ACUTE COMMUNICABLE DISEASE CONTROL

SPECIAL STUDIES REPORT
1999

County of Los Angeles
Department of Health Services

Public Health Programs
Disease Control Programs

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HEPATITIS A OUTBREAK AMONG METHAMPHETAMINE USERS LOS ANGELES COUNTY, 1999

BACKGROUND

Hepatitis A is caused by a virus that is primarily spread via fecal-oral or food/waterborne routes. The groups at highest risk are household and sexual contacts of infected persons, international travelers, Native Americans, and persons who live in areas endemic for hepatitis A. Other risk groups include sexually active heterosexuals, men who have sex with men, and illicit drug users. The Advisory Committee on Immunization Practices(ACIP) recommends post-exposure prophylaxis of contacts to acute cases with immune globulin (IG) because it is possible to halt the transmission of hepatitis A by providing the contacts with IG within two weeks of exposure.

Within one working day of diagnosis, physicians and laboratories are required to report all cases of acute hepatitis A to the Morbidity Unit of the Los Angeles County Department of Health Services. Once reported, each case is assigned to the appropriate local health district in which a public health nurse (PHN) interviews the case within 24 hours. Using the CDC Viral Hepatitis Surveillance Program (VHSP) form, the PHN seeks to identify risk factors and recent contacts with acute hepatitis A, and obtain names of contacts who need post-exposure IG.

In August 1999 a patient hospitalized with acute hepatitis A was reported to the Acute Communicable Disease Control (ACDC) Unit. Upon questioning, the patient revealed that he knew of at least three other people who had hepatitis A in the six weeks prior to his onset. The patient also admitted to methamphetamine use with these other people.

In order to better understand the role of methamphetamine in the transmission of hepatitis A in Los Angeles County, ACDC undertook two studies. The first study was descriptive, tracing the pattern of hepatitis A transmission among the patient and his group of friends. ACDC worked with the Long Beach City Health Department in this investigation, as more than half of the identified cases of hepatitis A were Long Beach residents.

In the second study, performed during August and September of 1999, ACDC assessed the use of methamphetamine by patients with acute hepatitis A by re-interviewing for drug use the cases of hepatitis A who had been reported to the Morbidity Unit. In this way the ability of the PHN using the VHSP form to identify illicit drug-associated cases of hepatitis A in Los Angeles County was also evaluated.

METHODS

For the purpose of these studies, a case of acute hepatitis A was defined as a person who tested positive for anti-hepatitis A IgM or who was diagnosed by a physician as having acute hepatitis A and epidemiologically linked to another patient with acute hepatitis A.

To trace the spread of hepatitis A in the case-patient's group of friends and family, the patient was carefully questioned about his risk factors for hepatitis A. We asked the case-patient for contact information on everyone he knew with symptoms of acute hepatitis A. We then asked each contact about their risk factors for acute hepatitis A, the extent of their contact with other cases (sexual, household, friend, drug-sharing partner, etc.) and the name of anyone else they knew who had been recently diagnosed with acute hepatitis A. Attempts were then made to speak with these contacts. Associations between people were also traced by the personal links recorded on the VHSP form or on a similar form used by the Long Beach City Health Department.

To determine the presence of methamphetamine use associated with hepatitis A, we re-interviewed non-outbreak associated patients with acute hepatitis A who had been reported during April-August 1999. We restricted our interviews to those between the ages of 20-50 who lived in the southeast health districts of Los Angeles County (roughly the demographics of the index patient and his social network) and who had no other identifiable risk factor for acute hepatitis A on initial interview by a district PHN. Using open-ended questions, we asked these patients about non-prescription drug use, focusing on methamphetamine. If they admitted to drug use, we asked if they knew of anyone else with acute hepatitis A with whom they shared drugs.

RESULTS

ACDC was able to trace several generations of confirmed acute hepatitis A through a cohort of 16 people, including the first case-patient, over a three-month period from May-August 1999. All were white, with an average age of 33 and a median age of 30 years; two patients, ages 40 and 49, were hospitalized. Seven patients were men and nine were women. Many in this cohort had known each other for years. Their exposures were through drug sharing, sexual contact, and household contact. Methamphetamine was the most common drug shared and was injected, ingested, smoked, and snorted.

Chronologically the first case-patient was a woman in her 20s whose onset was May 20, 1999. She felt that her infection source was a sexual partner; efforts to locate this partner were unsuccessful. By June 13th, two of her sexual and one of her drug-sharing partners

were diagnosed with acute hepatitis A. By July 7th, five other people, either sexual or drug-sharing partners of the first group, were diagnosed with acute hepatitis A. By the end of August, an additional seven other sexual, drug-sharing, or household contacts (including the index case-patient) of the original May-July cases were diagnosed with acute hepatitis A. Because of overlapping onset dates, and the multiple different kinds of contacts members of this cohort had with each other (sexual, household, drug sharing), it was impossible to trace a direct line of infection from one person to the next, except for the first cases in June.

Almost all of the cases admitted to knowing at least one other person with acute hepatitis A on the VHSP form. However, unlike the results of interviews by ACDC, few of the original VHSP forms indicated recent drug use. The VHSP has only one question about injection drug use. Many of the cohort smoked, but did not inject, methamphetamine. Not a single form identified a drug-sharing contact as needing prophylaxis.

Drug and methamphetamine use was commonly cited when re-interviewing non-outbreak cases of acute hepatitis A, although none of the VHSP forms recorded that information. These non-outbreak associated patients were often sexual and/or drug-sharing partners with someone else who had recent acute hepatitis A. We were not able to link any of these cases to the outbreak cohort but several cases, in retrospect, could be linked to each other**.** For example, we were able to trace the path of hepatitis A from a six-year-old child in January to his mother, his mother's ex-husband, the ex-husband's daughter (who was a methamphetamine user) and then to her drug-using contacts and a girlfriend of one of these contacts (last onset July 7, 1999).

CONCLUSIONS

A cohort of 16 patients with documented acute hepatitis A was identified and characterized. Methamphetamine sharing, household contact, and sexual contact were the engines that drove this outbreak. More aggressive questioning and contact identification in this outbreak might have helped prevent several generations of hepatitis A infection. The fact that this occurred in two different jurisdictions, and that drug use was not recognized as a risk factor for disease, hindered the recognition of this outbreak.

Methamphetamine use is under-reported and widely associated with transmission of hepatitis A in whites, aged 20-50 years, in certain health districts of Los Angeles County. The CDC VHSP form has one question about injection drug use (which is located in a separate section on bloodborne risk factors commonly associated with hepatitis B and C) and there are no questions about non-injection drug use.

DISCUSSION AND RECOMMENDATIONS

The ACIP has issued a recommendation that drug-sharing partners of acute cases of hepatitis A should receive post-exposure prophylaxis with immune globulin (IG) and hepatitis A vaccine. Therefore, it is important to ask case-patients about drug use, even if the case-patient acquired the hepatitis A from a non-drug source, in order to offer post-exposure prophylaxis (PEP) to their drug-sharing partners in the same way it would be offered to household and sexual contacts. This includes non-injection drug sharing partners because non-injection methamphetamine use has been associated with hepatitis A transmission.

Public health nurses should be encouraged to ask about all drug use, not just injection drug use, in order to offer PEP to all at-risk contacts. Documenting drug use would also help ACDC have a better understanding of the role of drug use in the spread of hepatitis A. If there is significant transmission associated with drug use, then immunization campaigns in outbreak and non-outbreak situations should be considered.

Better communication is needed between ACDC and the Long Beach City Health Department concerning interlocking clusters of hepatitis A. Each communicable disease investigation unit needs to be notified when there is a known contact with hepatitis A who lives in the other jurisdiction so that outbreak investigations can be coordinated.

The CDC is reconfiguring the VHSP form to better assess risk factors for hepatitis A, including adding a question about all drug use.

HEPATITIS B TRANSMISSION IN A NURSING HOME LOS ANGELES COUNTY, 1999

BACKGROUND

Hepatitis B is a bloodborne, viral disease of substantial public health consequence. With an estimated 140,000-320,000 new cases occurring each year in the United States, 140 to 320 cases die due to acute disease. Five to six thousand more cases die of complications of chronic hepatitis B. The main adult risk groups are sexually active heterosexuals, men who have sex with men, and intravenous drug users.

Acute hepatitis B is a reportable disease in Los Angeles County, and 92 cases were reported in 1998. Of these only three case-patients were 65 years of age or older. However, in October 1999, ACDC was notified of three cases-patients 80 years and older with acute hepatitis B. All had been residents of nursing home A (NHA) that had closed in July 1999 for financial reasons. The onset of Case 1 was August 18 and the onset of Case 2 was August 28, 1999. Both died in early September with hepatitis B listed on the death certificates as the cause of death. The local health district had investigated these cases but no risk factors, other than the common nursing home, were identified. When a third case of acute hepatitis B from the same nursing home was diagnosed in October, with an onset of September 28, the local health district notified ACDC. Since hepatitis B has an incubation period of 50 days-6 months, the first possible transmission date could have been as early as February 18, 1999.

METHODS

To assess the prevalence of hepatitis B in residents of NHA, ACDC sent letters to the administrators of the 18 different nursing homes where residents had been transferred after the closure of NHA to request that residents be tested for acute (anti-Hbc IgM), past (anti-HBc total), and chronic (HBsAg) infection with hepatitis B.

A case was defined as a former resident of the nursing home who tested positive for acute hepatitis B from February-December 1999. Residents were considered susceptible for acute infection with hepatitis B if all tests were negative. Residents were considered immune to acute infection with hepatitis B if they tested positive for past or chronic infection with hepatitis B.

To determine the risk factors for acquiring hepatitis B, ACDC performed a cohort study by reviewing the charts of all residents in this nursing home from February- July 1999. The

following risk factors were analyzed: age, sex, underlying illness, length of stay in the nursing home, and number of blood draws, injections, IV lines, and hospital or outpatient medical visits.

To determine the method of hepatitis B transmission, ACDC made a thorough review of infection control practices in NHA and contacted the manufacturer of medical devices.

Epi Info 6.04c was used to calculate relative risks and determine p-values with Fisher's exact test. Analysis was limited to cases with acute hepatitis B and those susceptible for acute hepatitis B (N=33).

RESULTS

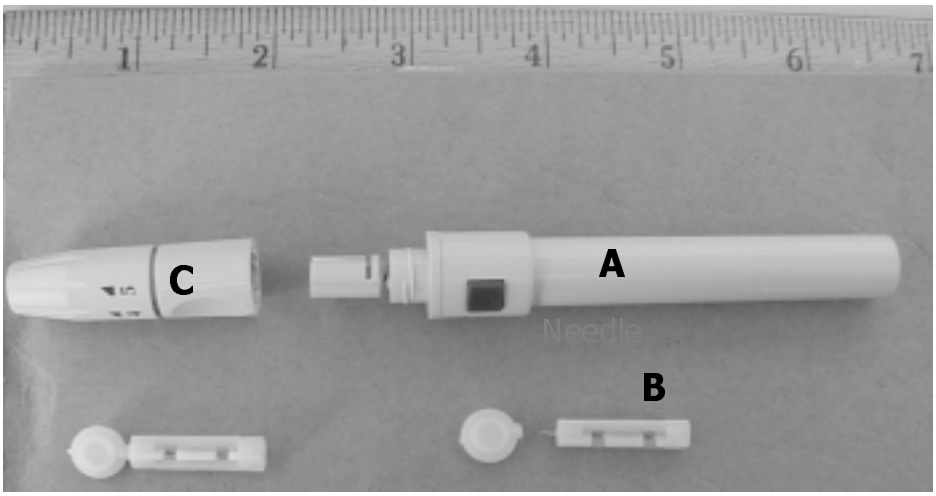
Fifty-nine persons were residents of NHA at some time between February 17 - July 21, 1999. Of the 59, 17 had died by the time of the investigation due to unrelated causes and we were unable to locate four. Of the remaining 38 residents, five had evidence of past infection with hepatitis B (anti-HBc total). These were considered immune to acute hepatitis B and we excluded them from our analysis. An asymptomatic acute case of hepatitis B was found on serosurvey; this made a total of four acute cases of hepatitis B when combined with the three previously reported cases. The serosurvey also revealed that the remaining 29 former residents had no markers of past infection. No one tested positive for chronic infection with hepatitis B.

On statistical analysis, the only risk factors associated with acute hepatitis B in these nursing home residents were having diabetes mellitus and having fingersticks (used to test the blood sugar of diabetics). Four of the nine residents with diabetes versus zero of 24 residents without diabetes had acute hepatitis B (RR=undefined, $p<0.004$). Furthermore, four of the five residents who received fingersticks, versus zero of 28 who did not have fingersticks, had acute hepatitis B (RR=undefined, $p<0.001$).

