Mumps Outbreak Control Guidelines

Infectious agent

Virus: *Paramyxovirus* of the genus *Rubulavirinae*

Clinical manifestations

Symptoms

- Prodromal symptoms
  - May precede parotitis by several days.
  - Non-specific and include myalgia, anorexia, malaise, headache and low-grade fever.
- Parotitis
  - The most common symptom, occurs in 31% to 65% of infections.
  - Defined as pain, tenderness and/or swelling of the parotid (salivary) glands.
  - Swelling pushes the angle of the ear up and out and obscures the angle of the jawbone below the ear.
  - Usually occurs within the first two days of symptom onset and is unilateral (25%) or bilateral.
  - Swelling of other salivary glands (e.g., sublingual, submandibular) in addition to parotitis may occur (up to 10% of cases), but rarely occurs in the absence of parotitis.
    - Involvement of the submandibular gland may be confused with anterior cervical lymphadenopathy.
  - Initial indication may be an earache or tenderness at the angle of the jaw.
- Other symptoms may include earache, nasal congestion, sore throat, difficulty swallowing, stiff neck, nausea, vomiting, abdominal pain, testicular pain and swelling.
- Up to 27% of infections were asymptomatic in the prevaccine era.
  - Since vaccine was introduced it is difficult to estimate the number of asymptomatic infections.
- Some individuals may have only nonspecific or primarily respiratory symptoms.
- Mumps is usually more severe in adults

Complications

General

- Among vaccinated persons, severe complications are uncommon but are more frequent among adults than children.

Aseptic meningitis

- In the prevaccine era, mumps accounted for up to 10% of symptomatic aseptic meningitis cases.
- In the postvaccine era, meningitis is seen in <1% of mumps cases.
- Resolves without sequelae in 3 – 10 days.
- Men are more commonly affected than women (3:1 ratio).

Orchitis and Oophoritis

- Orchitis is the most common complication in postpubertal males.
- In the prevaccine era, orchitis was reported in 12% to 66% of postpubertal males.
- In the postvaccine era, orchitis occurs in 3% to 10% of postpubertal males.
- Mumps orchitis is usually unilateral (60% to 83%) but can be bilateral.
- Orchitis usually occurs after parotitis, but it may occur before or at the same time as parotitis. Orchitis may also occur without parotitis.
- Approximately 30% to 50% of patients with orchitis have some degree of testicular atrophy, but sterility is rare.
- Oophoritis occurred in less than 1% of postpubertal females in recent outbreaks.
- There is no relationship of oophoritis to impaired fertility.

Hearing loss

- In the prevaccine era, permanent unilateral deafness occurred in 1 of 20,000 infected persons. Transient deafness was seen in 4.1% of infected males in a military population.
- In the postvaccine era, deafness occurs in fewer than 1% of reported cases.

Other complications include:

- Pancreatitis, encephalitis, mastitis.
- Spontaneous abortion can occur during the first trimester of pregnancy but there is no evidence that mumps during pregnancy causes congenital malformations.
- Deaths due to mumps are rare.

Incubation period

- 16 – 18 days (range 12 – 25 days).

Period of communicability

- Persons with mumps are most infectious (highest viral loads) several days before and after parotitis onset.
- The period for contact tracing for mumps is 2 days before through 5 days after parotitis onset.
- Virus has been isolated from saliva 7 days before to 11-14 days after onset of parotitis.
- Degree of contagiousness is similar to rubella and influenza, but is less than that for measles or varicella.

Transmission

- Humans are the only reservoir.
- Mumps disease is spread by mucus or droplets from the nose or throat of an infected person.
- Fomite transmission is possible through contact with objects contaminated by infectious droplets.
- Transmission also likely occurs from persons with asymptomatic infections and from persons with prodromal symptoms.

Basic epidemiology

- Occurs worldwide and is endemic year-round.
- Mumps vaccine is not used everywhere in the world and mumps is a common disease in many countries. Mumps outbreaks have occurred in congregate settings in the US, including NYS.

