

Local Health Department Guidelines for the Epidemiological Investigation and Control of Mumps

Maryland Department of Health and Mental Hygiene
Prevention and Health Promotion Administration
Infectious Disease Epidemiology and Outbreak Response Bureaus (IDEORB)
Center for Immunization
May 2017 - Updated to Include Information About Activation and
Deactivation of Emergency Response Operations

Introduction

Mumps is an acute viral illness that can affect both children and adults. Historically, mumps was a frequent cause of illness in young children, especially in the late winter and spring. Since the mumps vaccine was licensed in 1967 and recommended for routine immunization in 1977, mumps incidence has declined to very low levels in the U.S. The seasonality of mumps is now less evident, and cases usually occur year-round. Mumps cases and outbreaks continue to occur sporadically, and often involve individuals who recently traveled to mumps-endemic regions outside the U.S. or who were exposed to imported cases of mumps.

Although vaccination is the best strategy for preventing mumps infection, the vaccine is not 100% effective. Previously vaccinated individuals can still get mumps, and outbreaks have occurred in highly vaccinated populations. In 2006, a multistate mumps outbreak in the Midwestern U.S. resulted in over 6,500 reported cases, many of whom were college students who had received 2 doses of mumps vaccine. An outbreak in 2009, which resulted in over 3,000 cases in close-knit Jewish communities in New York and New Jersey, also involved a large proportion of previously vaccinated individuals. The early identification of mumps illness is important so that measures can be taken to prevent widespread mumps transmission in the community.

This document was written to provide guidance on the investigation of mumps cases and outbreaks. The recommendations in this document are intended to provide general guidance. Mumps incidents should be evaluated on an individual basis, with the consultation of local and state infection control staff if needed, to determine the appropriate steps for mumps prevention and control.

Questions regarding this document can be directed to:

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Disease Description

Mode of Transmission: Mumps is transmitted from person to person through airborne transmission, or direct contact with infectious respiratory droplets or saliva.

Incubation Period: The incubation period of mumps is 16 to 18 days (range: 12 to 25 days) from day of exposure.

Clinical Manifestation: Parotitis, which occurs in 30% to 40% of cases, is the most characteristic symptom of mumps. Parotitis can occur unilaterally or bilaterally, and results in swelling, tenderness and/or pain in one or more salivary glands. Parotitis may initially present as an earache or tenderness in the jaw area and typically occurs within 2 days of infection. The swelling usually resolves after 10 days.

Mumps infection can also be characterized by respiratory symptoms or nonspecific symptoms such as malaise, myalgia, headache and low-grade fever which last for 7 to 10 days. Up to 20% of individuals infected with mumps experience no symptoms. Children are more likely to be asymptomatic.

Some complications from mumps are known to occur more frequently in adults than children. Women who have mumps in their first trimester are at increased risk for spontaneous abortion.

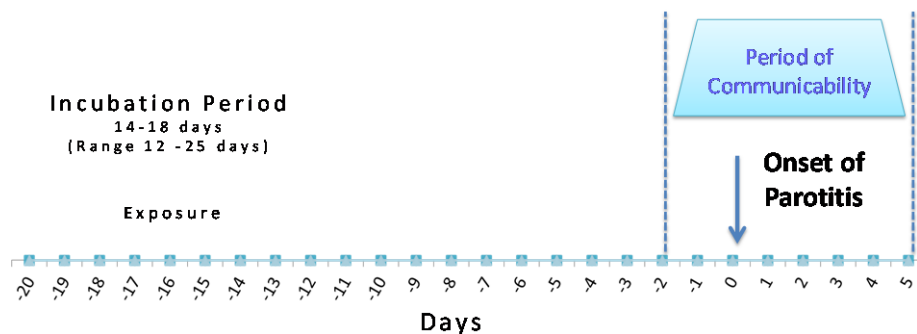
Aseptic meningitis is the most common complication from mumps and occurs asymptotically in 50% to 60% of cases. Up to 15% of patients have symptoms of meningitis, including headache and stiff neck, and symptoms typically resolve without sequelae in 3 to 10 days. Encephalitis is a rare complication from mumps.

