Pocket Guide for Immunizers:

Vaccination against Mosquito-Borne Illnesses

(Chikungunya, Japanese Encephalitis & Yellow Fever)

The purpose of this pocket guide is to serve as a tool for health care providers to learn more about vaccines against mosquito-borne illnesses, enabling them to provide pre-travel vaccine counselling to their patients.

Mosquito-borne illnesses are spread to humans through the bite of an infected mosquito. Worldwide, mosquito-borne illnesses include chikungunya, dengue, Japanese encephalitis, malaria, West Nile virus, yellow fever, and Zika. Unfortunately, vaccines are not available for all mosquito-borne diseases. However, in Canada, vaccines are available for the following diseases: **chikungunya, Japanese encephalitis,** and **yellow fever**, which are discussed in this pocket guide.

Note: *While there are available vaccines for dengue, none are currently authorized for use in Canada. For more information, refer to the Recommendations on use of QDENGA (dengue vaccine) in jurisdictions where it is authorized for travellers statement from the Committee to Advise on Tropical Medicine and Travel (CATMAT).*

Risk of exposure varies across the world and it is important for travellers to understand how to protect themselves when travelling to areas with vaccine-preventable mosquito-borne illnesses.

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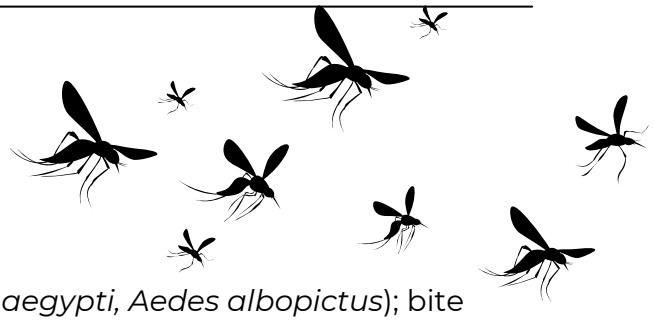
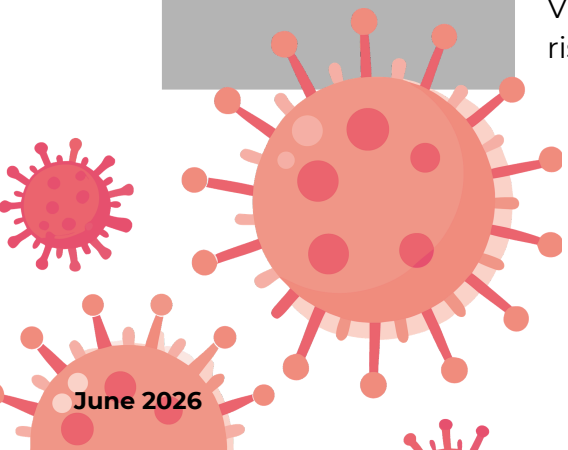


Part One: Chikungunya

Infectious agent	Chikungunya virus
Vector	Aedes mosquitoes (*Aedes aegypti, Aedes albopictus*); bite during daytime (especially at dawn and dusk)
Endemic areas	Tropical and subtropical regions (including parts of Asia, Africa, Mexico, the Caribbean, South America, Central America, the Pacific Islands, and the Southeastern U.S.) Higher risk during outbreaks/epidemics; generally low risk for people travelling outside of outbreak affected areas
Clinical syndrome	Fever; severe joint pain (arthritis-like); rash; fatigue; nausea; vomiting; headache; muscle pain
Incubation period	Typically 3–7 days (up to 12 days)
Complications	Rare; may affect eyes, heart, stomach, intestines, and nervous system; prolonged joint pain (weeks to months) in ~50% of cases; higher risk in infants, older adults, and those with chronic conditions (such as diabetes or high blood pressure)
Treatment	No specific treatment; supportive care for relieving symptoms (pain, fever, inflammation); prevention via mosquito bite avoidance Vaccine available in Canada for some travellers at increased risk of exposure



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What vaccine is available in Canada?