Case definition for case classification

Case definition approved by CSTE 2012
Case classification approved by CSTE 2012

Case classification

Suspect case:

- Parotitis, acute salivary gland swelling, orchitis, or oophoritis unexplained by another more likely diagnosis, OR
- a positive lab result with no mumps clinical symptoms (with or without epidemiological linkage to a confirmed or probable case).

Probable:

- Acute parotitis or other salivary gland swelling lasting at least 2 days, or orchitis or oophoritis unexplained by another more likely diagnosis, in:
  - a person with a positive test for serum anti-mumps IgM antibody, OR
  - a person with epidemiologic linkage to another probable or confirmed case or linkage to a group/community defined by public health during an outbreak of mumps.

Confirmed:

- A positive laboratory confirmation for mumps virus with RT-PCR or culture in a patient with an acute illness characterized by any of the following:
  - Acute parotitis or other salivary gland swelling, lasting at least 2 days
  - Aseptic meningitis
  - Encephalitis
  - Hearing loss
  - Orchitis
  - Oophoritis
  - Mastitis
  - Pancreatitis

Outbreak:

- Mumps is the only known cause of epidemic parotitis.
- CDC defines an outbreak as 3 or more cases linked by time and place.

Case classification for import status

Internationally imported case

- Defined as a case in which mumps results from exposure to mumps virus outside the U.S., AND
- Is 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
- The 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.

U.S.– acquired case

- 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 sub-classifications

- 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 is 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.
- 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.

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

Laboratory testing and diagnosis

Laboratory confirmation of mumps

- Clinical diagnosis of mumps may be unreliable. Cases of suspected mumps should be laboratory confirmed.
- Laboratory tests to diagnose mumps:
  - Isolation of mumps virus (culture) from a clinical specimen (buccal cavity/parotid duct fluid or oral swab), OR
  - Detection of mumps nucleic acid from a clinical specimen (e. g., standard real time reverse transcriptase polymerase chain reaction (RT-PCR) assay), OR
  - Detection of mumps IgM antibody in serum, OR
  - Seroconversion from IgG negative to IgG positive.
    - Note: A single serum sample tested for mumps-specific IgG is not useful for

diagnosing acute mumps infections. The presence of mumps-specific IgG indicates a recent or a prior exposure to mumps virus or mumps vaccine. Collection of acute and convalescent phase serum samples to demonstrate a 4-fold increase in IgG titer is not recommended. A 4-fold rise in IgG titer is rarely demonstrated between paired serum samples from persons who have received one or two doses of the measles, mumps and rubella (MMR) vaccine.

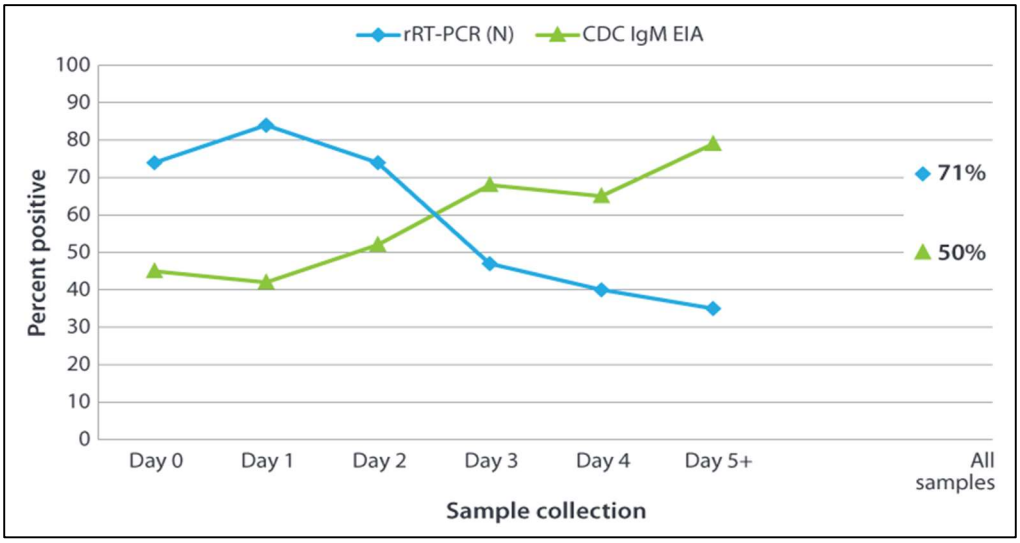
- Negative laboratory results do not necessarily rule out the diagnosis of mumps.
  - Laboratory diagnosis of mumps in vaccinated populations may be challenging, and serologic tests should be interpreted with caution because false negative results in vaccinated persons (i.e., a negative IgM antibody test in a person with true mumps) are common. With previous contact with mumps virus, either through vaccination (particularly with two doses) or natural infection, serum mumps IgM test results may be negative 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. Therefore, mumps cases should not be ruled out by negative laboratory results.

