Brief Report

Lessons from managing a campus mumps outbreak using test, trace, and isolate efforts

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INTRODUCTION/MUMPS BACKGROUND

Mumps is a transmissible disease caused by a paramyxovirus. In adults, clinical cases present as mild disease with headache, fever, and swelling in the salivary glands (parotitis). Untreated cases may progress to complications such as encephalitis or meningitis. The case fatality rate due to complications is 1/10,000.1

Mumps is transmitted from an infected to a susceptible individual through saliva or respiratory droplets. The (prevaccination) basic reproduction number, R0, for mumps is estimated around 10–12.2 Mumps has an average incubation period of 16-18 days, which ranges from 12 to 25 days.2

An estimated 91.5% of children in the United States receive measles-mumps-rubella (MMR) immunizations before they are 35 months old.3 Since August 2016, new students and all students living in university housing must provide proof of MMR immunization to Penn State University (PSU).4

OUTBREAK SUMMARY

In 2017, PSU’s University Park campus of ~38,000 students experienced a mumps outbreak. Eighty-four student cases of mumps were diagnosed through University Health Services (UHS), with an additional 32 cases in 2018. PSU’s UHS implemented contact tracing, testing, quarantine, and isolation to interrupt transmission. Positive test results triggered contact tracing. Using CDC guidelines for mumps, a contact was defined as any individual who was within 3 feet of the case for a prolonged period, or had direct exposure to a confirmed mumps reported ~7.4 (1-35) contacts on average. Findings from this outbreak can inform future outbreak management on college campuses, including COVID-19, by estimating average contacts per case, planning capacity for testing and quarantine/isolation, and strategically increasing compliance with suggested interventions.© 2020 The Author(s). Published by Elsevier Inc. on behalf of Association for Professionals in Infection Control and Epidemiology, Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/)

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Close contacts were predominantly reported outside of classrooms. No cases were linked through classroom exposure. No student athletes were infected or identified as potentially exposed contacts during this outbreak. Contact tracing was a valuable tool for identifying social interactions. Contact tracing and self-reported social behaviors identified the highest risk activities for transmission and exposure as social networks, coattendence at social gatherings, particularly banned social gatherings (see below), and sharing drinks. Likely reasons for low-student compliance in contract tracing during the mumps outbreaks are described below.

- The mumps outbreak coincided with disciplinary actions that prohibited parties at fraternities, though membership in a Greek organization was not a risk factor during this outbreak. Compliance with contact tracing declined when social interactions occurred at prohibited events. Contact tracing in these scenarios was unsuccessful on 2 levels.
  - Students did not want to admit they attended a prohibited event, though underage drinking did not deter compliance.
  - Students did not want to place their contacts at prohibited events.
- When contact tracing was successful in identifying exposed contacts, those individuals were difficult to reach. Avoidance of phone calls and emails prevented exposed contacts from receiving information regarding proper quarantine procedures or medical advice. Following first attempt phone calls, approximately 33% of calls were returned. After multiple efforts, approximately 70% of contacts were reached. When contacts were successfully reached, ~50% said they would not comply with quarantine measures and UHS could not enforce compliance.

In 2017, 21 of the total 84 cases were linked to least one other case by close contact; 19 of the 84 cases were the result of contact with infectious cases who had received a positive mumps diagnosis by the time their contacts were diagnosed (Fig 1).

The number of days that passed between acquiring information to reach a potentially exposed contact and getting in touch with the potentially exposed individual was not recorded. However, for future outbreaks, we will record this time period because it provides critical information regarding the efficiency of the response. Decreasing this lag will help reduce the transmission of pathogens.

- Overall, qualitative data collected during contact tracing showed students did not consider the threat of mumps infection to be significantly detrimental to their health. This attitude may have reduced compliance with preventative guidance. Different pathogens may yield different responses.

**FUTURE OUTBREAK MANAGEMENT**

The 2017 mumps outbreak provided valuable information for future university outbreak responses, including SARS-CoV-2 management. To encourage students to provide prompt and honest contact information and comply with health guidelines such as quarantine and isolation protocols, the following efforts should be considered:

- Incentivize students to honestly report all recalled contacts.
- Incentivize students who are identified as contacts to respond to contact tracers when attempts are made to reach them and to follow quarantine guidelines (consider common referral strategy: reward both case and contact when contact is confirmed).
- Clearly explain the privacy policy that the primary case’s identity is not revealed to contacts when they are contacted regarding potential exposure (though students in tight social groups may deduce who named whom).
- Remove all possible punishment for reporting contacts incurred during prohibited activities, particularly when physical distancing is suggested and gatherings are banned.
- Provide clear and honest messaging regarding the seriousness and severity of the circulating pathogen and the variability surrounding symptom severity, as with SARS-CoV-2 (consider partnering with campus-wide philanthropic missions for messaging and student-led outreach).
- Make isolation and quarantine procedures appealing, including quality meal provisions and comfortable quarters. Minimize the impact on students (no additional financial burden, minimize effort for students and instructors to continue instruction, etc.).
- Involve students in the messaging surrounding uptake of behavioral changes and compliance with behavioral interventions.

For COVID-19, universities may plan for most students to identify ~7.5 close contacts per case and employ appropriately sized contact tracing teams. These numbers can also help guide estimates for testing, rate of demand for quarantine and isolation quarters, and associated costs. Although university records identified classroom contacts, contact tracing was critical for identifying mumps transmission, which occurred in social settings.

Identifying social contacts, minimizing testing delays, and compliance with quarantine and isolation policies helps reduce pathogen transmission. Students in quarantine and isolation need daily checks and substantial support. They require monitoring for symptom development and progression, with access to medical care as necessary. Outbreak mitigation is strongly dependent on student compliance with isolation and quarantine guidelines while remaining on campus. Students should not travel to their parents’ homes, where they may put other individuals and communities at risk.

Parents may strongly influence students’ health decisions. University communications should include families. This information should emphasize (1) the importance of prompt contact tracing compliance, (2) that contact tracing programs and university disciplinary bodies are not linked, and (3) the importance of completing quarantine and isolation periods at the university to avoid intercommunity spread.

**CONCLUSIONS**

To effectively manage transmissible pathogens, students must cooperate with university outbreak management efforts and comply with behavioral interventions. Universities must provide timely, transparent outbreak updates, develop clear guidelines for action, and reward compliance in contact tracing, quarantine, and isolation protocols. Student compliance with behavioral interventions and contact tracing can save lives. Universities must emphasize the health benefits of disease reduction to students and the surrounding community.
References


