

Chickenpox and Shingles

Section 1

ABOUT THE DISEASE

Chickenpox and shingles are vaccine-preventable diseases. Vaccines can prevent disease in the people who are vaccinated and also protect unvaccinated individuals. **For the sake of clarity this chapter is separated into two sections. The section on shingles begins on page 15.**

A. Etiologic Agent

Chickenpox (varicella) is caused by the varicella zoster virus (VZV), a DNA virus belonging to the herpes virus group. Primary infection with VZV causes chickenpox. Once infection occurs, the virus can remain dormant in the body.

B. Clinical Description

Chickenpox is a febrile rash illness characterized by a diffuse (generalized), pruritic (itchy) rash, typically consisting of 250 to 500 lesions, that evolves from macules (spots) to papules (bumps) to vesicles (blisters), and eventually into dried crusts over 5–6 days. This is often referred to as “wild type” chickenpox, to differentiate it from “breakthrough” chickenpox which occurs in vaccinated individuals (see below). Vesicles have been described as superficial, delicate, and containing a clear liquid. All three types of lesions (macules, papules, and vesicles) are present at the same time, and they tend to be more abundant on covered parts of the body, with the highest concentration on the trunk. They can also occur on mucosal surfaces, such as the mouth and the throat. Prodromal symptoms, such as low-grade fever, malaise and other constitutional symptoms may precede the rash by 1–2 days, particularly in adults. Mild, atypical, and inapparent infections can occur, but are unusual in unvaccinated individuals. The disease is usually milder among children, and can be more severe in adolescents and adults. Immunity following chickenpox infection is considered to be long-lasting, but rarely, second cases of chickenpox do occur among immunologically normal individuals, especially if the first infection is in the first year of life.

Complications of Chickenpox

Complications of chickenpox include pneumonia (viral and bacterial), secondary bacterial infections (especially of the skin), thrombocytopenia (low platelet count), bleeding, arthritis, hepatitis, encephalitis or meningitis, neurological dysfunction, kidney impairment, and death (1/100,000 children aged 1–14 with chickenpox; 1/5,000 adults with chickenpox). Invasive group A streptococcal disease (GAS) has been reported as a complication of chickenpox and can result in cellulitis (relatively minor skin infection) or in necrotizing fasciitis (“flesh-eating bacteria”), overwhelming infection, and toxic shock syndrome (TSS). While pneumonia is unusual in healthy children, it is the most common complication in adolescents and adults.

- **Pregnant women, immunocompromised persons, children less than one year old, older adolescents, adults, patients with chronic skin or pulmonary disorders, and patients receiving steroids or chronic aspirin therapy are more likely to experience serious complications with chickenpox.** The risk is especially high when steroids, such as prednisone and cortisone, are given during the incubation period for chickenpox.
- **Infants born to women who developed chickenpox within a period of five days before delivery to two days after delivery are at high risk of severe chickenpox, which can be fatal.**
- Congenital varicella syndrome, characterized by developmental abnormalities, encephalitis, and low birth weight, may occur among 1–2% of infants born to women infected with chickenpox during the first two trimesters of pregnancy.

Breakthrough Chickenpox (also known as Vaccine-Modified Varicella Syndrome or VMVS)

Breakthrough chickenpox is a form of chickenpox that occurs in a vaccinated individual and is less severe due to the development of “partial immunity” sufficient to decrease symptoms and rash, but insufficient to prevent disease. Breakthrough chickenpox occurs more than 42 days after vaccination (and therefore is unlikely to be associated with recent vaccination). It usually presents as a generalized rash consisting of <50 lesions, with only a few vesicles. Patients are often afebrile and minimally symptomatic. Breakthrough cases with fewer than 50 lesions have been found to be one-third as contagious as varicella in unvaccinated persons with 50 or more lesions, but breakthrough cases with 50 or more lesions can be just as contagious as cases of varicella in unvaccinated persons. **Control measures are the same as with “wild type” chickenpox.** Crusting over and/or fading of lesions may occur more quickly than the usual 5 days after rash onset (e.g., 2–3 days after onset), allowing earlier return to childcare/school.

Breakthrough chickenpox can occur in up to 20% of vaccinated children and up to 30% of vaccinated adults. If the incidence of breakthrough disease is greater than 30% in any setting, the Massachusetts Department of Public Health (MDPH) should be notified for further investigation of the cases, and a vaccine ‘cold chain’ evaluation may be undertaken, as improper handling may affect the effectiveness of the vaccine.

Varicella-like rash in recently vaccinated persons (vaccine side effects)

Approximately 4% of children receiving varicella vaccine (compared with 2% of placebo recipients) develop a generalized rash, with a median of five lesions, 5-26 days postvaccination; and 4% develop a localized rash, with a median of two lesions, 8-19 days postvaccination. The rash may be atypical in appearance (maculopapular with no vesicles). Approximately 2% of children who received a placebo injection in the clinical trials also developed generalized rashes, some of which were varicella-like, indicating that not all rashes following vaccination are attributable to the vaccine. Rashes occurring 15-42 days after vaccination are more likely to be vaccine-type virus; rashes occurring within 2 weeks of vaccination or more than 42 days postvaccination are more likely to be wild type virus.

C. Vectors and Reservoirs

Humans are the only known host of VZV.

D. Modes of Transmission

Chickenpox is transmitted from person to person by droplet spread when a person coughs or sneezes; direct contact with upper respiratory secretions or lesions that have not yet crusted over; or airborne spread. (Note: *Although chickenpox can be airborne, this is rare. Airborne transmission would primarily occur in an exposed immunocompromised individual. Potential airborne spread should not routinely be used as a parameter to determine exposure. See Section 4B for guidance on how to identify those exposed to chickenpox.*)

Chickenpox is highly infectious, with secondary infection rates in susceptible household contacts as high as 90%. Exposure to chickenpox does not cause shingles. Exposure to shingles, however, can result in chickenpox in a susceptible person. See page 15 for more information about shingles.

E. Incubation Period

The incubation period for chickenpox is usually 14–16 days, with a range of 10–21 days from exposure to rash onset. This period may be prolonged for as long as 28 days by administration of varicella zoster immune globulin (VariZIG™) or immune globulin, intravenous (IGIV) after exposure, and it may be shorter in immunocompromised patients.

F. Period of Communicability or Infectious Period

The infectious period for chickenpox is from 1–2 days before the rash appears until all of the vesicles have formed scabs, which usually occurs within 5 days of rash onset. Contagiousness may be prolonged in immunocompromised patients.

Vaccinated persons with breakthrough chickenpox may develop lesions that do not crust (macules and papules only). These persons are no longer contagious once the lesions have faded (i.e., the skin lesions are in the process of resolving; lesions do not need to be completely resolved) or no new lesions appear within a 24-hour period, whichever is later.

G. Epidemiology

Chickenpox occurs worldwide, although incidence is lower in the tropics than in the temperate zones. In the U.S., during the pre-vaccine era, incidence was highest between March and May and lowest between September and November, and most cases of chickenpox in the U.S. occurred in children younger than ten years of age. Approximately 11,000 persons with varicella required hospitalization each year. Hospitalization rates were approximately 2–3 per 1,000 cases among healthy children and 8 per 1,000 cases among adults. Death occurred in approximately 1 in 60,000 cases. From 1990 through 1996, an average of 103 deaths from varicella were reported each year. Most deaths occur in immunocompetent children and adults. Since 1996, the number of hospitalizations and deaths from varicella has declined by more than 90%.

Changes in the epidemiology of chickenpox have been observed as an increasing proportion of children in the U.S. become protected by vaccination. In 2012, national vaccine coverage with one dose of varicella vaccine was almost 90% in children 19–35 months old. National surveillance at 3 sites (1.2 million people) demonstrated an 83–93% decrease in disease incidence and in hospitalization since the introduction of vaccine in 1995. Over the last few years, the number of cases of chickenpox in Massachusetts has declined by over 90%, as vaccination rates for children 19–35 months reached 91.5% in 2010. According to the Report of the Committee on Infectious Diseases of the American Academy of Pediatrics (the “Red Book”), the age of peak varicella incidence is shifting from children younger than 10 years of age to children 10 through 14 years of age, although the incidence in this and all age groups is lower than in the prevaccine era.

As vaccine coverage increases, and the incidence of wild-type chickenpox decreases, a higher proportion of chickenpox cases will occur in immunized people as breakthrough disease. In 2011, approximately 67% of reported cases in Massachusetts occurred in individuals with at least one dose of varicella-containing vaccine.

H. Vaccine Effectiveness

Chickenpox vaccine has been available since 1995. A single dose of varicella vaccine has been shown to be 70–90% effective at preventing chickenpox in general and over 95% effective at preventing severe disease. Two doses are 88% - 98% effective in preventing any form of varicella disease, according to CDC, and 100% effective in preventing severe varicella. Clinical studies suggest that a second dose of varicella vaccine boosts immunity and reduces the incidence of breakthrough disease in children.

I. Bioterrorist Potential

VZV is not considered to be of risk for use in bioterrorism.

Section 2

REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report any of the following:

- Individual cases of clinically diagnosed chickenpox; or
- Laboratory evidence of infection with varicella-zoster virus (VZV), including:
 - Isolation of VZV from a clinical specimen; or
 - Demonstration of VZV in a clinical specimen by detection of antigen or nucleic acid (DFA or PCR); or
 - Significant rise in serum varicella IgG antibody level by any standard serologic assay (please report both acute and convalescent antibody titers); or
 - Positive serology test for varicella IgM; or
- Unusual case(s)/clusters, as outlined in Section 3B; or
- Deaths for which chickenpox was a contributing cause.

Note: See Sections 3B and 3C for information on how to report a case.

B. Laboratory Testing Services Available

Laboratory diagnosis of chickenpox is not routinely required but may be useful in special circumstances like:

- Cases of atypical clinical presentation, mild or severe;
- Cases of severe disease;
- Post-vaccination events, such as:
 - Rash with >50 lesions 7–42 days post-vaccination;
 - Suspected secondary transmission of the vaccine virus;
 - Shingles; and
 - Any serious adverse event (e.g., pneumonia, encephalitis, cerebral ataxia);
- Clusters of breakthrough chickenpox in vaccinated individuals;
- Chickenpox reinfection in unvaccinated individuals.