There was a wide range of fingersticks that the residents received, from a low of 20 to a high of 304 over a period of 9-22 weeks. While increasing number of fingersticks seemed to be associated with acute hepatitis B, one resident acquired the disease after only 20 fingersticks (over 20 weeks). The resident who had fingersticks, but did not test positive for markers of hepatitis B, received a total of 21 fingersticks over a 21-week period.

NHA used a pen-like spring-loaded fingerstick device (Figure 1). **A** is the main body of the pen and is where disposable lancets are mounted. **B** is an example of such a lancet. **C**

Figure 1. Pen-like spring-loaded fingerstick device



is the cap that is screwed over the lancet after it is mounted. The end of the cap is held against the patient's skin and the spring-loaded mechanism is released so that the lancet is propelled through the tip of the cap into the skin and then it is fully retracted into the device. After use, the cap is removed and the lancet is discarded.

The nursing policy and procedure manual specified that the fingerstick devices should be disinfected according to manufacturer's instructions. Since hepatitis B can be resistant to decontamination with alcohol, the manufacturer's instructions are to never re-use caps between patients. However, in NHA, according to interviews, the nurses re-used the caps, cleaning them with alcohol between patients.

CONCLUSION

This cluster of four cases of acute hepatitis B in NHA was most likely caused by the improper re-use of the caps of the fingerstick devices. This is the first report of fatal hepatitis B associated with pen-like fingerstick devices. Ironically, the nursing procedure manual warned of an association of hepatitis B and fingerstick devices.

DISCUSSION

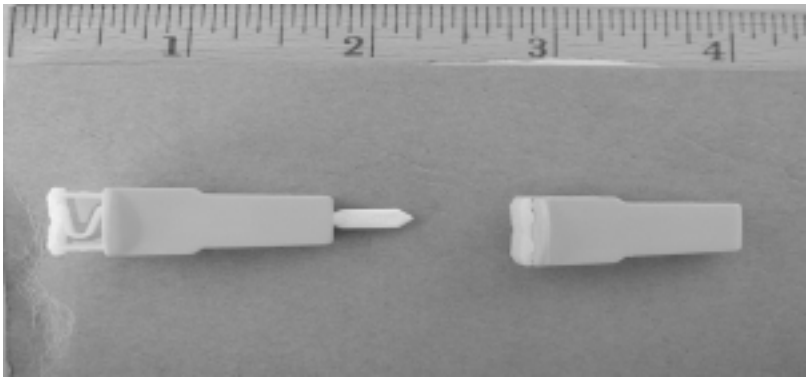
There have been several reports of non-fatal hepatitis B transmission in diabetics who receive fingersticks. In 1990, there was a report in the *MMWR* of 23 diabetic patients with acute hepatitis B who stayed on the same medical ward with a known hepatitis B carrier who was diabetic.[1] No other risk factor was identified except the re-use of the disposable platforms of another kind of spring-loaded fingerstick device. Consequently, the FDA issued a safety alert concerning the re-use of these disposable platforms. In 1997, *MMWR* reported two separate investigations of acute non-fatal hepatitis B associated with the re-use of caps in the pen-like spring-loaded fingerstick devices.[2]

There were four main limitations to our study. We were unable to serologically test 21 patients. However, we were able to get the death certificates of 17 patients who died and none cited hepatitis B as a cause of death. We have no information on the four patients who we were unable to locate. Because we did not test for hepatitis B surface antibody, which is a marker of hepatitis B vaccination, some of those that we classified as "susceptible" might have been immune if they had received the hepatitis B vaccine. Some of the "immune" cases might have been acute cases but had already cleared their IgM and their surface antigen by the time of our investigation. If so, this would change our analysis since none of the immune cases were diabetic. However, the immune cases do not differ significantly from controls in any of the other risk factors. Finally, we were unable to find a source for this outbreak. All five of the diabetics who received fingersticks had been in the nursing home for more than one year except case-patient 3 who may have been the source. She had been in and out of other hospitals and nursing homes before coming to this nursing home in May 1999. She might have gotten acute hepatitis B iatrogenically elsewhere. Nursing personnel responsible for fingersticks denied any signs or symptoms of acute hepatitis B. Many claimed previous vaccination with the hepatitis B vaccine. None were serologically tested for hepatitis B.

Had the nursing home remained open, our recommendations would have been threefold: each person should have their own fingerstick device; or each person should have their own cap for the device; and the staff should receive training about hepatitis B transmission with multi-use spring-loaded fingerstick devices.

However, California passed a bill that became effective in July of 1999 that makes these recommendations moot (Figure 2). It requires that all needle and needle-like devices have "engineered sharps injury protection." In other words, all sharp devices must be fully retractable or sheathed, and in no way reusable, so that health-care workers are protected from injury and disease. However, in the case of this nursing home the bill might have

Figure 2. Single use, fully retractable, fingerstick device



"Engineered Sharps Injury Protection"

protected patients from disease spread by health-care workers.

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SUMMARY OF THE EVALUATION OF THE LAC DHS HEPATITIS A SURVEILLANCE SYSTEM
LOS ANGELES COUNTY, 1999

INTRODUCTION

Consistently over the past ten years, the hepatitis A incidence rate for Los Angeles County (LAC) has exceeded the incidence rate for the nation. This remained true in 1998. The incidence rate of hepatitis A in LAC in 1998 was 9.7 per 100,000 compared to a national incidence rate of 8.6 per 100,000. Due to the high rates of hepatitis A in LAC, many resources are devoted both to patient follow-up by public health nurses (PHNs) and surveillance activities within the ACDC unit. To best allocate these resources, an evaluation of the surveillance system to determine areas of improvement was conducted.

METHODS

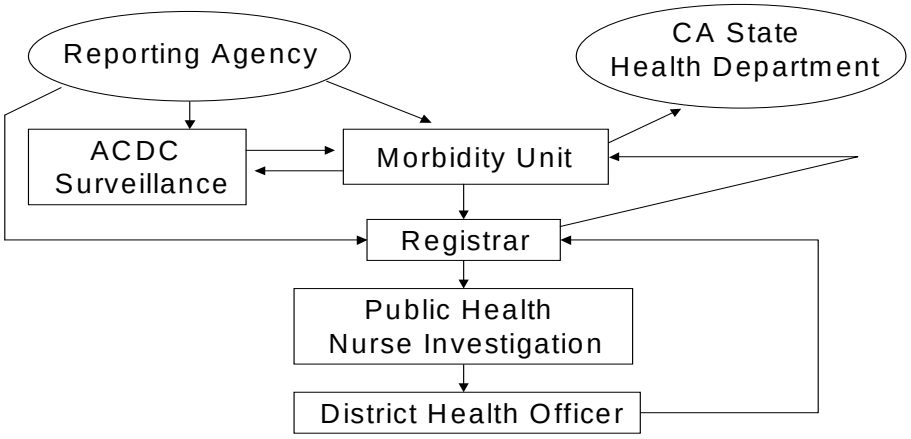
In the first half of 1999, the 1998 status of the Los Angeles County hepatitis A surveillance system was evaluated using standards given in the Centers for Disease Control and Prevention's (CDC) 1988 guidelines for evaluating surveillance systems[1]. We examined six attributes: simplicity, flexibility, acceptability, sensitivity, positive predictive value (PPV), and timeliness. Additionally, through the analysis we gained information on the accuracy of data collection and data entry as well as a better understanding of PHN beliefs and sources of information. We based our evaluation on the following sources: (1) key informant interviews; (2) case epidemiology forms; (3) an unrelated cohort study on hepatitis A risk factors, including reinterviewing of hepatitis A cases reported to LAC from January to March 1999; (4) a survey of public health nurses (PHN survey) that explored their views of hepatitis A investigations; and (5) hepatitis A surveillance statistics in LAC from previous years.

RESULTS

Simplicity: At least seven different people were involved in the "life cycle" of a reported hepatitis A case before it reached a surveillance epidemiologist at ACDC, where it was approved for reporting to the state (Figure 1). Additionally, the PHN survey (n=82) indicated that up to 72% of the PHNs were not completely satisfied with the epidemiology form in its current format.

Flexibility: Only 5% of PHNs responded to the ACDC survey request. This could have been due to a perception of low importance for this survey, too little time, lack of distribution within the district, and little flexibility to do something inconsistent with the daily work routine. Additionally, on average, PHNs had received less than one hour of hepatitis A training per year.

Figure 1. Hepatitis A Surveillance System
Los Angeles County, 1999



Acceptability: The acceptability among hepatitis A cases for interview by the PHN was 98%, indicating a high level of acceptance of the system by the cases. The acceptability of the system by PHNs, as indicated by their use of the case epidemiology form, was also satisfactory (more than 92% of the general risk factor information was completed. However, for questions related to sexual risk factors, nearly one third of case epidemiology forms lacked responses. This drop in response rate suggests that there is poor acceptance of these questions, either because cases are unwilling to provide this information or PHNs are not comfortable asking the sexual questions or do not consider them relevant risk factors for the transmission of hepatitis A.

Sensitivity: The sensitivity of the hepatitis A surveillance system will be evaluated through a laboratory survey through which we hope to identify the total number of hepatitis A cases diagnosed in these laboratories. In 95 reinterviews with hepatitis A patients conducted

during the unrelated cohort study, ACDC identified an additional five (secondary) cases that were never reported to us. This suggested a lack of sensitivity because of failure to report by laboratories as well as weakness in incomplete PHN case ascertainment.

Positive Predictive Value: The specificity of the hepatitis A antibody tests was used as an indicator of PPV of the individual test results. The manufacturer of the hepatitis A testing kit gives a very high specificity for the hepatitis A IgM test. Therefore, the PPV for the hepatitis A surveillance system is also high.

Timeliness: ACDC becomes aware of a hepatitis A case when a case epidemiology form, completed by a PHN, is received by the Morbidity Unit. Our evaluation found that, on average, ten days elapsed between onset of illness to medical diagnosis, followed by an additional 14 days between diagnosis and PHN interview. Finally, it took an average of 33 days from the time of the PHN interview for the case epidemiology form to reach the Morbidity Unit, for a total of 57 days between onset of illness and arrival of the case epidemiology form at the Morbidity Unit (Figure 2). Thus, the timeliness of the system was low.

Accuracy: While reinterviewing cases, we found that about a third of the initial interviews contained incorrect, or at least different, information. Contact information in 37% of cases and risk factor information in 20% of cases were different than in the PHN interview. In addition, two types of errors occurred during data entry. Responses in the case epidemiology form were given the wrong value in the database. (This error occurred 3-21% of the time for questions regarding sensitive occupations/situations.) Also, responses missing on the case epidemiology form were given an assumed response value within the database. (This error occurred 8-9% of the time for questions regarding sexual risk factors.)

PHN Identified Risk Factors: The majority of PHNs were aware of all risk factors for

Figure 2. Average time for information to travel within the LAC Department of Health Services, Los Angeles County, 1999

hepatitis A, with the exception of sexual risk factors. Only one third of PHNs acknowledged that sexual preference was a risk factor, and less than 20% knew that the number of sexual partners also was a risk factor. Additionally, only 6% of PHNs who felt that all of the questions on the case epidemiology form were relevant to hepatitis A indicated that injection drug use was a risk factor.

PHN Sources of Information: The vast majority (94%) of PHNs indicated that they obtained their investigative information from the LAC DHS Communicable Disease Control Manual. This provides standardization of the hepatitis A information and surveillance system procedures. However, in the past the manual has not been routinely updated. Therefore, new information may not be readily available to those who need it, except through sporadic memo distribution.

CONCLUSIONS

The current hepatitis A surveillance system has a high PPV for the individual case. In general, the hepatitis A surveillance system is well accepted by patients but lacks simplicity, flexibility, and timeliness. Future research is needed to better understand several of these attributes, including flexibility, acceptability, sensitivity, positive predictive value on an outbreak level, and representativeness.

REFERENCE

1. Centers for Disease Control and Prevention. Guidelines for evaluating surveillance systems. *MMWR* 1988; 37(S-5):1-18.

LABORATORY EXPOSURE TO *BRUCELLA* LOS ANGELES COUNTY, 1998-1999

BACKGROUND

Brucellosis is a systemic illness caused by any of four species of the bacterial genus *Brucella*. The disease causes bacteremia and localized abscesses in any organ, especially the liver, spleen, and bone, and may last for days, months, or even years if untreated. Brucellosis in human beings has a variable incubation period, and onset can be acute or insidious. The average incubation period is 3 to 4 weeks, but instances of up to 10 months have been reported; incubation may depend on dose and route of exposure, as well as host immunologic factors. Symptoms and signs include fever, chills, sweats, arthralgia, arthritis, malaise, weight loss, anorexia, splenomegaly, and hepatomegaly. Recovery is possible, but serious complications such as hepatic abscess and osteomyelitis can arise. The case-fatality rate is less than 2% for untreated cases, usually due to meningitis or endocarditis.

