Mumps

A. Protocol Checklist

General activities

- ☐ Enter available information into Merlin upon receipt of initial report
- ☐ Review background on disease, case definition, and laboratory testing
- ☐ Contact provider to obtain medical record/notes
- ☐ Interview patient(s)
  - ☐ Review disease facts and symptoms
  - ☐ Modes of transmission
  - ☐ Incubation period
  - ☐ Ask about exposure to relevant risk factors
    - ☐ Immunization history
    - ☐ Travel
    - ☐ Contact with a known case or symptomatic person(s)
    - ☐ Recent visit or attends college/university
    - ☐ Visit to or work in a health care setting
  - ☐ Identify symptomatic contacts
    - ☐ Conduct interviews with contacts
    - ☐ Determine whether case or symptomatic contacts are in sensitive situations (Section H)
    - ☐ Recommend exclusions for cases or symptomatic contacts
  - ☐ Provide education on transmission and prevention
  - ☐ Recommend case and contacts are up to date with immunization
  - ☐ Address case's questions or concerns
- ☐ Follow-up on special situations, including outbreaks or cases in sensitive situation (Section H)
- ☐ Enter additional data obtained from interview into Merlin notes

B. Disease reporting and epidemiology

Purpose of reporting and surveillance

1. To determine if there is a source of infection of public health concern and to stop transmission from such a source.
2. To assess the risk of the case transmitting infection to others and to prevent such transmission.
3. To identify cases and prevent further spread by recommending appropriate preventive measures, including exclusion.
4. To educate potentially exposed individuals about signs and symptoms of disease, thereby facilitating early diagnosis and reducing the risk of further transmission. This may include documenting evidence of immunity (Section H).
5. To identify and vaccinate susceptible individuals.
6. To assess exposure risk such as contact with a person with mumps and/or compatible symptoms or linkage to a mumps outbreak.

Legal reporting requirements

Laboratories and physicians are required to report to the local county health department (CHD) within one working day of identification/diagnosis.

CHD investigation and intervention responsibilities

1. Begin investigation within one business day of receiving report from provider or positive laboratory test.
2. Review Section G to administer appropriate measures to control further spread.
3. Ensure providers collect a buccal swab for commercial PCR testing as soon as mumps is suspected (Section D). If commercial PCR testing has not been conducted on cases identified as part of an outbreak **or** in a sensitive situation, obtain approval and facilitate transport of specimen to Florida Department of Health (FDOH) Bureau of Public Health Laboratories (BPHL) Virology Laboratory for mumps PCR.
4. Identify contacts of the case and potential settings for transmission during the period of communicability.
5. Educate exposed contacts to watch for symptoms for 12 days after the first exposure through 25 days after the last exposure and seek immediate evaluation if symptoms occur.
6. Enhance surveillance for at least two incubation periods (50 days) from onset of parotitis in the last case during outbreaks.
7. Provide appropriate notifications to child care centers, schools, and health care facilities to enhance surveillance, prevention, and disease reporting.
8. Report all suspect, probable, and confirmed cases in Merlin. An extended data screen is available in Merlin to report additional clinical data. Remember to enter the complete vaccination history for all cases.
9. If an outbreak of three or more cases is identified that are not household contacts, use the MERLIN outbreak module to create an outbreak and link the cases to the outbreak.

Etiologic agent

Mumps is caused by an RNA virus classified as a *Rubulavirus* in the Paramyxoviridae family.

Illness

Initial symptoms are nonspecific and include myalgias, loss of appetite, malaise, headache, and low-grade fever which may last 3–4 days. Parotitis (inflammation and swelling of the parotid glands, the major salivary glands on either side of the face) is the most common clinical manifestation of mumps, although it is not present in all infections. Parotitis may be unilateral or bilateral; other combinations of single or multiple salivary glands may be affected. Parotitis usually occurs within the first two days of symptom onset and presents as an earache or

tenderness on palpation of the angle of the jaw. Symptoms usually decrease within one week and resolve within 10 days.

