CONDITION

# Smallpox

Smallpox is a serious, contagious infection caused by the variola virus.

**WHAT IT IS**
Eradicated but potentially severe viral infection

**BODY SYSTEM**
Whole body, especially skin and immune system

**MAIN SYMPTOMS**
High fever, severe fatigue, headache, distinctive blistering rash

**WHAT CAUSES IT**
Infection with variola virus

**HOW IT IS DIAGNOSED**
Laboratory testing of rash samples

**MAIN TREATMENT**
Isolation, supportive care, and specialist antiviral medicines

**CAN IT BE CURED?**
Sometimes - antivirals and supportive care may help

**IS IT AN EMERGENCY?**
Yes - any suspected case needs immediate public health action

**LONG-TERM OUTLOOK**
Survivors may have permanent scars or vision problems

## Overview

Smallpox is a serious infection caused by the variola virus. It spreads between people and can cause high fever followed by a distinctive rash. The rash develops into firm, fluid-filled spots that later form scabs.

Smallpox was eradicated through worldwide vaccination. The last naturally occurring case was reported in 1977, and the World Health Organization declared smallpox eradicated in 1980. It does not currently circulate in the community anywhere in the world.

Routine smallpox vaccination stopped in many countries after eradication. A suspected case today would therefore be treated as an international public health emergency. The main concerns are an accidental laboratory release or deliberate release of the virus.

Several other conditions can cause fever and a blistering rash. These include chickenpox,

mpox and some medication reactions. These conditions are much more likely than smallpox, but laboratory testing is essential if public health specialists think smallpox is possible.

## Symptoms

Symptoms usually begin about 7 to 19 days after exposure. During this incubation period, the virus is in the body, but the person generally feels well and is not contagious.

The first symptoms can begin suddenly and may include:

A rash usually appears after several days of fever. It often starts inside the mouth and on the face before spreading to the arms, legs and trunk. Spots may also appear on the palms of the hands and soles of the feet.

The spots change in a regular pattern. They begin as flat areas, become raised, and then turn into firm, deep blisters filled with fluid or pus. The lesions in one area of the body tend to be at a similar stage. They eventually crust over and form scabs.

A person can spread smallpox once mouth or throat lesions appear. They remain contagious until every scab has fallen off and a fresh layer of skin has formed underneath. This usually takes several weeks.

Not everyone develops the classic pattern. Rare forms can cause bleeding into the skin or severe illness with flatter, softer lesions. These forms are uncommon but particularly dangerous.

- High fever
- Severe tiredness
- Headache
- Back pain
- Vomiting or abdominal pain in some people

## Causes and risk factors

Smallpox is caused by variola virus, which belongs to the orthopoxvirus family. The virus only naturally infected humans. Animals did not act as a continuing source of infection.

The virus mainly spreads through prolonged, close face-to-face contact. Infected droplets and saliva can carry it from the mouth or throat to another person. It can also spread through direct contact with rash material, scabs, clothing or bedding.

Smallpox is not thought to spread as easily as infections such as measles. However, transmission through the air over longer distances has occurred in enclosed settings under unusual conditions.

Because smallpox has been eradicated, people are not at routine risk in daily life. Risk would arise only if the virus were released or someone had unprotected contact with a confirmed case or infectious laboratory material.

People vaccinated decades ago may retain some immune protection, but it may not be complete. Past vaccination should not be assumed to prevent infection after a confirmed exposure.

## Diagnosis

Smallpox cannot be diagnosed safely from symptoms or photographs alone. Its rash can resemble other infections, especially during the early stages.

If smallpox is suspected, public health specialists arrange secure collection and transport of material from the rash. Testing is carried out in designated laboratories with strict safety controls.

Polymerase chain reaction, usually called PCR, is the main laboratory method. It looks for genetic material from variola virus. Other specialised tests may be used to examine or identify the virus.

Testing for more common causes, such as chickenpox or mpox, may be performed at the same time. A positive result for another infection can help explain the rash, but the testing plan is determined by public health and infectious disease experts.

People with suspected smallpox should not attend a clinic, emergency department or laboratory without warning staff first. Unexpected arrival could expose other people.

## Treatment and management

A suspected case requires immediate isolation. Care is coordinated by public health authorities, infection specialists and a hospital prepared to use high-level infection-control measures.

Supportive care helps the body cope with the infection. It may include fluids, oxygen, treatment for pain and fever, skin and wound care, and support for organ problems. Antibiotics like amoxicillin or doxycycline do not treat variola virus, although they may be used if damaged

skin develops a bacterial infection.

Tecovirimat and brincidofovir are antiviral medicines approved in the United States for treating smallpox. Their approvals relied partly on animal studies because it would be unethical and impractical to test treatment in people with smallpox after eradication. How much they improve survival in human smallpox is therefore not known.

Cidofovir has laboratory and animal evidence of activity against related viruses, but it is not approved specifically for smallpox and can cause significant kidney harm. Decisions about any antiviral like acyclovir or oseltamivir would be made by national public health authorities and specialist teams.