Brucellosis is a zoonotic disease of wild and domestic animals; human beings acquire infection from animals and their products, including meat and milk. Farmers, veterinarians, meat inspectors, and laboratory personnel are at occupational risk. Local cases have occurred among slaughterhouse workers and persons drinking raw milk in places where animal infection is common, especially Mexico and Central America.

Infection with *Brucella* species occurs from contact with infectious material through cuts on the skin or mucous membranes, as well as by consumption of contaminated meat or dairy products. Aerosolization is a potential mode of transmission for those working in laboratories where cultures of the organism are handled; the medical literature documents many examples of brucellosis acquired by laboratory workers either individually or in outbreaks.

In 1998 and 1999 there were three reported exposure incidents to *Brucella* among workers at seven clinical and reference laboratories in Los Angeles County (LAC). These incidents are summarized to draw attention to lapses in procedures that could have resulted in occupational transmission of this serious disease.

Incident #1

In April 1998, two *Brucella* isolates derived from a San Diego patient were mishandled by four medical facilities: a San Diego clinical laboratory and three reference laboratories in Los Angeles County. A child with fever was brought to a clinic for assessment; a blood

specimen for culture was obtained from the patient and processed on site in a San Diego laboratory (Lab A); when growth was detected, the isolate was forwarded to a reference laboratory in LAC (Lab B) for culture identification. Acute Communicable Disease Control (ACDC) was consulted when Lab B made a preliminary identification of *Brucella* species. ACDC contacted San Diego County Department of Health Services to report the brucellosis case and request that the originating facility, Lab A, be informed.

It was soon determined that the patient had visited two providers, and another blood specimen had been collected for culture. The second specimen had been sent to a reference laboratory in LAC (Lab C) for initial processing; when growth was detected by Lab C, the isolate was forwarded to its reference laboratory (Lab D) for identification. At the time these laboratories were notified by ACDC, they were unaware that brucellosis was suspected in the patient.

At the San Diego laboratory Lab A, the gram stain from blood culture material was interpreted as showing gram-positive micrococci; in Labs B and C, gram stains were interpreted as small gram-negative bacilli. At Lab D, an automated blood culture device made a preliminary identification of *Moraxella (Psychrobacter) phenylpyruvica*. In all four instances, staff did not feel the need to employ a biosafety cabinet for additional identification steps. In actuality, *Brucella* species are small, aerobic, gram-negative bacilli that can show a variable gram stain reaction; the rods are sometimes referred to as coccobacilli because of their small size.

At the three LAC laboratories, 35 workers were determined to have been exposed, based on criteria from the medical literature and consultation with CDC's Special Pathogens Branch.* Baseline serology was obtained from nearly all workers and antibiotic prophylaxis was recommended, pending confirmation of the organism's identity. The LAC Public Health Laboratory confirmed the organism as *Brucella melitensis*, considered to be the most communicable of the four species. Clinical follow-up and convalescent serologic tests failed to identify any cases of occupational infection. One worker developed a high fever about 2 weeks after exposure, but that symptom was attributed to another illness, and the worker remained seronegative for brucellosis. Another worker with stable, elevated brucella antibody titers recalled a similar occupational exposure several years ago in another country.

*Anyone sharing the same air space 9n the presence of a plate containing cononie of Brucella, especially B. miitensis, opened outside of a safety hood is considered at risk, including professional, administrative, and janitorial staff present during or shortly after opening such a plate. Workers obtaining specimens such as blood or stool from a brucellosis suspect, and those performing primary laboratory isolation steps are not at risk.

Incident #2

In May 1998, the blood isolate from a hospitalized patient (hospital A) was submitted to another hospital laboratory (hospital B) for identification. Gram stains of the liquid medium showed gram-negative rods in clumps, but solid medium showed no growth; these smears were prepared behind a safety shield but outside of a biosafety hood. A preliminary identification of *Brucella* was made by hospital B based on biochemical reactions; this was ultimately confirmed by the LAC Public Health Laboratory . The laboratory supervisor reported that six workers were exposed. After consultation with ACDC, the workers provided acute serum specimens and started prophylactic antibiotic treatment. During the three-week period before convalescent sera were obtained, one employee began to experience a low grade fever (to 100.6° F), nausea, leukopenia (WBC=2100), and lymphocytosis (42%). These symptoms and findings were not considered compatible with brucellosis. Final serologies from all six workers failed to demonstrate a rise in antibodies to *Brucella*.

Incident #3

A clinical laboratory processed a blood culture in March 1999; the attending physician later notified the technologist that the patient had previously been shown to have brucellosis. Gram stains and secondary cultures had already been prepared outside of a biological safety cabinet. Eight employees were considered exposed. Baseline brucella serologies were obtained from all eight, and seven initiated antibiotic prophylaxis; the eighth worker was nursing and elected not to be treated. Antibiotic compliance was poor due to medication side effects; only three workers continued therapy. Clinical monitoring and follow-up serologic studies identified no cases of brucellosis.

DISCUSSION

In LAC, an average of 7 cases of brucellosis were reported annually since 1994 (range 2-12). No outbreaks have ever been reported, but several factors increase the risk of outbreaks among LAC laboratory workers and food manufacturers. LAC has a large population that routinely travels to regions of brucellosis endemicity, including Southeast Asia, India, Mexico, and Central America, where this disease can be easily acquired. In addition, there are many abattoirs in LAC, potentially exposing workers to a number of zoonoses, including brucellosis. If these travelers or workers become ill with brucellosis, specimens for diagnosis will likely be processed at a local clinical laboratory. There are

also several national reference laboratories based in LAC, so cultures for identification may be sent here from throughout the US.

Outbreaks of illness among laboratory workers have been reported from both clinical microbiology laboratories as well as brucella vaccine manufacturing plants. In the laboratory, automated identification methods can misidentify the organism, as demonstrated in Lab D. Variable gram-staining characteristics of the genus may mislead medical technologists to relax precautions normally reserved for organisms with certain morphologic characteristics (Labs A, B and C). Therefore, current laboratory infection control recommendations state that all bacteriologic procedures after specimen inoculation should be performed in a biologic safety cabinet, regardless of the suspected organism, to avoid dispersion of bacteria into the air.

While brucellosis is a rare disease, it has the potential for chronic infection and even death in untreated cases. Measures to prevent its transmission in the medical workplace depend on well-known, standard infection control principles. Supervisors should review laboratory procedures and monitor staff compliance with safety features. Physicians should alert the laboratory when submitting specimens if brucellosis is suspected clinically.

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

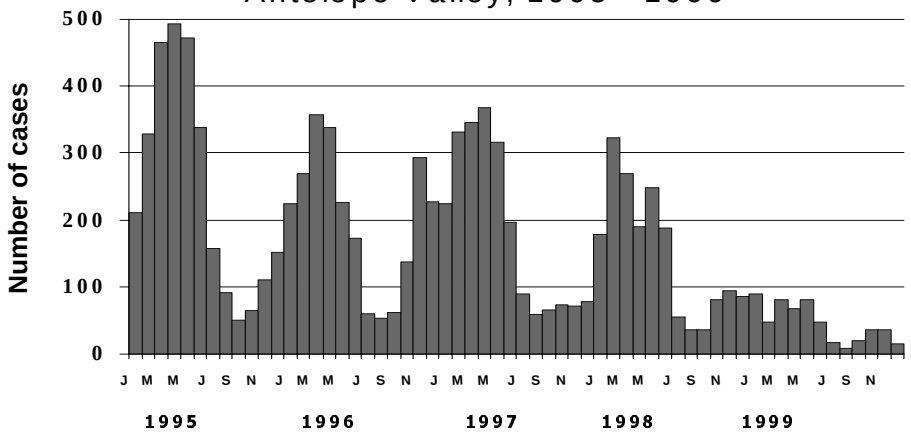
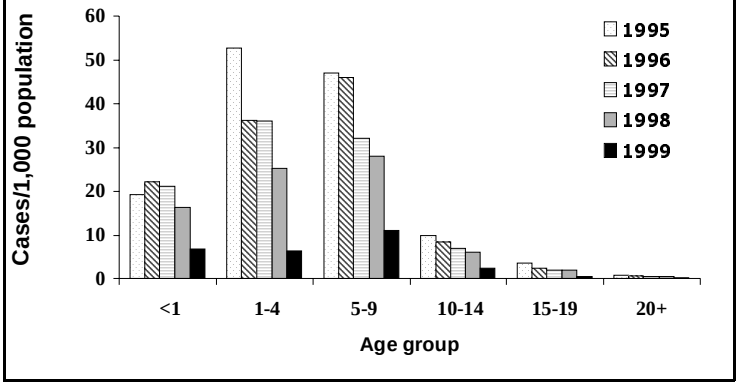


Table 1: Reported Cases of Varicella, Antelope Valley, 1995 - 1999

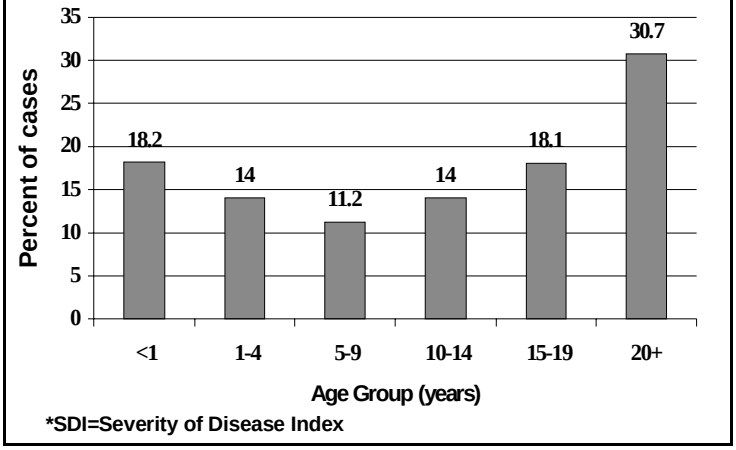
Case Status	1995		1996		1997		1998		1999		1995-1999	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Verified	2,934	(92)	2,422	(90)	2,219	(90)	1,785	(90)	587	(86)	9,947	(90)
Probable	166	(5)	189	(7)	138	(5)	120	(6)	49	(7)	662	(6)
Excluded	101	(3)	86	(3)	130	(5)	100	(5)	44	(7)	461	(4)
Total Reported	3,201	(100)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

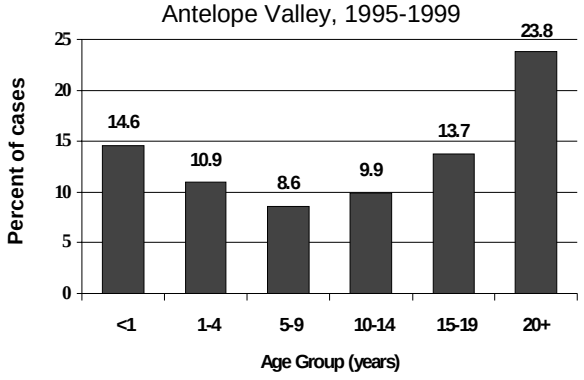
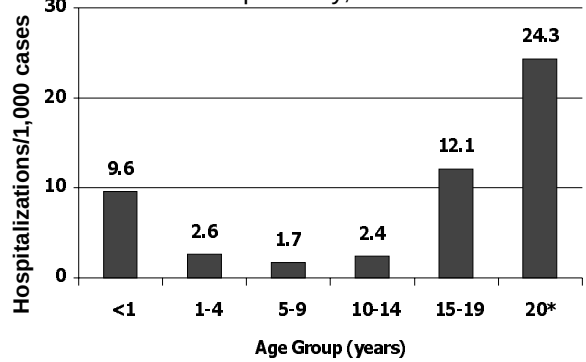


Figure 5
Varicella Hospitalization Rates
Antelope Valley, 1995-1999



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.

