

# The Use of School-Based Vaccination Clinics to Control Varicella Outbreaks in Two Schools

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**ABSTRACT.** School-based vaccination clinics were offered in 2 schools experiencing varicella outbreaks. The clinics raised coverage of susceptible children from 52.9% to 92.2% and from 68.8% to 85.3% in the 2 schools, respectively. Although routine immunization and school-entry requirements are the best strategies for preventing outbreaks, school-based vaccination clinics may greatly increase coverage and shorten outbreaks. *Pediatrics* 2000;105(1). URL: <http://www.pediatrics.org/cgi/content/full/105/1/e17>; varicella, outbreak control, varicella vaccine, school-based clinics, vaccine coverage.

ABBREVIATIONS. PDPH, Philadelphia Department of Public Health; ACIP, Advisory Committee on Immunization Practices.

Although varicella vaccine has been recommended for routine use in all susceptible children  $\geq 12$  months of age since 1995,<sup>1,2</sup> many children remain susceptible, having had neither natural infection nor vaccination. As a result, outbreaks in settings where children congregate, such as child-care centers and homeless shelters, are common and may be protracted.<sup>3-5</sup> The Philadelphia Department of Public Health (PDPH) responds to reports of varicella outbreaks by informing parents by letter of the outbreak and the availability of a vaccine. Despite this intervention, varicella outbreaks in Philadelphia schools continued to be reported in 1998 and 1999. We report the impact of school vaccination clinics on 2 concurrent varicella outbreaks in Philadelphia schools and data on susceptibility, vaccination coverage, and an estimate of the validity of parental report of varicella vaccination.

## METHODS

In December 1998 and January 1999, PDPH received reports of varicella cases occurring in a public school with 289 students in kindergarten to fifth grade (school A) and a private school with 370 students in kindergarten to eighth grade (school B). In February 1999, PDPH offered school-based vaccination clinics publicized by a letter sent home with each child. Parental report of the child's history of disease, vaccination status, and name of health care provider were collected by questionnaire, telephone interview, or home visit. If the date of varicella onset could not be recalled by parents for cases occurring during the outbreak, absentee records at the school were reviewed to determine the dates

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Received for publication Jul 26, 1999; accepted Oct 21, 1999.  
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of absenteeism for varicella or the midpoint of the month was used as an estimated onset date. Vaccinations were given to susceptible children (those with no history of varicella or vaccination) whose parent or guardian consented in writing.

Weekly surveillance for varicella cases after the vaccine clinics continued for 42 days (2 full incubation periods) following the last case. Vaccination coverage was defined as the proportion of all children without a history of varicella who were vaccinated. To validate parental report of varicella vaccination history, a 25% random sample of children whose parents reported varicella vaccination was selected from each school. Parental report of vaccination was verified using provider records and the immunization registry of Philadelphia.

To estimate the number of cases of varicella that may have been prevented by the intervention, we used the following assumptions. First, the vaccine would be 85% effective in preventing cases. Second, among susceptible children, a cumulative attack rate of 88% would have pertained in the absence of an intervention, as documented in a previous outbreak.<sup>4</sup> Further, we assume that cases occurring within a week of vaccination represent incubating wild virus and were not preventable by vaccination.

## RESULTS

The questionnaire response rate was 81% in school A and 94% in school B. Vaccination history before the clinics and disease history are shown in Table 1. In each grade, more children in school A were susceptible to varicella than in school B. Before the clinics, varicella vaccination coverage was 52.9% in school A and 68.8% in school B. In school A, 40 (83.3%) of 48 susceptible children were vaccinated at the school clinic on February 4; 18 (52.9%) of 34 susceptible children in school B received vaccine at the school clinic on February 3. As a result of the clinics, vaccination coverage of susceptible children rose from 52.9% to 92.2% in school A and from 68.8% to 85.3% in school B.

School A experienced 23 cases of varicella from November 3, 1998 to March 1, 1999, and school B had 14 cases from January 5, 1998 to February 18, 1999 (Figs 1 and 2). Both schools were closed from December 24 through January 3. In school A, the last case of varicella occurred in a susceptible unvaccinated child nearly 4 weeks after the clinic. In school B, 7 cases of varicella occurred after the clinic: 4 cases occurred in susceptible unvaccinated children and 3 cases occurred in vaccinated children. One of these children had been vaccinated in 1997 and had breakthrough disease, and 2 other children developed varicella after vaccination (1 child vaccinated at the school clinic developed varicella the same evening, another child vaccinated by a private provider during the outbreak developed varicella 12 days after vaccination).

