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Varicella (chickenpox) is a febrile rash illness resulting from primary infection with the varicella-zoster virus (VZV). Humans are the only source of infection for this virus. Varicella is characterized by a pruritic, maculopapular and vesicular rash usually with 250–500 skin lesions that evolves into noninfectious crusts over a 4- to 7-day period. While the initial lesions are crusting, new crops form; the simultaneous presence of skin lesions in various stages of evolution is characteristic of varicella.[1,2] Varicella can occur in vaccinated persons (termed breakthrough varicella). Compared with varicella in unvaccinated persons, breakthrough varicella is generally milder, often with fewer than 50 skin lesions, fewer vesicles (sometimes only maculopapular lesions and no vesicles), low or no fever, and fewer days of illness.[2] Given its modified clinical presentation, breakthrough varicella can be challenging for healthcare providers and parents to recognize clinically. Varicella is generally a mild disease, but severe complications can occur in any age group.[3–6] Severity is increased among immunocompromised persons, pregnant women, children younger than one year of age, and adults.[7] Severe complications include secondary bacterial infections (most notably those caused by group A beta-hemolytic *Streptococcus*, e.g., cellulitis, necrotizing fasciitis, septicemia, and toxic shock syndrome but also *S. aureus*), pneumonia, encephalitis, cerebellar ataxia, bleeding disorders, and Reye syndrome.[7] Rarely, these complications may result in death.[4] The potential for severe varicella exists among both vaccinated and unvaccinated persons. Congenital varicella syndrome, characterized by cutaneous scarring in a dermatomal distribution, hypoplasia of an extremity, microcephaly, ocular and neurologic abnormalities, and low birth weight, may occur among 0.4%–2.0% of infants born to women who develop

varicella during the first or second trimester of pregnancy.[8-10] Infants born to women who develop varicella within the period of five days before delivery to two days after delivery are at high risk of severe neonatal varicella. Immunity following varicella is considered to be long-lasting and a second case of varicella in otherwise healthy person is uncommon.[11,12] However, second cases may occur more commonly among immunocompromised persons.[13] After primary infection, VZV remains latent in the sensory-nerve ganglia and reactivates in approximately 1 in 3 of infected persons during their lifetime, resulting in herpes zoster (shingles).[14-16] Herpes zoster usually presents as a vesicular rash (appearing as clusters of vesicles) with pain and itching in a dermatomal distribution. Herpes zoster incidence increases with age, especially after age 50, and is more common among immunocompromised persons. A decline in the cell-mediated immunity is considered to be an important factor in the development of herpes zoster. Varicella is highly infectious, with secondary infection occurring in 61%–100% of susceptible household contacts.[17-21] Transmission of VZV occurs from person to person by direct contact with the vesicular fluid of skin lesions of persons with either varicella or herpes zoster or inhalation of aerosols from vesicular fluid of skin lesions of persons with varicella or herpes zoster; spread from oropharyngeal secretions of persons with varicella, that also may be aerosolized, may occur but to a much lesser extent. The incubation period for varicella is 10–21 days, most commonly 14–16 days. Persons with varicella are considered infectious from 1–2 days before the onset of rash until all lesions are crusted, typically 4–7 days after onset of rash. Vaccinated persons who get varicella may develop lesions that do not crust. These persons are considered contagious until no new lesions have appeared for 24 hours. Persons with herpes zoster are contagious while they have active, vesicular lesions (usually 7–10 days). Before the availability of varicella vaccine in the United States, almost everyone had varicella. Thus, the number of cases approximated the birth cohort, and in the early 1990s (the prevaccine era) this resulted in an average of about 4 million cases of varicella,