Diagnosis of mumps can be easily missed, as up to 20% of infections are asymptomatic, and an additional 40–50% may have only nonspecific or primarily respiratory symptoms, particularly among children less than five years of age. Persons with asymptomatic infection can transmit the virus.

Orchitis (inflammation of the testicles) is the most common complication, affecting up to 30% of infected males who have reached puberty. While painful, orchitis rarely leads to sterility. Other complications are also rare but may include encephalitis, deafness, meningitis, oophoritis (inflammation of the ovaries), mastitis (inflammation of the breasts), pancreatitis, myocarditis, arthritis, and nephritis (inflammation of the kidneys). Death due to mumps is rare.

Other parotitis etiologies
Although the mumps virus is the only agent known to cause epidemic parotitis, not all instances of parotitis are caused by it. Sporadic parotitis can also occur as a result of infection with other viral pathogens such as enteroviruses (including coxsackievirus), parvovirus B-19, adenoviruses, parainfluenza virus types 1–3 (PIV 1–3), influenza A and B, human herpesviruses 6 (HHV-6), Epstein-Barr virus (EBV), and bocavirus (HBoV) as well as infection with *Staphylococcus aureus* and other bacteria. Additionally, non-infectious causes of parotitis include drugs, tumors, immunologic diseases, and obstruction of the salivary duct.

Reservoirs

Humans are the only known reservoir of the virus that causes mumps.

Modes of transmission

Transmission occurs through respiratory droplets and through direct contact with nasopharyngeal secretions (mouth, nose, or throat of infected individual). Items used by an infected person, such as a coffee cup or soft drink can, can also be contaminated with the virus, which may spread to others if the item is shared.

Incubation period

The incubation period is usually 16–18 days but can range from 12–25 days after exposure.

Period of communicability

The mumps virus can be identified in respiratory secretions as early as seven days before onset of parotitis and up to nine days after. Therefore, mumps is most infectious a few days before and after parotitis onset. Most transmission likely occurs before and within five days of parotitis onset. Therefore, CDC recommends isolating mumps cases for five days after glands begin to swell. **The recommended period for contact tracing for mumps is two days before through five days after parotitis onset**.

Treatment

Supportive

Post Exposure Prophylaxis

None indicated.

Immunity

Immunity has generally been considered lifelong. Most adults born before 1957 are likely to have been infected naturally and may be considered immune even if they did not have recognized disease. However, recent evidence suggests that persons previously exposed to the virus through either vaccination or disease may still become infected and in some cases experience reinfection.

Vaccination

Current ACIP recommendations children for MMR (measles-mumps-rubella) vaccine:

- First dose at 12 through 15 months of age
- Second dose at 4 through 6 years of age

The second dose may be administered before 4 years of age provided greater than four weeks has elapsed following an MMR or 12 weeks has elapsed following an MMRV (measles-mumps-rubella-varicella, licensed for use in children 12 months of age through 12 years).

Vaccine is recommended for adults who do not have presumptive evidence of immunity including students at post high-school educational settings, health care personnel, international travelers, and people determined by public health authorities as having an increased risk during an outbreak (https://www.cdc.gov/vaccines/vpd/mmr/public/).

Waning Immunity

In response to the 2006 multistate mumps outbreaks (see outbreak articles, www.cdc.gov/mumps/resources/outbreak-articles.html). ACIP recommendations for prevention and control of mumps were updated. Evidence of immunity through documentation of vaccination is now defined as:

- One dose of live mumps vaccine for preschool-aged children and for adults not at high risk for exposure and infection, and
- Two doses of live mumps vaccine for school-aged children (i.e., grades K–12) and for adults at high risk for exposure and infection (i.e., health care workers, international travelers, and students at post-secondary education institutions)

In 2016, a third resurgence began with 6,366 mumps cases reported, the highest number of cases since 2006; more than two-thirds of cases were outbreak-associated with outbreaks occurring in 32 jurisdictions. To better characterize the burden of outbreaks nationally, CDC invited jurisdictions to submit aggregate-level outbreak data from January 1, 2016, through June 30, 2017. This data call captured 150 outbreaks in 39 jurisdictions, consisting of 3–2,942 cases per outbreak. Seventy-five (50%) of these outbreaks occurred in universities. Fifty percent of outbreaks consisted of less than 10 cases, but 20 (13%) outbreaks had 50 or more cases and accounted for 83% of the total case count. Fifty-five percent of all case-patients (n=9,200) and 70% of case-patients with known vaccination history (n=7,187) had two doses of MMR vaccine prior to infection. Like other outbreaks in the post-vaccine era, the proportion of complications was low, with 270 complications occurring among 9,200 case-patients (www.cdc.gov/vaccines/pubs/surv-manual/chpt09-mumps.html#f45).