**TABLE 1.** History of Varicella and Preclinic History of Varicella Vaccination by Grade Among Children in School A and School B, Philadelphia, PA, February 1999\*

Grade	Number of Classrooms		History of Varicella N (%)		History of Vaccination N (%)		Susceptible N (%)		Vaccine Coverage Before Clinic %	
	A	B	A	B	A	B	A	B	A	B
K	2	2	22 (51.1)	5 (19.2)	14 (32.6)	17 (65.4)	7 (16.3)	4 (15.4)	66.7	81.0
1	2	3	22 (47.8)	26 (56.5)	14 (30.4)	15 (32.6)	10 (21.8)	5 (10.9)	58.3	75.0
2	2	2	18 (53.0)	17 (46.0)	8 (23.5)	12 (32.4)	8 (23.5)	8 (21.6)	50.0	60.0
3	2	2	22 (62.9)	21 (60.0)	6 (17.1)	9 (25.7)	7 (20.0)	5 (14.3)	46.1	64.3
4	2	2	11 (47.8)	26 (72.2)	7 (30.4)	6 (16.7)	5 (21.8)	4 (11.1)	58.3	60.0
5	2	2	24 (70.6)	23 (65.7)	2 (5.9)	9 (25.7)	8 (23.5)	3 (8.6)	20.0	75.0
6-8	0	2		111 (90.2)		7 (5.7)		5 (4.1)		58.3
SE§	1	0	5 (45.4)		3 (27.3)		3 (27.3)		50.0	
Total			124 (54.9)	229 (67.8)	54 (23.9)	75 (22.2)	48 (21.2)	34 (10.0)	52.9	68.8

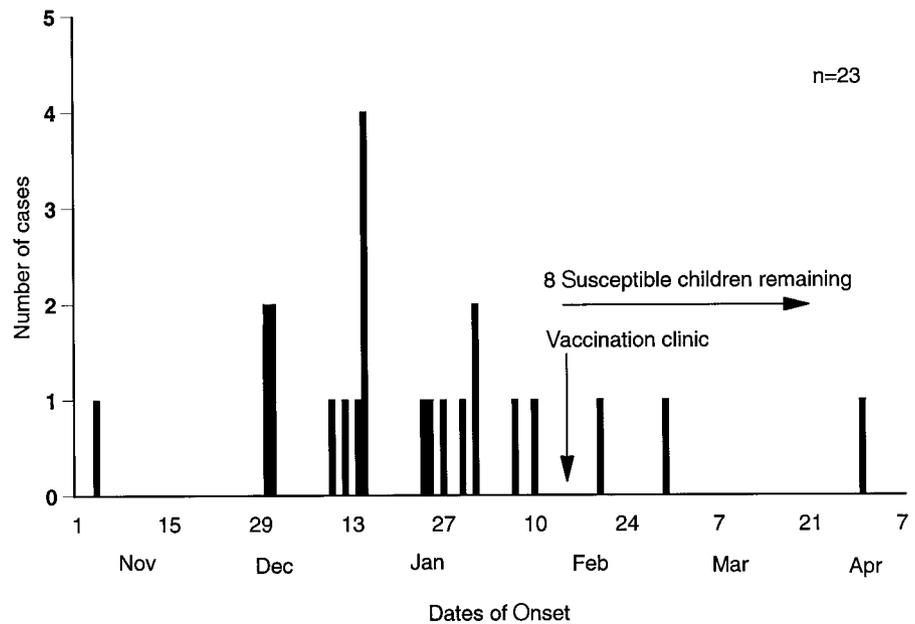
\* Excludes those reporting both history of disease and vaccination (14) and those unsure of their child's vaccination status (3).

† No history of varicella or varicella vaccination.

‡ Proportion of all children with no history of varicella who were vaccinated.

§ Special education class.

**Fig 1.** Varicella cases in school A, Philadelphia, PA, November 1998 to April 1999. Excludes those reporting both history of disease and vaccination and those unsure of their child's vaccination status.



\*school closed Dec 24 - Jan 4

### Varicella Cases Prevented

Assuming an attack rate of 88%, a total of 42 and 30 cases may have occurred among susceptible children in these schools in the absence of an intervention. Using a vaccine effectiveness of 85%, the vaccination of 40 and 18 susceptible children may have prevented up to 30 and 13 cases in the 2 schools, respectively.

