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BABESIOSIS IN A LOS ANGELES COUNTY RESIDENT ACQUIRED THROUGH BLOOD TRANSFUSION

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INTRODUCTION

Babesiosis is a parasitic infection of red blood cells (RBCs) caused by various species of the protozoan *Babesia*. Though most infections are asymptomatic, the disease can be potentially severe and even fatal, especially in aspenic individuals, the elderly, and the immunosupressed. The symptoms of babesiosis can mimic many systemic infectious diseases, including fever, chills, myalgias, fatigue, and jaundice due to hemolytic anemia [1, 2]. While a number of species of *Babesia* can cause illness in humans, most infections reported in the United States (US) are attributed to *B. microti*. The majority of these infections have occurred in the Northeast and less commonly in the Midwest. Although unusual, cases of *Babesia* infection have been documented from California and Washington, caused by the local isolate types CA-1 and WA-1 (currently identified as *B. duncani)* [1, 2].

Babesiosis is transmitted through the bite of an infected *Ixodes* tick. Occasionally, babesiosis can be transmitted via blood transfusions from asymptomatic parasitemic donors. Over fifty transfusion-related cases have been reported in the US [3] with the number of reports increasing annually [4, 5]. This report describes a transfusion-acquired case of babesiosis caused by *B. microti* in a Los Angeles County resident.

CASE REPORT

A 58 year-old man with metastatic esophageal cancer was admitted to a Los Angeles County (LAC) hospital on February 12, 2007, with hematemesis and anemia secondary to erosion of an esophageal tumor. Additional medical history included a right bundle branch block and idiopathic sinus tachycardia. His admitting physical examination noted fatigue and hypotension with the absence of fever, chills, night sweats, joint pain or swelling, headaches, rashes and lesions. The admitting laboratory evaluation was notable for a hemoglobin of 8.4 mg/dl and 71,000 platelets; liver function tests were mildly elevated with Aspartate aminotransferase (AST) of 202 mg/dL, Alanine transaminase (ALT) of 33 mg/dL, and total direct bilirubin of 0.7 mg/dL. A routine peripheral blood smear from the second hospitalization day showed rare *Babesia* organisms, subsequently confirmed at the Los Angeles County Public Health Laboratory (LAC PHL). Both acute and convalescent serum specimens were negative by indirect fluorescent antibody (IFA) testing for *B. microti* at a commercial laboratory. However, repeat testing conducted at the Centers for Disease Control and Prevention (CDC), confirmed that the acute specimen was negative but the convalescent specimen was positive with a titer of 1:64. *B. microti* DNA was also detected from whole blood at the commercial laboratory by polymerase chain reaction (PCR) analysis (Table 1). The case was empirically treated with azithromycin and atovaquone for seven days and given a blood transfusion for his anemia. He recovered with treatment and was discharged on February 16, 2007.

Prior to the February 12th admission, the case had visited the hospital numerous times for blood transfusions and other necessary medical procedures related to his cancer. These procedures included: laser tumor ablation on December 18, 2006; laparoscopic jejunostomy on January 7, 2007; and hepatic radiation therapy for capsular tumor distention that concluded on February 2, 2007. The case received a total of 6 units of packed red blood cells (PRBC) and 2 units of fresh frozen plasma (FFP) on January 1, 2007 and January 22-24, 2007. The case restarted chemotherapy on February 7, 2007.

The case resided in LAC, California. His recent travel history included a visit to Salt Lake City, Utah, from January 13 through January 20, 2007; however, due to his poor health, he did not engage in any outdoor activities. At least a year prior to this admission, the case visited an undeveloped property near Klamath Falls, Oregon, where he had spent time outdoors. The case could not recall ever incurring a tick bite, seeing ticks, or having any animal contact.

TRACEBACK INVESTIGATION OF BLOOD DONORS

The case had received blood products from three blood banks (Blood Banks A, B, and C) on admissions prior to his diagnosis for babesiosis. Table 1 summarizes the serologic and PCR testing results for specimens collected from the case and RBC donors from Blood Banks A and B. A total of six units of PRBCs were received; two units on January 1 from Blood Bank A and four units from January 22-24, 2006 from Blood Bank B. Additional donors from Blood Bank C had donated only FFP. FFP donors were not tested for *Babesia* infection due to the low risk of transmission associated with plasma products. The four donors from Blood Bank B resided within LAC and submitted blood for IFA testing at the same commercial laboratory; all tested negative for IgG and IgM against *B. microti*. One of two blood donors from Maine had both a positive IFA for total antibodies against *B. microti*, *B. divergens*, and *B. duncani*, as well as a positive specific titer of 1:256 against *B. microti*; with titers against other babesia species being negative. The second PRBC donor from Maine tested negative for all species of *Babesia*.

Table1. Results of serologic testing and PCR analyses for specimens collected from the case patient and donors of packed red blood cells.

				Test Results			
				B. microti		*B. duncani* (WA1)	*B. divergens*
	Location	Date of Transfusion	Date of Specimen	PCR	IFA*	IFA*	IFA*
Case	CA		2/12/2007	Positive	≤1:8	≤1:8	-
	CA		2/20/2007	-	1:64	≤1:8	-
Donor1	Blood Bank A (ME)	1/1/2007	2/26/2007	-	1:256	≤1:8	≤1:8
Donor2	Blood Bank A (ME)	1/1/2007	2/26/2007	-	≤1:8	≤1:8	≤1:8
Donor3	Blood Bank B (CA)	1/22/2007	2/21/2007	-	≤1:8	≤1:8	-
Donor4	Blood Bank B (CA)	1/23/2007	2/22/2007	-	≤1:8	≤1:8	-
Donor5	Blood Bank B (CA)	1/24/2007	2/21/2007	-	≤1:8	≤1:8	-
Donor6	Blood Bank B (CA)	1/24/2007	2/21/2007	-	≤1:8	≤1:8	-

* ≤1:8 is a negative titer for total antibody conducted at the CDC Reference Diagnostic Laboratory.

INVESTIGATION OF THE IMPLICATED DONOR

The implicated donor was a 49 year-old male resident of Maine, a region in the U.S. that is endemic for *B. microti*. Prior to the implicated donation in December 2006, this blood donor had donated blood three times back to October 2005. It is likely he became infected with babesiosis in the summer of 2006, when he presented with fever, chills, weight loss, and fatigue in late August, and was tested for various agents, including Lyme disease, but not for babesiosis. The donor's health eventually improved without a specific diagnosis or treatment, but evidently he remained parasitemic for several months following his symptom onset. The donor frequented tick-infested areas and hiked in New Hampshire prior to becoming ill. He also had close contact with pet cats that often had ticks. No other recipient of the implicated donor's blood products were found to be infected per personal communication with the Maine State Health Department.

CONCLUSION

A case of babesiosis was documented in a man with metastatic cancer who was residing in an area not endemic for *B. microti*. He most likely acquired his infection from a transfusion of infected PRBCs from an endemic area thousands of miles away. This conclusion was based upon the corroboration of laboratory and epidemiologic information. One of the donors from which the case received PRBCs not only resided in an area endemic for *B. microti*, but also tested serologically positive for the species. The incubation period from the time of transfusion exposure until the positive smear, was approximately 6 weeks. Observed incubation periods for transfusion-related babesiosis cases have ranged from 1 to 9 weeks [3]. Alternatively, it had been hypothesized that the case may have acquired the infection during his travel to Oregon in the year prior and was asymptomatic until his immunocompromised condition due to cancer. Cases have been known to remain asymptomatic for months or even years, and the incubation period for this case certainly fits this profile [1,2]. However, transfusion was ultimately implicated as the mode of transmission, as the states to which he traveled, Utah and Oregon, have never documented human cases of babesiosis. Infections acquired in these states would most likely be caused by the western *Babesia* agents, the *B. duncani,* or the CA1 isolate type. Furthermore, the case spent no time outdoors in Utah.

