VARICELLA ACTIVE SURVEILLANCE AND EPIDEMIOLOGIC STUDIES, 1995-1999

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 addition, in September 1995, the project was awarded supplemental funding to 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.

RESULTS

Of 11,070 reports of varicella with onset between January 1, 1995, and December 31, 1999, 9,947 (90%) were verified by telephone interview, 662 (6%) were classified as probable (cases/caretakers unreachable by telephone or declined to participate); and 461 (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. Verified cases decreased 67% in 1999 compared with 1998 and 80% since 1995 (Figure 1, Table 1).

Figure 1
Verified Varicella Cases by Month
Antelope Valley, 1995 - 1999

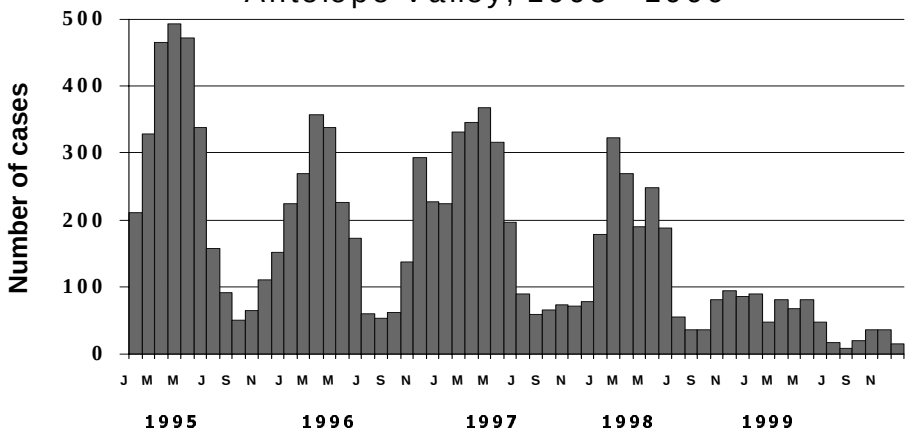
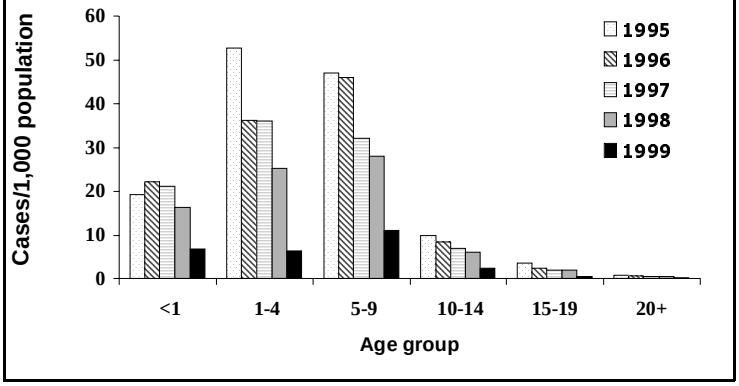


Table 1: Reported Cases of Varicella, Antelope Valley, 1995 - 1999

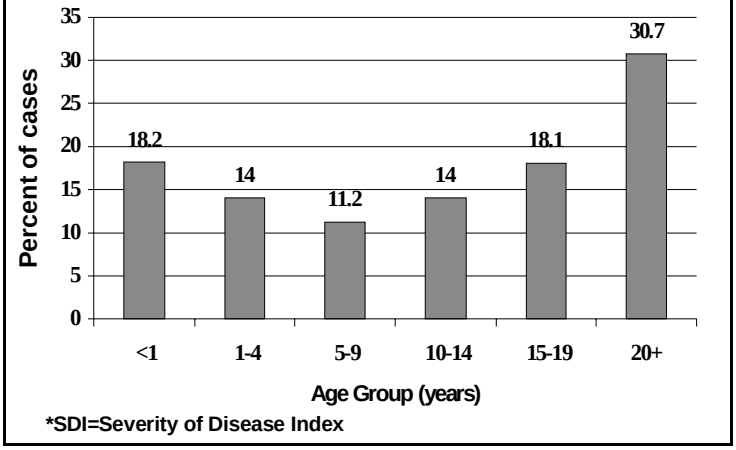
Case Status	1995		1996		1997		1998		1999		1995-1999	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Verified	2,934	(92)	2,422	(90)	2,219	(90)	1,785	(90)	587	(86)	9,947	(90)
Probable	166	(5)	189	(7)	138	(5)	120	(6)	49	(7)	662	(6)
Excluded	101	(3)	86	(3)	130	(5)	100	(5)	44	(7)	461	(4)
Total Reported	3,201	(100)	2,697	(100)	2,487	(100)	2,005	(100)	680	(100)	11,070	(100)