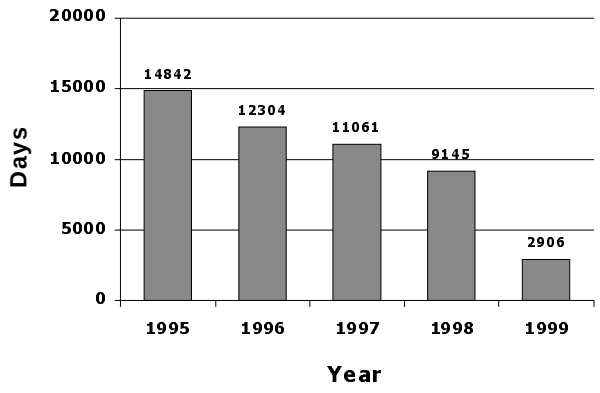
Breakthrough Cases. Of 587 verified cases reported in 1999, 73 (12.4%) occurred in persons who reported having received varicella vaccine. Vaccination status was confirmed by asking parents to check the immunization record card at the time of telephone interview or by medical office staff reviewing the 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,

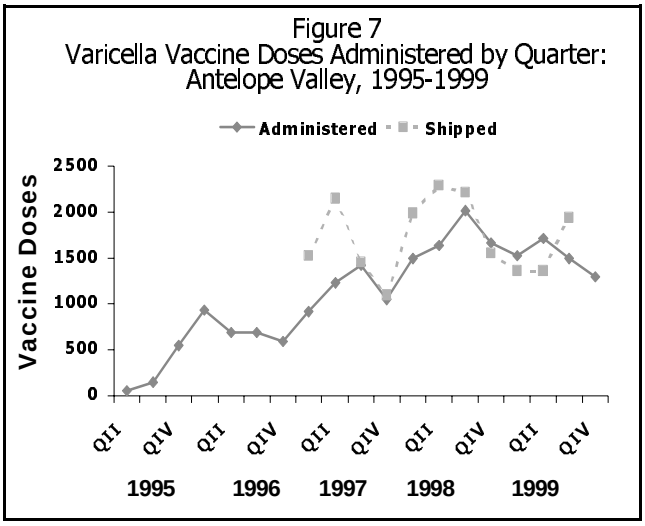
middle and secondary schools, preschools, and daycare facilities), and "health-care providers" (physicians, clinics, hospitals, and health maintenance organizations). We estimate completeness of surveillance data for this age group from all ascertainment sources to be approximately 68%, 70%, 74%, 78%,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

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GROUP A STREPTOCOCCAL INVASIVE DISEASE
LOS ANGELES COUNTY, 1999

BACKGROUND

Group A Streptococcus (GAS), *Streptococcus pyogenes*, a common cause of pharyngitis and uncomplicated skin and soft tissue infections, can also cause serious invasive disease. In the late 1980s, reports of severe invasive GAS infections, including streptococcal toxic shock syndrome and necrotizing fasciitis, began to appear with increasing frequency worldwide. Various theories have been offered to explain the apparent increase and severity of streptococcal infections in recent years, including possible changes in virulence of circulating strains and changes in host susceptibility. GAS invasive disease is not a legislatively-mandated reportable disease in California. Following a cluster of severe invasive GAS infections in previously healthy children in Southern California in 1993, the Acute Communicable Disease Control Unit requested reporting of GAS invasive disease from laboratories, hospitals, and health-care providers in Los Angeles County.

METHODS

GAS invasive disease is defined as isolation of *Streptococcus pyogenes* from a normally sterile body site (blood, cerebrospinal fluid, pleural fluid, peritoneal fluid, bone, joint fluid, or from tissue collected during surgical procedures). GAS invasive disease includes three potentially overlapping clinical syndromes:

- Streptococcal toxic shock syndrome (STSS) - characterized by early shock and multiorgan system failure;
- Necrotizing fasciitis (NF) -necrosis of subcutaneous soft tissue and skin with signs of severe systemic disease;
- Sterile site infections that do not meet the clinical criteria for STSS or NF, including nonfocal bacteremia, and focal infections (e.g., meningitis, pneumonia, peritonitis, osteomyelitis, septic arthritis, and deep soft tissue infections) with or without bacteremia.

Since reporting of GAS invasive disease was initiated in 1994, surveillance methods have varied from mainly passive during 1994 and most of 1995 to county-wide active surveillance between September 1995 and July 1996. Since July 1996, the Communicable Disease Active Surveillance Project (CDAS) has conducted stimulated passive surveillance for GAS

invasive diseases, along with several other nonmandated reportable diseases of public health importance, in approximately 60% of laboratories and hospitals in LAC.

RESULTS

In 1999, 114 cases of GAS invasive disease were reported, for a crude incidence rate of 1.2 cases per 100,000 population. Thirty-nine reports of skin/soft tissue infections were excluded because they did not meet the case definition for invasive disease. Of 62 cases for which outcome was known, there were 10 deaths, for an estimated case-fatality rate of 16%. The frequencies of total GAS invasive disease, STSS, and NF cases for years 1994-1999 are shown in Table 1.

Table 1. Frequency of Invasive GAS, STSS, and NF Los Angeles County, 1994-1999

Year	Invasive GAS	STSS		NF	
		N	(%)	N	(%)
1994	83	29	(35)	18	(22)
1995	103	16	(16)	17	(17)
1996	175	9	(5)	13	(7)
1997	205	7	(3)	9	(4)
1998	128	8	(6)	13	(10)
1999	114	6	(5)	11	(10)

Focus of Infection. The majority (56%) of invasive GAS cases were bacteremia without other identified focus of infection (Table 2).

Table 2. Clinical Features Associated with Invasive GAS Disease Cases Los Angeles County, 1999 (N = 114)

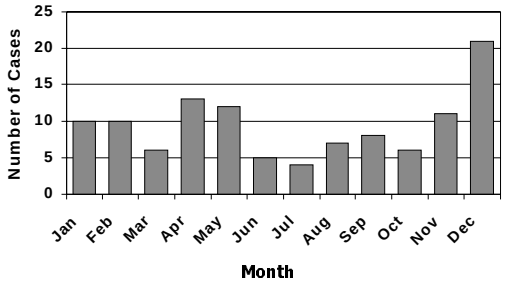
Focus of Infection*	No. of patients (%)	Age (yr) Median Range	STSS No. (%)	Death No. (%)*
Total	114 (100)	58 (0-93)	6 (5.2)	10/62 (16)
Skin-soft tissue infection				
Necrotizing fasciitis	11 (9.7)	45 (13-77)	2 (18)	2/6 (33)
Other	13 (11.4)	60 (0-93)	1 (7.7)	1/8 (12.5)
Pneumonia	10 (8.8)	46 (0-64)	1 (10)	0/6 (0)
Meningitis	2 (1.8)	1, 76	0	0
Septic arthritis/osteomyelitis	12 (10.5)	66 (0-88)	0	0
Bacteremia (without septic focus)	64 (56)	60 (0-93)	2 (3)	7/28 (25)
Peritonitis	2 (1.8)	30, 46	0	0

* Calculated only for those cases with available outcome data.

Seasonality. Cases occurred throughout the year but were more frequent during the winter and spring months (Figure 1). The pronounced winter/spring seasonality commonly associated with noninvasive GAS infections, however, was not observed.

Figure 1.

GAS Invasive Disease
Cases by Month of Specimen Collection
Los Angeles County, 1999



Age, Gender. The mean age of invasive GAS cases for which age data were available (n=104) was 52 years (median 58 years, range 2 months to 93 years). There were no differences between genders. Race/ethnicity data were available for 84 cases. Of these, 33 (43%) were Hispanic, 39 (46%) were non-Hispanic White, 2 (2%) (were Asian, and 10 (12%) were Black.

Necrotizing Fasciitis. NF was reported in 11 (9.7%) cases; 6 (55%) of the cases were male. The mean age of NF cases was 44 years (median 45 years, range 14-77 years). Outcome was reported for 6 of the 11 NF cases with a case-fatality rate of 33% (2/6). Two

patients with NF were also diagnosed with streptococcal toxic shock syndrome.

COMMENTS

These data are subject to several limitations. First, changes in surveillance methods over the study period make meaningful year-to-year comparisons difficult. Completeness of invasive GAS reporting in LAC has not been assessed. The national incidence rate of invasive GAS disease is estimated at 4-5 cases per 100,000 population, compared to the LAC rate of 1.2 cases per 100,000 in 1999. Second, invasive GAS surveillance is mainly laboratory-based and detailed demographic and clinical data are rarely included with the initial report. Hospital record review of reported invasive GAS cases would have provided more complete data but was done for only a small number of cases. It is likely that the number of deaths and the occurrence of additional foci of infections in bacteremic cases are substantially underestimated.

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INVASIVE PNEUMOCOCCAL DISEASE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERNS FOR *STREPTOCOCCUS PNEUMONIAE* IN LOS ANGELES COUNTY, 1997-1999

BACKGROUND

Streptococcus pneumoniae, or pneumococcal, infection is a major cause of morbidity and mortality worldwide and is the leading cause of pneumonia, bacteremia, and meningitis in the United States. An effective polysaccharide vaccine is available which protects individuals from 23 pneumococcal types that cause over 90% of the infections in the US. A major drawback to this vaccine is that it does not protect children less than two years of age who are high risk for severe disease. According to the Centers for Disease Control and Prevention, a conjugate vaccine for use in this age group was approved in 2000 and results indicate that the vaccine is safe and induces primary and booster antibody responses in children less than two years of age.[1]

With the widespread use of antibiotics, the problem of drug-resistance has emerged. In a report by the Centers for Disease Control and Prevention Working Group on *S. pneumoniae*, their nationwide population-based surveillance system observed a 14% to 25% increase of penicillin-nonsusceptible *S. pneumoniae* isolates from 1993-1994 to 1997.[2] Other classes of antimicrobials such as the macrolides, cephalosporins, and fluoroquinolones have also developed resistance.

In September 1995, the Los Angeles County (LAC) Department of Health Services (DHS) initiated a laboratory- and hospital infection control-based surveillance system for ten diseases and conditions including invasive pneumococcal disease (IPD). IPD was selected to measure the incidence in LAC, track antibiotic resistance patterns, potentially monitor immunization efficacy, and target vaccine coverage.

The following is a description of the trends of reported IPD and *S. pneumoniae* antimicrobial susceptibility patterns from 1997 to 1999 in individuals residing in LAC (excluding the cities of Long Beach and Pasadena).

METHODS

Demographic and laboratory information including antimicrobial susceptibility results were obtained from the surveillance system established by LAC-DHS. Cases were defined as LAC residents with a positive isolate for *S. pneumoniae* from a normally sterile site collected

in 1997, 1998, or 1999. To calculate incidence rates, 1997-1999 population data were derived from the 1990 census using sophisticated estimation techniques developed by the LAC Urban Research Section. Antimicrobial susceptibility was determined by disk diffusion or dilution diffusion. It was assumed that minimum inhibitory concentration (MIC) breakpoints utilized by participating laboratories were based on the National Committee for Clinical Laboratory Standards. The breakpoints for selected antimicrobial agents are illustrated in Table 1. An isolate of *S. pneumoniae* was considered nonsusceptible to an antimicrobial agent if the results indicated intermediate or high-level resistance. Data were entered in Microsoft Access 97 and analyzed using Epi-Info 6.04 and SAS Version 6.12.

Table 1. MIC Breakpoints for Selected Agents Used to Treat *Streptococcus pneumoniae* Infection

Antimicrobial	**MIC (μg/mL)** Susceptible	Intermediate	Resistant
Penicillin	≤0.06	0.12-1.0	≥2.0
3rd generation Cephalosporin (cefotaxime,ceftriaxone,cefuroxime)	≤0.5	1.0	≥2.0
Erythromycin	≤0.25	0.5	≥1.0
Trimethoprim-sulfamethoxazole (TMP-S)	≤0.5/9.5	1/19-2/38	≥4/76

DATA ANALYSIS

The annual incidence of reported IPD increased 13% from 8.7 cases per 100,000 (n=818) in 1997 to 9.8 cases in 1999 (n=894). As indicated by Table 2, the male-to-female rate ratios indicated that there were slightly more males who acquired IPD for all three years. In 1999, the mean age for IPD cases was 47 years (median 53 years, range 1 day to 100 years) which was comparable to that observed in 1997 and 1998.

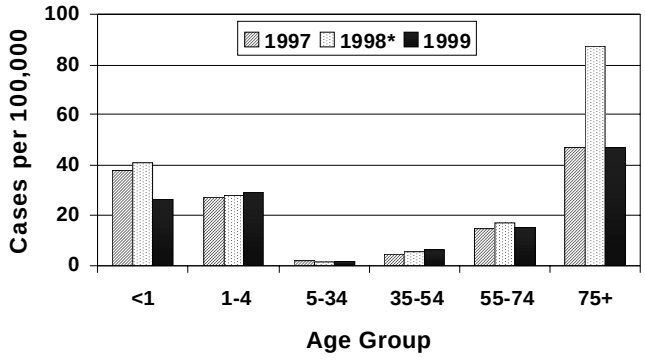
Table 2. Characteristics of IPD Cases Los Angeles County, 1997-1999

Characteristics*	**1997** (N=818)	**1998** (N=814)	**1999** (N=894)
Male:Female Ratio	1.10:1.00	1.06:1.00	1.03:1.00
Age (years)			
Mean	44	44	47
Median	49	50	53
Range	1 mo.-106	<1 day–102	1 day–100
Case fatality rate	15% (59/383)	15% (53/346)	17% (55/328)
Culture site			
Blood	771 (95%)	776 (96%)	836 (94%)
CSF/CSF&Blood	30 (4%)	28 (3%)	44 (5%)
Other	13 (2%)	10 (1%)	14 (2%)

*Data not available on race/ethnicity and characteristic information not available for all cases.

