

Chapter 9: Mumps

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Disease Description

Mumps is an acute viral illness caused by a paramyxovirus. The classic symptom is parotitis, a swelling of one or more of the salivary glands.¹ Nonspecific symptoms, including myalgia, anorexia, malaise, headache, and low-grade fever, may precede parotitis by several days. As many as 20–40% of infections are asymptomatic and nearly 50% are associated with nonspecific or primarily respiratory symptoms,^{2–5} particularly among children less than 5 years of age.^{6,7} Hence, the diagnosis may be easily missed. On average, infection occurs between 16–18 days after exposure to the mumps virus (incubation period range: 12–25 days).⁸

Fever may persist for 3–4 days, and parotitis, when present, usually lasts 7–10 days. Persons with mumps are considered most infectious from 1–2 days before until 5 days after onset of parotitis.⁵ However, mumps virus has been isolated from saliva from 7 days before until 8 days after symptom onset.^{9,10}

Severe complications of mumps are rare. However, mumps is a major cause of sensorineural deafness in children; deafness may be sudden in onset, bilateral, and permanent. Mumps-associated encephalitis occurs in 0.02–0.3% of cases, of which approximately 1% of encephalitis cases are fatal.⁹

Many complications of mumps, such as meningoencephalitis, are known to occur more frequently among adults than among children. Orchitis occurs in up to 37% of cases in postpubertal males; although it is frequently bilateral, it rarely causes sterility. Oophoritis and mastitis have also been reported in approximately 5% and 31% of cases, respectively, in postpubertal female patients. Pancreatitis has also been reported as a rare complication of mumps.⁹

Permanent sequelae such as paralysis, seizures, cranial nerve palsies, aqueductal stenosis, and hydrocephalus are rare, as are deaths due to mumps. Although some data suggest that mumps infection in the first trimester of pregnancy is associated with an increased rate of spontaneous abortion, there is no evidence that mumps during pregnancy causes congenital malformations.⁹

Not all cases of parotitis—especially sporadic ones—are due to mumps infection. Parotitis can be caused by parainfluenza virus types 1 and 3, Epstein Barr virus, influenza A virus, Coxsackie A virus, echovirus, lymphocytic choriomeningitis virus, human immunodeficiency virus, and noninfectious causes such as drugs, tumors, immunologic diseases, and obstruction of the salivary duct. However, other causes do not produce parotitis on an epidemic scale.¹¹

Background

Mumps vaccine was licensed in the United States in 1967. The Advisory Committee on Immunization Practices (ACIP) made an official recommendation for one dose of mumps vaccine for all children at any age after 12 months in 1977. In 1989, children began receiving two doses of mumps vaccine because of the implementation of a two-dose measles vaccination policy using the combined measles, mumps, and rubella (MMR) vaccine.¹²

Following mumps vaccine licensure, reported mumps decreased steadily from 152,209 cases in 1968 to 2,982 in 1985. During 1986–1987, a resurgence occurred with more than 20,000 reported mumps cases. The primary cause of this resurgence was low vaccination levels among adolescents and young adults.¹³ In the late 1980s and during the 1990s, outbreaks were reported among highly vaccinated populations.^{14–16} By 2003, only 231 mumps cases were reported, the lowest annual number since reporting began. However, in 2006, another resurgence occurred, with 6,584 reported cases. The incidence was highest among persons aged 18–24 years, many of whom were college students. Approximately 63% of all case-patients with known vaccination status in the main outbreak states had received two doses of MMR vaccine.¹⁷ Since the 2006

outbreak, the number of annual cases has declined; 800 cases were reported in 2007, 454 cases were reported in 2008, and 938 cases were reported through December 19, 2009, including an outbreak in the latter part of 2009 that comprised 586 of the reported cases for the year (2009 data are provisional).¹⁸

Cases of mumps imported into the United States will likely persist as long as mumps continues to be endemic globally. Mumps vaccine is routinely used in 57% of countries in the world.¹⁹

Importance of Rapid Case Identification

Identification of suspected or confirmed cases of mumps is important in the initiation of control measures to prevent the spread of the disease among persons who do not have presumptive evidence of immunity.

