CHICKENPOX

1. **Agent**: Varicella-zoster virus (VZV), a member of the herpesvirus family. VZV infection causes two clinically distinct forms of disease: varicella (chickenpox) and herpes zoster (shingles)

2. **Identification**:

   a. **Symptoms:**

   Varicella (chickenpox): Varicella is a highly contagious disease caused by VZV. It usually presents with a prodrome of mild fever, malaise, anorexia or headache for 1-2 days followed by onset of rash. The rash is generalized and pruritic and usually appears in successive crops over several days, initially as macules, then papules and then vesicular before crusting in 4-7 days. Lesions can cause enanthem and can appear first on the chest, back, and face, then spread over the entire body. Mild, atypical and inapparent infections also occur. "Breakthrough" varicella is infection occurring in a vaccinated person more than 42 days after vaccination. Breakthrough varicella is usually mild with fewer skin lesions and has a shorter illness compared to unvaccinated people who get varicella. The most common complications of varicella are secondary bacterial infection of skin lesions, dehydration, pneumonia, and central nervous system involvement. Hospitalization occurs in ~3 per 1,000 cases. The overall death rate is ~1 per 60,000 cases. Complications increase with age; there are reported death rates as high as 25 per 100,000 for persons in the 30- 49 age group.

   Zoster (herpes zoster, shingles): Zoster occurs more often in adults or immunocompromised persons and results from reactivation of latent VZV in sensory ganglia. Grouped vesicular lesions appear unilaterally in the distribution of 1 to 3 sensory dermatomes. Severe pain and paresthesia are common.

   Congenital Varicella Syndrome: Primary varicella infection in the first 20 weeks of gestation is occasionally associated with abnormalities in the newborn that include low birth weight, limb hypoplasia, cicatricial skin scarring, localized muscular atrophy, encephalitis, cortical atrophy, chorioretinitis, and microcephaly.

   Perinatal Varicella: Perinatal varicella occurs within first 10 days of life from a mother infected from 5 days before to 2 days after delivery; it has a 30% fatality rate. The severity of disease results from fetal exposure to the virus without the benefit of passive maternal antibody. Postnatally acquired varicella occurs after 10 days of age and is rarely fatal.

   b. **Differential Diagnosis**: Generalized herpes simplex, impetigo, drug rash, MPOX, secondary syphilis, smallpox, and other viral exanthems. See **EXANTHEMS—DIFFERENTIAL DIAGNOSIS** in Appendix A.

   c. **Diagnosis**: VZV polymerase chain reaction (PCR), serum antibody studies, direct smear and culture of lesion fluid.

3. **Incubation Period (time from exposure to onset of rash)**: Usually 14-16 days after exposure, with a range of 10-21 days. May be prolonged after receipt of varicella zoster immune globulin (VariZIG) and in the immunodeficient.

4. **Reservoir**: Human.

5. **Source**: Mucous membranes and vesicles.

6. **Transmission**: Highly contagious. Direct contact with patient with varicella or zoster; droplet or airborne spread of vesicle fluid (chickenpox and zoster) or secretions of the respiratory tract (chickenpox); indirectly by contaminated fomites. Scabs are not infectious.

7. **Infectious Period (Communicability)**: Communicable 48 hours before rash and

until all lesions have formed crusts (usually 5 days).

Communicability may be prolonged in persons with altered immunity.

8. **Specific Treatment**:
For cases: Acyclovir (IV) administered to susceptible immunocompromised persons is effective in reducing varicella morbidity when administered within 24 hours of rash onset. The FDA licensed oral acyclovir for varicella in otherwise healthy children. The American Academy of Pediatrics considers the use of oral acyclovir appropriate in otherwise healthy persons at increased risk of moderate to severe varicella, such as those older than 12 years, those with chronic skin or pulmonary disorders, those receiving chronic salicylate therapy or short, intermittent or aerosolized corticosteroids or in secondary case-patients that live in the households of infected children.

9. **Immunity**: Infection confers long-term immunity. However, second attacks of chickenpox can occur.

