Mumps exposure of a health care provider working in a neonatal intensive care unit leads to a hospital-wide effort that prevented an outbreak

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Background: Control measures were instituted in a neonatal intensive care unit (NICU) in Syracuse, New York, when a neonatologist became ill with mumps after returning from Africa. Two health care providers (HCPs) who worked with the neonatologist developed parotitis within 13 days of exposure. Outbreak control included furloughing the neonatologist and the 2 HCPs until after 5 days of the onset of parotitis, cohorting and isolating all exposed infants in the NICU, and implementing droplet precautions. All susceptible HCPs were immunized, and all HCPs were required to wear surgical masks when within 3 feet of patients.

Results: Five HCPs developed parotitis. The neonatologist and 2 of the HCPs were confirmed cases, and 2 other HCPs did not meet the case definition. Twenty-six HCPs who worked in other units of the hospital besides the NICU developed nonspecific signs and symptoms of illness. Of the 2,904 HCPs tested, 287 (10%) had negative antibody results, and 153 (8%) were age 40 years or older. Of the 287 HCPs with negative antibody titers, 200 (70%) received the mumps-measles-rubella vaccine in response to this effort. No cases of mumps were reported in exposed infants, children, or adult patients during the time of exposure.

Conclusion: Infection control efforts, including vaccinating susceptible HCPs and instituting droplet precautions, might have prevented mumps infection in the NICU patients.

Key Words: Neonates; mumps outbreak; infection control.

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METHODS

Crouse Hospital is a 476-bed community hospital in close proximity to Upstate University Hospital, a 400-bed academic medical center, in Syracuse, New York. Adult patient rooms are single and dual occupancy; the NICU is multiple occupancy, with 7 nurseries each housing 6-9 isolettes, 2 single-occupancy rooms, and 1 treatment room (self-contained units; a total of 55 isolettes). Control measures and careful secondary case surveillance were instituted in the NICU when a neonatologist became ill with mumps on August 3, 2008, after returning from a trip to an orphanage in Ethiopia in which a mumps outbreak had occurred.
This individual worked two 12-hour shifts during the onset of symptoms, providing care to all infants in the NICU. During this time, she also evaluated an infant in the newborn nursery and an infant who presented to the emergency room. The next afternoon, she attended a baby shower with other hospital employees and their friends and families in the NICU conference room.

Outbreak control prevention included cohorting and isolating all infants exposed to the neonatologist to one nursery or an area of the nursery, implementing droplet precautions throughout the unit, immunizing all HCPs who did not have documented evidence of laboratory immunity to mumps, and requiring all exposed HCPs to wear a surgical mask when within 3 feet of patients. Visiting in the NICU was restricted to parents only. Facilities who accepted a neonatal transport during the incubation period were notified of the possible exposure to mumps. All exposed HCPs and those HCPs who might have been exposed to HCPs with signs and symptoms were supplied with surgical masks, which they were required to wear during patient care. They were allowed to reuse the masks and were instructed to discard a mask at the end of shift or when it got wet. Masking compliance was enforced by the infection control practitioners and nurse managers.

Nonimmune exposed HCPs who refused immunization or could not be immunized because of medical conditions were furloughed from the ninth day after the first unprotected exposure to mumps throughout the 26th day after the last exposure. HCPs who had been vaccinated for mumps previously but received only a single dose of mumps vaccine continued working after being exposed to mumps and were scheduled to receive the second dose 28 days later. They were educated about the symptoms of mumps and instructed to report to the employee health department if they developed symptoms. These control methods were reviewed and approved by the New York State Health Department and the Centers for Disease Control and Prevention. Surveillance for mumps infection in exposed infants was initiated and specifically included sending urine cultures for mumps when these infants developed temperature instability, fever, respiratory symptoms, or other signs of sepsis.

Given the proximity of the NICU to other hospital units and the possibility of spread from HCPs in the NICU to employees in other units, the hospital enacted a screening policy for all HCPs as well. All HCPs with upper respiratory symptoms, jaw pain, and fever were evaluated in the employee health office. Blood samples for IgM and IgG antibody testing, buccal swabs for mumps, and nasopharyngeal swabs for analysis for other viruses by reverse-transcription polymerase chain reaction (RT-PCR) were collected and sent first to the New York State Department of Health and later to a reference laboratory. A return office visit was scheduled in 4 weeks to obtain serum for convalescent mumps IgG and IgM serology.

