

# Mumps

## Section 1: ABOUT THE DISEASE

### A. Etiologic Agent

Mumps is caused by the mumps virus (genus *Paramyxovirus*, family *Paramyxoviridae*).

### B. Clinical Description

Mumps is a systemic disease characterized by swelling of one or more salivary glands, usually the parotid glands. Parotitis tends to occur early and may first be noted as an earache or pain on palpitation at the angle of the jaw. Symptoms tend to decrease after one week and usually resolve after ten days. Prodromal symptoms are non-specific and may include myalgia, anorexia, malaise, headache, and low-grade fever. As many as 20-40% of mumps infections are asymptomatic and nearly 50% are associated with non-specific or primarily respiratory symptoms, particularly among children under 5 years of age.

Symptomatic aseptic meningitis occurs in up to 10% of cases. Patients usually recover without complications, but may require hospitalization. Encephalitis occurs rarely (0.02-0.3% of cases), and permanent sequelae or death are uncommon. Infection in adulthood is likely to produce more severe disease, including mastitis, which occurs in up to 31% of females aged >15 years, and orchitis, which occurs in 37% of post-pubertal males, though it rarely causes sterility. Other rare complications include arthritis, renal involvement, myocarditis, cerebellar ataxia, pancreatitis, and hearing impairment.

Mumps infection during the first trimester of pregnancy can increase the risk of spontaneous abortion, although no evidence exists that mumps infection in pregnancy causes congenital malformations. While death due to mumps is rare, more than half the fatalities occur in adults.

*Note: Swelling of the salivary glands can also be caused by infection due to parainfluenza virus types 1 and 3, influenza A, Coxsackie A, echovirus, Staphylococcus aureus, lymphocytic choriomeningitis virus, HIV, and noninfectious causes such as drugs (e.g., phenylbutazone, thiouracil, iodides), tumors, starch ingestion, metabolic disorders (diabetes, cirrhosis, and malnutrition), immunologic diseases, and obstruction of the salivary duct. However, other infectious causes of parotitis do not cause epidemic parotitis.*

### C. Vectors and Reservoirs

Humans are the only known host for mumps. While persons with asymptomatic or nonclassical infection can transmit the virus, no true carrier state is known to exist.

### D. Modes of Transmission

Mumps is transmitted by respiratory droplets and by direct contact with nasopharyngeal secretions. While mumps can be transmitted by the airborne route, this is rare and should not be a parameter for determining exposure, especially in the school setting.

### E. Incubation Period

The incubation period is usually 16–18 days, with a range of 12–25 days.

## F. Period of Communicability or Infectious Period

Persons with mumps are usually considered infectious from 2 days before through 5 days after onset of parotid swelling. (However, virus may be isolated from saliva up to 7 days before the onset of swelling.) The initial day of swelling should be counted as day zero. Mumps is similar to influenza and rubella in infectiousness and is not as contagious as measles or chickenpox. Inapparent infections can be communicable.

## G. Epidemiology

Mumps occurs worldwide. In the U.S., it is endemic year-round, peaking in winter and spring. Eighty percent of adults with or without a history of mumps have serologic evidence of immunity. The incidence of mumps in the U.S. had declined since an effective vaccine came into use in 1967. In 1986 and 1987 there was a relative resurgence of mumps, apparently due to the absence of comprehensive state immunization requirements, and in some instances, vaccine failure. The number of mumps cases reported in the U.S. has declined steadily since 1989, thanks in large part to the two-dose MMR vaccination policy. However, resurgences have occurred in recent years. Outbreaks in highly vaccinated populations still occur, probably due to vaccine failure.

Mumps vaccine effectiveness has been estimated at 73-91% for one dose, and 76-95% for two doses.

Most adults born in the U.S. before 1957 have been infected and are probably immune to mumps. Mumps may be seen in unimmunized children or adolescents. Mumps may also occur in individuals from other countries where mumps vaccine wasn't routinely given and exposure to mumps is limited.

## H. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism.

## Section 2:

# REPORTING CRITERIA AND LABORATORY TESTING

## A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report any of the following:

- A suspect or confirmed case of mumps, as diagnosed by a health care provider;
- Isolation of mumps virus from clinical specimen;
- Significant rise (four-fold or greater) in serum mumps immunoglobulin G (IgG) antibody titer between acute and convalescent sera by any standard serologic assay; or
- Positive serologic test for mumps immunoglobulin M (IgM) antibody.