The MDPH State Public Health Laboratory Institute (MA SPHL) provides limited testing services for chickenpox, under special circumstances only. Prior approval from an MDPH epidemiologist at (617) 983-6800 is required for all chickenpox testing at MA SPHL. Among chickenpox testing services offered at the MA SPHL, the PCR assay is the most useful in terms of timeliness and sensitivity. The MA SPHL can also perform rapid and conventional viral culture(s), if necessary. Anti-varicella IgM antibody testing is less reliable and is not performed at the MA SPHL. **Please see Attachment F for more information about laboratory testing for varicella.**

Section 3

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To monitor the impact of vaccination on age-specific incidence and on severity of chickenpox.
- To evaluate vaccine effectiveness under conditions of routine use and to track instances of vaccine failure.
- To identify groups and areas in which risk of disease is highest so prevention and control efforts can be focused.
- To track and minimize the occurrence of complications, such as invasive GAS infection.

B. Laboratory and Health Care Provider Reporting Requirements

Healthcare providers and other health professionals who identify a case of chickenpox, as defined by the reporting criteria in Section 2A, should report the case by completing the MDPH *Varicella (Chickenpox)* case reporting form and faxing it to the Office of Integrated Surveillance and Informatics Services (ISIS) at (617) 983-6220. MDPH will then notify the appropriate LBOH as described in Section C below. This form can be found at the end of this chapter or by calling ISIS at (617) 983-6801 to request an electronic version of the form.

In addition, healthcare providers and others should report any unusual cases, outbreaks, or cases in high-risk settings or among high-risk populations immediately by telephone to the LBOH and to the MDPH Division of Epidemiology and Immunization at (617) 983-6800, so that epidemiologists can collect additional information and assist with investigation and control measures, as needed.

Examples of such cases include:

- Unusual presentation or severe complications (including invasive GAS infection, pneumonia, hospitalization);
- Deaths for which chickenpox was a contributing cause;
- Immunocompromised individuals, pregnant women, and other individuals at high risk of complications, as described in section 1B;
- Cases or clusters of cases in healthcare settings, childcare centers with infants, and other high-risk institutional settings (e.g., prisons, jails, group homes, dormitories, shelters, military settings);
- Outbreaks in any setting.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of active varicella virus infection (not just immunity) shall report such evidence of infection directly to the MDPH *through secure electronic laboratory reporting (ELR) mechanisms*, or other method, as defined by the Department, within 24 hours. MDPH will then notify the appropriate LBOH as described in Section 3C below.

Please note: *Shingles cases should not be reported to the LBOH or to the MDPH.*

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Reporting Requirements

MDPH regulations (105 CMR 300.000) stipulate that chickenpox is reportable to the LBOH and that each LBOH must report any case of chickenpox or suspect case of chickenpox, as defined by the reporting criteria in Section 2A. The majority of chickenpox cases are reported directly to MDPH via case reporting form or through ELR. Cases reported directly to MDPH will populate the MAVEN “LBOH Notification but no follow-up required” workflow for acknowledgement by the appropriate LBOH.

Cases not already in MAVEN should be reported to ISIS using the MDPH *Varicella (Chickenpox)* case reporting form. This form can be found at the end of this chapter or may be obtained by calling ISIS at (617) 983-6801 to request an electronic version of the form. The completed form should be faxed to ISIS at (617)983-6220.

Case Investigation & Using MAVEN

For routine cases of chickenpox, information should be reported by the provider or other health professional via case report form. These cases will populate the “LBOH Notification but no follow-up required workflow” and can be acknowledged by the LBOH by checking the box next to the event in the workflow and clicking the “Populate LBOH Notified to Yes” button at the bottom of the screen. Events can also be acknowledged by

opening the Administrative Question Package (QP) and selecting “Yes” for the first question “Step 1 - LBOH acknowledged” under the “Local Health and Investigation” section.

For unusual cases, outbreaks, and cases in high-risk settings, as described above in section 3B, additional follow-up may be necessary in collaboration with an MDPH epidemiologist. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

Section 4

CONTROLLING FURTHER SPREAD

About control measures: The rigor of control measures for chickenpox depends on the setting and the population at risk for infection. While the general chickenpox control measures outlined below are appropriate for most settings and populations (e.g., healthy vaccinated daycare attendees; school-age youth with high vaccination rates; workplaces with employee populations thought to be highly vaccinated; LTCFs with residents presumed to have already had chickenpox) more stringent control measures are needed in certain settings where the risk of transmission, as well as the likelihood of severe disease among those exposed, is increased. **These more stringent control measures are discussed in Part C, Managing Special Situations.**

Factors to consider when determining the risk environment include:

- Number of susceptible individuals who are at high risk for complications of chickenpox (immunocompromised, pregnant women, newborns) – see below and also Managing Special Situations on page 11;
- Residential/institutional setting which may facilitate transmission (examples of high-risk residential settings include, but are not limited to, correctional facilities, group homes, shelters, military settings, dormitories, or work places with a large number of non-U.S. born individuals) – see below and also Managing Special Situations on page 11;
- Healthcare setting – see below and also Managing Special Situations on page 11;
- Number of individuals who were not born in the U.S. (and therefore may be susceptible to chickenpox); and
- Number of individuals who may not be able to provide reliable histories of past disease.

After determining risk factors for continued spread (e.g., susceptible exposed individuals, exposed individuals at high risk for complications, and type of setting), control measures may need to be more rigorous than the general chickenpox control measures outlined below (e.g., acceptance of past history of disease as evidence of immunity, acceptable time period for post-exposure vaccination, acceptability of post-exposure vaccination at all). Typically, if there are concerns about large numbers of susceptible individuals, particularly those who may be at high risk for complications, it makes sense to adopt more rigorous control measures. However, the general chickenpox control measures identified below are appropriate for most settings.

Control measures for schools, prisons and jails, infant daycares and healthcare settings are addressed in Section 4C.

A. Isolation and Quarantine Requirements (105 CMR 300.200)

Minimum Period of Isolation of Patient with Chickenpox

If vesicles are present, until lesions have dried and crusted or until no new lesions appear, usually by the fifth day (counting the day of rash onset as day zero). If no vesicles are present, until the lesions have faded (i.e., the skin lesions are in the process of resolving; lesions do not need to be completely resolved) or no new lesions appear within a 24-hour period, whichever is later.

Minimum Period of Quarantine of Contacts

Susceptible contacts in non-healthcare settings, who are not appropriately immunized or are without laboratory evidence of immunity or a reliable history of chickenpox, shall be excluded from school, work and other public activities from the 8th through the 21st days after their exposure to the case while the case was infectious. If the exposure was continuous, susceptibles shall be excluded from days 8–21 after the case’s rash onset. In high-risk settings, the MDPH may impose more rigorous exclusion criteria. Neonates born to mothers with active chickenpox shall be isolated from susceptibles until 21 days of age. Healthcare workers who are not appropriately immunized, are without laboratory evidence of immunity, or do not have a reliable history of chickenpox, shall be excluded from work from the 8th day after their first exposure during the case’s infectious period through the 21st day after the last exposure during the case’s infectious period. Anyone receiving VariZIG™ or IGIV shall extend their exclusion to 28 days post-exposure.

B. Protection of Contacts of a Case

1. Verify diagnosis and determine the type of rash.

Contact must be made with the diagnosing healthcare provider to confirm the diagnosis, if exclusions are going to occur.

Types of chickenpox rash illness are: 1) wild type, 2) breakthrough, or 3) vaccine-associated. Use *Attachment B: Guidelines for Evaluating Chickenpox-like Rash* as a guide. If you need guidance call the MDPH and an epidemiologist will help you to determine which type it is.

Cases of wild-type chickenpox and breakthrough chickenpox disease are treated equally with regard to infectiousness and control measures, as outlined below. Vaccine-associated rashes, which typically occur 15-42 days after vaccination, are thought to be only rarely infectious. See pages 1 and 2 of this chapter for description of rashes (wild type, breakthrough and vaccine-associated) and Attachment B. For this reason, control measures are generally not necessary and neither is exclusion, provided no high-risk susceptible contacts are identified.

2. Isolate the case.

Case should be isolated if vesicles are present, until all lesions have crusted over, usually by the 5th day after rash onset, but sometimes longer in immunocompromised patients. If no vesicles are present, isolate the patient until the lesions have faded (i.e., the skin lesions are in the process of resolving; lesions do not need to be completely resolved) or no new lesions appear within a 24-hour period, whichever is later.

Acyclovir treatment: the American Academy of Pediatrics (AAP) recommends that certain groups at **increased risk for moderate to severe varicella** be considered for oral acyclovir treatment. These high risk groups include:

- healthy persons older than 12 years of age;
- persons with chronic cutaneous or pulmonary disorders;
- persons receiving long-term salicylate therapy;
- and persons receiving short, intermittent, or aerosolized courses of corticosteroids.

Some healthcare providers may elect to use oral acyclovir for secondary cases within a household. For maximum benefit, oral acyclovir therapy should be given within the first 24 hours after the varicella rash starts. For more information see Attachment G.

Aspirin: Children (≤ 18 years of age) should **not** receive aspirin or other salicylates because they are associated with an increased risk for Reye syndrome.

3. **Identify all those exposed.**

Exposure to chickenpox is defined as contact with nasopharyngeal secretions or lesions, face-to-face interaction, or sharing indoor airspace with an infectious person (e.g., occupying the same 2–4-bed ward or adjacent beds in a large ward) during the patient’s infectious period (2 days before rash onset until lesions have crusted over).

Consider mode of transmission, and immune status of both the case and of the exposed. (Immunosuppressed cases are more infectious and exposed persons who are immunosuppressed are at higher risk for complications.) Keeping these criteria in mind, consider members of the following groups who may have been in contact with the case during his/her infectious period:

- Household members (could include staff and clients in a group home or shelter);
- School/childcare students and staff (consider interaction patterns, staffing patterns, and possibilities of shared airspace, face-to-face contact, and saliva exchange);
- Staff and patients of healthcare facilities;
- Work place contacts (especially in childcare, school, and healthcare settings);
- Social and religious groups;
- Sports teams and extracurricular activity groups;
- Bus/carpool mates;
- Close friends;
- Persons potentially exposed at social events or while traveling.

Note: See Section 4C for more information on managing special situations, including schools, prisons and jails, infant daycare and healthcare settings.