**RESULTS**

A total of 65 neonates were exposed to mumps. These neonates were cohorted in one nursery or to a separate area of the nursery and placed on droplet precautions or discharged to home. None of the 32 exposed infants who exhibited temperature instability, fever, respiratory symptoms, or sepsis had a positive urine culture for mumps. These infants had a mean gestational age of 28 weeks (range, 23-32 weeks) and a mean birth weight of 1,150 g (range, 500-1,800 g). Urine cultures were used for the screening test, given the absence of published guidelines on diagnosing mumps infection in neonates, as well as the lack of guidance on the clinical presentation of mumps in this population. One study reported a sensitivity of 54% and a specificity of 100% of viral isolation for mumps in urine and oral samples, and corresponding values of 84% and 100% in oral samples.6

Between August 16 and September 23, 2008, a total of 5 HCPs, including the neonatologist (A), developed parotitis. Two HCPs (B and C) had worked with the neonatologist within 13 days from the time of exposure and met the clinical case definition for mumps infection (ie, acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland lasting more than 2 days, with no other apparent cause, and laboratory-confirmed or epidemiologically linked to a confirmed case). Two other HCPs (D and E) who did not work with the neonatologist developed parotitis more than 25 days later and were not considered confirmed cases. HCP D worked on an adult medical unit only. HCP E had consulted on patients in the NICU and cared for patients on other hospital units and at 2 neighboring hospitals 2-3 days before the onset of parotitis.

A total of 26 HCPs who worked throughout the hospital developed other symptoms. All buccal swabs performed on HCPs with parotitis were negative for mumps by RT-PCR. Nasopharyngeal swabs performed on HCPs with jaw pain, fever, headache, and upper respiratory symptoms were negative for parainfluenza type 1-5, adenovirus, metapneumovirus, and respiratory syncytial virus by RT-PCR. Acute- and convalescent-phase serology were performed, but the data are difficult to interpret, because all of these symptomatic HCPs had documented receipt of the measles-mumps-rubella (MMR) vaccine or laboratory-confirmed evidence of immunity. The acute- and convalescent-phase serology was positive in neonatologist A but negative in HCPs B and C, who met the clinical case definition and were epidemiologically linked to the confirmed case (Table 1).
Data on mumps antibody titers were obtained from 3,551 HCPs, including HCPs from Upstate University Hospital, who worked during the time of exposure at Crouse Hospital. Of these 3,551 HCPs, 2,904 (82%) required antibody titer testing; of these 2,904, 287 (10%) had a negative antibody titer, and 153 (8%) were age 40 years or older (Table 2). Of the 287 HCPs with negative antibody titers, 200 (70%) received the MMR vaccine. No cases of mumps were reported in the exposed infants, children, or adult patients during the period of exposure. Antibody titers from the neonates’ mothers or from cord blood were not obtained, because it was impossible to quickly measure these levels, and the information would not have affected the management of these exposed neonates.

### DISCUSSION

In this report, we describe a widespread mumps exposure of preterm infants and HCPs within and in proximity to a high-volume NICU. The early recognition of the index case as mumps and rapid implementation of aggressive infection control measures likely contributed to preventing an outbreak in hospital. Serologic screening of all HCPs who worked at Crouse Hospital during the period of the mumps exposure revealed that despite high rates of immunization and/or history of remote mumps illness, 10% of those screened were mumps-seronegative.

The effectiveness of a single dose of mumps vaccine is approximately 80%, and that of 2 doses is 88%-95%. A neonatologist had received 2 doses of MMR vaccine before medical school, but became infected with mumps while traveling in Ethiopia. The neonatologist heard about a suspect mumps outbreak occurring in a nearby orphanage and thought that she was immune. Her adopted child did not develop any signs or symptoms of mumps infection. The neonatologist’s diagnosis of mumps was confirmed by clinical signs and symptoms and positive acute- and convalescent-phase serology. Serologic and culture data were difficult to interpret in the HCPs who were case contacts, who had been immunized before the mumps exposure and had laboratory evidence of immunity. Mumps IgM may be transient or missing in persons who have had one or more doses of mumps-containing vaccine. A negative serologic test, especially in a vaccinated person, should not rule out a mumps diagnosis, because the tests are not sufficiently sensitive to detect infection in all persons with clinical illness. As such, in the absence of an alternative diagnosis, a person meeting the case definition of mumps should be reported as a mumps case despite negative serologic test results.

