



## **ACTIVE VARICELLA SURVEILLANCE AND EPIDEMIOLOGIC STUDIES: SUMMARY 2003—ANTELOPE VALLEY, CALIFORNIA**

### **BACKGROUND**

Before introduction of the varicella vaccine, approximately 4 million cases of varicella occurred each year in the US, resulting in an annual average of 11,000 hospitalizations and 100 deaths. In 1995, the varicella vaccine was licensed for all susceptible people 12 months of age and older and was added to the Recommended Childhood Immunization Schedule in 1996.

Since varicella is not a nationally notifiable disease, a surveillance system to monitor the impact of the varicella vaccination was needed. Thus in September 1994, the Los Angeles County Department of Health Services entered into a cooperative agreement with the Centers for Disease Control and Prevention (CDC) to establish active surveillance for varicella (“chicken pox”) in Antelope Valley, California. The Varicella Active Surveillance Project (VASP) collects baseline information on disease incidence and varicella vaccine coverage by age group. Surveillance for herpes zoster in children <20 years old was added in 2000.

After nine years of data collection, the objectives of VASP in Antelope Valley are: 1) to maintain active surveillance for monitoring varicella disease, 2) to maintain active surveillance for herpes zoster, 3) to continue to monitor varicella vaccine coverage by age group, 4) to measure the impact of varicella vaccine on varicella disease, and 5) to conduct other applied epidemiological research related to varicella disease and varicella vaccine.

### **METHODS**

A verified case of varicella is defined as illness with acute onset of a diffuse papulovesicular rash without other known cause. For herpes zoster, a case is defined as a macular-papular or vesicular rash, unilateral, involving at least one dermatome diagnosed by a licensed healthcare provider. Reporting sites that participate in this surveillance project include public and private schools, day care centers with enrollments of 12 or more children, public health clinics, hospitals, private practice physicians and health maintenance organization offices, employers with 500 or more employees, correctional facilities, and miscellaneous others likely to identify and report cases of varicella and zoster. The number of varicella/zoster reporting sites has increased from 284 in 1995 to 313 in 2003—primarily due to population growth. Nearly 100% of identified reporting sites participated in the project.

Reporting sites submit the Varicella/Zoster Surveillance Log to VASP on a biweekly basis. This log includes date of report, case name, age, race/ethnicity, address and telephone number. After obtaining informed consent, a structured telephone interview is conducted with each case or their parent/guardian by a member of VASP. Detailed demographic, clinical, and health impact data are collected, and additional cases or susceptible contacts within the household are identified. Susceptible household contacts to varicella cases are then re-interviewed four to six weeks after the initial contact to identify additional cases. All providers currently administering the varicella vaccine submit the Varivax Immunization Report on a monthly basis.