4. **Identify susceptibles among the exposed.**

Susceptibles are those without evidence of immunity, as defined in Attachment A.

A positive antibody titer drawn immediately after exposure may be acceptable evidence of immunity depending on the setting. However, vaccination of exposed individuals should not be delayed pending the results of antibody testing. If post-exposure antibody titer testing is done, consult with an MDPH epidemiologist to determine whether exclusion is necessary and, if so, the appropriate exclusion period.

5. **Identify and exclude susceptible individuals at high risk for complications who can’t be immunized: infants, pregnant women, and immunosuppressed.**

Recommend the exclusion of high-risk susceptible contacts from a setting until 1 incubation period (21 days) after their last exposure, or if they receive VARIZIG® or IGIV, until 28 days after their last exposure (to protect others should they develop infection). After this time, they may return if no additional cases have been identified. If a healthcare setting is involved, see Section 4C for more information.

For people exposed to varicella who cannot receive varicella vaccine, varicella zoster immune globulin can prevent varicella from developing or lessen the severity of the disease. Once these individuals are identified they should be referred for treatment. Varicella-zoster immune globulin (VARIZIG®) prophylaxis (or immune globulin, intravenous, if varicella-zoster immune globulin is not available) is recommended for all high-risk individuals including:

- immunocompromised individuals without evidence of immunity to varicella,
- pregnant women without evidence of immunity to varicella
- and certain newborns (see below).

VARIZIG® is approved for administration as soon as possible following varicella-zoster virus exposure, ideally within 96 hours (4 days) for greatest effectiveness, and within 10 days. After 10 days this treatment is not likely to be helpful. Patients receiving monthly high-dose (≥ 400 mg/kg) immune globulin, intravenous (IGIV) are likely to be protected and probably do not require VARIZIG®, if the most recent dose of IGIV was administered ≤ 3 weeks before exposure. Post-exposure prophylaxis with acyclovir should also be considered if VARIZIG® and IGIV within 10 days are not an option. Please see the Guidelines on VARIZIG® or IGIV Prophylaxis in Attachment G for information about dosage and administration of these products.

When deciding whether or not VARIZIG® or IGIV is indicated, three factors should be considered carefully:

1. The likelihood the exposed person is susceptible to varicella;
2. The probability that a given exposure to varicella or zoster will result in infection; and
3. The likelihood that complications will develop if the person is infected.

Immunocompromised individuals without evidence of immunity to varicella

An immunocompromised individual should be referred to their healthcare providers. Examples include children with leukemia or lymphoma who have not been vaccinated; people on medications that suppress the immune system, such as high-dose systemic steroids or chemotherapeutic agents, and people with cellular immune-deficiencies or other immune system problems. These individuals have a higher risk for serious complications with chickenpox infection, including disseminated disease resulting in multiple organ system involvement. Complications include pneumonia and encephalitis.

Pregnant women without evidence of immunity to varicella

A pregnant woman should be referred to her obstetrician. Susceptible pregnant women who contract varicella may be at higher risk for serious complications than adults in general, and their fetuses are at risk for congenital varicella syndrome.

- Prenatal assessment of women for evidence of varicella immunity is recommended. Birth before 1980 is not considered evidence of immunity for pregnant women exposed to varicella.
- Women who do not have evidence of varicella immunity should receive the first dose of vaccine before discharge from the health-care facility after delivery. The second dose should be administered 4--8 weeks later which may coincide with a postpartum visit. Women should be counseled to avoid conception for 1 month after each dose of varicella vaccine.
- Susceptible pregnant women who cannot receive VARIZIG® (or IGIV if varicella-zoster immune globulin is not available) as soon as possible following exposure, and within 10 days of exposure, should be closely monitored by their clinicians for signs and symptoms of varicella. Institute treatment with acyclovir, if illness occurs.

Certain newborns

Some newborns (e.g., immunocompromised, hospitalized or underweight pre-term, or born to a mother with chickenpox) are also at increased risk for complications and should receive treatment:

- Newborns whose mothers have varicella from five days before to 2 days after delivery
- Premature babies exposed to varicella (or herpes zoster) during the period for which they require hospital care for their prematurity, specifically:
 - Hospitalized premature infants born at ≥ 28 weeks of gestation whose mothers do not have evidence of immunity
 - Hospitalized premature infants born at < 28 weeks of gestation or who weigh ≤ 1000 grams at birth **regardless** of their mother's varicella immune status

- According to the American Academy of Pediatrics (2012), mothers who develop varicella 5 days before through 2 days after delivery should be separated from their infants, but their expressed milk can be used for feeding.

6. **Immunize all other susceptibles.**

Recommend varicella vaccine to eligible, susceptible, exposed individuals. Anyone with a history of receiving 1 dose should receive a second dose. Contact MDPH at (617) 983-6800 or your local board of health if you have questions. See *Attachment C: Special Considerations in the Administration of Varicella Vaccine* (found at end of this chapter) for information about some groups who should not receive varicella vaccine.

Varicella vaccination ≤ 3 days after exposure to an individual with chickenpox is approximately 90% effective in preventing disease, and vaccination ≤ 5 days is approximately 70% effective in preventing disease and even more effective in modifying disease. Vaccinating someone who is incubating chickenpox or is immune to chickenpox is not harmful. If vaccine is given following exposure, recipients should be informed that chickenpox could occur despite vaccination. Please note the following:

- In most healthcare settings, and some other high risk settings, such as infant daycare facilities, prisons, shelters and group homes (see Section C, Managing Special Situations), vaccination should occur within three days of exposure, if possible. In these high risk settings MDPH or the local board of health may need to determine the acceptable vaccination interval and evidence of immunity that is satisfactory.
- In most non-healthcare settings, including schools, vaccination within five days is acceptable.
- Long-term care facilities, depending on their population (e.g., lower risk situation of relatively healthy, U.S.-born individuals), may choose vaccination within five days after exposure. Those with high-risk patients (e.g., many patients with underlying medical problems, including those who require mechanical ventilation, have immunosuppression, or have neurologic compromise) or foreign-born staff should choose vaccination within three days after exposure. Contact MDPH at (617) 983-6800 if you have questions.
- Parents of children with valid medical or religious exemptions should confirm that these children are susceptible. A child may have a history of chickenpox or laboratory evidence of immunity, despite having a religious exemption on file. If these children are susceptible and refuse vaccination they are to be excluded, as indicated below.
- If chickenpox develops in susceptible individuals, with or without postexposure vaccination, antiviral treatment (e.g., acyclovir) should be considered for adolescents, adults, and secondary case patients who are household contacts of infected children.

Although only 1 dose of varicella vaccine is needed post-exposure to allow return to school or work, everyone who only has 1 dose, should routinely receive a 2nd dose at least 28 days after the 1st or at least 3 months after the first dose, if younger than 13 years of age.

7. **Exclude/quarantine all other exposed susceptible contacts who have not been immunized, if required.** The following susceptible contacts who have not been immunized must be quarantined if exposed:

- If there was a discrete (one time) exposure, exclude susceptibles on days 8–21 from exposure to someone who was infectious with chickenpox.
- If there was continuous exposure (e.g., attended school for two or more days while person with chickenpox was infectious), exclude susceptibles on day 8 through day 21 following exposure **to the rash**. This does not apply to high risk settings or populations (e.g., healthcare).

Special Considerations:

- Healthcare workers, including school nurses, as well as exposed inpatients, should be managed as described in Section 4C. Consultation with the MDPH can help determine the best course of action for a high-risk setting.
- Neonates born to mothers with active chickenpox shall be isolated from susceptibles until 21 days of age. According to the American Academy of Pediatrics (2012), mothers who develop varicella 5 days before through 2 days after delivery should be separated from their infants, but their expressed milk can be used for feeding.
- Anyone receiving VARIZIG® or IGIV shall extend his/her exclusion to 28 days post-exposure because VARIZIG® or IGIV may prolong the incubation period of chickenpox.

8. Document key requirements/recommendations and educate individuals who may have been exposed.

Supply potentially exposed individuals with information. In institutional settings, including childcare centers and schools, provide potentially exposed attendees (or their parents) and staff with:

- 1) Written or verbal notice of the case or outbreak (without personal identifiers), containing dates by which vaccination must occur and exclusion period dates, as appropriate – call (617) 983-6800 for a sample notice (also referred to as advisories and alerts);
- 2) The MDPH *Chickenpox Fact Sheet*, available at <http://www.mass.gov/eohhs/gov/departments/dph/programs/id/epidemiology/factsheets.html>
- 3) The *Varicella Vaccine Information Statement (VIS)*, available at <http://www.cdc.gov/vaccines/hcp/vis/vis-statements/varicella.html> and <http://www.immunize.org/vis/index.htm>.

Review the importance of careful hand washing with staff and students, especially after touching discharges from nose, throat, or chickenpox lesions, and the importance of not sharing eating utensils or toys that are put into the mouth.

9. Conduct surveillance.

Surveillance for chickenpox should occur for 42 days (2 incubation periods) after the last exposure to chickenpox. For those who received VARIZIG® or IGIV and where immunocompromised individuals are involved, surveillance should continue for 56 days.

C. Managing Special Situations

Refer to the steps listed as control measures in Section 4B: Protection of Contacts of a Case. In special situations some control measures may be more strict in order to protect vulnerable susceptible populations or intervene in an outbreak. This section explains those differences for schools, infant daycares, healthcare (acute and long-term care), congregate housing (prison, jails, dormitories, shelters, group homes, military housing) and institutional settings where group A streptococcal (GAS) infection is also present.

Schools

As indicated previously, exposure to chickenpox is defined as contact with nasopharyngeal secretions or lesions, face-to-face interaction, or sharing close indoor airspace with an infectious person during the patient's infectious period (2 days before rash onset until lesions have crusted over). Close proximity and sustained contact are high risk for chickenpox transmission. Identifying “zones of exposure” is a critical step in developing specific control interventions for chickenpox. When dealing with school settings, follow the parameters about determining zones of exposure, as described previously. The following are examples of exposure in a school setting:

- Sharing the same classroom;
- Sitting at the same table in a lunchroom;
- Sitting within several seats of the case in an auditorium;
- Riding the same bus/carpooling; or
- Participating on the same sports team or extracurricular activity.

In most settings, casual, brief contact would not constitute exposure for a contact or for an entire school. However, if the individual with chickenpox is immunocompromised or if any contacts are immunocompromised, wider “zones of exposure” may be considered, after consultation with the MDPH.

