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## VARICELLA OUTBREAK IN A DAYCARE:

### CHALLENGES AND OPPORTUNITIES FOR PREVENTING VARICELLA OUTBREAKS IN THIS SETTING

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#### Abstract

As a result of single-dose varicella vaccination, daycare outbreaks have become rare. We investigated a daycare outbreak resulting from a misdiagnosed varicella case in an unvaccinated attendee. Of 25 attendees aged 12–32 months without evidence of immunity, 7 (28%) were unvaccinated due to religious/philosophical opposition or recent 1st birthday. Single-dose vaccination reduced disease by 92% compared with no vaccination.

#### Keywords

varicella; outbreak; varicella vaccine; childcare

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After introduction of the single-dose varicella vaccination (VV) program in the United States in 1996, rates of varicella disease, hospitalizations and deaths declined dramatically.<sup>1</sup> In Philadelphia, single-dose VV coverage rates have been >88% among children aged 19–35 months since 2002, and daycare outbreaks have been rare.<sup>2</sup> However, when they do occur, varicella outbreaks in daycare settings present challenges for control because of attendees younger than the age for vaccination.

In September 2010, the Philadelphia Department of Public Health (PDPH) was notified of a varicella outbreak in a daycare center. Given that this was the 1st varicella outbreak reported in a daycare setting in Philadelphia since 2004, PDPH conducted an investigation to describe it and assess the role attendees unvaccinated for varicella played in disease transmission.

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## MATERIALS AND METHODS

### Outbreak Setting

The outbreak occurred in a privately owned, fully licensed daycare established in 2000, serving a multicultural/multilingual community. The facility comprised 4 classrooms (2 for those aged 12–24 months and 2 for those < 24 months) and had 26 attendees. The 5 staff members were assigned to 1 of the 2 age groups during regular hours. Attendees from both age groups share a common space during before- and after-care.

### Case Definitions

We defined a varicella case as a maculopapulovesicular rash illness with no other apparent cause between September 3 and September 27, 2010, in an attendee or staff member with either laboratory confirmation or an epidemiologic link to another laboratory-confirmed case. Breakthrough varicella cases were those occurring in individuals vaccinated >42 days before rash onset. Children aged >12 months without any VV were classified as unvaccinated for varicella. Evidence of varicella immunity was considered documentation of 1-dose VV or reported history of varicella disease for foreign-born attendees and staff.

### Surveillance and Outbreak Control Measures

According to city regulations, 1 dose of VV is required for daycare attendees eligible for vaccination. Additionally, all confirmed and suspected cases of varicella should be reported to PDPH. When an outbreak is suspected (≥ 5 cases in 1 setting), PDPH recommends exclusion of: children with exanthematous disease, unimmunized children until evidence of vaccination or immunity<sup>1</sup> is provided and immunocompromised students and/or staff members. Postexposure vaccination is also recommended.

### Epidemiologic Investigation

PDPH staff routinely investigates all outbreak-associated cases of varicella using a standardized questionnaire<sup>3</sup> and collects lesion specimens for laboratory confirmation. Detection of varicella-zoster virus (VZV) DNA by polymerase chain reaction was performed at the Centers for Disease Control and Prevention National VZV Laboratory. For this outbreak, PDPH collected information on demographics for all daycare attendees and their parents. Immunization history was validated using either the Philadelphia Immunization Information System or healthcare provider records. Parents of attendees who were unvaccinated for varicella were interviewed in an effort to understand circumstances that lead to them not being vaccinated. When necessary, interpreter assistance was provided by PDPH staff.

### Analysis

We conducted descriptive analyses to summarize the characteristics of cases, daycare attendees and staff and calculated single-dose VV effectiveness using the standard calculation.<sup>4</sup> Adult staff members, attendees with history of disease and attendees who received VV during the outbreak were excluded from VV effectiveness analysis.

## RESULTS

The index case was an unvaccinated 15-month-old child who developed rash on September 1, 2010, and was excluded from the daycare center on September 3. Despite the persistence of active rash, the case was considered not to be varicella and was cleared by a healthcare provider to return to daycare on September 7. This case was not reported by the healthcare provider or the daycare to PDPH. On September 16, PDPH was alerted by another healthcare provider of 3 cases among attendees from this daycare: 1 with rash onset on September 15 and 2 with rash onset on September 16. Investigation of these 3 cases resulted in identification of the index case and of an additional case in a staff member.

Of the attendees and staff, 27% and 20%, respectively, did not have evidence of varicella immunity before the start of the outbreak (Table 1). On September 21, 2010, 2 of the 7 attendees without evidence of immunity were excluded from the daycare based on PDPH recommendation. Among the remaining 5, 3 were already diagnosed as cases, 1 was mistakenly not excluded by the daycare director and 1 had been out of the daycare on holiday after being exposed to the index case. On September 26, 2010, these last 2 attendees described also developed maculopapulovesicular rash, raising the number of cases to 7.

