

K01: Infectious Diseases (General Information)

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Updated: December 07, 2020

Reviewed:

Introduction

Paramedics are exposed to a wide range of infectious diseases as part of their daily work. Many of these diseases have characteristic and particular signs and symptoms, whereas others are only evident through appropriate diagnostic testing. The purpose of this clinical practice guideline is to offer general advice on preventing paramedic exposures, and limiting the effect of infectious diseases on the broader health care system.

Essentials

- Paramedics should become familiar with and regularly review the [BCEHS Exposure Control Plan](#) for information on managing infectious disease hazards.
- Whenever possible, select personal protective equipment based upon diagnosed or suspected illnesses. Follow directions for donning and doffing personal protective equipment.
- Very few infectious diseases have specific clinical features that are amenable to prehospital treatment. Consider the use of CPG [K02: Sepsis](#) when warranted.
- Paramedics are encouraged to consult with CliniCall for additional guidance on these issues.

General Information

Measles

- Measles is a severe illness caused by the measles virus. It is very contagious and spreads easily. Because of immunization, measles is rare in Canada, but outbreaks occur in communities where vaccination rates are low. It is endemic in some countries, particularly in South East Asia, and should be considered in the returning traveller with rash, fever, and cough.
- In individuals who are not immunocompromised, measles classically features four stages: incubation, prodrome, exanthema (rash), and recovery.
 - The incubation period of measles is between six and 21 days, with a median time of 13 days.
 - A two- to four-day prodromal phase is characterized by fever, malaise, and anorexia, a stuffy or runny nose, and cough. If present, Koplik spots (small white spots which appear on the inside of the mouth and throat) typically occur approximately 48 hours prior to the exanthem.
 - The characteristic exanthema, or rash, develops approximately two to four day after onset of fever; it consists of a red maculopapular rash, which classically begins on the face and head and spreads downward. Cough may persist for one to two weeks after measles. The occurrence of fever beyond the third to fourth day of rash suggests a measles-associated complication.
- Staff are considered immune to measles if they:
 - Are born in or before 1957.
 - Can provide evidence of 2 documented doses of measles vaccine.
 - Have laboratory confirmed evidence of measles in the past
- It is important to perform a point of care risk assessment – does the patient have symptoms consistent with measles? If yes, apply airborne precautions:
 - Wear N95 respirator
 - Have patient cover their nose and mouth with their sleeve or tissue when coughing, sneezing, or speaking
 - Have patient wear a surgical mask
 - Wear gloves and gown if there is potential for contamination from respiratory secretions or drainage from skin blisters or lesions
 - Ensure proper ventilation in vehicles: create a negative pressure environment in the patient compartment of ambulance, and set the rear exhaust fans in the patient compartment to HIGH in order to maximize air extraction

- Excellent hand hygiene must be performed, especially after gloves and other PPE used are removed
- Provide notification to the receiving facility
- On arrival at destination, the driver (not wearing PPE), should coordinate with hospital staff to ensure safe patient placement
- Leave patient compartment open to ventilate for at least 20 minutes after arrival. Open doors and windows. Exhaust fans should remain on whenever possible.
- Clean and disinfect all used equipment and touched surfaces in vehicle
- If possible, have one paramedic access items required from kits and pass to the paramedic providing care
- Use a face shield with N95 respirator when performing aerosol generating medical procedures, especially when working with airborne disease transmission risks. These include nebulizer therapy, suctioning, bag-valve mask ventilation, and endotracheal intubation.

Tetanus

- Tetanus is a nervous system disorder characterized by muscle spasms that is caused by the toxin-producing anaerobe *Clostridium tetani*. The bacteria generally enter through a break in the skin such as a cut or puncture wound by a contaminated object, and produce toxins that interfere with normal muscle contractions. The term "lockjaw" (now called trismus) serves as a reminder of one of the cardinal features of tetanus – intense, painful spasms of the masseter muscles.
- Signs and symptoms of tetanus infection include:
 - Stiff jaw or neck muscles, which make it difficult to move the jaw or neck normally
 - Strange-looking smile that does not go away
 - Tight, painful muscles that do not let go
 - Difficulty breathing, swallowing, or both
 - Irritability and restlessness
 - Diaphoresis
 - Tachycardia, arrhythmias
 - Fever
 - Painful muscle spasms
- Unlike many infectious diseases, recovery from naturally acquired tetanus does not result in immunity to tetanus. Paramedics are considered immune to tetanus if they have an up to date tetanus vaccination.
- In British Columbia, tetanus vaccination is offered to Grade 9 students. Prophylactic vaccination should be considered and encouraged for all wounds, including open wounds, bites, crush injuries, frostbite, burns, and corneal abrasions.
- Tetanus is not communicable from person to person
- Most patients who develop tetanus are not completely vaccinated and do not receive adequate wound prophylaxis, even when they present for medical care. Incomplete vaccination is more likely in the following groups:
 - Injection drug users
 - Immigrants
 - Rural populations
 - Older adults