Because school populations are usually highly vaccinated, and school nurses frequently know which students are susceptible and/or at high risk for medical complications from chickenpox, the general chickenpox follow-up recommendations described in Section 4B, items 1-9, are usually accomplished fairly quickly. The challenge is determining who is exposed, which can depend on how classes and activities are conducted at the school, transportation to and from school, afterschool activities, and so forth. Typically, susceptible close contacts are notified individually, with a letter providing specific dates by which vaccination must occur or exclusion will begin, and a general letter about chickenpox in the school is sent to those who have not been identified as close contacts (but may be in the same class or the same grade). The scope of this notification varies by the situation and the school. Sample letters are available by calling (617) 983-6800.

Daycare with Infants under 1 Year of Age

Vaccination is not recommended for persons under the age of 12 months, but these infants may be at increased risk for complications of chickenpox. In the daycare setting, any exposed infant for whom vaccination is not recommended should be excluded from the daycare and other activities from day 8 to day 21. Any children who are over 12 months of age should get a first dose of vaccine, if there are no contraindications. If the vaccine is given within 3-5 days of exposure, that child usually may return to daycare. Daycares with multiple high-risk children should take a conservative approach. A child who has 1 dose of vaccine when exposed may get a second dose as long as 3 months have elapsed since the first dose. Teachers and caregivers should also confirm their immune status either by titer, 2 dose vaccine history, birth in the US before 1980, or physician certified disease.

Healthcare Settings (Including Acute and Long-term Care Facilities)

All healthcare workers should ensure that they are immune to varicella virus. Birth in the US before 1980 is not acceptable presumptive evidence of immunity for healthcare providers.

- According to the Advisory Committee for Immunization Practices (ACIP), healthcare personnel (HCP) who have received 2 doses of varicella vaccine and who are exposed to VZV should be monitored daily during days 8-21 after exposure for fever, skin lesions and systemic symptoms suggestive of varicella. HCP should be excluded from a work facility immediately, if symptoms occur.
- HCP who have received 1 dose of vaccine and who are exposed to varicella should receive a second dose within 3 days after exposure (provided four weeks have elapsed after the first dose). Within 5 days may be acceptable in some low risk healthcare settings. After vaccination, management is similar to that of 2-dose vaccine recipients. Those who did not receive a second dose or who received the second dose >3 days after exposure should be excluded from work for 8-21 days after exposure.
- Unvaccinated HCP, who have no other evidence of immunity, who are exposed to varicella are potentially infective from days 8-21 after exposure and should be furloughed during this period. They should receive postexposure vaccination as soon as possible. Vaccination within 3-5 days of

exposure might modify the disease, if infection occurred. Vaccination >5 days postexposure is still indicated because it induces protection against subsequent exposures (if the current exposure did not cause infection).

Susceptible healthcare workers shall be excluded from their occupation from the 8th day after their first exposure during the case's infectious period through the 21st day after the last exposure to the infectious case. **In most healthcare settings, healthcare personnel who have received one dose of varicella vaccine will not need to be excluded if they have been vaccinated with a second dose within 3 days of exposure.** The exception may be long-term care facilities, which may use a five-day window for vaccination of staff if the patient population is low risk (believed to be immune, for example, due to age).

- In some very high-risk settings, infection preventionists may wish to exclude or reassign all susceptibles, regardless of timing of vaccination post-exposure. Decisions about exclusion will depend on such factors as the setting (e.g., neonatal ICU, oncology unit, transplant unit) and the degree of direct patient contact.
- Anyone receiving VARIZIG® or IGIV shall extend his/her exclusion to 28 days post-exposure.
- In healthcare settings, discharge all exposed, susceptible patients as soon as possible. Isolate on contact precautions and airborne isolation all such patients who cannot be discharged from day 8 after first exposure through day 21 after last exposure to someone who was infectious.

Immunization at time of employment is recommended for all healthcare workers and is particularly important for susceptible healthcare workers who have close contact with persons at high-risk for serious complications, including: a) premature infants born to susceptible mothers; b) premature infants who are born at <28 weeks of gestation or who weigh $\leq 1,000$ g at birth (regardless of maternal immune status); c) pregnant women; and d) immunocompromised individuals. Healthy adolescents and adults are also at higher risk for complications, and healthy, full-term newborns born to susceptible mothers may be as well.

Serologic screening and antibody titers: In healthcare institutions, serologic screening of personnel who have a negative or uncertain history of chickenpox disease is likely to be reliable and cost-effective. However, routine testing for chickenpox immunity after 2 doses of vaccine is unnecessary and is not recommended. HCP with evidence of two doses who subsequently have a negative titer for varicella should be considered immune. This is because serologic tests are generally not sufficiently sensitive to detect vaccine-induced antibody. On the other hand, HCP with a history of varicella disease who subsequently have a negative titer for varicella should not be considered immune. It is expected that the titer result would be positive in those with a history of varicella disease, and it makes sense to err on the side of caution when evaluating evidence of immunity in the healthcare setting.

Congregate Housing (prisons and jails, dormitories, shelters, group homes, military housing, etc.)

As indicated previously, exposure to chickenpox is defined as contact with nasopharyngeal secretions or lesions, face-to-face interaction, or sharing close indoor airspace with an infectious person during the patient's infectious period (2 days before rash onset until lesions have crusted over). In congregate housing settings, there may be many individuals who live in the facility who may have close contact with the patient while the patient is infectious. The population exposed may or may not be at high risk of complications from chickenpox, or may have an uncertain vaccination history. Because some settings include residents at increased risk for complications, residents with uncertain vaccination history, as well as living in close quarters that can facilitate transmission (e.g., a prison, jail or shelter), vaccination of susceptible residents and staff within three days of exposure may be necessary to avoid exclusion or quarantine. MDPH or the local board of health may need to determine acceptable vaccination intervals and evidence of immunity. As with schools, close proximity to the case should be evaluated in terms of zones of exposure, such as the following:

- Sharing the same bedroom or cell/cell block; sharing the same home-like residence;
- Sitting at the same table in a lunchroom; sitting within several seats of the case in a TV room or living room; riding the same bus/carpooling; or
- Participating in the same work, recreation or other activity.

Institutional Settings Where Group A Streptococcal (GAS) Infection is Also Present

Invasive GAS infection as a complication of chickenpox is relatively rare but can be very dangerous. The MDPH has detailed control measures for childcare centers and schools where chickenpox cases are accompanied by GAS infection, whether invasive or non-invasive. The central strategy involves rapid vaccination of exposed susceptibles and antibiotic treatment where indicated. Usually, in non-high-risk settings, varicella vaccine should be given within five days after exposure, while in high-risk settings (including most healthcare settings) vaccine should be given within three days. Contact the MDPH Division of Epidemiology and Immunization immediately for assistance at (617) 983-6800. Also refer to the *Group A Streptococcus (Invasive)* chapter for more information about this infection.

D. Preventive Measures

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adults, is the best preventive measure against chickenpox and subsequent shingles. To decrease the occurrence of breakthrough disease, CDC now recommends:

- Implementation of a routine 2-dose varicella vaccination program for children, with the first dose administered at age 12–15 months and the second dose at age 4–6 years;
- A second dose catch-up varicella vaccination for children, adolescents, and adults who previously had received 1 dose;
- Routine vaccination of all healthy persons aged >13 years without evidence of immunity.

Prenatal assessment of women for evidence of varicella immunity is recommended. Birth before 1980 is not considered evidence of immunity for pregnant women. Women who do not have evidence of varicella immunity should receive the first dose of vaccine before discharge from the health-care facility after delivery. The second dose should be administered 4--8 weeks later, which may coincide with a postpartum visit. Women should be counseled to avoid conception for 1 month after each dose of varicella vaccine.

Good personal hygiene (which consists of proper hand washing, disposal of used tissues, not sharing eating utensils, etc.) is also important. Please refer to the most current versions of the ACIP statements on varicella (listed under the References section), MDPH's Immunization Guidelines, and MDPH's Massachusetts Immunization Program-State Supplied Vaccines and Patient Eligibility Criteria for details about varicella vaccine, the recommended schedule, who should and shouldn't get the vaccine, and who is eligible to receive state-supplied vaccine. These, as well as other relevant resources, are available through the MDPH Division of Epidemiology and Immunization at (617) 983-6800. A Chickenpox (Varicella) Public Health Fact Sheet for the general public is available from the MDPH Division of Epidemiology and Immunization or on the MDPH website at: <http://www.mass.gov/eohhs/gov/departments/dph/programs/id/epidemiology/factsheets.html>

See pages 19, 20 and 21 for References and Attachments.

Section 1

ABOUT THE DISEASE

Shingles is not a reportable condition in Massachusetts. However, because shingles is caused by the virus that causes chickenpox, and cases of chickenpox can occur in susceptible individuals following close contact with people with shingles, local boards of health may be involved in making recommendations to protect the close contacts of a person with shingles, or even recommendations for quarantine of susceptible close contacts.

A. Etiologic Agent

Shingles (herpes zoster) is caused by the varicella zoster virus (VZV), a DNA virus belonging to the herpes virus group. Primary infection with VZV causes chickenpox. Like other herpes viruses, VZV has the capacity to persist in the body as a latent infection after the primary infection. Shingles results from reactivation of latent infection.

B. Clinical Description

Following primary infection (chickenpox), VZV remains in human nerve tissues and is reactivated later in life in approximately 32% of infected persons (50% of those living to age 85), resulting in shingles (herpes zoster). Shingles presents as a red, painful, itchy, and blistering rash, typically in one area on one side of the body, in the distribution of a nerve (dermatome). There is usually no fever or other systemic symptoms. Less commonly, the rash can be more widespread and affect three or more dermatomes. This condition is called disseminated shingles. Pain and itching in the area of the shingles may persist after the lesions have resolved (post-herpetic neuralgia, or PHN). People with PHN can have severe pain in the areas where they had the shingles rash, even after the rash has cleared up.

Shingles can be treated with several antiviral agents. It can become more serious in immunocompromised persons, with generalized skin eruptions and central nervous system, pulmonary, hepatic, and pancreatic involvement.