*Note: See Section 3C for information on how to report a case.*

## B. Laboratory Testing Services Available

### *Serologic Testing*

It is very important to obtain laboratory confirmation for cases and suspect cases of mumps. Due to cross reacting antibodies and other issues, sensitivity and specificity of commercially available IgM tests are problematic. The Centers for Disease Control and Prevention (CDC) and the MDPH do not recommend

mumps IgM testing by commercial laboratories for confirmation or elimination of a diagnosis of mumps. Sera should be submitted to the MDPH Hinton State Laboratory Institute (SLI) for IgM testing. Mumps IgM detection by the enzyme-linked immunoassay (EIA) method performed at the SLI is very specific and has the additional advantage of low (or absent) cross reactivity with parainfluenza viruses.

### **Mumps IgM Test**

At least 2 mL of acute serum should be collected at the initial medical visit and submitted to the SLI for IgM testing. If this acute serum is IgM positive, a convalescent specimen is not necessary and the case is confirmed. If the acute-phase IgM result is negative, a second (convalescent) serum specimen should be collected  $\geq 14$  days after the first specimen.

- In unvaccinated individuals, IgM is almost always present at the onset of symptoms, though collecting an “intermediate” specimen at least 5 days after onset can be considered if the acute specimen is negative for IgM.
- In previously vaccinated individuals, IgM is rarely measurable during the illness and therefore, IgM testing cannot be used to rule-out mumps in a vaccinated individual (one or two doses).

### **Mumps IgG Paired-Titer Testing**

Paired serologic testing can be done at the SLI if the acute IgM testing is either negative or not interpretable (e.g., performed at commercial lab; indeterminate or unequivocal result; inappropriate timing of specimen). The paired serum specimens are run at the same time and are used to demonstrate a four-fold increase in IgG titer or a seroconversion from negative to positive from acute to convalescent, which is considered a positive diagnostic result for mumps. As noted above, acute serum should be collected as soon as possible after onset of parotid swelling; convalescent serum should be collected at least 14 days later.

- In unvaccinated individuals, IgG antibody increases rapidly after onset of symptoms and is long-lasting.
- In vaccinated persons, the IgG may already be quite elevated in the acute phase blood sample, which may prevent a four-fold rise in IgG titer in the convalescent specimen.

Note that a positive IgG from an acute specimen cannot be used to rule-out current mumps infection.

### **Shipment of Sera**

Sera should be sent with a cold pack and a completed SLI *Specimen Submission Form* (found on the MDPH website at [http://www.mass.gov/Eeohhs2/docs/dph/laboratory\\_sciences/general\\_submission\\_form.pdf](http://www.mass.gov/Eeohhs2/docs/dph/laboratory_sciences/general_submission_form.pdf)) to:

**Virus Serology Laboratory  
MDPH Hinton State Laboratory Institute (SLI)  
305 South Street  
Jamaica Plain, MA 02130**

Before sending sera, please call a MDPH immunization epidemiologist at (617) 983-6800 or (888) 658-2850.

### **Virus Isolation/Molecular Characterization of Mumps**

In addition to serum, the collection of clinical specimens for mumps virus isolation on each person is extremely important and should be done on all individuals with suspected mumps. Mumps virus can be isolated from buccal swab, oropharyngeal or nasopharyngeal swab, urine, and cerebrospinal fluid (CSF). The preferred specimen for viral isolation is the buccal swab. Molecular characterization of isolated mumps virus is very useful in the confirmation of mumps in vaccinated individuals. It is also helpful in

epidemiologic investigation; for example, to determine the source of infection and which cases and outbreaks are linked. In cases of mumps meningitis, the virus is readily isolated from CSF.

#### *Parotid Gland/Buccal Swab*

A buccal swab is the best type of sample for viral isolation. Collect a buccal swab up to 5 days after symptom onset, preferably within 3 days after onset. (Specimens collected >5 days after onset will only be tested by SLI in consultation with an MDPH epidemiologist.)

- In unvaccinated persons, virus may be isolated from 7 days before until 8 days after parotid swelling. Maximal viral shedding, however, generally occurs just prior to and within the first 3 days of parotitis onset.
- In vaccinated persons, buccal swaps should be collected within 1 to 3 days of parotitis onset, otherwise viral detection in RT-PCR or culture may have low yield.

Massage the parotid gland area (the space between the cheek and teeth just below the ear) for about 30 seconds prior to collection of the buccal secretions. The parotid duct (Stenson's duct) drains in this space near the upper rear molars.

#### *Other Specimens*

A throat swab (oropharyngeal or nasopharyngeal swab) can also be collected and placed in its own tube of viral transport medium (VTM). Agitate the swab(s) for at least 30 seconds in 2–3 mL of VTM or other sterile isotonic solution (phosphate buffered saline or cell culture medium).