Influenza

- Influenza is an acute respiratory illness caused by influenza A or B viruses that occurs in outbreaks and epidemics worldwide, mainly during the winter season. Signs and symptoms of upper and/or lower respiratory tract involvement are present, along with indications of systemic illness such as fever, headache, myalgia, and weakness. Although acutely debilitating, influenza is a self-limited infection in the general population (uncomplicated influenza); however, it is associated with increased morbidity and mortality in certain high-risk populations (complicated influenza).
- Influenza typically begins with the abrupt onset of fever, headache, myalgia, and malaise. These symptoms are accompanied by manifestations of respiratory tract illness, such as nonproductive cough, sore throat, and nasal discharge. Older adult patients are particularly likely to have subtle signs and symptoms. Typical findings such as sore throat, myalgias, and fever may be absent and general symptoms such as anorexia, malaise, weakness,

and dizziness may predominate.

- Fever usually ranges from 37.8 to 40.0°C but can get as high as 41.1° Fever is often higher in children than adults. Gastrointestinal illness, such as vomiting and diarrhea, are usually not part of influenza infections in adults but can occur in 10 to 20 percent of influenza infections in children.
- Each individual acquires a number of influenza infections throughout life. It is expected that up to ~15% of a European population in a temperate climate is infected with influenza in any winter season with higher percentages in children and lower in older people
- Whether individuals fall ill after infection is dependent on a number of factors. These include previous exposure to a similar influenza virus that has induced a complete or partial protective immunity to the now circulating virus or, exposure through vaccination with an updated matching influenza vaccine strain.
- Influenza virus can potentially be transmitted through:
 - Droplet exposure of mucosal surfaces (e.g., nose, mouth, and eyes) by respiratory secretions from coughing or sneezing;
 - Contact, usually of hands, with an infectious patient or fomite (a surface that is contaminated with secretions) followed by self-inoculation of virus onto mucosal surfaces such as those of the nose, mouth, and eyes; and
 - Small particle aerosols in the vicinity of the infectious individual.
- Transmission of influenza through the air over longer distances, such as from one patient room to another, is thought not to occur. All respiratory secretions and bodily fluids, including diarrheal stools, of patients with influenza are considered to be potentially infectious.
- The Government of Canada and Public Health Agency of Canada have provided recommendations regarding infection control measures for seasonal influenza infection in health care settings. All healthcare workers should be vaccinated against seasonal influenza annually.
- Precautions to prevent the spread of influenza infections in health care facilities include the use of routine and droplet precautions when caring for patients infected with influenza virus. Face masks should be used for the routine care of patients with suspected or confirmed influenza infection, and N95 respirators (or an equivalent respirator) should be used during aerosol-generating procedures.

H1N1 Influenza

- H1N1 Swine influenza A (swine flu or pig flu) is a respiratory disease that occurs in pigs that is caused by the Influenza A virus. Swine influenza virus is common throughout pig populations worldwide. Transmission of the virus from pigs to humans is not common and does not always lead to human influenza, often resulting only in the production of antibodies in the blood. People with regular exposure to pigs are at increased risk of swine flu infection. The meat of an infected animal poses no risk of infection when properly cooked.
- In late March and early April 2009, an outbreak of H1N1 influenza A virus infection was detected in Mexico, with subsequent cases observed in many other countries including the United States. In June 2009, the World Health Organization (WHO) raised its pandemic alert level to the highest level, phase 6, indicating widespread community transmission on at least two continents. The pandemic was declared to be over in August 2010.
- The signs and symptoms of influenza caused by pandemic H1N1 influenza A virus were similar to those of seasonal influenza, although gastrointestinal manifestations appeared to be more common with pandemic H1N1 influenza A.
- The most common clinical findings of the 2009 H1N1 influenza A pandemic were fever, cough, sore throat, malaise, and headache; vomiting and diarrhea were also common, both of which are unusual features of seasonal influenza. Other frequent findings included chills, myalgias, and arthralgias.
- The H1N1 virus that caused the 2009-2010 flu pandemic is a regular human flu virus and continues to circulate seasonally worldwide.
- 2009 H1N1 influenza virus appears to be transmitted from person to person through close contact in ways similar to other influenza viruses. Although the relative contribution of each mode is uncertain, influenza virus can potentially be transmitted through:
 - Droplet exposure of mucosal surfaces (e.g., nose, mouth, and eyes) by respiratory secretions from coughing or sneezing;
 - Contact, usually of hands, with an infectious patient or fomite (a surface that is contaminated with secretions) followed by self-inoculation of virus onto mucosal surfaces such as those of the nose, mouth, and eyes; and
 - Small particle aerosols in the vicinity of the infectious individual.
- Transmission of influenza through the air over longer distances, such as from one patient room to another, is thought not to occur. All respiratory secretions and bodily fluids, including diarrheal stools, of patients with 2009

