VARICELLA ACTIVE SURVEILLANCE AND EPIDEMIOLOGIC STUDIES: 1995-1998

BACKGROUND

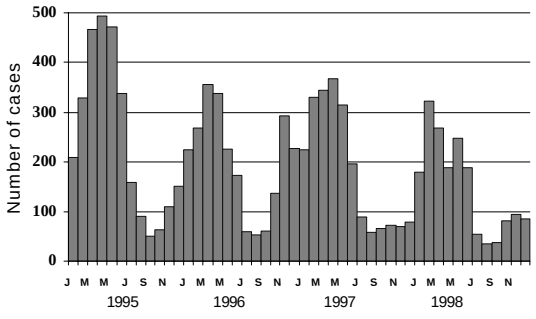
Varicella vaccine was approved by the U.S. Food and Drug Administration in March 1995.[1] In September 1994, the Acute Communicable Disease Control Unit entered into a cooperative agreement with the Centers for Disease Control and Prevention to conduct active surveillance for varicella among the approximately 300,000 residents of the Antelope Valley Health Services District. Our objectives were (1) to define baseline varicella epidemiology before licensure and widespread vaccine use; (2) to identify changes in varicella epidemiology occurring as a result of vaccine use; and (3) to describe the clinical and epidemiologic features of varicella in vaccinated cases. In September 1995, the project was awarded supplemental funding to (4) monitor vaccine use in the study population

METHODS

We selected the Antelope Valley for the study, in part, because its relative geographic isolation tends to encourage use of local schools and health care providers. The project collects case reports of varicella from over 300 surveillance units, representing 100% sampling of the total Antelope Valley population. Surveillance units include all primary care physicians; all hospitals and clinics; all public and private schools and child care centers with enrollments of 12 or more children; employers with 500 or more employees; correctional facilities; and miscellaneous others likely to identify and report cases of varicella. Case reports and data regarding vaccine administration are collected every two weeks. A structured telephone interview is conducted with each case or parent/guardian to collect detailed demographic, clinical, and health impact data and to determine if there are additional cases or susceptible contacts within the household. Susceptible household contacts are reinterviewed four to six weeks after the initial contact to identify additional cases. Data collection began January 1, 1995.

Figure 1

Varicella
Verified Cases by Month
Antelope Valley, 1995 - 1998



RESULTS

Of 2,005 cases of varicella reported between January 1 and December 31, 1998, 1,785 (89%) were verified by telephone interview and collection of clinical data completed, 120 (6%) were unreachable by telephone or declined to participate, and 100 (4%) were excluded when case interviews revealed that illness or school absence was not due to varicella (Table 1). In this report, analysis is limited to verified cases. The number of cases decreased 19.6% in 1998 compared with 1997; verified cases decreased 39.2% since 1995 (Figure 1).

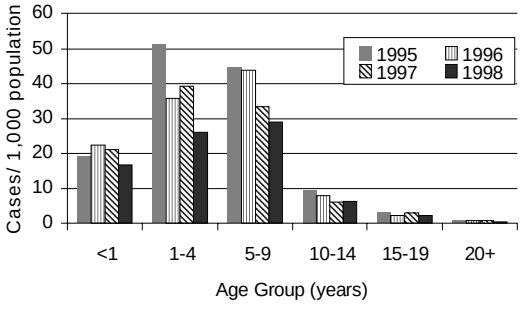
Table 1. Reported Cases of Varicella, Antelope Valley, 1995 - 1998

Case Status	1995		1996		1997		1998		1995-1998	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Verified	2,934	(92)	2,421	**(90)**	2,219	**(90)**	1,785	(90)	9,395	(90)
Probable	166	(5)	189	(7)	138	5	120	(6)	613	(6)
Excluded	101	(3)	86	(3)	130	5	100	(5)	417	(4)
Total Reported	3,201	(100)	2,696	(100)	2,487	(100)	2,005	(100)	10,425	(100)

Age Distribution. Annual incidence rates declined in all age groups over the four-year study period; the largest decrease, 49%, was observed among 1- to 4-year-olds. In 1998, highest incidence rates occurred among children 5 to 9 years of age, followed by 1- to 4-year-olds and infants less than one year old (Figure 2). In 1998, the average age of a case was 8.0 years compared with 7.1 years in 1995.