Recommendations for Administering a Third Dose of MMR Vaccine During Mumps Outbreaks

In 2017, in response to a nationwide increase of mumps outbreaks identified in previously vaccinated persons, the ACIP implemented a recommendation for a third dose of MMR vaccine for at-risk groups during mumps outbreaks. This recommendation was established for groups of people who public health authorities determine are at an increased risk for acquiring mumps because of an outbreak. Based on that recommendation, when mumps outbreaks occur, public health authorities should be prepared to do the following:

- Identify groups of people who may have close contact with a mumps patient during an outbreak
- Investigate the setting to determine if a group is at increased risk for acquiring mumps and should receive a third dose of MMR vaccine

The purpose of the guidance is to help health authorities determine when to recommend a third dose of MMR vaccine during an outbreak of mumps. Further information on third dose MMR recommendations during a mumps outbreak can be found at www.cdc.gov/mumps/health-departments/MMR3.html.

Mumps in Florida

From 2014 to 2018, Florida reported 156 confirmed and probable cases. From 2014 to 2016, 27 confirmed and probable cases (average incidence rate of 0.05 per 100,000 population) were reported in which 11% were identified as being outbreak associated. Then in 2017 and 2018, Florida experienced a significant increase in cases reported with 129 confirmed and probable cases (an average incidence rate of 0.31 per 100,000 population) statewide. Approximately 47% of mumps cases reported in 2017 and 2018 were outbreak associated. A few notable outbreaks identified in college age students and in a middle school located in south Florida contributed to the increase. Of the total number of cases identified in 2017 and 2018, 97 (75%) were acquired in Florida, 9 (7%) of the cases were acquired in the US but not in Florida, 7 (5%) were acquired outside the US, and 16 (12%) were unknown as to where the case may have acquired the disease. Of the cases reported within those two years, ages ranged from 2 to 83 years old with an average of 31 years old. The highest age-specific incidence rates within the last two years were among those between 10 to 14 years of age (14%) and 30 to 39 years of age (16%). There were 18 (14%) cases with an average age of 38 years of age that reported hospitalization due to illness of mumps.

C. Case definition

Background

Mumps is an illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland(s), lasting at least two days; acute illness is characterized by a mumps-associated complication such as aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, parotitis or other salivary gland swelling, mastitis, or pancreatitis.

Clinical criteria for case classification

Confirmatory:

One or more of the following:

- Acute parotitis lasting at least two days, **or**
- Other salivary gland swelling lasting at least two days, **or**
- Aseptic meningitis, **or**
- Encephalitis, **or**
- Hearing loss, **or**
- Orchitis, **or**
- Oophoritis, **or**
- Mastitis, **or**
- Pancreatitis

Presumptive:

One or more of the following:

- Acute parotitis lasting at least two days, **or**
- Other salivary gland swelling lasting at least two days, **or**
- Orchitis, **or**
- Oophoritis

Supportive:
One or more of the following:

- Parotitis, **or**
- Acute salivary gland swelling, **or**
- Orchitis, **or**
- Oophoritis

Laboratory criteria for diagnosis
Confirmatory:
Either of the following:

- Isolation of mumps virus in cell culture from clinical specimen (e.g., blood, urine, oral swab), **or**
- Detection of mumps nucleic acid (e.g., standard or real-time polymerase chain reaction [PCR])

Presumptive:
Positive anti-mumps IgM antibody

Epidemiologic criteria for case classification
A person who is epidemiologically linked to a confirmed or probable mumps case

Case classification
Confirmed:
A person with confirmatory clinical criteria and confirmatory laboratory criteria

Probable:
Either of the following:

- A person with presumptive clinical criteria and presumptive laboratory criteria in the absence of a more likely diagnosis, **or**
- A person with presumptive clinical criteria and epidemiological criteria in the absence of a more likely diagnosis

Suspect:
Either of the following:

- A person with confirmatory or presumptive laboratory criteria without clinical criteria, **or**
- A person with supportive clinical criteria without confirmatory or presumptive laboratory criteria in the absence of a more likely diagnosis

Criteria to distinguish a new case from a previous report
Not applicable.

