prevention of tetanus
- Provide primary immunization with a tetanus-containing vaccine to all individuals as per the Newfoundland and Labrador Immunization Manual
- Target vaccination programs that are easily accessible for groups such as those born before vaccination programs were implemented, immigrants with uncertain or incomplete vaccination histories, and individuals who inject nonprescription drugs
- Encourage adults to receive a booster of a tetanus-containing vaccine every 10 years
- Offer an early booster to those traveling to a developing country, if a booster dose has not been administered within the last five years
- Provide tetanus prophylaxis for wound management as per the Newfoundland and Labrador Immunization Manual at web site
http://www.health.gov.nl.ca/health/publichealth/cdc/im_section5.pdf
- A fact sheet is available at following websites:
http://immunize.ca/uploads/tetanus/tetanus_brochure_2013_e.pdf
<http://www.phac-aspc.gc.ca/im/iyc-vve/faq-dis-mal/tetanus-tetanos-eng.php>
<http://www.phac-aspc.gc.ca/im/vpd-mev/tetanus-tetanos-eng.php>

OR
OR

- Other educational materials available include:
 - A poster
http://immunize.ca/uploads/tetanus/tetanus_poster_2013_e.pdf
 - A video
<http://www.youtube.com/watch?v=4EeVUHA4tmQ&list=PLJH3y0duq2ZE53dj80lb2VsahjUXo3UmX>

REPORTING REQUIREMENTS AND PROCEDURES

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network of Public Health Intelligence (CNPHI) tool for alerts and/ or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s in the Quarterly Communicable Disease Report (CDR), which is posted on the Public Health website
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response to an outbreak occurring across Regional Health Authorities

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4.13 Varicella (Chickenpox)

Etiology

Varicella (chickenpox) is a generalized viral disease caused by varicella zoster virus (VZV), a deoxyribonucleic acid (DNA virus) of the *Herpesvirus* family.

Case Definitions

Only confirmed cases of disease should be reported.

Confirmed Case

Clinical evidence¹⁰ of illness and laboratory confirmation of infection:

- isolation or direct antigen detection of varicella-zoster virus (VZV) from an appropriate clinical specimen **OR**
- detection of VZV DNA **OR**
- seroconversion or significant rise (e.g., fourfold or greater) by and standard serologic assay in varicella-zoster IgG titre between acute and convalescent sera **OR**
- positive serologic test for varicella-zoster IgM antibody **OR**
- Clinical evidence of illness in a person with an epidemiological link to a confirmed case of chickenpox or VZV infection

Probable Case

Clinical evidence of illness in the absence of laboratory confirmation or epidemiological link to a laboratory confirmed case of chickenpox.

Clinical Presentation

Primary varicella zoster virus infection causes varicella (chickenpox) and reactivated infection results in herpes zoster (shingles). Herpes zoster generally occurs decades after the initial infection. Varicella presents with fever, headache, and a rash that is maculopapular for a few hours, vesicular for 3-4 days and leaves a granular scab. The vesicles collapse when punctured. The vesicular rash typically consists of 250-500 lesions in varying stages of development and resolution (crusting).

They may be abundant or mild and not profuse enough to note that an infection is present. Complications are seen more frequently if the infections occur in adolescence, adulthood or in an immunocompromised host, with higher rates of encephalitis, pneumonia and death. Babies who develop varicella within the first 28 days of birth are at higher risk from developing severe generalized varicella.

¹⁰ 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.

Complications from infection include secondary bacterial skin infections, otitis media, bacteremia, osteomyelitis, septic arthritis, endocarditis, necrotizing fasciitis, toxic shock like syndrome, mild hepatitis and thrombocytopenia.

Infections that occur early in pregnancy may result in congenital varicella syndrome in 0.7% of cases. After 13-20 weeks gestation the incidence is 2%.

Herpes zoster or shingles is a reactivation of latent varicella infection in the dorsal root ganglia in a localized area. The lesions are restricted to an area supplied by the sensory nerves along nerve pathways and are usually unilateral causing severe pain.

Diagnosis

The diagnosis is generally made based on symptoms. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

Varicella occurs worldwide and, in countries without vaccination programs, it is mainly a disease of childhood, developing in 50% of children by the age of 5 years and 90% by the age of 12 years. In the pre-vaccine era, it is estimated that there were approximately 350,000 varicella cases and 1,500 to 2,000 varicella-related hospitalizations each year in Canada. However, assessing the effect of varicella immunization programs on the incidence of the disease is difficult as varicella infections are significantly under-reported, with less than 10% of the expected cases reported annually. Canadian studies have found decreases in the burden of varicella following the introduction of immunization programs.

The varicella immunization program was implemented in Newfoundland and Labrador (NL) in January 2005. The vaccine was administered at 12 months of age for children born January 2004 and onwards. A catch-up program was offered children at 4-6 years of age who were born between 2001 to 2003 who had not previously received a dose of varicella vaccine and who did not have a history of natural disease. Prior to 2005 varicella cases were reported by weekly aggregate cases and since varicella was considered a common childhood illness most cases were not reported to public health. From 2005 to 2009, varicella cases were reported in the age groups eligible for varicella immunization and from 2010 to present, all varicella cases are reported. In NL, the average number of cases hospitalized involving a varicella diagnosis for the years 2000 – 2005 was 21.8 cases, and from 2006 – 2010 the average number of cases involving a varicella diagnosis was 5.2 cases.

Reservoir

Humans.

Transmission

VZV is spread by the airborne route as well as by direct contact with the virus shed from skin lesions. The attack rate among susceptible contacts in household settings is estimated at 65% to 87%. In utero, infection also can occur as a result of transplacental passage of virus during maternal varicella infection.

