POLIOVIRUS INFECTION

1. **Agent**: Poliovirus, an enterovirus with antigenic types 1, 2, and 3. Type 1 is most often the etiologic agent in paralytic illnesses, type 3 less so and type 2 least commonly. Type 1 most frequently causes epidemics. Most vaccine-associated cases are due to type 2 or 3. The last case of poliovirus infection caused by wild poliovirus in the Americas was reported in 1991 from Peru.

2. **Identification**:

   a. **Symptoms**: Acute viral illness, severity ranging from asymptomatic to paralytic disease. Most people who get infected with poliovirus will not have any visible symptoms. About 1 out of 4 people with poliovirus infection will have flu-like symptoms that can include: sore throat, fever, headache, nausea and vomiting, tiredness, and stomach pain. A smaller proportion of people with poliovirus infection will develop meningitis or acute flaccid paralysis. Paralysis typically affects the spine resulting in flaccid, asymmetric, and most commonly affecting the lower extremities. Case fatality ratio for spinal paralytic cases is 2%-10% in epidemics and increases with age. Paralysis usually progresses within 2-3 days and is often permanent. Less commonly, patients can have bulbar polio with weakness of facial, oropharyngeal and respiratory muscles, which can have a much higher case fatality ratio of 25-75%. Non-paralytic poliovirus infection can present as aseptic meningitis, also common in other enterovirus infections.

   b. **Differential Diagnosis**: Other types of aseptic meningitis, bacterial meningitis, tuberculous or fungal meningitis, brain abscess, leptospirosis, lymphocytic meningitis, encephalitis due to infectious or toxic agents, tick paralysis. Guillain-Barrè syndrome may initially resemble poliovirus infection as can West Nile Virus neurological disease. Other enteroviruses can cause acute flaccid paralysis simulating paralytic poliovirus infection.

   c. **Diagnosis**: Isolation of poliovirus from stool or pharynx early in the course of the disease is presumptive evidence of poliovirus infection. Two stool specimens collected ≥24 hours apart as early as possible in illness (ideally within 14 days of onset), throat/respiratory specimens, and CSF as clinically indicated are recommended to increase probability of poliovirus isolation. Serology is also useful. Recipients of oral live- attenuated polio vaccine (OPV) can excrete virus in feces for several weeks; however, OPV is no longer commercially available in the U.S. Isolation of virus in CSF, when accomplished, is diagnostic of CNS disease. CSF shows excess cells; lymphocytes predominate. Neutralizing and complement-fixing antibodies appear during the first two weeks of illness.

3. **Incubation**: Range 3-6 days for abortive polio (non-specific febrile illness)—typically 7-21 days for paralytic polio, but occasionally as short as 4 days.

4. **Reservoir**: Humans, most frequently in-apparent cases, especially children.

5. **Source**: Pharyngeal secretions; feces of infected persons.

6. **Transmission**: Humans are the only known reservoir of poliovirus. Poliovirus is very contagious and spreads through person-to-person fecal-oral or oral-oral contact. Where sanitation is good, oral-oral, and respiratory may be more important than fecal-oral spread; it rarely occurs through milk and water where good sanitary conditions prevail. Transmission from mother to newborn has been reported.

Immunodeficient patients may excrete virus for prolonged periods. In temperate climates, poliovirus infections are most common in the summer and fall. An infected person can spread the virus to others immediately before and up to 2 weeks after symptoms appear. Infections typically peak in the summer months in temperate climates, but there is no seasonal pattern in tropical climates.

7. **Communicability**: Virus demonstrable in pharynx from 36 hours to approximately 1 week after exposure; in feces, from 72 hours to 6 weeks after exposure and occasionally for months. Infectivity is greatest 7-10 days before and after onset of symptoms.

8. **Specific Treatment**: Supportive.

9. **Immunity**: Type-specific of long duration.