H1N1 influenza are considered to be potentially infectious.

- The Government of Canada and Public Health Agency of Canada have provided recommendations regarding infection control measures for seasonal influenza infection in health care settings. All healthcare workers should be vaccinated against seasonal influenza annually.
- Precautions to prevent the spread of influenza infections in health care facilities include the use of standard and droplet precautions when caring for patients infected with influenza virus. Face masks should be used for the routine care of patients with suspected or confirmed influenza infection, and N95 respirators (or an equivalent respirator) should be used during aerosol-generating procedures.

Tuberculosis

- Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis* (MTB) bacteria. Tuberculosis generally affects the lungs, but can also affect other parts of the body. Inhalation of *Mycobacterium tuberculosis* and deposition in the lungs leads to one of four possible outcomes: immediate clearance of the organism, primary disease (rapid progression to active disease), latent infection (with or without subsequent reactivation disease), or reactivation disease (onset of active disease many years following a period of latent infection).
- The classic symptoms of active TB are a chronic cough with blood-containing sputum, fever, night sweats, shortness of breath, and weight loss.
- Fever is usually low grade at onset but becomes marked with progression of disease.
- Cough may be absent or mild initially, but as the disease progresses the cough becomes more continuous, and productive of yellow or yellow-green and occasionally blood-streaked sputum.
- Anorexia, wasting, and malaise are common features of advanced disease and may be the only presenting features in some patients.
- Bacille Calmette-Guérin (BCG) is a live strain of *Mycobacterium bovis* developed by Calmette and Guérin for use as an attenuated vaccine to prevent tuberculosis and other mycobacterial infections. Bacillus Calmette-Guérin does not consistently prevent pulmonary infection. The magnitude of protection appears to be in the range of 80 percent in the first 15 years of life but is much lower subsequently. The greatest benefit of BCG appears to be diminished risk of TB, including tuberculous meningitis and disseminated disease in children, and pulmonary disease in adults.
- Person-to-person transmission of TB occurs via inhalation of droplet nuclei. When people with active pulmonary TB cough, sneeze, speak, sing, or spit, they expel infectious aerosol droplets 0.5 to 5.0 µm in diameter. A single sneeze can release up to 40,000 droplets. Each one of these droplets may transmit the disease, since the infectious dose of tuberculosis is very small (the inhalation of fewer than 10 bacteria may cause an infection).
- It is important to perform a point of care risk assessment – does the patient have symptoms consistent with TB? If yes apply airborne precautions:
 - Wear N95 respirator
 - Have patient cover their nose and mouth with their sleeve or tissue when coughing, sneezing, or speaking
 - Have patient wear a surgical mask
 - Wear gloves and gown if there is potential for contamination from respiratory secretions or drainage from skin blisters or lesions
 - Ensure proper ventilation in vehicles: create a negative pressure environment in the patient compartment of ambulance and set the rear exhaust fans in the patient compartment to HIGH in order to maximize air extraction (engineering control)
- Excellent hand hygiene must be performed, especially after gloves and other PPE used are removed

Varicella

- Chickenpox (varicella) is an infection caused by the varicella-zoster virus. Varicella is a common and highly infectious childhood disease that is found worldwide. Symptoms appear 10 to 21 days after infection and last about 2 weeks. The defining symptom is a characteristic blister-like rash, which can cause severe irritation. Most children have a relatively mild illness, but severe illness may occur in adults and people with depressed immunity because of existing illness or because of a treatment that they are receiving (e.g. chemotherapy).
- The first noticeable symptom is the onset of a slight fever, which is usually followed by some mild constitutional symptoms, such as a headache, runny nose and a general feeling of malaise.
- The defining symptom of varicella is the eruption of skin lesions on all areas of the body, including on the scalp and on the mucous membranes of the mouth and upper respiratory tract. These fluid-filled lesions or vesicles occur in "crops", so that several stages of old and new lesions will be present at the same time.
- Varicella (chickenpox) is an acute infectious disease. It is caused by varicella-zoster virus (VZV), which is a DNA

virus that is a member of the herpes virus group. After the primary infection, VZV stays in the body (in the sensory nerve ganglia) as a latent infection. Primary infection with VZV causes varicella. Reactivation of latent infection causes herpes zoster (shingles).