Comment
Epidemiologic classification of internationally imported and U.S.-acquired cases

- **Internationally imported case:** An internationally imported case is defined as a case in which mumps results from exposure to mumps virus outside the U.S. 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 U.S. and onset of parotitis or other mumps-associated complications within 25 days of entering the U.S. and 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 U.S.-acquired case is defined as a case in which the patient has not been outside the U.S. during the 25 days before onset of parotitis or other mumps-associated complications or is known to have been exposed to mumps within the U.S.

U.S.-acquired cases are subclassified 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., a genotype that is not occurring within the U.S. in a pattern indicative of endemic transmission. An endemic genotype is the genotype of any mumps virus that occurs in an endemic chain of transmission (i.e., 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.
- **Endemic case**: A case for which epidemiological or virological evidence indicates an endemic chain of transmission. Endemic transmission is defined as a chain of mumps virus transmission continuous for ≥12 months within the U.S.
- **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.

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

With previous contact with mumps virus either through vaccination (particularly with two doses) or natural infection, serum mumps IgM test results may be negative; IgG test results may be positive at initial blood draw and viral detection in RT-PCR or culture may have low yield. Therefore, mumps cases should not be ruled out by negative laboratory results. Serologic tests should be interpreted with caution, as false positive and false negative results are possible with IgM tests.

Currently, there is insufficient information to determine whether any mumps strains are endemic to the U.S. or to distinguish endemic from non-endemic strains.

D. Laboratory testing

Criteria for diagnosis

Acute mumps infection can be detected by real-time reverse transcriptase polymerase chain reaction (rRT-PCR) or positive mumps virus culture. Mumps antibodies indicating an acute infection can be detected in serum by the presence of IgM antibodies or a significant rise in IgG antibody titer in acute- and convalescent-phase serum specimens or IgG seroconversion.

Mumps can most reliably be diagnosed by isolation of the mumps virus or detection of mumps nucleic acid by PCR assay on secretions collected from the buccal mucosa during the first 3 days following onset of parotitis but no more than 8 days after. The ideal day for testing a buccal specimen on a vaccinated individual is the day of parotitis onset (day 0). The further out from the initial 3–5 days of onset, the less probability of virus detection. Although buccal swab is the preferred specimen, an accompanying urine sample may be submitted if collection of the buccal swab has been delayed (not within 0–3 days of parotitis onset) as urine samples may allow for virus detection ≥4 days after symptom onset; specimens should be collected no more than 10 days after parotitis onset.

If the patient is male with a symptom of orchitis (which can occur 1–2 weeks after parotitis), a urine sample is recommended for testing.

Services available at BPHL

To differentiate mumps infections from other etiologies, FDOH encourages mumps virus rRT-PCR testing at commercial laboratories for all suspected infections. However, if commercial mumps PCR testing has not been conducted on cases during the investigation of outbreaks or cases identified in **sensitive situations** (i.e., an attendee or employee of a day care/child care setting or an employee in a health care setting with direct patient care); facilitate transport of specimens to FDOH BPHL Virology Laboratory for mumps PCR.

The Bureau of Public Health Laboratories-Jacksonville and -Tampa can identify mumps virus from buccal swabs (Stenson duct exudates), oropharyngeal swabs, and urine using PCR methods. Specimens should immediately be placed in cold storage for transport to the laboratory.

Testing for mumps at BPHL requires prior consultation and approval with the virology laboratory or Regional Epidemiologist and Laboratory Liaison.