Orchitis (testicular inflammation) is a complication that can occur in up to 50% of postpubertal males with mumps. Symptoms of orchitis include: testicular swelling, tenderness, nausea, vomiting and fever. Testicular swelling and pain usually subside within 1 week, but tenderness may last for weeks. Orchitis rarely results in sterility.

Oophoritis (ovarian inflammation) develops in approximately 5% of women and adolescent girls, and does not affect fertility.

Deafness occurs in approximately 1 of 20,000 reported cases and occurs unilaterally in 80% of those cases. Death due to mumps is rare.

Mumps Disease Progression



Communicability Period: An infected individual is contagious from 2 days before to 5 days after onset of parotitis. The degree of contagiousness is similar to rubella and influenza. Mumps is less contagious than measles or varicella.

CDC Surveillance Case Classification and Definitions

CDC Surveillance case classification of mumps

1) Clinical Case Definition: An illness characterized by acute onset of unilateral or bilateral self-limited swelling of the parotid or other salivary gland(s) lasting at least 2 days, and without other apparent cause.

2) Clinically compatible illness: An illness clinically compatible with mumps is characterized by: parotitis or other salivary gland swelling, aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, mastitis, or pancreatitis.

3) Laboratory tests suggestive of mumps: (see *Testing/Laboratory Diagnosis* Section for details)

- Isolation of mumps virus from a clinical specimen
- Detection of mumps nucleic acid by polymerase chain reaction (PCR)
- Detection of mumps IgM antibody
- Demonstration of mumps-specific antibody response, in the absence of recent mumps vaccination by:
 - A four-fold increase in mumps IgG antibody titer as measured by a quantitative assay, or
 - A seroconversion from negative to positive using a standard serologic assay of paired acute and convalescent serum specimens.

4) CDC Case Classification:

- **Suspect:**
 - 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 immunoglobulin M (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 mumps laboratory confirmation for mumps virus with reverse transcription polymerase chain reaction (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
- Note: The most current CDC case definitions can be found at: http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/case_definitions.htm#m

5) Outbreak: An outbreak is defined as two or more epi linked cases, at least one lab confirmed, occurring within 25 days in a common setting. Mumps is the only cause of epidemic parotitis.

Definitions

Internationally Imported case: An internationally imported case results from mumps exposure that occurs outside the United States, as evidenced by:

- at least some of the exposure period (12-25 days before onset of parotitis or other mumps-related complications) occurring outside the U.S. , and,
- onset of parotitis or other mumps-related complications occurring within 25 days after entry into the United States, and,
- no known exposure to mumps in the U.S. during the exposure period.

U.S.-acquired case: A case is considered U.S.-acquired if travel outside of the U.S. did not occur in the 25 days before onset of parotitis or other mumps-related complications, or, was known to have been exposed to mumps within the U.S. In addition, U.S.-acquired cases are sub-classified into 4 mutually exclusive categories:

- **Import-linked**, if the case is epidemiologically linked to an internationally imported case.
- **Imported-virus**, if the case is not epidemiologically linked to an internationally imported case but viral genetic evidence indicates infection with an imported mumps genotype, defined as a genotype that is not occurring in the U.S. in a pattern of endemic transmission. Endemic transmission is defined as a chain of mumps virus transmission that is continuous for ≥ 12 months within the U.S.
- **Endemic**, if evidence indicates that the case is epidemiologically or virologically linked to endemic transmission in the United States.

- **Unknown source**, if epidemiological and virological link to importation or endemic transmission in the U.S. cannot be established.

An import-associated case is defined as a case that is classified as internationally imported, import-linked or imported-virus.

Testing/Laboratory Diagnosis

Patients with clinical signs and symptoms consistent with mumps should receive laboratory testing to confirm a mumps diagnosis (see *Definitions and CDC Surveillance Case Classification* section above for list of laboratory tests suggestive of mumps). Persons who are asymptomatic for mumps, including asymptomatic close contacts of a confirmed mumps case, should *not* be tested.

DHMH recommends collection of:

- 1) a blood specimen for serologic antibody testing,
- 2) a swab of buccal mucosa for viral detection, and
- 3) a urine specimen for viral detection.

Viral detection can be done by culturing the virus or detecting viral nucleic acid using PCR. PCR testing is widely available and results are generally available within 3 days. Culture results have limited clinical usefulness since results may take up to 4 weeks to be available. Laboratory tests for mumps are summarized in Table 1.

