

Local Health Department Guidelines for the Epidemiological Investigation and Control of Varicella

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Prevention and Health Promotion Administration
Infectious Disease Bureau
Center for Immunization
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Introduction

Chickenpox is an acute infectious disease caused by varicella zoster virus (VZV). VZV causes two distinct diseases: 1) varicella (also known as chickenpox) as the primary infection, and 2) herpes zoster (shingles), as recurrent infection which occurs when latent VZV reactivates. Acute chickenpox is generally mild and self-limited, but may be associated with complications, most commonly in adults, immunocompromised persons, and newborns of mothers with rash onset within five days before to forty-eight hours after delivery.

In 2006, the Advisory Committee on Immunization Practices (ACIP) voted to recommend routine two-dose chickenpox vaccination for children. Chickenpox vaccine should also be administered to adolescents and adults 13 years of age and older who do not have chickenpox immunity. About 15%–20% of people who have received one dose of chickenpox vaccine still get chickenpox if they are exposed, but their disease is usually mild, and may present atypically. Chickenpox developing more than 42 days after vaccination is known as breakthrough chickenpox disease.

This document was written to provide guidance on the investigation of chickenpox cases. The recommendations in this document are intended to provide general guidance. Chickenpox incidents should be evaluated on an individual basis, with the consultation of local and state infection control staff if needed, to determine the appropriate steps for chickenpox prevention and control.

Questions regarding this document can be directed to:

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Disease Description

Mode of Transmission: Chickenpox is highly contagious and spreads from person to person by direct contact with vesicular fluid from persons with either chickenpox or shingles, airborne droplets from an infected person's cough or sneeze, or from aerosolization of virus from skin lesions. In utero infection can also occur as a result of transplacental passage of virus during maternal chickenpox infection. The virus is believed to have a short survival time outside of the infected host.

Incubation Period: The incubation period of chickenpox is from 14 to 16 days (range: 10 to 21 days). The incubation period may be up to 28 days for persons who have received Varicella-Zoster Immune Globulin (VariZIG) or Immune Globulin Intravenous (IGIV). The incubation period may also be lengthened in persons who are immunocompromised.

Clinical Characteristics: Chickenpox infection is characterized by a *prodrome* which may precede the onset of rash. Adults may have one to two days of fever and malaise prior to rash onset, but in children, the rash is often the first sign of disease.

The rash is generalized and pruritic (itchy) and may progress rapidly from macules to papules to vesicular lesions. The rash usually appears first on the scalp, then on the trunk, and then the extremities. The highest concentration of lesions is usually on the trunk. Lesions can also occur on the oropharynx, respiratory tract, vagina, conjunctiva, and the cornea. Lesions are usually 1 to 4 mm in diameter, and vesicles contain a clear fluid. Vesicles will eventually dry and crust. Healthy children usually have 200 to 500 lesions.

The clinical course in healthy children is generally mild characterized by malaise, itching, and fever up to 102°F for two to three days. Adults may have more severe symptoms.

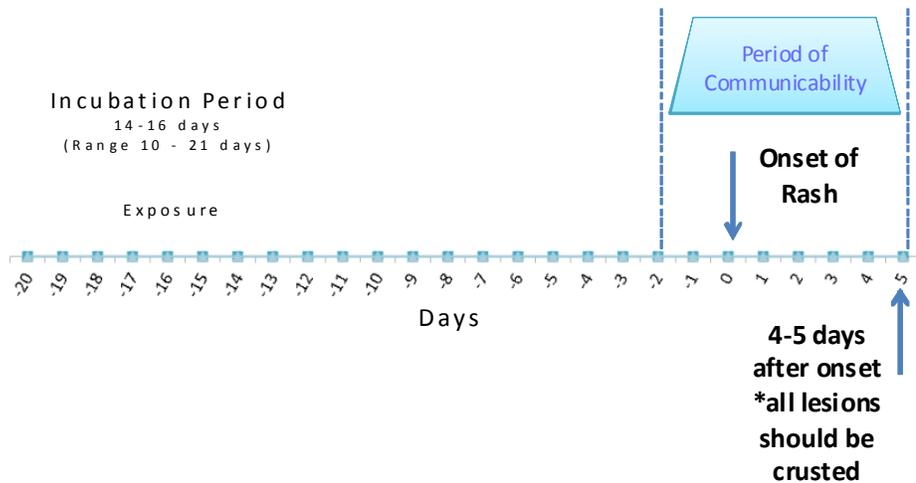
Serious complications from chickenpox include bacterial infections which can involve many sites of the body including the skin, tissues under the skin, bone, lungs (pneumonia), joints, and blood. Other serious complications are due directly to infection with the varicella-zoster virus and include viral pneumonia, bleeding problems, and infection of the brain (encephalitis).