- In most cases, getting chickenpox confers lifelong immunity. Multiple infections in a single individual can occur, but are rare.
- Varicella is spread through the air when an infected person sneezes or coughs. It can also be spread through contact with the fluid from varicella blisters, or the saliva of a person who has the disease. A pregnant woman with varicella can pass it to her baby before birth.
- The US Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics, and infectious disease experts have published guidelines or algorithms designed to aid clinicians in the control of nosocomial exposures to Varicella.
 - Patients with varicella should be placed on airborne and contact precautions. All healthcare personnel should wear an N95 respirator when in contact with patient with suspected infection, even if they are considered immune (eg, they completed the vaccine series or have a history of disease). This is because varicella vaccine is not 100 percent effective in preventing infection, and providing consistent recommendations helps ensure adherence to these precautions which provide respiratory protection.
- It is important to perform a point of care risk assessment – does the patient have symptoms consistent with Varicella? If yes apply airborne precautions:
 - Wear N95 respirator
 - Have patient cover their nose and mouth with their sleeve or tissue when coughing, sneezing, or speaking
 - Have patient wear a surgical mask
 - Wear gloves and gown if there is potential for contamination from respiratory secretions or drainage from skin blisters or lesions
 - Ensure proper ventilation in vehicles: create a negative pressure environment in the patient compartment of ambulance and set the rear exhaust fans in the patient compartment to HIGH in order to maximize air extraction (engineering control)
- Excellent hand hygiene must be performed, especially after gloves and other PPE used are removed
- The CDC recommends that healthcare personnel who care for immunocompetent patients with dermatomal zoster (shingles) use routine precautions alone, without airborne and contact isolation precautions. Routine precautions entail:
 - Hand hygiene before and after contact with every patient, regardless of whether gloves are also used
 - Use of gloves, gowns, and eye protection in situations in which exposure to blood or body secretions is possible
 - Use of respiratory hygiene/cough etiquette by patients or health care workers with cough or respiratory secretions; this includes covering the nose and mouth when coughing, disposing of used tissues promptly, and practicing hand hygiene after contact with respiratory secretions. Use of a mask and spatial separation of patients with respiratory symptoms in waiting areas is also warranted.
 - Safe injection practices and safe disposal of needles and sharp instruments in impervious containers

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K02: Sepsis

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Updated: January 20, 2021

Reviewed:

Introduction

Sepsis is a syndrome of life-threatening organ dysfunction resulting from a dysregulated host response to an infection. In Canada, 1 in 18 deaths are directly related to or complicated by sepsis, with the condition having long lasting psychosocial effects on survivors. Sepsis disproportionately affects the very young (below 1 year of age) and older adults (above 50). Paramedics must recognize the potential for sepsis, and provide care to protect a patient's airway and ensure adequate oxygenation, ventilation, and end-organ perfusion.

Essentials

- The National Early Warning Score-2 (NEWS2) is a screening tool designed to identify patients at high risk for deterioration from all causes, including sepsis. Paramedics should routinely obtain a NEWS2 score on all patients and use these findings to help guide management, including transport methods, pre-arrival notification, and in-hospital advocacy.
- Use appropriate personal protective equipment. For patients with suspected respiratory infections, paramedics should use droplet precautions.
- Patients with chronic fluid-retention (e.g., congestive heart failure or chronic renal failure) may also be fluid depleted and require fluid resuscitation. Assess for signs of volume overload continually throughout patient contact and stop infusion if edema becomes apparent.
- Lactated Ringers is the fluid of choice in sepsis, as it is less likely to worsen or provoke acidosis, and has fewer effects on renal perfusion.