Specimen Collection

Specimens for PCR

Collect as soon as mumps is suspected for optimal detection/isolation

- Days 0–3 after parotitis onset: buccal swab ONLY
- Days 4–10 after parotitis onset: buccal swab (priority) AND urine specimen

Buccal Swab

- Massage the parotid gland for about 30 seconds prior to collecting specimen.
- Place the Dacron* swab between rear molars and cheek (on the affected side if parotitis is unilateral), swab around the area, and then leave swab in place 10–15 seconds.
- Place swab(s) in a tube container 2–3 mL of viral transport medium (VTM).
- Keep cold on ice pack or refrigerate and ship as soon as possible to BPHL to receive with 24 to 72 hours. If greater than 72 hours, than freeze at -70°C and ship on dry ice.
- CDC specimen collection video: www.youtube.com/watch?v=ThvoJBjsUvQ

*For swab collection, synthetic swabs are preferred over cotton swabs as the cotton may contain substances that are inhibitory to enzymes used in the RT-PCR.

Urine Specimen

- Collect a minimum of 10 mL (up to 50 mL) collected in a urine transport tube. Do not submit urine in urine collection cups as these tend to leak during transport. Use a sterile tube with secure closure to prevent leakage. Each tube should be in a separate zip-seal bag. Use sterile tubes for urine and seal or cap container(s) securely to avoid leakage and loss of specimen.
- Keep cold and ship on cold pack within 24–72 hours of collection. If greater than 72 hours, then freeze at -70°C and ship on dry ice.

Testing requests

Submitting specimens to BPHL
A completed laboratory requisition DH1847
https://floridahealth.sharepoint.com/sites/DISEASECONTROL/LAB/Shared%20Documents/DH1847--rev-5-13.pdf

Packaging and shipping

1. Place each specimen in a separate zip-lock plastic bag. **Do not** wrap the requisition around the tube or place it inside the bag with the specimen.
2. Follow packaging and shipping guidelines for diagnostic specimens (Biological Substance, Category B, UN3373). All suspect diagnostic specimens must be shipped and packaged according to International Air Transport Association (IATA) and Department of Transportation (DOT) Packaging Instructions 650 for Biological Substance, Category B agents. Per these regulations anyone who handles, offers for transport, or transports specimens must be trained and certified to do so. State specimens must be packed in a basic triple packaging system consisting of a primary watertight container wrapped with absorbent material, secondary watertight container, and an outer shipping package. Enclose an itemized list of contents between the secondary packaging and the outer packaging.
3. Contact BPHL for packaging and shipping training dates. BPHL conducts approximately 20 face-to-face trainings per year all over Florida, free of charge. FDOH employees must register for the classes in the FDOH online training system, TRAIN. For shipping guidance, contact BPHL. Additional shipping trainings are also available commercially through vendors.
4. Specimens should be sent in a small Styrofoam cooler with gel-ice packs. The gel-ice packs should not be in direct contact with vials.
5. FedEx Priority overnight shipping is recommended. Provide a tracking number to the laboratory staff and address the package **ATTENTION: Virology Section**.
6. **If shipping on a Friday:** If a sample must be sent on a Friday (not recommended), the box marked for Saturday delivery on the shipper's form MUST be checked off to avoid sample sitting in shipper's warehouse.

Contact the laboratory with questions:

Jacksonville Virology:
904-791-1539 or 904-791-1540

Tampa Virology:
813-233-2211 or 813-233-2307

Interpretation of results

To identify a case of true mumps infection, current mumps diagnostics do not always satisfactorily identify disease. With previous contact with mumps virus either through vaccination (particularly with two doses) or natural infection, mumps IgM serum test results may be negative, IgG test results may be positive at the initial blood draw, and viral detection in RT-PCR or culture may have low yield if the buccal swab is collected more than three days after parotitis onset. In addition, 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. Because of this, the majority of cases that test negative for mumps and do not have another likely cause for parotitis "lasting two days or more" must still be considered suspected mumps.

