Centers for Disease Control and Prevention

Vaccine Safety

Vaccine Safety Home

Monkeypox Vaccines

Safety Information

Vaccine Guidance during the 2022 Mpox Outbreak

If you are a healthcare provider, please refer to the interim clinical considerations for up-to-date information about the use of mpox vaccines.

About Mpox

Mpox is a potentially serious disease caused by infection with *Monkeypox virus*. *Monkeypox virus* is part of the same family of viruses as variola virus, the virus that causes smallpox.

Mpox can be spread through close, personal, often skin-to-skin contact, including direct contact with mpox rash, scab, or body fluids (any type of sex, kissing, hugging, or massage), touching items that have been used by someone with mpox, and through contact with respiratory secretions (saliva, mucus). The disease can be spread from the time symptoms start until the rash has healed (all scabs have fallen off and a fresh layer of skin has formed). Learn more about the detection and transmission of the *Monkeypox virus*.

People infected with *Monkeypox virus* can experience a range of symptoms that can include a rash and flu-like symptoms. The symptoms start within three weeks of exposure to the virus and the illness typically lasts 2-4 weeks. Learn more about mpox.

The first case of mpox was recorded in 1970 and since then cases have been reported in several central and western African countries. Beginning in 2022, there has been an outbreak of monkeypox in countries without a history of the disease. Learn more about the 2022 mpox outbreak.

There are vaccines that can help prevent mpox.

Available Vaccines

Vaccine Information Statements

Vaccine Information Statements (VISs) are information sheets produced by CDC that explain both the benefits and risks of a vaccine.

JYNNEOS

Smallpox/Mpox vaccine for people ages 18 years and older at risk for smallpox or mpox infection.

There are two types of vaccines available in the United States that can prevent mpox. Both vaccines are made from a virus called **vaccinia**, which is a poxvirus related to mpox, but less harmful.

The two types of vaccines are **replication-deficient modified vaccinia Ankara (MVA) vaccine** and **replication-competent vaccinia virus vaccine**.

Replication-deficient MVA vaccine

JYNNEOS™ (also known as Imvamune or Imvanex in other countries) is a live, replication-deficient MVA vaccine. That means it does not produce infectious virus in humans, and therefore cannot cause clinical infections.

It is licensed by the U.S. Food and Drug Administration (FDA) and approved as a two-dose series for the prevention of smallpox and mpox and for people ages 18 years and older. During the 2022 mpox outbreak, FDA authorized JYNNEOS™ under emergency use in persons younger than 18 years to help prevent mpox.

Learn more about the FDA EUA for JYNNEOS .

Replication-competent vaccinia virus vaccine

ACAM2000® is a live replication-competent vaccinia virus vaccine. This vaccine can cause a clinical vaccinia infection in humans, as well as produce infectious virus that can spread to others. However, this vaccine cannot cause smallpox or mpox.

It is approved for the prevention of smallpox in people who are at high risk of smallpox infection. During the 2022 mpox outbreak, ACAM2000 was made available for use against mpox under an Expanded Access Investigation New Drug Application (EA-IND) protocol. CDC recommends that vaccination with ACAM2000 may be considered for people ages 1 year and older who have been determined to be high risk for infection to prevent mpox as an alternative to JYNNEOS.

Learn more about Expanded Access

2022 Mpox Vaccine Considerations

CDC recommends the use of JYNNEOS as the primary vaccine to prevent mpox as it is associated with fewer potential side effects than ACAM2000.

Learn more about Mpox Vaccines

Talk with your healthcare provider about vaccines.

They can answer questions and offer advice based on your specific health needs.

Who Should Get Vaccinated to Prevent Mpox

Considerations relating to who should or should not get a vaccine to prevent mpox are evolving due to the 2022 mpox outbreak. CDC's Interim Clinical Considerations will have the most current information on who should or should not get a vaccine to prevent mpox.

Visit CDC's Interim Clinical Considerations for use of JYNNEOS and ACAM2000 vaccines during the 2022 U.S. Mpox outbreak for additional information.

Manufacturer Package Inserts

JYNNEOS

JYNNEOS [PDF – 11 Pages] : FDA approved this vaccine in 2019. It is approved for use in people ages 18 years and older and determined to be at high risk for smallpox or mpox infection. The FDA also issued an EUA for JYNNEOS use in people under ages 18 years and for alternative routes of administration for those ages 18 years and older during the 2022 mpox outbreak. The EUA is listed on the FDA's page on Mpox EUA Information .