Mumps is readily spread from person to person via respiratory droplets. Parotitis is the most common manifestation, occurring in 30%-40% of infected patients; however, 20% of mumps infections are asymptomatic. At our hospital, 26 HCPs had a nonspecific respiratory symptom, which has been reported in 40%-50% of mumps cases. Because a nonspecific respiratory illness was circulating among the staff, and quickly determining the microbiologic etiology of this illness was impossible, we attempted to prevent possible mumps transmission to patients and their families through aggressive infection control procedures. The decision to implement droplet

### Table 1. Mumps antibody titers IFA and mumps rNP

<table>
<thead>
<tr>
<th>Case</th>
<th>Mumps titters IFA</th>
<th>Mumps rNP*</th>
<th>IgG EIA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IgM 1 Acute</td>
<td>IgM 2 Convelescent</td>
<td>IgG 1 Acute</td>
</tr>
<tr>
<td>A, index</td>
<td>&lt;10</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>B, case</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>40</td>
</tr>
<tr>
<td>C, case</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>160</td>
</tr>
<tr>
<td>D, not case</td>
<td>&lt;10</td>
<td>—</td>
<td>40</td>
</tr>
<tr>
<td>E, not case</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>80</td>
</tr>
</tbody>
</table>

IFA, immunofluorescence assay; rNP, recombinant mumps nucleoprotein; P, positive control; N, negative control; EIA, enzyme immunoassay.

NOTE. Mumps rNP: Positive IgG, ≥1.10; negative, ≤0.9. IgM-MNP: P - N ≥ 0.093; P/N ≥ 3.0 positive.

### Table 2. Results of titers for IgG antibodies against mumps virus for 2,844 HCPs with a history of 1 or 2 doses of MMR vaccine, by age group

<table>
<thead>
<tr>
<th>Age 20-29 years</th>
<th>Age 20-39 years</th>
<th>Age ≥40 years</th>
<th>All HCPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative, n (%)</td>
<td>57 (13)</td>
<td>77 (14)</td>
<td>153 (8)</td>
</tr>
<tr>
<td>Positive, n (%)</td>
<td>384 (87)</td>
<td>472 (86)</td>
<td>1,701 (92)</td>
</tr>
<tr>
<td>Total, n (%)</td>
<td>441 (16)</td>
<td>549 (19)</td>
<td>1,854 (65)</td>
</tr>
</tbody>
</table>

Note: n = 2,904 (60 lacked date of birth, and 4 of 60 were antibody-negative).
precautions for the entire hospital staff was based on concerns about not knowing which staff members had actually been exposed and infected. This was our decision and not part of the recommendations of the Centers for Disease Control and Prevention or the New York State Department of Health. Patients and their families were grateful that the hospital staff was taking extraordinary measures to protect them. Most of the HCPs were compliant with masking. The most common reason for noncompliance was discomfort of the earlobes, nose, and mouth.

In the present study, 287 (10%) of the HCPs who had a history of receiving 1 or 2 doses of MMR vaccine were seronegative, and 8% of those over age 40 were seronegative despite a patient-reported history of mumps infection. The decision to obtain titers for all HCPs in our hospital was based on the fact that the cost of obtaining antibody titers was lower than the cost of vaccinating all exposed HCPs, as well as concerns about the possibility of depleting the MMR vaccine supply in areas in New York State where outbreaks had already occurred.

Here we report a wide-scale mumps exposure that began in a NICU. The infection control efforts that were instituted to prevent an outbreak allowed us to assess mumps seroprevalence in the entire hospital. Immunizing and vaccinating susceptible HCPs and requiring exposed HCPs to wear masks when within 3 feet of patients might have prevented mumps infection in patients, but not in some exposed HCPs. These data may be helpful for future reference regarding the controversy about who should be vaccinated and/or screened during an outbreak.

References