E. Case Investigation and Follow-up

Contact the physician or hospital within 1 business day of the report

1. Confirm that a mumps infection has been diagnosed in the reported case.
2. Obtain a copy of the medical record to acquire the following:
   a. Date of onset
   b. Signs and symptoms (especially parotitis)
   c. Predisposing conditions (e.g., immunosuppression, immunization status)
   d. Tests performed (including PCR and rule out testing for other diseases that cause parotitis [e.g., influenza, Mononucleosis, Group A Streptococcal, etc.])
3. Ask what information has been given to the case, including whether the case knows about the diagnosis and control measures to reduce transmission.

4. Obtain as much demographic information as possible, including contact information (home, cellular, pager and/or work numbers). Ask how and where the case can be contacted (i.e., at hospital or home).
5. Notify the physician that you will be contacting the case as FDOH follows up on all cases of mumps to assess risks factors to better characterize the occurrence of mumps infection in Florida and to identify potential means for preventing further illness. It may also be appropriate at this point to determine if the physician has any concerns about the health department contacting the case.

Interview the case

1. Contact the case by telephone, home visit, or visit to the hospital. Interviews should be completed as soon as possible after being reported to optimize recall and potentially conduct additional testing (i.e., collect buccal swab/urine for PCR test).
2. Use the extended data form in Merlin to assist in the interview.
3. Items to cover during interview include:
   a. Provide brief background on disease, including possible modes of transmission, incubation period, symptoms, etc.
   b. Immunization status
   c. Exposures during exposure period (12–25 days before onset)
   d. Travel outside Florida or the United States. Determine dates and locations of travel.
   e. Determine if others (e.g., family, friends, coworkers, customers, cases, etc.) are known or thought to be ill with similar symptoms. If so, inquire about possible common source exposures. Obtain the name, phone number or address, and clinical information of the ill person. Anyone meeting the probable definition should be reported and investigated in the same manner as a confirmed case.
   f. Determine if the case or any of their symptomatic household or other close contacts are associated with **sensitive situations** (i.e., an attendee or employee of a day care/child care setting or an employee in a health care setting with direct patient care). Determine the dates and times the case worked to determine the risk of transmission to others. **See Section H for recommended exclusions for symptomatic cases or contacts in sensitive situations.**
   g. Provide basic instruction to cases and potentially exposed contacts about contact precautions, quarantine recommendations, hand hygiene, immunizations, etc. See **Section G for recommendations on controlling further spread.**

Environmental health investigation

Not applicable.

F. Merlin data entry and reports

Merlin data entry

Create a case in Merlin under **Mumps (Merlin disease code=07290)** upon initial receipt of initial report**.** Enter the data collected into Merlin, being sure to include all required fields on the Basic Data screen, complete the Case Symptoms and Extended Data screens, and associate all relevant labs and attach medical notes. Please associate **ALL** labs received via electronic laboratory reporting (ELR) to the patient record. Remember to enter the vaccination history for all cases.

Contact the Merlin helpdesk at Merlin.Helpdesk@flhealth.gov for assistance, if needed.

G. Controlling further spread

Case and household education on prevention recommendations

1. Minimize close contact with other people, especially babies and people with weakened immune systems who cannot be vaccinated.

2. Stay home from work or school for five days after your glands begin to swell and try not to have close contact with other people who live in your house.
3. Cover your mouth and nose with a tissue when you cough or sneeze and put your used tissue in the trash can. If you don't have a tissue, cough or sneeze into your upper sleeve or elbow, not your hands.
4. Wash hands well (for at least 20 seconds) and often with soap and teach children to wash their hands too.
5. Don't share drinks or eating utensils.
6. Regularly clean surfaces that are frequently touched (such as toys, doorknobs, tables, counters) with soap and water or with cleaning wipes.

Isolation of cases

CDC recommends isolation of infected individual for five days after onset of parotitis. The incubation period for mumps can range from 12–25 days.

Management of contacts

Symptomatic contacts: If the probable definition is met, the contact should be reported, investigated, and managed in the same manner as a confirmed case. See Section H for recommended exclusions for symptomatic contacts in sensitive situations (i.e., an attendee or employee of a day care/child care setting, a food handler or an employee in a health care setting with direct patient care).
Asymptomatic Contacts: Contacts should be provided education on incubation period and symptoms and informed to contact their health care provider and the county health department should they develop symptoms.

