Official websites use .gov A .gov website belongs to an official government organization in the United States. Secure .gov websites use HTTPS A lock ( ) or https:// means you've safely connected to the .gov website. Share sensitive information only on official, secure websites. Authors: Nina B. Masters, PhD; Jessica Leung, MPH; Jamie Tappe, MPH; Mona Marin, MD; Stephen N. Crooke, PhD; Bettina Bankamp, PhD; Sara Oliver, MD; Paul Rota, PhD Mumps is an acute viral illness caused by a paramyxovirus and typically presents as swelling of the parotid (parotitis) or other salivary gland[s]. Mumps parotitis may be unilateral or bilateral and usually lasts about 3 to 7 days (average 5 days); most cases of parotitis resolve within 10 days of onset. Nonspecific prodromal symptoms may precede parotitis by several days, including low-grade fever, which may last 3–4 days, myalgia, anorexia, malaise, and headache. The incubation period for mumps ranges from 12–25 days, but parotitis typically develops 16 to 18 days after exposure to mumps virus.[1] Fully vaccinated persons can get infected with mumps virus but are at much lower risk for mumps illness and its complications. Mumps reinfection in patients who previously had natural infection or recurrent mumps (parotid swelling resolves and then weeks to months later occurs on the same or other side) can also occur. [2–4] Mumps infection may present only with nonspecific or primarily respiratory symptoms or may be asymptomatic.[5] Among unvaccinated people, approximately 20% of infections can be asymptomatic;[6–8] the frequency of asymptomatic infection among vaccinated people is unknown. The most common complications of mumps include orchitis, oophoritis, mastitis, pancreatitis, hearing loss, meningitis, and encephalitis. Complications may occur in the absence of parotitis.[9,10] The frequency of complications is lower in vaccinated patients compared with unvaccinated patients (Table 1).[11-14] Among vaccinated patients, complications of mumps are uncommon but occur more frequently among adults than children, mainly due to higher rates of orchitis among post-pubertal males.[8] Up to half of patients with mumps orchitis develop atrophy of the affected testicle(s).[15,16] While there is a

theoretical risk for temporary sterility or subfertility from oligospermia, azoospermia, or asthenospermia among men with mumps orchitis,[15] no studies have assessed risk for permanent infertility. Nephritis, myocarditis, and other sequelae, including paralysis, seizures, cranial nerve palsies, and hydrocephalus have also been reported in mumps patients but are uncommon. Death due to mumps is exceedingly rare. Table 1. Frequency of complications among unvaccinated and vaccinated patients with mumps Mumps virus is transmitted person to person through direct contact with saliva or respiratory droplets of a person infected with mumps (i.e., droplet transmission). Mumps is not as easily transmitted as measles or varicella, viruses that spread via predominately airborne transmission. Mumps typically requires close contact to spread, especially among vaccinated populations. Close contact* is defined for mumps as: A person with mumps is considered infectious from 2 days before through 5 days after parotitis onset.[22] Although mumps virus has been isolated from 7 days before through 11–14 days after parotitis onset,[22–24] the highest percentage of rRT-PCR positive results and the highest virus loads occur closest to parotitis onset and decrease rapidly thereafter.[22,25,26] As a result, specimens for PCR testing should be collected within 10 days, ideally within 0–3 days, of parotitis onset (specimen collection details can be found in the mumps chapter of the Laboratory Support for Surveillance of Vaccine-Preventable Diseases). Transmission may also occur from persons with asymptomatic infections or only prodromal symptoms.[27] No studies have assessed peak infectiousness in mumps patients who do not have parotitis (e.g., patients who only have nonspecific respiratory symptoms or only have complications like orchitis). In lab-confirmed patients without parotitis, onset of first symptom can be used in place of onset of parotitis to estimate a patient’s infectious period. Mumps virus has been isolated up to 14 days in urine[28] and semen[29], but for optimal specimen collection and interpretability of results, specimens for PCR testing should be collected within 10 days of parotitis onset (specimen collection details can be found in the mumps chapter