Importance of Surveillance

Information obtained through surveillance is used to follow disease trends in the population, to assess progress towards disease reduction goals, and to characterize populations requiring additional disease control measures.

Disease Reduction Goals

The 338 reported cases of mumps in 2000 met the Healthy People 2000 reduction goal of fewer than 500 cases. Subsequently, a goal of elimination of indigenous mumps by the year 2010 was made.²⁰ However, a major resurgence in mumps in 2006 highlighted the challenges of obtaining this goal. Mumps is endemic throughout the world, and achieving elimination is difficult in a context where the mumps virus continues to be imported. In addition, the current two-dose vaccination program has a vaccine effectiveness of only 76–95%.²¹

Case Definition

The following case definition for mumps was approved by the Council of State and Territorial Epidemiologists (CSTE) in 2008.²²

Clinical case definition

An illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid and/or other salivary gland(s), lasting at least 2 days, and without other apparent cause.

Clinically compatible illness

Infection with mumps virus may present as aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, parotitis or other salivary gland swelling, mastitis or pancreatitis.

Laboratory criteria

- Isolation of mumps virus from clinical specimen, or
- Detection of mumps nucleic acid (e.g., standard or real time RT-PCR assays), or
- Detection of mumps IgM antibody, or
- Demonstration of specific mumps antibody response in absence of recent vaccination, either a fourfold increase in IgG titer as measured by quantitative assays, or a seroconversion from negative to positive using a standard serologic assay of paired acute and convalescent serum specimens.

Case classification

Suspected: A case with clinically compatible illness or meets the clinical case definition without laboratory testing, or a case with laboratory tests suggestive of mumps without clinical information.

Probable: A case that meets the clinical case definition without laboratory confirmation and is epidemiologically linked to a clinically compatible case.

Confirmed: A case that a) meets the clinical case definition or has clinically compatible illness and b) is either laboratory confirmed or is epidemiologically linked to a confirmed case.

Case classification for import status

Internationally imported case: a case in which mumps results from exposure to mumps virus outside the United States as evidenced by at least some of the exposure period (12–25 days before onset of parotitis or other mumps-associated complications) occurring outside the United States and the onset of parotitis or other mumps-associated complications within 25 days of entering the United States with no known exposure to mumps in the U.S. during that time. All other cases are considered U.S.-acquired cases.

U.S.-acquired case: a case in which the patient had not been outside the United States during the 25 days before onset of parotitis or other mumps-associated complications or was known to have been exposed to mumps within the United States.

U.S.-acquired cases are sub-classified into four mutually exclusive groups

Import-linked case: Any case in a chain of transmission that is epidemiologically linked to an internationally imported case.

Imported-virus case: A case for which an epidemiologic link to an internationally imported case was not identified but for which viral genetic evidence indicates an imported mumps genotype (i.e., transmission of the genotype has not been occurring in the United States for ≥ 12 months).

Endemic case: A case for which epidemiological or virological evidence indicates that a chain of mumps virus transmission has been continuously occurring for ≥ 12 months within the United States (i.e., endemic transmission). An endemic genotype is the genotype of any mumps virus that occurs in a chain of transmission lasting ≥ 12 months. Any genotype that is found repeatedly in U.S.-acquired cases should be thoroughly investigated as a potential endemic genotype, especially if the cases are closely related in time or location.

Unknown source case: A case for which an epidemiological or virological link to importation or to endemic transmission within the U.S. cannot be established after a thorough investigation. These cases must be carefully assessed epidemiologically to assure that they do not represent a sustained U.S.-acquired chain of transmission or an endemic chain of transmission within the U.S.

Note 1: Internationally imported, import-linked, and imported-virus cases are considered collectively to be import-associated cases.

Note 2: Currently, there is insufficient information to determine whether any mumps strains are endemic to the United States or to distinguish endemic from non-endemic strains.

Note 3: States may also choose to classify cases as “out-of-state-imported” when imported from another state in the United States. For national reporting, however, cases will be classified as either internationally imported or U.S.-acquired.