ACAM2000

ACAM2000 [PDF – 11 Pages] : The U.S. Food and Drug Administration (FDA) approved this vaccine in 2007. It is approved for use in people who have a high chance of getting smallpox. During the 2022 mpox outbreak, ACAM2000 is allowed to be used under the Expanded Access Investigation New Drug Application (EA-IND) protocol.

Common Side Effects

Vaccines, like any medicine, can have side effects. The most common side effects are usually mild and go away on their own.

Severe allergic reactions following vaccination are rare, but can be life threatening.
Symptoms of a severe allergic reaction can include hives, swelling of the face and throat, difficulty breathing, a fast heartbeat, dizziness, and weakness.

If such reactions occur, call 9-1-1 and get the person to the nearest hospital.

Smallpox and Mpox Vaccine, Live, Non-replicating – JYNNEOS

Common Side Effects

- Injection site reactions, including pain, redness, swelling, hardening of the skin, and itching. Injections site reactions, except for pain, may occur more frequently after intradermal administration than after subcutaneous administration.
- Headache
- Muscle pain
- Fatigue (tiredness)
- Nausea
- Change in appetite
- Chills
- Fever

Before Getting JYNNEOS

People who have certain health conditions may not be able to get JYNNEOS. People should talk to their healthcare provider before getting JYNNEOS if they:

- Have had a severe allergic reaction (e.g., anaphylaxis) after a previous dose of JYNNEOS or another smallpox vaccine
- Have a history of severe allergic reaction (e.g., anaphylaxis) following gentamicin or ciprofloxacin
- Have a history of severe allergic reaction to chicken or egg protein AND are currently avoiding exposure to all chicken or egg proteins

People with minor illnesses, such as a cold, may be vaccinated.

People who have been recommended to receive JYNNEOS due to exposure to *Monkeypox virus* should be vaccinated regardless of concurrent illness, pregnancy, breastfeeding, or weakened immune system.

Smallpox (Vaccinia) Vaccine, Live – ACAM2000

Healthcare providers should consult CDCs Interim Clinical Considerations for the most current information on who should or should not get a vaccine to prevent mpox. Learn more about Interim Clinical Considerations for Use of JYNNEOS and ACAM2000 Vaccines during the 2022 U.S. Mpox Outbreak.

Common Side Effects

- Itching
- Swollen lymph nodes
- Sore arm
- Fever
- Headache
- Body ache
- Mild rash
- Fatigue (tiredness)

Serious Side Effects

- Heart problems (including myocarditis and pericarditis)
- Swelling of the brain or spinal cord
- Problems with the vaccination site blister, such as it becomes infected
- Spreading the virus to other parts of the body or to another person
- Severe allergic reaction after vaccination
- Accidental infection of the eye (may cause swelling of the cornea, causing watery, painful eyes and blurred vision, scarring of the cornea, and blindness)

Who Should Not Get ACAM2000

People who have immune system related illnesses, such as HIV, should not get ACAM2000. Infants younger than age 12 months should not receive ACAM2000.

The risk for serious ACAM2000 vaccine side effects are greater in people with certain conditions, and they should not get the vaccine. People with the following conditions should talk to their doctor about ACAM2000:

- Have three or more of the following risk factors for heart disease: high blood pressure, high cholesterol, diabetes, high blood sugar, a family history of heart problems, or smoking

- Have heart or blood vessel problems, including angina, previous heart attack, artery disease, congestive heart failure, stroke, or other cardiac issues
- Have skin problems, such as eczema, atopic dermatitis, burns, impetigo, contact dermatitis, chickenpox, shingles, psoriasis, or uncontrolled acne
- Are pregnant, could be pregnant, plan to become pregnant or breastfeeding
- Are taking steroid eye drops or ointment
- Have had problems after previous doses of smallpox vaccine or are allergic to any part of smallpox vaccine, such as antibiotics neomycin or polymyxin B

People with minor illnesses, such as a cold, may be vaccinated.

In some cases, the healthcare provider may decide to postpone vaccination with ACAM2000 or vaccinate with JYNNEOS. For children and adolescents ages 1 to 16 years, the safety and effectiveness has not been evaluated; assess risks versus benefits before administering ACAM2000.

VAERS Reporting Requirements for Mpox Vaccines

The vaccination provider must report all serious* adverse events following administration of JYNNEOS or ACAM2000 vaccine and vaccine administration errors to the Vaccine Adverse Event Reporting System (VAERS) by submitting online at https://vaers.hhs.gov/reportevent.html .