of the Laboratory Support for Surveillance of Vaccine-Preventable Diseases). No studies have assessed if mumps virus can be transmitted through either of these fluids. Mumps infection that occurs in pregnant women is generally benign and not more severe than in women who are not pregnant. Few studies have been conducted to determine if there is a risk that mumps infection in pregnant women may cause complications during pregnancy. One study from 1966 reported an association between maternal mumps infection during the first trimester of pregnancy and an increase in the rate of spontaneous abortion or intrauterine fetal death,[30] but this association was not found in another study.[31] Another study did not find a significant association between low birth weight and mumps infection during pregnancy.[32] While there are case reports of congenital malformations in newborns born to mothers who had mumps during pregnancy,[33] the only prospective, controlled study found rates of malformations were similar between newborns of mothers who had mumps and those of mothers who did not have mumps during pregnancy.[34] Not all cases of parotitis—especially sporadic ones—are due to mumps infection. Parotitis can be caused by parainfluenza virus types 1–3, Epstein Barr virus, influenza A virus (H3N2), human herpes virus 6A and 6B, herpes simplex viruses 1 and 2, Coxsackie A virus, echovirus, adenoviruses, lymphocytic choriomeningitis virus, and human immunodeficiency virus.[35] There have also been limited case reports of parotitis associated with COVID-19. Parotitis can also result from noninfectious causes such as drugs, tumors, immunologic diseases, and obstruction of the salivary duct. However, other causes do not produce parotitis on an epidemic scale.[36,37] Top of Page In the prevaccine era, mumps was a notable cause of morbidity in the United States, with well over 100,000 cases reported each year. During that time, mumps was a universal childhood disease, with highest incidence among children 5–9 years of age.[38,39] Permanent unilateral deafness caused by mumps occurred in 1 of 20,000 infected persons. Bilateral, severe hearing loss was very rare.[19] Before 1967, mumps accounted for approximately 10% of all cases of aseptic

meningitis.[40] In 1967, mumps encephalitis accounted for 36% of all reported encephalitis cases.[38] During 1962–1967, there were 3 deaths per 10,000 reported mumps cases.[38] Mumps also substantially affected US armies during mobilization.[41] The average annual rate of hospitalization resulting from mumps during World War I was 55.8 per 1,000, which was exceeded only by the rates for influenza and gonorrhea.[41] Mumps vaccine was licensed in the United States in 1967.[38] In 1977, the Advisory Committee on Immunization Practices (ACIP) made a recommendation for 1 dose of mumps vaccine for all children at any age after 12 months.[42] In 1989, children began receiving 2 doses of mumps vaccine because of implementation of a 2-dose measles vaccination policy using the combined measles, mumps, and rubella vaccine (MMR).[43] In 2006, ACIP recommended a 2-dose mumps vaccine policy routinely for school-aged children, students at post-high school educational institutions, health-care personnel, and international travelers, and recommended that a second dose be considered in outbreak settings for children aged 1-4 years and adults who had received 1 dose.[44] Following mumps vaccine licensure and ACIP recommendations for its use, reported cases of mumps steadily decreased from >152,000 cases in 1968 to 2,982 cases in 1985.[45] During 1986–1987, a resurgence occurred with more than 20,000 reported mumps cases. The primary cause of this resurgence was low vaccination levels among adolescents and young adults.[45] In the late 1980s and early 1990s, outbreaks were reported among primary and secondary school children who had previously received 1 dose of mumps-containing vaccine. [46,47] The second dose of MMR vaccine recommended in 1989 subsequently improved mumps control as well. The launch of the Vaccines for Children’s program in 1994 further expanded access to routine childhood immunizations, including MMR. By the early 2000s, reported mumps cases declined to an average of less than 300 cases annually.[48] Starting in 2006, there has been an increase in the number of mumps cases and outbreaks reported in the United States, with several peak years. The