Additional Treatment Information

- Sepsis can cause increased capillary permeability. All patients receiving fluid administration must be continually monitored for signs of volume overload, such as the development of pulmonary edema.
- If available, Lactated Ringers is the crystalloid fluid of choice over normal saline in sepsis. It is less likely to provoke or worsen acidosis, and has fewer effects on renal perfusion. If unavailable, normal saline remains an acceptable choice for fluid replacement.
- Administration of vasopressors through peripheral IV lines carries a risk of significant extravasation injury. If vasopressors are used, they must be given through a 20G or larger IV catheter placed above the wrist. Paramedics must continually monitor for signs of extravasation; if swelling or pain around the IV site are present, the receiving facility must be notified immediately.
- Capillary blood glucose levels should be assessed in all patients with suspected sepsis. A measurement of > 6.7 mmol/L, in absence of diabetes, suggestive of underlying hypermetabolic state which may be a sign of sepsis.
- Notify receiving facilities early for immunocompromised patients who are suspected of having sepsis. These patients often require isolation on arrival.

General Information

- NEWS2 relies on several physiological parameters already measured by paramedics in their practice:
 - Respiratory rate
 - Oxygen saturation
 - Systolic blood pressure
 - Pulse rate
 - Level of consciousness or new-onset confusion
 - Temperature
- Primary risk factors for sepsis include:
 - Age > 65

- Immunosuppression
- Diabetes
- Obesity
- Current diagnosis of cancer
- Hospitalisation within the preceding 90 days
- In isolation, malodorous urine is not associated with a urinary tract infection.
- Elderly individuals with sepsis frequently do not have fever. Patients should be asked about antipyretic medications, as these may mask fever. In all patients, the absence of fever does not exclude sepsis. Hypothermia, where it is present, is an ominous sign in sepsis.
- Paramedics should consider the possibility of meningococcal septicemia, and invasive group A streptococcus (necrotizing fasciitis).

National Early Warning Score-2

BC Emergency Health Services advocates the use of the National Early Warning Score (NEWS2) to identify patients at risk of sudden deterioration. NEWS2 scores should be obtained on all patients, and used to guide clinical decision-making, particularly in the areas of transport, destination selection, pre-arrival notification, ongoing monitoring, and emergency department advocacy.

Physiological Parameter	Score						
	3	2	1	0	1	2	3
Respiratory rate	≤ 8		9 – 11	12 – 20		21 – 24	≥ 25
SpO2 %	≤ 91	92 – 93	94 – 95	≥ 96			
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤ 90	91 – 100	101 – 110	111 – 119			≥ 220
Pulse per minute	≤ 40		41 – 50	51 – 90	91 – 110	111 – 130	≥ 131
Consciousness				Alert			Altered
Temperature	≤ 35.0		35.1 – 36.0	36.1 – 38.0	38.1 – 39.0	≥ 39.1	

Score	Clinical Risk	Practitioner Response
Aggregate score 0 – 4	Low	Routine monitoring Routine transport or referral pathway as required
Score of 3 in any individual parameter	Low-medium	Monitor carefully Routine transport as required
Aggregate score 5 – 6	Medium	Monitor carefully Attempt to optimize oxygenation, ventilation, and perfusion Consider advanced care intercept where available Consider emergent transport to hospital Consider pre-arrival notification Consider ClinCall consultation
Aggregate score ≥ 7	High	Monitor continuously Maximize oxygenation, ventilation, and perfusion Seek advanced care intercept but do not delay for Emergent transport to hospital Pre-arrival notification

NEWS2 is not intended to replace sound clinical judgment. Its purpose is to alert practitioners to the risk of sudden deterioration, and to help identify those patients who require more aggressive monitoring, treatment, and advocacy, and is particularly valuable in the context of infectious diseases and suspected sepsis.

Interventions

First Responder

- Position supine to improve blood pressure if not in respiratory distress
- Do not walk the patient
- Supplemental oxygen as required

- → [A07: Oxygen and Drug Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- Obtain and document NEWS2 score
- Provide supplemental oxygen to maintain $\text{SpO}_2 \geq 94\%$
 - → [A07: Oxygen and Drug Administration](#)
- Perform full-body assessment to examine for presence of mottling or non-blanching rash. Consider meningococcal septicemia.

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access and correct hypotension or hypoperfusion:
 - → [D03: Vascular Access](#)
- Correct hypotension and/or hypoperfusion:
- Consider CPAP if necessary to support oxygenation in cases of respiratory infection

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Concurrent use of vasopressors and fluid resuscitation is patient specific. Consider Clini-Call for consultation.
- [KetAMINE](#) is the preferred induction agent if advanced airway management is required to maintain airway patency, oxygenation or ventilation
 - → [PR18: Anesthesia Induction](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider norepinephrine

Evidence Based Practice

[Sepsis Syndrome](#)

[Septic Shock](#)

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