The vaccination provider is responsible for **mandatory** reporting of the following listed events following JYNNEOS or ACAM2000 vaccination to VAERS:

- Vaccine administration errors, whether or not associated with an adverse event
- Serious* adverse events (irrespective of attribution to vaccination)
- Cases of cardiac events, including myocarditis and pericarditis
- Cases of thromboembolic events and neurovascular events

*Serious adverse events are defined as:

- Death
- A life-threatening adverse event
- In-patient hospitalization or prolongation of existing hospitalization
- A persistent or significant incapacity or substantial disruption of the ability to conduct normal life functions
- A congenital anomaly/birth defect
- An important medical event that based on appropriate medical judgement may jeopardize the individual and may require medical or surgical intervention to prevent one of the outcomes listed above

Providers are encouraged to also report to VAERS any additional clinically significant adverse events following vaccination, even if they are not sure if vaccination caused the event.

On August 9, 2022, FDA issued an Emergency Use Authorization (EUA) for JYNNEOS mpox vaccine. It authorizes the vaccine to be administered in one of two ways:

1. Intradermally (between the layers of the skin) preferably on the inner aspect of the forearm, or
2. Subcutaneously (under the skin) in the upper arm above the elbow.

These are considered routes of vaccination. When submitting a VAERS report, ensure that you document the **Route** in **Section 17** of the VAERS form, by choosing “intradermal” or “subcutaneous” from the selection menu.

For more information about reporting requirements, see How to submit a report to VAERS .

More Information

Who Should Not Get Vaccinated?

Some people should not get certain vaccines or should wait before getting them. Read the CDC guidelines for each vaccine.

Orthopoxviruses (Smallpox and Monkeypox) Vaccines - ACIP Recommendations and Guidance

Official recommendations for smallpox and mpox vaccines from the Advisory Committee on Immunization Practices (ACIP).

Mpox and Smallpox Vaccine Guidance

Guidance for healthcare professionals on mpox and smallpox vaccine.

Interim Clinical Considerations for Use of JYNNEOS and ACAM2000 Vaccines during the 2022 U.S. Mpox Outbreak

Learn about considerations for mpox vaccination, including availability and effectiveness of vaccines.

A Closer Look at the Safety Data

JYNNEOS

The modified vaccinia Ankara vaccine (JYNNEOS) was developed to offer a safer smallpox vaccine option for people who would not be able to safely receive ACAM2000 (live vaccinia virus vaccine). When JYNNEOS received FDA approval, it was approved to prevent smallpox and mpox. JYNNEOS is the preferred vaccine to prevent mpox.

The overall JYNNEOS clinical trial program included 22 studies and a total of 7,859 people ages 18 through 80 years of age who received at least 1 dose of JYNNEOS.

In one clinical trial, researchers found people with skin conditions (either active or history of skin conditions such as eczema or atopic dermatitis) who received JYNNEOS experienced mild to moderate skin reactions from the vaccine. No safety concerns were found during this study in people with skin conditions.

Several studies assessed the cardiac safety of people who received JYNNEOS. During a study of the vaccine and placebo groups, there were three cases of heart palpitations, two cases of tachycardia and no cases of myocarditis or pericarditis detected. Overall, data did not suggest an increased risk of myocarditis or pericarditis after vaccination with JYNNEOS compared with placebo controls.

Which adverse events are considered “serious?”

By the Code of Federal Regulations (CFR) Title 21, an adverse event is defined as serious if it involves any of the following outcomes:

- Death
- A life-threatening adverse event
- A persistent or significant disability or incapacity
- A congenital anomaly or birth defect
- Hospitalization, or prolongation of existing hospitalization

Learn more about adverse events.

Across all 22 clinical trials, the safety profile of JYNNEOS was favorable in all populations, including people with HIV or other immunocompromising conditions. There were no clinically relevant differences in the safety or the reactogenicity of JYNNEOS in populations who were or were not previously exposed to a vaccinia virus vaccine.

The reported complications from live vaccinia virus vaccines, such as rashes caused by the virus (including generalized and progressive vaccinia), erythema multiforme (skin reaction from an infection or medication), or encephalitis, were not observed during the clinical trials for JYNNEOS.