Disseminated shingles

Appearance of lesions outside the primary or adjacent dermatomes is known as disseminated shingles. This generally occurs only in people with compromised immune systems. Disseminated shingles can be difficult to distinguish from varicella. In patients with disseminated shingles, standard precautions plus contact precautions and airborne isolation should be used until lesions are dry and crusted.

Shingles in vaccinated individuals has been reported, although the risk of developing shingles from wild-type virus is 4–5 times greater than the risk from vaccine virus.

VZV Meningitis

VZV, when reactivated, can also result in VZV meningitis, with or without rash. Symptoms are usually consistent with aseptic meningitis: headache, stiff neck, neck pain, nausea and vomiting, and mental status changes. VZV is found in the CSF of patients with VZV meningitis. In one study (Ihekweba et al., 2008), 88% of patients with VZV meningitis had a shingles rash. Like shingles, it can be treated with several antiviral agents. It can become serious in immunocompromised persons. Aseptic meningitis is a reportable condition in Massachusetts.

C. Vectors and Reservoirs

Humans are the only known host of VZV

D. Modes of Transmission

Shingles is transmitted from person to person only by **direct contact with lesions**. However, in certain cases where shingles is disseminated or in the case of an immunocompromised individual with localized shingles, droplet and even airborne spread is also possible.

Exposure to shingles can result in chickenpox in a susceptible person.

E. Incubation Period

Shingles has no incubation period; it is caused by reactivation of latent infection from primary chickenpox disease.

F. Period of Communicability or Infectious Period

The infectious period for shingles lasts until all lesions have crusted over.

G. Epidemiology

Shingles is found worldwide and has no seasonal variation. There are an estimated one million cases of shingles in the United States annually. The overall annual incidence in the U.S. is approximately 4 cases per 1000 population (CDC, based on 2000 census). Annual incidence among people 60 or older in the U.S. is about 10 cases per 1000 population.

This disease increases with advancing age and is more common among immunocompromised persons and among children with a history of intrauterine chickenpox or chickenpox occurring within the first year of life. The latter have an increased risk of developing shingles at an early age. Approximately 32% of the general population will experience shingles during their lifetime.

H. Vaccine Effectiveness

The vaccine for shingles (Zostavax®) is recommended for use in people 60 years old and older to prevent shingles. The older a person is, the more severe the effects of shingles typically are, so all adults 60 years old or older should get the shingles vaccine. In a clinical trial involving thousands of adults 60 years old or older, Zostavax reduced the risk of shingles by about half (51%) and the risk of post-herpetic neuralgia by 67%. While the vaccine was most effective in people 60-69 years old it also provided some protection for older groups. Research suggests that the shingles vaccine is effective for at least six years. Ongoing studies are being conducted to determine exactly how long the vaccine protects against shingles.

I. Bioterrorist Potential

VZV is not considered to be of risk for use in bioterrorism.

Section 2

REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Shingles is not a reportable disease or condition in Massachusetts. Chickenpox is reportable (see page 4).

B. Laboratory Testing Services Available

The MDPH State Public Health Laboratory does not provide testing for shingles.

Section 3

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

*Shingles cases **do not** need to be reported to the LBOH or to the MDPH.*

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Because chickenpox is caused by the virus that causes shingles, LBOH may be involved in making recommendations to protect the close contacts of a person with shingles, or even recommendations for quarantine of susceptible close contacts. Because direct contact with lesions is usually required to transmit the varicella virus from a patient with shingles to someone who is susceptible to chickenpox, the scope of follow-up is usually relatively narrow with shingles, as compared to chickenpox.

Reporting Requirements

*Shingles cases **do not** need to be reported to the LBOH or to the MDPH per MDPH regulations (105 CMR 300.000).*

Section 4

CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (105 CMR 300.200)

There are no isolation or quarantine requirements for shingles cases. However, unless the shingles rash can be completely covered, it is advisable that individuals with shingles stay at home until the rash is crusted over and dry. In addition, susceptible contacts of shingles cases with pertinent exposures, as defined in Section 4B, should be excluded for the same time periods as susceptible contacts of chickenpox cases.

B. Protection of Contacts of a Case

Control measures are the same as the steps listed for chickenpox above and include identification of those exposed, and vaccination of susceptible contacts to protect them from developing chickenpox.

Exposure to uncomplicated shingles is defined as **contact with lesions**, (e.g., through close patient care, touching, or hugging). Exposure to disseminated shingles (or localized or disseminated shingles in an immunocompromised person) is defined as: 1) contact with lesions (e.g., through close patient care, touching, or hugging); or 2) sharing indoor airspace (e.g., occupying the same 2–4-bed ward or adjacent beds in a large ward).

Lesions in individuals with shingles carry the virus that causes chickenpox. Therefore, persons with shingles must be very careful about personal hygiene and must wash their hands if they touch their lesions. In otherwise healthy individuals, lesions that are covered appear to pose little risk to susceptible individuals. **Unless the shingles rash can be completely covered, it is advisable that individuals with shingles stay at home until the rash is crusted over and dry. Children with shingles whose lesions cannot be covered should be excluded from childcare/school until their lesions have crusted.**

In a high-risk setting with patients at high risk of complications from varicella, if there is doubt about a case's ability to comply with keeping lesions covered (e.g., young children, individuals with developmental delay), the case may be asked to stay home until he/she is no longer infectious. Additionally, those with shingles should avoid contact with those at higher risk for infection with VZV or complications from VZV infection (e.g.,

unvaccinated infants, immunocompromised people). This is not possible in some settings, and in these situations, exclusion of the case (or the high-risk individual[s]) may be considered.

Those who have disseminated shingles, or are immunocompromised with either localized or disseminated shingles, can transmit VZV via the airborne route and should stay home, or if in the hospital, should be placed in airborne isolation for the duration of the illness if such airborne isolation is possible.

Susceptible individuals who are exposed to shingles lesions should be treated the same as susceptible chickenpox contacts. See the Chickenpox portion of this chapter, starting on page six.

C. Managing Special Situations

Schools

Students and staff with shingles should stay home until lesions are completely crusted over, unless the rash can be completely covered and the person with shingles is fastidious with regard to hand hygiene.

Daycare with Infants

Staff with shingles should stay home until lesions are completely crusted over, unless the rash can be completely covered and the person with shingles is fastidious with regard to hand hygiene. Staff working with unvaccinated infants should be very cautious about transmission of varicella-zoster virus and reassignment or isolation should be strongly considered until lesions are completely crusted over. Staff with disseminated shingles and immunocompromised staff with shingles should be excluded from work for the duration of their illness.

Healthcare Settings (Including Acute and Long-term Care Facilities)

Staff with localized shingles should cover lesions with a taped dressing and should be removed from direct care of patients at high risk (neonates, pregnant women, immunocompromised persons of any age) until their skin lesions have become dry and crusted. Patients with localized shingles should be cared for using standard precautions (including, but not limited to, hand washing, gloves, masks, eye protection during activities likely to generate splashes, and nonsterile gowns) until all lesions are crusted. Current or prospective roommates should be immune. Staff with disseminated shingles and immunocompromised staff with shingles should be excluded from work for the duration of their illness. Patients with disseminated shingles and immunocompromised patients with shingles (either localized or disseminated) require airborne isolation (negative pressure room) and contact precautions for the duration of the illness, if possible.

D. Preventive Measures

The vaccine for shingles (Zostavax®) is recommended for use in people 60 years old and older to prevent shingles. The older a person is, the more severe the effects of shingles typically are, so all adults 60 years old or older should get the shingles vaccine. In a clinical trial involving thousands of adults 60 years old or older, Zostavax reduced the risk of shingles by about half (51%) and the risk of post-herpetic neuralgia by 67%. While the vaccine was most effective in people 60-69 years old it also provided some protection for older groups. Research suggests that the shingles vaccine is effective for at least six years, but may last much longer. Ongoing studies are being conducted to determine exactly how long the vaccine protects against shingles.

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adult groups, **is the best preventive measure against chickenpox and subsequent shingles**. Please refer to the most current versions of the ACIP statements on varicella (listed under References section), MDPH's Immunization Guidelines, and MDPH's Massachusetts Immunization Program-State Supplied Vaccines and Patient Eligibility Criteria for details about varicella vaccine, the recommended schedule, who should and shouldn't get the vaccine, and who is eligible to receive state-supplied vaccine. These, as well as

other relevant resources, are available through the MDPH Division of Epidemiology and Immunization at (617) 983-6800.

Good personal hygiene (which consists of proper hand washing, disposal of used tissues, not sharing eating utensils, etc.) is also important.

A Chickenpox (Varicella) Public Health Fact Sheet for the general public is available from the MDPH Division of Epidemiology and Immunization or on the MDPH website at:

<http://www.mass.gov/eohhs/gov/departments/dph/programs/id/epidemiology/factsheets.html>

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for chickenpox. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: The most up-to-date CDC case definitions are available on the CDC website at

<https://www.cdc.gov/nndss/case-definitions.html>

Case Definition for Varicella (as defined by CSTE, 1999, 2010)

The following varicella case definitions were approved by CSTE in June 1999 and updated in 2010. Case definitions for varicella cases and deaths can be found on CDC's web site under Nationally Notifiable Diseases Surveillance System.

Varicella Clinical Case Definition

An illness with acute onset of diffuse (generalized) maculopapular vesicular rash without other apparent cause. In vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is usually mild with fewer than 50 skin lesions and shorter duration of illness. The rash may also be atypical in appearance (maculopapular with few or no vesicles).

Varicella Case Classification

Probable: A case that meets the clinical case definition but is not laboratory confirmed nor epidemiologically linked to another probable or confirmed case.

Confirmed: A case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or a probable case.

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

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ATTACHMENTS

Attachment A: Evidence of Immunity to Varicella

Attachment B: Guidelines for Evaluating Chickenpox-Like Rash

Attachment C: Special Considerations in the Administration of Varicella Vaccine

Attachment D: Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines

Attachment E: Guidance for Interpreting a Past History of Chickenpox

Attachment F: Laboratory Testing for Varicella

Attachment G: VariZIG™ Guidelines

Attachment A

Evidence of Immunity to Varicella¹

Evidence of immunity to varicella includes any of the following:

- Documentation of age-appropriate vaccination against chickenpox; or
- Laboratory evidence of immunity or laboratory confirmation of disease²; or
- Born in the United States before 1980. **However, this should not be considered evidence of immunity for healthcare workers, pregnant women and immunocompromised persons.** Persons born outside the United States should meet one of the other criteria for varicella immunity
- A healthcare provider diagnosis or verification of chickenpox³; or
- History of shingles (herpes zoster) based on healthcare provider diagnosis⁴.