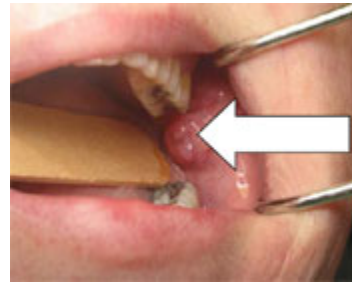
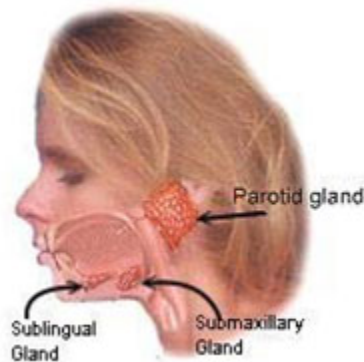
Specimens may be submitted to the DHMH Laboratory for serologic testing and viral detection. However, you must obtain approval from the Center for Immunization staff prior to viral detection specimen submission.

Laboratory testing for mumps is helpful in confirming mumps infection in persons with clinically compatible illness. However, laboratory diagnosis may be challenging in previously vaccinated persons because:

- 1) the IgM antibody response may be transient or undetectable by standard assay.
- 2) viral shedding may occur for a shorter period, as compared to unvaccinated persons, making viral isolation from mucosal specimens difficult beyond the first few days after symptom onset.
- 3) IgG antibody levels rise quickly soon after exposure, resulting in a high IgG antibody level at the time an acute specimen is collected. As a result, the 4-fold rise in IgG titer that is expected when comparing the acute specimen titer to a convalescent specimen titer is not seen. Detection of a 4-fold increase in IgG titer is rarely used to support a mumps diagnosis in previously vaccinated persons.

Recommended steps for testing:

- 1) At first contact with a suspected case of mumps, obtain a serologic specimen to test for mumps IgM antibodies and mumps IgG titer (quantitative). Ideally, the specimen should be obtained within 3 days of parotitis onset, and not after 10 days of parotitis onset.
- 2) At the same visit, collect a swab of the buccal mucosa for PCR and culture. Viral specimens are extremely helpful in confirming mumps infection since serologic testing may not be able to distinguish past infection from current infection. To collect the buccal swab:
 - a. Massage the parotid (salivary gland) for 30 seconds
 - b. 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 gum by sweeping the swab near the upper molar to the lower molar area.
 - c. The buccal swab should be collected using a commercial product designed for throat specimens or a flocked polyester fiber swab. Swabs should be placed in viral transport medium and shipped on cold packs.



- 3) If feasible, collect a urine specimen at the time the buccal and serologic specimens are collected, for PCR and culture. Urine specimens should be collected in a sterile container with leak-proof screw top lid and shipped on cold packs.
- 4) If the IgM test result is inconclusive or negative, it is sometimes advisable to obtain a convalescent serologic specimen 2-3 weeks after collection of the initial (acute) specimen to repeat the IgM antibody test and obtain a convalescent IgG titer. A second IgM negative result does not rule out mumps unless the IgG result is also negative.
- 5) If an IgM negative result is obtained from a specimen collected ≤ 3 days after parotitis onset in an unvaccinated person, another specimen should be collected 5-7 days after symptom onset to confirm the result.

Interpretation of results:

Laboratory evidence of mumps is commonly obtained by detecting mumps IgM antibody in a single serum specimen, detecting a rise in the titer of IgG antibody in two serum specimens drawn roughly two weeks apart, or detection of mumps RNA in a urine or buccal specimen. Neither laboratory evidence *alone* nor clinical symptoms without laboratory testing is sufficient to confirm acute mumps infection.

Conversely, a negative mumps laboratory result in a person with clinical symptoms of mumps regardless of vaccination status does not rule out mumps as a diagnosis of acute infection.