Figure 2
Varicella Annual Incidence by Age
Antelope Valley, 1995-1999



Age Distribution. Annual incidence rates declined in all age groups over the five-year study period; the largest decrease, 88%, was observed among 1- to 4-year-olds. In 1999, highest incidence rates occurred among children 5 to 9 years of age, followed by infants less than one year old and 1- to 4-year-olds (Figure 2). In 1999, the average age of a case was 8.5 years compared with 7.1 years in 1995.

Figure 3
Proportion of Cases with SDI* ≥ 2, by Age
Antelope Valley 1995-1999



Disease Severity. Overall disease severity was rated on a scale of 1 (mild, uncomplicated disease) through 5 (severe disability or death). Throughout the study period, the vast majority of cases (85%-90%) [data not shown] experienced an overall severity of disease rating of 1. Consistently, infants, teenagers 15- to 19-years-old, and adults were significantly (p <0.005) more likely to have a severity of disease index of 2 or greater (Figure 3).

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 59 (10%) cases in 1999, 191 (11%) in 1998, 234 (10%) in 1997, 200 (8%) in 1996, and 375 (13%) in 1995. Secondary bacterial infection was the most common complication, followed by otitis media. Complications were more likely to occur in infants and adults (Figure 4). Major complications in 1999 included pneumonia (4 cases) and meningitis (one case). In 1999, approximately 9% of cases received antibiotics during their illness, compared with 12% in 1995; adult cases were significantly more likely to be treated with the antiviral agent acyclovir than were children 19 years and younger throughout the study period (27.8% and 4.7%, respectively, p < 0.01).

Figure 4
Varicella-associated Complications by Age
Antelope Valley, 1995-1999

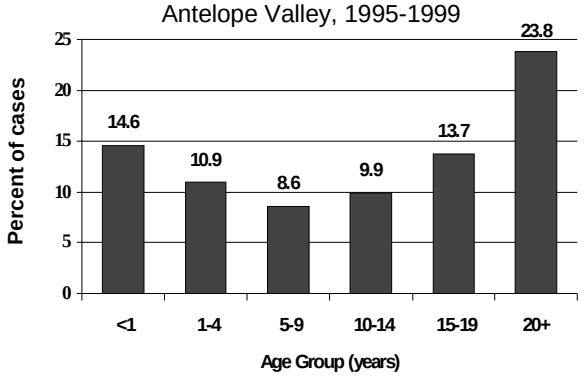
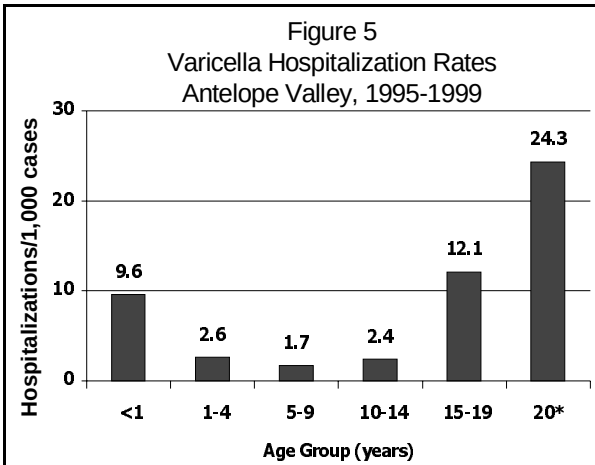


Figure 5
Varicella Hospitalization Rates
Antelope Valley, 1995-1999



Hospitalization rates per 1,000 varicella cases were 2.0 in 1995, 2.9 in 1996, 6.7 in 1997, 3.4 in 1998 and 6.8 in 1999. Overall hospitalization rates were significantly higher for adults than for younger age groups (Figure 5). There have been no deaths attributed to varicella in the Antelope Valley in the years 1995-1999.