Breakthrough disease is described as a case of wild-type chickenpox infection occurring more than 42 days after vaccination. Such disease is usually mild with shorter duration of illness, fewer symptoms, and fewer than 50 skin lesions. Breakthrough cases with fewer than 50 lesions have been found to be one third as contagious as chickenpox in unvaccinated persons with 50 or more lesions but breakthrough cases with 50 or more lesions can be just as contagious as cases in unvaccinated persons.

Varicella- like (vaccine) rash is described as a rash in a recently vaccinated person that may be either wild- or vaccine-type virus. A rash that occurs within 2 weeks of vaccination or more than 42 days after vaccination is more likely to be wild-type virus. A rash that occurs 15-42 days post-vaccination is more likely to be vaccine-type virus.

After primary infection with chickenpox, the virus remains dormant in sensory nerve cell bodies. Reactivation of the virus results in shingles. Shingles presents as a localized sometimes pruritic, often painful, vesicular rash that generally appears unilaterally in one or more dermatomes. Shingles only occurs in persons who have had chickenpox or the chickenpox vaccine.

Varicella Disease Progression



Communicability Period: An infected individual is contagious from 1 to 2 days before until all lesions are crusted over (average 4-7 days after rash onset). A person is considered no longer infectious once all of the lesions are crusted (average range 4-7 days). Secondary attack rates in susceptible household contacts are as high as 90%.

Persons with shingles are contagious during the vesicular stages of rash. The rash typically crusts over within 7-10 days but may take from 2-6 weeks to heal completely. If a susceptible person is exposed to shingles, the person MAY develop chickenpox as a result of the exposure, but they will not “catch” shingles.

Definitions and CDC Surveillance Case Classification

CDC Surveillance case classification of varicella

1) Clinical Case Definition: An illness with acute onset of diffuse (generalized) maculopapulovesicular rash without other apparent cause.

2) Laboratory criteria for diagnosis:

- Isolation of varicella virus from a clinical specimen
- Varicella antigen detected by direct fluorescent antibody (DFA) test
- Varicella-specific nucleic acid detected by polymerase chain reaction(PCR)
- Significant rise in serum anti-varicella immunoglobulin G (IgG) antibody level by any standard serologic assay

Note: Laboratory confirmation of cases of varicella is not routinely recommended except for fatal cases and in other special circumstances.

3) CDC Case Classification:

- **Probable:** an acute illness with
 - Diffuse (generalized) maculopapulovesicular rash, AND
 - Lack of laboratory confirmation, AND
 - Lack of epidemiologic linkage to another probable or confirmed case.
- **Confirmed:** an acute illness with diffuse (generalized) maculopapulovesicular rash, AND:
 - Epidemiologic linkage to another probable or confirmed case, OR
 - Laboratory confirmation by any of the above stated laboratory criteria for diagnosis.

Note: Two probable cases that are epidemiologically linked would be considered confirmed even in the absence of laboratory confirmation.

Note: The most current CDC case definitions can be found at:

http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/varicella_current.htm

4) Outbreak:

The occurrence of ≥ 3 chickenpox cases that are related in place and epidemiologically linked within 28 days (two average incubation periods).

Testing/Laboratory Diagnosis

Laboratory testing is not routinely required, but is useful if confirmation of the diagnosis or determination of chickenpox susceptibility is necessary. For outbreak settings lab testing for confirmation of the diagnosis should be done. Since chickenpox disease in the United States has declined due to routine chickenpox vaccination, the need for laboratory confirmation has increased as atypical cases (oftentimes, due to breakthrough chickenpox disease) become more common and as physicians have reduced experience in diagnosing chickenpox.