epidemiology has shifted from the majority of cases occurring among unvaccinated children during the pre-vaccine era to most cases occurring in fully vaccinated adolescents and young adults, mainly driven by outbreaks on college campuses, close-knit communities, and other congregate settings. Although this resurgence began with geographically localized large outbreaks, it has since transitioned to outbreaks of varying sizes and settings across most US states. In 2006, the first peak year, 6,584 cases were reported, predominately among midwestern college students.[12] In the 6 states where most cases were reported, approximately 63% of patients with known vaccination status had received 2 doses of MMR vaccine.[12] In 2007 and 2008, the number of annual cases nationwide declined to 800 and 454 cases, respectively.[49,50] From 2009 to 2010, 2 large outbreaks occurred, the first among Orthodox Jewish communities in the Northeast (3502 cases)[13] and the second in the U.S. Territory of Guam (505 cases).[14] Cases in these outbreaks were mainly among fully vaccinated children and adolescents.[13,14] Between July 2010 and December 2015, at least 23 large outbreaks (20–485 cases per outbreak) were reported in 18 states, most of which occurred among fully vaccinated young adults of college age.[51] Following a relative decline in cases from 2011–2013 (~200–500 cases reported annually), cases began to increase again in 2016 and 2017, peaking with >6,000 cases reported in both years.[52,53] From January 2016 through June 2017, 39 health departments (37 states, New York City, Washington DC) reported 150 outbreaks, accounting for >9,000 cases.[54,55] Median outbreak size was 10 cases (range: 3–2,954 cases). Outbreaks occurred in many different settings, including universities, schools, athletics teams and facilities, church groups, workplaces, large parties or events, and households. Of 7,187 (78%) patients with known vaccination status, 75% had ≥2 doses of MMR vaccine.[55] Since 2007, patients aged <18 years account for approximately 1/3 of all reported mumps cases, with the majority being vaccinated (among patients aged ≥1 year with known vaccination status, 74% of 1–4-year-olds had received ≥1 MMR and 86% of

5–17-year-olds had received ≥2 MMR doses).[56] In 2019, there were approximately 3,800 cases reported, occurring in a range of different outbreak settings[57] with 898 cases reported in detention facilities across several states, primarily among adult migrants.[58] During 2020–2022, there has been a large reduction in mumps cases likely due to social distancing and the other COVID-19 prevention measures, with 150–700 reported annually.[57] A Cochrane review and meta-analysis published in 2021 found a pooled estimate of vaccine effectiveness of two doses of MMR vaccine against clinical mumps disease of 86% (RR 0.12, CI: 0.04-0.35), and 1 dose of 72% (RR 0.24, CI: 0.07-0.76),[59] lower than for the other two components of the MMR vaccine (97% for measles after two doses and 97% for rubella after one dose). While evidence is limited, experts believe that several factors contribute to some vaccinated people being at risk for mumps infection, including: Introduction of mumps virus into settings with intense or frequent close contact exposures that facilitate transmission can lead to outbreaks among highly vaccinated people. Examples of intense close contact exposures include physical contact, such as attendance at a crowded party, or during dancing, contact sports, kissing or sexual activity and sharing of gym equipment or drinks. Examples of frequent close contact exposures include prolonged contact such as living in confined or shared spaces; repeated contact such as meeting regularly, or sharing a daily routine. In 2012, CDC issued interim guidance on consideration of the use of a third dose of MMR vaccine during mumps outbreaks for specific target populations. One study conducted during a large university outbreak in 2015–2016 found that students who received a third MMR vaccine dose had a 78% lower risk of mumps than those with 2 doses.[60] The increased burden of mumps and results from this study, led the Advisory Committee on Immunization Practices (ACIP) to examine the evidence on use of a third dose of MMR vaccine during mumps outbreaks.[61] In October 2017, ACIP recommended a third dose of a mumps-containing vaccine‡ for people who are identified by public health authorities as being part of a group or