Laboratory Testing

If mumps is suspected, laboratory testing should be performed. Acute mumps infection can be laboratory confirmed by the presence of serum mumps IgM, a significant rise in IgG antibody titer in acute- and convalescent-phase serum specimens, positive mumps virus culture, or detection of virus by reverse transcriptase polymerase chain reaction (RT-PCR). However, laboratory-confirming the diagnosis of mumps in highly vaccinated populations may be challenging: serologic tests should be interpreted with caution because false negative results in vaccinated persons (i.e., a negative serologic test in a person with true mumps) are common. These challenges are discussed below.

Serologic testing

The serologic tests available for laboratory confirmation of mumps acute infection and immunity vary among laboratories. The state health department can provide guidance regarding available laboratory services.

- At the initial visit, a serum specimen should be obtained to test for mumps IgM antibodies.
- If the acute-phase specimen is positive for IgM, a second specimen is not necessary. If the acute-phase IgM result is negative, a second (convalescent) serum specimen could be collected 2–3 weeks after the onset of symptoms.
- The paired serum specimens may also be used to demonstrate a fourfold increase in IgG titer or a seroconversion from negative to positive from acute to convalescent, which is considered a positive diagnostic result for mumps. Prior immunologic experience with mumps, either from childhood disease or from vaccination, may be documented by the presence of serum IgG mumps-specific antibodies in the acute-phase specimen.

Tests for IgM antibody Enzyme immunoassay (EIA) is a highly specific test for diagnosing acute mumps infection. At the direction of the state health department, healthcare providers and state and local health departments may send serum specimens from suspected mumps cases to the CDC Measles, Mumps, Rubella, and Herpes Laboratory Branch for IgM detection by EIA. See “Specimen collection and management” section below.

Immunofluorescence assays (IFA) have the advantage of being relatively inexpensive and simple. The reading of IFA-IgM tests requires considerable skill and experience since nonspecific staining may cause false-positive readings.

Note: Commercially available EIA kits and IFA antibody assays for detection of mumps IgM are not currently FDA-approved. Therefore, each laboratory must validate these tests independently.

Timing of the IgM response in mumps

- **Unvaccinated persons:** IgM antibody is detectable within 5 days after onset of symptoms, reaches a maximum level about a week after onset, and remains elevated for several weeks or months^{23, 24}.
- **Vaccinated Persons:** The timing of the IgM response to mumps infection in vaccinated persons is highly variable.²⁵ The IgM response may be absent or short lived, and false-positive and false-negative results are possible with IgM tests.

Tests for IgG antibody

IgG tests can be performed in the state laboratory or at CDC. A variety of tests for IgG antibodies to mumps are available and include EIA, IFA, and plaque reduction neutralization. The specific criteria for documenting an increase in titer depend on the test.

IgG testing for laboratory confirmation of mumps requires the demonstration of seroconversion from negative to positive by EIA or a fourfold rise in the titer of antibody against mumps as measured in plaque-reduction neutralization assays or similar quantitative assays. The tests for IgG antibody should be conducted on both acute- and convalescent-phase specimens at the same time. The same type of test should be used on both specimens. EIA values are not titers, and increases in EIA values do not directly correspond to titer rises.

- **Unvaccinated persons:** In unvaccinated persons, IgG antibody increases rapidly after onset of symptoms and is long-lasting.
- **Vaccinated Persons:** Among vaccinated persons, the IgG may already be quite elevated in the acute-phase blood sample, which may prevent a fourfold rise in IgG titer in the convalescent serum specimen.

Molecular typing is recommended because it provides important epidemiologic information.

Virus detection (RT-PCR and culture)

Mumps virus can be detected from fluid collected from the parotid duct, other affected salivary gland ducts, the throat, from urine, and from cerebrospinal fluid (CSF). Parotid duct swabs yield the best viral sample. This is particularly true when the salivary gland area is massaged approximately 30 seconds prior to swabbing the buccal/parotid duct, so that the specimen contains the secretions from the parotid or other salivary duct glands. Efforts should be made to obtain the specimen as soon as possible after onset of parotitis or meningitis. Clinical specimens should ideally be obtained within 3 days and not more than 10 days after parotitis onset.