¹Bone marrow transplant recipients should be considered susceptible *regardless* of past history of disease.

²Commercial assays can be used to assess disease-induced immunity, but they lack adequate sensitivity to detect vaccine-induced immunity reliably (may yield false negative results). Therefore, someone with documentation of age-appropriate vaccination and a subsequent negative titer should still be considered immune. On the other hand, someone with a history of chickenpox with a subsequent negative titer should be considered susceptible, particularly in healthcare and other high-risk settings.

³Self-reported history of chickenpox is acceptable for adults and college students, with review by appropriate healthcare or supervisory staff. Self reported history is not acceptable in healthcare settings.

⁴Verification of history or diagnosis of typical disease can be done by any healthcare provider (e.g., school or occupational clinic nurse, nurse practitioner, physician assistant, physician, appropriate supervisory or public health staff). For people reporting a history of, or presenting with, atypical and/or mild disease, assessment by a physician or their designee is recommended and one of the following should be sought: a) an epidemiologic link to a typical varicella case or b) laboratory confirmation, if laboratory testing was performed at the time of acute disease. When such documentation is lacking, people should not be considered as having a valid history of disease, because other diseases may mimic mild atypical varicella.

Attachment B Guidelines for Evaluating Chickenpox-like Rash (Wild Type vs. Breakthrough vs. Vaccine-Associated)

The three most important features are: 1) the severity of the chickenpox-like illness, 2) any known exposure to chickenpox, and 3) the time interval since receipt of varicella vaccine, as outlined below.

	WILD TYPE	BREAKTHROUGH	VACCINE-ASSOCIATED
Symptoms	<ul style="list-style-type: none"> Generalized rash (typically 200 – > 500 lesions with many vesicles) Fever Cough <p>(if “partial” immunity has developed, symptoms may be attenuated)</p>	<ul style="list-style-type: none"> Generalized rash, more maculo-papular than vesicular (usually < 50 lesions) Often afebrile Minimally symptomatic 	<ul style="list-style-type: none"> Generalized rash, more maculopapular than vesicular (< 20 lesions [median=5]) Some localized vesicles at the site of injection (median=2) Afebrile Asymptomatic
<i>and</i>			
Exposure to chickenpox	often a known or possible exposure	often a known or possible exposure	No known exposure
<i>and</i>			
Timing Post Vaccination	rash occurs < 7 days or > 42 days (but can also occur between 7 – 42 days)*	rash usually occurs > 42 days (but can also occur between 7 – 42 days)*	rash occurs at 7-21 days (but can occur up to 42 days)*
↓			
Occurrence		Up to 30% of vaccinated children and adults, respectively, with household exposure to wild-type varicella	Side effect of the vaccine (occurs in 4% of vaccinees)
↓			
Infectious	Highly infectious	< 50 lesions, one-third as infectious as wild type >50 lesions, as highly infectious as wild type	<ul style="list-style-type: none"> <i>Much less</i> infectious than non-vaccine modified wild-type disease If transmission occurs, infection may be asymptomatic or attenuated
↓			
Exclude	Exclude from school until all lesions have dried and crusted over, or until no new lesions appear, usually by the 5 th day after rash onset.	If vesicles present, exclude as for wild-type chickenpox. If no vesicles present, until lesions have faded (i.e., the lesions are in the process of resolving; lesions do not need to be completely resolved) or no new lesions appear within a 24 hour period, whichever is later.	If no high-risk susceptible contacts are identified and local policy permits, the child may attend school.

*Rashes occurring days 7-42 post vaccination may be due to either wild-type or vaccine-type virus. PCR may be used to differentiate.

[Please see the accompanying page for more details.]

Guidelines for Evaluating Chickenpox-like Rash, cont.

Distinguishing rash induced by varicella vaccine virus from rash caused by wild-type virus in a vaccine recipient is critical in making appropriate infection control decisions and patient management decisions, particularly regarding individuals at risk for serious complications of varicella.

The three most important features to consider in making these determinations are:

- 1) the severity of the chickenpox-like illness,
- 2) any known exposure to chickenpox, and
- 3) the time interval since receipt of varicella vaccine.

The guidance outlined below is provided to assist in making this determination.

There are three possible categories of chickenpox-like rash in vaccine recipients:

1. **Wild-type chickenpox** (can occur at any time post-vaccination, but rashes occurring < 7 and > 42 days should be considered wild type):
 - a) < 7 days post-vaccination – In this case, exposure to wild-type virus happens prior to or immediately following vaccination. Wild-type chickenpox can occur in this scenario because there has been insufficient time for immunity to develop prior to exposure.
 - b) 7 - 42 days post-vaccination – In this case, it is difficult to determine if the rash is due to wild-type or vaccine-type virus. PCR testing is available at CDC to make this determination. This test is not done routinely and results are not usually available quickly. Therefore, if the rash does not appear to be a “side effect” of the vaccine (as described in #3 below), it should be considered wild-type with regard to infectiousness and susceptible contacts should be excluded, as indicated.
 - c) > 42 days post-vaccination – In this case, the vaccine recipient has not responded sufficiently to the vaccine prior to exposure. The lack of vaccine-induced protection may also reflect insufficient time post-vaccination for immunity to develop, or it may be due to host- or vaccine-specific issues impairing response to vaccine (“vaccine failure”). In these instances, the illness usually presents as typical chickenpox with a generalized rash with 200 to > 500 lesions with many vesicles, fever, and cough. There is often a known or possible exposure to chickenpox. The patient should be considered infectious and excluded until the lesions dry and crust over, usually 5 days after rash onset.
2. **Breakthrough chickenpox** or vaccine-modified varicella syndrome (VMVS) is a form of wild-type chickenpox that is less severe due to the development of “partial immunity” that was not sufficient to prevent disease, but was able to attenuate symptoms. It usually occurs > 42 days post-vaccination, but can also occur between 7–42 days. VMVS can occur in up to 10% of vaccinated children and 30% of adults. VMVS usually presents as a generalized rash consisting of < 50 lesions, usually more maculopapular, with a few vesicles. Breakthrough cases with fewer than 50 lesions have been found to be one third as contagious as varicella 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. Patients are often afebrile and minimally symptomatic. If vesicles are present, exclusion is the same as for a wild-type case of varicella. If no vesicles are present, exclude until the lesions have faded (i.e., the skin lesions are in the process of resolving; lesions do not need to be completely resolved) or no new lesions appear within a 24 hour period, whichever is later. If the incidence of breakthrough disease is greater than 30% in any particular setting, MDPH should be notified for further investigation of the cases and a vaccine ‘cold chain’ evaluation should be performed.
3. **Vaccine-associated rash** (“side effect” from vaccine) – This is reported in 4% of vaccine recipients, although in trials, 2% of placebo recipients also developed varicella-like rashes. Approximately 4% of children receiving varicella vaccine (compared to 2% of placebo recipients) develop a generalized rash with a median of five lesions 5-26 days postvaccination, and 4% develop a localized rash with a median of two lesions 8-19 days postvaccination. This rash typically occurs at 7–21 days, but is possible up to 42 days post-vaccination. It usually presents as a generalized rash, more maculopapular than vesicular, consisting of < 20 lesions and/or a few vesicles at the site of injection (median = 2). If there are more than 20 lesions, the rash is unlikely to be a vaccine-associated rash. Patients are afebrile and otherwise asymptomatic. If the clinical presentation fits these criteria, and there is no known exposure to chickenpox, this rash may be attributed to varicella vaccine. Rash occurring within 2 weeks of or more than 42 days after vaccination is more likely to be wild-type virus, and rash occurring 15-42 days postvaccination is more likely to be vaccine-type virus. Although there are no official guidelines, the rash is caused by attenuated vaccine virus, and for this reason, many experts believe that it is much less infectious than disease caused by wild-type virus. When transmission of vaccine virus has occurred, infection has been found to be mild or asymptomatic. Cases of vaccine associated rash may be considered to be NOT infectious, if there are no susceptible contacts at high-risk for complications of varicella. If local child care/school policy permits, the vaccinee does NOT need to be excluded. However, they should be advised to avoid close contact with high-risk individuals until the rash has resolved. Child care and school programs will need to develop their own policies. *Note:* Chickenpox-like rashes occurring during this time period may be caused by wild-type virus, particularly if there is a known or possible exposure to chickenpox. (See wild-type above.)

Attachment C Special Considerations in the Administration of Varicella Vaccine

Note: for the most up-to-date information on vaccine contraindications and precautions, see the package insert, the CDC [Guide to Contraindications and Precautions](#) and/or the ACIP [General Recommendations on Immunizations](#) and/or the Red Book of the American Academy of Pediatrics.

- 1) The groups listed below should **not** receive varicella vaccine *except* as specified in the box below. Please consult the package insert for a full list of contraindications and precautions.
- Infants less than 12 months of age.
 - Pregnant women. (Women should avoid getting pregnant until ≥ 1 month after vaccination.)
 - Those with anaphylactic reaction to neomycin or other vaccine component (consult package insert).
 - Those on salicylate therapy, due to the risk of Reye syndrome. (If varicella vaccine has been given, salicylate therapy should be deferred for ≥ 6 weeks.)
 - Those with moderate or severe illness at the time of the scheduled vaccination (temporary contraindication).
 - Those with immunocompromising conditions, including malignancies, primary or acquired immunodeficiency, and immunosuppressive therapy, except as noted in box below.

**Groups with Potentially Immunocompromising Conditions
Eligible to Receive Varicella Vaccine**

Persons with most forms of immunocompromise should not receive live vaccines ([MMWR](#), 2011). The degree of altered immunocompetence in a patient should be determined by a physician. The following persons with immunocompromising conditions are eligible to be considered for routine varicella immunization using monovalent varicella vaccine (Red Book 2012). However, varicella vaccine should not be used as post-exposure prophylaxis. If exposed, they should receive VariZIG™ or IGIV as soon as possible and within 10 days of exposure.