IXCHIQ® (Chik-LAV) is the only chikungunya vaccine authorized for use in Canada.

Table 1: Preparations of chikungunya vaccine authorized for use in Canada

Class code	Class details	Authorized ages for use	Product name
Chik-LAV	Live, attenuated vaccine	Ages 12 to 64 years	IXCHIQ® - Valneva

Note: *Throughout the rest of this guide, the vaccine will be referred to by class code.*

What is the recommended dosage and how is it given?

The Chik-LAV vaccine is administered as a single 0.5 mL dose given intramuscularly (IM), ideally **at least 6 weeks before travel**. No booster dose is currently recommended.

How do I choose when to offer the vaccine?

Table 2: Recommendations for use of chikungunya vaccine by age group

Age group	Recommendaton for use
Ages 12 to 17 years	Authorized for use by Health Canada, but CATMAT has not yet issued specific guidance for this age group.
Ages 18 to 64 years	Not routinely recommended. Considered for individuals at high risk of exposure, such as travellers to areas experiencing a chikungunya outbreak and/or those with longer or repeated travel to affected regions. An individualized assessment and discussion are recommended.

Note: *As good practice, personal protective measures to prevent insect bites should be recommended to all patients travelling to chikungunya-affected locations.*

Who should not receive chikungunya vaccine?

Table 3: Not recommended for use by specific population

Group	Not recommended for use
Ages 65 years and older	Not recommended for this age group. Individuals in this age group are advised to avoid travel to chikungunya outbreak areas when possible due to higher risk of serious adverse events.
Pregnant and breastfeeding people	Contraindicated during pregnancy due to the live vaccine strain and the fact that there is limited safety data available. There is also limited safety data during breastfeeding. Pregnancy should be avoided for 1 month after vaccination.
Immuno-compromised persons	Contraindicated for immunocompromised persons due to the live vaccine strain and the fact that there is limited safety data available.

Shared decision-making and individualized assessment

If travel is unavoidable for any of the groups listed in **Part 1, Table 3**, shared-decision making and an individualized assessment are required with your patient. **Assessment considerations should include, but are not limited to**, destination and outbreak status, duration and frequency of travel, underlying medical conditions (e.g., diabetes, heart disease), and traveller's values and risk tolerance.

To assist with shared decision-making and individualized assessment, refer to the following resources:

- Remarks and Table 1. Example of individualized assessment in the CATMAT statement on *Recommendations for the use of chikungunya live attenuated vaccine (IXCHIQ)*
- Immunization in pregnancy and breastfeeding chapter in the *Canadian Immunization Guide*
- Immunization of immunocompromised persons chapter in the *Canadian Immunization Guide*