Figure 2

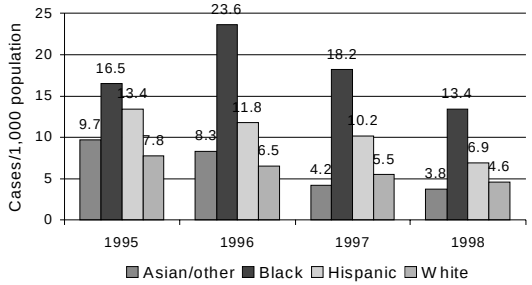
Varicella
Incidence Rates by Age
Antelope Valley, 1995-1998



Race/Ethnicity.
While age-adjusted incidence rates decreased in all racial/ethnic groups in 1998, disproportionately high rates continue to occur among Blacks (Figure 3). Black children 5 to 9 years old experienced the highest rates of any racial/ethnic group (59.4 cases per 1,000 population). Higher than anticipated rates among Blacks may be an artifact of inaccurate midcensus population estimates for the Antelope Valley; data from California Basic Educational Data System (CBEDS) suggest that the number of school-aged Blacks in the Antelope Valley is substantially higher than estimations projected from the 1990 MARS file for the Antelope Valley Health District.

Figure 3

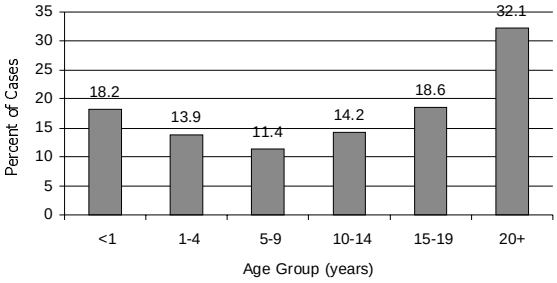
Varicella
Incidence Rates by Race/Ethnicity
Antelope Valley, 1995-1998



Disease Severity. As in previous years, the vast majority of cases (87%) experienced an overall severity of disease rating of 1 (mild, uncomplicated disease). None received a rating of 5 (severe, life-threatening disease or death). Consistently, young children and adults were significantly ($p < 0.05$) more likely to have a severity of disease index of 2 or greater (Figure 4).

Figure 4

Varicella
Proportion of Cases with SDI ≥ 2, by Age
Antelope Valley, 1995-1998

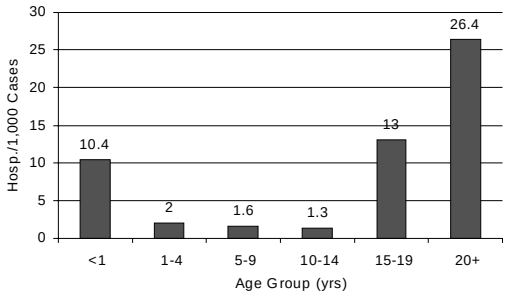


Complications, defined as conditions or events occurring within two weeks of rash onset for which the case-patient was evaluated and treated by a health-care provider, were reported in 191 (11%) cases in 1998, 220 (10%) in 1997, 194 (8%) in 1996, and 381 (13%) in 1995. Otitis media was the most common complication, followed by secondary bacterial infections. Major complications in 1998 included pneumonia (5 cases) and encephalitis and invasive group A streptococcal infection (one case each). In 1998,approximately 8% of cases received antibiotics during varicella, compared with 12% in 1995; 27% of adult cases and 6% of cases in younger age groups received acyclovir in 1998.

Hospitalization rates per 1,000 varicella cases were 2.0 in 1995, 2.9 in 1996, 6.7 in 1997,and 3.4 in 1998. Hospitalization rates were significantly higher for adults than for younger age groups (Figure 5). No deaths or long-term sequelae were reported in 1998.

Figure 5

Varicella
Hospitalization Rates per 1,000 Cases by Age
Antelope Valley, 1995-1998



Reported Second Infections. A history of previous varicella was reported by 169 (9.5%) cases in 1998. The average age was 4.1 years at initial infection and 11.7 years at second infection.

Breakthrough Cases. Of 1,785 verified cases reported in 1998, 89 (5.0%) occurred in persons who reported having received varicella vaccine. Vaccination status was confirmed by asking parents to check the immunization record card at the time of telephone interview or by medical office staff reviewing the office immunization record. Of the 89 cases reporting prior vaccination, 72 developed varicella 42 or more days after vaccination and were considered breakthrough cases. Eighty-two percent of breakthrough cases had 50 or fewer lesions (less than average) and 18% had average number of lesions: overall disease severity was rated as mild (SDI=1) for 90% of breakthrough cases and none had severe disease.

Health Impact Data. The total number of days of school or work missed by cases and caretakers due to varicella declined from 14,842 in 1995 to 8,986 in 1998.