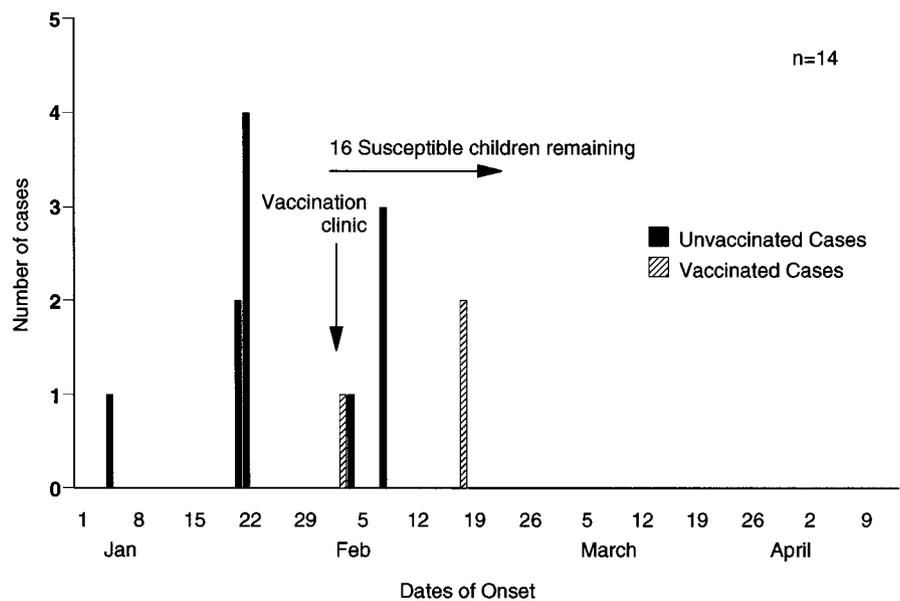
### Parental Report of Vaccination History

Twelve (75%; 95% confidence interval: 47.6,92.7) of 16 parents in school A correctly reported their child's previous varicella vaccination. Parents of the 4 children lacking documentation of varicella vaccination were contacted and referred to clinics providing vaccination. Eighteen (94.7%; 95% confidence interval: 74.0,99.9) of 19 parents in school B correctly reported vaccination; the remaining child's medical record documented previous disease.

### DISCUSSION

Varicella vaccination can avert or modify disease when administered up to 3 to 5 days after exposure<sup>6,7</sup> and has been shown to be effective in controlling outbreaks in homeless shelters and the military.<sup>3,8</sup> The Advisory Committee on Immunization Practices (ACIP) recently recommended vaccination for outbreak control and use of varicella vaccine postexposure.<sup>9</sup> Our experience suggests that even with relatively high levels of coverage, school-based outbreaks occur and may be protracted. Our intervention was held 2 months and 1 month into the school A and B outbreaks, respectively. Although the earliest possible intervention would have prevented the most cases, our intervention was effective in increasing vaccine coverage, decreasing disease susceptibility, and shortening the outbreak. Additionally, vaccination may have protected unvaccinated susceptible children indirectly by interrupting transmission. In school A, the 11-day

**Fig 2.** Varicella cases in school B, Philadelphia, PA, January 1999 to April 1999. Excludes those reporting both history of disease and vaccination and those unsure of their child's vaccination status.



\*school closed Dec 24 - Jan 4

school break may have contributed to the resolution of the outbreak, although cases occurred throughout the period of school closure and cases continued to occur after the school break suggesting that transmission had not been interrupted.

The timing of the 7 cases reported after the vaccination clinic in school B suggests that 5 were incubating wild-type disease. Two other cases were both mild (<50 lesions). One child developed breakthrough disease after vaccination in 1997, and another child developed a modified case of varicella 12 days postvaccination, which could have been attributable to either wild or vaccine virus; we did not perform strain identification to determine the causative strain. No cases occurred among vaccinated children in school A after the clinic and the case that occurred in an unvaccinated child was presumed to have been exposed outside of school because onset occurred more than 1 incubation period after the last documented case in the school outbreak.

Although the sample size was small, this study suggests that 5% to 25% of parental reports of vaccination may be incorrect; the establishment of a policy to document varicella vaccine or varicella disease history in school records will provide more accurate information, which may be consulted rapidly during outbreak control efforts. Similarly, physicians should document in the medical records a child's positive history of disease in lieu of vaccination. This will become increasingly important as states implement day care and school requirements for varicella vaccination.

The high vaccine coverage seen in these school-aged children indicates an effective catch-up vaccination program in Philadelphia, especially in the youngest grade (kindergarten) in which coverage was 67% and 81% before the clinic. Among younger children 19 to 35 months of age, coverage in Philadelphia was 52% for July 1997 to June 1998—the highest in the country (Centers for Disease Control and Prevention, unpublished data, 1999).

School outbreaks are best prevented by implementation of ACIP recommendations for universal vaccination of children at 12 to 18 months of age and catch-up vaccination of older susceptible children. ACIP recently recommended that states institute requirements for child care and school entry to greatly increase coverage.<sup>9</sup> In the absence of a school requirement, vaccination clinics in schools and day care centers can help reduce the number of susceptible children and shorten outbreaks when they occur.

#### ACKNOWLEDGMENTS

We thank the children, parents, and staff of schools A and B, the Family Resource Network in the City of Philadelphia, and the City of Philadelphia Health Department for their participation and collaboration in this study. We thank Susan Chu, PhD, for comments on this paper and Mary McCauley for editorial assistance.

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DOI: 10.1542/peds.105.1.e17

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The online version of this article, along with updated information and services, is located on the World Wide Web at:

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