REPORTING PROCEDURES

1. **Reportable**. *California Code of Regulations*, Section 2500. **Report case or suspected case within one working day of identification.**

2. **Report Form**: POLIOVIRUS INFECTION OR POLIOMYELITIS CASE REPORT (CDPH 8421)

   If vaccine-associated: VACCINE ADVERSE EVENT REPORTING SYSTEM (VAERS)

3. **Epidemiologic Data**:

   a. Clinical information: Date of onset of paralysis and weakness; signs, symptoms; sites of paralysis, degree and extent of involvement.

   b. Immunization history on case, household and other close contacts. Record if any contacts or case received oral polio vaccine less than or equal to 75 days before onset of case's symptoms. Record date, type of vaccine, and person or agency that administered each immunization. Include vaccine manufacturer and lot number if available.

   c. Travel history of case and close contacts and information on visitors during incubation period. Consider international travel or foreign visitors in a 30-day period before onset.

   d. History of contact with any known cases of polio and the date of contact, if applicable.

CONTROL OF CASE, CONTACTS & CARRIERS

Investigate on the day of report.

CASE:
Hospitalization at a facility capable of strict isolation is recommended. For patients suspected of excreting wild poliovirus, contact precautions are indicated for the duration of hospitalization or until three negative stool samples are collected on three consecutive days. Implement respiratory isolation for 7 days from onset.

Survivors of polio are susceptible to infection by the remaining antigenic types. These individuals should receive the appropriate polio immunization for their age

CONTACT:
Certain groups of individuals must be urgently traced and tested as they may have had contact with the exposed persons (or their stools) and therefore may also be at risk of polio virus infection or transmitting the virus:

- Household contacts: people who lived with the exposed person and shared a toilet during the infectious period. These people, particularly children and the unimmunized, are at greatest risk as they may have had contact with the potentially infected person prior to the detection of the virus. Sexual contacts should be considered as a similar risk. Identify family, playmates, relatives, babysitters, day-care center staff and large group contacts.
- Toilet contacts: other people (non-household contacts) who shared a toilet with the exposed person during the infectious period, before the toilet was cleaned or disinfected, such as those

sharing a toilet at the workplace and visitors to the home. These are especially relevant when the isolation of the exposed individual is delayed.

- Food consumer contacts: people who ate food prepared by the polio virus-exposed person.
- Facility first-aid workers or first responders: individuals who rendered assistance to the exposed person, without using PPE. Any personnel directly exposed should be regarded as potentially infected exposed persons and managed accordingly.
- Health care workers: individuals who cared for the exposed person during the
infectious period.
- Sewerage workers: although at very low risk, individuals who may also need to be considered in situations of proven infection, where a PV2-infected person was excreting into the general sewerage system prior to isolation and collection and incineration/inactivation of stools.
- Restrictions only if symptomatic—then treat as case.
- Un-immunized children who are contacts to a polio case should receive the number of doses of enhanced potency inactivated polio vaccine (IPV) required to complete the immunization series for their age. School-aged children and adolescents who completed a primary series in the past can be given an additional dose of IPV to further decrease their already very small risk of becoming infected. Unvaccinated adults (including adults without a written record of vaccination) should receive the 3 dose primary series. Incompletely immunized adults who previously received less than a full primary series of OPV or IPV should receive the remaining required doses of IPV regardless of the interval since the last dose and the type of vaccine that was received. Adults who previously completed a primary immunization series against polio can receive a single dose of IPV. See the AAFP's polio vaccination recommendations for specific groups.

IMMUNIZATIONS:

Oral Polio Virus (OPV):

OPV is not currently commercially available in the United States. However, this vaccine is still recommended for control of polio outbreaks—and the CDC stockpiles the vaccine for that purpose. With currently available OPV products, the live attenuated polioviruses replicate in the intestinal mucosa, and vaccine viruses are excreted in the stool of the vaccinated person for up to 6 weeks. Persons in contact with fecal materials may then become infected. Replication of OPV may lead to vaccine associated paralytic polio (VAPP) in one of 2-3 million doses administered. In 2016, all OPV- using countries switched from tri-valent to bi- valent OPV which only contains types 1 and 3 polioviruses. Of note, in California, OPV doses administered on or after April 1, 2016, are not considered valid toward meeting school immunization requirements. Any outbreaks of polio (transmission from even one case) must be managed in consultation with the Vaccine Preventable Disease Control Program.