Cases of babesiosis rarely occur, in California and the western US. When they do occur the cases often have a history significant for travel to endemic areas of the country. This has been particularly true for occurrences of babesiosis in LAC. The babesiosis case investigated is unique as he is one of the few cases of babesiosis acquired by transfusion in a nonendemic area after receiving a blood product from a donor living in an endemic area. Only one previous case report has been published similar to our investigated case [5]. Further, the case did not demonstrate any overt symptoms typical of babesiosis, nor did he produce antibodies against the disease for many weeks post-exposure to infected PRBC. His cancer and side effects from chemotherapy may have masked symptoms caused by babesiosis as well as undermining his immune system so that he was unable to mount a strong antibody response. This case demonstrates that even in transfused patients, who show no obvious signs of babesiosis, infection should be considered, particularly if they have received blood products from endemic areas. When babesiois is suspected, medical evaluation in both febrile and non-febrile patients should include a blood smear done as part of routine septic or anemic work-up, and serologic and PCR evaluation of whole blood.

Currently, babesiosis is not a part of the routine blood donor screening. Transfusion-associated babesiosis can be reduced by discouraging blood donors from endemic regions to donate blood (between May and September) with a history of fevers within the 2 months before intended donation, and not accepting those with a recent history of tick bites [6]. Screening of blood for *Babesia* may be adopted by blood donor agencies in the near future and may reduce transfusion-associated babesiosis. Given the increasing use of blood products from donors throughout the United States, the increasing prevalence of ticks, the parasite, and susceptible people, clinicians should be increasingly alert to the possibility of babesiosis.

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LOS ANGELES COUNTY DEPARTMENT OF PUBLIC HEALTH PARTICIPATION IN UNITED STATES POSTAL SERVICE BIOHAZARD DETECTION SYSTEM FULL-SCALE EXERCISES

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INTRODUCTION

In August and October of 2007, Los Angeles County (LAC) Department Public Health (DPH) participated in full-scale Biohazard Detection System (BDS) exercises at United States Postal Service (USPS) facilities in Los Angeles County. The Acute Communicable Disease Control Program (ACDC) Training Unit participated in the planning, coordinating, and training process for the exercises in collaboration with USPS, the United States Postal Inspection Services (USPIS), Los Angeles County and City Fire Departments, DPH's Office of Development and Organizational Training (OD&T), Emergency Preparedness and Response Program (EPRP) and Community Health Service (CHS) in LAC Service Planning Area (SPA) 3 and 6. Both exercises simulated the LAC DPH response to a positive BDS alarm, which is an early warning system that regularly analyzes air samples for the presence of anthrax spores in the mail [1]. Prior to these exercises, USPS facilities in LAC had conducted BDS exercises with DPH and other first responder agencies. The two exercises in 2007 provided LAC DPH the opportunity to exercise, test, and evaluate the readiness and preparedness of new elements, including the activation of the LAC DPH Department Operation Center (DOC), notification and deployment of public health staff to assume Incident Command System (ICS) roles and functions at the DOC, a simplified Point of Dispensing (POD) model, deployment of the mobile DPH Command Center, and real-time response after regular work hours.

PRE-EVENT EXERCISE PLANNING

Planning Meetings and Discussions

Several planning meetings among the ACDC Training Unit, EPRP, OD&T, CHS SPAs, EMS, USPS BDS Emergency Coordinators, USPIS, LAC and City Fire Departments took place prior to both full-scale exercises. The USPS retains primary authority for BDS program implementation and training of their employees; and LAC DPH's initial response includes Post-Exposure Prophylaxis (PEP) medication distribution to those employees identified as potentially having been exposed to anthrax and Laboratory Response Network (LRN) lab testing of the BDS sample cartridge. Pre-event planning also involves understanding the roles and responsibilities from all participating agencies involved to ensure optimal response action.

Two pre-event planning meetings were hosted by the USPS BDS Coordinators at both USPS facilities, which included representation from the other responding agencies. These meetings provided an opportunity to discuss and review logistics such as establishing the BDS notification process, entry to the facility and set-up area for Unified Command, pre-designated areas for fire department hazmat decontamination tents and dispensing of PEP; and clarification of issues or concerns from the responding partners prior to the actual exercise.

Pre-Positioning of POD Supplies

Pre-positioning of POD supplies required for DPH response was previously established and agreed upon with both USPS facilities in a secure room located near the PEP dispensing areas. The ACDC Training Unit ordered, inventoried, and organized the supplies to ensure adequate amounts were available. Supplies were labeled by POD station and was easily accessible for use during the exercise and real incident. Pre-positioning of supplies eliminated the additional task of gathering, storing and transporting supplies in a time of heightened emergency response, as well as decreasing the set-up time for response by SPA CHS staff for PEP dispensing. A complete list of supplies are maintained and updated by the ACDC Training Unit and was provided to the SPA for their reference in the event of an actual response. Supplies are replenished, updated or purchased as needed.

BDS POD Training Sessions

Approximately two weeks prior to the scheduled BDS full-scale exercises, the ACDC Training Unit, EPRP, and OD&T conducted training sessions for both SPA 3 and SPA 6 staff who had command or supervisory roles (i.e., Unit Leaders, Group Supervisors, Section Chiefs, and Command Staff) within the POD organizational structure. This was an opportunity to review information with SPA staff and answer questions and concerns regarding:

- DPH roles and responsibilities in a BDS incident
- BDS POD model
- POD organizational structure
- ICS and staffing roles in a BDS POD
- on-site (just-in-time) orientation for staff
- radio etiquette and communications
- Unified Command (SPA 6)

Upon completion of the training, each participant completed an evaluation to provide feedback of the training, which included their understanding of the POD model, staffing roles in the BDS POD, and demonstration on how to use orientations guides to conduct on-site orientation to staff.

Other Pre-event Activities

Other pre-event activities involved the development of the Master Scenario Events List (MSEL) for integration at the POD and DOC sites. The MSEL incorporated various artificial simulations and messages to inject throughout both exercises to stimulate questions, decision-making of command staff, public health recommendations, and response to the media, local hospitals and general public – all which may arise in a real event. These were the first BDS exercises coordinating with the DPH DOC and POD. Pre-event exercise evaluation tools were developed with pre-defined criteria for use by the evaluation teams at both the POD and DOC sites.

EXERCISE DESIGN

Two full-scale BDS exercises were held on August 21, 2007, from 9AM to 11AM and on October 30, 2007, from 4PM to 6PM. The scenario for both exercises involved a BDS alarm ringing at the USPS facility detecting possible anthrax and requiring response agencies to respond to the incident. For the exercises, POD participants from the SPAs were pre-deployed on-site at the USPS facilities prior to the alarm, and DPH DOC players were pre-designated.