Successful virus isolation should always be confirmed by immunofluorescence with a mumps-specific monoclonal antibody or by molecular techniques. Molecular techniques such as RT-PCR can also be used to detect mumps RNA directly for mumps confirmation in appropriately collected specimens.

Urine samples are not preferred, as they are less likely than oral specimens to contain sufficient virus copies or virus-infected cells for culture or detection by molecular methods.

Molecular typing is recommended because it provides important epidemiologic information. Molecular epidemiologic surveillance, (i.e., genotyping of virus) allows the building of a sequence database that will help track transmission pathways of mumps strains circulating in the United States. In addition, genotyping methods are available to distinguish wild-type mumps virus from vaccine virus.

- **Unvaccinated persons:** Virus may be isolated from the buccal mucosa from 7 days before until 8 days after salivary enlargement. Maximal viral shedding, however, generally occurs just prior to and within the first 3 days of parotitis onset.
- **Vaccinated Persons:** Emphasis should be placed on obtaining mumps clinical specimens from buccal mucosa within 1 to 3 days after onset of symptoms (usually parotitis), otherwise viral detection in RT-PCR or culture may have low yield.

In the case of specimens for virus culture or PCR assay, immediately place specimens in a cold storage container and transport to the laboratory.

Specimen collection and management

Specific instructions for specimen collection and shipping may be obtained from the CDC mumps website at: [<http://www.cdc.gov/mumps/clinical/ga-specimen-collect.html>]²⁶ or by contacting the CDC MMR and Herpes Virus Laboratory Branch at 404-639-1156 or 404-639-3512. Specimens for virus isolation and genotyping should be sent to CDC as directed by the state health department.

For additional information on use of laboratory testing for surveillance of vaccine-preventable diseases, see [Chapter 22](#), “Laboratory Support for the Surveillance of Vaccine-Preventable Diseases.”

Reporting

Each state and U.S. territory has regulations or laws governing the reporting of diseases and conditions of public health importance.²⁷ These regulations and laws list the diseases that are to be reported and describe those persons or groups responsible for reporting, such as healthcare providers, hospitals, schools, laboratories, daycare and childcare facilities, and other institutions. Persons reporting these conditions should contact their state health department for state-specific reporting requirements.

Reporting to CDC

A provisional report of probable and confirmed cases should be sent by the state health department to CDC via the National Notifiable Diseases Surveillance System (NNDSS). Electronic reporting of case records should not be delayed because of incomplete information

or lack of confirmation. Following completion of case investigations, case records should be updated with any new information and resubmitted to CDC. Final laboratory results may not be available for the initial report but should be submitted via NNDSS when available.

Information to collect

The following data should be collected in the course of the case investigation. Additional information may be collected at the direction of the state health department.

- Demographic information
 - Name
 - Address
 - Date of birth
 - Age
 - Sex
 - Ethnicity
 - Race
 - Country of birth
 - Length of time in United States
 - Reporting source
 - County
 - Earliest date reported
- Clinical
 - Date of illness onset, especially parotitis
 - Duration of parotitis
 - Symptoms
 - Parotitis or other salivary gland involvement (pain, tenderness, swelling)
 - Other symptoms (e.g., headache, anorexia, fatigue, fever, body aches, stiff neck, difficulty in swallowing, nasal congestion, cough, earache, sore throat, nausea, abdominal pain)
 - Complications
 - Meningitis
 - Deafness (transient or permanent)
 - Encephalitis
 - Orchitis
 - Oophoritis
 - Mastitis
 - Pancreatitis
 - Other
 - Hospitalization, reason/association to mumps, duration of stay
 - Outcome (patient survived or died)
 - Date of death
 - Postmortem examination results
 - Death certificate diagnoses
- Treatment
 - Medications given
 - Duration
- Laboratory
 - Serology (IgM, IgG)
 - Virus detection (PCR, culture)
 - Specimen collection date(s)