REPORTING PROCEDURES

1. Outbreaks associated with an acute health care facility: report within one working day of identification by electronic transmission (including fax and email), telephone, or mail (Title 17, Section 2500, *California Code of Regulations*). Contact the Communicable Disease Reporting System: Tel: (888) 397-3993 or (213) 240-7821, Fax: (888) 397-3778 or (213) 482-5508, Email: ACDC-MorbidityUnit@ph.lacounty.gov

   Report Form: CDPH 8554-OTHER OUTBREAK

2. Outbreaks associated with a sub-acute health care facility: report within one working day of identification by electronic transmission (including fax and email), telephone, or mail (Title 17, Section 2500, *California Code of Regulations*). Contact the Communicable Disease Reporting System: Tel: (888) 397-3993 or (213) 240-7821, Fax: (888) 397-3778 or (213) 482-5508, Email: ACDC-MorbidityUnit@ph.lacounty.gov

   Report Form: CDPH 8554-OTHER OUTBREAK

3. Fatal cases: within one working day of identification by electronic transmission (including fax and email), telephone, or mail (Title **1**7, Section 2500, *California Code of Regulations*). Contact the Communicable Disease Reporting System: Tel: (888) 397-3993 or (213) 240-7821, Fax: (888) 397-3778 or (213) 482-5508, Email: ACDC-MorbidityUnit@ph.lacounty.gov

   Vaccine Preventable Disease Control Program (VPDCP) will file: VARICELLA DEATH INVESTIGATION WORKSHEET and must notify the State Division of Communicable Disease Control immediately. See Instructions for the Varicella Death Investigation Worksheet.

4. Hospitalized cases (not cases of herpes zoster/shingles): report within one working day of identification by electronic transmission (including fax and email), telephone, or mail (Title 17, Section 2500, California Code of Regulations). Contact the Communicable Disease Reporting System: Tel: (888) 397-3993 or (213) 240-7821, Fax: (888) 397-3778 or (213) 482-5508, Email: ACDC-MorbidityUnit@ph.lacounty.gov

   VPDCP will file: VARICELLA (CHICKENPOX) HOSPITALIZED CASE REPORT (CDPH 8299).

5. **Epidemiologic Data:**

   a. Transmission setting
   b. Source of transmission
   c. Vaccination status of source patient

CONTROL OF CASE, CONTACTS & CARRIERS

Routine investigation of individual cases of chickenpox or shingles is not required.

CASE:

CDC Definition – Varicella

Clinical Criteria
In the absence of a more likely alternative diagnosis:

- An acute illness with a generalized rash with vesicles (maculopapular vesicular rash), **OR**
- An acute illness with a generalized rash without vesicles (maculopapular rash).

Laboratory Criteria
Confirmatory Laboratory Evidence[a]

- Positive polymerase chain reaction (PCR) for varicella-zoster virus (VZV) DNA, **OR**
- Positive direct fluorescent antibody (DFA) for VZV DNA, **OR**
- Isolation of VZV, **OR**
- Significant rise (i.e., at least a 4-fold rise or seroconversion [b,c,d]) in paired acute and convalescent serum VZV immunoglobulin G (IgG) antibody.

Supportive Laboratory Evidence:

- Positive test for serum VZV immunoglobulin M (IgM) antibody.

a A negative laboratory result in a person with a generalized rash with vesicles does not rule out varicella as a diagnosis.
b Not explained by varicella vaccination during the previous 6-45 days.
c Seroconversion is defined as a negative serum VZV IgG followed by a positive serum VZV IgG.
d In vaccinated persons, a 4-fold rise may not occur.

Epidemiologic Linkage
Confirmatory Epidemiologic Linkage Evidence:

- Exposure to or contact with a laboratory-confirmed varicella case, **OR**
- Can be linked to a varicella cluster or outbreak containing ≥1 laboratory-confirmed case, **OR**
- Exposure to or contact with a person with herpes zoster (regardless of laboratory confirmation).