Urine is to be collected as a back up specimen only. Up to 45 mL should be collected aseptically in a sterile container within 5 days of onset of illness and sent immediately on wet ice to SLI. If a patient has both an acceptable buccal swab and a urine submitted, only the swab will be tested. The only times a urine may be tested are when 1) the swab is dry or unacceptable or 2) when it is the only sample sent for testing.

Collect CSF during the first three days of meningitis (if meningitis is present). Collect 1–2 mL in a sterile container.

All specimens should be collected as described above, maintained at 4°C, and delivered to the SLI on wet ice or ice pack within 24 hours of collection. If the specimen is collected over the weekend, it must be kept frozen at -70°C and submitted to the SLI on dry ice.

Specimens for mumps virus isolation may be submitted to the SLI Virus Isolation Laboratory. **Do not freeze specimens for viral isolation** at -20°C as storage at this temperature will rapidly inactivate mumps virus. Contact a MDPH immunization epidemiologist, at (617) 983-6800 or (888) 658-2850, for further instructions on specimen collection and shipment.

## **Section 3: REPORTING RESPONSIBILITIES AND CASE INVESTIGATION**

### **A. Purpose of Surveillance and Reporting**

- To identify cases and susceptible exposed people rapidly in order to prevent further spread of the disease.
- To distinguish between failure to vaccinate and vaccine failure, and to address the problem.

## B. Laboratory and Health Care Provider Reporting Requirements

Mumps is reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of mumps, as defined by the reporting criteria in Section 2A.

*Note: The MDPH requests that information about a case of mumps be reported as soon as possible to a MDPH immunization epidemiologist at the MDPH Division of Epidemiology and Immunization by calling (617) 983-6800 or (888) 658-2850.*

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of mumps infection shall report such evidence of infection directly to the MDPH within 24 hours.

## C. Local Board of Health (LBOH) Reporting and Follow-up Responsibilities

### *Reporting Requirements*

MDPH regulations (*105 CMR 300.000*) stipulate that mumps is reportable to the LBOH and that each LBOH must report any case of mumps or suspect case of mumps, as defined by the reporting criteria in Section 2A. A MDPH immunization epidemiologist, in collaboration with the LBOH, will complete the official MDPH *Mumps Case Report Form* (found at the end of this chapter). Using this form, cases will be reported to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS). Refer to the *Local Board of Health Timeline* at the end of this manual's *Introduction* section for information on prioritization and timeliness requirements of reporting and case investigation.

### *Case Investigation*

***Due to national surveillance and reporting requirements, the MDPH will often take the lead on mumps case investigation (including filling out the official case report form) and disease control recommendations, in collaboration with the LBOH. The MDPH will keep the LBOH informed of all significant developments and will request the assistance of the LBOH as needed.***

### **Initial Questions to Ask the Health Care Provider and Patient**

In order to assess the likelihood that a suspect case is a true case prior to laboratory testing, the MDPH and/or other public health staff helping in the investigation should ask about:

1. Clinical presentation, including date of onset of symptoms, particularly parotitis, duration of parotitis, and complications (e.g., meningitis, deafness, encephalitis, mastitis, or orchitis);
2. Mumps immunization history;
3. Country of origin and length of residence in U.S.;
4. Recent history of travel (to where and dates);
5. Whether there were any recent out-of-town visitors (from where and dates);
6. Whether there was any recent contact with anyone with similar symptoms;
7. Risk factors for disease;
8. Possible transmission setting (e.g., childcare, school, health care setting); and

9. Laboratory information, including viral isolation and serologic test results.

Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

## **Section 4: CONTROLLING FURTHER SPREAD**

**This section provides detailed control guidelines. The LBOH should familiarize themselves with the information. However, the MDPH will take the lead on implementing control measures, in collaboration with the LBOH.**

### **A. Isolation and Quarantine Requirements (150 CMR 300.200)**

#### *Minimum Period of Isolation of Patient*

Through 5 days after onset of gland swelling (counting the initial day of gland swelling as day zero).

#### *Minimum Period of Quarantine of Contacts*

Students and staff born in or after 1957 who are not appropriately immunized or who do not have laboratory evidence of immunity will be excluded from work or classes from the 12th through the 26th day after their last exposure. When multiple cases occur, susceptibles need to be excluded through 26 days after the onset of the last case at the school or workplace.

Health care workers (or patients), regardless of year of birth, who are not appropriately immunized or do not have laboratory evidence of immunity will also be excluded (or isolated), as above. Additional control measures may be recommended by the MDPH.