The following components of the BDS response were tested:

- evacuation of USPS employees
- USPS employee decontamination
- DPH internal BDS alarm notification
- DPH DOC activation
- Unified Command at the incident site
- communication between the POD and the DPH DOC
- BDS sample cartridge collection and transport to the DPH Laboratory Response Network (LRN) for repeat Polymerase Chain Reaction (PCR) testing (August exercise only)
- delivery of BDS prophylaxis medication to the POD site
- DPH distribution of medication prophylaxis to USPS employees via a POD

EXERCISE GOALS AND OBJECTIVES

The exercise goals and objectives to be measured for both exercises were determined and agreed upon by the exercise evaluation team, EPRP, and SPA POD command staff, which included the following:

Goal 1: Test DPH Internal BDS Notification

Objective 1: Perform initial DPH internal BDS notification within 30 minutes of the DPH AOD (Administrative Officer of the Day) or the ACDC on duty physician being notified of BDS alarm by USPS

Objective 2: Test the efficiency of transition from BDS Notification to DPH Emergency Management structure/DOC ICS activation by addressing next action steps in the BDS notification protocol

Goal 2: Test POD Operations

Objective 1: Set up a functional POD utilizing the current POD model at the USPS site within one hour of accessing supplies at the facility

Objective 2: Dispense prophylactic medication with labeling to the USPS staff at a rate of 200 per hour

Objective 3: Utilize proper communication techniques to effectively relay messages among command and management POD staff utilizing 2-way radios (October exercise)

Objective 4: Set up Unified Command Post at the incident site with Fire and USPS (October exercise)

Goal 3: Activate DPH DOC

Objective 1: Set up and establish the DPH DOC

Objective 2: Designate ICS positions and have staff arrive to DOC within 30 minutes of notification

Objective 3: Understand functions/roles at the DPH DOC

Goal 4: Communications

Objective 1: Establish and maintain effective communication between the POD ICS and the DOC with regular reports

Objective 2: Test communications via CWIRS, 2-way radios, satellite, cell phone without power

A simplified, updated version of the LAC DPH POD model was tested for the first time at both exercises. Both exercises required the POD site logistics section to determine and maximize the space available for set-up to ensure efficient processing of clients through the five major POD areas.

1. *Queuing Area*: clients wait to receive the required medication screening forms
2. *Registration Area:* clients complete the required medication screening form, followed with review by a member of the registration team.
3. *Dispensing Area:* clients receive the default medication
4. *Evaluation Area:* clients with contraindications to the default medication or those with special medical needs are further evaluated by a clinical team
5. *Q & A Area:* clients can ask further question or obtain additional information regarding anthrax facts, stress, and other resources

Table 1 indicates the number of public health participants at both USPS BDS full-scale exercises.

Table 1. Number of Participants at the USPS BDS Full-Scale Exercise

Participants	August 21, 2007 (SPA 3)	October 30, 2007 (SPA 6)
POD Players	45	62
DOC Players	9	6
USPS Clients	118	102
Exercise Evaluators		
• POD site	8	8
• DPH DOC	3	2

EVALUATION

A set of predefined criteria were used for evaluation of the exercises. DPH staff with familiarity of BDS and ICS, were identified during the planning stage to serve as evaluators at both the POD and DOC site. They would provide documentation of quantitative and qualitative findings of the overall exercise. At the POD site, three team members were assigned to shadow clients (i.e., Post Office workers) through the POD process and note the length of time the client spent in the POD process. One team member was posted at each of the POD areas (Registration, Dispensing, Evaluation, and Q&A) and one at the Incident Command Post. Team members posted at the POD areas were asked to randomly note the length of time clients interacted with POD staff in their area. All team members were also asked to note any significant observations, provide a qualitative evaluation of their observations, and make any recommendations.

Following the exercises, evaluators participated in a hot wash (i.e., post-exercise debriefing) and provided feedback regarding their observations. Their findings and overall evaluations were reviewed and incorporated into the exercise After Action Reports by ACDC Training Unit, with input from OD&T, EPRP, SPA command staff, USPS and Fire Departments.

Table 2 indicates quantitaive data measured at the BDS full-scale exercises.

Table 2. Summary of Events at the USPS BDS Full-Scale Exercises

Measures	August 21, 2007 (SPA 3)	October 30, 2007 (SPA 6)
• Time from BDS alarm to ACDC activation of DPH Internal BDS Notification Protocol	27 min	4 min
• Time from BDS notification to DOC activation	25 min	11min
• Time from BDS alarm to PH LRN receipt of BDS sample cartridge	3 hours	Not tested
• Time to set-up POD	50 min	36 min
• Time to deliver medication from cache site to USPS sire (from time order was given)	52 min	3 hours
• Average POD dispensing rate (clients/hr)	236/hour	207/hour
• Average client time through POD	5:36 min	7:35 min

LESSONS LEARNED

Overall, the BDS full-scale exercises were an excellent learning experience and provided DPH staff and other partner agencies the opportunity to practice responding to a BDS incident. Challenges were experienced in the areas of communications and Unified Command. Areas for improvement have been identified in the continued process of preparing to respond to a BDS incident.

Major Recommendations

- Continue trainings and drills on the PH DOC, ICS structure, chain of command, and POD just-in-time orientation
- Incorporate the PH Emergency Desk to receive initial notification from the USPS of a BDS alarm
- Continue trainings on Unified Command for POD command staff
- Continue communication with the Fire Department to pre-establish set up areas for the Incident Command Post and incorporation of Unified Command
- Provide back-up radios for POD staff
- Develop press releases and key public messages to bring to the PH DOC which are preapproved
- Improve POD area set-up and signage to maximize efficiency of client throughput
- Continue update of LAC BDS Incidence Response Plan to include FAQ and procedures for decontamination, PPE, and prophylaxis

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HEALTH ALERT NETWORK AND TULAREMIA SURVEY SUMMARY

Bessie Hwang, MD, MPH

BACKGROUND

Increasing the utility of the Health Alert Network (HAN) notification process and how HAN information is distributed is vital for effective alerting systems. HAN rapidly disseminates public health advisories and alerts to healthcare providers using email and fax notifications. The hospital Infection Control Professionals (ICPs) have been identified by Acute Communicable Disease Control (ACDC) as a key group for receiving HAN alerts. The ICP contact list used for HAN alerts is maintained by the Hospital Outreach Unit (HOU), therefore, a survey was conducted by the liaison public health nurses to determine whether the HAN alerts are received by the ICPs and how the information is disseminated once received.

METHODS

Following a positive result for *Francisella tularemis* in an environmental monitor, a HAN alert providing information about tularemia was sent to ICPs, emergency departments, and laboratories two weeks following the HAN alert. A brief follow-up survey was emailed to the ICPs with the following questions;

- Do you receive HAN alerts?
- Did you receive the tularemia HAN alert?
- What actions did you take with the tularemia HAN alert?

RESULTS

Results showed 102 hospitals/ICPs were surveyed with 90 (88%) responding. For hospitals with more than one ICP, only the response of the primary ICP was included. For ICPs representing more than one hospital, the ICP's response was used for each hospital. Of these, 79 (88%) ICPs were receiving HAN alerts and 73 (81%) received the tularemia HAN alert (Table 1). Fifteen hospitals responded with "no action". Most ICPs distributed the HAN alert information including notifying the emergency department, infectious disease physician, nursing staff, urgent care, and laboratory (Table 2). Only a few did not distribute the HAN information further. The reasons given for not receiving the HAN alerts include new ICP, or no ICP at this time.