Skin lesions are the preferred specimen collection site for laboratory confirmation of chickenpox disease.

Blood specimens are used to test for chickenpox immunity. VZV can be isolated from scrapings of a vesicle base during the first 3 to 4 days of the eruption. Other specimen sources such as nasopharyngeal secretions, saliva, blood, urine, bronchial washings, and cerebrospinal fluid are considered less desirable sources than vesicular fluid and skin lesions since they are less likely to give positive results.

PCR: *PCR is the method of choice for rapid clinical diagnosis.* This test is sensitive, specific, and widely available. PCR is a powerful technique that permits the rapid amplification of specific sequences of viral DNA.

Virus Culture: The diagnosis of VZV infection may be confirmed by culture isolation. VZV may be cultured from other sites such as blood and cerebrospinal fluid, especially in immunocompromised patients. Viable VZV cannot be recovered from crusted lesions.

Serologic testing: Serologic tests can be used to detect the presence of IgM antibody, or, a four-fold increase in IgG antibody titer between acute and convalescent serum specimens taken 2 weeks apart. Single serologic IgG tests may be used to identify the immune status of persons whose history of exposure to chickenpox is unknown. Routine testing after vaccination to confirm immunity is not recommended because of the potential for false-negative results.

Recommended steps for testing:

For PCR Testing

- 1) Obtain a low to moderate risk rash kit.
- 2) Gently lift the scab from the lesion.
- 3) Place the scab into a container such as a swab specimen tube. If there is more than one scab, place each scab individually in separate containers.
- 4) Use the edge of a clean slide to loosen and collect skin cells or fluid from the lesion.
- 5) Using a sterile swab, rub the lesion vigorously enough to ensure skin cells and/or fluid are collected.
- 6) You may also press the slide directly to the lesion to collect skin cells and/or fluid
- 7) Clearly label the specimen for submission to the laboratory.

For Serology Collection

- 1) Collect at least 1mL of blood into a red top tube or serum separator vacutainer tube.
- 2) If possible, separate the serum from the cells in a centrifuge for 15 minutes.
- 3) Clearly label the specimen for submission to the laboratory.

Note: A video demonstrating the techniques for chickenpox specimen collection may be accessed at the CDC website via the following link: <http://www.cdc.gov/shingles/lab-testing/collecting-specimens.html#video>

Treatment

The healthcare provider will provide various treatment options. Acyclovir, famcyclovir, or valacyclovir (medicines that work against the herpes virus) are recommended for persons who are more likely to develop serious disease, including persons with chronic skin or lung disease, otherwise healthy individuals 13 years of age or older, and persons receiving steroid therapy. However, only acyclovir is currently licensed for use in treating chickenpox.

Persons whose immune systems have been weakened from disease or medication should contact their doctor immediately if they are exposed to or develop chickenpox. Pregnant women who develop or are exposed to chickenpox should immediately discuss prevention and treatment options with their doctor.

Calamine lotion and oatmeal baths may help relieve some of the itching. Do not use aspirin or aspirin-containing products to relieve a child's fever. The use of aspirin in children with chickenpox has been

associated with the development of Reye's syndrome (a severe disease affecting all organs, but most seriously affecting the liver and brain and may cause death). Use of non-aspirin medications such as acetaminophen (e.g., Tylenol®) is recommended.

Prevention/Vaccination

Vaccination remains the most effective way to prevent chickenpox infection. All healthy children 12 months through 12 years of age should have two doses of chickenpox vaccine, administered at least 3 months apart. Children who have evidence of immunity to chickenpox do not need the vaccine. People 13 years of age and older who do not have evidence of immunity should get two doses of the vaccine 4 to 8 weeks apart.

Case/Outbreak Investigation:

Timely and thorough case investigation should: confirm the patient's diagnosis; ensure appropriate medical follow-up for affected persons; identify the source of infection; locate persons who may have been exposed; and isolate potentially infectious persons to prevent transmission of illness in the community.

Recommended case investigation procedures

(Refer to *Special Settings* Section for additional guidance on case/outbreak investigation procedures relevant to schools and hospitals.)