Table 1: Summary of Laboratory Testing for Mumps

	IgM Testing	IgG Testing	Virus Detection by PCR	Virus Detection by Culture
Window period for specimen collection	IgM is detectable within 5 days after symptom onset and reaches a peak 1 week after symptom onset. IgM remains elevated for weeks to months. (IgM response may be absent or transient in previously vaccinated persons)	IgG is detectable shortly after symptom onset and is long-lasting.	Ideally, swab of buccal mucosa should be collected within 3 days of parotitis onset, and not after 10 days of parotitis onset. For previously vaccinated persons, virus is most likely to be detected within 5 days of symptom onset, when maximal viral shedding is occurring.	Ideally, swab of buccal mucosa should be collected within 3 days of parotitis onset, and not after 10 days of parotitis onset. For previously vaccinated persons, virus is most likely to be detected within 5 days of symptom onset, when maximal viral shedding is occurring.
Type of Specimen	Blood	Blood	Buccal swab; Urine	Buccal swab; Urine
Benefits	-Rapid results, high clinical usefulness -IgM testing widely available -EIA tests for mumps IgM are highly specific -IgM can often be detected shortly after parotitis onset (Note: if collected within the first 3 days of onset, a negative result can occur)	-Rapid results, high clinical usefulness -IgG testing widely available	- Rapid results, high clinical usefulness - Swabs of buccal mucosa yield the best viral sample	- Considered the gold standard for mumps confirmation - Less likely to yield falsely positive results, as compared to PCR

Limitations	<ul style="list-style-type: none"> -Recent mumps vaccination and some other illnesses (e.g. parainfluenza 1, 2, and 3; Epstein-Barr) can cause false-positive - Lab testing alone does not confirm mumps - Negative IgM result in person with prior mumps illness or vaccination does not rule out acute infection 	<ul style="list-style-type: none"> -Requires an acute and convalescent specimen to confirm diagnosis (a single IgG positive result is not sufficient for laboratory confirmation of mumps as it does not distinguish between acute and past infection) - Lab testing alone does not confirm mumps 	<ul style="list-style-type: none"> - Lab testing alone does not confirm mumps - Urine samples are less likely to yield a detectable viral sample as compared to oral swabs - Possibility of falsely positive results due to sample contamination 	<ul style="list-style-type: none"> - Takes up to 4 weeks for results; limited clinical usefulness
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Treatment

There is no specific antiviral treatment for mumps.

Prevention/Vaccination

Vaccination remains the most effective way to prevent mumps infection. Live attenuated mumps virus vaccine is incorporated with measles and rubella vaccine as a combined vaccine (MMR). The current ACIP recommendations for routine vaccination for children indicate a first dose of MMR at 12-15 months of age with a second dose at school entry (4-6 years). Two doses of MMR vaccine are also recommended for adults at high risk, such as international travelers, college students, or healthcare workers born during or after 1957. For healthcare workers born before 1957 without other evidence of immunity, one dose MMR should be considered.

Case/Outbreak Investigation

When a patient is suspected of having mumps, a case investigation should be started immediately. Timely and thorough case investigation should: confirm the patient’s diagnosis; ensure appropriate medical follow-up for affected persons; identify the source of infection; locate persons who may have been exposed; and isolate potentially infectious persons to prevent transmission of illness in the community.

Case investigation procedures should not be delayed pending confirmatory lab results. Interviewing the case-patient and case-patient’s healthcare provider promptly after case notification is necessary so that infection control measures can be implemented immediately should laboratory results confirm mumps infection.

Recommended case investigation procedures:

(Refer to *Special Settings* Section for additional guidance on case investigation procedures relevant to schools, hospitals, and settings where close contact may facilitate transmission of mumps.)

1) Confirm mumps diagnosis

- Obtain specimen for lab testing if patient is experiencing clinical symptoms of mumps (Refer to *Testing/Laboratory Diagnosis* Section for details)

2) Identify source of infection

- Interview patient about contact with other known mumps cases or persons with symptoms of mumps.
- Assess whether patient traveled outside of the U.S. in the 25 days prior to parotitis onset to determine if mumps infection was acquired in the U.S. or abroad.
- Obtain an accurate and complete immunization history of the case.

3) Identify exposed and susceptible persons

Initiate a contact investigation to identify persons who may have been exposed to mumps through contact with the case-patient during the infectious period (2 days before to 5 days after onset of parotitis). It is important to note that persons who have previously received mumps-containing vaccine may still get mumps illness since the vaccine is not 100% effective. Birth before 1957 also does not guarantee immunity to mumps.