Inactivated Polio Virus (IPV):

Since 1996, the United States has transitioned to use of IPV to reduce the occurrence of VAPP, with the exclusive use of IPV since 1999.

1. IPV is recommended for routine use in the USA. All children should receive four doses of IPV at ages 2, 4, and 6-18 months and 4-6 years.
2. Adults aged ≥18 years who are known or suspected to be unvaccinated or incompletely vaccinated against polio should complete a primary polio vaccination series with IPV. Fully vaccinated adults at increased risk for poliovirus exposure may receive a single lifetime booster dose of IPV.

Persons at Increased Risk for Poliovirus Exposure:

- Travelers to areas or countries where polio is endemic or epidemic
- Laboratory and health care workers who handle specimens that might contain polioviruses
- Laboratory workers with polio risk should have

protective titer (1:8). Health care workers or other caregivers who have close contact with patients in a community with a polio outbreak
- Other adults who are identified by public health authorities as being part of a group or population at increased risk for exposure to poliovirus because of an outbreak

Before traveling to areas where wild poliovirus is still circulating, all travelers should ensure that they have completed the recommended age-appropriate polio vaccine series and received a booster dose, if necessary. Additionally, travelers should be aware that in 2014, the World Health Organization implemented temporary polio vaccination requirements affecting the following countries: Afghanistan, Cameroon, Equatorial Guinea, Ethiopia, Iraq, Israel, Nigeria, Pakistan, Somalia, and Syria. Long-term travelers (staying > 4 weeks) to these countries may be required to show proof of polio vaccination when departing these countries between 4 weeks and 12 months before the date of departure. Travel vaccination requirements and recommendations for polio-affected countries are subject to change; consult current World Health Organization guidance and applicable CDPH guidance at the time of evaluation.

California law requires exclusion from school if conditions for admission are not fulfilled or if a pupil who is not completely immunized is exposed to polio case. See *California Code of Regulations*, Title 17.

DIAGNOSTIC PROCEDURES

Clinical and epidemiological histories are required to aid the laboratory in test selections.

1. **Serology**: Paired sera required. Collect 2-3 weeks apart. Collect baseline serum at onset or day of exposure and second specimen 2-3 weeks after.

   Container: Serum separator tube. If possible, centrifuge to separate serum as soon as possible after collection.

   Laboratory Form: Test Requisition and Report Form H-3021

   Examination Requested: Enter "Polio Serology" in Title 17/OTHER (SPECIFY)

   Material: Serum, 8-10 ml.

   Storage: Refrigerate.

   Remarks: Specimens should be obtained from all patients with paralytic disease suspected to be caused by poliovirus. Collect first blood specimen as early as possible. Collect the second approximately 3 weeks after the first. Send each specimen as it is collected. Do not store.

2. **Culture**: Molecular testing is the preferred method for diagnosis of enteroviruses, mimicking polio. Stool specimen and throat swab required. For paralytic cases, CSF recommended.

   Container: Collect stool specimens in a sterile, wide-mouth, screw-capped vial; Collect throat swabs in viral transport media. CSF is collected in sterile tube.

   Laboratory Form: Test Requisition and Report Form H-3021

   Examination Requested: Enter "Enterovirus/Polio PCR" in Title 17/OTHER (SPECIFY)

   Material: 10-20 g of stool (no preservative), throat swab in viral transport media, CSF in sterile tube (no preservative). Collect daily stool specimens and throat swabs (using flocked swab) as early as possible in the course of the disease for at least 7 days Ideally specimens are collected within 14 days of onset of paralytic disease. Specimens are also collected for polio virus exposed persons, contacts, or cases of laboratory exposure.

   Storage: Keep refrigerated and deliver to the Public Health Laboratory as soon as possible. Specimens must be delivered to the laboratory within 24 hours of collection.