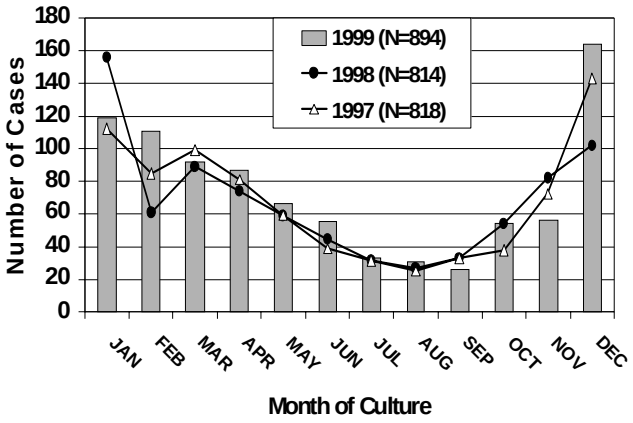
From 1997 to 1999, the case fatality rate increased from 15% to 17% (Table 2). The validity of this data is questionable since the outcome status of approximately 58% of the cases for 1997, 1998, and 1999 were reported as "unknown". The case fatality rates may be underestimated since reporting of positive isolates is required within 24 hours. Unless the patient is severely ill, many times the final outcome of current infection has not yet been determined. The distribution of cases by culture site varied little from 1997 to 1999. Mortality was not significantly associated with having meningitis in 1998 (odds ratio [OR]: 2.53; 95% confidence interval [CI]: .61 to 7.77, p=.10) and 1999 (OR: 1.57; 95%CI: .39 to 4.61, p=.34).

Figure 1. Incidence Rates of IPD by Age
Los Angeles County, 1997-1999



*1998 population data estimated using a different technique than previous years.

Figure 2. IPD Cases By Month of Culture
Los Angeles County, 1997-1999

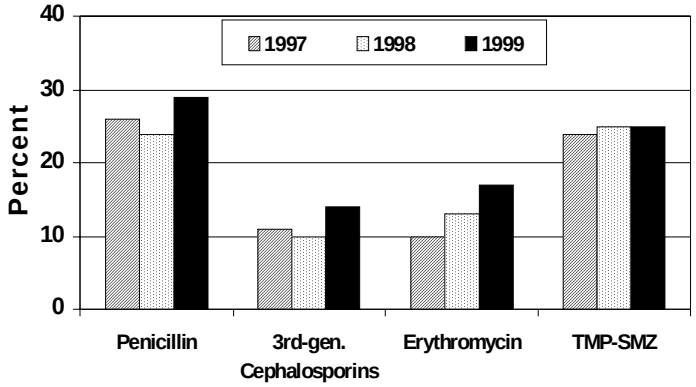


For 1999, the highest age-specific incidence rates occurred in children under five years and adults 75 years and over, which is common with IPD (Figure 1). Comparing 1999 to 1998, the age-specific incidence rates decreased appreciably in the less-than-one-year (-36%) and 75-years-and-over (-46%) age groups. However, in the 75 and older age group, the 1998 rate was skewed because different methodology was utilized to estimate the 1998 population data than in 1997 and 1999.

The IPD cases for 1997-1999 followed the typical seasonal pattern, peaking in late winter then gradually declining through spring. In February and December 1999, the frequency of cases was substantially higher than the previous year (Figure 2). In January 1998 and

December 1999, the observed increases mirrored severe respiratory illness seasons in the winter of 1997-1998 and 1999-2000.

Figure 3. Proportion of IPD Cases Nonsusceptible* to Selected Antimicrobial Agents Los Angeles County, 1997-1999



*Nonsusceptible includes intermediate and high-level resistance.

In 1999, South District had the highest rate of IPD at 13.68 per 100,000 population (24 cases) followed by Southwest with a rate of 11.71 (43) and San Fernando with 11.05 (41). The West and West Valley District had the highest number of cases (59 for both). From 1997-1999, San Fernando District was among the top four districts with the highest crude and age-adjusted rates (using the age groups in Figure 1). From 1997 to 1999, the age-adjusted rates were highest in Harbor District (17.12 per 100,000) and San Fernando District (15.12 per 100,000) for 1997 followed by South District (14.27 per 100,000) for 1999.

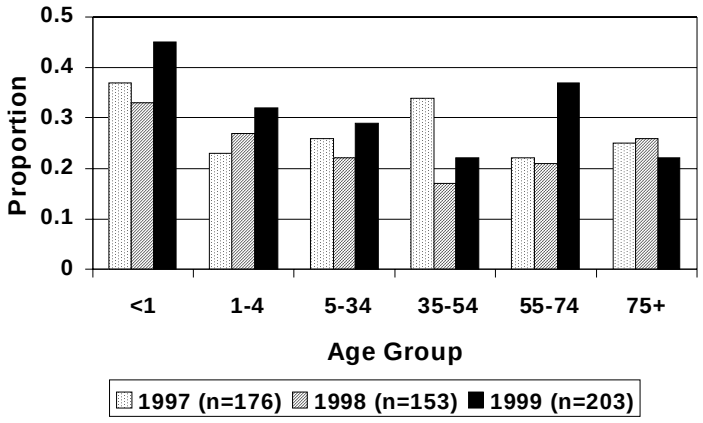
The proportion of penicillin nonsusceptible *Streptococcus pneumoniae* (PNSP) isolates has fluctuated from 26% in 1997, down to 24% in 1998, and up to 29% in 1999 (Figure 3). From 1997 to 1999, the percent of cases nonsusceptible to erythromycin and third generation cephalosporins increased while trimethoprim-sulfamethoxazole (TMP-SMZ) remained about the same.

In 1999, the proportion of PNSP cases was higher than previous years among all age groups except adults 35-54 and 75 years and over. The largest increase (76%) of penicillin resistance in 1999 was in adults 55-74 year old age group (Figure 4). Overall, infants less than one year have the greatest proportion of penicillin nonsusceptibility for the three-year period. In 1999, there was a significant difference between age groups regarding penicillin nonsusceptibility (χ^2=17.64, p-value=.003) but the previous two years were not significant. From the data collected, mortality was not significantly associated with penicillin nonsusceptibility.

DISCUSSION

LAC observed a trend of increasing incidence and antibiotic nonsusceptibility for cases of IPD from 1997 to 1999. Extremes of age were identified as risk factors for acquiring IPD and possibly for penicillin nonsusceptibility. Resistance was not associated with increased mortality.

Figure 4. PNSP Cases by Age
Los Angeles County, 1997-1999



With the current surveillance system, we are limited in describing the epidemiology of IPD because important factors such as race/ethnicity, clinical presentation, medical risk factors, outcome and other possible risk factors (exposure to a nursing home, daycare center, etc.) are not available or are unreliable. To overcome some of the shortcomings of the data, a retrospective case-control study was initiated in 1999 using hospital discharge data to examine possible risk factors associated with acquiring penicillin- nonsusceptible IPD in hospitalized patients in LAC. This study will finish in October 2000. Also, in conjunction with the release of the conjugate vaccine, we plan to use the IPD surveillance system to assess the vaccine efficacy among children aged less than two years.

With the widespread overuse of antibiotics, drug-resistance will continue to increase as a major public health threat. Through educational programs targeting the community and medical establishment about proper antibiotic usage, DHS will be able to reduce the growing numbers of drug-resistant pathogens. In addition, with the newly developed pneumococcal conjugate vaccine for very young children and the pneumococcal polysaccharide vaccine for the elderly and high-risk individuals, vaccination campaigns can help decrease the incidence of penicillin-susceptible and resistant invasive pneumococcal disease.

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SURVEILLANCE OF INFLUENZA THROUGH ACTIVITY OF RESPIRATORY ILLNESS IN NURSING HOMES LOS ANGELES COUNTY, 1999

In 1997 and 1999, Los Angeles County experienced influenza seasons that presented major challenges to the emergency medical system of the county. Above all, emergency rooms were not able to accept patients and requested to "divert" more than 50% of emergency cases brought in by ambulances. An investigation of the 1997 crisis showed a multifactorial origin of this problem, such as purely medical reasons (for example, the vaccine strain did not match the circulating strain resulting in a longer hospital stay of affected individuals, particularly the elderly), shortages of nursing staff, and the reduction of staffed beds in the county within the last 10 years in combination with a steady increase of the population. Furthermore, nursing staff often like to request time off in the last week of December. If public health officials knew in a timely fashion when the wave of influenza cases would start to flood the county, they could warn hospitals to judiciously allow nursing staff time for leave.

In 1997, Acute Communicable Disease Control (ACDC) learned that nursing home surveillance provided data that could be used retrospectively to predict the coming influenza season at least one week ahead of other traditional surveillance systems. In 1999, ACDC performed surveillance involving 10 nursing homes under a centralized administration. ACDC asked the nursing home director to provide the monthly breakdown of the following: (1) the count or population of each of the nursing homes and (2) the number of respiratory illnesses in the week of interest. We calculated the expected proportion of respiratory illness by averaging the proportion of respiratory illness in the last four weeks prior to the week of illness. The upper level of the expected range was calculated as the average plus two times the standard deviation of the four weeks. When the proportion of respiratory illness during the week of interest exceeded the upper level of the expected range, an "alarm" triggered. We compared this "nursing home surveillance system" with standard methods, such as the curve of passively reported influenza isolates in 1999/2000.

Figure 1 shows the evolution of respiratory illnesses of any etiology during the influenza season 1999/2000. Weeks 49 and 50 in 1999 as well as week 1 in 2000 indicate an "alarm." In contrast, the number of the influenza isolates increases one week later, on week 50 (Figure 2). Therefore, nursing home surveillance for respiratory illness provides better sensitivity for predicting the rise of influenza, one week before the (retrospectively constructed) curve of influenza isolates (routine surveillance) is able to confirm the rise However, a limitation of this analysis is that nursing home data was provided only at the end of each month, therefore in an untimely fashion.

Figure 1: Respiratory illness rate among residents of 10 Skilled Nursing Facilities (SNF), Los Angeles County, 1999