10,500–13,500 hospitalizations (range: 8,000–18,000), and 100–150 deaths each year.[3–5] Varicella primarily affected children; approximately 90% of cases occurred before 15 years of age, with the highest incidence reported among children 1–4 years of age.[3,22,23] Varicella vaccine was licensed and has been recommended in the United States since 1995. A two-dose series is recommended, with routine administration of the first dose at 12–15 months of age and the second dose at 4–6 years of age.[24] Vaccination of older children, adolescents and adults without evidence of immunity to varicella and persons who had received only one dose of vaccine is also recommended. The minimum interval between the doses is 3 months for persons younger than 13 years of age and 4 weeks for persons 13 years of age and older. One dose varicella vaccination coverage among children 19–35 months of age reached 90% in 2007, stabilizing around at least 90% thereafter; ≥ 2 -dose varicella vaccination coverage among adolescents 13–17 years of age without history of varicella was 92% in 2020.[25,26] Attaining and maintaining high vaccine coverage led to substantial declines in varicella morbidity and mortality in the United States. Overall, in 2018–2019, varicella incidence declined >97% based on data from four states that have continuously reported varicella to the National Notifiable Diseases Surveillance System (NNDSS) since before the varicella vaccination program.[27] The second dose of varicella vaccine for children was added to the national program in 2007.[24] During the 2-dose era, data from 39 states and DC have shown an 89% decline in varicella incidence.[27] Incidence declined in all age groups with the greatest declines among children 5–14 years of age (92%–95%). As vaccination coverage has increased, about half of varicella cases now occur among vaccinated persons. Similarly, the severe outcomes of varicella declined substantially. Compared with the prevaccine years, by 2018–2019, varicella hospitalizations declined 90% and deaths with varicella as the underlying cause of death declined 89% for all ages.[28] After 25 years of the varicella vaccination program, fewer than 1,400 hospitalizations and 18–30 deaths are occurring

annually in the United States. The greatest decline for both hospitalizations and deaths (97% and >99%, respectively) was among persons <20 years of age, born during the varicella vaccination program, in whom these severe outcomes have been nearly eliminated.[28] The varicella vaccination program has also substantially reduced the number of outbreaks in the U.S. Additionally, outbreak size and duration declined from a median of 15 cases per outbreak and 45 days duration early in the vaccination program to 7 cases and 30 days duration during the mature phase of the vaccination program.[29] Elementary schools continue to be the most common sites for varicella outbreaks and are the main reporting sources for outbreak surveillance although the proportion of school outbreaks has decreased over time. Despite low susceptibility among adults (generally less than 5%), outbreaks have been reported from a variety of adult settings, including correctional facilities, hospitals, military training facilities, refugee centers, immigration detention facilities, homeless shelters, other residential institutions, and cruise ships. Top of Page For specific information about varicella vaccination, refer to the Pink Book varicella chapter which provides information on the varicella vaccines, vaccination schedule and use, contraindications and precautions, adverse events and reactions, and vaccine storage and handling. Evidence of immunity to varicella includes any of the following:[24]

- 1.) Documentation of age-appropriate vaccination
- 2.) Laboratory evidence of immunity or laboratory confirmation of disease
- 3.) Born in the United States before 1980
- 4.) A healthcare provider diagnosis of varicella or verification of history of varicella disease
- 5.) A healthcare provider diagnosis of herpes zoster or verification of history of herpes zoster

As varicella disease has declined with the introduction of a vaccine, the need for laboratory confirmation has concomitantly grown because fewer physicians have seen varicella and breakthrough disease is often milder with fewer lesions and may lack characteristic vesicles. Laboratory confirmation of suspected varicella is becoming increasingly necessary to inform clinical and public health management and understand the true

burden of disease and is now routinely recommended. The preferred diagnostic test to confirm varicella is detection of viral DNA by real-time PCR. For additional information on laboratory disease surveillance, including specific instructions for specimen collection and shipping, see Chapter 22, Laboratory Support for Surveillance of Vaccine-Preventable Diseases. For any other questions regarding laboratory testing, varicella contacts are listed in Table 1. Reporting varicella cases in childcare centers, schools, other institutions, military barracks, and other group settings will facilitate public health action and outbreak control. A single case should trigger intervention measures because it could lead to transmission and outbreaks. In addition, in certain high-risk settings (e.g., hospitals and other healthcare settings, schools that may have students who are immunocompromised), rapid case identification and public health action are important to prevent infection of susceptible persons at high risk for serious complications of varicella, such as immunocompromised persons and pregnant women, for whom varicella vaccine is contraindicated.[24] Varicella surveillance helps to facilitate public health actions at the state and local level and to monitor the impact of the varicella vaccination program. Specifically, surveillance data are needed to:

Top of Page The following case definitions were approved by the Council of State and Territorial Epidemiologists (CSTE) for varicella cases in June 2023[30] and for varicella deaths in 1998.[31]

Clinical Criteria In the absence of a more likely alternative diagnosis: OR **Laboratory Criteria**^a **Confirmatory Laboratory Evidence:** OR OR OR **Supportive Laboratory Evidence:** *

* Note: The categorical labels used here to stratify laboratory evidence are intended to support the standardization of case classifications for public health surveillance. The categorical labels should not be used to interpret the utility or validity of any laboratory test methodology.

^aA negative laboratory result in a person with a generalized rash with vesicles does not rule out varicella as a diagnosis.

^b PCR of scabs or vesicular fluid is the preferred method for laboratory confirmation of

varicella. In the absence of vesicles or scabs, scrapings of maculopapular lesions can be collected for testing.

cNot explained by varicella vaccination during the previous 6–45 days.

dSeroconversion is defined as a negative serum VZV IgG followed by a positive serum VZV IgG.

eIn vaccinated persons, a 4-fold rise may not occur.

flgM serology has limited value as a diagnostic method for VZV infection and is not recommended for laboratory confirmation of varicella. However, an IgM positive result in the presence of varicella-like symptoms can indicate a likely acute VZV infection. A positive IgM result in the absence of clinical disease is not considered indicative of active varicella. Epidemiologic Linkage Criteria

Confirmatory Epidemiologic Linkage Evidence: OR OR Presumptive Epidemiologic

Linkage Evidence: Healthcare Record Criteria Confirmed: OR Probable: OR OR

Confirmed: A death resulting from a confirmed case of varicella which contributes directly or indirectly to acute medical complications that result in death. Probable: A

death resulting from a probable case of varicella which contributes directly or indirectly to acute medical complications that result in death. Varicella-like rash in vaccine

recipients: A varicella-like rash in a recently vaccinated person may be caused by either wild- or vaccine-type virus or have other etiologies. Approximately 4%–6% of 1-dose

and 1% of 2-dose vaccine recipients, respectively, develop a generalized rash with a median of 5 lesions 5–26 days postvaccination, and 1%–3% develop a localized rash at

the injection site with a median of 2 lesions 8–19 days postvaccination.[32] The rash

may be atypical in appearance (maculopapular with no vesicles). Attribution of disease

to vaccine strain VZV can be done by distinguishing wild-type VZV from vaccine-strain VZV using strain differential PCR. Breakthrough disease is a case of infection with

wild-type VZV occurring more than 42 days after vaccination. Disease is usually mild with a shorter duration of illness, fewer constitutional symptoms, and generally fewer

than 50 skin lesions. Breakthrough cases with fewer than 50 lesions have been found to be one-third as contagious as varicella in unvaccinated persons, but breakthrough cases with 50 or more lesions are as contagious as cases in unvaccinated persons.[33] Though generally mild, about 25%–30% of breakthrough cases among 1-dose vaccinated children have clinical features more similar to those in unvaccinated children and rare, severe presentations with visceral dissemination have been reported.[34] Persons who received two doses of vaccine are less likely to have breakthrough disease than those who received one dose.[35,36] Additionally, breakthrough varicella may be further attenuated among 2-dose vaccine recipients though the difference was not always statistically significant.[29,37] No cases of breakthrough varicella with visceral dissemination have been reported among 2-dose vaccinees.[34]