Presumptive Epidemiologic Linkage Evidence:

- Exposure to or contact with a probable varicella case that had a generalized rash with vesicles.

Probable:

- Meets clinical evidence with a generalized rash with vesicles,
  OR
- Meets clinical evidence with a generalized rash without vesicles **AND**:
  - Confirmatory or presumptive epidemiologic linkage evidence, **OR**
  - Supportive laboratory evidence.
  OR
- Meets healthcare record criteria* **AND**:
  - Confirmatory or presumptive epidemiologic linkage evidence, **OR**
  - Confirmatory or supportive laboratory evidence.

**A person whose healthcare record contains a diagnosis of varicella or chickenpox but no rash description.*

Confirmed:
Meets clinical evidence **AND** confirmatory laboratory evidence,
OR
Meets clinical evidence with a generalized rash with vesicles **AND** confirmatory epidemiologic linkage evidence.

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

1. Chickenpox (Varicella): Avoid contact with immunologically compromised persons. Exclude from school or work until all lesions have crusted over (usually 5 days for unvaccinated persons) after onset of rash, or sooner if all lesions are crusted and no new lesions are formed.

2. Zoster (Shingles): Avoid all contact with immunocompromised persons. Case may work with immunocompetent persons as long as all lesions are covered, and they are also immunocompetent.

CONTACTS (Postexposure Prophylaxis):

Note: The following guidelines apply mainly to chickenpox contacts—contact to a shingles case is defined as direct contact with active lesions.

1. Passive Immunization with VariZIG: should be administered as soon as possible and within 10 days of first exposure to:
   a. Immunocompromised persons without evidence of varicella immunity
   b. Pregnant women without evidence of varicella immunity
   c. Newborn infants whose mother has onset of chickenpox within 5 days before delivery or within 48 hours after delivery (VariZIG is not indicated for neonates whose mothers have shingles)
   d. Hospitalized preterm infants born at 28 weeks gestation or later whose mothers do not have evidence of immunity
   e. Hospitalized preterm infants born earlier than 28 weeks' gestation or who weigh 1,000 grams or less at birth, regardless of maternal history of varicella disease or vaccination

Note: The FDA approved VariZIG for use in the U.S. as a commercially available product. VariZIG is produced by a Canadian manufacturer. With FDA's recent approval, investigational new drug (IND) procedures are no longer required for VariZIG. This product is available to DPH through the DPH Pharmacy (213) 250-8616. If you need to contact the distributor, call FFF Enterprises at their 24-hour telephone number: 1-800-843- 7477.

2. Active Immunization with Varicella Vaccine: Consideration for varicella vaccination for susceptible adults and children is required.

   a. The American Academy of Pediatrics recommends varicella vaccine administration to susceptible children up to 5 days after exposure to prevent or modify disease.

   b. The Advisory Committee on Immunization Practices has updated its routine varicella recommendations to add a second dose of varicella vaccine for children 4-6 years of age. Especially during varicella outbreaks, persons who have received only one dose of varicella vaccine should receive their second dose, provided the appropriate minimal interval has elapsed since the first dose (3 months for children 12 months through 12 years and 4 weeks for person 13 years and older).

   c. The CDC recommends administrating the first dose of the MMR vaccine and varicella vaccine at 12-47 months old, unless the parent or caregiver expresses a preference for combined Measles, Mumps, Rubella and Varicella (MMRV) vaccine. MMRV vaccine is associated with a higher risk for fever and febrile seizures among young children.

   d. Inform patients that some contacts may have been exposed at the same time as the index case and that the vaccine will not protect against disease in such circumstances.