1) Confirm chickenpox diagnosis

Chickenpox testing is not routinely recommended in all instances. Testing is recommended for circumstances in which high risk individuals may have been infected/exposed or where there is a high risk for spread of disease or outbreak in schools, hospitals, and other settings where close contact may facilitate transmission.

- Obtain specimen for lab testing (Refer to *Testing/Laboratory Diagnosis* Section for details).

2) Interview the case-patient and make recommendations for exclusion

Interview the case-patient about contact with other known chickenpox or shingles cases or persons with symptoms of chickenpox in an effort to identify the source of infection.

- Assess the patient's exposure history within one previous incubation period (21 days).
- Utilize the CDC Varicella Surveillance Worksheet (attached) to guide the interview and collect other relevant information (i.e. demographics, clinical details, vaccine history, etc.).
- Confirmed cases of chickenpox should be excluded from regular activity until all lesions are crusted over (usually 4-7 days after rash onset).

3) Identify exposed and susceptible persons

Initiate a contact investigation to identify persons who may have been exposed to chickenpox through contact with the case-patient during the infectious period (1-2 days before rash onset until all lesions are crusted over).

Persons can be considered **exposed to chickenpox** if they share close indoor contact (e.g., in the same room) or face-to-face contact. Experts differ in their opinion about the duration of contact, but many suggest contact within 3 feet for ≥ 1 hour. Exposures can occur in various settings including: the home, workplace, school, prison, dormitory, airplane, doctor's office, etc. Contact with case-patients may vary widely in type and duration. Therefore, chickenpox exposures should be evaluated on a case-by-case basis following an interview with the case and/or contact person to determine the nature of exposure.

A **susceptible individual** is defined as a person who has not received age appropriate vaccination or does not have documented history of disease. In general, a person can be considered immune to chickenpox if they:

- 1) Have written documentation of age-appropriate vaccination:
 - a. Pre-school aged children aged ≥ 12 months: 1 dose
 - b. School-aged children, adolescents, and adults: 2 doses (for children who received their first dose at age <13 years and for whom the interval between the 2 doses was ≥ 28 days, the second dose is considered valid)
- 2) Have laboratory evidence of immunity:
 - a. Laboratory confirmation of disease
 - b. Serologic confirmation of immunity
- 3) Were born in the United States before 1980. For healthcare personnel, pregnant women, and immunocompromised persons, birth before 1980 should not be considered evidence of immunity.
- 4) Have documentation of diagnosis or verification of a history of chickenpox disease or shingles by a healthcare provider.

Healthcare worker (HCW) evidence of immunity includes:

- 1) Documentation of two doses of chickenpox vaccine administered at least 28 days apart with the first dose being administered no earlier than the first birthday;
- 2) Laboratory evidence of immunity to chickenpox or laboratory confirmation of disease;
- 3) Diagnosis or verification of a history of chickenpox or shingles by a health care provider.

Note: Birth before 1980 is not considered evidence of immunity for HCWs because of the potential for nosocomial transmission of chickenpox to high-risk patients.

Healthcare institutions should establish protocols and recommendations for screening and vaccinating HCWs and for management of HCWs after exposure in the workplace.

- Interview the case-patient regarding contact with others during the infectious period (1-2 days before rash onset until all lesions are crusted over (usually 4-7 days after rash onset).
- If the case-patient reports travel (e.g. via plane) during the infectious period, contact staff at Maryland Department of Health and Mental Hygiene Center for Immunization for assistance in identifying passengers and persons in other jurisdictions/locations who may need to be contacted.
- Obtain and document immunization histories and susceptibility information for all contacts.
- The need to collect specimens on symptomatic contacts should be evaluated on a case-by-case basis.

4) Initiate chickenpox control measures

Exposed contacts should be identified promptly and evaluated for their need to receive **post-exposure prophylaxis**.