Exposures can occur in various settings including: the home, workplace, school, prison, dormitory, airplane, doctor's office, etc. Contact with case-patients may vary widely in type and duration. Therefore, mumps exposures should be evaluated on a case-by-case basis following an interview with the case and/or contact person to determine the nature of the exposure.

A **susceptible individual** is defined as a person who has not received 2 doses of mumps-containing vaccine on or after his/her 1st birthday or does not have documented history of disease. In general, a person can be considered immune to mumps if they:

- 1) Have written documentation of receiving 2 mumps-containing vaccines; or,
- 2) Have documentation of past mumps infection, diagnosed by a physician; or,
- 3) Were born before 1957; or,
- 4) Have serologic evidence of immunity (IgG antibody detected in a lab test).

Note: Verbal confirmation of immunity is not acceptable. Additionally, although birth before 1957 is acceptable evidence of immunity, healthcare facilities should strongly consider vaccinating workers who were born before 1957 and have no documentation of receiving 2 mumps-containing vaccines.

- Interview the case-patient regarding contact with others during his/her infectious period (2 days before to 5 days after parotitis onset).

- If the case-patient reports travel (e.g. via plane) during his/her infectious period, contact staff at Maryland Department of Health and Mental Hygiene Center for Immunization for assistance in identifying passengers and persons in other jurisdictions/locations who may need to be contacted.
- Obtain and document immunization histories for case-patient and all contacts.
- All symptomatic contacts should be tested for mumps and followed as suspected mumps cases.

4) Initiate mumps control measures

Mumps immune globulin is not effective as post-exposure prophylaxis and is no longer manufactured in the U.S. Mumps vaccine has not been shown to prevent illness in those already infected but should be administered, preferably as MMR, to susceptible persons as it may prevent future infection. Persons who have received only one dose of mumps vaccine previously, should get a second dose of mumps vaccine.

- Standard and droplet precautions are appropriate until 5 days after onset of parotitis (including hand hygiene and cough etiquette).
- Mumps vaccine should be provided to susceptible persons.
- Susceptible persons who receive vaccination:
 - Can be immediately readmitted to childcare or school.
 - Must be excluded from direct patient contact and work in a medical facility from the 12th day after first unprotected exposure through the 25th day after last exposure, regardless of whether or not they received vaccine.
- Persons who are exempt from mumps vaccination or who decline to be vaccinated should be excluded:
 - From schools and child care until at least the 26th day after the onset of parotitis in the last case identified.
 - From medical settings from the 12th day after first exposure through the 25th day after last exposure.

During this time period, they should be monitored for the development of symptoms consistent with mumps.

5) Conduct surveillance

Active surveillance should be maintained for at least 2 incubation periods (50 days) after the last reported confirmed case to ensure that all cases are identified.

Special Settings

In addition to following the recommended steps for case investigation described above, the following mumps control measures should be conducted for cases and outbreaks occurring in settings where mumps can be transmitted easily due to crowding and/or close contact of individuals.

1) Schools and Childcare Centers

- Assess immunization status of staff and students.
- Vaccinate susceptible staff and students who are not up-to-date on mumps vaccination.
- Susceptible persons who receive mumps vaccination (whether it is their 1st or 2nd dose) can return to the school or childcare immediately.
- Susceptible persons who refuse vaccination must be excluded from school or childcare until at least the 26th day has passed from the onset of parotitis in the last case of mumps identified in the school.
- Persons who develop symptoms of mumps should be excluded from school or childcare for 5 days after parotitis onset.
- Request that the school notify parents/guardians that a mumps case has been identified in the school. A letter and mumps fact sheet should be sent to each parent/guardian.

2) Healthcare Settings

- Assess immunization status of all staff, including persons involved in direct patient care (e.g. nurses, physicians, phlebotomists) as well as persons who work in the patient care setting (e.g. clerical staff, front office staff, technicians).
- Vaccinate susceptible persons who were exposed and susceptible to mumps.

Note: Persons born before 1957 can be considered immune to mumps. However, if they have direct contact with patients, mumps vaccination should be strongly considered.

- Susceptible persons who were exposed and have no immunity to mumps should be excluded from direct patient contact and the affected medical facility from the 12th day after first unprotected exposure through the 25th day after last exposure, regardless of whether they receive vaccine after exposure. They can resume patient contact on the 26th day after their exposure date provided they are not experiencing symptoms of mumps infection.
- Healthcare personnel with documentation of 1 vaccine dose may remain at work and should receive the second dose of MMR.
- Susceptible persons who develop symptoms of mumps should be excluded from the facility for 5 days after parotitis onset.