- Vaccine information
 - Dates of mumps vaccination
 - Number of doses of vaccine given
 - Manufacturer of vaccine
 - Vaccine lot number
 - If not vaccinated, reason
- Epidemiologic
 - Epidemiologic linkages
 - Transmission setting (e.g., college, daycare, doctor's office)
 - Import status (e.g., internationally imported or U.S.-acquired). See Case Classification section above.
 - Location of exposure (country, if international import; state, if out-of-state import)
 - Travel history

Vaccination

Live attenuated mumps virus vaccine is incorporated with combined MMR vaccine. Monovalent mumps vaccine is no longer produced in the United States. For prevention of mumps, the current ACIP recommendations for routine vaccination for children indicate a first dose of MMR at 12–15 months of age and a second dose at 4–6 years of age (school entry).²⁸

For prevention of mumps, two doses of MMR vaccine are also recommended for adults at high risk, including international travelers, college students, or healthcare workers born during or after 1957.^{28,29} All other adults born during or after 1957 without other evidence of mumps immunity should be vaccinated with one dose of MMR vaccine.^{28,29} Vaccination recommendations for an outbreak setting are discussed in the “Outbreak Control” section later in this chapter.

Mumps vaccine effectiveness has been estimated at 73–91% for 1 dose and 76–95% for 2 doses.^{21,30–32}

Mumps vaccine is also now available as a combined measles, mumps, rubella and varicella (MMRV) vaccine. MMRV vaccine can be used for children aged 12 months through 12 years who need a first dose of MMR and varicella vaccine, or who need a second dose of MMR and either a first or second dose (as indicated) of varicella vaccine.³³

Note: The recommendations for use of measles, mumps, rubella and varicella (MMRV) vaccine have been updated.³³

For the first dose of measles, mumps, rubella, and varicella vaccines at ages 12 through 47 months, either MMR and varicella vaccines or MMRV vaccine can be used. Compared with use of MMR and varicella vaccines given separately at the same visit, use of MMRV vaccine results in one fewer injection but is associated with a higher risk for fever and febrile seizures 5 through 12 days after the first dose among children aged 12 through 23 months (about one extra febrile seizure for every 2,300–2,600 MMRV vaccine doses).³³ For the first dose of measles, mumps, rubella, and varicella vaccines at ages 48 months and older and for dose two at any age (15 months through 12 years), use of MMRV vaccine generally is preferred over separate injections of its equivalent component vaccines (i.e., MMR and varicella vaccines). Parents should consult with their child's physician to decide whether MMRV or MMR plus varicella vaccine given separately at the same visit should be administered.

Enhancing Surveillance

The activities listed below can help increase the number of suspected mumps cases that are reported and improve the comprehensiveness and quality of reports that are received. Additional guidelines for enhancing surveillance are given in [Chapter 19](#), “Enhancing Surveillance.”

Active surveillance for mumps should be conducted for every confirmed and probable mumps case, if possible.

Obtaining accurate and complete immunization histories

Vaccination histories may be obtained from schools (generally available for children attending licensed childcare centers or kindergarten through high school), medical providers, or immunization records provided by the case-patient. Immunization registries, if available, can also readily provide vaccination histories.

Laboratory testing

Laboratory testing should be performed. See “Laboratory Testing” Section earlier in the chapter. Consult with the state health department for guidance regarding available laboratory services.

Mumps specimens may also be sent to CDC for testing if this resource is needed.

Investigating contacts

Identifying all contacts (e.g., household, child care, and other close contacts) and following up with susceptible persons may reveal previously undiagnosed and unreported cases.

Promoting awareness

Healthcare personnel should be aware that mumps outbreaks have occurred in highly vaccinated populations (e.g., college students). Therefore, mumps should not be ruled out on the assumption that individuals are already immune because of vaccination.

Active surveillance

Active surveillance for mumps should be conducted for every confirmed and probable mumps case, if possible. For general information on improving surveillance of vaccine-preventable diseases, see [Chapter 19](#), “Enhancing Surveillance.”