- In both unvaccinated and vaccinated persons, false positive IgM results can occur because assays may be affected by other diagnostic entities that cause parotitis. Parainfluenza viruses 1, 2, and 3, influenza A virus, Epstein-Barr virus, adenovirus, and human herpesvirus 6 have all been noted to interfere with mumps serologic assays.

Recommended laboratory specimens

- For all suspected cases of mumps, obtain clinical specimens (buccal cavity/parotid duct swab or oral swab) for viral isolation. Buccal swabs for RT-PCR and culture should be ideally be obtained within 3 days of the onset of parotitis, and should not be collected more than 8 days after parotitis onset.
- For all suspected cases of mumps, obtain a serum for mumps IgM and IgG at the time of clinical suspicion.
- If the acute IgM specimen collected ≦ 3 days after parotitis onset is negative, and the case has a negative (or not done) RT-PCR result, a second serum specimen collected 5-10 days after symptom onset is recommended because in some cases IgM response is not detectable until 5 days after symptom onset. In some vaccinated individuals, the IgM response may be transient or not appear.
  - A second negative IgM result does not rule out mumps unless the IgG result is also negative.

Percentage of Mumps Specimens Determined Positive by CDC IgM Capture EIA or rRT-PCR (N target gene) as a Function of Time Post Parotitis Onset*



The percentage of positive results obtained from testing 296 confirmed mumps cases from New York City by day of sample collection after onset of symptoms. The serum samples were tested for presence of IgM using the CDC capture IgM EIA. The buccal swab samples were tested by rRT-PCR using the mumps nucleoprotein (N) gene as the target.

*Done in collaboration with New York City Department of Health and Mental Hygiene Public Health Laboratory, New York, NY

Mumps virus was isolated from 209 (71%) of the 296 buccal swabs tested.
Source: https://www.cdc.gov/mumps/lab/qa-lab-test-infect.html

- During influenza season, the CDC and NYSDOH recommend that clinicians who are evaluating a patient with acute parotitis, that is not associated with a laboratory-confirmed mumps outbreak, include influenza in the differential diagnosis and consider testing the patient for influenza viruses, even in the absence of respiratory symptoms. Influenza testing as part of a viral respiratory panel which includes parainfluenza viruses may further assist diagnostic efforts.
- During the 2014-15 influenza season, several hundred cases of confirmed influenza infection with parotitis were reported to CDC. Parotitis after influenza appears to occur more often after infection with influenza A (H3N2) viruses. Among these cases, more than 80% had one or more respiratory symptoms (cough, sore throat, or runny nose); most had mild illness. NYSDOH has also documented cases of influenza associated parotitis. Additionally, NYSDOH has documented several cases of parotitis associated with parainfluenza virus infection.

Specimen collection

Collection for PCR, culture and serology

- Notify the local health department when submitting any mumps specimens for testing.

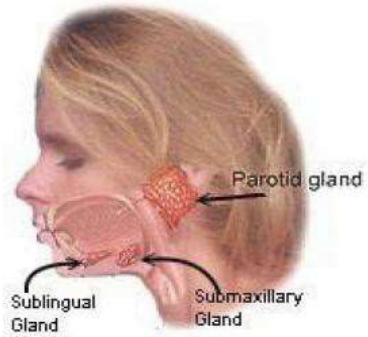
- If submitting specimens to Wadsworth Laboratory, you must complete an Infectious Diseases Requisition Form. Carefully complete the form, including clinical information, onset date of parotitis or jaw swelling, provider name and phone number; patient name, DOB and county of residence.
- Specimen kits are not routinely available from Wadsworth Laboratory. For questions or special requests, please contact the NYSDOH Bureau of Immunization at (518) 473-4437 or Diagnostic Immunology or Virology at (518) 474-4177.