- Airborne and standard precautions are appropriate until all lesions have crusted over (usually 4-7 days after rash onset).
- Chickenpox vaccine should be administered within 3 to 5 days (72 – 120 hours) of exposure to susceptible people 12 months of age and older if there are no contraindications to vaccine use. ACIP recommends that all persons without evidence of immunity to chickenpox be offered vaccine even if more than 5 days have passed since the first exposure in order to provide protection against subsequent exposures.
- Among those that cannot receive chickenpox vaccine, Varicella Zoster Immune Globulin (VariZIG) may be administered up to 96 hours after exposure. The decision to administer VariZIG depends on the exposed individual's susceptibility, probability that infection will occur, and the likelihood that complications of chickenpox will develop if the exposed person is infected. VariZIG is an investigational drug that is only available in the United States through a special clinical study. Physicians can request VariZIG by calling the 24-hour telephone number of FFF Enterprises (800-843-7477).
- The decision to administer VariZIG or acyclovir is strongly dependent on the type and extent of exposure, and the health of the candidate. Candidates for VariZIG and acyclovir generally include immunocompromised susceptible people, susceptible pregnant women, a newborn infant whose mother had onset of chickenpox within 5 days before delivery or within 48 hours of delivery, and hospitalized pre-term infants in specific situations. Consult with DHMH for other situations where VariZIG might be considered.
- Oral acyclovir may be used if VariZIG is not available or greater than 96 hours have passed. Oral acyclovir is generally not recommended for immunocompetent individuals.
- Susceptible persons who receive vaccination (whether it is their 1st or 2nd dose of chickenpox vaccine):
 - Can be immediately readmitted to childcare or school
 - Must be excluded from the healthcare facility from the 8th through the 21st day after last exposure, regardless of whether or not they received vaccine.

- Persons who are medically exempt from chickenpox vaccination or who decline to be vaccinated should be excluded:
 - From schools and childcare through the 21st day after the onset of rash in the last case identified.
 - From the health care facility from the 8th through the 21st day after last exposure.
- During this time all susceptible contacts should be monitored for the development of symptoms consistent with chickenpox. If symptoms develop, they should be excluded until all lesions have crusted over (usually 4-7 days after rash onset).

5) Conduct surveillance

Active surveillance should be maintained for at least 2 incubation periods (42 days) after the rash onset of the last reported confirmed case to ensure that all cases are identified.

Special Settings

In addition to following the recommended steps for case investigation described above, the following chickenpox control measures should be conducted for cases and outbreaks occurring in settings where chickenpox can be transmitted easily due to crowding and/or close contact of individuals.

1) Schools and Childcare Centers

- Exclude the case-patient until no longer infectious.
- Assess immunity status of staff and students.
- Administer post-exposure vaccination to staff and students who are exposed and susceptible to chickenpox. In outbreak situations, a second dose of chickenpox vaccine is also recommended for children 1 to 4 years of age where vaccine is not contraindicated.
- Persons who receive post-exposure vaccination (whether it is their 1st or 2nd dose of chickenpox vaccine) can return to the school or childcare immediately.
- Persons who refuse post-exposure vaccination may be excluded from school or childcare through 21 days after the onset of rash in the last case of chickenpox identified in the school. Exclusions based on exposure to a single case should be made on a case-by-case basis.

A notification letter should be sent to all parents of students attending the facility informing them about the case/outbreak. The letter should provide information about chickenpox and the recommendations for post-exposure prophylaxis.

2) Residential Institutions and Healthcare Settings

- Airborne and contact precautions are recommended for patients with chickenpox until all lesions have crusted (usually 4-7 days after rash onset). Employees with chickenpox should be placed on leave immediately.
- Assess immunization status of all exposed patients and HCW, including persons involved in direct patient care (e.g. nurses, physicians, phlebotomists) as well as persons who work in the patient care setting (e.g. clerical staff, front office staff, technicians).