Immunization recommendations

A live attenuated mumps virus vaccine (Jeryl Lynn strain) was introduced in the United States in 1967 and is available in combination with rubella and measles live virus vaccines (MMR). Routine immunization with MMR is recommended during childhood; the first dose of MMR is recommended at 12–15 months of age with a second dose recommended at 4–6 years. The state of Florida requires students entering, attending, or transferring to public/non-public schools K–12 to have two doses of the MMR as documented on the Florida Certification of Immunization form (DH 680). Public/non-public pre-K students should have age-appropriate doses as indicated. See the Florida immunization schedules and requirements for further detail. **See Section I for appropriate link**. Two doses of MMR vaccine are also recommended for students attending college and other post-secondary institutions, international travelers, and health care personnel. Although about 95% of susceptible persons develop antibodies after a single dose of vaccine, only about 80% can be considered protected. After two doses of vaccine, 90% of persons are considered protected.

Mumps vaccine is also available as a combined mumps, measles, rubella and varicella vaccine (MMRV) (CDC.: Use of Combination Measles, Mumps, Rubella, and Varicella Vaccine, May 7, 2010 / 59(RR03);1-12. Accessed July 30, 2010 at www.cdc.gov/mmwr/preview/mmwrhtml/rr5903a1.htm?s_cid=rr5903a1_e).

Contraindications

Contraindications to vaccine include a severe allergic reaction (e.g., anaphylactic allergy) to neomycin, gelatin or a previous dose of MMR vaccine, pregnancy, and immunodeficiency or immunosuppression. Persons with moderate or severe acute illness should not be vaccinated until the illness has resolved. Receipt of antibody-containing blood products (e.g., immune globulin, whole blood, or packed red blood cells) may interfere with seroconversion following mumps vaccination. Vaccine should be given two weeks before, or deferred for at least three months following, administration of an antibody-containing blood product.

For more information about MMR vaccine schedules, adverse reactions and contraindications, please see the current Pink Book at www.cdc.gov/vaccines/pubs/pinkbook/index.html.

Outbreak control
In October 2017, ACIP updated the recommendation for a third dose of a mumps-containing vaccine for persons previously vaccinated with two doses of a mumps-containing vaccine who are identified by public health as being at an increased risk for mumps because of an outbreak to improve protection against mumps.

The main strategy for controlling a mumps outbreak is to define the population(s) at risk and transmission setting(s) and to rapidly identify and vaccinate persons without presumptive evidence of immunity or, if a contraindication exists, to consider excluding persons without presumptive evidence of immunity from the setting to prevent exposure and transmission.

A study looking at the effectiveness of a third dose of the MMR vaccine for mumps outbreak control was published in the New England Journal of Medicine in which a third dose of MMR vaccine was administered to a highly vaccinated population of college students during a mumps outbreak in 2015–2016. The study found a lower attack rate for mumps in students who received a third dose of MMR compared with students who had two doses and an increased risk for mumps with increased time since the second dose of MMR. Receipt of a third dose of MMR was associated with a 78% lower risk for mumps than receipt of two doses.

For more information using MMR vaccine to control outbreaks of mumps please see the journal at www.indianpediatrics.net/dec2017/1047.pdf.

Assessing for increased risk; when should a third dose of MMR vaccine be recommended
The CDC provides a decision matrix to assist public health authorities when determining if a group of people is at increased risk for acquiring mumps during an outbreak and how to determine if there is evidence of transmission for mumps in a setting. Please refer to guidance document at www.cdc.gov/mumps/health-departments/MMR3.html.

H. Managing sensitive situations

Case or symptomatic contact attends or works at a day care facility

1. **All symptomatic close contacts** with an illness compatible with mumps should be referred to a health care provider for assessment and laboratory testing; the health care provider should be made aware of the persons close contact with a mumps case.
2. **All symptomatic close contacts** should be excluded from school, workplace and child care until they have been determined not to have mumps or until the 5 days after onset of parotitis.
3. **Susceptible asymptomatic contacts** should be excluded from school, workplace, and child care from the 12th day after the first exposure through 26 days after the last exposure.