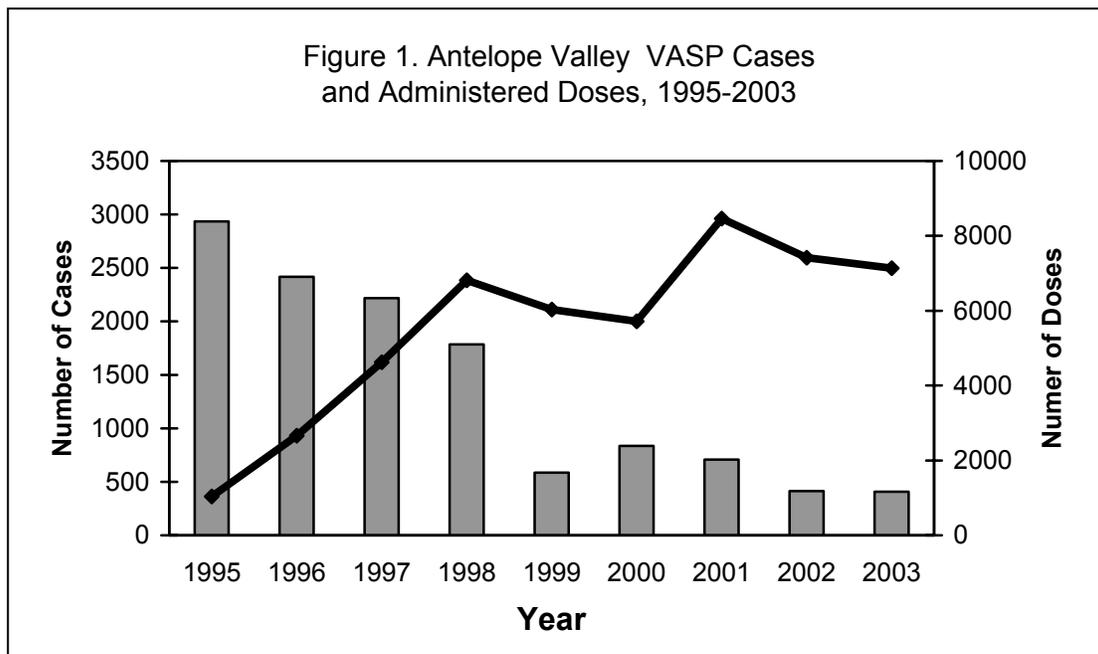
From 1995 to 2002, varicella data was entered into a Turbo Pascal based database designed by project staff; however, beginning in 2003, all data entry for varicella and zoster is entered into MS Access and data analysis is performed with SAS v. 8.2 (SAS Institute, Cary, NC). Trend analysis was utilized to examine of disease incidence with time. Completeness of reporting is estimated using two-source (schools and healthcare providers) capture-recapture methods.



## RESULTS/DISCUSSION

Verified varicella cases, those with collection of clinical data, have decreased by 86% over the nine year project period—from 2,934 varicella cases in 1995 to 408 cases in 2003. Among 5–9 year-olds, varicella incidence decreased from 54.9 cases per 1,000 in 1995 to 5.2 per 1,000 in 2003. In 2003, children ages 5–9 years of age had the highest varicella incidence (5.2 per 1,000 population), followed by children 10–14 years of age (3.5 per 1,000) and preschoolers age 1–4 years of age (3.1 per 1,000).

The percentage of breakthrough cases (those occurring >42 days after vaccination) has increased from 1% of verified cases in 1996 to 39.2% in 2003. Cumulative breakthrough cases (1995–2003) as a percent of cumulative vaccine doses administered (1995–2003) ranged from 0.65% (24/3,686) in 1996 to 1.6% (783/49,829) in 2003 (Figure 1).



Most reported varicella disease continues to be mild. In 2003, 94.1% of cases had mild uncomplicated varicella disease and 5.9% had either a high fever or a bacterial infection treated with antibiotics. None reported lower respiratory tract infections. Of the 408 verified cases in 2003, 17 (4.1%) reported a complication; this compares to 13% in 1995. The most common complication in 2003 was infected lesions (47.0%, 8/17). There were no hospitalizations due to varicella complications in 2003.

Using two-source capture-recapture estimates, varicella completeness of reporting estimation has remained relatively steady over the 9 year study period, ranging from a low of 50.4% in 1995 to a high of 62% in 2002; in 2003 estimated completeness was 55.2% for children 2–18 years of age.

Fifty-five reporting sites provided varicella vaccine; persons one year of age received the majority (57%; 4,050/7,083 doses) of the administered doses in 2003, followed by two year olds (9.7%; 686/7,083 doses). The Antelope Valley birth cohort is approximately 5,000.

Herpes zoster (HZ) analysis was confined to individuals <20 years old. HZ cases decreased 26% from 73 in 2000 to 54 in 2003. Zoster incidence declined among children in all age groups from 2000 to 2003. In the 1–9 year-old age group, there was a statistically significant decline ( $p < 0.05$ ) in the incidence of HZ reported between 2000 and 2003 using trend analysis. Considering cumulative cases from 2000 to 2003, more HZ cases reported a history of varicella disease ( $n = 191$ ) than a history of receiving varicella vaccine



(n=25). There were no HZ cases with a history of varicella vaccine in those 10 to 19 years of age, a group with low vaccination coverage. In HZ cases with a history of varicella vaccination, the mean age of HZ was 4.9 years. In contrast among those with previous varicella infection, the mean age of HZ was 11.3 years. When vaccinated and unvaccinated individuals between 1–4 years were compared, the mean time to zoster was similar in those with disease history (2.39 years) and vaccination history (2.04 years). There were no HZ hospitalizations in 2003.