### **B. Protection of Contacts of a Case**

1. Implement control measures before serologic confirmation.
2. Inquire about contact with a known or suspect case or travel during the mumps exposure period (12–25 days prior to onset). Ask other questions outlined in Section 3C.
3. Identify all who have been exposed. To identify those exposed, think in terms of the “zones of exposure,” and consider members of the following groups, if they were in contact with the case during his/her infectious period:
  - a. Household members,
  - b. School/daycare (students and staff),
  - c. Staff and patients at medical facility where patient was seen,
  - d. Individuals at workplace of case (especially daycare centers, schools, and medical settings),
  - e. Religious/social groups,
  - f. Sports teams and other extracurricular groups,
  - g. Bus/carpool mates,

- h. Close friends, and
  - i. Persons potentially exposed at social events, travel sites, etc.
4. Identify high-risk susceptibles who had contact with the case during the infectious period:
- a. Pregnant women should be referred to their obstetricians for screening and management. (In childcare or school settings, remember to determine whether any teachers, student teachers, staff, or students are pregnant.)
  - b. Immunosuppressed individuals should be referred to their health care providers.
  - c. Infants <12 months of age should be referred to their pediatricians.
5. Identify all other susceptibles. These are individuals without proof of immunity, including those with medical or religious exemptions to immunization. Proof of immunity is defined as:
- a. Birth in the U.S. before 1957, unless a health care worker or a college student;
  - b. Documentation of  $\geq 1$  dose of mumps-containing vaccine on or after the first birthday; or
  - c. Serologic proof of immunity.

Note: Persons born outside of the U.S. (without written proof of immunity) are considered susceptible, regardless of year of birth.

In addition, past history of disease, regardless of whether it is physician-diagnosed, is not an acceptable proof of immunity.

6. Immunize all susceptibles  $\geq 12$  months of age for whom MMR is not contraindicated. Vaccination is not expected to prevent illness or development of disease after infection in someone recently exposed to mumps. Exposed individuals should be vaccinated to protect against subsequent exposures.

Because vaccine effectiveness is not 100%, a second dose of mumps-containing vaccine will be recommended during large or ongoing outbreaks for individuals who have received only one dose previously. Furthermore, birth before 1957 does not guarantee mumps immunity, and in outbreak settings, vaccination with a mumps-containing vaccine should be considered for those born before 1957 who may be exposed to mumps and who may be susceptible.

Keep in mind the following:

- a. The combination MMR vaccine is the preferred formulation for all those  $\geq 12$  months of age (MMR vaccine should never be given to infants).
  - b. Vaccinating an exposed individual who may be incubating mumps virus is not harmful.
  - c. Immune globulin (IG) is of no value as post-exposure prophylaxis and is not recommended.
7. Exclude as follows:
- a. Case: Exclude through 5 days after onset of parotitis (counting the day of swelling onset as day zero). The suspect case may return to normal activities on the 6th day.
  - b. Contacts: Individuals with zero doses of mumps-containing vaccine should be excluded from work/school. In most settings, these persons will usually be readmitted immediately after they are vaccinated. Individuals with one-dose of mumps-containing vaccine should receive a second dose

and be allowed to remain in work/school. Exclude all remaining susceptible persons (including those with medical or religious exemptions) on days 12–26 after exposure, or if there are multiple cases, for 26 days after onset of parotitis in the last reported case in the outbreak setting. They may return on the 27th day.

In some outbreak situations, MDPH may recommend additional control measures.

8. Conduct active surveillance for mumps for 2 incubation periods (50 days) after onset of the last case.

## **C. Managing Mumps in Health Care Settings**

### *Proof of Immunity*

Although birth in the U.S. before 1957 is generally considered to be acceptable evidence of immunity to mumps, many experts believe this criterion is not sufficiently reliable for health care settings. Health care workers born before 1957 should have one dose of MMR, though two doses are recommended. Note that in an outbreak, two doses will be required. Health care workers born in or after 1957 should have two doses of MMR. An effective routine MMR vaccination program for health care workers (in addition to standard precautions) is the best approach to preventing nosocomial transmission.

Prior serologic proof of immunity is also acceptable for health care workers.

Past history of disease, regardless of whether it is physician-diagnosed, is not an acceptable proof of immunity.

### *Isolation of Patients*

Patients should be placed on droplet precautions through nine days after onset of parotid swelling (counting the day of onset as day zero). They may be taken off precautions on the tenth day.