Health care settings

1. **Prevention and control strategies in health care settings**
   Prevention and control strategies should be applied in all health care settings, including outpatient and long-term care facilities. These measures include:
   - Assessment of presumptive evidence of immunity of health care personnel, including documented administration of two doses of live mumps virus vaccine, laboratory evidence of immunity or laboratory confirmation of disease, or birth before 1957 (*See section Health care personnel: presumptive evidence of immunity*),
   - Vaccination of those without evidence of immunity,
   - Exclusion of health care personnel with active mumps illness, as well as health care personnel who do not have presumptive evidence of immunity who are exposed to persons with mumps,
   - Isolation of patients in whom mumps is suspected, and

- Implementation of droplet precautions, in addition to standard precautions.

Resource: MMWR Immunization of Health-Care Personnel (ACIP) www.cdc.gov/mmwr/pdf/rr/rr6007.pdf

2. **Health care personnel: presumptive evidence of immunity**
   The presumptive evidence of immunity criteria for health care personnel differs slightly from the criteria for community settings. The following criteria should be followed to assess presumptive evidence of immunity among health care personnel.
   - Written documentation of vaccination with two doses of live mumps or MMR vaccine administered at least 28 days apart
   - Laboratory evidence of immunity (Mumps IgG reactive in serum, equivocal results should be considered negative)
   - Laboratory confirmation of disease*
   - Birth before 1957*

*For exposed unvaccinated personnel born before 1957 who lack evidence of mumps immunity or lack confirmation of disease, the health care facility should recommend two doses of MMR vaccine.

3. **Management of health care personnel who are exposed to persons with mumps**
   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. Irrespective of their immune status, all exposed health care personnel should report any signs or symptoms of illness during the incubation period, from 12 through 25 days after exposure**.**

4. **For health care personnel who <u>do not</u> have acceptable presumptive evidence of immunity**
   Health care personnel without evidence of immunity should be excluded from the 12th day after the first unprotected exposure to mumps through the 25th day after the last exposure. Previously unvaccinated health care personnel who receive a first dose of vaccine after an exposure are considered non-immune and should be excluded from the 12th day after the first 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.

5. **For health care personnel with partial vaccination**
   Health care 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 second 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**.**

6. **For health care personnel who have presumptive evidence of immunity**
   Health care personnel with evidence of immunity do not need to be excluded from work following an unprotected exposure. However, two doses of MMR vaccine do not provide 100% protection from mumps. Some vaccinated personnel may remain at risk for mumps, and steps should be taken to reduce the risk of infection. Therefore, health care personnel should be educated about symptoms of mumps, including non-specific presentations, and should notify occupational health if they develop these symptoms

I. Resources and references

Resources

Florida Immunization Guidelines. FloridaHealth.gov/programs-and-services/immunization/children-and-adolescents/schedules-and-requirements/index.html

CDC Mumps Homepage. www.cdc.gov/mumps/index.html

CDC, Pink Book. www.cdc.gov/vaccines/pubs/pinkbook/index.html

ACIP recommendations for use of combined Measles, Mumps, Rubella, and Varicella Vaccine. www.cdc.gov/mmwr/preview/mmwrhtml/rr5903a1.htm?s_cid=rr5903a1_e#box

Effectiveness of a third dose of MMR vaccine for mumps outbreak control. www.indianpediatrics.net/dec2017/1047.pdf

References

1. American Academy of Pediatrics. (2018-2021). *Red Book: 2015 Report of the Committee on Infectious Diseases* (31th ed.). Grove Village, IL: American Academy of Pediatrics.

2. Cardemil CV, Dahl RM, James L, Wannemuehler K, Gary HE, Shah M, et al. Effectiveness of a third dose of MMR vaccine for mumps outbreak control. N Engl J Med 2017;377(10):947–56. doi: 10.1056/NEJMoa1703309 www.indianpediatrics.net/dec2017/1047.pdf.

3. CDC, VPD Surveillance Manual, Mumps

4. Control of Communicable Disease Manual 20th edition David L. Heymann MD, editor