Specimen source

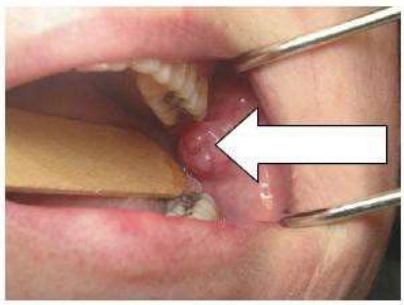
- For RT-PCR/culture: buccal swab (urine, saliva, and cerebrospinal fluid are not currently recommended due to the low yield of virus).
- For mumps IgM and IgG: serum/whole blood.

Procedure

- PCR and Culture
  - For best results, collect specimen as soon as mumps is suspected, ideally within 3 days of onset of swelling.
  - For mumps RT-PCR, a swab in viral transport media (VTM) should be sent. Dry swabs are not acceptable. Swab and media requirements are the same as those used for influenza PCR testing.
  - Synthetic or flocked polyester swabs (non-cotton) should be used. Examples of synthetic swabs include Dacron, Copan, and BBL CultureSwab.
  - Massage the parotid or affected salivary gland area for 30 seconds prior to collection.
  - Rub the synthetic swab on the buccal cavity near the upper rear molars between the cheek and the teeth on the affected side (see illustration).
  - Immerse swab tips in 2 – 3 ml of VTM (typically a pink liquid). If VTM is unavailable, another option for transport is universal transport medium (UTM).
  - Break the swab so the tip is left in the medium. Seal tightly.
  - Label the transport medium tube with the patient's name and date of collection. If patient name is not on the specimen tube, the lab will not be able to perform testing.
  - If testing for influenza or other respiratory viral pathogens, oropharyngeal or nasopharyngeal swabs should be collected and submitted in a separate appropriately labeled VTM tube
  - Swab the buccal cavity, which is the space near the upper rear molars between the cheek and the teeth. Swab the area between the cheek and the gum by sweeping the swab near the upper molar to the lower molar area.



Swab the buccal cavity (photo on right), which is the space near the upper rear molars between the cheek and the teeth. Swab the area between the cheek and gum by sweeping the swab near the upper molar to the lower molar area.



Source: https://www.cdc.gov/mumps/lab/detection-mumps.html

- Mumps IgM and IgG
  - Collect 7 – 10 ml of blood using a serum separator tube (red top with gray stripe, sometimes referred to as "mottled-top" or 'tiger- top").
  - Spin down specimen if possible.
  - Serum specimen collection
    - Collect acute phase serum at initial presentation.
    - Obtain second specimen 5-10 days after onset of symptoms if initial IgM (collected ≤ 5 days after parotitis onset) is negative and PCR is negative or was not collected.

Transport

- Serum for IgM and IgG
  - Do NOT freeze.
  - Refrigerate at 4°C (39°F) until shipped.
  - Ship with frozen gel packs.
  - Samples must have an outer packaging to prevent freezing.
- PCR and viral culture samples
  - Following collection, samples should be maintained at 4°C (39 °F) and shipped on frozen gel packs (4°C) within 24 hours.
  - Can ship with dry ice or frozen gel packs.
  - If unable to ship within 24 hours, preserve sample at -70°C (-94°F) (stand-alone freezer unit). If a specimen cannot be appropriately frozen, refrigerate at 4°C (39 °F). Do not use standard combination refrigerator/freezer units as freeze-thaw cycles should be avoided.
  - Frozen samples should be shipped on dry ice.

Mailing instructions for Wadsworth Laboratories

- To ensure timely processing, consult with the NYSDOH Bureau of Immunization prior to specimen shipment.
- Complete and include the Wadsworth Infectious Disease Requisition Form with specimen(s).
- Mumps IgM and IgG serology submission by overnight priority shipping.
  - Specimens must be delivered Monday - Friday (no weekends, no holidays).
  - Put specimen kit into Styrofoam mailing box.
  - Include 1 – 2 frozen gel packs to keep specimen refrigerated.
  - Overnight delivery should be sent to:

    Diagnostic Immunology
    David Axelrod Institute
    Wadsworth Center, NYSDOH
    120 New Scotland Ave
    Albany, NY 12208

    Questions: Call Wadsworth Center at (518) 474 – 4177.