Monitoring surveillance indicators

Regular monitoring of surveillance indicators can help identify specific areas of the surveillance and reporting system that need improvement. These indicators should be monitored:

- The proportion of confirmed cases reported to NNDSS with complete information (e.g., date of birth, onset date, clinical case definition, hospitalization, laboratory testing, vaccine history, date reported to health department, transmission setting, outbreak-related, and epidemiologic linkage)
- The interval between date of symptom onset and date of public health notification
- The proportion of confirmed cases that are laboratory confirmed
- The proportion of cases that have an imported source

Case Investigation

The Mumps Surveillance Worksheet (Appendix 10) may be used as a guideline to collect case information during a case investigation; the details are discussed below.

Establishing a diagnosis of mumps

Clinical diagnosis of mumps may be unreliable. Cases of suspected mumps should be laboratory confirmed; however, negative laboratory results among vaccinated persons do not necessarily rule out the diagnosis of mumps, particularly if there is an outbreak of parotitis. Case investigation and control activities at the household level should not be delayed pending the return of laboratory results. See “Case Definition” section above.

Obtaining accurate, complete immunization histories

Mumps case investigations should include complete immunization histories that are verified by documentation of administration of all doses. Verbal history of receipt of mumps vaccine is not considered adequate proof of vaccination. Some case-patients or their caregivers may have personal copies of immunization records available that include dates of administration; these are acceptable for reporting purposes.

Identifying the source of infection

Efforts should be made to identify the source of infection for every confirmed case of mumps. Case-patients should be asked about contact with other known patients. When no history of contact with a known case can be documented, opportunities for exposure to unknown cases should be sought. After determining when and where transmission likely occurred, investigative efforts should be directed to these locations. If this is a single, sporadic case, try to establish an epidemiological link.

Assessing potential transmission and identifying contacts

The potential for further transmission should be assessed. Contacts of the case-patient during the infectious period should be identified, assessed for immunity, and educated about signs and symptoms.

Obtaining specimens for virus detection

Efforts should be made to obtain clinical specimens (buccal cavity/parotid duct fluids, throat swabs, urine, or CSF) for viral isolation for all sporadic cases and at least some cases in each outbreak at the time of the initial investigation.

Note: The recommendations for isolation of persons with mumps in community settings have been updated.³⁴

CDC now recommends a 5-day period after onset of parotitis for a) isolation of persons with mumps in the community and for b) use of droplet precautions, in addition to standard precautions.

Outbreak Investigation

Rapid detection, investigation, and implementation of control measures may reduce the occurrence and magnitude of outbreaks.³⁵ The following are general guidelines for an outbreak investigation:

Tracking information collected

A line listing of cases on a spreadsheet allows for quick identification of known and unknown data and ensures that complete case investigations are done.

Identifying the population affected by the outbreak

As described above, every suspected case should be investigated thoroughly during an outbreak. In very large outbreaks, it may not be possible to investigate each reported case thoroughly.

Based on the findings of individual case investigations, the population affected by the outbreak should be characterized in terms of person (who is getting mumps and how many case-patients have had zero doses, one dose, or two doses of mumps-containing vaccine), place (where are the cases), and time (when did the outbreak start, and is it still going on). These essential data elements allow public health officials to determine the population at risk of infection (e.g., unvaccinated preschool-age children, high school students who have only received one dose of mumps vaccine, persons who visited the emergency department of Hospital A on a certain day), determine where transmission is occurring (e.g., child care centers, high schools, colleges, healthcare settings), and identify individuals who are at potential risk of infection (e.g., other unvaccinated preschool-age children, students attending other schools).

Enhancing surveillance for mumps

Local or state health departments should contact healthcare providers in outbreak areas to inform them of the outbreak and request reporting of any suspected cases. Active surveillance should be maintained for at least two incubation periods (50 days) following parotitis onset in the last case. Two incubation periods allow for the identification of transmission from subclinical infections or unrecognized cases.

Many of the activities outlined in the “Enhancing Surveillance” section earlier in this chapter are applicable in the outbreak setting. Previously unreported cases may be identified by reviewing laboratory records.

Outbreak Control

Initial preparation for control activities may need to be started before laboratory results are known, but are unlikely to be implemented until either the laboratory results are back or until at least two infected persons have a confirmed epidemiological link.