Incubation period

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. Varicella zoster immunoglobulin (VZIG) may extend the incubation period to 28 days. Varicella can develop between 2 and 16 days after birth in infants born to mothers with active varicella around the time of delivery; the usual interval from onset of rash in a mother to onset in her neonate is 9 to 15 days.

Communicability

The contagious period is from 1-2 days before the onset of the rash and lasts until all lesions are crusted usually five days. Those with zoster may be infectious for a week after the appearance of the vesiculopustular lesion. Infection usually confers immunity but a very mild case (few spots) may leave a person vulnerable for a second infection.

Control Measures

Management of Case

Investigation

- Assess for evidence of immunity and vaccine history
- Assess for vaccine-modified disease (breakthrough infection)
- Identify susceptible contacts with significant exposure during the period of communicability

Significant exposure is considered:

- Continuous household contact (living with the case),
- Sharing the same hospital room as a case,
- Prolonged face-to-face contact
- Health care workers with more than 15 minutes of face-to-face contact or one hour in patient's room

Treatment

- There is no specific treatment, treatment should be based on the symptoms of the patient
- In persons under the age of 18 years, avoid the use of acetylsalicylic acid (ASA, Aspirin) because of the association with Reye's syndrome

- The decision to use antiviral therapy and the route and duration of therapy should be determined by specific host factors, extent of infection, and initial response to therapy
- In immunocompetent hosts, most virus replication has stopped by 72 hours after onset of the rash
 - Oral antivirals are not recommended for routine use for healthy children with varicella
 - Oral antiviral should be considered for those at increased risk of moderate to severe varicella
- Intravenous antiviral therapy is recommended for immunocompromised patients and therapy initiated within 24 hours of rash onset, maximizes efficacy

Varicella Zoster Immune Globulin (VZIG) is not effective once symptoms have developed. To access VZIG call the DH&CS **729-3430** or the MOH after hours **1-866-270-7437**.

Immunization

The case does not need to be vaccinated.

Exclusion

- A child with mild illness should be allowed to return to school or daycare as soon as he or she is well enough to participate normally in all activities, regardless of the state of the rash. Parents, particularly parents of immunosuppressed children, should be notified that chickenpox is in the class as well as be provided with information on the VZV incubation period and how to detect early VZV
- Cases should avoid contact with:
 - Immunocompromised individuals
 - Susceptible pregnant women (particularly those in the third trimester)
 - Hospitalized premature infants, and
 - Infants born to susceptible mothers
- Airborne and Contact Precautions are recommended for hospitalized cases
- Air travel is not recommended until lesions have crusted due to the recirculation of cabin air
- Swimming in public pools is not recommended until lesions have healed and crusts are no longer present

Management of Contacts

Definition of Contact

A contact is someone who has significant exposure during the infectious period.

Immunoprophylaxis

- To determine the immunization requirement of contacts it is necessary to:
 - Assess for evidence of immunity and vaccine history

- Assess disease history or serological evidence of disease
- Assess shingles disease history
- A contact is considered immune and does not need to be vaccinated if one or more of the following is reported:
 - Self-reported history of varicella if born before 2004 (except for health care workers)
 - For those born in 2004 or later and for health care workers, a health care provider diagnosis of varicella or herpes zoster
 - Documented evidence of immunization with two doses of a varicella-containing vaccine
 - A history of laboratory confirmed varicella infection
 - Laboratory evidence of immunity
- If the contact is non-immune:
 - Univalent varicella vaccine given as soon as possible and within 3 and up to 5 days after exposure has been shown to be approximately 90% effective in preventing or reducing the severity of varicella and is the post-exposure management of choice for susceptible, healthy, non-pregnant persons
 - Varicella vaccination is not indicated for post-exposure management of infants less than 12 months of age, as the vaccine is not authorized for this age group and these infants are generally protected by maternal antibodies
- Varicella-zoster Immune Globulin (VZIG) may be given to high-risk non-immune individuals within 96 hours of significant exposure. It is used exclusively in prevention. VZIG should be considered for:
 - Immunocompromised individuals
 - Newborns whose mothers develop varicella within five days prior to delivery up to 48 hours after delivery
 - Hospitalized preterm infants (28 weeks or more of gestation) if mother lacks evidence of immunity against varicella
 - Hospitalized infants (less than 28 weeks of gestation or birth weight 1000 g or less) regardless of maternal antibody

Exclusion

No exclusion for contacts is required. However, susceptible household contacts should avoid contact for the incubation period with:

- Immunocompromised individuals
- Susceptible pregnant women (particularly those in the third trimester)
- Hospitalized premature infants, and
- Infants born to susceptible mothers

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures.

Education and Prevention Measures

Immunize susceptible persons according to the Newfoundland and Labrador Immunization Manual available at web site

http://www.health.gov.nl.ca/health/publichealth/cdc/health_pro_info.html#immunization

- Offer vaccine to susceptible eligible individuals
- For students in the school setting susceptibility will be based on history of disease or appropriate past varicella immunization.
 - Serological testing will not be required
 - Healthcare workers should demonstrate proof of immunity upon hire
 - Proof of immunity may include history of disease, serological evidence of disease or documented age-appropriate doses of varicella vaccine.

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratory) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease control nurses (CDCNs) and Infection control practitioners (ICP), in the particular region as required for follow-up and case investigation
- The CDCN in collaboration with the ICP (if necessary) will collect case details
- The CDCN will enter the case details into the electronic reporting system and utilize the Canadian Network for Public Health Intelligence (CNPHI tool) for alerts and/or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health web site
<http://www.health.gov.nl.ca/health/publichealth/cdc/informationandsurveillance.html>
- Coordinates the response if an outbreak occurs across RHAs.

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