Reported Second Infections. A history of previous varicella was reported by 679 (6.9%) cases between 1995 and 1999. The average age was 3.7 years at initial infection and 11.3 years at second infection. A special study of second infections was undertaken in 1999 and will be reported separately.

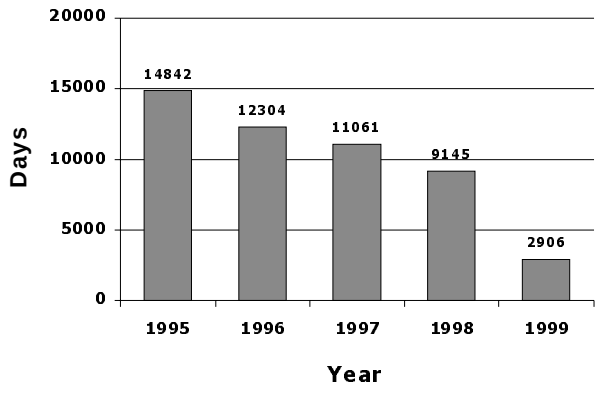
Breakthrough Cases. Of 587 verified cases reported in 1999, 73 (12.4%) occurred in persons who reported having received varicella vaccine. Vaccination status was confirmed by asking parents to check the immunization record card at the time of telephone interview or by medical office staff reviewing the office immunization record. Of 288 cases reporting prior vaccination between 1996 and 1999, 205 developed varicella 42 or more days after vaccination and were considered breakthrough cases (24, 1% of total cases in 1996 and 45, 8.2% in 1999) . Over seventy-five percent of breakthrough cases had 50 or fewer lesions (less than average) (data not shown).

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 2,906 in 1999 (Figure 6).

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 and independent data sources (two-source capture-recapture methods).[2-4] The two ascertainment sources used were “schools” (elementary,

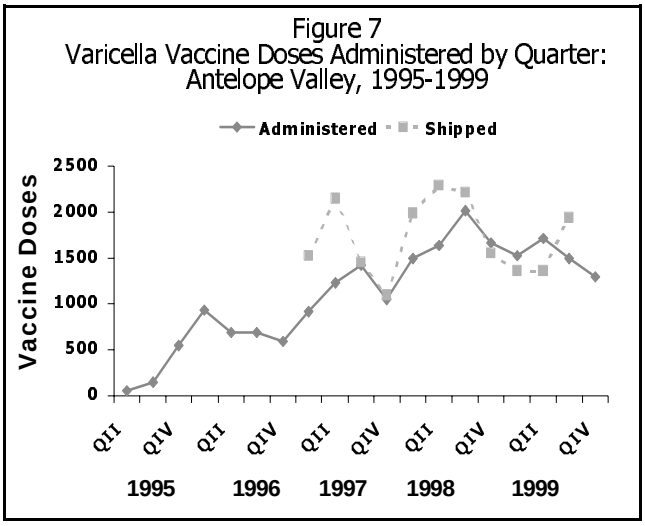
middle and secondary schools, preschools, and daycare facilities), and "health-care providers" (physicians, clinics, hospitals, and health maintenance organizations). We estimate completeness of surveillance data for this age group from all ascertainment sources to be approximately 68%, 70%, 74%, 78%, and 74% for 1995, 1996, 1997, 1998, and 1999, respectively.

Figure 6
Days of School/Work Missed Due to Varicella
Antelope Valley, 1995-1999



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 during most of 1995. Federally funded vaccine was made available in March 1997 to DHS clinics and other participants of the Vaccines for Children program. Vaccine administration levels show an increasing trend throughout the five-year study period (Figure 7). One-year-olds received 52% (3,123) of the 6,020 doses of vaccine administered in 1999. Vaccine coverage in 1999 among one-year-olds is estimated at approximately 69% (based on a birth cohort of 4,555 in 1998).

Figure 7
Varicella Vaccine Doses Administered by Quarter:
Antelope Valley, 1995-1999



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] Five 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 an 80% 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.

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

REFERENCES

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2. Hook EB, Regal RR. The value of capture-recapture methods even for apparent exhaustive surveys: the need for adjustment for source of ascertainment intersection in attempted complete prevalence studies. *Am J Epidemiol* 1992;135:1060-7.

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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.