- Only immune staff should care for patients with chickenpox infection.
- Exposed, susceptible patients should be placed under airborne and contact precautions from the 8th through the 21st day after exposure to the index patient (28 days for those who received VariZIG).
- Exposed HCWs who have received 2 doses of vaccine should be monitored daily during days 8-21 after exposure through the employee health program or by an infection control nurse to determine clinical status (i.e., daily screening for fever, skin lesions, and systemic symptoms).
- Exposed HCWs who have received 1 dose of vaccine and who are exposed to chickenpox should receive the second dose of vaccine within 3-5 days post exposure to rash (provided 4 weeks have elapsed after the first dose). After vaccination, management is similar to that of 2-dose vaccine recipients described above. Those who do not receive a second dose or who received a second dose >5 days after exposure should be excluded from work for 8-21 days after exposure.
- Unvaccinated HCWs who have no evidence of immunity and are exposed to natural chickenpox, disseminated shingles, or uncovered lesions of localized shingles are potentially infective from days 8-21 after exposure and should be furloughed during this period. Post-exposure vaccination should be administered as soon as possible after exposure; however vaccination is indicated even if greater than 5 days have elapsed because it will provide protection against subsequent exposures.
- In the case of an outbreak, HCW without evidence of immunity who have contraindications to vaccination should be excluded from the outbreak setting through 21 days after rash onset of the last identified case-patient because of the risk for severe disease in these groups.

Reporting

All suspected chickenpox deaths must be reported within 1 working day as stated per COMAR 10.06.01.03. Outbreaks are reportable within 24 hours of notification. All case investigations should be promptly entered into NEDSS (National Electronic Disease Surveillance System) and the information reviewed for completeness and accuracy. The following table summarizes information that should be collected during case investigations and entered into NEDSS:

Table 1: Summary of information to collect during case investigation

Type of Information	Information to be collected and reported
Demographic	Name Address Date of birth Sex Race/Ethnicity Country of birth

	Reporting source Jurisdiction Date reported
Clinical	Pre-existing medical conditions History of chickenpox (to document reported second infections) Medications Date of rash onset Duration of rash Symptoms and date of onset Hospitalizations Complications
Laboratory information	Virus isolation test dates and results, if applicable PCR test dates and results, if applicable DFA test dates and results, if applicable Serologic test dates and results, if applicable
Epidemiologic	Transmission setting Source of transmission Vaccination status of source patient
Vaccination Status	Number of doses of chickenpox vaccine Date(s) of vaccination Type and manufacturer of vaccine Vaccine lot number If not vaccinated, reason
Outcome	Case classification Date of death, if applicable

Vaccine Adverse Events

Adverse events that occur after administration of the chickenpox vaccine should be reported to the Vaccine Adverse Event Reporting System (VAERS), a passive reporting system used to monitor vaccine safety. Any clinically significant events, unexpected events following vaccination and/or events listed on the vaccine manufacturer's package insert should be reported to VAERS. Adverse events may be reported by submitting a VAERS form online, by fax or by mail. Visit <http://vaers.hhs.gov> for detailed instructions on reporting.

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Varicella Case Definition available at: http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/varicella_current.htm

Sample letter to parents:

Dear Parent,

Several cases of chickenpox have been reported in students attending our school. Although chickenpox is usually not a serious illness, it often causes children to miss days at school while they have a rash.

Chickenpox is a highly contagious disease that is spread by coughing and sneezing, by direct contact and by the virus from skin lesions. Symptoms of chickenpox include a skin rash of blister-like lesions, covering the body but usually more concentrated on the face, scalp, and the trunk. Most, but not all, infected individuals have fever, which develops just before or when the rash appears.

If your child does develop symptoms of chickenpox, notify your child's health care provider. Your child will be excluded from attending school until the rash has crusted over, which occurs in about a week. Please notify the school nurse to inform them if your child becomes ill within the next week, especially if your child is diagnosed with the chickenpox disease.

If your child develops chickenpox and has been around any adults or children that are pregnant, undergoing treatment for cancer, are currently taking a long term steroid medication for certain health conditions, or have been diagnosed with HIV, please have them contact their doctor for further advice.

Although only one chickenpox vaccine is required for school entry, in general it is recommended by the Centers for Disease Control and Prevention and the Maryland Department of Health and Mental Hygiene that students receive two. The varicella (chickenpox) vaccine has been used successfully to control the spread cases in certain settings. Please contact your child's physician if you are unsure if your child has had two chickenpox vaccines. If exposed, persons who have been vaccinated against the disease may get a milder illness, with less severe rash (sometimes only involving a few red bumps that look similar to insect bites) and mild or no fever.

If you have any questions or concerns, please contact (school nurse at ###-###-####) or the (county name) Health Department at ###-###-####.

Sincerely,