Exposed susceptible patients should be placed on droplet precautions from the 12th day after the earliest exposure through the 26th day after the last exposure. They may be taken off precautions on the 27th day.

### *Exclusion of Staff*

- Personnel who become sick should be excluded from work through 9 days post parotid swelling onset. They may return on the 10th day.
- Exposed susceptible personnel (including those with medical or religious exemptions) should be excluded from the 12th day after their first exposure through the 26th day after their last exposure, if there are multiple exposures. They may return on the 27th day.

### *Surveillance*

Conduct active surveillance for mumps for 2 incubation periods (50 days) after onset of the last case.

## **D. Preventive Measures**

### *Personal Preventive Measures/Education*

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adult groups, is the best preventive measure against mumps. Good personal hygiene (which consists of proper hand washing, disposal of used tissues, not sharing eating utensils, etc.) is also important.

A Mumps Public Health Fact Sheet for the general public can be obtained from the MDPH Division of Epidemiology and Immunization or on the MDPH website at [www.mass.gov/dph](http://www.mass.gov/dph). Search for “Public Health Fact Sheets.”

## ADDITIONAL INFORMATION

The following is the formal Centers for Disease Control and Prevention (CDC) surveillance case definition for mumps. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

*Note: The most up-to-date CDC case definitions are available on the CDC website at <http://www.cdc.gov/ncphi/diss/nndss/casedef/>.*

### Case Definition for Mumps (As Defined by CSTE, 2008)

#### *Clinical Case Definition*

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

#### *Laboratory Criteria for Diagnosis*

- 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 four-fold 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*

##### **Suspect**

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 testing and is epidemiologically-linked to a clinically compatible case.

##### **Confirmed**

A case that 1) meets the clinical case definition or has clinically compatible illness, and 2) is either laboratory confirmed or is epidemiologically linked to a confirmed case.

Please refer to the *MMWR Measles, Mumps, and Rubella—Vaccine Use and Strategies for Elimination of Measles, Rubella, and Congenital Rubella Syndrome and Control of Mumps* publication (listed in the *References* section), the most current versions of MDPH’s *Immunization Guidelines*, MDPH’s model standing orders for measles, mumps and rubella vaccine, and *Massachusetts Immunization Program State-Supplied Vaccines and Patient Eligibility Criteria*, for recommended schedules, groups recommended, and groups eligible to receive state-supplied vaccine.

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# Mumps

## LBOH Action Steps

*This form does not need to be submitted to the MDPH with the case report form. It is for LBOH use and is meant as a quick-reference guide to mumps case investigation activities.*

LBOH staff should follow these steps when mumps is suspected or confirmed in the community. For more detailed information, including disease epidemiology, reporting, case investigation, and follow-up, refer to the preceding chapter.

*Note: Due to national surveillance and reporting requirements, the MDPH will usually take the lead on mumps case investigation (including filling out the official case report form) and disease control recommendations, in collaboration with the LBOH. MDPH epidemiologists will keep the LBOH informed of all significant developments and will request the assistance of the LBOH, as needed.*

## Reporting

- Immediately notify the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 or (888) 658-2850, to report any confirmed or suspect case(s) of mumps.

## Case Investigation

- Work with MDPH to ensure that appropriate clinical specimens are collected and submitted to the MDPH Hinton State Laboratory Institute (SLI) for confirmation.
- Work with MDPH to obtain the information necessary for completion of the case report form, including source of exposure, clinical information, vaccination history, laboratory results, and source of infection. (MDPH will complete the form and submit it to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services [ISIS]).

## Prevention and Control

- Work with MDPH to institute isolation and quarantine requirements (*105 CMR 300.200*), as they apply to a particular case.
- Identify high-risk and susceptible individuals, including those with medical or religious exemptions.
- Vaccinate susceptible individuals with mumps-containing vaccine (if not contraindicated). MMR vaccine is preferred.
- Conduct surveillance for two incubation periods.

## Managing Mumps in Schools and Other Institutions

In addition to the prevention and control measures described above:

- Implement surveillance for new cases.
- Notify and educate staff, students, and/or patients.
- Test and exclude symptomatic individuals.

- Isolate remaining susceptible contacts (in some non-health care settings, susceptibles may be readmitted if they receive post-exposure vaccination.)

### **Managing Mumps in Health Care Settings, Schools, and Other Institutions**

In addition to the prevention and control measures described above:

- Notify infection control or employee health of confirmed or suspect case(s) in institution.
- Ensure all health care personnel have proof of immunity appropriate for health care setting.
- In health care settings, susceptibles who get vaccinated after exposure are not allowed to return until the end of the exclusion period.