**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
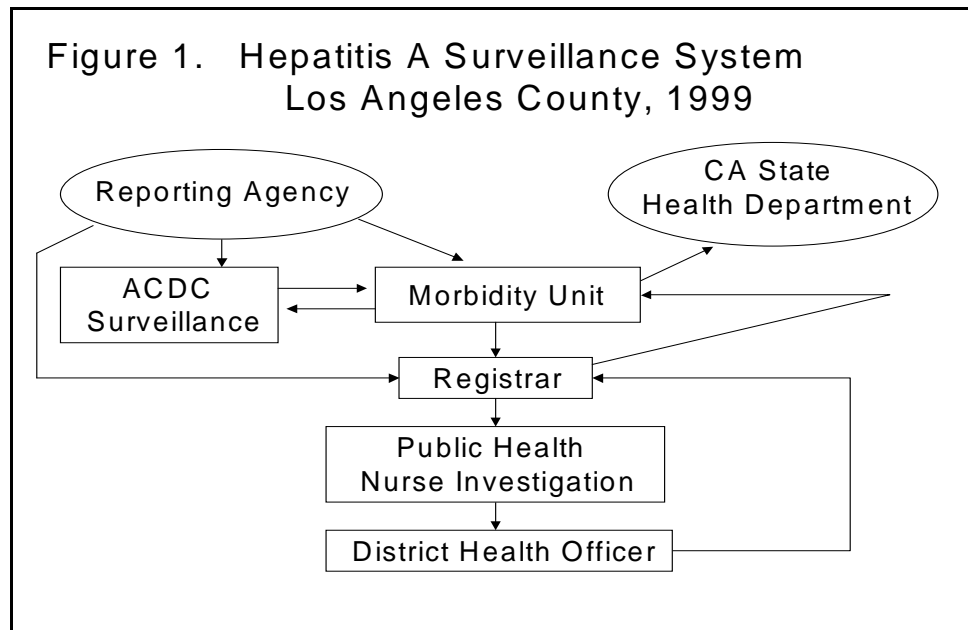
Acceptability: The acceptability among hepatitis A cases for interview by the PHN was 98%, indicating a high level of acceptance of the system by the cases. The acceptability of the system by PHNs, as indicated by their use of the case epidemiology form, was also satisfactory (more than 92% of the general 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
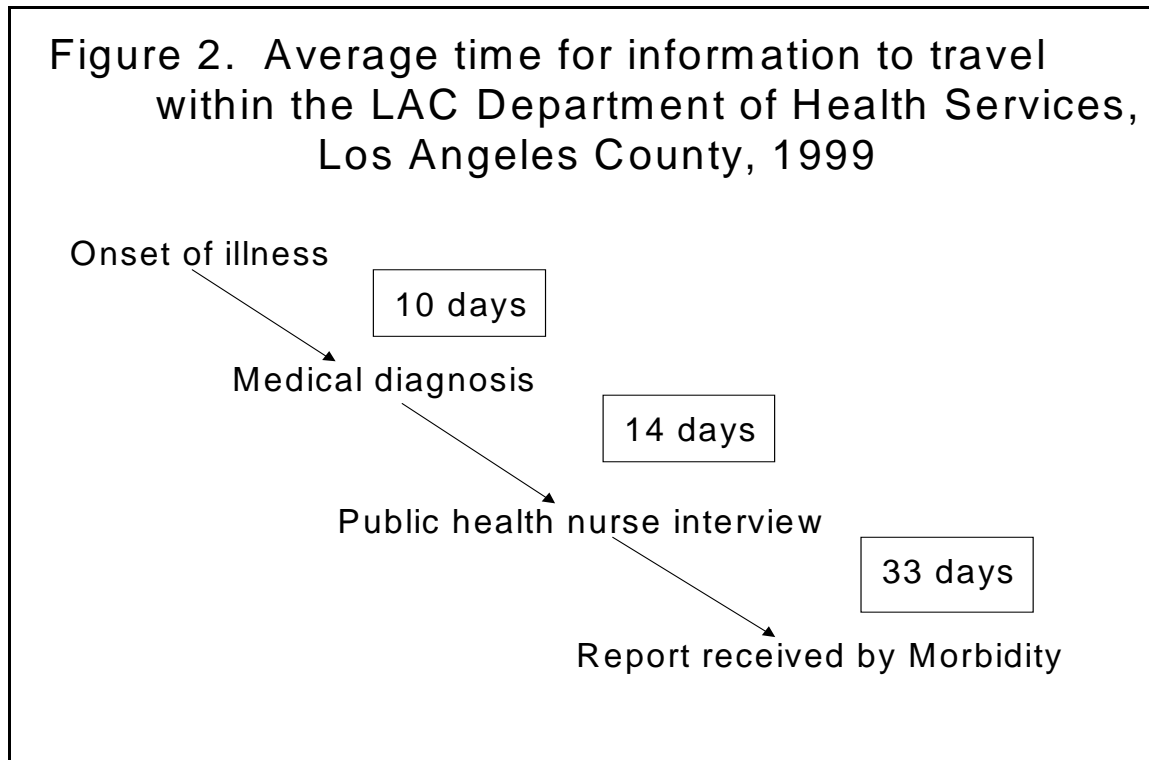
during the unrelated cohort study, ACDC identified an additional five (secondary) cases that were never reported to us. This suggested a lack of sensitivity because of failure to report by laboratories as well as weakness in incomplete PHN case ascertainment.

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

Onset of illness

10 days

Medical diagnosis

14 days

Public health nurse interview

33 days

Report received by Morbidity

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.

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*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.