Table 1. Tularemia HAN Survey Summary Time Frame

Total number of hospitals in Los Angeles County	104
Number of hospitals contacted	102 (98%)
Number of hospitals/Primary ICP who responded	90 (88%)
Number of hospitals/Primary ICP who did not respond	12 (12%)
Number of Hospitals/Primary ICP receiving HAN alerts	79 (88%)
Number of Hospitals/Primary ICP who received Tularemia HAN alert	73 (81%)
Total number of Hospitals/Primary ICP who receive HAN alerts but did not receive Tularemia Alert	6 (8%)

Table 2. ICP Response to Tularemia Alert	
Action	**Number of Responses**
Notified Emergency Department	33
Notified Physicians	19
Notified Infectious Disease Physician	15
Notification of Laboratory	11
Put on Infection Control Committee agenda	11
Physician/Staff Lounge posting of HAN	5
Notified Pharmacy	3
Notified Nursing Staff	2
Notified Safety Officer	1
Notified Employee Health	1
Notified Urgent Care	1
No action	15

CONCLUSION

Effective and timely dissemination of health information to the medical community is vital. Infectious disease outbreaks, emerging diseases, and potential bioterrorism events require an effective mechanism to disseminate important medical information. This survey confirmed that the majority of ICPs (88%) received HAN alerts effectively through email dissemination. Also, HAN alert information was distributed by the ICP to the hospital staff. HOUs were able to update the ICP database for future HAN alert distribution. Other helpful feedback included the addition of a suggested hospital staff distribution. For example, “Please distribute to the physicians, emergency department, and laboratory”. Similar surveys should be conducted for the laboratories and physicians to ensure timely and effective public health communication to the medical community.

ACKNOWLEDGEMENT

Thank you to the Hospital Outreach Unit for maintaining the database and for conducting this survey.

CYSTICERCOSIS TRENDS IN LOS ANGELES COUNTY, 1988 TO 2007

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ABSTRACT

Thirty-two percent of cysticercosis mortality, reported nationally (1990-2002, N=221), occurs in Los Angeles County (LAC). A review of recently reported and trends of LAC cases, total hospitalizations and mortality was performed.

Demographics and symptoms of reported cases (2003-2007) were reviewed. Cysticercosis incidence trends for reported cases (1988-2007), hospitalized cases (1991-2005), and mortality (1988-2004) were calculated.

Recently reported cases (2003-07) are primarily young (mean age 35 years), Latinos (87%), with symptoms that include seizures (46%), headaches (70%) and eye disorders (28%). The reported case incidence rate has decreased (-3.4% per year on average, R^2=0.8) since 1988, as well did total hospitalizations (-4.9% per year, R^2=0.7) and mortality (-0.4%, R^2=0.4).

Cysticercosis mainly affects young adult Latino/as in LAC Trends in the incidence of reported cases, total hospitalizations, and mortality, may indicate a decrease in cysticercosis morbidity in LAC in recent years.

BACKGROUND

Cysticercosis is a parasitic infection caused by the larval form of the tapeworm *Taenia solium* found worldwide. According to the World Health Organization (WHO), cysticercosis of the central nervous system (neurocysticercosis) is the most important neurological disease of parasitic origin in humans, causing serious morbidity in areas where it is endemic (Latin America, China, India, and sub-Saharan Africa) [1]. The WHO estimates there are 2.5 million people worldwide harboring the *T. solium* tapeworm, and many more infected with the larval stage of the disease (cysticercosis). The parasitic life cycle requires both pigs and humans, but a history of pork consumption is not necessary to acquire cysticercosis infection, as exemplified by four cases reported among an Orthodox Jewish community in New York [2].

Cysticercosis is acquired through exposure to water, foods, or surfaces contaminated with feces from a human tapeworm carrier. In many cases the tapeworm carrier is asymptomatic and generally acquires the tapeworm by consumption of undercooked pork from an infected pig. Cysticercosis may occur as a result of tapeworm carrier autoinfection [3]. Once the infective eggs (embryophores) are ingested, they mature into larva in the intestines and later migrate to any part of the body, but those migrating to the cerebellum have the most pronounced symptoms. Neurocysticercosis can result in hydrocephalus, seizures, and death.

In the US there were 221 deaths due to cysticercosis from 1990-2002 [4]. Mortality was highest for Latinos (85%) and men (ARR=1.8), with the mean age at death of 40 years. Most fatalities were foreign-born (85%) with many born in Mexico (62%); but US born persons were also affected (15%). Contributing factors to cysticercosis deaths included hydrocephalus (26%), cerebral edema (10%), cerebral compression (7%), and seizures (5%). LAC accounts for approximately 32% (n=70) of the deaths reported nationally.

California is one of four states in the US that require reporting for cysticercosis. The LAC Department of Public Health (DPH) initiated an intervention program in 1988 to screen close contacts of reported cases to identify and treat carriers [5]. A review of this program from 1988 to 1991 (n=138) revealed a mostly Hispanic population (91%) with an equivalent gender ratio (F:M=1:1) and a mean age of 28 years. The mortality rate was found to be 6%. Carriers were identified in 7% of cases (n=6) who had household contacts tested (N=72). This intervention program in LAC is ongoing.

To characterize more recent cysticercosis cases in LAC and to assess the burden of disease, a review of reported cases, hospitalizations, and mortality due to cysticercosis was performed for all years where data

was available. In addition, the question of why mortality appears higher for males than females even though the reported cases reveal equivalent gender ratio will be addressed.

METHODS

To assess the demographics, symptoms, clinical findings, and outcomes of recently reported cysticercosis cases in LAC, a review of cases reported in the last five years was performed (2003-2007). Epidemiological case history forms completed by public health nurses during case interviews were reviewed. The form was designed to capture major symptoms categories, clinical findings, birth place history and year of migration. Reported cases in LAC were defined as having symptoms consistent with a cysticercosis infection along with identification of cystic lesions present in the cerebellum by computed tomography (CT), by magnetic resonance imaging (MRI), or by identification of larval migration elsewhere in the body.

Trends in cysticercosis morbidity in LAC were reviewed by calculating crude incidence rates for reported cases (1988-2007), hospitalized cases (1991-2006), and mortality (1983-2004). Population numbers for LAC were obtained from the California Department of Finance web site and national population numbers were obtained from the US census web site. A cysticercosis death was defined as a death reported on a death certificate listing cysticercosis as the primary or contributing cause of death (ICD9 code 123.1 or ICD10 codes B69- B69.9). Hospitalized cysticercosis patients were defined as persons discharged from the hospital with a primary diagnosis of cysticercosis (ICD9 code 123.1). The Office of State Wide Health Planning and Development (OSHPD) data set was used. Estimates for repeat visits were calculated by matching persons by date of birth and gender for years where identifiers were available (2002-2005).

RESULTS – Reported Cases

There were 65 cases of cysticercosis reported to LAC DPH in the last five years (2003-2007). Epidemiologic case history forms were completed for 61 of these cases (94%), and there were four cases that were lost to follow-up. Recently reported cysticercosis cases (2003-2007) are primarily Latino (87%), slightly more likely to be male than female (F:M 1:1.3), and between the ages of 20-39 years (53%); mean age 35 years (Table 1). Most cases report having a birth place outside of the United States (79%); Mexico (62%), El Salvador (7%), Honduras (4%), and India (4%). The average length of time a case reported living in the US before being diagnosed was 14 years (median =10 years, range 0-44 years).