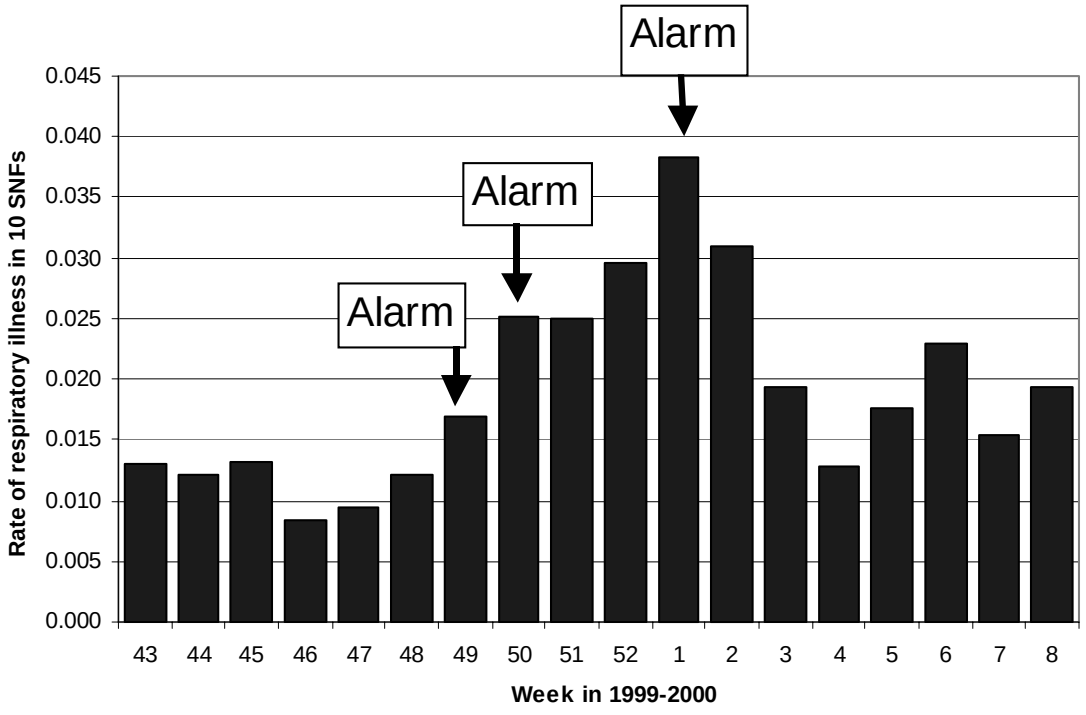
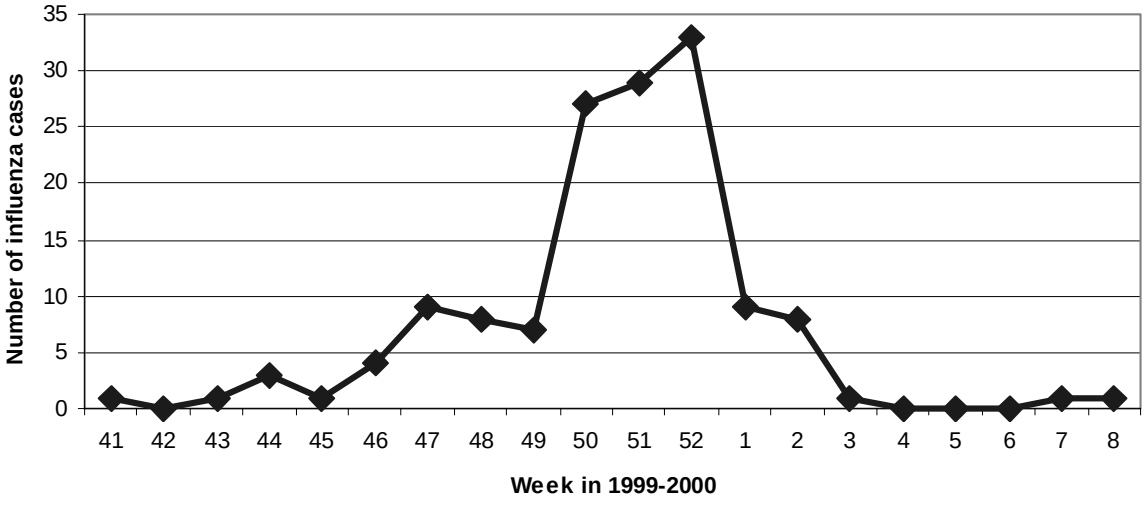


Figure 2: Confirmed cases of influenza A, by week, 1999/2000, Los Angeles County



In summary, it appears worthwhile to explore the role of respiratory illness surveillance in nursing homes as a tool to predict the annual rise of influenza cases throughout the county.

CAMPYLOBACTER: RESISTANCE TO QUINOLONES IN LOS ANGELES COUNTY

BACKGROUND

California has the highest incidence of *Campylobacter* in the United States. Of particular concern is the increase in resistance to quinolone antibiotics, such as ciprofloxacin, which has been seen in several countries such as Greece, Spain, Taiwan, and the Unite States.[1-5]

A cross-sectional study was designed to determine the prevalence of ciprofloxacin resistant *Campylobacter* isolates in Los Angeles County (LAC). Because use of quinolones in poultry has been correlated with *Campylobacter* resistance,[4,5]a random sample of chickens from LAC markets were tested for ciprofloxacin-resistant *Campylobacter spp*.

METHODS

Between May 1 and October 31, 1998, a total of 484 Campylobacter cases were reported to Acute Communicable Disease Control (ACDC) of LAC. Of these, 192 (40%) had *Campylobacter* isolates submitted. Thirty-seven isolates were excluded from the study because they belonged to non-LAC residents, were submitted outside the study period, or had incomplete demographic information. Blood and stool specimens were also submitted to the LAC Public Health Laboratory (PHL) from three County Hospitals (Harbor-UCLA, LAC-University of Southern California, and Olive View), LAC Public Health Centers, and Kaiser Permanente between May 1 and October 31, 1998. Speciation and antibiotic susceptibility were determined for three antibiotics: ciprofloxacin, erythromycin, and tetracycline. Susceptibility testing was done for ciprofloxacin using the gradient diffusion minimum inhibitory concentration (MIC) method (E test). E test method breakpoints of ≤ 1 mcg/ml, >1 mcg/ml and <4 mcg/ml, and ≥ 4 mcg/ml were termed “susceptible,” “intermediate,” and ”resistant,” respectively.

A telephone survey was simultaneously conducted to determine the exposure of the cases to foreign travel, pets, antibiotics, predisposing conditions, and consumption of undercooked chicken.

To determine the level of *Campylobacter* resistance to ciprofloxacin in poultry, thirty-one chickens were purchased randomly from local markets.

RESULTS

Of the 155 cases included in the study, 92 (59%) were male and 63 (41%) were female. The median age was 22 years (Table 1). Most of the cases (115 or 74%) were Hispanic (Table 2). Kaiser Permanente reported most of the cases (54%), while County Hospitals reported 39% of the cases, and 7% were reported from Health Centers.

Table 1. Gender and Age Comparison of Study Cases and Reported Cases

	Number of study cases (%)	Number of reported cases (%)
Female	**63 (41)**	**143 (30)**
Male	**92 (59)**	**186 (38)**
Total	**155 (100)**	**484 (100)***
Median age	**22**	**28**

***Missing or unknown values led to only 329 values for gender.**

Table 2. Race/Ethnicity Comparison of Study Cases and Reported Cases

Race/ethnicity	Number of study cases (%)	Number of reported cases (%)
African American	**7 (4)**	**10 (3)**
Asian	**4 (3)**	**32 (10)**
Hispanic	**115 (74)**	**141 (43)**
White	**26 (17)**	**134 (40)**
Other	**3 (2)**	**12 (4)**
Total	**155 (100)**	**484 (100)***

***Missing or unknown values led to only 329 values for gender.**

Campylobacter species were identified in 152 (98%) stool or blood specimens. The most commonly isolated species was *C. jejuni* (92.2%, n=149), followed by *C. upsaliensis* (5.5%, n=8), *C. coli* (1.6%, n=2), and *C. fetus* (0.8%, n=1).
Only five cases had isolates resistant to ciprofloxacin (Table 3). The median age of these cases was 5 years; four (80%) were children between the age of 1 and 7 years; four (80%) were Latino. None of the resistant cases had a history of foreign travel or exposure to a pet with ciprofloxacin-resistant *Campylobacter*. Only two (40%) cases with resistant isolates had eaten chicken in the seven days prior to illness.
Thirty-one whole chickens were randomly sampled from various LAC markets. Twenty-one (68%) chickens provided isolates, all of which were susceptible to ciprofloxacin.

Table 3. *Campylobacter* antibiotic susceptibility results

Antibiotic susceptibility	Antibiotic		
	Ciprofloxacin	Erythromycin	Tetracycline
Susceptible	**150 (97)**	**81 (52)**	**103 (66)**
Intermediate	**0 (0)**	**74 (47)**	**1 (1)**
Resistant	**5 (3)**	**0 (0)**	**141 (43)**

CONCLUSIONS

There were limitations to this study:

1. In some cases, there was up to a month lag time between the onset of illness and the time of the interview. This may have caused recall bias, and diluted the correlation between some of the factors and *Campylobacter* resistance.
2. The study sample may not represent all LAC cases, but rather the population who visit the submitting hospitals and Health Centers.
3. The chickens which were purchased for the resistance study were a small sample, and may not have been representative of the entire poultry supply in the LAC area.

The results of our study suggest the following conclusions:

- *Campylobacter* resistance to ciprofloxacin is very low in LAC.
- *Campylobacter* resistance may not be correlated with foreign travel, pet exposure, or poultry consumption.
- The most commonly isolated species was *C. jejuni*, while *C. upsaliensis* was isolated in 5.5% of the cases.

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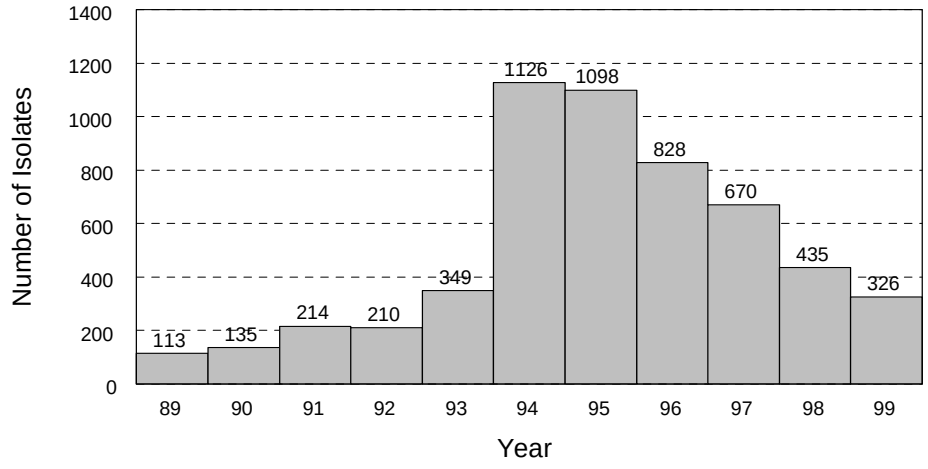
SALMONELLA SEROTYPE ENTERITIDIS IN LOS ANGELES COUNTY, 1999

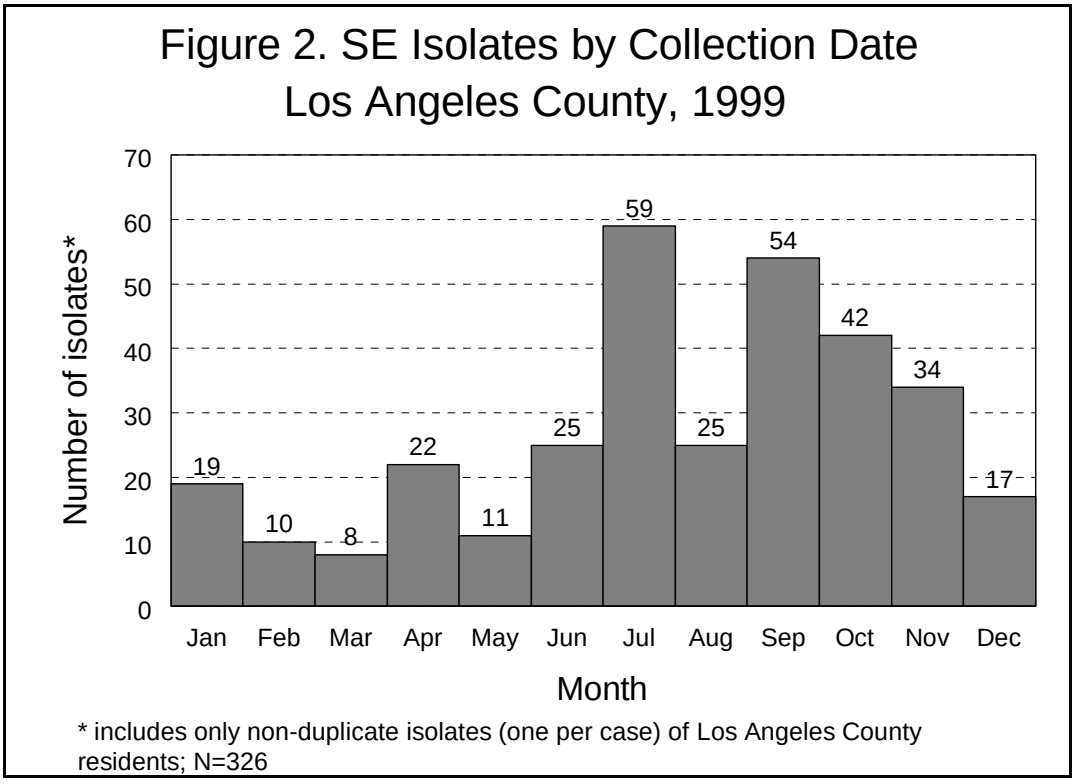
Since 1994, reported cases of *Salmonella* serotype Enteritidis (SE) have gradually decreased in Los Angeles County (LAC). In 1994, following a marked increase in SE cases, a case-control study of sporadic cases was conducted by the Acute Communicable Disease Control Unit (ACDC) and the California Department of Health Services.[1] The case-control study showed a strong association between SE infection and consumption of eggs, especially raw or undercooked eggs. Eating in restaurants also was associated with increased risk of SE infection. The majority of cases occurred in young adults. Since 1994, an increasing proportion of cases of SE have been occurring in children under five years and the elderly, and almost all of these are phage type 4, indicating that SE phage type 4 has become established in the Los Angeles County population.