The main strategy for controlling a mumps outbreak is to define the at-risk population(s) and transmission setting(s), and to rapidly identify and vaccinate persons without presumptive evidence of immunity; or, if a contraindication exists, to exclude persons without presumptive evidence of immunity from the setting to prevent exposure and transmission. According to ACIP recommendations published in 2006, acceptable presumptive evidence of mumps immunity includes at least one of the following: a) written documentation of receipt of one or more doses of a mumps-containing vaccine administered on or after the first birthday for preschool-aged children and adults not at high risk, and two doses of mumps-containing vaccine for school-aged children and high risk adults (i.e., healthcare workers, international travelers, and students at post-high school educational institutions); b) laboratory evidence of immunity; c) birth before 1957; or d) documentation of physician-diagnosed mumps. Persons who do not meet the above criteria are considered susceptible.²⁹ Healthcare settings have slightly different criteria for acceptable presumptive evidence of immunity, and these criteria are detailed in the ‘Healthcare Personnel Acceptable Evidence of Immunity’ section below.

If susceptible persons can be vaccinated early in the course of an outbreak, they can be protected.

MMR vaccine should be administered to susceptible persons. Although MMR vaccination has not been shown to be effective in preventing mumps in persons already infected, it will prevent infection in those persons who are not infected. If susceptible persons can be vaccinated early in the course of an outbreak, they can be protected. However, because of the long incubation period for mumps, cases are expected to continue to occur for at least 3 weeks among newly vaccinated persons who may have been infected before vaccination.³⁶ As with all vaccines, some individuals will not gain immunity after receipt of mumps vaccine. Depending on the epidemiology of the outbreak (e.g., the age groups and/or institutions involved), a second dose of mumps-containing vaccine should be considered for children aged 1–4 years and adults who have received one dose previously.²⁹

In order to control mumps outbreaks in schools, students with zero doses of MMR vaccine and no other evidence of mumps immunity should be excluded from schools/colleges affected by a mumps outbreak or other unaffected schools that are deemed by local public health authorities to be at risk for transmission of disease.²⁸ Excluded students can be readmitted immediately after they are vaccinated. Students who have a history of one dose of MMR vaccination should be vaccinated and allowed to remain in school. Students who have been exempted from mumps vaccination for medical, religious, or other reasons should be excluded until the 26th day after the onset of parotitis in the last person with mumps in the affected school.²⁸

Healthcare Settings

Prevention and control strategies should be applied in all healthcare settings, including outpatient and long-term care facilities. These measures include:

1. assessment of presumptive evidence of immunity of healthcare personnel, including: documented administration of two doses of live mumps virus vaccine, laboratory evidence of immunity or laboratory-confirmation of disease, or born before 1957 (refer to next section, “Healthcare Personnel Acceptable Presumptive Evidence of Immunity” for footnotes)
2. vaccination of those without evidence of immunity
3. exclusion of healthcare personnel with active mumps illness as well as healthcare personnel who do not have presumptive evidence of immunity who are exposed to persons with mumps

4. isolation of patients in whom mumps is suspected, and
5. implementation of droplet precautions, in addition to standard precautions

An effective vaccination program is the best approach to prevent healthcare-associated mumps transmission. Healthcare facilities are encouraged to review employee immunization status for mumps and other vaccine preventable infections. Healthcare facilities should provide MMR vaccine to all personnel at no charge.

Note: The recommendations for isolation of persons with mumps in healthcare settings have been updated.

CDC now recommends a 5-day period after onset of parotitis for a) isolation of persons with mumps in healthcare settings and for b) use of droplet precautions, in addition to standard precautions.³⁶

Healthcare Personnel Acceptable Presumptive Evidence of Immunity

The presumptive evidence of immunity criteria for healthcare personnel differs slightly from the criteria for community settings. The following criteria should be followed to assess presumptive evidence of immunity among healthcare personnel.³⁷

1. Documentation of live mumps containing vaccination⁺⁺

⁺⁺ *The first dose should be administered on or after the first birthday; the second dose of mumps-containing vaccine should be administered no earlier than one month (i.e., a minimum of 28 days) after the first dose. Combined MMR vaccine should be used whenever any of its component vaccines is indicated.*