Top of Page Each state and territory has regulations or laws governing the reporting of diseases and conditions of public health importance.[38] These regulations and laws list the diseases to be reported and describe the persons or institutions responsible for reporting, including healthcare providers, hospitals, laboratories, schools, childcare facilities, and other institutions. Persons reporting case(s) should contact their state health department for state-specific reporting requirements. States not conducting case-based surveillance are encouraged to progressively implement individual case reporting integrating varicella surveillance into an existing system where feasible. This can be done by establishing statewide or sentinel surveillance. Statewide surveillance involves adding varicella to the list of notifiable diseases that are reported to the state health department. Sentinel site surveillance involves identifying sites such as schools, childcare centers, physicians' practices, hospitals, colleges, and other institutions to perform surveillance for varicella. Sentinel sites can be limited to a geographic area, such as a county or city, or selected to be representative of the entire state population. States may also consider requesting reports from sites that already participate in other surveillance networks. States can

expand the number of sites as they develop their system with the intention of eventually having statewide surveillance. Notifications for confirmed or probable cases of varicella should be sent to CDC using event code 10030 through National Notifiable Diseases Surveillance System (NNDSS). Case notifications should not be delayed because of incomplete information or lack of confirmation. Data can be updated electronically as more information becomes available. The state in which the patient resides at the time of diagnosis should submit the case notification to CDC. If jurisdictions have questions about varicella reporting and case notification, please contact the Division of Viral Diseases, Viral Vaccine Preventable Diseases Branch at CDC. The following are core and disease-specific data elements that are epidemiologically important and needed for varicella case classification and should be collected during case investigations. Please also refer to the Varicella Surveillance Worksheet for a complete list of the variables that should be collected during case investigations (Appendix 20 [4 pages]). Additional information may be collected at the direction of the state health department. In bold, are the critical variables used to monitor the impact of the varicella vaccination program. In 1998, CSTE recommended that varicella-related deaths be placed under national surveillance, and varicella-related deaths became nationally notifiable on January 1, 1999.[31] Varicella deaths can be identified through death certificates, which may be available through state vital records systems and may be more readily available soon after death in states using electronic death certificates. State public health departments may also request that local health departments, healthcare practitioners, and hospitals report varicella deaths that occur in their community. Because varicella is a vaccine-preventable disease, all deaths due to varicella should be investigated. Investigation may provide insight into risk factors for varicella mortality and may help identify missed opportunities for, and barriers to, vaccination. A worksheet is provided to guide varicella death investigations (see Appendix 19) [4 pages]. Deaths should be reported to the CDC National Center for

Immunization and Respiratory Diseases, Division of Viral Diseases, Viral Vaccine Preventable Diseases Branch and to NNDSS. Top of Page All patients with suspected varicella should be investigated. A single case should trigger intervention measures because it could lead to transmission and outbreaks. Clinical diagnosis of varicella can be unreliable. Cases of suspected varicella should be laboratory confirmed. Laboratory confirmation of varicella is important as varicella may present with mild or atypical presentation making clinical diagnosis especially challenging. Patients with varicella should self-isolate at home until no longer infectious, unless medical care is needed (all lesions have crusted or, if no vesicles were present, when no new lesions appear within a 24-hour period). For residential institutions and healthcare settings, patients should be immediately isolated in a closed-door room (negative pressure room if available) until they are no longer infectious; staff with varicella should be excluded from the setting and self-isolate until no longer infectious. As part of the case investigation, the potential for further transmission should be evaluated, and contacts of the patient during the infectious period should be identified. Guidance can be found in the Outbreak Investigation section. These recommendations include prior guidance published in the document Strategies for the Control and Investigation of Varicella Outbreaks Manual, 2008, which has been retired. An outbreak of varicella is defined as the occurrence of ≥ 3 varicella cases that are related in place and are epidemiologically linked. Confirmation of the Outbreak Notification of the Outbreak Case Identification and Management Management of Contacts Establish Surveillance for Additional Cases Communication with Providers and the Public about Varicella Definitions Schools Daycares/Preschools Residential institutions and healthcare settings Correctional/detention facilities Ships/Flights To receive email updates about this page, enter your email address:

