

## VARICELLA (CHICKENPOX) HERPES ZOSTER

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Varicella (chickenpox) is the primary infection caused by the varicella-zoster virus (VZV).

VZV is a DNA virus and a member of the herpes virus group. Like other herpes viruses, VZV has the capacity to persist in the body after the primary (first) infection as a latent infection. Primary infection with VZV results in chickenpox. Herpes zoster (shingles) is the result of recurrent infection. The virus is extremely labile and is unable to survive for long in the environment.

### Epidemiology

Humans are the only source of infection for this virus.

Varicella is highly contagious. Infection occurs when the virus comes in contact with the mucosa of the upper respiratory tract or the conjunctiva of a susceptible person. Person-to-person transmission occurs either from direct contact with VZV lesions from varicella or herpes zoster, or from airborne spread. Varicella is much more contagious than herpes zoster. Based on studies of transmission among household members, about 90% of susceptible close contacts will get varicella after exposure to persons with disease.

Skin lesions appear to be the major source of transmissible VZV; transmission from infected respiratory tract secretions is possible but probably less common. There is no evidence of VZV spread from fomites. In utero infection occurs as a result of transplacental passage of virus during viremic maternal varicella infection. Children who acquire their infection at home (secondary familial cases) often have more skin lesions than the index case. Healthcare-associated transmission is well documented in pediatric units.

In temperate climates in the prevaccine era, varicella was a childhood disease with marked seasonal distribution, with peak incidence during late winter and early spring and among children younger than 10 years of age. High rates of vaccine coverage in the United States have effectively eliminated discernible seasonality of varicella. In tropical climates, acquisition of varicella often occurs later in childhood, resulting in a significant proportion of susceptible adults.

Following implementation of universal immunization in the U.S. in 1995, varicella incidence declined in all age groups as a result of personal and herd immunity. In areas with active surveillance and high one-dose vaccine coverage, the rate of varicella disease decreased by approximately 90% between 1995 and 2005. Since recommendation of a routine second dose of vaccine in 2006, varicella outpatient visits have declined by an additional 60%, and varicella hospitalizations have declined by an additional 40%. The age of peak varicella incidence is shifting from children younger than 10 years of age to children 10 to 14 years of age, although the incidence in all age groups is lower than in the prevaccine era. Immunity to varicella generally is lifelong. Symptomatic reinfection is uncommon in immunocompetent individuals. As with other viral diseases, re-exposure to natural (wild-type) varicella may lead to reinfection that boosts antibody titers without causing clinical illness or detectable viremia. Asymptomatic primary infection is unusual.

Since 2007, coverage with one or more doses of varicella vaccine among 19- through 35-month-old children in the U.S. has been greater than 90%. As the majority of children are vaccinated against varicella and the incidence of wild-type varicella decreases, a greater proportion of varicella cases are occurring in immunized people as breakthrough disease.

Patients are contagious from one to two days before onset of rash until all lesions have crusted. The incubation period is 14 to 16 days from exposure, with a range from 10 to 21 days. The incubation period may be prolonged up to 28 days after receipt of Varicella-Zoster Immune Globulin (VariZIG) or Immune Globulin Intravenous (IGIV) and can be shortened in immunocompromised patients. Varicella can develop between two to 16 days after birth in infants born to mothers with active varicella around the time of delivery; the usual interval from onset of rash in a mother to onset in her neonate is nine to 15 days.

### **Clinical Manifestations**

Primary infection results in chickenpox, manifesting in unvaccinated people as a generalized, pruritic, vesicular rash typically consisting of 250 to 500 lesions in varying stages of development (papules, vesicles), and resolution (crusting), low-grade fever, and other systemic symptoms. The rash usually appears first on the scalp, followed by the trunk and then the extremities, with the highest concentration of lesions on the trunk (centripetal distribution). Lesions can also occur on the mucous membranes of the oropharynx, respiratory tract, vagina, conjunctiva, and the cornea. Lesions are usually one to four millimeters in diameter. The vesicles are superficial and delicate and contain clear fluid on an erythematous base. Vesicles may rupture or become purulent before they dry and crust. A mild prodrome may precede the onset of rash and adults may have one to two days of fever and malaise prior to rash onset. In children, the rash is often the first sign of disease.

VZV establishes latency in sensory (dorsal root, cranial nerve, and autonomic including enteric) ganglia during primary VZV infection. This latency occurs with wild-type VZV or with the vaccine strain. Reactivation results in herpes zoster, characterized by grouped vesicular skin lesions in the distribution of one to three sensory dermatomes, frequently accompanied by pain and/or itching localized to the area. The immunologic mechanism that controls the latency of VZV is not well understood; however, factors associated with recurrent disease include aging, immunosuppression, intrauterine exposure to VZV, and varicella at a young age (younger than 18 months).

### **Varicella Images [via Public Health Image Library (PHIL)]**



Image 1: Unvaccinated adolescent with varicella lesions in various stages



Image 2: Breakthrough varicella in a vaccinated child



Image 3: Shingles rash in an adult

## Complications

**Acute varicella** is generally mild and self-limited, but may be associated with complications. Varicella severity and complications are increased among immunocompromised persons, pregnant women, children younger than one year of age, and adults. 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), pneumonia, encephalitis, cerebellar ataxia, Reye syndrome, and death.

**Congenital varicella syndrome**, characterized by hypoplasia of an extremity, skin abnormalities, encephalitis, microcephaly, ocular abnormalities, mental retardation, and low birth weight, may occur among 0.4% to 2.0% of infants born to women who develop varicella during the first or second trimester of pregnancy. 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.

**Postherpetic neuralgia**, pain that persists after resolution of the zoster rash, is a distressing complication that may last for weeks to months but is very unusual in children. Zoster occasionally becomes disseminated in immunocompromised patients, with lesions appearing outside the primary dermatomes and/or visceral complications. VZV reactivation less frequently occurs in the absence of skin rash (zoster sine herpette); these patients may present with aseptic meningitis, encephalitis, stroke, or gastrointestinal tract involvement (visceral zoster).

**Reye syndrome** may follow varicella, although this outcome has become very rare with the recommendation not to use salicylate-containing compounds (e.g., aspirin, bismuth-subsalicylate) for children with chickenpox.

## Immunocompromised Individuals

Immunocompromised people with primary (varicella) or recurrent (herpes zoster) infection are at increased risk of severe disease. Severe varicella and disseminated zoster are more likely to develop in children with congenital T-lymphocyte defects or acquired immunodeficiency syndrome (AIDS) than in people with B-lymphocyte abnormalities. Other groups of pediatric patients who may experience more severe or complicated varicella include infants, adolescents, patients with chronic cutaneous or pulmonary disorders, and patients receiving systemic corticosteroids, or other immunosuppressive therapy, or long-term salicylate therapy.

In immunocompromised children, progressive, severe varicella may occur with continuing erupting of lesions (rarely, including hemorrhagic skin lesions) along with high fever persisting into the second week of illness and visceral dissemination (i.e., encephalitis, hepatitis, and pneumonia).

Severe and even fatal varicella has been reported in otherwise healthy children on high-dose corticosteroids (greater than 2 mg/kg/day of prednisone or equivalent) for treatment of asthma and other illnesses. The risk is especially high when corticosteroids are administered during the varicella incubation period.

## Congenital VZV Infection

Fetal infection after maternal varicella during the first or early second trimester of pregnancy occasionally results in fetal death or varicella embryopathy, characterized by limb hypoplasia, cutaneous scarring, eye abnormalities, and damage to the central nervous system.

The incidence of the congenital varicella syndrome among infants born to mothers who experience gestational varicella is approximately 2% when infection occurs between eight and 20 weeks of gestation. Rarely, cases of congenital varicella syndrome have been reported in infants of women infected after 20 weeks of pregnancy, the latest occurring at 28 weeks gestation. Children infected with VZV in utero may develop zoster early in life without having had extrauterine varicella; the exact risk is unknown.

## **Perinatal Infection**

Varicella infection has a higher case-fatality rate in infants when the mother develops varicella from five days before to two days after delivery, because there is little opportunity for development and transfer of maternal antibody across the placenta prior to delivery and the infant's cellular immune system is immature. When varicella develops in a mother more than five days before delivery and gestational age is 28 weeks or more, the severity of disease in the newborn is modified by transplacental transfer of VZV-specific maternal immunoglobulin (Ig) G antibody. Neither wild-type VZV nor Oka vaccine strain virus have been shown to be transmitted by human milk; expressed/pumped milk from a mother with varicella or zoster can be given to the infant, provided no lesions are on the breast.

## **Mortality**

Before varicella vaccination was included in routine childhood immunization, approximately 11,000 varicella-related hospitalizations and 100 to 125 deaths were reported annually in the United States; in Louisiana, the estimate would be 200 hospitalizations and two to three deaths. Varicella deaths declined by 87% during 2008 to 2011 as compared to 1990 to 1994 based on data from the National Center for Health Statistics. The Centers for Disease Control and Prevention (CDC) estimates that each year more than 3.5 million cases of varicella, 9,000 hospitalizations, and 100 deaths are prevented by varicella vaccination in the United States.

## **Diagnostic Tests**

As varicella disease has declined with introduction of vaccine, the need for laboratory confirmation has grown. This is because fewer physicians have direct experience with natural infection and breakthrough disease is often atypical in appearance, results in fewer lesions, and may lack characteristic vesicles. Varicella hospitalizations and deaths, as well as other severe or unusual disease, should routinely be laboratory confirmed.

Postvaccination situations for which specimens should be tested include 1) rash occurring seven 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 test to confirm varicella infection is detection of viral DNA.

Skin lesions are the preferred sample for laboratory confirmation of varicella. Peripheral blood samples (serum or plasma) are preferred to test for varicella immunity. Samples from skin lesions should be collected by unroofing a vesicle, preferably a fresh fluid-filled vesicle, and then rubbing the base of a skin lesion with a polyester swab. If only macules or papules are present, suitable samples can often be obtained by scraping the lesion (e.g., with the edge of a glass microscope slide), swabbing the abraded lesion with a polyester swab, and then collecting any material that was accumulated on the object that was used to scrape the lesion on the same swab. Scabs from skin lesions are also excellent samples for PCR detection of VZV DNA. Other sources such as nasopharyngeal secretions, saliva, blood, urine, bronchial washings, and cerebrospinal fluid are less likely to provide an adequate sample than vesicular swabs and scabs from skin lesions and can often lead to false negative results.

## **Rapid VZV Identification**

Polymerase chain reaction (PCR) is the method of choice for rapid confirmation of a clinical diagnosis. It is very sensitive, specific and widely available. Results can be obtained within hours. PCR is a powerful technique that allows for the rapid amplification of specific sequences of viral DNA that would otherwise be present in clinical samples at concentrations well below detectable limits.

If PCR is not available, the DFA test can be used, although it is only about 60% as sensitive as 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 at the base. At the same time, care must 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 use with DFA.

Because infected-cell viral proteins persist after cessation of viral replication, PCR and DFA may be positive when viral cultures are negative.

## **Viral Strain Identification**

The purpose of strain identification is to distinguish wild VZV from the vaccine (Oka/Merck) strain. This can be done by strain differential real-time PCR or PCR combined with restriction fragment length polymorphism analysis. It is most often used for suspected vaccine-related adverse events, including herpes zoster in a vaccinee, rash with more than 50 lesions seven to 42 days after vaccination, any serious adverse event (pneumonia, ataxia, encephalitis) occurring after vaccination, and suspected secondary transmission. Genotyping is available free of charge through the specialized reference laboratory at the CDC (404) 639-0066, and also through a safety research program sponsored by Merck & Co (800) 672-6372.

## **Viral Culture**

The diagnosis of VZV infection may be confirmed by culture (isolation) of VZV, but is generally not recommended because of the length of time for results and the insensitivity of the approach compared with PCR. Although newer, more sensitive and rapid culture techniques can provide results within two to three days, they are still substantially less sensitive than PCR, and may fail to confirm as many as 50% of varicella infections. Infectious VZV is usually recoverable from fluid from varicella lesions for two to three days and from zoster lesions for seven days or longer. VZV may be cultured from other sites such as blood and cerebrospinal fluid, especially in immunocompromised patients. Viable VZV cannot be recovered from crusted lesions.

## **Serologic Testing**

IgM serology can provide evidence for a recent active VZV infection, but cannot discriminate between a primary infection and reinfection or reactivation from latency since specific IgM antibodies are transiently produced on each exposure to VZV. IgM tests are also inherently prone to poor specificity. 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 the 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 (VariZIG) or vaccination. Commercial enzyme-linked immunosorbent assays (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.

A variety of methods have been used to detect IgG antibody to varicella zoster virus, both wild and vaccine strains. Currently available tests may not be sensitive enough to detect low levels of antibody post vaccination; however, the following tests may be useful:

- Enzyme-linked immunosorbent assays (ELISA). The ELISA tests are widely used for screening of varicella immune status, especially when large numbers of specimens are tested. The ELISA tests range in sensitivity from 86% to 97% and range in specificity from 82% to 99% for detecting antibody after natural infection. Commercial ELISA are highly specific but less sensitive than the fluorescent antibody to membrane antigen test (FAMA) with the result that 10% to 15% of individuals who are immune may be identified as susceptible.
- Latex agglutination (LA). The LA test is useful for screening for varicella immunity. LA is a rapid, simple to perform assay to detect antibodies to VZV; dilutions of sera are added to latex particles coated with VZV glycoprotein antigen. It requires no specialized equipment, is as sensitive as the FAMA and is more sensitive than the enzyme-linked immunosorbent assay (ELISA). It is however, less sensitive than FAMA in detecting antibody response following vaccination. False-positive results may occur, which could mistakenly categorize a susceptible person as immune.
- Fluorescent antibody to membrane antigen (FAMA). The FAMA test is highly sensitive and is the "gold standard" for screening for immune status for VZV, but is not widely available. In convalescent-phase serum specimens, up to 100% are positive by FAMA and 96% by LA. After vaccination of persons who were previously VZV antibody negative, 77% are positive by FAMA, 61% by LA and 47% by ELISA.

Commercial assays can be used to assess disease-induced immunity, but they lack sensitivity to always detect vaccine-induced immunity (i.e., they might yield false-negative results). Data are not available regarding the sensitivity and specificity of serologic tests in immunocompromised patients. Detection of VZV IgG after one dose of varicella vaccine might not correspond to adequate protection in immunocompromised people, and false-positive results can occur. Therefore, regardless of serologic test results, careful questioning of the child and parents about potential past disease or exposure to disease can be helpful in determining immunity.

## **Treatment**

Nonspecific therapies for varicella includes keeping fingernails short to prevent trauma and secondary bacterial infection from scratching, frequent bathing, application of Calamine lotion to reduce pruritus, and acetaminophen for fever. Children with varicella should not be given aspirin because administration of salicylates to children with varicella increases the risk of Reye syndrome. Salicylate therapy should be stopped in an unimmunized child who is exposed to varicella. Treatment with ibuprofen is controversial, because it has been associated with life-threatening streptococcal skin infections and should be avoided if possible.

Although VariZIG or, if not available, IGIV, administered shortly after exposure, can prevent or modify the course of disease, immune globulin preparations are not effective treatment once disease is established.

## **Antiviral Therapy**

Some experts recommend preemptive antiviral therapy in select circumstances for mildly immunocompromised patients without evidence of immunity or for immunocompetent patients for whom varicella

prevention is desired (e.g., healthy older adolescent or adult contacts for whom vaccination is not possible) who have been exposed to varicella or herpes zoster.

Acyclovir (20 mg/kg per dose, administered orally four times per day, with a maximum daily dose of 3200 mg) or valacyclovir (20 mg/kg per dose, administered orally three times per day, with a maximum daily dose of 3000 mg) beginning seven to ten days after exposure and continuing for seven days can be used. Limited data on acyclovir as post-exposure prophylaxis are available for healthy children; no studies have been performed for adults or immunocompromised people.

The decision to use antiviral therapy and the route and duration of therapy should be determined by host factors and extent of infection. Antiviral drugs have a limited window of opportunity to affect the outcome of VZV infection. In immunocompetent hosts, most virus replication has stopped by 72 hours after onset of rash; the duration of replication may be extended in immunocompromised hosts. Oral acyclovir and valacyclovir are not recommended by the American Academy of Pediatrics (AAP) or the Advisory Committee on Immunization Practices (ACIP) for routine use in otherwise healthy younger children with varicella, because their use results in only a modest decrease in symptoms. Antiviral therapy should be considered for otherwise healthy people at increased risk of moderate to severe varicella, such as unvaccinated people older than 12 years, and those with chronic cutaneous or pulmonary disorders, those receiving long-term salicylate therapy, or those receiving short or intermittent courses of corticosteroids. Some experts also recommend use of oral acyclovir or valacyclovir for secondary household cases in which the disease usually is more severe than in the primary case.

Acyclovir is a category B drug based on U.S. 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 pregnant patients with serious complications of varicella.

Intravenous acyclovir therapy is recommended for immunocompromised patients, including patients being treated with high-dose corticosteroid therapy for more than 14 days. Therapy initiated early in the course of the illness, especially within 24 hours of rash onset, maximizes benefit. Oral acyclovir should not be used to treat immunocompromised children with varicella because of poor oral bioavailability. Some experts have used valacyclovir, with its improved bioavailability compared with oral acyclovir, in selected immunocompromised patients perceived to be at low to moderate risk of developing severe varicella, such as HIV-infected patients with relatively normal concentrations of CD4+ T-lymphocytes and children with leukemia in whom careful follow-up is ensured. Famciclovir is available for treatment of VZV infections in adults, but its efficacy and safety have not been established for children.

## **Surveillance**

Varicella is a condition reportable within five business days of diagnosis.

Surveillance is needed to document and monitor the vaccination impact on disease incidence, morbidity and mortality; evaluate the effectiveness of prevention strategies; and evaluate vaccine effectiveness under conditions of routine use.

With varicella vaccine coverage increasing and disease burden declining, varicella disease surveillance is especially important to monitor changes in varicella epidemiology. Surveillance data are used to assess progress towards Healthy People 2020 disease reduction goals and determine whether any improvements to the vaccination policy are needed. Healthy People 2020 goals for varicella include a greater than 80% reduction in the estimated number of varicella cases among children younger than 18 years of age compared to 2008; greater than 90% vaccine coverage among children 19 to 35 months of age; greater than 95% vaccination coverage with two doses of varicella vaccine among children in kindergarten; and greater than 90%, two-dose vaccine coverage among adolescents.

## Case Definition

### Clinical Case Definition

An illness with acute onset of diffuse (generalized) maculopapulovesicular rash without other apparent cause. In vaccinated persons, varicella that develops more than 42 days after vaccination (breakthrough disease) due to infection with wild-type VZV, is usually mild, with fewer than 50 skin lesions and of shorter duration of illness. The rash may also be atypical in appearance (maculopapular with few or no vesicles).

### Laboratory Criteria for Diagnosis

- Demonstration of VZV DNA by polymerase chain reaction (PCR) tests from a clinical specimen, ideally scabs, vesicular fluid, or cells from the base of a lesion is the preferred method for varicella diagnosis. PCR is also useful for confirming breakthrough disease. Other methods such as DFA and culture, are available for diagnosis but are less sensitive and specific than PCR.
- Positive serologic test for varicella-zoster immunoglobulin M (IgM) antibody when varicella-like symptoms are present.
- Four-fold or greater rise in serum varicella immunoglobulin G (IgG) antibody titer by any standard serologic assay between acute and convalescent sera.

### Case Classification

- Probable: a case that meets the clinical case definition, is not laboratory confirmed, and is not 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 probable case.

## Investigation

Reporting of varicella cases in childcare centers, schools, other institutions, military barracks, and other group settings will facilitate public health action and outbreak control. 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.

### Information to Collect

For routine surveillance of varicella, patient demographics, vaccination history, laboratory results, and clinic notes should be reported to the state health department. In special circumstances, collection of additional information on individual cases is warranted. Such circumstances include outbreak investigations, hospitalized cases, or exposure of potentially susceptible persons at high risk of serious complications of varicella such as might occur in a hospital setting. For more information or for assistance with case investigation, contact the state health department.

### Outbreak Investigation

The CDC defines a varicella outbreak as the occurrence of greater than or equal to five varicella cases that are related in place and are epidemiologically-linked. Investigation of outbreaks of varicella is recommended, especially: those occurring in a healthcare setting; those involving patients with complications (e.g., pneumonia, encephalitis, invasive Group A streptococcal infection, or hemorrhagic complications) and/or hospitalizations; those involving persons at risk for severe varicella because of their age or underlying conditions (e.g., immunocompromised persons, cancer patients, pregnant women, neonates whose mothers are not immune); and those with cases among persons vaccinated with two doses



of varicella vaccine. The investigation of outbreaks provides an opportunity to study vaccine effectiveness in the field and to more accurately describe morbidity from this disease that is vaccine-preventable. If vaccine effectiveness is found to be lower than expected, vaccine storage and handling practices should be reviewed.

## **Outbreak Control**

The identification of a single case of varicella should trigger intervention measures because this case could lead to an outbreak. Once an outbreak of varicella is confirmed, the affected population should be surveyed to identify all cases. Implementing outbreak control measures requires various activities, including notification of the outbreak, exclusion or isolation of varicella case-patients and, if appropriate, herpes-zoster case-patients, and management of persons without evidence of immunity. Priority should be given to outbreaks in which disease is severe or associated with complications. In such outbreaks, vaccination of susceptible children one year of age and older, adolescents and adults should be carried out to prevent additional cases of severe varicella.

Even if aggressive outbreak control using varicella immunization clinics is not feasible, efforts should be made to inform the affected population (e.g., students and staff at the child care center or school) that varicella is a potentially serious and even life-threatening disease which may be prevented by vaccination. Written materials on varicella and varicella vaccine should be provided recommending that susceptible persons (or their parents/care givers) contact their health care provider to receive the varicella vaccine. For guidance on outbreak control, contact the state health department.

## **Immunization**

### **Characteristics**

Varicella vaccine is a live attenuated preparation of the serially propagated and attenuated Oka strain. The product contains gelatin and trace amounts of neomycin. The monovalent vaccine was developed in the early 1970s and was licensed in March 1995 by the FDA for use in healthy people 12 months or older who have not had varicella illness. Quadrivalent measles-mumps-rubella-varicella (MMRV) vaccine was licensed in September 2005 by the FDA for use in healthy children 12 months through 12 years of age.

### **Immunogenicity and Vaccine Efficacy**

Approximately 76% to 85% of immunized healthy children older than 12 months develop a humoral immune response to VZV at levels considered associated with protection after a single dose of varicella vaccine. Seroprotection rates and cell-mediated immune responses approach 100% after two doses.

The effectiveness of one dose of varicella vaccine is about 82% against any clinical varicella and 98% against severe disease. Two doses of vaccine demonstrated 92% effectiveness against any clinical varicella.

### **Simultaneous Administration with Other Vaccines or Antiviral Agents**

Varicella-containing vaccines may be administered at the same visit as MMRV vaccine. If not given at the same time, the interval between administration of a varicella-containing vaccine and MMR vaccine should be at least 28 days. Because of susceptibility of vaccine virus to acyclovir, valacyclovir, or famciclovir, these antiviral agents usually should be avoided from one day before to 21 days (the outer limit of the incubation period) after receipt of a varicella-containing vaccine.

### **Adverse Reactions Following Vaccination**

Varicella vaccine is safe; reactions generally are mild and occur with an overall frequency of approximately 5% to 35%. Approximately 20% to 25% of immunized people will experience minor

injection site reactions (e.g., pain, redness, swelling). In approximately 1% to 3% of immunized children, a localized rash develops, and in an additional 3% to 5%, a generalized varicella-like rash develops. These rashes typically consist of two to five lesions and may be maculopapular rather than vesicular; lesions usually appear five to 26 days after vaccination. However, not all observed post-immunization rashes can be attributable to vaccine. After MMRV or monovalent varicella vaccine plus MMR, a measles-like rash was reported in 2% to 3% of recipients. Fever was reported in a higher proportion after the first dose of MMRV than after the first dose of monovalent varicella vaccine plus MMR (22% vs 15%) in young children. Both fever and measles-like rash usually occurred within five to 12 days of immunization, were short of duration, and resolved without sequelae.

A slightly increased risk of febrile seizures is associated with the higher likelihood of fever following the first dose of MMRV compared with MMR and monovalent varicella. After the second vaccine dose administered in older children (four to six years of age), there were no differences in incidence of fever, rash, or febrile seizures among recipients of MMRV vaccine compared with recipients of simultaneous MMR and varicella vaccines.

### **Breakthrough Disease**

Breakthrough disease is defined as a case of wild-type varicella infection occurring more than 42 days post-vaccination. Such disease is almost always mild, with rash frequently atypical (predominantly maculopapular with a median of fewer than 50 lesions), a lower rate of fever, and faster recovery than disease in unimmunized children. It may be mistaken for other conditions, such as insect bites or poison ivy. Vaccine recipients with mild breakthrough disease are approximately one third less contagious than unimmunized children.

Breakthrough varicella infection could be a result of several factors, including interference of vaccine virus replication by circulating antibodies, impotent vaccine due to storage or handling errors, or inaccurate recordkeeping. Interference from live viral vaccine administered before varicella vaccine could also reduce vaccine effectiveness. A study in two health maintenance organizations found that children who received varicella vaccine less than 30 days after MMR vaccination had a 2.5-fold increased risk of breakthrough varicella compared with those who received varicella vaccine before, simultaneous with, or more than 30 days after MMR. Inactivated vaccines (DTaP, Hib, IPV, and hepatitis B) and OPV did not increase the risk of breakthrough varicella if administered less than 30 days prior to varicella vaccine.

### **Secondary Transmission of Vaccine Virus**

Vaccine-strain VZV can cause herpes zoster in immunocompetent and immunocompromised people. However, data from post-licensure surveillance indicate that the age-specific risk of herpes zoster is lower among immunocompetent children immunized with varicella vaccine than among children who had had natural varicella infection. Wild-type VZV has been identified in skin lesion specimens in people with herpes zoster after immunization, indicating that herpes zoster in immunized people also may result from unrecognized natural VZV infection that occurred before or after immunization.

Vaccine-strain VZV transmission to contacts is rare (documented from only 9 vaccinees, resulting in 11 secondary cases) but can occur within 10 to 21 days after exposure to a person recently vaccinated or to a person who develops herpes zoster due to vaccine-strain virus. In all cases, the immunized person had a rash following vaccine. Some experts believe that immunocompromised people with skin lesions that are presumed to be attributable to vaccine virus should receive acyclovir or valacyclovir treatment. Attempts to confirm the presence of VZV should be made in these patients usually via PCR assay.

### **Recommendations for Immunization**

Both monovalent varicella vaccine and MMRV have been licensed for use for healthy children 12 months through 12 years of age. Children in this age group should receive two 0.5 mL doses of monovalent

varicella vaccine or MMRV administered subcutaneously, separated by at least three months. However, provided the second dose is administered a minimum 28 days after the first dose, it does not need to be repeated.

All healthy children should receive the first dose of varicella-containing vaccine at 12 through 15 months of age. The second dose of vaccine is recommended routinely when children are four to six years of age. Because of the minimal potential for increased febrile seizures after the first dose of MMRV vaccine in children 12 through 15 months of age, AAP recommends a choice of either MMR plus monovalent varicella vaccine or MMRV for toddlers receiving their first immunization of this kind. Parents should be counseled about the rare possibility of their child developing a febrile seizure one to two weeks after immunization with MMRV for the first immunizing dose. For the second dose at four to six years of age, MMRV generally is preferred over MMR plus monovalent varicella to minimize the number of injections. A catch-up second dose of varicella vaccine should be offered to all children seven years and older who have received only one dose.

If the first dose of varicella-containing vaccine is administered five or more days before the first birthday, the dose does not count toward the two doses needed for evidence of immunity to varicella. In such a circumstance, the varicella dose should be repeated at 12 to 15 months, as long as at least 28 days have elapsed from the invalid dose.

Immunocompetent individuals 13 years or older without evidence of immunity should receive two doses of monovalent varicella vaccine, separated by at least 28 days. For people who previously received only one dose of varicella vaccine, a second dose is necessary. Only monovalent varicella vaccine is licensed for this age group.

Children who had chickenpox diagnosed by a physician or verification of history of varicella disease can be assumed to be immune to varicella. Children without a reliable history or with an uncertain history of chickenpox should be considered susceptible. Serologic testing of such children prior to vaccination is not warranted, because the majority of children between 12 months and 12 years of age without a clinical history of chickenpox are susceptible. Prior history of chickenpox is not a contraindication to varicella vaccination.

Epidemiologic and serologic studies indicate that up to 90% of adults are immune to varicella. As a result, serologic testing prior to vaccination is likely to be cost effective for adults. As with children, a prior history of chickenpox is not a contraindication to varicella vaccination.

Assessment of varicella immunity of all adolescents and adults and vaccination of those who are susceptible, is desirable to protect these individuals from the higher risk of complications from acquired varicella. Specific assessment efforts should be focused on adolescents and adults who are at highest risk of exposure and those most likely to transmit varicella to others. This group includes persons who live or work in environments in which there is a high likelihood of transmission of varicella, such as teachers of young children, daycare workers and residents and staff in institutional settings; persons who live or work in environments in which varicella transmission may occur (e.g. college students, inmates and staff of correctional institutions and military personnel); non-pregnant women of childbearing age, in order to reduce the risk of VZV transmission to the fetus if the susceptible woman should develop varicella during pregnancy; international travelers.

The ACIP recommends that all healthcare workers be immune to varicella, either from a reliable history of varicella disease or vaccination. In healthcare settings, serologic screening of personnel who are uncertain of their varicella history, or who claim not to have had the disease, is likely to be cost effective. Testing for varicella immunity following two doses of vaccine is not necessary because 99% of persons are seropositive after the second dose. Seroconversion may not always result in full protection against disease. If a fully vaccinated healthcare worker is exposed to varicella, they should be monitored daily during days eight to 21 after exposure and placed on sick leave immediately if symptoms suggestive of

varicella develop. Healthcare professionals who have received only one dose of vaccine and who are exposed to varicella should receive the second dose with a single-antigen varicella vaccine, preferably within three to five days of exposure, provided four weeks have elapsed after the first dose.

There has not been any documented transmission of varicella from vaccinated healthcare personnel. As a safeguard, institutions may wish to consider precautions for personnel who develop a rash following vaccination (e.g., avoidance of contact with persons at high risk of serious complications, such as susceptible immunosuppressed persons).

## **Contraindications and Precautions to Vaccination**

Contraindications and precautions are similar for all varicella-containing vaccines. As with other vaccines, varicella vaccine should not be administered to people who have moderate or severe illnesses, with or without fever. This precaution is intended to prevent complicating the management of an ill patient with a potential vaccine adverse event, such as fever. Persons with a severe allergic reaction (anaphylaxis) to a vaccine component or following a prior dose of vaccine should not receive varicella vaccine.

Varicella vaccine should be administered to immunocompetent patients without evidence of varicella immunity, if it can be administered more than or equal to four weeks before initiating immunosuppressive therapy. Varicella vaccine should not be administered to highly immunocompromised patients. Certain categories of patients (e.g., patients with HIV infection without severe immunosuppression or with a primary immune deficiency disorder without defective T-cell-mediated immunity, such as primary complement component deficiency disorder or chronic granulomatous disease [CGD]) should receive varicella vaccine. Children with impaired humoral immunity alone may be immunized. Immunodeficiency should be excluded before immunization in children with a family history of immunodeficiency.

In people with possible altered immunity, only monovalent varicella vaccine (not MMRV) should be used for immunization against varicella. The Oka vaccine strain remains susceptible to acyclovir, and if a high-risk patient develops vaccine-related varicella, then acyclovir or valacyclovir should be used as treatment.

Persons with immunosuppression due to leukemia, lymphoma, generalized malignancy, immune deficiency disease, or immunosuppressive therapy should not be vaccinated with a varicella-containing vaccine. However, treatment with low dose (less than 2 mg/kg/day), alternate day, topical, replacement, or aerosolized steroid preparations is not a contraindication to vaccination. Persons whose immunosuppressive therapy with steroids has been stopped for one month (three months for chemotherapy) may be vaccinated. Varicella vaccine is available from the manufacturer through a research protocol for special use in certain patients with acute lymphoblastic leukemia in remission.

Persons with moderate or severe cellular immunodeficiency resulting from infection with human immunodeficiency virus (HIV), including persons diagnosed with AIDS should not receive varicella vaccine. HIV-infected children with CD4 T-lymphocyte percentage of 15% or higher, and older children and adults with a CD4 count of 200 per microliter or higher may be considered for vaccination. These persons may receive MMR and single-antigen varicella vaccines, but should not receive MMRV.

Because persons with impaired cellular immunity are potentially at greater risk for complications after vaccination with a live vaccine, these vaccinees should be encouraged to return for evaluation if they experience a post-vaccination varicella-like rash.

Women known to be pregnant or attempting to become pregnant should not receive a varicella-containing vaccine. To date, no adverse outcomes of pregnancy or in a fetus have been reported among women who inadvertently received varicella vaccine shortly before or during pregnancy. Although the manufacturer's package insert states otherwise, the ACIP recommends that pregnancy be avoided for one month following receipt of varicella vaccine. The ACIP recommends prenatal assessment and postpartum vaccination for varicella.

The manufacturer and the CDC established a Varicella Vaccination in Pregnancy registry to monitor the maternal–fetal outcomes of pregnant women inadvertently given varicella vaccine. The telephone number for the registry is (800) 986-8999.

Although there is no evidence that either varicella or varicella vaccine exacerbates tuberculosis, vaccination is not recommended for persons known to have untreated active tuberculosis. Tuberculosis skin testing is not a prerequisite for varicella vaccination.

The effect of the administration of antibody-containing blood products (e.g., immune globulin, whole blood or packed red blood cells, or intravenous immune globulin) on the response to varicella vaccine virus is unknown. Because of the potential inhibition of the response to varicella vaccination by passively transferred antibodies, varicella or MMRV vaccine should not be administered for three to 11 months after receipt of antibody containing blood products. ACIP recommends applying the same intervals used to separate antibody-containing products and MMR to varicella vaccine. Immune globulin should not be given for three weeks following vaccination unless the benefits exceed those of the vaccine. In such cases, the vaccinees should either be revaccinated or tested for immunity at least three months later (depending on the antibody-containing product administered) and revaccinated if seronegative.

A personal or family (i.e., sibling or parent) history of seizures of any etiology is a precaution for MMRV vaccination. Studies suggest that children who have a personal or family history of febrile seizures or family history of epilepsy are at increased risk for febrile seizures. Children with a personal or family history of seizures should be vaccinated with MMR vaccine and varicella vaccine because the risks for using MMRV vaccine in this group of children generally outweigh the benefits.

No adverse events following varicella vaccination related to the use of salicylates (e.g., aspirin) have been reported to date. However, the manufacturer recommends that vaccine recipients avoid the use of salicylates for 6 weeks after receiving varicella or MMRV vaccine because of the association between aspirin use and Reye syndrome following chickenpox.

## **Vaccine Storage and Handling**

Varicella vaccine is very fragile and must be handled with extreme care. To maintain potency, the lyophilized vaccine must be stored frozen between -50°C and -15°C (-58°F and +46°F). Household freezers, including frost-free models, manufactured within the last five to ten years, are designed to maintain temperatures as low as -40°F (-20°C), and are acceptable for storage of the vaccine. Refrigerators with ice compartments that are not tightly enclosed, or are enclosed with unsealed, uninsulated doors (i.e., small dormitory-style refrigerator/freezer combinations), are not capable of maintaining the required storage temperature.

The vaccine diluent should be stored separately at room temperature or in the refrigerator. The vaccine should be reconstituted according to the directions on the package insert and only with the diluent supplied, which does not contain preservative or other antiviral substances that might inactivate the vaccine virus. Once reconstituted, the vaccine must be used immediately to minimize loss of potency. The vaccine must be discarded if not used within 30 minutes of reconstitution. Mishandled vaccine should be clearly marked and placed in the freezer separate from properly handled vaccine. After storing the vaccine, the manufacturer must be contacted for recommendations before any of the mishandled vaccine is used. The Merck Vaccine Division varicella information telephone number is (800) 9VARIVAX [(800) 982-7482]. If the vaccine has been kept cold, or has been exposed to room temperature for a very short time, the manufacturer may recommend that the expiration date be shortened and that the vaccine be used as quickly as possible. Mishandled vaccine should never be destroyed until the manufacturer has been consulted.

Because of the lability of varicella vaccine, transport of the vaccine from a central clinic or storage area to an off-site clinic can be difficult. If off-site transport is attempted, a high-quality container should be

used, the vaccine should be transported on dry ice and the temperature should be monitored continuously, to assure that the appropriate storage temperature is maintained. The vaccine may be kept at refrigerator temperature for up to 72 hours, but must then be discarded if not used. The vaccine should not be refrozen.

## **Varicella Zoster Immune Globulin (VariZIG)**

VariZIG is a purified human immune globulin preparation made from plasma containing high levels of anti-varicella antibodies (immunoglobulin class G [IgG]) that is lyophilized. When properly reconstituted, VariZIG is approximately a 5% solution of IgG that can be administered intramuscularly.

In March 2013, a VZIG product, VariZIG (Cangene Corporation, Winnipeg, Canada) was licensed by the FDA. The licensed product can be requested from the sole authorized U.S. distributor, FFF Enterprises (Temecula, California), for patients who have been exposed to varicella and who are at increased risk for severe disease and complications. VariZIG can be obtained by calling FFF Enterprises at (800) 843-7477 at any time or by contacting the distributor online at <http://www.fffenterprises.com>.

CDC and AAP recommend administration of VariZIG as soon as possible following exposure, ideally within 96 hours for greatest effectiveness; limited data suggest benefit when administered up to 10 days after exposure.

The decision to administer VariZIG depends on three factors:

1. The likelihood that the exposed person has no evidence of immunity to varicella
2. The probability that a given exposure to varicella or zoster will result in infection
3. The likelihood that complications of varicella will develop if the person is infected

The patient groups recommended by ACIP to receive VariZIG include the following:

- Immunocompromised patients
- Pregnant women
- Neonates whose mothers have signs and symptoms of varicella around the time of delivery (i.e., five days before to two days after); VariZIG or IGIV is not indicated if the mother has zoster
- Preterm infants born at 28 weeks gestation or later who are exposed during the neonatal period and whose mothers do not have evidence of immunity
- Preterm infants born earlier than 28 weeks' gestation or who weigh 1,000 g or less at birth and were exposed during the neonatal period, regardless of maternal history of varicella disease or vaccination

Administration of VariZIG or IGIV as soon as possible to immunocompromised children who are exposed with no history of varicella or vaccination and/or unknown or negative serologic test results is recommended. The degree and type of immunosuppression should be considered in making this decision.

VariZIG is administered intramuscularly at the recommended dose of 62.5 units (0.5 vial) for children weighing less than 2.0 kg; 125 units (one vial) for children weighing 2.1 to 10 kg; 250 units (two vials) for children weighing 10.1 to 20 kg; 375 units (three vials) for children weighing 20.1 to 30 kg; 500 units (four vials) for children weighing 30.1 to 40 kg; and 625 units (five vials) for all people weighing more than 40 kg.

IGIV is administered intravenously at the dose of 400 mg/kg. Patients receiving monthly high-dose IGIV (400 mg/kg or greater) at regular intervals are likely to be protected if the last dose of IGIV was administered three weeks or less before exposure.

## **Subsequent Exposures and Follow Up of VariZIG Recipients**

For patients who become eligible for vaccination, varicella vaccine should be administered more than or equal to five months after VariZIG administration. Because varicella-zoster immune globulin might prolong the incubation period by more than or equal to one 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%). 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.

## **Hospital Exposure**

If an inadvertent exposure occurs in the hospital to an infected person by a patient, health care professional, or visitor, the following control measures are recommended:

- Healthcare professionals, patients, and visitors who have been exposed and who lack evidence of immunity to varicella should be identified.
- Varicella immunization is recommended for people without evidence of immunity, provided there are no contraindications to vaccine use.
- VariZIG should be administered to appropriate candidates up to days 10 post-exposure. If VariZIG is not available, IGIV should be considered as an alternative.
- If vaccine cannot be administered and VariZIG/IVIG is not indicated, preemptive oral acyclovir or valacyclovir can be considered.
- All exposed patients without evidence of immunity should be discharged as soon as possible.
- All exposed patients without evidence of immunity who cannot be discharged should be placed in isolation from days eight to 21 after exposure to the index patient. For people who received VariZIG or IGIV, isolation should continue until day 28.
- Healthcare professionals who have received two doses of vaccine and who are exposed to VZV should be monitored daily during days eight through 21 after exposure through the employee health program or by an infection control nurse to determine clinical status. They should be placed on sick leave immediately if symptoms such as fever, headache, other constitutional symptoms, or any suspicious skin lesions occur.
- Healthcare professionals who have received only one dose of vaccine and who are exposed to VZV should receive a second dose, preferably within three to five days of exposure, provided four weeks have elapsed after the first dose. After immunization, management is similar to that of two-dose vaccine recipients.
- Immunized healthcare professionals who develop breakthrough infection should be considered infectious until vesicular lesions have crusted or, if they have maculopapular lesions, until no new lesions appear within a 24-hour period.

## **Isolation of the Hospitalized Patient**

In addition to standard precautions, airborne and contact precautions are recommended for patients with varicella until all lesions are dry and crusted, typically at least five days after onset of rash but a week or longer in immunocompromised patients. In patients with varicella pneumonia, precautions are prolonged for the duration of illness. For immunized patients with breakthrough varicella with only maculopapular lesions, isolation is recommended until no new lesions appear within a 24-hour period, even if lesions have not resolved completely.

For exposed patients without evidence of immunity, airborne and contact precautions from eight until 21 days after exposure to the index patient also are indicated; these precautions should be maintained until 28 days after exposure for those who received VariZIG or IGIV.

Airborne and contact precautions are recommended for neonates born to mothers with varicella until 21 days of age, or until 28 days of age if VariZIG or IGIV was administered. To minimize the possibility of infection of the infant, the mother and the infant should be isolated separately until the mother's vesicles have dried, even if the infant has received VariZIG. If the infant develops clinical varicella, the mother may care for her infant. If the neonate is born with lesions (e.g., congenital varicella), the mother and her newborn should be isolated (they can be isolated together) and discharged home when clinically stable. If the infant is clinically stable for discharge during the incubation period and has not developed varicella, isolation to complete the 21- or 28-day period should continue at home. If the infant needs to see the healthcare provider during that period, the office should be notified of the need for airborne and contact precautions.

Infants with varicella embryopathy do not require isolation if they do not have active skin lesions.

Airborne and contact precautions are recommended for both immunocompetent and immunocompromised patients with disseminated zoster for the duration of illness. Immunocompromised patients with localized disease require airborne and contact precautions until disseminated infection is ruled out. For immunocompetent patients with localized zoster, standard precautions and complete covering of the lesions (if possible) are indicated until all lesions are crusted.

## **Control Measures**

### **Evidence of Immunity to Varicella**

Evidence of immunity to varicella includes any of the following:

1. Documentation of age-appropriate immunization
  - a. Preschool-aged children (i.e., older than or equal to 12 months of age): one dose
  - b. School-aged children, adolescents, and adults: two doses
2. Laboratory evidence of immunity or laboratory confirmation of disease
3. History of varicella or herpes zoster diagnosed by a physician
4. Birth in the United States before 1980 (should not be considered evidence of immunity for healthcare personnel, pregnant women, and immunocompromised persons).

### **Child Care and School**

Exclusion of individuals with varicella is routinely recommended for outbreak control. Children with uncomplicated varicella who have been excluded from school or child care may return when the rash has crusted or, in immunized people without crusts, until no new lesions appear within a 24-hour period.

Exclusion of children with zoster whose lesions cannot be covered is based on similar criteria. Children who are excluded may return after the lesions have crusted. Lesions that are covered pose little risk to susceptible people, although transmission has been reported.

### **Care of Exposed People**

Potential interventions for people without evidence of immunity exposed to a person with varicella or herpes zoster include:

1. Varicella vaccine, administered ideally within three days but up to five days after exposure (followed by a second dose of vaccine at the age-appropriate interval after the first dose)
2. When indicated and available, VariZIG (or IGIV)



3. If the child cannot be immunized and VariZIG is not indicated or is unavailable, preemptive oral acyclovir or valacyclovir starting day seven after exposure.

Exclusion is also recommended for exposed, susceptible individuals who may be in contact with persons at high risk of serious complications (e.g. health care workers and family members of immunocompromised persons). Exclusion is required for the duration of the period of communicability.

Healthcare workers with active varicella or susceptible workers with a history of exposure to a patient or staff with active varicella should be relieved from direct patient contact. This exclusion should take place from the 10th day after the first exposure through the 21st day after last exposure. Staff with zoster should cover lesions and should not care for high-risk patients until their skin lesions have become dry and crusted. Healthcare workers who are susceptible to varicella and exposed to an individual with active zoster should be relieved from direct patient contact for the same duration as workers exposed to persons with varicella.

### **Vaccine for Control**

Varicella vaccine should be administered to healthy people without evidence of immunity who are 12 months or older, including adults, as soon as possible, preferable within three days and possibly up to five days after varicella or herpes zoster exposure, if there are no contraindications to vaccine use. This approach may prevent or modify disease. Patients should be counseled that not all close exposures result in infection, so vaccination even after three to five days following exposure is still warranted. A second vaccine dose should be administered at the age-appropriate interval after the first dose. Physicians should advise parents and their children that the vaccine may not protect against disease in all cases, because some children may have been exposed at the same time as the index case. If exposure to varicella does not cause infection, post-exposure vaccination should induce protection against subsequent exposure.

Varicella vaccination is recommended by the ACIP in order to prevent outbreaks among patients and staff in health care settings. These outbreaks pose a special problem because varicella may be transmitted between patients and staff. For this reason, many healthcare institutions have existing employee screening programs to determine if employees have had varicella in the past. If employees do not have a history of varicella based on serologic testing, many hospitals will provide varicella vaccine.

### **School Letter Templates**

#### **Sample Notification Letter**

**[date]**

Dear Parent/Guardian,

This letter is to notify you that a student in **[grade]** at **[school name]** in **[town]**, Louisiana has been diagnosed with chickenpox. This individual will not be attending school until they are well.

Chickenpox, also known as varicella, causes an acute illness with a rash. The time from exposure to the development of symptoms is 10 to 21 days. People are contagious one to two days before the rash appears and remain contagious until the last lesion has crusted over and healed. Should your child develop a suspicious rash, please keep them at home and have them evaluated by their physician.

The current immunization schedule recommends that all children who have not had chickenpox disease receive a total of two doses of chickenpox (varicella) vaccine. The first dose is usually given at 12 months of age, and the second dose is usually given after four years of age. If your child is not up-to-date on varicella vaccine, it is recommended that they receive the vaccination as soon as possible and bring a copy of their updated immunization record to school.

If your child or anyone else in your household has a weakened immune system or is pregnant and has never had chickenpox or the vaccine, talk with your healthcare provider immediately.

Chickenpox is a very contagious infection caused by the varicella-zoster virus. It is spread from person to person by direct contact or through the air from an infected person's coughing or sneezing. It causes a blister-like rash, itching, tiredness and a fever lasting an average of four to six days. Most children recover without any problems, but severe illness is possible.

If your child or anyone in your household currently has symptoms that look like chickenpox, contact your regular health care provider to discuss your child's symptoms and to see if anyone in the home needs to be vaccinated. Anyone who has chickenpox should avoid contact with others who have not had chickenpox or who are not vaccinated against chickenpox. Sick children should not attend school, day care, work, parties and/or other gatherings until the blisters become crusted (about four to six days after the rash appears) or no new lesions appear within a 24 hour period. Keep all chickenpox spots and blisters clean and watch for possible signs of infection, including increasing redness, swelling, drainage and pain at the wound site.

Please contact the school to report your child's chickenpox, if he or she is or becomes infected. If you have any questions, you may contact the Louisiana Office of Public Health during business hours at (504) 568-2600 and after hours at (800) 256-2748. More information about chickenpox is available at: <http://www.cdc.gov/vaccines/vpd-vac/varicella/fs-parents.html>.

Remember, it is important to keep your child up to date on all immunizations.

Thank you,

Louisiana Office of Public Health

### **Sample Exclusion Letter**

**[date]**

Dear Parent/Guardian,

This letter is to notify you that students in **[grade]** at **[school name]** in **[town]**, Louisiana have been diagnosed with chickenpox. Ill individuals will not be attending school until they are well. Chickenpox, as you may know, is caused by the varicella-zoster virus. It is a highly contagious illness that can be spread easily through coughs, sneezes, or through direct contact with secretions from the rash of affected individuals.

For the protection of your child and to prevent further transmission of this illness in the school, the Louisiana Office of Public Health requires that children who are unvaccinated or who do not meet the sufficient criteria for vaccination against the varicella-zoster virus be excluded from school for at least 21 days following the identification of the last case in school. As of the last identified case to date, the earliest return date for those who do not obtain the varicella vaccine as recommended shall be **[date]**.

Students may be allowed to return to school before this date if immediate vaccination is received. This is based on the fact that it takes on average 10 to 21 days for an individual to develop chickenpox symptoms after being exposed. Thus, if a child is vaccinated before the tenth day of exposure and before they show any signs or symptoms of the disease, they may be considered immune for our purposes. Accordingly, students obtaining the required varicella vaccination, and showing proof of such immunization by or before **[date]**, may immediately return to school.

We realize this may pose an inconvenience for you and your child, but in the interest of protecting the health of other students and the community, we are requesting your full cooperation with these measures. If you have any questions, you may contact the Louisiana Office of Public Health during business hours at (504) 568-2600 and after hours at (800) 256-2748. More information about chickenpox is available at: <http://www.cdc.gov/vaccines/vpd-vac/varicella/fs-parents.html>.

Thank you,

Louisiana Office of Public Health