Table 1. Demographics of Reported Cysticercosis Cases
Los Angeles County, 2003-2007 (N=61)

Demographic	n	%
Race/ Ethnicity		
Latino	53	87
Caucasian	4	7
Asian Indian	2	3
African American	2	3
Gender		
Male	34	56
Female	27	44
Age Group		
0-19	9	15
20-39	33	54
40-59	13	21
60+	6	10
Mean Age: 35 yrs (range 1-86 yrs)		
Born outside the U.S*	48	79
Born in Mexico	35	57
Time living in the US		
Mean = 14 years		
Median = 10 years		

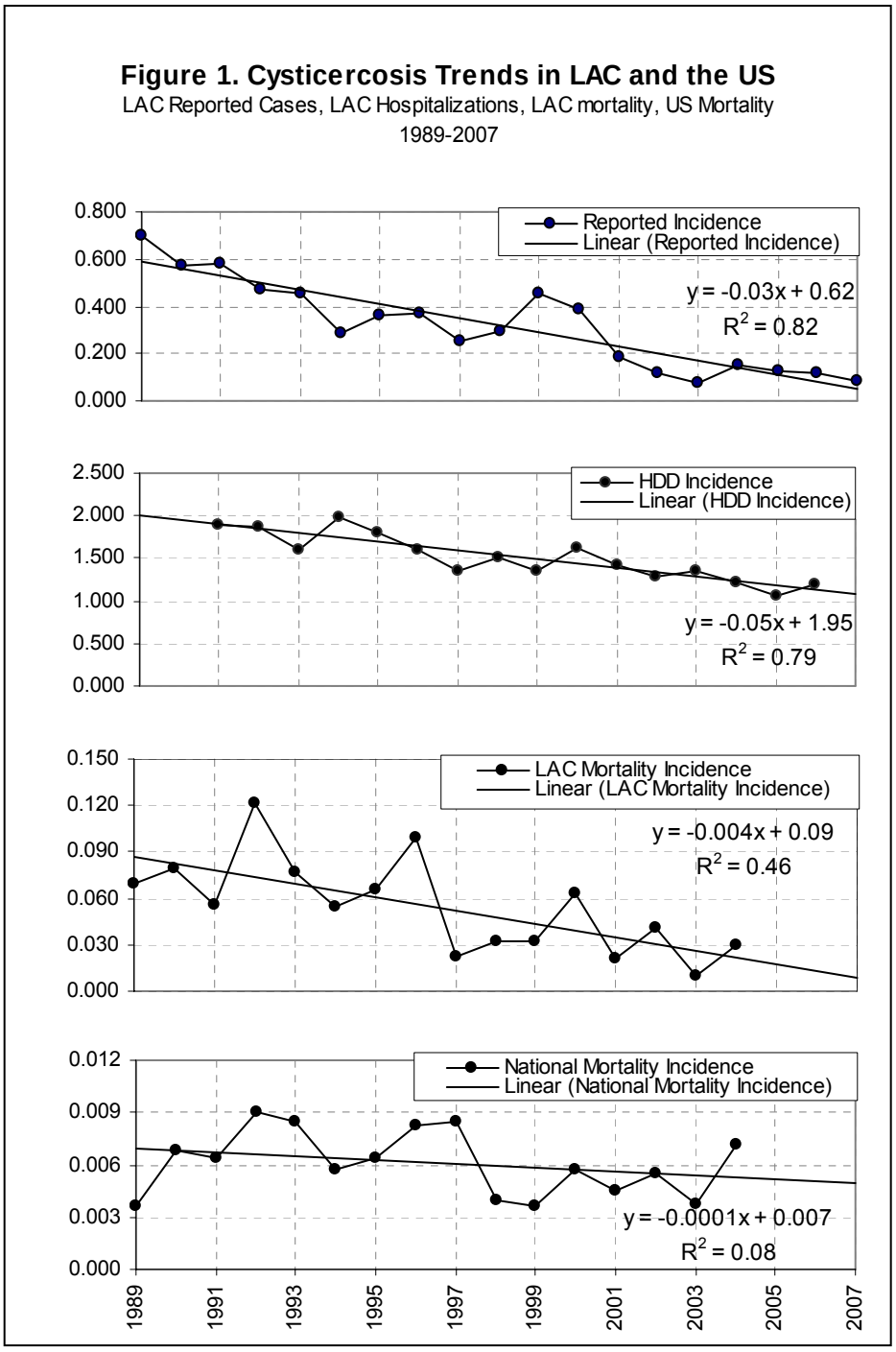
Note: Information available for 60 cases

Common symptoms reported among cases included headaches (70%) and seizures (46%), and many complained of eye disorders (28%) (Table 2). Cases who experienced seizures had a younger mean age than those who did not (28 versus 41 years, $p<0.01$). Clinical findings included hydrocephalus (15%) and stroke (7%). Cases who had hydrocephalus had a slightly older mean age than those who did not (40 versus 34 years, $p>0.05$) and were more likely to be male than female (F:M 2:7, $p>0.05$). Most cases were hospitalized (83%) and there were four deaths reported (7%). The mean age of deaths was 45 years and ranged from 21 to 75 years.

Reported cysticercosis cases in LAC have decreased steadily since they were first made reportable; with a total of 676 cases reported from 1988 to 2007 (Figure 1). Crude annual case incidence decreased on average by 3.4% per year (R=0.8) during the study period. The highest incidence rate was reported in 1988 (0.9 per 100,000, N=75) and the lowest incidence rate was reported in 2003 (0.1 per 100,000, N=8). The average annual crude incidence was 0.3 per 100,000.

Table 2. Symptoms, Clinical Findings and Outcomes of Reported Cases
Los Angeles County, 2003-07, (N=61)

	n	%
Symptoms		
Headaches	43	70
Seizures	28	46
Eye disorder	17	28
Light headed or dizziness	4	7
Vomiting	4	7
Body numbness	2	3
Clinical Findings		
Hydrocephalus	9	15
Stroke	4	7
Dementia	4	7
Subcutaneous lesion	2	3
Cranial nerve palsy	1	2
Bone lesion	1	2
Meningitis	1	2
Outcome		
Hospitalized	55	83
Death	4	7



RESULTS – Hospitalizations

There were 2,158 cysticercosis hospitalizations that occurred between 1991-2005. The largest number of hospitalizations occurred in 1994 (n=181) and the smallest number occurring in 2005 (n=108). There was an average of 144 hospitalizations per year. The average crude annual incidence of hospitalizations decreased by 3.7% per year (R^2=0.7) (Figure 1). The number of first-time hospitalizations for cysticercosis could only be determined from data sets where identifiers were provided (2003-2005). Of the 401 hospitalizations that occurred from 2003-2005 in LAC, 17% (n=67) were repeat visits.