Project Highlights: Project activities include the following publications and presentations.

- Seward JF, Zhang JX, Maupin TJ, Mascola L, Jumaan AO. Contagiousness of varicella in vaccinated cases: A household contact study. JAMA 2004; 292:704-708. Abstract available at: [www.jama.ama-assn.org/cgi/content/abstract/292/6/704](http://www.jama.ama-assn.org/cgi/content/abstract/292/6/704)
- Hall S, Maupin TJ, Seward J, Jumaan AO, Peterson C, Goldman G, Mascola L, Wharton M. Second varicella infections: Are they more common than previously thought? Pediatrics 2002; 109(6):1068–1073. Abstract available at: [ww.pediatrics.aappublications.org/cgi/content/abstract/109/6/1068?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=Maupin&fulltext=Varicella&searchid=1106594359715\\_12947&stored\\_search=&FIRSTINDEX=0&sortspec=relevance&journalcode=pediatrics](http://www.pediatrics.aappublications.org/cgi/content/abstract/109/6/1068?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=Maupin&fulltext=Varicella&searchid=1106594359715_12947&stored_search=&FIRSTINDEX=0&sortspec=relevance&journalcode=pediatrics)
- Seward JF, Watson BM, Peterson CL, Mascola L, Pelosi JW, Zhang JX, Maupin TJ, Goldman GS, Tabony LJ, Brodovicz KG, Jumaan AO, Wharton M. Varicella disease after introduction of varicella vaccine in the United States, 1995–2000. JAMA 2002; 287:606–611. Abstract available at: [www.jama.ama-assn.org/cgi/content/abstract/287/5/606](http://www.jama.ama-assn.org/cgi/content/abstract/287/5/606)
- Population-based study of herpes zoster in children and adolescents post varicella vaccine licensure, 2000–2002. Poster presentation. 41<sup>st</sup> Annual Meeting of IDSA 2003: San Diego, CA.

Ongoing Research Projects:

1. **Varicella Zoster Virus Susceptibility Among Women in Antenatal Clinic Population:** This study will describe susceptibility to varicella and identify geographical and racial/ethnic differences among pregnant females. There are 436 participants from the Antelope Valley enrolled in the study thus far.
2. **Laboratory Confirmation of Varicella Disease:** With declining varicella disease incidence and increasing proportion of breakthrough cases, the validity of clinical diagnosis has been raised. Free lesion (PCR) and serological (IGG & IGM) testing to confirm diagnosis is offered to Antelope Valley Healthcare Providers. Approximately 70 specimens have been collected thus far.
3. **Analysis of Antelope Valley Varicella Outbreaks, 1995–2003:** The number of outbreaks, the number of children affected per outbreak and the duration of the outbreaks declined steadily since introduction of the varicella vaccination program. No outbreaks occurred in daycare centers in 2002 or 2003 where vaccination coverage is expected to be the highest.
4. **Varicella Breakthrough Analysis 1995 to 2003:** Using Antelope Valley and West Philadelphia VASP data, the clinical picture of breakthrough disease is in the process of analysis.
5. **Varicella Hospitalizations, 1995–2002:** Using Antelope Valley, Texas and West Philadelphia VASP data, hospitalized varicella cases are being reviewed in depth to derive a clinical description and assess severity.
6. **Chickenpox or Smallpox—The Use of the Febrile Prodrome as a Distinguishing Characteristic:** Antelope Valley and West Philadelphia VASP data is being used to describe the prodrome characteristics of varicella cases.
7. **Determining Risk of a Second Varicella Infection, A Case Comparison Study, Antelope Valley VASP 1995–2003:** Current national varicella immunization policy assumes that a single natural infection with varicella-zoster virus or vaccine confers lifelong immunity. Antelope Valley is comparing second infections reported within the VASP database from 1995 to 2003 to a comparison group matched by gender and month of onset.

It is anticipated that information from this project will continue to impact varicella surveillance and control strategies nationwide.