2. Born before 1957^{&.£.¥}

[&] *May vary depending on current state or local requirements.*

[£] *For unvaccinated personnel born before 1957 who lack laboratory evidence of mumps immunity or laboratory confirmation of disease, healthcare facilities should consider vaccinating personnel with two doses of MMR vaccine at the appropriate interval.*

[¥] *For unvaccinated personnel born before 1957 who lack laboratory evidence of mumps immunity or laboratory confirmation of disease, healthcare facilities should recommend two doses of MMR vaccine during an outbreak of mumps.*

Note: In the event that a nosocomial outbreak occurs, healthcare facilities should have a plan in place for the implementation of the 2-dose recommendation for all healthcare personnel, including those who were born before 1957 and lack laboratory evidence of immunity or laboratory confirmation of disease. Healthcare facilities may choose to proceed with appropriate assessment and vaccination of personnel born before 1957 before an outbreak occurs.

3. Laboratory evidence of immunity (i.e., positive mumps IgG) or laboratory confirmation of disease
 - Though there are no data that correlate levels of serum antibody with protection from disease, presence of mumps specific IgG antibodies can be considered evidence of mumps immunity. Routine serologic testing is not recommended for healthcare personnel but may be useful for evaluating personnel who have had unprotected exposure to mumps and do not have other proof of immunity. If serology is to be used to assess the immune status of healthcare personnel after an unprotected exposure, the test should be done as soon after the exposure as possible.
 - Results of serum antibody tests in vaccinated persons are difficult to interpret. In vaccinated persons, antibody levels are often lower than following natural infection, and commercially available tests may not detect such low antibody levels. As a result, post-vaccination serologic testing to verify an immune response to MMR or its component vaccines is not recommended. There are no data on the effect of additional (greater than two) doses of mumps vaccine on antibody levels or protection from disease.

Healthcare Personnel Exclusion

Receipt of MMR vaccine is not a reason to exclude personnel from work. Healthcare personnel with active mumps illness and those who are non-immune and have had unprotected exposures to mumps should be excluded from work. Unprotected exposures are defined as being within three feet of a patient with a diagnosis of mumps without the use of proper personal protective equipment (surgical mask). Irrespective of their immune status, all exposed healthcare personnel should report any signs or symptoms of illness during the incubation period, from 12 through 25 days after exposure.

Management of healthcare personnel with illness due to mumps

- A diagnosis of mumps should be considered in exposed healthcare personnel who develop non-specific respiratory infection symptoms during the incubation period after unprotected exposures to mumps, even in the absence of parotitis.
- Healthcare personnel with mumps illness should be excluded for 5 days after the onset of parotitis.

Management of healthcare personnel who are exposed to persons with mumps For healthcare personnel who do not have acceptable presumptive evidence of immunity

Healthcare personnel without evidence of immunity should be excluded from the 9th day after the first unprotected exposure to mumps through the 25th day after the last exposure. The mumps vaccine cannot be used to prevent the development of mumps after exposure. Hence, previously unvaccinated healthcare personnel who receive a 1st dose of vaccine after an exposure are considered non-immune and should be excluded from the 9th day after the first exposure to mumps through the 25th day after the last exposure.

For healthcare personnel with partial vaccination

Those personnel who had been previously vaccinated for mumps, but received only one dose of mumps vaccine may continue working following an unprotected exposure to mumps. Such personnel should receive a 2nd dose as soon as possible, but no sooner than 28 days after the first dose. They should be educated about symptoms of mumps, including non-specific presentations, and should notify occupational health if they develop these symptoms.

For healthcare personnel who have presumptive evidence of immunity

Healthcare personnel who are immune do not need to be excluded from work following an unprotected exposure. However, because one dose of MMR vaccine is between 73–91% effective in preventing mumps and two doses is 76–95% effective, some vaccinated personnel may remain at risk for infection. Therefore, healthcare personnel should be educated about symptoms of mumps, including non-specific presentations, and should notify occupational health if they develop these symptoms.

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