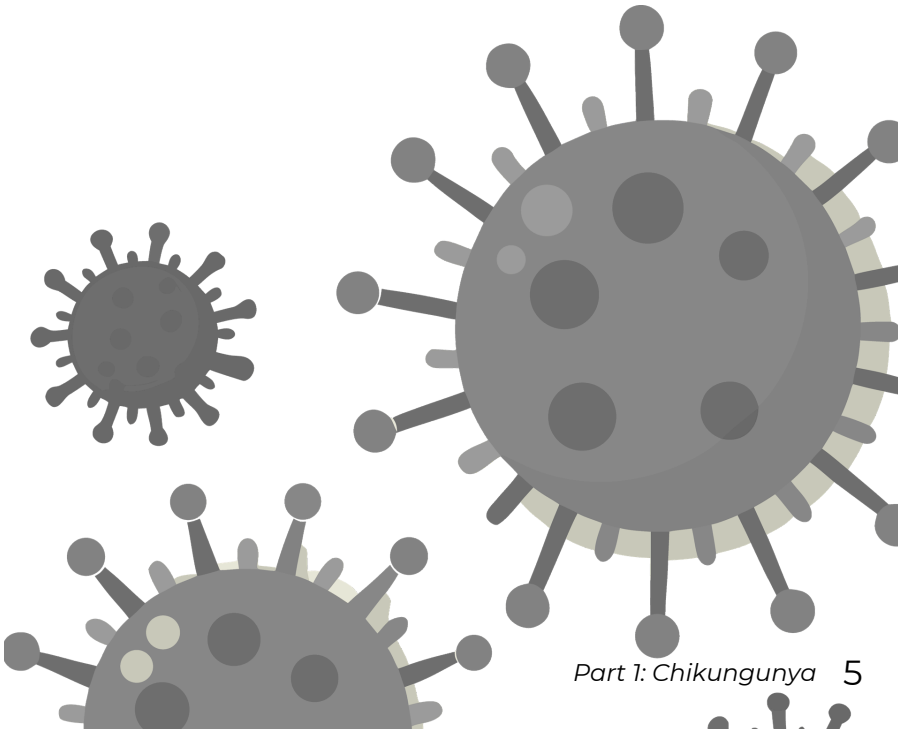
A note on co-administration

It is not recommended that Chik-LAV be given at the same visit as other live or inactivated vaccines due to limited safety data.

What about side effects and adverse events?

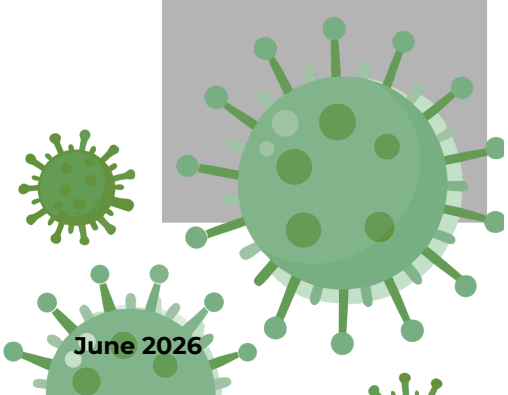
Common side effects / vaccine experience	Mild–moderate: tenderness at injection site, headache, fatigue, muscle pain, joint pain, fever; occur within 10 days and resolve on their own
CLARs (Chikungunya-like Adverse Reactions)	Occur within 30 days; may resemble natural infection: arthritis, back pain, rash/skin symptoms, swollen lymph nodes, neurological, cardiac, or eye symptoms; may include common side effects of vaccine as well
Severe adverse effects	Rare (<0.1%)
Severe CLARs	Occur in ~1.6%; defined as symptoms interfering with daily activities or requiring medical care

For additional information, refer to the Safety and adverse events section of the chikungunya vaccine chapter in the *Canadian Immunization Guide*.



Part Two: Japanese encephalitis

Infectious agent	Japanese encephalitis virus
Vector	*Culex* and *Aedes* mosquitoes; primarily bite from sunset to sunrise
Endemic areas	Much of Asia and parts of Oceania; transmission during the summer/fall in temperate regions (e.g., China, Japan, Korea), transmission year-round in tropical/subtropical regions (e.g., Vietnam, Thailand, Malaysia, Indonesia, Singapore) Higher risk outdoors in rural/agricultural areas; lower risk in indoor urban settings
Clinical syndrome	Most infections are asymptomatic Symptomatic cases can include fever, headache, vomiting; severe disease can include encephalitis, seizures, stiff neck, confusion, weakness, movement disorders, behavioural/mental changes, paralysis, coma, permanent neurological damage
Incubation period	Typically 5–15 days
Complications	<1% develop encephalitis; case fatality ~20–30% in severe cases; long-term neurological damage common in survivors; highest risk in infants and older adults
Treatment	No specific antiviral treatment; supportive care for relieving symptoms (pain, fever, inflammation); prevention via mosquito bite avoidance Vaccine available in Canada for some travellers at increased risk of exposure



What vaccine is available in Canada?

