Malaria

Revision Dates

<table>
<thead>
<tr>
<th>Case Definition</th>
<th>March 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Requirenments</td>
<td>March 2017</td>
</tr>
<tr>
<td>Epidemiology/Public Health Management</td>
<td>March 2017</td>
</tr>
</tbody>
</table>

Case Definition

**Confirmed Case**
Laboratory confirmation of infection with or without clinical illness\(^A\):
- Demonstration of *Plasmodium* sp. in a blood smear/film (thick and thin).
  OR
- Detection of *Plasmodium* sp. nucleic acid (e.g., PCR) in an appropriate clinical specimen.

**Probable Case**
Laboratory evidence of infection with or without clinical illness\(^A\):
- Detection of *Plasmodium* sp. antigen\(^B\) in an appropriate clinical specimen.

\(^A\) Clinical illness: Symptoms vary and include fever, headache, back pain, chills, sweats, myalgia, nausea, vomiting, diarrhea and cough.

\(^B\) Including rapid antigen detection testing.
Reporting Requirements

2. Physicians, Health Practitioners and others
   A physician, health practitioner or person in charge of an institution shall in accordance with Sections 22(1)(b) or 22 (1.1) and 22(2) of the Public Health Act (PHA), notify the Medical Officer of Health (MOH) (or designate) of the zone, of all confirmed and probable cases in the prescribed form by mail, fax or electronic transfer within 48 hours (two business days).

3. Laboratories
   All laboratories shall report all positive laboratory results by mail, fax or electronic transfer within 48 hours (two business days) to the MOH (or designate) of the zone and the Chief Medical Officer of Health (CMOH) (or designate).

4. Alberta Health Services and First Nations and Inuit Health Branch (FNIHB)
   - The MOH (or designate) of the zone where the case currently resides shall forward the initial Notifiable Disease Report (NDR) of all confirmed and probable cases to the CMOH (or designate) within two weeks of notification and the final NDR (amendment) within four weeks of notification.
   - For out-of-province and out-of-country reports, the following information should be forwarded to the CMOH (or designate) by phone, fax or electronic transfer within 48 hours (two business days):
     - name,
     - date of birth,
     - out-of-province health care number,
     - out-of-province address and phone number,
     - positive laboratory report and
     - other relevant clinical/epidemiological information.
Etiology
Malaria is caused by protozoan parasites of the genus *Plasmodium*.\(^{(1)}\) Five species of the disease are known to infect humans: *P. falciparum, P. vivax, P. ovale, P. malariae* and *P. knowlesi*.

Clinical Presentation
Signs and symptoms of uncomplicated malaria are variable, however, most patients experience fever.\(^{(1,2)}\) In addition to fever, common associated symptoms include flu like symptoms (headache, abdominal pain, myalgia, and malaise). Rigors and chills often occur. The diagnosis may be difficult as the fever pattern in the first few days resembles that seen in the early stages of many other illnesses. Most infections produce a primary attack of malaria within 2 – 4 weeks after the mosquito bite occurs. The case fatality rate of uncomplicated malaria is 0.3%.

Severe malaria is most commonly caused by *Plasmodium falciparum*.\(^{(1,2)}\) It is the most widespread and dangerous of the four species and has a high case fatality rate. When untreated, *Plasmodium falciparum* infection can lead to fatal cerebral malaria including coma, seizures, renal and respiratory failure, and death. Prompt treatment is essential, even in mild cases, as irreversible complications may appear suddenly. The case fatality of treated severe malaria is 15-20%; almost always fatal if untreated.\(^{(1)}\)

*Vivax, malariae, and ovale* malarias are generally not as life-threatening as *falciparum* malaria.\(^{(1)}\) *Vivax* and *ovale* malarias may appear many months after an individual has returned from an endemic area. Illness initially begins with malaise and a slowly rising fever. Over the next few days shaking chills occur and the body temperature rises rapidly, often accompanied by headache and nausea. When left untreated, the symptoms of *vivax, ovale* or *malariae* malaria subside in 10 – 30 days. Relapses may occur for up to five years but in the case of *malariae* infections, relapses can occur for up to 40 – 50 years after infection.

Infection, especially with *P. vivax* and *P. falciparum*, during pregnancy is an important cause of infant mortality (i.e., spontaneous abortion, stillbirths) and low birth weight.\(^{(3)}\) Congenital malaria can occur. Manifestations may resemble neonatal sepsis including fever, poor appetite, lethargy, and irritability.

Persons who are partially immune or have taken prophylactic medications may have an atypical clinical presentation.\(^{(1)}\)

Reservoir
Malaria is primarily maintained in a human – *Anopheles* mosquito cycle.\(^{(1,2)}\)

Transmission
Malaria is transmitted to humans via the bite of an infected female *Anopheles* mosquito found in a malaria-endemic area (e.g., sub-Saharan Africa).\(^{(1,2)}\)

In rare situations, malaria can also be acquired through:\(^{(1,2)}\)
- contaminated blood/blood products,
- organ transplantation,
- needlestick injuries, and
- mother-to-infant transmission.