- Persons with impaired humoral immunity, e.g. hypogammaglobulinemia, dysgammaglobulinemia.
- HIV-infected children who are asymptomatic or mildly symptomatic and aged > 12 months with age-specific CD4+ T-lymphocyte percentages of > 15%, (If to be vaccinated, these children should receive 2 doses with a 3-month interval between doses and be monitored for adverse events. These children may have a higher risk of developing a vaccine-associated rash.) and adults with comparable levels of immune function, CD4+ T-lymphocyte count ≥ 200 cells/ul.
- Patients with leukemia, lymphoma, or other malignancies whose disease is in remission and whose chemotherapy has been terminated for at least 3 months can receive live-virus vaccines.

- Children with acute lymphoblastic leukemia (ALL) with expert guidance and with availability of antiviral therapy, should complications occur (Red Book 2012).
- Persons on non-suppressive topical, aerosol, or local injections of steroids.
- Persons receiving systemic steroids and who are not otherwise immunocompromised, if they are receiving < 2 mg/kg of body weight or a total of ≤ 20 mg/day of prednisone or its equivalent. (Persons on higher-dose steroid therapy cannot receive varicella vaccine—see section on steroids below.)

- Those having received blood products (except washed red blood cells), plasma, or immune globulin, including VariZIG™, within the previous 3-11 months (please refer to Attachment D.) The effect of administration of immune globulin on the antibody response to varicella vaccine is not known. Because of potential inhibition of the response, varicella vaccine should not be administered after receipt of an immune globulin preparation or a blood product (except washed red blood cells). In addition, varicella vaccine should be given ≥ 2 weeks before these blood products. If immune globulin or a blood product is given during this 2-week interval, the individual should be reimmunized after the appropriate interval, as specified in Attachment D, or tested for varicella immunity at that time and reimmunized if seronegative.

2) Guidelines for administration of live virus vaccines to individuals on steroid therapy*:

Steroid Therapy	Recommendations for Deferral
High dose systemic steroids daily or on alternate days for ≥ 14 days (≥ 2mg/kg QD or ≥ 20 mg QD of prednisone)	Defer live virus vaccines for ≥ 1 month after treatment has stopped.
High dose systemic steroids daily or on alternate days for < 14 days (≥ 2 mg/kg QD or ≥ 20 mg QD prednisone)	Can give live virus vaccines immediately after treatment is discontinued. However, some experts recommend deferring until ≥ 2 weeks after treatment has stopped, if possible.
Low or moderate doses of systemic steroids given daily or on alternate days (< 2 mg/kg QD or < 20 mg QD of prednisone)	Can give live virus vaccines on treatment.
Physiologic maintenance doses of steroid (replacement therapy)	Can give live virus vaccines on treatment.
Topical, aerosol or local injections of steroids (e.g., skin, aerosol, eyes, intra-articular, bursal, tendon injections)	Can give live virus vaccines on treatment. However, if this therapy is prolonged and there is any clinical or laboratory evidence of immunosuppression, defer for ≥ 1 month after treatment has stopped.
Individuals with a disease which in itself is considered to suppress the immune response and who are receiving systemic or locally acting steroids	Should not give live virus vaccines, except in special circumstances.

* Steroid therapy is not a contraindication for administration of killed vaccines.

Adapted from: CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). MMWR. 2011; 55(RR15);1-48:29.

Attachment D
Intervals between Administration of Immunoglobulin Preparations
and Live Virus Vaccines, including Measles-Containing and Varicella Vaccines¹

¹This table is not intended for determining the correct indications and dosages for using antibody-containing products. For the most up-to-date resources for clinicians, see the CDC web site, the CDC Pink Book, the Red Book of the American Academy of Pediatrics, and other resources for clinicians.

Product/Indication	Dose/Route	Recommended Interval in Months
Tetanus Immune Globulin (TIG)	250 units (10 mg IgG/kg) IM	3
Immune Globulin (IG) for Hepatitis A Prophylaxis		
Contact prophylaxis	0.02 mL/kg (3.3 mg IgG/kg) IM	3
International travel 3 – 5 mos	0.06 mL/kg (10 mg IgG/kg) IM	3
Hepatitis B IG (HBIG)	0.06 mL/kg (10 mg IgG/kg) IM	3
Rabies IG (RIG)	20 IU/kg (22 mg IgG/kg) IM	4
Varicella IG (VariZIG)	125 units/10 kg (20-40 mg IgG/kg) IM, maximum 625 units	5
Measles prophylaxis		
IG IM	0.50 mL/kg (80 mg IgG/kg) IM, maximum dose 15mL	6
IGIV	400 mg/kg	8
RSV prophylaxis - palivizumab monoclonal antibody to F protein (Synagis/MedImmune)	15 mg/kg (monoclonal) IM	None
Cytomegalovirus intravenous immune globulin	3.0 mL/kg (150 mg/IgG/kg) IV	6
Blood transfusion		
Red blood cells (RBCs), washed	10 mL/kg (negligible IgG/kg) IV	None
RBCs, adenine-saline added	10 mL/kg (10 mg IgG/kg) IV	3
Packed RBCs	10 mL/kg (20-60 mg IgG/kg) IV	5
Whole blood	10 mL/kg (80-100 mg IgG/kg) IV	6
Plasma/platelet products	10 mL/kg (160 mg IgG/kg) IV	7
IGIV		
Replacement therapy for immune deficiencies	300-400 mg/kg IV	8
Therapy for Immune thrombocytopenic purpura (ITP) (as IGIV)	400 mg/kg IV	8
	1,000 mg/kg IV	10
Therapy for ITP	1,600 – 2,000 mg/kg IV	11
Therapy for ITP or Kawasaki disease		

Adapted and updated from: AAP's Red Book: 2012:p38. and CDC. MMWR 2013;62 (No.2):24

Note on other live vaccines: Blood and other antibody-containing products (except washed red blood cells) can also diminish the response to rubella vaccine, and potentially to mumps vaccine. Therefore, after immune globulin preparations or other antibody-containing products are received, mumps and rubella vaccines should be deferred for ≥ 3 months. If RSV-IGIV is given, mumps, rubella and varicella vaccines should be deferred for ≥ 9 months. If RSV-IM is given, no deferral is needed for any live virus vaccines.

Attachment E

Guidance for Interpreting a Past History of Chickenpox

History of chickenpox should be carefully evaluated in order to determine the likelihood that the patient has actually had chickenpox in the past, and is therefore no longer susceptible:

- In the pre-vaccine era (before 1995), the rash of chickenpox was distinct and subclinical cases were rare.
- Since chickenpox has been endemic in the U.S., epidemiologic and serologic studies indicate that >95% of U.S. adults born after 1980 are immune to chickenpox, and such adults with a negative or uncertain history are actually 71–93% likely to have VZV antibodies when tested. **Those individuals born in the U.S. before 1980 are considered immune (Note: does not apply to healthcare providers).**
- In foreign-born adult populations, particularly those from tropical countries, the proportion immune to chickenpox is likely to be much lower as chickenpox may be less common in these countries. **Therefore, those born outside the U.S. before 1980 should be considered immune only if they have a reliable history of disease.**
- History of disease is likely to vary in different populations, and every effort should be made to obtain accurate histories of disease. These efforts should include the use of interpreters, as available, and verification of history with family members.
- For those individuals reporting atypical or mild cases of chickenpox, it is important to help establish the likelihood of disease by asking if household members or other close contacts (e.g., contacts in childcare, school, or other outbreak settings) had chickenpox within three weeks of the individual's illness (or if there was laboratory confirmation at time of acute illness). If such documentation is lacking, persons should not be considered as having a valid history of disease because other diseases may mimic mild atypical chickenpox.
- **If there is any question about the 'reliability' of the past history of chickenpox, the individual should be considered susceptible, unless serologic evidence of immunity is obtained.**
- Serologic testing for immunity is an option for individuals with a negative or uncertain history of disease. If the person believes that they have had chickenpox, but they have a negative titer, they should be considered susceptible.

Attachment F

Laboratory Testing

The MDPH State Public Health Laboratory Institute (MA SPHL) provides limited testing services for chickenpox under special circumstances only. Most testing is done at commercial and hospital laboratories. PCR is the method of choice for rapid diagnosis. Prior approval from an MDPH epidemiologist at (617) 983-6800 is required for all chickenpox testing at MA SPHL.

As varicella disease has declined with introduction of vaccine, the need for laboratory confirmation has grown because fewer physicians have direct experience with breakthrough infections, which are often atypical in appearance, result in fewer lesions, and may lack characteristic vesicles. Hospitalizations and deaths due to apparent varicella, as well as other severe or unusual disease, should routinely be laboratory confirmed. Postvaccination situations for which specimens should be tested include: 1) rash with more than 50 lesions occurring 7 to 42 days after vaccination; 2) suspected secondary transmission of the vaccine virus; 3) herpes zoster in a vaccinated person; or 4) any serious adverse event. In an outbreak, it is recommended that three to five cases be confirmed, regardless of vaccination status. The preferred diagnostic tests to confirm varicella infection include DNA detection methods for virus identification. For additional information on laboratory support for vaccine-preventable disease surveillance, see CDC Manual for the Surveillance of Vaccine-Preventable Diseases, [Chapter 22, "Laboratory Support for Surveillance of Vaccine-Preventable Diseases."](#)

Specimen collection

Skin lesions are the preferred specimen for laboratory confirmation of varicella disease. Blood specimens are preferred to test for varicella immunity. Specimens from skin lesions are best collected by unroofing a vesicle, preferably a fresh fluid-filled vesicle, and then rubbing the base of the skin lesion with a polyester swab. Scabs from skin lesions are also optimal specimen types for PCR detection of VZV DNA. 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. Collecting skin lesion specimens from breakthrough cases can be especially challenging because the rash is often maculopapular with few or no vesicles. A video demonstrating the techniques for collecting various specimens for varicella confirmation, including specimens from breakthrough cases, can be found on the [CDC shingles web site](#).

Virus isolation and identification

The table below provides a summary of the laboratory tests used for varicella, the types of specimens appropriate for each test, and comments about the tests. Further details about the most commonly used laboratory tests for varicella are also provided below.

Rapid varicella zoster virus identification:

Polymerase Chain Reaction (PCR). PCR is the method of choice for rapid clinical diagnosis.

This test is sensitive, specific, and widely available. Results are available within several hours. PCR is a powerful technique that permits the rapid amplification of specific sequences of viral DNA.