population at increased risk for mumps because of an outbreak. Subsequently, CDC developed guidance for health departments on implementation of the recommendation. The duration of protection from a third dose of MMR vaccine is unknown. Immunological studies suggest the added protection from a third MMR dose may be short term, as people who received a third dose were observed to have a boost in neutralizing antibodies one month after vaccination that then declined to near-baseline levels after one year [62]. More studies are needed to assess vaccine effectiveness over time and if other mechanisms of the immune response may provide longer term protection. Therefore, a third dose of MMR vaccine is recommended only for additional individual protection against mumps during outbreaks, as demonstrated by vaccine effectiveness studies conducted during outbreaks. ACIP currently recommends two doses of MMR vaccine for routine vaccination; there is no recommendation for routine vaccination with a third dose. Worldwide, mumps is not as well controlled as measles and rubella. From 1999–2019, on average, about 500,000 mumps cases were reported to the World Health Organization annually [63]; however, global mumps incidence is challenging to estimate as mumps is not a notifiable disease in many countries. As of 2021, mumps vaccine is routinely used in 123 of 194 (63%) countries.[64] Since the mid-2000s, mumps outbreaks have also been reported among populations with high 2-dose MMR coverage in other countries, including United Kingdom,[65] Ireland,[66] New Zealand,[67] Canada,[68] Netherlands,[69] Spain,[70] and Norway.[71] Most sequenced mumps specimens in these recent outbreaks were genotype G [68, 69, 71]. Despite these outbreaks, mumps incidence is still much higher in countries that do not have routine mumps vaccination. Top of Page For specific information about mumps vaccination, refer to the Pink Book, which provides general recommendations, including vaccine use and scheduling, immunization strategies for providers, vaccine content, adverse events and reactions, vaccine storage and handling, and contraindications and precautions. Top of Page The following case definition for mumps was updated and

approved by the Council of State and Territorial Epidemiologists in 2023.[72] to improve the specificity of the case definition for mumps, particularly for sporadic cases. In the absence of a more likely alternative diagnosis, an acute illness characterized by: Confirmed: Probable: Suspect: Top of Page If mumps is suspected, laboratory testing should be performed. rRT-PCR testing is preferred to serologic testing for mumps whenever possible. This is because rRT-PCR testing allows for opportunities for molecular characterization of circulating mumps viruses. Additionally, in vaccinated persons, the IgM response may not be detectable, and there are also concerns with cross-reactivity to other viruses. All specimens sent to CDC or Association of Public Health Laboratories (APHL)-Vaccine Preventable Diseases (VPD) Reference Centers should be accompanied by complete information on the case's symptom onset date and vaccination status. Refer to Chapter 22, "Laboratory Support for Surveillance of Vaccine-Preventable Diseases" for detailed information on laboratory testing for mumps and specific information on specimen collection and shipment. To help local and state health departments conserve public health resources during mumps outbreaks, CDC, in collaboration with CSTE and APHL, developed guidance to optimize mumps testing practices. This guidance is intended to reduce the testing burden during outbreaks. CDC Guidance for Optimizing Mumps Testing can be found on the CDC website. Health departments can also distribute the CDC Mumps Testing Job-Aid Flow Charts to educate providers on scenarios where specimen collection is appropriate. Public health laboratories are encouraged to send select specimens (Guidance on mumps testing can be found in the Laboratory Testing Chapter in the CDC Manual for the Surveillance of Vaccine-Preventable Diseases and on the CDC Mumps Laboratory Testing website) to CDC or the APHL VPD Reference Center laboratories for routine molecular surveillance (e.g., sequencing the small hydrophobic (SH) gene to determine the mumps virus genotype). Molecular surveillance is important to monitor any changes in the genotype or strain prevalence over time and to trace pathways of transmission. Since 2006, over