Demographics of first-time hospitalized cases (n=334) were very similar to reported cases (Latino 89%, mean age 37 years, gender F:M = 1:1). Most of these persons sought medical attention

through the emergency room (76%), and most were admitted to acute care (99%). The average length of hospital stay was 5.2 days (0-52 days); comparable to the average length of a hospital stay in the US 4.8 days, 2003 est.). Most were discharged home (89%) and the average cost of their hospital stay was $32,000 (range: 0-$826K). Most patients had seizures listed as additional diagnoses (46%), followed by hydrocephalus (17%). For the same time period there were 38 cases reported to LAC DPH. A conservative estimate would suggest that only 9% of hospitalized cases (38/334) are reported to LAC DPH. A more exact reporting rate would require matching hospitalized cases with reported cases, which cannot be done with OSHPD data for confidentiality reasons.

RESULTS – Mortality

There were 51 cysticercosis deaths from 1993-2004 in LAC (Figure 1). The average annual mortality was 0.05 per 100,000 with deaths over time decreasing by 0.4% per year (R^2=0.4). As with reported cases, a majority of deaths from cysticercosis occurred among Latinos (86%). Mean age of deaths were slightly older than reported cases (41 versus 35 years) and were more likely to be male (gender F:M= 1:1.7). Only 68% of deaths recorded on death certificates in LAC were reported to the health department. All female deaths were reported to the health department, where as only 48% of males were reported.

There were 333 cysticercosis deaths reported nationally from 1993-2004 (Figure 1). LAC represented 40% of these deaths reported in the 1st half of the years reviewed (1983-1993), but only 25% of deaths reported in the 2nd half (1994-2004) (P<0.01). Mortality for the US appears without an obvious upward or downward temporal trend.

DISCUSSION

Morbidity from reported cases of cysticercosis is severe, with seizures occurring in nearly half of the recently reported cases in LAC (2002-2007) and most cases requiring hospitalization. As found in the earlier study of LAC cases [5] (1988-1991), recently reported cases are mainly Latinos (87% versus 91%). The mean age of recently reported cases was slightly older then that reported in the previous study (33.0 versus 27.4 years), which may indicate that cases are not diagnosed until later in their disease process. Mortality found in our review was comparable to what was found in the earlier study (6.8% versus 5.8%).

The symptoms and clinical findings among recently reported cases in LAC differed slightly from what was found in a review of neurocysticercosis cases admitted to a hospital in Houston, Texas [6] and what was found in a review of cysticercosis mortality in the US [4]. The proportion of cases with hydrocephalus found in this review (15%) was lower than that found in their hospital study (29%) and their mortality study (26%). The proportion of seizures found in our review (47%) was also lower than that found in their hospital study (75%), but much higher than found in their review of mortality (5%). Our review found more complaints of headaches than did the Houston review (70% versus 15%) and comparable rates of confusion or dementia (7% versus 7%).

As with the previous study in LAC [5], most cases were US immigrants (79% versus 84%), with most listing Mexico as their birth place (57% versus 60%). Our review found that foreign born cases report living in the US for a longer period of time before becoming reported than the Houston review [6] (14 versus five years). Both reviews would seem to suggest either a prolonged period of time from exposure to disease manifestation or possible continued contact with infected family, friends, or foods from their birth place.

Trends in reported cases and hospitalized cases may indicate a decreasing morbidity from the disease in LAC. However, the downward trend in mortality was less impressive; indicating that some of the decrease in reported cases may be due, in part, to an increase of clinicians failing to report. However, LAC represents a smaller proportion of the nationally reported deaths over time.

CONCLUSION

Trends in the incidence of reported cases, total hospitalizations, and mortality, may indicate a decrease in cysticercosis morbidity in LAC in recent years. This may be the result of LAC's public health intervention program, as well as public health efforts in Latin America from which many of the cases immigrate. However, this trend could also indicate an increasing failure to recognize the disease and/or failure to report

the disease to the health department. Much effort was placed on identifying and reporting cases by the health department in the late 1980's, but less effort has been put into the project in more recent years.

Cysticercosis continues to be a problem in LAC, with many cases that are unreported. Increased reporting from hospitals and clinicians will allow for public health follow-up of cases, identification, and treatment of tapeworm carriers, prevention of additional cases, and reduction of the burden of disease in LAC. Perhaps a public health reminder via a newsletter encouraging neurologist working with Latino or immigrant populations to report diagnosed cases would be beneficial.

LIMITATIONS

Any conclusions, based on the reporting of cases to the health department or on death certificates, are limited by reporting practices of practitioners. Any conclusions based on hospital discharge data may be limited by billing incentives which may over-estimate the actual burden of the disease. The incidence of the total number of hospitalizations listed in this review over-estimates the incidence of new hospitalized cases because of repeat visits; but assuming that repeat visits are constant overtime, the trend for first time hospitalized cases should be similar. Symptoms and clinical information were reported on epidemiological case history forms with single check boxes. Estimates based on single check boxes may be downwardly biased as an unchecked box is understood to be a "No" response when it may actually be an unknown response.

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OUTPATIENT MEDICAL PROCEDURES AND PATIENT SAFETY: WHO'S MINDING THE STORE?

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ABSTRACT

Healthcare-associated infections (HAIs) and patient safety concerns continue to generate news reports and editorials. Acute care hospitals are routinely scrutinized by professional and/or accrediting organizations (e.g., the Joint Commission, Accreditation Association for Ambulatory Health Care); and are closely regulated by state and federal laws. These measures were enacted to provide consistent standards of care within healthcare facilities and ultimately result in greater protections for the patient. However, private medical offices are not held to the same rigorous standards, and medical services, including minor invasive procedures, are not routinely regulated by the government or a private entity unless specifically requested by the provider.

Increasingly, procedures that were once considered in the domain of the hospital operating room are now routinely performed in outpatient settings such as, ambulatory clinic, medical office, or procedure center. Improper cleaning and disinfection of reusable medical devices (RMDs), such as flexible endoscopes, are essential to the HAI discussion. Manufacturer's instructions on cleaning and disinfection of RMDs, as well as instructions for the disinfection solution, are frequently complicated with multiple steps that must be rigorously adhered to before proceeding to the next step.

This report describes an outbreak investigation of multiple bacterial organisms among patients who underwent cystoscopy in a hospital-associated medical office, the measures taken to enhance patient safety and collaborations between the health department and professional urology organizations to caution private providers on the importance of proper cleaning and disinfection of medical equipment to prevent HAIs.

BACKGROUND

On June 19, 2007, Los Angeles County Department of Public Health (LACDPH) Acute Communicable Disease Control (ACDC) program was notified of four patients who developed urinary tract infections within 48 hours of a cystoscopy procedure performed in a hospital-associated medical office (MO). Three patients had cystoscopy during a one week period in May 2007 and one had cystoscopy in April 2007. Two patients were hospitalized and there were no deaths.

Upon identification of the cluster of infections, the physicians at the MO voluntarily discontinued cystoscopy procedures and consulted with an infectious disease physician and the infection control professional (ICP) from the nearby associated hospital to assist with the investigation. The consultants interviewed MO staff and observed cystoscope cleaning, disinfecting, and storage practices. In June 2007, the MO reopened after multiple control measures recommended by the infection control consultants were implemented.

METHODS

Setting

The setting was a busy, hospital-associated MO general urology practice in Los Angeles County.

Case Characterization

A case patient was defined as a patient who underwent cystoscopy from April 1 through May 25, 2007 and subsequently developed clinical or microbiologic evidence of a urinary tract infection within 48 hours of the procedure.