IXIARO® (JE) is the only Japanese encephalitis vaccine authorized for use in Canada.

Table 1: Preparations of Japanese encephalitis vaccine authorized for use in Canada

Class code	Class details	Authorized ages for use	Product name
JE	Inactivated, Vero cell culture-derived, adsorbed vaccine	Ages 2 months and older	IXIARO® - Valneva

Note: *Throughout the rest of this guide, the vaccine will be referred to by class code.*

What is the recommended dosage and how is it given?

The JE vaccine is administered as a primary 2-dose series (0.25 mL or 0.5 mL depending on age), given intramuscularly 28 days apart (see Table 2 for dose recommendations by age group). If feasible, travellers should complete the primary immunization series **at least 7 days before travel** to ensure optimal protection.

How do I choose when to offer the vaccine?

The JE vaccine is recommended only for **travellers at increased risk of disease** (e.g., those spending extended periods abroad, making multiple trips to, or having substantial exposure in rural areas of endemic regions).

Refer to the Risk Factors section of the in the Japanese encephalitis vaccine chapter of the *Canadian Immunization Guide*.

Table 2: Recommendations for use of JE vaccine by age group

Age group	Recommendation for use
Ages 2 months to less than 3 years	A primary series consists of two separate 0.25mL doses, administered on day 0 and day 28.
Ages 3 years and older	A primary series consists of two separate 0.5mL doses, administered on day 0 and day 28.

Accelerated schedule (primary JE vaccine series)

If there is insufficient time to complete the recommended primary series, an accelerated JE vaccine schedule may be used for **individuals aged 18 to 64 years, with doses administered on day 0 and day 7.**

If there is not enough time to complete the accelerated schedule, **a single dose or two doses administered simultaneously at different injection sites may be considered for individuals aged 18 to 64 years**. While two doses given at the same time produce a better immune response than a single dose, the level of protection is still likely lower than that achieved with the standard schedule.

Vaccination of specific populations

Table 3: Recommendations for use of JE vaccine by specific population

Group	Recommendation for use
Pregnant and breastfeeding people	No direct safety or efficacy data for this group. Animal studies have not shown harm to fertility or pregnancy outcomes. Vaccination may be recommended if travel to high-risk areas in unavoidable, as JE infection during pregnancy can lead to serious outcomes, including miscarriage.
Immuno-compromised persons	Vaccination may be recommended if travel to high-risk areas in unavoidable. Immune response may be weaker and shorter-lasting. Strict mosquito bite prevention measures are advised, and earlier booster doses may be needed. A specialist referral may be helpful in complex cases.
Laboratory and healthcare personnel	Individuals with ongoing occupational exposure to or working directly with the virus should be vaccinated and receive a booster dose 12 months after the primary series. Healthcare providers working abroad should consider vaccination if their travel plans place them at high risk of exposure, based on destination and activities.

For additional information on specific populations, refer to the following chapters in the *Canadian Immunization Guide:*

- Immunization in pregnancy and breastfeeding
- Immunization of immunocompromised persons
- Immunization of workers

A note on booster doses and reimmunization

Table 4: Recommendations on booster doses of JE vaccine

# of doses	Recommendation for use
Single booster dose	In general, may be administered 12 to 24 months after completion of primary series for those who remain at risk. A delayed booster dose can still be given after 24 months (no need to restart the series). Adults aged 65+ should be given a single booster dose earlier than 12 months after completion of primary series.
Second booster dose	An additional booster dose may be considered for individuals who remain at risk and for whom more than 10 years have passed since their first booster dose.

A note on co-administration and interchangeability

Co-administration: There is limited data showing that the JE vaccine can be administered concomitantly with other vaccines. However, since JE is an inactivated vaccine, it may be administered concomitantly with other vaccines, provided that separate injection sites and equipment are used.