SE continues to be the most common *Salmonella* serotype identified from isolates submitted to the Public Health Laboratory. In 1999, SE comprised 326 of 1239 (26%) of *Salmonella* isolates serotyped for LAC cases (Figure 1). Of all *Salmonella* isolates, SE represented 50% in 1994 and 32% in 1998. In 1999, the overall incidence of SE was 3.5 cases/100,000 population compared to13.5/100,000 for all *Salmonella*.

Figure 1. SE Isolates by Year*
Los Angeles County, 1989-1999



*Includes total isolates identified by the LAC Public Health Laboratory



The highest frequency of SE cases occurred during the summer months and early fall (Figure 2), similar to other *Salmonella* serotypes. There was a dramatic spike in July due to two large outbreaks which occurred on a college campus. SE isolates were identified from feces (93%), followed by blood (4%), urine (1%), and other/unknown specimens (2%). There were 52 hospitalizations (16%), with an average of 6.8 inpatient days each. SE infection was a contributing cause of death in one person with underlying disease (asthma and renal failure).

In 1999, 7/21 (33%) salmonellosis outbreaks were due to SE phage type 4, which has established itself as the most common SE phage type in Southern California. Three of the outbreaks occurred during the hot late summer/early fall months, when layer chickens may be stressed by the heat and shed more *Salmonella* via the ovary into the eggs. Eggs were the suspected source for three outbreaks. The suspected sources for the other four outbreaks included chicken, foodhandler(s), and unidentified sources (Table 1).

Table 1. Salmonella Enteritidis Outbreaks in Los Angeles County, 1999

Onset month	Outbreak setting	Number ill	Culture positive	Phage type	Suspected vehicle	Suspected source
Jan	Restaurant	3	2	4	Egg dishes	Shell eggs
Jan	Restaurant	2	2	4	Chile relleno	Shell eggs
July	College campus	29	6	4	Egg dishes	Shell eggs
July	College campus	82	20	4	Salad bar items	Foodhandler
Sept	College campus	34	19	4	Unknown	Unknown
Oct	Restaurant	2	2	4	Sushi	Unknown
Nov	Family party	7	4	4	Chicken dish	Chicken

ACDC continues to monitor sporadic cases and outbreaks of SE and works with private industry groups and the state and federal governments. ACDC works toward the improvement of egg production, egg distribution processes, and consumer education in order to decrease risk of SE infection.

SALMONELLA SEROTYPE THOMPSON ASSOCIATED WITH CILANTRO

SUMMARY

A statewide outbreak of *Salmonella* serotype Thompson occurred during March 1999 in California. Prior to the statewide outbreak being identified, Los Angeles County (LAC) had investigated an outbreak of *Salmonella* Thompson which occurred in a small Mexican restaurant (Restaurant A). A statewide case-control study implicated cilantro as the cause of the LAC and statewide outbreaks. As a result of the case-control study, LAC identified another small *Salmonella* Thompson outbreak associated with a small chain restaurant (Restaurant C). This report focuses on the outbreak involving Restaurant A and includes a brief summary of the statewide outbreak.

RESTAURANT A OUTBREAK

On March 25, 1999, a LAC District Public Health Nurse notified the Acute Communicable Disease Control (ACDC) Unit that the son of the owner of Restaurant A had salmonellosis. Subsequently, three separate Foodborne Incident (FBI) reports were identified in which a total of ten individuals became ill after eating in Restaurant A. Restaurant A is a small Mexican restaurant chain with eight locations in the San Gabriel Valley. Illness was associated with only one location.

METHODS

Outbreak-associated cases were defined as persons who ate food purchased at Restaurant A between March 15-31, 1999, with stool cultures positive for *S.* Thompson (confirmed case) or with fever and diarrhea (probable case). Using a standardized questionnaire, ACDC interviewed Restaurant A cases about symptoms and food history. Stool specimens were collected from a sampling of ill patrons and from all employees of Restaurant A. Stool specimens were also collected from household contacts of those meeting a case definition if the household contact was symptomatic or if the household contact was determined to be in a sensitive occupation/situation. The LAC Food and Milk Unit inspected Restaurant A on March 26, 1999.

RESULTS

Of 41 total outbreak-associated cases, 33 had stool cultures positive for *S.* Thompson. The confirmed cases consisted of 26 restaurant patrons, five restaurant employees, and two household contacts of restaurant employees. Four (12%)of the confirmed cases were hospitalized. Five persons with positive stool cultures were asymptomatic (two patrons, two restaurant employees, and one household contact of a restaurant employee). The age range of cases was from 4-70 years, with a mean age of 33.8 years; 55% of the cases were female. Exposure dates were from March 16 to 19. Onset dates of illness were from March 17 to 22. The mean incubation period was 25 hours (range 6-83), and the mean duration of illness was 106 hours (range 24-168). Symptomatic cases experienced diarrhea (97%), abdominal cramps (87%), fever (84%), chills (77%), nausea (74%), and vomiting (58%).

Analysis of the food items consumed implicated a condiment mixture that included chopped cabbage, cilantro, onion, and tomato. This was the only food consumed that was common to ill restaurant patrons. The attack rate of those persons who ate food containing this mixture was 94%. However, this mixture was included in at least one food item consumed by each restaurant patron. Therefore, no comparison could be made to persons who did not eat the specific food item. Because the attack rate calculations were the same for each ingredient in the condiment mix, no single ingredient in the mix was implicated. Thus, LAC Department of Health Services was unable to initiate a produce traceback. No food samples ere tested for *Salmonella*.

Restaurant A was closed from March 29 to April 7, 1999, by order of the Health Officer due to the multiple violations found at the time of inspection as well as the number of employees (five of eight) who were removed from food handling after having positive stool cultures for *S*. Thompson. Violations included food stored at unsafe temperature, and food storage problems.

SUMMARY OF STATEWIDE SPORADIC *SALMONELLA* THOMPSON OUTBREAK INVESTIGATION

In early April 1999, subsequent to the outbreak associated with Restaurant A, the California Department of Health Services (CA DHS) detected an increase in *S*. Thompson cases with illness onset in March 1999 throughout the state of California. All but two of the cases resided in Southern California. CA DHS was aware of the LAC outbreak involving Restaurant A, but the sporadic cases denied contact with Restaurant A.

For the statewide outbreak, a case was defined as a culture-positive case of *S*. Thompson in California in March 1999. The CA DHS identified 35 sporadic cases, 17 of whom were LAC residents. Onsets for the cases were from March 6 to 31, 1999 (LAC cases had onsets from March 10 to 27, 1999). Two case-control studies to determine possible risk factors were conducted by the state in April and May 1999. The first was a matched case-control study using *S*. Thompson cases and randomly selected controls. One case- associated with the Restaurant A outbreak was included in this study. The second case-control study used controls who had infections with *Salmonella* serotypes other than Thompson, with onsets during the month of March. The first case-control study found a significant association (odds ratio of 3.5, 95% confidence limits of 1.1 and 11.4) between illness and eating cilantro, either as a garnish or in salsa, at a restaurant.

A traceback investigation of cilantro served at selected restaurants during the outbreak was done to identify the source of contaminated cilantro. Three restaurants with clusters of cases (Restaurants A, B, and C) and two restaurants where cases ate cilantro but not salsa (Restaurants D and E) were included in the traceback investigation. Restaurant and distributor invoices were reviewed in an attempt to trace cilantro to specific farms. Although the traceback investigations did not produce conclusive results, several similarities between suppliers and growers were discovered. Three of the five restaurants received cilantro from growers in the same region of Mexico; two of these restaurants (Restaurant A and B) shared a common grower. The two other restaurants shared a common distributor. Unfortunately, poor record keeping prevented definitive results and no environmental investigations of the farms were done.

Local health departments, including LAC, surveyed 10 restaurants where *S*. Thompson cases ate fresh salsa or cilantro. This survey included questions about the cutting and storage of cilantro, as well as the storage of freshly made salsa. All restaurants reported they washed cilantro in water before use, and then chopped the cilantro with a knife. All stored cilantro, whole leaf or chopped, as well as freshly prepared salsa in refrigerated conditions. Seven of the restaurants used the chopped cilantro within two days; one used the cilantro within 2-3 days; one reported “up to 4 days,” and one stated that the cilantro could last for a week.

The CA DHS case-control study resulted in the identification of a second LAC restaurant associated outbreak of *S*. Thompson (Restaurant C). In this outbreak, three cases (two of whom were LAC residents) ate at one location of a small chain restaurant in mid-March. A fourth case ate at a different location of the same chain restaurant. None of these cases reported eating any dish containing cilantro. However, this restaurant uses cilantro, and shared a common supplier of cilantro with Restaurant D.

CONCLUSIONS

Even though a single food item was not implicated in the outbreak at Restaurant A, a condiment mixture including several produce items accounted for 94% of illness. The source of contamination was undetermined in the Restaurant A outbreak, but ample opportunity for cross-contamination was evident after the Food and Milk Unit inspection. A case-control study conducted by the CA DHS implicated cilantro as the most likely cause of the LAC outbreak at Restaurant A as well as an outbreak of sporadic *S*. Thompson cases that occurred in California. Contaminated cilantro from Mexico was the most likely source of this outbreak of *Salmonella* Thompson.

DISCUSSION

Handling of contaminated cilantro and using it in salsa in restaurants increase the risk of sporadic contamination and foodborne illness among many people. Chopping and pooling poorly washed cilantro may distribute the contaminant, while storage without refrigeration could permit reproduction of bacteria.
Inoculation studies performed by the CA DHS during their investigation suggested that the release of nutrients through chopping may promote the growth of bacteria. Those working in the food service industry, as well as the public, should be instructed to chop cilantro just prior to use, and to keep cilantro refrigerated after chopping. Efforts to avoid contamination of water in the fields where produce is grown, and the use of potable water to wash fresh produce are needed to prevent future outbreaks caused by contaminated produce. Accurate record keeping by all parties involved in the distribution of fresh produce is essential for traceback investigations to be successful.

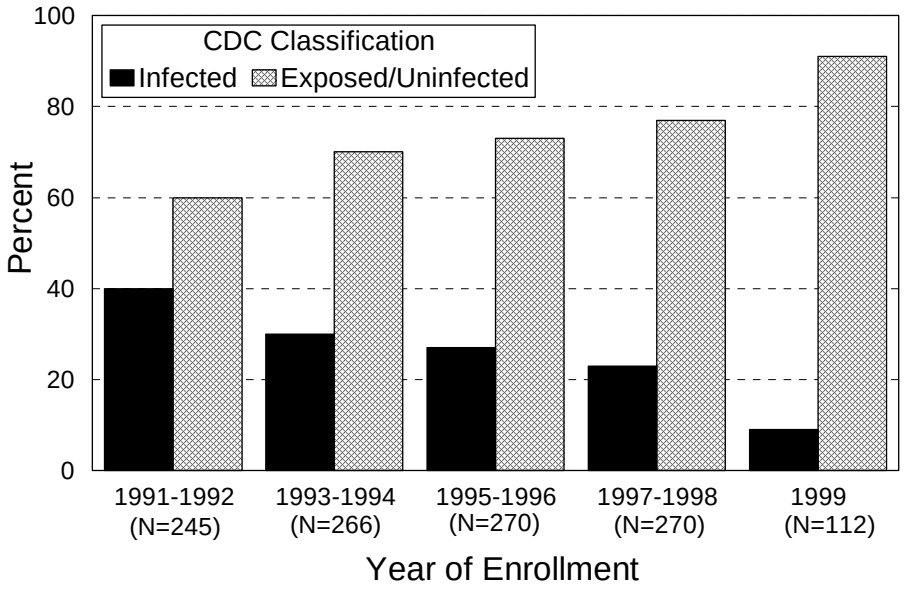
PEDIATRIC HIV DISEASE - PEDIATRIC SPECTRUM OF DISEASE

In March 1988, the Los Angeles County (LAC) Department of Health Services began conducting active surveillance for children HIV-exposed and infected under the age of 13 years as part of the Centers for Disease Control and Prevention's national Pediatric Spectrum of Disease(PSD) research project. Case ascertainment included all children who had died with an AIDS or HIV-diagnosis and all who were still alive and in medical care. As of December 31, 1999, with active case surveillance at the 10 major LAC pediatric referral centers, a total of 1,547 HIV-exposed and infected children had been reported to PSD. This number includes 1,348 LAC resident children and 199 nonresident children receiving care in LAC (including those who had died). PSD collects information at baseline, when the child is initially evaluated for HIV and then every 6 months for the life of the child. Children who reach adolescence are followed until they are transferred to an adult AIDS clinic. Currently, 344 children and adolescents are under HIV care in LAC.