Patient Cultures

Urine cultures were obtained on all case patients. Four case patients also had blood cultures performed.

Environmental Cultures

Fourteen environmental cultures were obtained by the consultants. Sites sampled included the handwashing or utility sink, three plastic bins used to soak the cystoscope, cotton balls, forceps, two tubes of cleaning fluid, sterile water, lubricant from a multi-use tube, lidocaine gel from a multi-use tube, glutaraldehyde, enzymatic cleaner, and sterile saline that was flushed through the cystoscope and sent for culture.

Molecular Analysis

Pulsed-field gel electrophoresis (PFGE) was performed on environmental and available clinical *Pseudomonas aeruginosa* (*P*. *aeruginosa*) and *Enterobacter cloacae* (*E. cloacae*) isolates.

Medical Record Review

On August 23, 2007, ACDC staff queried records of the 117 patients who had cystoscopy performed during the period April 1- May 25, 2007.

Cystoscope Cleaning and Disinfection

Cystoscopy procedures were performed using a STORZ® Karl Storz Endoscopy flexible cystoscope with vent port. Cystoscope cleaning and disinfection were performed by two long-term employees in the same room where cystoscopy procedures were performed.

State and Federal Consultation

ACDC consulted with the California Department of Public Health (CDPH) and the Centers for Disease Control's (CDC) Division of Healthcare Quality Promotion (DHQP) to discuss the findings of this investigation and to consider the risk of bloodborne pathogen transmission.

Outcomes

ACDC collaborated with the local and regional urological society to remind the members of the importance of proper cystoscope cleaning and disinfection. The associated acute care hospital hired a nurse to track and review current cleaning and disinfection practices at multiple hospital associated MO practices and clinics.

Infection Control Measures

Control recommendations were provided and implemented prior to the July 2007 ACDC site visit. Multiple findings were addressed, including performance of instrument cleaning and disinfection steps, in the wrong order; storing instruments in Metrocide (glutaraldehyde); failure to monitor the concentration of the disinfection solution; failure to maintain disinfectant solution containers, storing containers unlabeled and without lids; presence of one small sink for instrument cleaning and handwashing, whose faucet had an aerator attached; lack of documentation logs or timer.

Literature Review

Numerous articles were reviewed on flexible endoscopes in general, gastrointestinal endoscopy, endoscope cleaning and disinfection, outbreaks in which endoscopes played a role, and potential transmission of bacteria (*P. aeruginosa*) and viruses (human immunodeficiency virus [HIV], hepatitis B, hepatitis C) after cystoscopy.

RESULTS

Case Characterization

Three case patients were initially identified by the MO. One case had cystoscopy performed on May 17, 2007 and developed UTI symptoms two days later. The other two cases had cystoscopy performed on May 23, 2007 and also developed UTI symptoms two days later. Two of the three cases were hospitalized; one was hospitalized with pyelonephritis while the second hospitalized patient was diagnosed with urosepsis. Active case finding during the medical record review identified two additional cases. Also, ACDC determined that one additional patient met the case definition criteria, for a total of six cases. This patient had a cystoscopy on April 19, 2007 but was not considered a case by the consultants due to his history of pre-existing chronic prostatitis. The urine culture grew *Klebsiella oxytoca* (*K. oxytoca*) and *E. cloacae*, and the consultants considered the chronic prostatitis as the source of his subsequent infection.

Patient Cultures

Four case patients had urine cultures that were positive for Gram-negative organisms, including *E. cloacae*, *P. aeruginosa* and *K. oxytoca.* One case patient also grew *K. oxytoca* on blood culture. Prophylactic post-procedure fluoroquinolones were prescribed for five of the six cases.

Environmental Cultures

Five environmental cultures obtained from a plastic bin used to soak the cystoscope in glutaraldehyde, the sink, a plastic bin used to rinse the cystoscope with sterile water, a cotton ball, and forceps grew *P. aeruginosa*. Other organisms isolated from environmental cultures included non-fermenting Gram-negative rods (NFGNR), *E. cloacae*, and Gram-positive rods.

Molecular Analysis

The *P. aeruginosa* case isolate (case 1) and four of the five *P. aeruginosa* environmental isolates were indistinguishable by PFGE and were designated strain A (Table 1). The fifth *P. aeruginosa* environmental isolate, obtained from the sink, differed from the other isolates by seven or more bands and was considered unrelated. PFGE was also conducted on two *E. cloacae* isolates obtained from the germicide forceps and one *E. cloacae* isolate from a second case (case 2). Isolates obtained from the germicide forceps differed from one another by just two bands, and were designated strain A1 and A2, considered closely related. The case two isolate differed by seven or more bands from the two germicide isolates, were designated strain B and considered unrelated.

Site Visit

ACDC conducted a site visit in July 2007 and met with medical, nursing, and administrative staff. The consultants who had assisted with the investigation also attended. The objectives of the meeting were to review the information gathered thus far by the consultants, review past and current cystoscope cleaning and disinfection practices, and to provide further recommendations. A walk-through of the cystoscopy suite was conducted and a step-by-step cystoscope cleaning and disinfection demonstration was provided by the MO staff, who revealed that these practices had been occurring for at least 17 years. ACDC subsequently identified additional procedures detailed in the manufacturer's guidelines that were not being followed. These included:

- failure to rinse the cystoscope in distilled water to remove gross debris
- failure to use a short brush to clean the ports
- failure to rinse the cystoscope in distilled water after cleaning with enzymatic solution
- failure to check the pH after mixing the glutaraldehyde solution with activator or periodically during the 14-day period of use
- failure to use fresh sterile water to rinse the cystoscope after the glutaraldehyde soak

- failure to hang the cystoscope to dry so that moisture does not collect on or near it

ACDC provided recommendations which included detailed instructions on cleaning, disinfection, and documentation.

Cystoscope Cleaning and Disinfection

The consultants identified several areas where manufacturer or CDPH guidelines on the reprocessing of cystoscopes were not being followed. These inconsistencies included soaking the cystoscope in glutaraldehyde solution for only 15 minutes, followed by rinsing in enzymatic cleaner, while the manufacturer recommended cleaning first with enzymatic cleaner followed by soaking in the glutaraldehyde solution for 45 minutes. Other inconsistent practices included cleaning and disinfecting the cystoscope in the same room as the cystoscopy procedures, and not using a brush to initially clean the scope prior to disinfection.

Infection Control Review/Investigation of Re-usable Medical Device

The consultants developed a new policy and procedure for cystoscope cleaning and disinfection that took into account the several lapses noted. The technicians also were instructed in proper cleaning and disinfection practices by staff from another urology practice associated with the MO. The manufacturer of the cystoscope inspected the scope for defects.

Medical Record Review

As previously noted, two additional patients were identified that had cystoscopy performed in April 2007 and had post-procedure urine cultures that grew *E. cloacae*. These infections may have been attributable to inappropriate cleaning and disinfection of the cystoscope.

Literature Review

ACDC was unable to find published evidence of an increased risk of bloodborne pathogen transmission from inadequately processed cystoscopes, although bacterial outbreaks after urological procedures have been described many times.

State and Federal Consultations

Discussion with CDC DHQP and CDPH concluded that the risk of bloodborne pathogen transmission in this setting is very low, yet it is not nonexistent. No additional follow-up was recommended.