   Contraindications to the vaccine:
   a. Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component
   b. Severe immunodeficiency
   c. Pregnancy
   d. Family history of altered immunocompetence, unless verified clinically or by laboratory testing as immunocompetent

   Precautions to the vaccine:
   a. Recent (≤11 months) receipt of antibody-containing blood product (specific interval depends on product)
   b. Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination (avoid use of these antiviral drugs for 14 days after vaccination)
   c. Use of aspirin or aspirin-containing products
   d. Moderate or severe acute illness with or without fever
   e. If using MMRV, see MMR/MMRV for additional precautions

3. Determination of Susceptibility: Contacts with a positive disease history are considered immune. Assume those with a negative or unknown history are susceptible. Test serologically for immunity promptly if considering VariZIG instead of varicella vaccine. The criteria below provide evidence of immunity to varicella for the purposes of a contact investigation:

a. Documentation of age-appropriate varicella vaccination (preschool-aged children (i.e., ≥12 months of age): 1 dose; school-aged children, adolescents, and adults: 2 doses); or
b. Laboratory evidence of immunity; or
c. Prior laboratory confirmation of disease; or
d. U.S. birth before 1980 (this should not be considered evidence of immunity for healthcare personnel, immunocompromised persons, pregnant women, and persons born outside the U.S.); or
e. Prior healthcare provider diagnosis or verification of a history of varicella or shingles.

4. Contacts In Health Facilities:
   a. Interview exposed patients and staff about prior varicella disease to determine susceptibility. See above.
   b. Susceptible exposed patients should be discharged, isolated, or cohorted for the same time-period. Only immune staff should care for these patients. Give exposed, susceptible patients who are immunosuppressed VariZIG, if it can be administered within 10 days of first exposure.
   c. Susceptible exposed employees involved in the care of high-risk patients should not work from the 8th through the 21st day after exposure, even if varicella vaccine is given. If VariZIG was given to an employee, he/she should remain off work from days 8-28 after exposure.

5. Contacts in Non-Healthcare Settings: Contacts for whom varicella vaccine is indicated must be <19 years of age to receive DPH-supplied vaccine. Those ≥19 for whom VariZIG is not appropriate should be referred to their medical provider for varicella vaccine.

OUTBREAK DEFINITION

In general, the threshold for a community outbreak investigation should be 3 or more cases related in place within a 3-week period. In the presence of nosocomial varicella or known or suspected concurrent streptococcal infections, or among populations at high risk for complications (e.g., immunocompromised, or susceptible adolescents or adults), the threshold for response could be 1 or 2 cases.

INVESTIGATION AND CONTROL OF SCHOOL OUTBREAKS OF VARICELLA (3 OR MORE CASES)

Exposure Notification Letters
- Exposed (Healthcare staff and non-healthcare) to Varicella Notification
- FACILITY (Healthcare and non-healthcare) notification of Varicella Exposure
- Unexposed to Varicella Notification
- End of Varicella Situation

1. Identify and exclude all acute chickenpox cases from school until all lesions have crusted over (usually 5 days for unvaccinated persons). Vaccinated persons with varicella may develop macules and papules only; these persons are no longer contagious when the macules and papules have faded. Skin lesions can be in the process of resolving but do not need to be completely resolved.

2. Identify persons that have had close contact with the case or cases during the time period of two days before, to five days after case had rash onset. Close contact is defined as direct physical or face-to-face contact, or one or more hours of room contact with an infectious person.

3. Identify susceptible persons among the close contacts. Also, identify susceptible close contacts that are at high risk for serious disease or complications if they get varicella and recommend VariZIG for these persons if it can be given within 10 days of first exposure to the varicella case. (For definition of high-risk, see item 5 under **PREVENTION-EDUCATION section of this document**.)

4. For grades where students are of the age to have been covered by the California school varicella vaccination entry requirement implemented on July 1, 2001, and after consultation with VPDC surveillance staff,

exclude all high-risk susceptible persons (immunocompromised persons, newborns, pregnant persons), as soon as a single probable or confirmed case of varicella is identified. These students should be excluded from the start of the outbreak for up to 21 days after the onset of the last case. Previously unvaccinated persons who are vaccinated during an outbreak may return to school two weeks after receipt of one dose of chickenpox vaccine if they have not become ill with chickenpox due to exposure. Such students would still need to receive the second dose of vaccine to comply with current varicella vaccine recommendations. CDPH does not generally recommend excluding healthy students without evidence of varicella immunity from school during an outbreak.