Direct Fluorescent Antibody (DFA). If PCR is not available, the DFA test can be used, although it is less sensitive than PCR and requires more meticulous specimen collection and handling.

A vesicle should be unroofed and scrubbed with sufficient vigor to ensure that cellular matter is collected from the base. Care must also be taken to avoid bleeding from the lesion as serum antibodies can interfere with the test and generate false-negative results. Crusts from lesions are not suitable for DFA.

Because viral DNA persists after cessation of viral replication or after viral death, DFA or PCR may be positive when viral cultures are negative.

Virus strain identification: Methods are available in specialized laboratories to identify VZV strains and distinguish wild-type VZV from the vaccine (Oka/Merck) strain. Such testing is used in situations when it is important to distinguish wild-type from vaccine-type virus, e.g., in suspected vaccine adverse events. The National VZV Laboratory at CDC has the capacity to distinguish wild-type VZV from Oka strain using both strain differential real-time PCR or PCR combined with restriction fragment length polymorphism analysis.

Virus culture: The diagnosis of VZV infection may be confirmed by culture (isolation) of VZV. Newer, more sensitive and rapid culture techniques can provide results within 2–3 days, although they are less sensitive than PCR. Infectious VZV is usually recoverable from fluid from varicella lesions for 2–3 days and from zoster lesions for 7 days or longer. VZV may be cultured from other sites such as blood and cerebrospinal fluid, especially in immunocompromised patients. Culturable VZV cannot be recovered from crusted lesions.

Serologic testing: Serologic tests are available for confirmation of disease. They include capture IgM or fourfold rise from acute- and convalescent-phase IgG antibodies to VZV. **Testing using commercial kits for IgM antibody is not recommended because available methods lack sensitivity and specificity; false-positive IgM results are common in the presence of high IgG levels.** The National VZV Laboratory at CDC has developed a reliable IgM capture assay. Paired IgG acute- and convalescent-phase antibody tests are used in situations of mild or atypical presentation of disease when immediate therapy is not indicated and when, for clinical reasons, a confirmed diagnosis of the acute illness is important, e.g., a suspected second infection due to varicella. In addition, the laboratory at CDC has developed an IgG avidity assay, which can be used to identify recent primary VZV infection using a single VZV IgG-seropositive serum specimen.

Single serologic IgG tests may be used to determine the immune status of persons whose history of varicella is negative or uncertain and who may be candidates for varicella zoster immune globulin (VZIG) or vaccination. Commercial ELISAs are recommended for the purpose of screening. Routine testing for varicella immunity following vaccination is not recommended.

Commercially available serologic IgG tests are not sufficiently sensitive to detect low levels of antibody following vaccination. There is evidence to suggest that the latex agglutination method, another method to test for serologic IgG, may result in false-positive results that could mistakenly categorize a susceptible person as immune.

Laboratory tests available for varicella confirmation

Test	Specimen	Comments
Tissue culture	Vesicular fluid; biopsy specimens from sterile sites (e.g., CSF, joint fluid)	Used to detect VZV. Can be expensive. Limited availability. Requires up to a week for result.
PCR	Vesicular swabs or scrapings; scrapings from maculopapular lesions; scabs from crusted lesions; biopsy tissue	Very sensitive and specific for detecting VZV. Real-time methods (not widely available and require special equipment) have been designed that distinguish vaccine strain from wild-type. Results rapidly available (within 3 hours).
DFA	Vesicle scraping; swab of lesion base (must include cells)	Identify VZV. More rapid and sensitive than culture. Less sensitive than PCR.

Tzanck smear	Vesicle scraping; swab of lesion base (must include cells)	Detects multinucleated giant cells with inclusions. Diagnostic of alpha herpes viruses (VZV, herpes simplex viruses). Less sensitive than DFA.
Capture IgM	Acute or convalescent serum specimens for VZV IgM	Specific. IgM inconsistently detected. Not reliable method for routine confirmation, especially in vaccinated persons, but positive result indicates current/recent VZV immune response. However, positive results in the absence of clinical disease would not be considered confirmation of active varicella disease. Requires special equipment.
EIA	Acute and convalescent serum specimens for IgG	Requires special equipment. Specific but may not be sensitive enough to identify vaccine-induced immunity.
LA	Acute and convalescent serum specimens for IgG	Rapid (15 min). No special equipment needed. More sensitive but less specific than EIA. Can produce false-positive results.
IFA	Acute and convalescent serum specimens for IgG	Requires special equipment. Good sensitivity, specificity.
gpELISA	Acute and convalescent serum specimens for IgG	Highly specific and sensitive but not widely or commercially available. Suitable for evaluation of vaccine seroconversion.
FAMA	Acute and convalescent serum specimens for IgG	Highly specific and sensitive but not widely or commercially available. Suitable for evaluation of vaccine seroconversion.

Abbreviations: CSF, cerebrospinal fluid; VZV, varicella-zoster virus; PCR, polymerase chain reaction; DFA, direct fluorescent antibody; EIA, enzyme immunoassay; LA, latex agglutination; IFA, indirect fluorescent antibody; gpELISA, glycoprotein-based enzyme-linked immunosorbent assay; FAMA, fluorescent antibody to membrane antigen.

Source: CDC, [Varicella Chapter](#), 2011.

Attachment G

Guidelines for VariZIG™ or IGIV Prophylaxis

Always check the CDC for updates, at <http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/varicella.html>

For people exposed to varicella or herpes zoster who cannot receive varicella vaccine, varicella zoster immune globulin can prevent varicella from developing or lessen the severity of the disease. Patient groups recommended by CDC to receive VariZIG include the following:

- Immunocompromised patients without evidence of immunity
- Newborn infants whose mothers have signs and symptoms of varicella around the time of delivery (i.e., 5 days before to 2 days after).
- Hospitalized premature infants born at ≥ 28 weeks of gestation whose mothers do not have evidence of immunity to varicella
- Hospitalized premature infants born at < 28 weeks of gestation or who weigh ≤ 1000 g at birth, regardless of their mothers' evidence of immunity to varicella
- Pregnant women without evidence of immunity

It is only recommended for people who cannot receive the vaccine and: 1) who lack evidence of immunity to varicella, 2) whose exposure is likely to result in infection, and 3) who are at **high risk for severe varicella**.

The varicella zoster immune globulin product licensed for use in the United States is VariZIG™. VariZIG should be given as soon as possible after exposure to varicella-zoster virus (VZV) – ideally within four days - and within 10 days of exposure. For more information, see the *Morbidity and Mortality Weekly Report* article on [Updated Recommendations for Use of VariZIG — United States, 2013](#). However, when VariZIG™ is not available, administration of immune globulin intravenous (IGIV) should be considered as an alternative. IGIV should be administered as soon as possible within 10 days of exposure. Although licensed preparations of IGIV are known to contain anti-varicella antibody titers, the titer of any specific lot of IGIV that might be available is uncertain because it is not routinely tested for anti-varicella antibodies.

When deciding whether or not VariZIG™ or IGIV is indicated, three factors should be considered carefully:

- The likelihood the exposed person is susceptible to varicella;
- The probability that a given exposure to varicella or zoster will result in infection; and
- The likelihood that complications will develop if the person is infected.

Persons at risk of severe varicella include:

- Immunocompromised patients without evidence of immunity to varicella, such as—
 - children with leukemia or lymphoma who have not been vaccinated
 - people on medications that suppress the immune system, such as high-dose systemic steroids or chemotherapeutic agents
 - people with cellular immune-deficiencies or other immune system problems
- **Newborns whose mothers have varicella from 5 days before to 2 days after delivery**
- **Premature exposed babies exposed to varicella or herpes zoster**, specifically—
 - hospitalized premature infants born at ≥ 28 weeks of gestation whose mothers do not have evidence of immunity
 - hospitalized premature infants born at < 28 weeks of gestation or who weigh $\leq 1,000$ grams at birth regardless of their mothers' varicella immunity status
- Pregnant women without evidence of immunity to varicella

Patients receiving monthly high-dose (≥ 400 mg/kg) immune globulin intravenous (IGIV) are likely to be protected and probably do not require VariZIG if the most recent dose of IGIV was administered ≤ 3 weeks before exposure.

VariZIG Administration

VariZIG is supplied in 125-IU vials and should be administered intramuscularly as directed by the manufacturer. The recommended dose is 125 IU/10 kg of body weight, up to a maximum of 625 IU (five vials). The minimum dose is 62.5 IU (0.5 vial) for patients weighing ≤ 2.0 kg and 125 IU (one vial) for patients weighing 2.1–10.0 kg (2).

For patients who become eligible for vaccination, varicella vaccine should be administered ≥ 5 months after VariZIG administration.

Because varicella zoster immune globulin might prolong the incubation period by ≥ 1 week, any patient who receives VariZIG should be observed closely for signs and symptoms of varicella for 28 days after exposure.

Antiviral therapy should be instituted immediately if signs or symptoms of varicella occur.

Most common adverse reactions following VariZIG administration were pain at injection site (2%) and headache (2%) (2).

Contraindications for VariZIG administration include a history of anaphylactic or severe systemic reactions to human immune globulins and IgA-deficient patients with antibodies against IgA and a history of hypersensitivity (2).

IGIV Administration

The recommended IGIV dose for postexposure prophylaxis of varicella is 400 mg/kg, intravenously, administered once.

Acyclovir Treatment

Oral acyclovir therapy is not recommended by the Advisory Committee on Immunization Practices or American Academy of Pediatrics (AAP) for use in otherwise healthy children experiencing typical varicella without complications. For maximum benefit, acyclovir therapy should be given within the first 24 hours after the varicella rash starts.

The AAP recommends that certain groups at increased risk for moderate to severe varicella be considered for oral acyclovir treatment. These high risk groups include:

- healthy, persons older than 12 years of age
- persons with chronic cutaneous or pulmonary disorders
- persons receiving long-term salicylate therapy
- persons receiving short, intermittent, or aerosolized courses of corticosteroids
- IV acyclovir is recommended for immunocompromised persons and for pregnant patients with varicella

Some health care providers may elect to use oral acyclovir for secondary cases within a household.

Acyclovir is a category B drug based on US Food and Drug Administration (FDA) Drug Risk Classification in pregnancy. Some experts recommend oral acyclovir or valacyclovir for pregnant women with varicella, especially during the second and third trimesters. Intravenous acyclovir is recommended for the pregnant patient with serious complications of varicella.