Three factors play a role in the local transmission of malaria: competent mosquito vectors, a suitable climate for mosquito transmission and infected, infective people.\(^{(4)}\) In several locations in Canada, such as Ontario, Quebec and British Columbia, a few species of *Anopheles*, such as *An. quadrimaculatus* and *An. freeborni* are capable of reproducing and transmitting *Plasmodia*.\(^{(5)}\)
addition, parts of Canada in the summer months meet the climate requirements for optimal parasite development and reproduction.\(^4\) However, the third factor, numbers of infected and infective humans in Canada, is not sufficiently high due to a combination of high standards of living, ready access to medical services and treatment, even if travel and immigration could potentially introduce parasites into local human populations.

**Incubation Period**
The incubation period ranges from 9 – 40 days and varies with the species; shorter for *P. falciparum*, and longer for *P. malariae*.\(^1\) Individuals with partial immunity and those taking prophylaxis may have a prolonged incubation period.\(^5\) With infection by blood transfusion, the incubation period depends on the number of parasites infused.\(^1\) The time is usually short but may range up to two months.\(^1\)

**Period of Communicability**
Malaria cases have the ability to infect other people via blood as long as the infective gametocytes are present in the blood of the case.\(^1\) This may be under a year for untreated *P. falciparum*, up to five years for *P. vivax* and *P. ovale*, and up to several decades for *P. malariae*.\(^5\)

Although infection acquired via blood transfusion is rare, donated blood may remain infectious for up to one month.\(^2\)

**Host Susceptibility**
Susceptibility is universal.\(^1\) Immunocompromised individuals, including those with HIV, young children, the elderly and pregnant women are particularly susceptible. In endemic areas, where infection rates are high, people are repeatedly infected and develop tolerance or partial immunity to malaria. Until they have acquired this immunity, children remain highly vulnerable to infection, as do travellers to endemic areas.\(^2\) Individuals who immigrate to Canada/Alberta and are infected with asymptomatic/sub-clinical malaria may go on to develop disease a few months after arrival.\(^6\)

**Incidence in Alberta**
Malaria first became notifiable in Alberta in 1985. The number of cases reported in Alberta in 2015 (n=100) has increased 4-fold since 2000 (n=25), likely due to increases in travel and immigration as well as changes in testing (e.g., PCR testing). Malaria is not considered endemic to Alberta.

**Public Health Management**

**Diagnosis**
Laboratory confirmation is made by direct microscopic examination of intracellular parasites on stained blood films (e.g., smear) or by PCR testing.\(^1\) Rapid antigen detection tests (RDTs) are useful in countries where there is no malaria microscopy expertise or equipment, for remote diagnosis, and potentially for outbreak purposes.\(^7\) If RDTs are used they need to be confirmed either by PCR or by smear.

**Key Investigation**
- Confirm the diagnosis.
- Determine where the case may have been exposed, taking into consideration the incubation period, reservoir, and mode of transmission. Relevant history includes:
  - History of recent travel or immigration,
  - History of recent blood transfusion (within previous 60 days),
  - History of recent needlestick injury,
History of previous malarial illness.
- Prophylaxis taken (i.e., medication, dosage, adherence).

**Case Management**
- Prompt diagnosis, accurate identification of species, and appropriate initial management is essential to prevent malaria-associated morbidity and mortality.\(^{(1,8)}\)
- Consultation with an infectious disease specialist is strongly recommended.

**Treatment of a Case**
- The choice of treatment is based on the infecting species, possible drug resistance, the severity of disease and to some extent, the place acquired. In addition, the patient’s age, as well as the safety, availability and cost of antimalarial drugs are taken into consideration.

**Management of Contacts**
- There is no direct follow-up of contacts; however, it may be prudent to identify others who may have been exposed to the same source as the case to find undiagnosed cases.

**Preventive Measures**
- Provide the following recommendations to travelers going to malaria-endemic areas:
  - Consult a health care provider or visit a travel health clinic preferably six weeks before you travel.
  - Protect yourself from mosquito bites:\(^{(9)}\)
    - remain in well-screened or completely enclosed, air-conditioned areas whenever possible,
    - wear light-colored clothing and cover up as much as possible with long pants, long-sleeved loose fitting shirts, shoes/boots (not sandals) and a hat.
    - sleep under a bed net, preferably treated with insecticide, and
    - use insect repellent (containing DEET or Icaridin), 15 minutes after sunscreen, on exposed skin and on clothing.
  - Use malaria prophylaxis and continuing to take the antimalarial medication for the specified duration following return.
  - See a health care professional if a febrile illness occurs during or following travel.
References