5. As soon as an outbreak is identified, advise the school to send out notification letters to parents and staff informing them about the outbreak. The letter should recommend varicella vaccination for susceptible persons who do not have contraindications to the vaccine as soon as possible (includes a second vaccination for children who did not receive the second dose of varicella vaccine — see item 2 in **"CONTACTS"** section of this document). The letter should also inform all high-risk persons to consult with their health care provider about the chickenpox exposure (pregnant women should inform their prenatal care provider as soon as possible). Based on patterns of transmission, it may only be necessary to notify parents and staff of children in the same classroom where the exposure occurred; however, in other instances it may also be reasonable to notify persons in groups such as the band or sports team with which the case participates. If there is documented transmission among several grade levels, it may even be necessary to notify the entire school. **Templates of notification letters regarding exposures (for schools or other facilities) are available from the VPDC.**

6. **Surveillance Period:** District public health nursing should continue to follow the outbreak and provide weekly updates to VPDC surveillance staff until there have been no new cases for 21 days from the last communicable day of the last case. Notify VPDC surveillance staff by phone when the outbreak has been closed.

7. When the outbreak is closed, complete the outbreak investigation form VARICELLA (CHICKENPOX) HOSPITALIZED CASE REPORT (CDPH 8299), obtain necessary review and approval by SPA medical director, and forward to the Morbidity Central Reporting Unit.

8. District public health nursing should notify the VPDC surveillance staff of any outbreak reports or 1-2 cases among high-risk populations reported directly to the district by the facility.

Note: For outbreaks involving Los Angeles Unified School District (LAUSD) schools, work with the LAUSD nursing services office when initiating the investigation and when conducting follow-up activities.

PREVENTION-EDUCATION

1. Children entering kindergarten, as well as children 18 months and older entering or already in childcare are required to show proof of vaccination or physician documentation of prior varicella disease, as of July 1, 2001.

2. Keep fingernails short and control scratching of lesions.

3. Alert patient to possible complications: viral pneumonia, encephalitis, secondary infections, Reye syndrome.

4. Children with varicella should **not** receive aspirin or medication containing salicylate, which is associated with development of Reye syndrome.

5. Greatest risk for complications is for immunocompromised persons (e.g., those with leukemia, cancer, HIV/AIDS, etc.), as well as those on steroids or other immunosuppressive drugs.

6. Disinfect fomites soiled with discharges of nose, throat, and lesions.

7. VZV vaccine was licensed in 1995 in the USA for use in healthy children (>12 months) and most adults. This vaccine should not be used to immunize women who are pregnant or who intend to become pregnant within one month. If pregnant woman is inadvertently immunized call the Varicella Vaccination in Pregnancy registry (1-800-986-8999).

DIAGNOSTIC PROCEDURES

Vesicular or maculopapular lesions or scabs are the preferred method for laboratory confirmation of varicella. Laboratory diagnosis of varicella is not routinely required. However, consider varicella when confirming outbreaks, especially if previously vaccinated cases are experiencing breakthrough disease. In addition, confirmation of hospitalized and fatal varicella cases is required to rule out the rare possibility of smallpox; see chapter on SMALLPOX. Serological testing is helpful in confirming current or past disease, or susceptibility to future disease. Clinical and epidemiological history is required to aid the laboratory in test selections. **See Appendix for Specimen Collection Tubes.**

A. Polymerase Chain Reaction (PCR)

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. Cerebrospinal fluid testing is also acceptable in cases with neurological symptoms.

Specimen Collection Methods: Video

VESICULAR, MACULOPAPULAR & SCABS

Laboratory Form: VZV PCR Test Requisition and Report Form H-3021

Container: Store swabs from vesicular, maculopapular lesions and scabs in a Universal Viral Transport medium.