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    David Axelrod Institute
    Wadsworth Center, NYSDOH
    120 New Scotland Avenue
    Albany, NY 12208

    Questions: Call Wadsworth Center at (518) 474 – 4177.

Note: If specimens shipped to Wadsworth are not going to be received by the lab on Monday through Friday, please contact the Wadsworth Center Laboratory for any questions about weekend storage and handling. Specimens that are room temperature when received will not be able to be tested.

Case investigation

Demographics

- Name
- DOB
- Gender
- Home address
- Race and ethnicity
- Occupation
- Country of birth
- Length of time in the U.S.

Reporting source

- County
- Earliest date reported

Clinical information

- Date of illness onset. If prodromal symptoms occurred note the date of onset and description of symptoms
- Parotitis or other salivary gland involvement (pain, tenderness, swelling)
- Date of parotitis (or other salivary gland swelling) onset
- Duration of parotitis (or other salivary gland swelling)
- Other symptoms (e.g., headache, anorexia, fatigue, fever, body aches, stiff neck, difficulty swallowing, nasal congestion, cough, earache, sore throat, nausea, abdominal pain)

Complications

- Meningitis, encephalitis, hearing loss (transient or permanent; unilateral or bilateral), orchitis (unilateral or bilateral), oophoritis, pancreatitis and mastitis
- Hospitalization (dates, duration, relation to mumps)

Laboratory results

- Laboratory name
- Date of specimen(s)
- Type of test(s) done
- Additional laboratory results, if applicable (e.g., influenza, parainfluenza, EBV)

Treatment

- Medications given
- Duration of treatment

Vaccine history

- Number of doses of vaccine given
- Type of vaccine administered (i.e., MMR, MMRV, or single antigen mumps vaccine)
- Dates of mumps vaccination for each dose
- Manufacturer of vaccine
- Vaccine lot number
- If not vaccinated, reason

Outcome

- Recovered or died
- Date of death
- Postmortem examination results
- Death certificate diagnosis

Epidemiology

- Transmission settings (employment, home, school, daycare, extra-curricular activities)
- Residence type (e.g., congregate or shared living, private residence)
- Source of exposure and transmission
- Epidemiologic linkage
- Outbreak association
- Travel history within 25 days of illness onset
- Importation status
- Previous history of mumps

Line listing

- Create if linked to at least three confirmed or probable cases

Outbreak control measures

- The main strategy for controlling a mumps outbreak, where 3 or more cases are linked by time and place, is to define the at-risk population and a transmission setting, AND
  - To rapidly identify and vaccinate susceptible persons, OR
  - If a contraindication exists, to exclude susceptible persons from the outbreak setting to prevent exposure and transmission.

- The MMR vaccine should be administered to susceptible persons.
- Mumps vaccination has not been shown to be effective in preventing mumps in persons already infected, however it will help prevent infection in susceptible persons who are not infected if they are vaccinated early in the course of an outbreak.
- Because of the long incubation period for mumps, cases may continue to occur among exposed persons for at least 3 weeks following exposure, even if they were vaccinated during their incubation period.
- Public health authorities should identify groups of people who have or likely had close contact with confirmed, probable or suspected cases of mumps. Close contact for mumps is defined as:
  - having direct contact with a mumps patient's infectious respiratory secretions by droplet transmission (e.g., kissing, sharing water bottles, cups or eating utensils, being coughed or sneezed on within 3 feet of an infected person); or
  - being in close proximity (less than 3 feet) for a prolonged period of time with a person infected with mumps during their period of communicability.
- Examples of groups with likely close contact include: household contacts, romantic or sexual partners, persons from the same study group, social group, fraternity or sorority as a mumps case, or athletes who share sports facilities or equipment with a mumps case.
- **Third dose MMR vaccine recommendations during mumps outbreaks**:
  - Some persons previously vaccinated with two doses of a mumps-containing vaccine who are identified by public health authorities as at increased risk for acquiring mumps may benefit from a third dose of a mumps-containing vaccine during an outbreak. To determine whether a third dose of MMR is indicated, public health authorities should identify the level of transmission that has occurred in the setting, and the likelihood of transmission for each identified exposed individual or group. Refer to the following tables in order to determine whether and for whom a third dose of MMR is recommended:

Table 1. Evidence of mumps transmission*

Evidence of transmission	Time since onset of parotitis in first case	OR	Epidemiological link
No evidence of transmission	< 1 incubation period	OR	Case(s) likely exposed outside the setting (e.g., associated with travel or an external event or other outbreak)
Evidence that transmission occurred	1 - < 2 incubation periods	OR	Case(s) likely exposed within the setting and close contact with an index case(s) was reported (e.g., socialized or attended the same party with a case)
Evidence of sustained or extensive transmission	≥ 2 incubation periods	OR	Case(s) likely exposed within the setting, close contact exposures are difficult to identify, and there is an increasing number of cases (e.g., cannot be epidemiologically linked to a known case or linked to multiple cases)

*Adapted from CDC guidance for public health authorities on use of a 3rd dose of MMR vaccine during mumps outbreaks. Accessed February 25, 2020. https://www.cdc.gov/mumps/health-departments/MMR3.html

Table 2. Likelihood of mumps transmission*

	Community	University or college campus	School (K-12)	Work place
Low likelihood	Community festival or fair with infrequent social interaction† among attendees	Lecture halls; dorms with infrequent social interaction†	Classrooms without cases	Building floor with shared break room
Moderate likelihood	Church group; hobbyist group with frequent meetings; choir	Social group; house/dorm with moderate social interaction†; non-sport extracurricular events	Classrooms with cases; afterschool activities other than sports	Project group that meets daily
High likelihood	Large close-knit community, household or social group; gym with regular close contact among members; crowded venues such as clubs or bars	House/dorm with intense social interaction†; fraternities/sororities; sports teams	Gym class or other class involving close contact activities; adolescent friend group; sports teams	Group of employees who regularly socialize

*Adapted from CDC guidance for public health authorities on use of a 3rd dose of MMR vaccine during mumps outbreaks. Accessed February 25, 2020. https://www.cdc.gov/mumps/health-departments/MMR3.html

†Social interaction includes attending parties or other social gatherings together, sharing drinks, dancing, or playing sports

Table 3. Third MMR decision matrix*

Evidence of transmission	Likelihood of transmission		
	Low	**Moderate**	**High**
No evidence of transmission	Not recommended	Not recommended	Consider if transmission occurs
Evidence that transmission occurred	Not recommended	Consider if transmission continues	Third MMR recommended
Evidence of sustained or extensive transmission	Consider if transmission continues	Third MMR recommended	Third MMR recommended

*Adapted from CDC guidance for public health authorities on use of a 3rd dose of MMR vaccine during mumps outbreaks. Accessed February 25, 2020. https://www.cdc.gov/mumps/health-departments/MMR3.html

- Any recommendation for a third MMR in an outbreak setting should be made in consultation with the NYSDOH.
- If public health authorities indicate administration of a third dose of MMR, initial administration should be limited only to recommended groups. Public health authorities may consider expanding to additional groups (indicated “Consider if transmission continues” in Table 3 above) if case counts continue to increase despite third dose administration to the recommended groups, if there is poor MMR update in the recommended groups and/or if the group(s) at increase risk include hard-to-reach or vulnerable populations.