Of the 7 identified cases, 1 was laboratory confirmed as having wild-type VZV; no other case had specimen obtained or tested for VZV. The case among the staff members was unvaccinated, had 2 days of fever, 50–249 lesions and rash lasting 7 days. Of the 6 cases among attendees, 5 were unvaccinated; 3 developed fever; 4 had <50 lesions, 2 had 50–249 lesions; median rash duration was 7 days (range 3–10 days) and 1 was treated with acyclovir for 3 days. One of the unvaccinated cases received routine VV while on holiday, after being exposed to the index case, but not in response to the exposure. The case developed rash 6 days after VV and was excluded from the VV effectiveness calculation. The 1 vaccinated case had received VV a year before the outbreak and developed only 1 vesicular lesion on the scalp (breakthrough case).

The attack rate among vaccinated attendees ( $1/18 = 0.06$ ) was substantially lower than the attack rate among unvaccinated attendees ( $4/6 = 0.67$ ). The vaccine effectiveness of single-dose VV was 92% (95% confidence interval: 39–99%).

Of the 7 attendees without evidence of varicella immunity, all were <12 months; 3 had religious exemptions and 4 attendees had recently passed their 1st birthday (Table 1). Although several parents were aware of the requirement for VV and had intended to vaccinate their children, some expressed preference that immunity be acquired through disease rather than vaccination, as is common in their home countries. This parental attitude resulted in reluctance, rather than refusal, to vaccinate against varicella promptly after the 1st birthday, and prompt vaccination was not reinforced by the daycare or their healthcare provider.

Another daycare attendee, who had not received VV per recommendations following the outbreak, developed varicella 8 weeks after this outbreak, coinciding with another outbreak that occurred in a school geographically close to the daycare and serving the same

community. No specific link between the 2 outbreaks was identified, and no subsequent cases were reported from either facility.

## DISCUSSION

While varicella outbreaks have been rare in daycare settings since implementation of the single-dose VV program, the potential for outbreaks remains, particularly if there are pockets of children unvaccinated or undervaccinated for varicella. Delays in vaccination in early childhood has allowed for outbreaks of other highly transmissible imported diseases like measles.<sup>5</sup>

Vaccination against measles, mumps, rubella and varicella is recommended at 12–15 months of age, because maternally acquired antibodies towards these diseases are expected to have waned around the 1st birthday. In a daycare setting, if most attendees receive these vaccines closer to 15 months of age, there is potential for accumulation of a substantial number of susceptible individuals in close contact, as was the case in this outbreak. Furthermore, while the immunization regulation for daycares in Philadelphia mandates attendees to be immunized according to the most current Advisory Committee on Immunization Practices schedule, a 60-day “grace period” is provided for new enrollees. We believe that failure to closely follow immunization recommendations for the attendees of this daycare at enrollment and when they achieved age milestones relevant to vaccinations, as well as failure to enforce appropriate exclusion measures, were all factors that allowed this outbreak to propagate.

In the United States, VV is the most commonly refused early childhood vaccination by parents.<sup>6,7</sup> Children of parents who refuse VV have been shown to be at increased risk of varicella infection.<sup>7</sup> Increased incidence of other vaccine-preventable diseases has been reported in communities with high rates of nonmedical exemptions to school immunization requirements.<sup>8</sup> Of note, routine single-dose VV was effective at preventing varicella among vaccinated attendees of this daycare.

Few studies have explored attitudes of foreign-born parents towards vaccinations. Nevertheless, we speculate that in foreign-born populations, language barriers, awareness of school entry requirements or access to care may pose substantial barriers to vaccination. A study from Kyrgyzstan showed 15% opposition to mandatory vaccination.<sup>9</sup> In this outbreak, we observed that some foreign-born parents had variable opinions/beliefs about vaccinations, especially regarding vaccines that are not routinely recommended in their native country.

This outbreak highlights the ongoing importance of establishing and enforcing immunization regulations and outbreak control measures in daycares. With implementation of a routine 2-dose VV program, varicella incidence continues to decline nationally.<sup>10</sup> In case of an outbreak, a second dose is recommended even for children 1–4 years of age who are not routinely receiving a second VV dose. For infants <12 months of age, measures may include cohorting in a separate room, exclusion from daycare till the outbreak clears and vaccination with VV during the outbreak accepting that VV has to be repeated when the

appropriate age is reached to ensure immunity. To further protect daycare attendees, vaccination of daycare staff without evidence of varicella immunity both for personal health protection and to prevent disease spread is recommended.<sup>1</sup> Outbreaks can lead to loss of work days by both parents and staff and increased risk of disease for other students/persons with vaccination contraindications. Additional effort should be made to reach communities prone to delaying VV or not vaccinating for varicella and to promote reporting of notifiable disease by daycares, as is done for schools.

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**TABLE 1**

Demographic Characteristics and Varicella Immunity Data of Daycare Attendees and Staff

Characteristics	Daycare Attendees	Staff
	N = 26 (%)	N = 5 (%)
Age	12–32 months (median: 23.3 months)	34–50 years (median: 36 years)
Gender		
Female	11 (42)	5 (100)
Birth country		
United States	23 (88)	0
Other	2 (8)	5 (100)
Unknown	1 (4)	0
Parent's birth country		n/a
At least 1 foreign born	21 (81)	
United States	1 (4)	
Unknown	4 (15)	
Evidence of immunity		
1-dose varicella vaccination	18 (69)	0
History of varicella disease	1 (12)	4(80)
Reason unvaccinated	N = 8	
Religious exemption	3 (38)	n/a
Recently passed 1st birthday*	4 (50)	n/a

\* 6, 7, 18 and 85 days from 1st birthday.

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