Interchangeability: There is no available data on whether the JE vaccine currently in use —a Vero cell culture-derived vaccine—can be safely or effectively interchanged with older mouse brain-derived JE vaccines or with other JE vaccines used internationally.

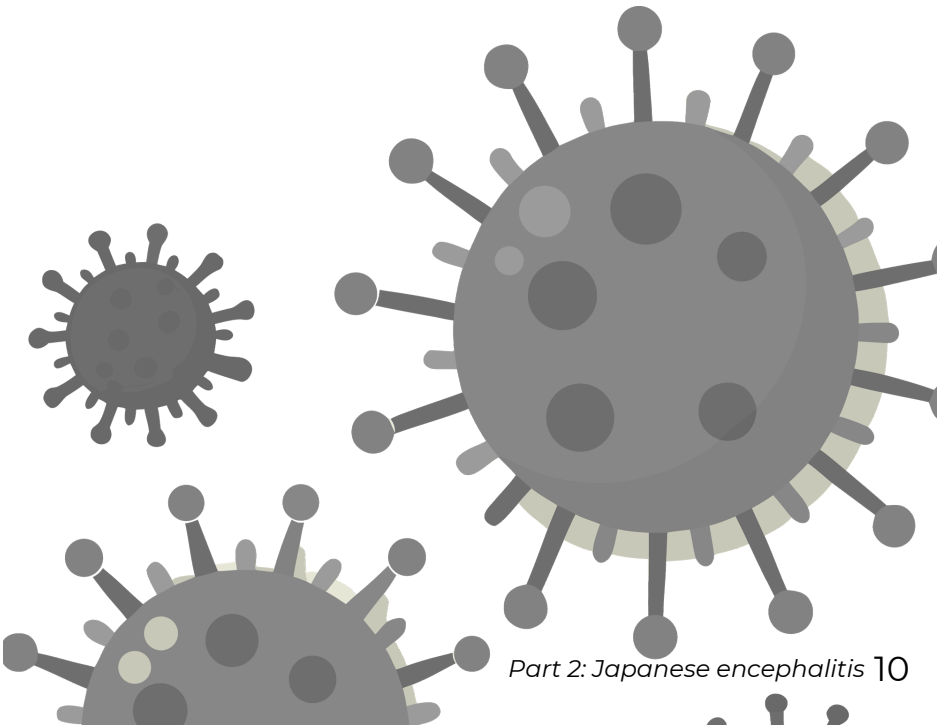
What about contraindications?

JE vaccines are contraindicated for individuals who have had a severe allergic reaction (anaphylaxis) to a previous dose or who have a known severe allergy to any vaccine component or its container. Vaccination should be postponed in people with severe acute illness, but it does not need to be delayed for those with mild or moderate illness, even if fever is present.

For additional information, refer to the Contraindications and precautions chapter in the *Canadian Immunization Guide*.

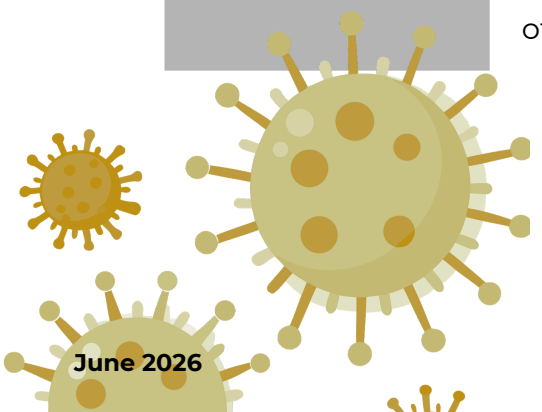
What about side effects and adverse events?