Outbreak Control measures for school and day care settings

- Students and staff with or under investigation for mumps should be excluded from school for five days from the onset of parotid swelling.
- Conduct a record review of all students/staff born on or after 1/1/57 listing those who are susceptible to mumps. Susceptibles include those without one of the following:
  - For students in child care, nursery school, Head Start or a pre-kindergarten program:
    - Documentation of 1 or more doses of live mumps-containing vaccine given after the first birthday OR
    - Serologic evidence of immunity OR
    - Laboratory confirmation of disease.
  - For students in grades K-12:
    - Documentation of 2 doses of live mumps-containing vaccine given after the first birthday and separated by at least 28 days (4 weeks) OR
    - Serologic evidence of immunity OR
    - Laboratory confirmation of disease.
  - For faculty and non-clinical staff:
    - Documentation of 1 or more doses of live mumps-containing vaccine given after the first birthday OR
    - Serologic evidence of immunity OR
    - Laboratory confirmation of disease.
  - For clinical staff (e.g., school nurses):
    - Documentation of 2 or more doses of a live mumps-containing vaccine given after the first birthday and separated by at least 28 days (4 weeks) OR
    - Serologic evidence of immunity OR
    - Laboratory confirmation of disease.

  Note: Although the presence of mumps-specific IgG, as detected using a serologic assay (EIA or IFA), is considered evidence of mumps immunity, it does not necessarily predict the presence of neutralizing antibodies or protection from mumps disease.
- Notify susceptibles or their parents or guardians of a possible exposure to mumps.
- During an outbreak, exclude susceptible students born on or after 1/1/57 for 26 days after the last person with mumps in the school has been isolated.
- Vaccinate susceptibles if indicated. In an outbreak setting, persons with a history of one dose of mumps-containing vaccine should be offered a second vaccine dose and be allowed to remain in school, even if they are in a group that is routinely only recommended for one dose. Vaccine does not prevent disease if already exposed but can provide future protection against mumps disease.
- Excluded students may be readmitted immediately after vaccination unless they have symptoms of mumps.
- Increase surveillance for additional cases and exclude, test, investigate and report suspect cases as appropriate.

Control of outbreaks in summer camps:

- Review immunization records of all contacts born on or after 1/1/57.

- List those who have not had 2 appropriately timed doses of mumps vaccine, serologic proof of immunity or laboratory confirmation of disease.
- Persons who cannot readily provide documentation of mumps immunity must be vaccinated, excluded or appropriately isolated in the camp setting. The LHD or NYSDOH can provide guidance for isolation recommendations.
- Persons vaccinated with mumps-containing vaccine may be immediately readmitted to the camp setting unless they have symptoms of mumps.
- Increase surveillance for additional cases and exclude, test, investigate and report suspect cases as appropriate.
- For extracurricular activities, all participating individuals must be in compliance with the standards of mumps immunity, be properly vaccinated or excluded.
    - The LHD should be notified of the planned event to review the activity plans and the mumps immunity status of the participating persons. The LHD, in consultation with the NYSDOH, may advise cancellation of travel events based on the nature of the outbreak.
    - Also, based on the nature of the mumps outbreak, camp activities may be confined to the camp grounds with no other groups attending until after 1 full incubation period has passed (e.g., 26 days) after the last case is isolated.

Control of outbreaks in the college/university setting:

- Students and staff with or under investigation for mumps should be excluded from the college/university setting for five days from the onset of parotid swelling.
    - To minimize risk of transmission during isolation, efforts should be made to accommodate isolation of students to a private room with a private bathroom, particularly in dormitory settings.
- Conduct a record review of all students (enrolled in 6 or more credits) born on or after 1/1/57 to identify those who are susceptible to mumps. Susceptible post-secondary students include those without one of the following:
    - Documentation of at least 2 doses of live mumps-containing vaccine given on or after the first birthday and separated by at least 28 days (4 weeks).
    - Serologic evidence of immunity or laboratory confirmation of disease.
        Note: Although the presence of mumps-specific IgG, as detected using a serologic assay (EIA or IFA), is considered evidence of mumps immunity, it does not necessarily predict the presence of neutralizing antibodies or protection from mumps disease.
- Notify susceptibles of a possible exposure to mumps.
    - Encourage susceptible students to get vaccinated, if they have no contraindications.
    - Provide susceptible students with specific information on prevention, symptoms of mumps and what to do if they develop any symptoms.
- Provide education to the college/university community on prevention, symptoms of mumps and what to do if they develop symptoms.
    - The American College Health Association (ACHA), with assistance from the CDC, has developed a toolkit to assist colleges and universities in providing accurate and engaging information to students regarding MMR vaccine, especially in the event of a mumps outbreak on campus. The toolkit is available for download at https://www.acha.org/mumpsToolkit.
- During an outbreak, consider excluding susceptible students born on or after 1/1/57 for 26 days after the last person with mumps in the school has been isolated.
    - Consider exclusion of susceptible individuals in consultation with the local

health department and the NYSDOH, Bureau of Immunization. Exclusion would be considered based on the epidemiology of the illness, i.e. where the outbreak is occurring (sports team, dormitory, club, fraternity, sorority, etc.), number of ill individuals, risk setting, etc.

- Offer to vaccinate students, faculty and staff as indicated.
  - Persons with no documentation of immunity or no mumps containing vaccine should receive their first dose;
  - Persons with a history of one dose of mumps-containing vaccine should receive their second vaccine dose.
  - Vaccine does not prevent disease if already exposed but can provide future protection against mumps disease.
- Excluded students without symptoms of mumps may be readmitted immediately after providing:
  - Documentation of at least 1 dose of a live mumps-containing vaccine given on or after the first birthday OR
  - Laboratory evidence of immunity.
- Increase surveillance for additional cases and exclude, test, investigate and report suspect cases as appropriate.

Control measures for healthcare settings

Preventing transmission of mumps in health care settings consists of four major components:

- Assessment of evidence of immunity of health care personnel (HCP) including: documented laboratory evidence of immunity, birth before 1957 or appropriate vaccination history.
- Vaccination of those without evidence of immunity.
- Exclusion of HCP with active mumps illness as well as non-immune HCP who are exposed to persons with mumps.
- Isolation of patients in whom mumps is suspected.

Evidence of immunity of health care personnel (HCP) includes:

- Documentation of 2 doses of a live mumps-containing vaccine
  - HCP born on or after 1/1/57 with no history of mumps vaccination and no other evidence of immunity should receive 2 doses (minimum interval of 28 days between doses).
  - HCP who have received only 1 dose previously should receive a second dose.

  OR
- Birth before 1/1/57
  - For unvaccinated personnel born before 1957 who lack laboratory evidence of mumps immunity, healthcare facilities should consider vaccinating these personnel with 2 doses of MMR vaccine at the appropriate interval.

  OR
- Serologic evidence of immunity (i.e. positive mumps IgG)
  - 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 HCP but may be useful for evaluating personnel who have had unprotected exposure to mumps who do

not have other proof of immunity.
    - If serology is to be used to assess the immune status of a HCP 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 levels following natural infection, and commercially available tests may not detect such low levels of antibody. 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.
    OR
- Laboratory confirmation of disease.

Management of HCP with illness due to mumps:

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

Management of HCP who are exposed to persons with mumps:

- Unprotected exposures are defined as being within 3 feet of a patient with a diagnosis of mumps without the use of droplet and standard precautions.
- Irrespective of their immune status, all exposed HCP should report any signs or symptoms of illness during the incubation period, from 12 until 25 days after exposure.
- For HCP who do not have acceptable presumptive evidence of immunity:
    - Non-immune personnel should be excluded from the 12th 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. Previously unvaccinated HCP who receive a first dose of vaccine after an exposure are considered non-immune and must be excluded from the 12th day after the first exposure to mumps through the 25th day after the last exposure.
- For HCP with partial vaccination:
    - Those personnel who had been previously vaccinated for mumps but received only one dose of mumps-containing 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.
    - They should notify occupational health if they develop symptoms.
- For HCP who are immune:
    - HCP who are immune do not need to be excluded from work following an unprotected exposure.
    - Because 1 dose of MMR vaccine is about 80% effective in preventing mumps and 2 doses is about 90% effective, some vaccinated personnel may remain at risk for infection.
    - HCP should be educated about symptoms of mumps, including non-specific presentations, and should notify occupational health if they develop these

symptoms.

Isolate patients in whom mumps is suspected, maintaining droplet and standard precautions for 5 days after onset of parotitis.

- For further information, review the isolation protocol: https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html

Reporting

- A Confidential Case Report Form (DOH-389) must be submitted.
- The LHD must be notified within 24 hours when a mumps case is suspected or identified.
- The LHD must notify the NYSDOH Bureau of Immunization regional office staff within 24 hours of its notification.