Sources:

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A Randomized, Double-Blind, Placebo-Controlled Phase II Trial Investigating the Safety and Immunogenicity of Modified Vaccinia Ankara Smallpox Vaccine (MVA-BN®) in 56-80-Year-Old Subjects. [PLoS One. 2016]

A Multicenter, Open-Label, Controlled Phase II Study to Evaluate Safety and Immunogenicity of MVA Smallpox Vaccine (IMVAMUNE) in 18-40 Year Old Subjects with Diagnoses Atopic Dermatitis. [PLoS One. 2015]

Safety and Immunogenicity of Modified Vaccinia Anakara-Bavarian Nordic Smallpox Vaccine in Vaccinia-Naïve and Experienced Human Immunodeficiency Virus-Infected Individuals: An Open-Label, Controlled Clinical Phase II Trial. [Open Forum Infect Dis. 2015]

Cardiac Safety of Modified Vaccinia Ankara for vaccination against smallpox in a young, healthy study population. [PLoS One. 2015]

ACAM2000

There are several serious adverse events that have been reported following the first vaccination or revaccination at a later date with live vaccinia virus smallpox vaccine (ACAM2000). Serious adverse events that have occurred include:

- **Myocarditis and pericarditis:**
  The heart muscle and lining become inflamed. The package insert states the suspected cases were observed at a rate of 5.7 per 1,000 primary vaccinees.
- **General, progressive, and severe vaccinia:**
  This condition can occur in immunocompromised people and is caused by the uncontrolled replication of the vaccinia virus. The virus causes open wounds and, depending on the severity, can lead to death.
- **Eczema vaccinatum resulting in permanent sequelae or death:**
  This occurs when the vaccinia virus spreads and causes an overall rash and systemic reactions.
- **Fetal death:**
  Pregnant people who have received a live vaccinia virus vaccine are more susceptible to spontaneous abortion (miscarriage).
- **Encephalitis, Encephalomyelitis and Encephalopathy:**
  These are conditions of inflammation of brain, spinal cord, or both.
- **Erythema multiforme major (EMM), including Stevens-Johnson Syndrome (SJS):**
  EMM is a skin reaction from an infection or medication. SJS is a rare and serious disorder that affects skin, moist surfaces of the body (such as inside of the mouth and throat), genitals, and eyes.
- **Ocular complications and blindness:**
  When the vaccinia virus enters the eye region, it can cause eyelid infections, swelling, sensitivity to light, irritation and damage to the cornea, and possible blindness.

These are serious risks and certain individuals who receive live vaccinia virus vaccine are more prone to these adverse events.

Source: ACAM2000 Product Insert (fda.gov) [PDF – 11 pages]

In March 2008, ACAM2000 replaced the previous stockpiled smallpox vaccine, Dryvax®, as the only licensed smallpox vaccine at the time. While not routinely administered, ACAM2000 was administered to people entering military service and those working in labs handling variola (smallpox) virus. As part of the post-licensure marketing commitments for ACAM2000, FDA, CDC, Department of Defense, and the vaccine manufacturer, gathered additional safety data on adverse events following vaccination. In March 2011, a routine safety data review within Vaccine Adverse Event Reporting System (VAERS), co-managed by CDC and FDA, identified a safety concern of acute ischemic cardiac events (ICE) following ACAM2000 vaccination.

Researchers reviewed all reports to VAERS submitted from March 1, 2008 through June 30, 2013, following ACAM2000 vaccination. Possible ICE cases were identified by searching for specific medical terms, including myocardial ischemia (lack of blood flow back to the heart), acute myocardial infarction (heart attack), and ischemia (restriction of blood supply to any part of the body). A clinical review of the cardiovascular reports identified 16 cases of myocarditis/pericarditis (inflammation of the heart muscle or lining of the heart) and 15 ICE cases. This review did not confirm the concerns of ICE following ACAM2000. The study also suggested that with pre-vaccination screening of ACAM2000, cardiac events in a generally healthy population remain uncommon.

Source: Ischemic Cardiac Events and Other Adverse Events following ACAM2000® Smallpox Vaccine in the Vaccine Adverse Event Reporting System [Vaccine. 2018]

How CDC Monitors Vaccine Safety

CDC and FDA monitor the safety of vaccines after they are approved or authorized. If a problem is found with a vaccine, CDC and FDA will inform health officials, health care providers, and the public.

CDC uses 3 systems to monitor vaccine safety:

- The Vaccine Adverse Event Reporting System (VAERS): an early warning system, co-managed by CDC and FDA, to monitor for potential vaccine safety problems. Anyone can report possible vaccine side effects to VAERS.
- The Vaccine Safety Datalink (VSD): a collaboration between CDC and 13 healthcare organizations that conducts vaccine safety monitoring and research.
- The Clinical Immunization Safety Assessment (CISA) Project: a partnership between CDC and several medical research centers that provides expert consultation and conducts clinical research on vaccine-associated health risks.

Related Scientific Articles

2015 to Present

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