Reporting

All suspected mumps cases must be reported to staff at the Maryland Department of Health and Mental Hygiene Center for Immunization within 24 hours after initial notification. All case investigations should be promptly entered into NEDSS (National Electronic Disease Surveillance System) and the information reviewed for completeness and accuracy. The following table summarizes information that should be collected during case/outbreak investigations and entered into NEDSS:

Table 2: Summary of information to collect during case/outbreak investigation

Type of Information	Information to be collected and reported
Demographic	Name Address Date of birth Sex Race/Ethnicity Reporting source Date reported Jurisdiction
Clinical	Date of parotitis onset Duration of parotitis Other symptoms Onset of other symptoms Hospitalizations Complications
Laboratory	Serologic test date(s) and result(s) Date of specimen collection for viral isolation
Epidemiologic	Source of exposure/infection (e.g. note epidemiologic link to confirmed cases or outbreaks) Import status (e.g. Imported, U.S.-acquired)
Vaccination History	Date(s) of mumps vaccination(s) Reason for vaccination exemption, if applicable
Outcome	Case classification Date of death, if applicable

Vaccine Adverse Events

Adverse events that occur after administration of the mumps vaccine should be reported to the Vaccine Adverse Event Reporting System (VAERS), a passive reporting system use to monitor vaccine safety. Any clinically significant events, unexpected events following vaccination and/or events listed on the vaccine manufacturer’s package insert, should be reported to VAERS. Adverse events may be reported by submitting a VAERS form online, by fax or by mail. Visit <http://vaers.hhs.gov> for detailed instructions on reporting.

Activation and Deactivation of Emergency Response Operations

The Infectious Disease Epidemiology and Outbreak Response Bureau (IDEORB), in consultation with the Director and Deputy Director of the Prevention and Health Promotion Administration, will activate emergency response operations when one or more of the following criteria are met:

- Existing staffing is inadequate to assign responsibilities to maintain critical operations for more than three operational periods
- Resources (financial or material or operational) required to mount and/or sustain an ongoing emergency response are needed from outside of the Bureau or Administration
- A non-infectious disease event substantially disrupts critical operations of the unit

IDEORB, in consultation with the Director and Deputy Director of the Prevention and Health Promotion, will deactivate emergency response operations when one or more of the following criteria are met:

- Public health problem is contained or resolved
- Emergency response is incorporated into normal operations and adequate resources are available to sustain all ongoing responses
- Non-infectious event is over and disruption impacting critical operations no longer exists

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Mumps Case Definition available at:

http://www.cdc.gov/osels/ph_surveillance/nndss/casedef/mumps_current.htm

Sample letter to parents:

Dear Parents,

We have just been notified of a suspect case of mumps in your child's school. Mumps is a contagious disease that often begins with parotitis or swelling of the salivary glands on one or both sides of the neck area. Fever and headache may also occur. Symptoms may first be noticed as an earache. The swelling usually appears 14-18 days after a person is exposed. The illness is usually mild but can result in complications such as meningitis or deafness.

Mumps is spread when an infected person coughs or sneezes, or shares food/drinks. A person with mumps can be spread the disease from 2 days before the swelling appears until 5 days after the swelling appears.

Students suspected of having mumps will be excluded from school and may return to school following the 5th day after the swelling appears. Exposed unvaccinated students and staff should receive a dose of vaccine as soon as possible. Those unvaccinated students and staff that receive vaccine will be allowed back to school immediately. Unvaccinated students and staff that do not receive vaccine due to medical or religious reasons will be excluded from school until 25 days after the onset of swelling in the last case of mumps.

Mumps can be prevented with appropriate vaccination. Mumps vaccine is administered to children in combination with measles and rubella vaccine (MMR) in a two dose series. Please check with your health care provider to make sure your child's shots are up-to-date.

Please watch your child for any symptoms of mumps (neck swelling) over the next several weeks. If you notice any of these symptoms in your child, please notify your primary care physician and the (typically, school nurse and/or county health department) at (phone number) as soon as possible.

Sincerely,