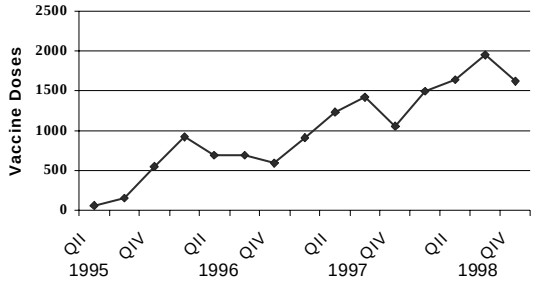
Completeness of Surveillance Data. We estimated completeness of surveillance data for children 2 to 18 years of age using capture-recapture methods by analyzing the degree of overlap between two incomplete lists of cases (two-source capture-recapture methods).[2-4] The two ascertainment sources used were “schools” (elementary, middle and secondary schools, preschools, and daycare facilities), and “health-care providers” (physicians, clinics, hospitals, and health maintenance organizations). We estimated completeness of surveillance data for this age group from all ascertainment sources to be approximately 68%, 70%, 74%, and 78% for 1995, 1996, 1997, and 1998, respectively.

Varicella Vaccine Utilization. Varicella vaccine became available in the private sector in late May 1995, but acceptance by parents and providers appeared to be low throughout much of 1995. Los Angeles County clinics began administering vaccine in March 1997. Vaccine administration levels showed an increasing trend throughout the four-year study period (Figure 6). One-year-olds received 47% (3,139) of the 6,706 doses of vaccine

administered in 1998. Vaccine coverage among one-year-olds was estimated at approximately 63% (based on a birth cohort of 5,000).

Figure 6

Varicella
Vaccine Doses Administered by Quarter
Antelope Valley, 1995-1998



SUMMARY AND DISCUSSION

The Los Angeles County Varicella Active Surveillance Project is providing data on varicella epidemiology that has not been previously available in such detail.[5] Four full years of data suggest that vaccine utilization is having an impact on the burden of varicella disease in the Antelope Valley as evidenced by a 40% reduction in the number of verified cases over the study period. The disproportionate decline in incidence among 1- to 4-year-olds most likely reflects vaccine use in that age group as part of the routine childhood immunization schedule. The finding of disproportionately high rates among Blacks requires further analysis but most likely is an artifact of inaccurate population estimates for the Antelope Valley. The 2000 Census should resolve these questions.

The Los Angeles County Project will be funded at least through September 2000. The study provides a unique opportunity to monitor changes in varicella morbidity and mortality and vaccine field efficacy as vaccine utilization increases.

REFERENCES

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4. Regal RR, Hook EB. Goodness-of-fit based confidence intervals for estimates of the size of a closed population. *Stat Med* 1984;3:287-91.

5. Los Angeles County Department of Health Services, Acute Communicable Disease Control. Varicella Active Surveillance Project Annual Summary 1998:1-46.

VARICELLA OUTBREAKS AFTER VACCINE LICENSURE: PROBLEMS WITH VACCINATION COVERAGE, STORAGE OR EFFICACY?

In 1998, three years after vaccine licensure, childcare centers (CCC) and schools in Los Angeles County continued to report varicella outbreaks. Parents and school administrators contacted the Acute Communicable Disease Control Unit (ACD) about the outbreaks, frequently expressing concern that a high proportion of ill children had previously been immunized. This stimulated ACD to investigate two CCC outbreaks in order to identify a cause, such as low vaccination coverage levels or unexpected low vaccine effectiveness.

Information on past history of varicella, illness during the outbreak, and prior varicella vaccination among childcare center attendees was collected. In the first of the two outbreaks (CCC "H"), vaccination coverage levels among the children were high; in the other outbreak (CCC "L"), levels were low. CCC "H" had a vaccination coverage level of 87% (34/39) compared to 30% (6/20) in CCC "L." The overall attack rate was lower in CCC "H"(31%) than in CCC "L" (61%; p-value=0.03). Vaccine effectiveness for varicella was 71% in CCC "H" and 100% in CCC "L." In general, vaccinated children with varicella had milder disease than those who were unvaccinated, although this was not statistically significant. Vaccine had been administered by six different health care providers. Five had stored and handled the vaccine correctly; the sixth had retired and could not be evaluated.

In conclusion, varicella outbreaks occurred in CCCs with both high and low vaccination coverage levels. Vaccination led to a lower attack rate in CCC"H" and appeared to protect from severe disease. Vaccine effectiveness was within the range predicted by the literature (70-90%) and there was no indication of improperly stored or mishandled vaccine.