98% of sequenced mumps isolates in the United States are from the same genotype (genotype G), with limited sequence diversity within the genotype [73]. The high level of similarity among US sequences limits the usefulness of routine genotyping to inform the epidemiologic investigation during outbreak(s). However, if the epidemiology suggests a case(s) may not be related to an outbreak, a notable difference (i.e., different genotype or strain) can help identify sporadic cases and inform outbreak response efforts. More research is needed to evaluate the minimum difference needed between sequences to determine if cases are epidemiologically related. With wide global distribution of genotype G viruses, and the same circulating Sheffield reference strain endemic in Canada,[74] sequencing larger segments of the mumps genome may be useful to identify sources and epidemiologic linkages.[75] However, information on the distribution of mumps lineages around the world is currently limited and not sufficient to identify country of origin for imported cases. Specimen collection and shipping are important steps in obtaining laboratory diagnosis or disease confirmation. Guidelines have been published for specimen collection and handling for viral and microbiologic agents. Information is also available on using CDC laboratories as support for reference and disease surveillance; this includes: Specific instructions for specimen collection may be obtained via the Specimen Collection, Storage, and Shipment site. For questions regarding laboratory testing, Mumps contacts are listed in Table 1 of the Laboratory Support for Surveillance of Vaccine-Preventable Diseases. Top of Page Mumps is currently a reportable condition in all US states. Each state and US territory has regulations or laws governing the reporting of diseases and conditions of public health importance.[76] These regulations and laws list the diseases that are to be reported and describe those persons or groups responsible for reporting, such as healthcare providers, hospitals, laboratories, schools, daycare and childcare facilities, and other institutions (e.g., correctional and detention facilities). Persons reporting these conditions should contact their Local or State Health Department for

state-specific reporting requirements. Provisional notifications of all probable and confirmed mumps cases should be sent by the State Health Department to CDC using event code 10180 via the National Notifiable Diseases Surveillance System (NNDSS) within 7 days (i.e., the next reporting cycle). Electronic reporting of case records should not be delayed because of incomplete information or lack of confirmation. Following completion of case investigations, case records should be updated with any new information and resubmitted to CDC. Final laboratory results may not be available for the initial report but should be submitted via NNDSS when available. The state in which the patient resides at the time of diagnosis should submit the case notification to CDC. For people who may be under the custody of a law enforcement agency, the state of the facility in which the patient was housed at onset of parotitis, or onset of first symptom in the absence of parotitis, should submit the case notification to CDC. For further inquiries, please email: ncirddvdmmrhp@cdc.gov The following data should be collected during mumps case investigation. Additional information may be collected at the direction of the Local or State Health Department. Demographic information Reporting source Clinical information Outcome Laboratory *CDC currently only accepts buccal swabs for rRT-PCR, check with your local laboratory/VPD reference center to see what sample types are acceptable. Vaccine information Epidemiologic *Internationally imported cases would be those with international travel within 25 days of symptom onset and no known exposure to mumps virus in the U.S. during that time. Top of Page Information obtained through surveillance is used to monitor disease trends in the population and to characterize populations requiring additional disease control measures. Regular monitoring of surveillance indicators can help identify specific areas of the surveillance and reporting system that need improvement. The following indicators should be monitored by the state health department. Top of Page All persons with suspected mumps should be investigated. Identification and investigation of mumps cases is important in the

initiation of control measures to prevent the spread of the disease. In settings with high risk for transmission, such as schools, universities, close-knit communities, and correctional/detention facilities, health departments may want to be more proactive. In these settings, health departments should consider conducting case investigations and providing recommendations before laboratory results are known or before additional cases are identified. Implementation of control measures may be contingent on setting, likelihood of ongoing transmission, and available resources. The Mumps Surveillance Worksheet (Appendix 10) provides key information to be collected during a case investigation. Additional guidance on case investigation can be found in the section Investigate and confirm suspected mumps in the Strategies for the Control and Investigation of Mumps Outbreaks web page. Top of Page A mumps outbreak is defined as 3 or more cases linked by time and place. Every suspect case of mumps should be investigated to determine if they are part of an outbreak. A critical part of case investigation during an outbreak is to determine if the case and their close contacts are part of a group or population at increased risk for mumps. All people in the group at increased risk should be recommended to receive an additional dose (“outbreak” or third dose) of MMR vaccine for added personal protection. Guidance on mumps outbreak response and control, including use of a third dose of MMR vaccine, can be found on the CDC Strategies for the Control and Investigation of Mumps Outbreaks web page. Setting specific guidance is also provided on the Strategies for the Control of Outbreaks page, including responding to mumps in healthcare settings, universities, and correctional/detention facilities. Top of Page To receive email updates about this page, enter your email address:

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