Storage: Refrigerate specimens at (2-8°C). Transport refrigerated on cold packs to the laboratory as soon as possible within 48 hours. **Do NOT freeze any specimens.**

Vesicular lesions:

1. Use a sterile polyester swab (Do NOT use **calcium alginate or wooden stems swabs)** to vigorously wipe the base of the lesion to collect vesicular fluid. The base of the lesion usually contains virus.
2. Apply enough pressure to collect epithelial cells without causing bleeding.
3. When multiple swabs from the same patient are collected place each swab in a separate viral transport media to avoid cross-contamination.
4. Label tubes individually and ensure they are resistant to breakage.

***Maculopapular lesions:* Glass Slide**

1. Rake the edge of the slide over the selected lesion, abrading the lesion with sufficient vigor to ensure that skin cells are gathered onto the slide.
2. Use a sterile polyester swab to scrub the abraded lesion and (using the same swab) collect the material collected on the edge of the slide.
   a. **Important:** If more than one lesion is sampled, use a separate swab for each one.
   b. With young children: It may be less stressful for them if you ask them to help with this.
3. Insert the swab into a viral transport media and close it.
4. The swab for each sampled lesion must be placed in a separate swab tube.

Scabs

1. Use a glass slide to lift scabs off the skin.
2. Transfer directly to a viral transport media

B. Serology for diagnosis: Paired acute and convalescent sera (IgG).

Note: IgM 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.

Laboratory Form: Test Requisition and Report Form H-3021

Examination Requested: Under IMMUNOSEROLOGY/VIROLOGY select "Varicella IgG Antibody"

Container: Red or gold top serum separator vacutainer tube, a red-gray top vacutainer tube.

Material: Whole clotted blood.

Amount: 8-10 ml.

Storage: Refrigerate at 2-8°C. Ship on cold packs within 2 days of sample collection.

Remarks: Collect first blood specimen as early as possible. Collect the second approximately 2 weeks after the first. Send each specimen as it is collected. Do not store.

C. Serology to Determine Immunity Status: Submit single blood specimen as outlined above for IgG testing.

D. Microscopy (Smear): When doing smear of lesion(s), collect swab for culture at the same time. This test is less specific and sensitive than PCR testing. More rapid and sensitive than culture.

Laboratory Form: Test Requisition and Report Form H-3021

Examination Requested: VZV Direct fluorescent antibody (DFA).

Container: Two clean slides in a holder.

Material: Cellular material from base of lesions. Use sterile cotton swab (viral culturette) to break open early-stage vesicles (before crusting state), absorb fluid, and scrape cells from the base of the lesion. Spread material evenly onto clean slides in circular areas about the size of a dime. Make at least 1 slide with 2 smears—2 slides if possible. Air-dry and submit in closed slide container, then place swab back into culturette for culture (see below).

Storage: Ambient temperature.

E. Culture: This test is less specific and sensitive than PCR testing. The length of time to receive results is 14 business days.

Laboratory Form: Test Requisition and Report Form H-3021

Examination Requested: VZV Culture.

Container: Viral transport medium or universal transport medium

Material: Vesicle fluid, Eye swab, corneal scrapings, throat swab, throat washings, rectal swab. Please refer to page 235 in the PHL Test Catalog for these specimens:

Eye swab or corneal scraping: swab the inflamed conjunctiva or corneal lesions.

Throat swab or washings: swab the affected area or have patient gargle with sterile buffered saline.

Rectal swab: insert swab into the rectum.

Storage: Keep refrigerated at 2-8 °C. Transport to the laboratory within 48 hours. Ship on cold packs. Do not freeze any specimen when the clinical background suggests VZV.

APPENDIX

Test	Specimen Collection Tube
Varicella zoster virus (VZV) IgG Specimen: Blood to test Immunity	Red or gold-top SST® 
(VZV) Viral Culture and Identification Specimens: Vesicle fluid, eye swab, corneal scrapings, throat swab, throat washings, rectal swab, feces, CSF, biopsy or autopsy tissue; urine, body fluids, blood	Universal Viral Transport Media