Common side effects / vaccine experience	Mild to moderate: tenderness and/or pain at injection site; headache; fatigue; muscle pain; fever; generally self-limiting
Additional common side effects (children 2 months to <3 years)	Diarrhea; influenza-like illness; irritability; decreased appetite; vomiting; swelling and hardening at injection site
Severe adverse effects	No other commonly reported serious adverse effects



Part Three: Yellow Fever

Infectious agent	Yellow fever virus
Vector	*Aedes and Haemagogus* mosquitoes; bite during daytime (especially around sunrise and sunset)
Endemic areas	Tropical regions of Africa and South America; higher risk in rural/jungle areas, extended stays, and outdoor activities; overall risk low for most travellers but varies by destination, season, and exposure
Clinical syndrome	Early symptoms include fever, flu-like illness, abdominal pain, back pain, chills, fatigue, headache, joint and muscle pain, loss of appetite, nausea/vomiting, weakness; many people recover after this stage Severe symptoms (~15%) include jaundice, internal bleeding, organ failure, shock
Incubation period	Typically 3–6 days
Complications	Severe disease in ~15%; ~50% of severe cases fatal (usually within 10–14 days); liver involvement (jaundice); multi-organ failure
Treatment	No specific treatment; supportive care for relieving symptoms (pain, fever, inflammation); prevention via mosquito bite avoidance Vaccine available in Canada for some travellers at increased risk of exposure



What vaccines are available in Canada?

YF-VAX® (YF) is the only yellow fever vaccine authorized for use in Canada.

Table 1: Preparations of yellow fever vaccine authorized for use in Canada

Class code	Class details	Authorized ages for use	Product name
YF	Live, attenuated vaccine	Ages 9 months and older	YF-VAX® - Sanofi

Note: *Throughout the rest of this guide, the vaccine will be referred to by class code.*

What is the recommended dosage and how is it given?

The YF vaccine is administered as a single 0.5 mL dose given subcutaneously, ideally **at least 6 weeks before travel**. Booster doses may also be considered for specific populations.

How do I choose when to offer the vaccine?

The decision to vaccinate a traveller against YF should consider the travel itinerary, country entry requirements (including stopovers and transit), risk of exposure, and individual factors such as age and immune status, as well as the risk of serious adverse events associated with vaccination. Vaccination is generally not recommended for travellers whose itineraries are limited to areas with low or no risk of yellow fever exposure.

Table 2: Recommendations for use of YF vaccine by age group

Age group	Recommendation for use
Ages 6 to 8 months	Off-label use. A single dose may be considered in this age group only when travel to a high-risk area is unavoidable and risk of disease is high. In general, infants under 9 months should not receive the YF vaccine due to the risk of neurologic complications. The decision should carefully balance the risk of yellow fever infection against the increased risk of vaccine-related adverse events.

Age group	Recommendation for use
Ages 9 months and older	A single dose is recommended for immunocompetent individuals travelling to countries where YF transmission is present. Caution for individuals >60 years due to potential higher incidence of serious adverse events. Prioritize effective mosquito protection and discuss risk vs. benefits of vaccination if travel to YF-risk areas cannot be avoided.

Vaccination of specific populations

Table 3: Recommendations for use of YF vaccine by specific population

Group	Recommendation for use
Pregnant and breastfeeding people	Generally avoided during pregnancy. Should be considered only when travel to a YF-risk area is unavoidable and effective mosquito protection is not possible. Generally not recommended during breastfeeding of infants under 9 months, due to rare reports of vaccine virus transmission causing infant encephalitis.
Immuno-compromised persons	Generally not recommended due to the risk of vaccine-related disease. For high-risk exposure where travel is unavoidable, people with mild immune suppression may be offered the vaccine with counselling, while people with severe immune suppression require case-by-case vaccine decision-making with a physician and specialist.
Persons with chronic diseases	Reimmunization every 10 years is recommended for HIV-positive individuals travelling to YF-risk areas.

Group	Recommendation for use
Laboratory personnel	Recommended for laboratory personnel who work with the YF-virus and who work in YF-endemic areas. Reimmunization every 10 years is also recommended for this group, unless protective antibodies levels are confirmed through serology testing.