Vaccination may be offered quickly to people who have been exposed. When given within a few days of exposure, it may prevent infection or make the illness less severe. Contacts may also need monitoring and limits on contact with other people during the incubation period.

## Complications

Smallpox can affect more than the skin. Possible complications include:

Some people develop blindness or reduced vision if the eyes are involved. Joint and bone complications can occur, particularly in children, but are less common.

Historically, the most common form of smallpox killed about 3 in 10 people who developed it. Some forms were more severe. These figures come from the era before eradication and modern intensive care, so they cannot precisely predict the outcome of a future case.

- Dehydration from fever, poor intake or vomiting
- Bacterial infection of skin lesions
- Pneumonia
- Inflammation of the brain, called encephalitis
- Inflammation or scarring of the eye
- Pregnancy loss or severe illness during pregnancy
- Permanent pitted scars after lesions heal

## Prevention

The eradication of smallpox is the main reason people are protected today. There is no naturally circulating virus to encounter.

Smallpox vaccines are kept in national stockpiles for emergency use. They are not routinely offered to the general public because the current risk of exposure is extremely low and the vaccines can cause side effects.

Some laboratory and emergency-response workers may be offered vaccination because of their work. Vaccine choice depends on health history, immune status, pregnancy and the type of potential exposure. Some smallpox vaccines use a live vaccinia virus, which is related to variola but does not cause smallpox.

During an outbreak, public health teams would identify contacts, offer vaccination where appropriate, monitor exposed people and isolate confirmed cases. This strategy is sometimes called ring vaccination because it creates a protective ring around each case.

Vaccination after exposure works best when given promptly. Anyone told that they were exposed should follow public health instructions rather than trying to obtain or use a vaccine independently.

## Living with it and what to expect

There are no people currently known to be living with an ongoing smallpox infection. Historically, the active illness usually lasted several weeks.

Fever and severe weakness came first. The rash then progressed through blisters, pustules and scabs. A person remained contagious until all scabs separated. Recovery could be slow, even after the fever and rash improved.

Survivors usually cleared the virus rather than developing a lifelong infection. Many were left with deep, pitted scars, especially on the face. Scars can remain permanently, although their appearance may soften over time.

Some survivors had lasting vision loss or problems related to complications affecting the brain, joints or bones. Others recovered without major long-term disability. The outcome depended on the form of smallpox, severity of illness and complications.

A confirmed modern case would probably involve a prolonged hospital stay, strict isolation and extensive follow-up. Public health teams would also trace contacts and monitor them for symptoms. Emotional support could be important because isolation, uncertainty and public attention may be difficult to manage.

## When to get medical help

Smallpox is not a routine explanation for fever or a rash. Chickenpox, shingles, mpox, hand-foot-and-mouth disease and medication reactions are far more likely.

Seek routine medical advice if you have a new unexplained rash, particularly if it comes with fever or you feel unwell. Contact the service before attending if the rash is blistering or you may have an infectious illness.

Get urgent public health or emergency advice if:

Call before going to a healthcare setting. Explain the possible exposure clearly so staff can arrange safe assessment.

Call emergency services for severe breathing difficulty, collapse, confusion, a seizure or difficulty waking. Mention any suspected smallpox exposure during the call. Do not use public transport or enter a crowded waiting room unless emergency staff direct you to do so.

- A public health authority says you were exposed to smallpox
- You handled possible variola virus material without proper protection
- You develop fever or a widespread rash after a confirmed exposure
- You develop a severe illness linked to a suspected or confirmed case

## Common questions

Does smallpox still exist?

Smallpox no longer circulates naturally. Known stocks of variola virus are held under strict security in two World Health Organization collaborating centres. Governments maintain surveillance and emergency plans because an accidental or deliberate release remains possible.

Is smallpox the same as chickenpox or mpox?

No. Chickenpox is caused by varicella-zoster virus, while mpox is caused by monkeypox virus. Smallpox is caused by variola virus. Their rashes can look similar, but the infections differ in severity, spread and treatment.

Can I catch smallpox from an old vaccination scar?

No. An old vaccination scar does not contain variola virus and cannot spread smallpox. People recently vaccinated with a live vaccinia vaccine must care for the vaccination site carefully because vaccinia can spread from the site to another part of the body or another person.

Does a childhood smallpox vaccination still protect me?

It may provide some lasting protection, but the amount is uncertain and may not be enough

after a significant exposure. Public health authorities may recommend another vaccine dose during an emergency even if you were vaccinated in the past.

Why is there no routine smallpox vaccination now?

Routine vaccination ended because smallpox was eradicated. With no natural exposure risk, the possible harms of vaccinating everyone would outweigh the benefit. Vaccines are kept for people with specific occupational risks and for emergency outbreak control.

Could smallpox come back naturally?

There is no known animal reservoir, and variola virus is not circulating among people. A natural return is considered very unlikely. Current planning focuses on possible laboratory accidents or deliberate release.

## Sources

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