CDC CLASSIFICATION

Of the total 1,547 children reported to PSD, 581 were HIV-infected, 882 were perinatally exposed but uninfected, and 84 were exposed and of indeterminate HIV status due to the persistence of maternal HIV antibody. Of the 581 HIV-infected children, 299 or 51% had an AIDS-defining condition and met the CDC classification criteria for AIDS[1]. Of these, 23 were diagnosed with an AIDS defining illness after 12 years of age. An additional 18 infected children 13 years or older met the adult AIDS definition with a CD4 lymphocyte count <400µL. In 1999, 112 HIV-exposed or infected children were reported to PSD of whom 3% had an AIDS diagnosis at last medical contact, an additional 6% were infected but without AIDS, 40% were of indeterminate status, and 51% were uninfected. Of the 11 infected children reported in 1999, only two were identified at birth and four were non-LAC residents at the time of their HIV diagnosis. The proportion of infected children has decreased from 40% of the total children reported in 1991-1992 to only 9% in 1999 (Figure 1).

Figure 1: CDC Classification and Year of Child's Enrollment
Los Angeles County January 1991 - December 1999



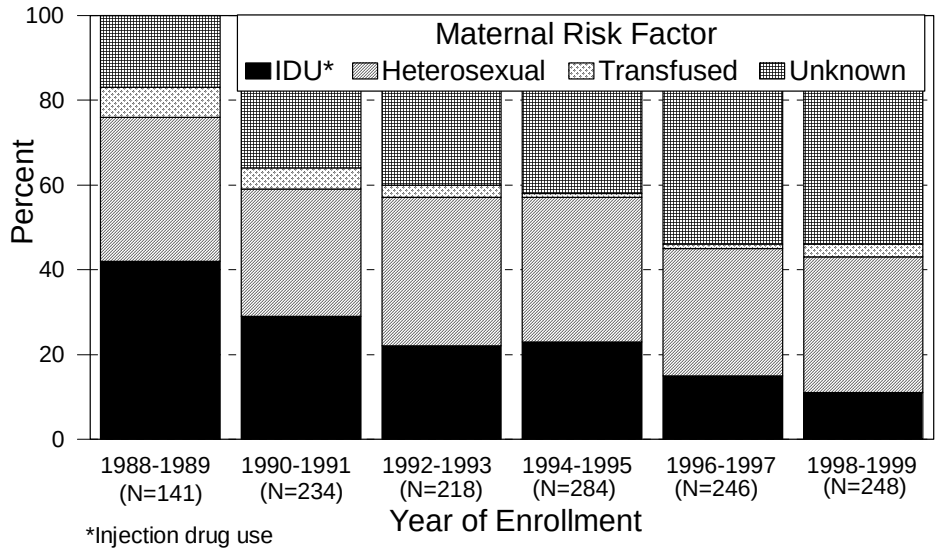
Source: DHS, Pediatric Spectrum of HIV Disease Study

MODE OF TRANSMISSION

Among the 665 HIV-infected children and adolescents, including 84 children with still indeterminate HIV status, 492 (74%) had perinatally acquired (PA) infection from an HIV-infected mother, 124 children (19%) were infected from a contaminated blood transfusion, and 39 (6%) were children with hemophilia or a coagulation disorder. Two children were infected due to breastfeeding. Among the PA group, 23% had a mother who was an intravenous drug user (IDU), 12% had a mother who had sex with an IDU, 24% had a mother who had sex with an HIV+ or high-risk male, 4% had a mother infected through a blood transfusion, and 37% had a mother whose risk factor for HIV infection could not be identified. Sexual abuse is suspected as a risk factor for four children and confirmed for one child.

The proportion of perinatally exposed children whose mother's risk factor for HIV was IDU has decreased from 42% in 1988-89 to 13% in 1999 (Figure 2). Correspondingly, the number of children infected due to an HIV-infected mother with unknown risk has increased each year from 17% in 1988-89, to 53% in 1999.

Figure 2. Maternal HIV Risk Factors of Children with Perinatally Acquired HIV Exposure by Year of Child's Enrollment
Los Angeles County, March 1988 - December 1999



Source: DHS, Pediatric Spectrum of HIV Disease Study

DEMOGRAPHICS

Among the 665 HIV-infected and still indeterminate children and adolescents reported, 34% were Black, 42% Hispanic, 21% White, 3% Asian, and 1% other/unknown. Of the 112 hiv exposed and infected children reported in 1999, 37% were Black, 50% Hispanic, and 9% White.

The distribution of HIV-infected and indeterminate children by gender shows slightly more males than females (52% vs. 48%) due to the disproportionate number of transfusion-associated and hemophiliac cases among males.

Most children (72%) had a biologic parent as their primary caretaker at the latest medical contact: 21% lived with another relative or were in foster care, 3% with adoptive parents, and 4% in other or unknown living arrangements. The PA group was more likely to be living in foster care or with another relative than the transfused and hemophiliacs (26% vs. 5%, and 3%, respectively). Within the PA group, the Hispanics were the least likely to be in foster care or living with another relative (15% vs. 37% for Blacks and 32% for Whites).

CASE FATALITY AND SURVIVAL

The cumulative fatality rate for AIDS cases was 65% (194/299). Fifteen (4%) of the children not meeting the AIDS case definition have died. The mean age at AIDS diagnosis for the PA cases was 29 months (median 14.0 months) compared to the mean age at aids diagnosis of 88 months for the transfused cases (median 88 months), and 160 months for the hemophiliacs (median 143 months). Estimated median survival from AIDS diagnosis to death or date of last medical contact was 52 months for PA cases and 28 months for the transfused cases and 22 months for the hemophiliacs (Kaplan-Meier product-limit estimates).

Among the 344 HIV-infected and indeterminate children still alive and still followed by PSD, 17% were less than 2 years of age, 33% were between 2-7 years, 26% were 8-12 years, and 23% were 13 years or greater. Twenty-seven of the 80 children aged 13+ years met the pediatric criteria for AIDS and an additional 18 met the new adult criteria for AIDS with a CD4<200.

PRENATAL ZDV AND PERINATAL TRANSMISSION

Beginning in 1994, zidovudine (ZDV) use during pregnancy, labor, and delivery became a recognized means to prevent perinatal HIV transmission. Of the 536 infants born in 1995-1999 to HIV-infected women and reported to PSD, 395 (74%) of their mothers received ZDV during pregnancy; 79% received prenatal care. Similarly, 361 (73%) received ZDV during labor and delivery. In 1999, 88% received prenatal care, 93% received antiretrovirals either during pregnancy or labor and delivery, and 76% of the mothers received both. Compared to the 20-25% transmission rate observed before 1994, the overall rate of transmission for all children born in 1995-99 and reported to PSD was 10%.

UNIVERSAL OFFERING OF PRENATAL HIV TESTING AND COUNSELING

As of January 1, 1996, all prenatal providers are legally required to offer HIV testing and counseling and document the offering in the patient's medical record. Statistics from six health centers who directly report to Acute Communicable Disease Control (ACDC) showed a 74% acceptance rate for 1999. One HIV-positive woman was identified in 1999. ACDC continues to evaluate risk assessment data on pregnant women who test HIV positive. Seventy-nine women since 1989 have been identified in LAC clinics; 56 (71%) reported risk assessment information to ACDC. Twenty-eight (50%) of these women could not identify any known risk factor for HIV infection. Women identified as HIV positive are referred to tertiary care centers to receive specialized care for themselves and their unborn infants.

REFERENCE

Centers for Disease Control and Prevention Appendix: Revised Surveillance Case Definition for HIV Infection. *MMWR 1999;48(RR-13):29-31.*

DEVELOPMENT AND EVALUATION OF OUTBREAK DETECTION ALGORITHMS FOR COMMUNICABLE DISEASES

Executive Summary

The literature describes several different statistical methods to aid in outbreak detection from routine surveillance data. Based on the results of our preliminary review of existing methods, we developed and evaluated four outbreak detection methods that could be useful within Los Angeles County (LAC). All four methods have in common that either the current week's case count or that of the current last four weeks are compared to a reference. From this reference a threshold is calculated. If this threshold is exceeded, an alarm is triggered.

Table 1. Comparison of Four Outbreak Detection Methods

Name of Method	Weeks of interest	Reference period	Alarm Rule
Column 1	Column 2	Column 3	Column 4
Current-Year	current week	previous 6 weeks	If no. of cases in col. 2 > [average of no. of cases in col. 3 + 2sd*]
Current/ Previous-Year	current week	five 6-week blocks (two from current year; three from previous year)	If no. of cases in col. 2 > [average of medians of five 6-week blocks in col. 3 +2sd*]
MMWR Five-Year	current 4-week period	15 previous 4-week blocks (three each from previous 5 years)	If [col. 2 ⁄ mean of col. 3] > [1 + 2 (sd* of col. 3 ⁄ mean of col.3)]
CuSums	current week	five 6-week blocks (two from current year; three from previous year)	"Delta" = col. 2 - average of medians of col. 3 Cusum = Cumulative sum of deltas Alarm: If sum of four deltas > average of medians of col. 3

*****standard deviation

To test these methods, we chose to use the campylobacteriosis database, which contains data with consistent quality back to 1983. With approximately 1200 cases annually (ranging from 825-1725 cases), campylobacteriosis is reported frequently enough to apply these statistical tests for identification of possible outbreak situations. We created a spreadsheet of campylobacter case reports from 1983 to 1998 by week of occurrence. Using these data, we created individual spreadsheets for each outbreak detection methods. Since the MMWR Five-Year Method requires five years of historical data 1988 was the first

year that all four methods could be implemented. We defined an "alarm week" as a week in which at least one method triggered an alarm. From 1988 to 1998, 161 weeks triggered at least one alarm for an average of 14.6 alarm weeks per year. Among the weeks with any alarms during this time period, 90 (56%) had one alarm, 51 (32%) had two alarms, 17 (11%) had three alarms, and 3 (2%) had four alarms.

Not every statistical alarm indicates an outbreak, so we aimed to evaluate periods that were either "more likely" to represent outbreaks or which were known periods of historical outbreaks. We therefore selected first, based on arbitrary rules based on frequency of alarms, 15 "alarm periods" of 1-4 weeks' duration (with possible outbreak "character") in addition to ten "known outbreak periods" of campylobacteriosis between 1983 and 1998.

We explored the hypothesis that cases from alarm periods/known outbreak periods differ from generally occurring campylobacter cases. We compared cases from alarm periods/known outbreak periods with cases reported in "comparison periods" by race, sex, age, and place of residence. The comparison period was determined similarly to the reference period in the Current/Previous-Year Method. Since we compared four variables, we calculated a total of 60 (15x4) p-values for the alarm periods and 40 (10x4) p-values for the known outbreak periods. We defined a statistical test as significant if it yielded a p-value of ≤ 0.05. Among the alarm periods, 11 (18.3%) of the 60 p-values were ≤ 0.05. Among the 10 known outbreak periods, 8 (20%) of the 40 p-values were ≤ 0.05.

Because it was not possible to verify differences observed between alarm periods/known outbreak periods and comparison periods through in-depth investigations, we attempted to at least evaluate the frequency of statistically significant results. Again, we assumed that weeks without alarms are representative of the "general population" of cases of campylobacter. We therefore "evaluated" those non-alarm weeks just as if they were alarm-weeks and defined comparison weeks to those weeks without alarms exactly as we did for the weeks with alarms/known outbreaks. One would then expect that the statistical analyses of campylobacter cases from weeks with no alarms versus campylobacter cases from comparison weeks would not yield as many results with p-values of ≤ 0.05 as were observed in the analyses of the alarm periods/known outbreak periods. We randomly selected one period per year from 1988 – 1998 (n=11) out of the pool of weeks with zero alarms. In the analysis of the 11 randomly selected non-alarm periods, we performed 44 (11 x 4) comparisons and only two (4.5%) of these resulted in p-values ≤ 0.05.

Finally, we calculated a Chi-square statistic comparing the frequency of significant differences (n = 11 + 8 = 19) for age, sex, race, or place of residence found in the analysis of the alarm periods/known outbreak periods to that in the randomly selected non-alarm periods (n=2). An analyzed comparison in the alarm periods/known outbreak periods was

4.9 times (95% confidence interval = 1.03 – 32.2; p=0.02) more likely to result in a significant p-value than an analyzed comparison in the random non-alarm periods.

Certain alarm weeks/known outbreaks could contain subpopulations of cases of campylobacteriosis whose differences might be picked up by the simple analysis of demographic variables. Our findings suggest that there may in fact be hidden outbreaks of campylobacteriosis that may be detectable with the use of outbreak detection methods such as the ones described here.

In summary, we showed that it is relatively simple to implement up to four different outbreak detection methods. Health departments may want to use them either individually or in combination to identify frequency patterns that warrant further investigation. In the future, we recommend implementing these methods prospectively in order to determine the validity and usefulness of the methods.