For additional information on specific populations, refer to the following chapters in the *Canadian Immunization Guide:*

- Immunization in pregnancy and breastfeeding
- Immunization of immunocompromised persons
- Immunization of persons with chronic diseases
- Immunization of workers

A note on booster doses and reimmunization

In general, booster doses are **not needed.**

However, CATMAT recommends a **one-time booster on a case-by-case basis for individuals** whose initial immune response may have been reduced, whose previous dose may have been inadequate or undocumented, or who face particularly high exposure risk (e.g., outbreaks, frequent or prolonged travel), especially if 10 years or more have passed since primary vaccination.

There is limited evidence on long-term immunity in those vaccinated in early childhood, and no routine booster recommendation exists for young children; decisions should be individualized.

A note on co-administration

The YF vaccine can be given at the same time with the following vaccines: measles, mumps, rubella, polio, diphtheria, tetanus, pertussis, hepatitis B, hepatitis A, oral cholera, and oral or parenteral typhoid. It is recommended that separate injection sites and equipment be used.

If YF vaccine is not given at the same visit as other live injectable vaccines, a minimum interval of 4 weeks is recommended. Oral typhoid and oral cholera vaccines may be given at any time before or after YF vaccination. There is **no available data on interactions between YF vaccine and some other vaccines**, such as rabies, HPV, Japanese encephalitis, live attenuated influenza, or varicella vaccines. For additional information, refer to the Timing of vaccine administration chapter in the *Canadian Immunization Guide*.

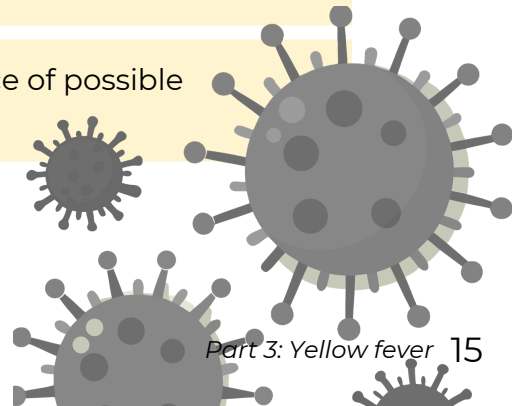
What about contraindications?

The YF vaccine is contraindicated in individuals with severe immune deficiency, thymus disease (e.g thymoma, myasthenia gravis, thymectomy) associated with abnormal immune function, in those who have had an anaphylactic reaction to a previous YF vaccine, or who have a severe allergy to any vaccine component. **Infants under 6 months of age** should not receive the vaccine due to the risk of serious neurologic adverse events. Vaccination should be **postponed during moderate or severe acute illness**, but may proceed in people with mild illness. Individuals with suspected **hypersensitivity or non-anaphylactic allergies** (including egg proteins and gelatin) should be referred for specialist evaluation. Most can be safely immunized following evaluation.

For additional information, refer to the Contraindications and precautions chapter in the *Canadian Immunization Guide*.

What about side effects and adverse events?

Common side effects / vaccine experience	Mild & transient: headache; muscle pain; low-grade fever; injection site reactions; generally short-lived & well tolerated
Serious adverse effects	Rare; occur mostly after first dose; more frequent with increasing age; severe reactions to boosters are very rare
YEL-AND (neurotropic disease)	Rare; affects nervous system; occurs within 30 days of vaccination; almost exclusively after primary dose; higher risk in infants <9 months and older adults; recovery usually complete; death is rare
YEL-AVD (viscerotropic disease)	Very rare but severe; resembles wild-type yellow fever; causes multi-organ failure; high fatality rate; higher risk in older adults and those with thymus disease; occurs almost exclusively after first dose
Other rare reactions	Very rare anaphylaxis; limited evidence of possible transmission through breastfeeding



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