Outcomes

ACDC provided the local urology association a letter detailing cystoscope cleaning and disinfection practices and a step-by-step fact sheet to the urology association members, and also distributed during the annual conference of the regional urology association in October 2007.
A full-time nursing position was created by the associated hospital to track RMD cleaning and disinfection practices.

DISCUSSION

This report describes an outbreak of UTIs caused by multiple bacterial organisms in patients who underwent cystoscopy in an outpatient urology MO over a two week period. Cystoscopy is a procedure used to visualize the urinary tract for a variety of reasons (e.g., frequent urinary tract infections, incontinence and urinary blockage). A rigid or flexible endoscope may be used. The entire procedure takes 10-20 minutes and is performed using local anesthesia (flexible scope) or general anesthesia (rigid endoscope).

The urine culture of case patients grew *K. oxytoca*, *E. cloacae* and *P. aeruginosa*. Environmental cultures obtained from various surfaces, equipment or medications were positive for NFGNR, *P. aeruginosa*, *E. cloacae* and gram positive rods. The strain of *P. aeruginosa* isolated from one case was indistinguishable from environmental isolates, indicating that there was widespread bacterial contamination in the cystoscopy suite that was likely associated with the patients' infections.

While the cystoscope was never established as the source of the infections, our investigation concluded that the improper cystoscope cleaning and disinfection practices contributed to the outbreak. Although national guidelines for endoscopy reprocessing have been published, there have been outbreaks of bacterial UTIs attributed to improperly disinfected cystoscopes [1, 2].

The outbreak investigation resulted in multiple changes to the MO cystoscope cleaning practices, including the development of a new policy and procedure for cystoscope cleaning and disinfection, removing the cleaning and disinfection process to a room separate from the procedure room, and the use of brushes to clean the cystoscope. In addition, the cystoscopy cleaning technicians were instructed in the appropriate cleaning and disinfection practices and the manufacturer of the cystoscope inspected the scope for defects.

Several factors contributed to the management and successful conclusion to this outbreak, including the physician's astute and early identification of a problem, the willingness to seek consultant expertise, and the cooperation extended to public health department staff.

Infections acquired in the health care setting reflect universal patient safety concerns. Staff lack of knowledge and compliance with infection control policies; inadequate cleaning and disinfection of RMDs and insufficient regulatory oversight within the outpatient setting are factors that may contribute to the increase in HAIs.

Many invasive medical and surgical procedures, originally performed in the hospital arena, have now moved to the outpatient setting, a dramatic shift over the past 20 years. Lower costs as well as new techniques, equipment and medications are reasons cited in the literature for the change in setting [3, 4].

Improper disinfection and sterilization, complicated manufacturers' or disinfection solution guidelines, confusing and sometimes conflicting professional association cleaning standards, inadequate equipment maintenance and lack of staff knowledge are frequently cited as causes of infection or outbreaks after RMD use during a medical or surgical procedure [5, 6, 7, 8]. As noted by Rutala and Weber, "Multiple studies have documented lack of compliance with established guidelines for disinfection and sterilization" [9].

Public attention and media pressure over HAIs, medical errors and patient safety concerns have galvanized lawmakers to pass legislation to address these topics. California is one of a handful of states that passed laws to regulate office-based surgery [10]. However, the same regulatory standards and mandates do not apply to the private medical office setting. A handful of professional and quasi-regulatory agencies, such as Joint Commission and the Accreditation Association for Ambulatory Health Care, address patient safety concerns in medical office practices, but their scope is limited, the service is voluntary, and the provider must request the service.

Patient safety concerns surrounding HAIs have increased with public awareness, and the health care system has initiated efforts to address safety issues that occur in the acute care setting [11]. However, the outpatient office setting has not been systematically addressed, most likely due to the complexity of problems when working with private providers, regulatory agencies and professional organizations. The lack of third-party regulation and limited oversight of these services needs further exploration before universal standards that address outpatient medical procedures can be developed.

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SURVEY OF COMMUNITY HEALTH SERVICES' INTERACTIONS WITH SKILLED NURSING FACILITIES IN LOS ANGELES COUNTY

Lauren Burwell, MD and Laura MacColl, MPH

BACKGROUND

The number of Communicable Disease (CD) outbreaks reported by skilled nursing facilities (SNFs) has been increasing over the past five years. In 2005, SNFs reported 76 outbreaks, while in 2006, SNFs reported 173 outbreaks. Most of these reported outbreaks were due to gastroenteritis or scabies. In 2007, the Los Angeles County Department of Public Health (LAC DPH) Acute Communicable Disease Control Program (ACDC) assigned two staff members to work directly with the SNFs in LAC and Community Health Services (CHS) staff in order to address acute communicable disease issues in these facilities. ACDC administered a survey to identify training needs of CHS staff and to facilitate their work with outbreak investigations in SNFs.

METHODS

ACDC prepared a 12-question survey and distributed it using Zoomerang™; an online survey software. Questions assessed respondents' interests in specific training areas. Respondents were asked to describe their interactions with SNFs during outbreak investigations, estimate the frequency of their interactions with the SNFs in their respective districts, report ways that ACDC could improve the CD Outbreak Investigation-Healthcare Facility form (H-1164), and identify the issues that ACDC could address. Respondents were also asked to report their job title and the Service Planning Area (SPA) in which they work.

In September 2007, the Public Health Nursing Director sent an email with a link to the web-based survey to CHS Nurse Managers (NMs) and Public Health Nurse Supervisors (PHNS'). PHNS' were asked to forward the email and link to the Public Health Nurses (PHNs) that they supervise. In October 2007, the Acting Director of CHS sent the same email with the link to the web-based survey to Area Health Officers (AHOs) and Area Medical Directors (AMDs). In mid-October, an additional email was sent to NMs and PHNS' reminding them to complete the survey. The survey was closed on October 31, 2007.

Responses were exported from Zoomerang into Microsoft Excel and analyzed using SAS version 9.1. Several responses were measured on a 5-point Likert scale (1: strongly uninterested or strongly disagree; 5: strongly interested or strongly agree). Descriptive analysis of the Likert items included calculation of the frequency and the mean of responses. Likert responses were dichotomized. Responses ≥ 4 were categorized as interested or agreed, and those ≤ 3 were categorized as not interested or disagreed. Bivariate analysis was performed using Fisher's exact test for categorical variables. Reported p-values are 2-tailed.

RESULTS

Demographics

Approximately 223 persons were contacted by email to complete the survey. Of these, 101 (45%) responded. The majority of respondents were district PHNs. Most respondents worked in SPA 6, SPA 4, or SPA 3 (Table 1). Seven percent of respondents reported frequent interaction with SNFs, 22% reported somewhat frequent interaction, 56% reported infrequent interaction, and 11% reported that they do not interact with SNFs.

TABLE 1. Characteristics of Respondents (N=101)	
Demographic	**n (%)**
Job Title	
District Public Nurse	73 (72)
District Public Health Nurse Supervisor	17 (17)
Nurse Manager	4 (4)
Area Medical Director	3 (3)
Area Health Officer	1 (1)
Service Planning Area	
1 (Antelope Valley)	3 (3)
2 (San Fernando)	10 (10)
3 (San Gabriel)	19 (19)
4 (Metro)	21 (21)
5 (West)	6 (6)
6 (South)	23 (23)
7 (East)	11 (11)
8 (South Bay)	5 (5)

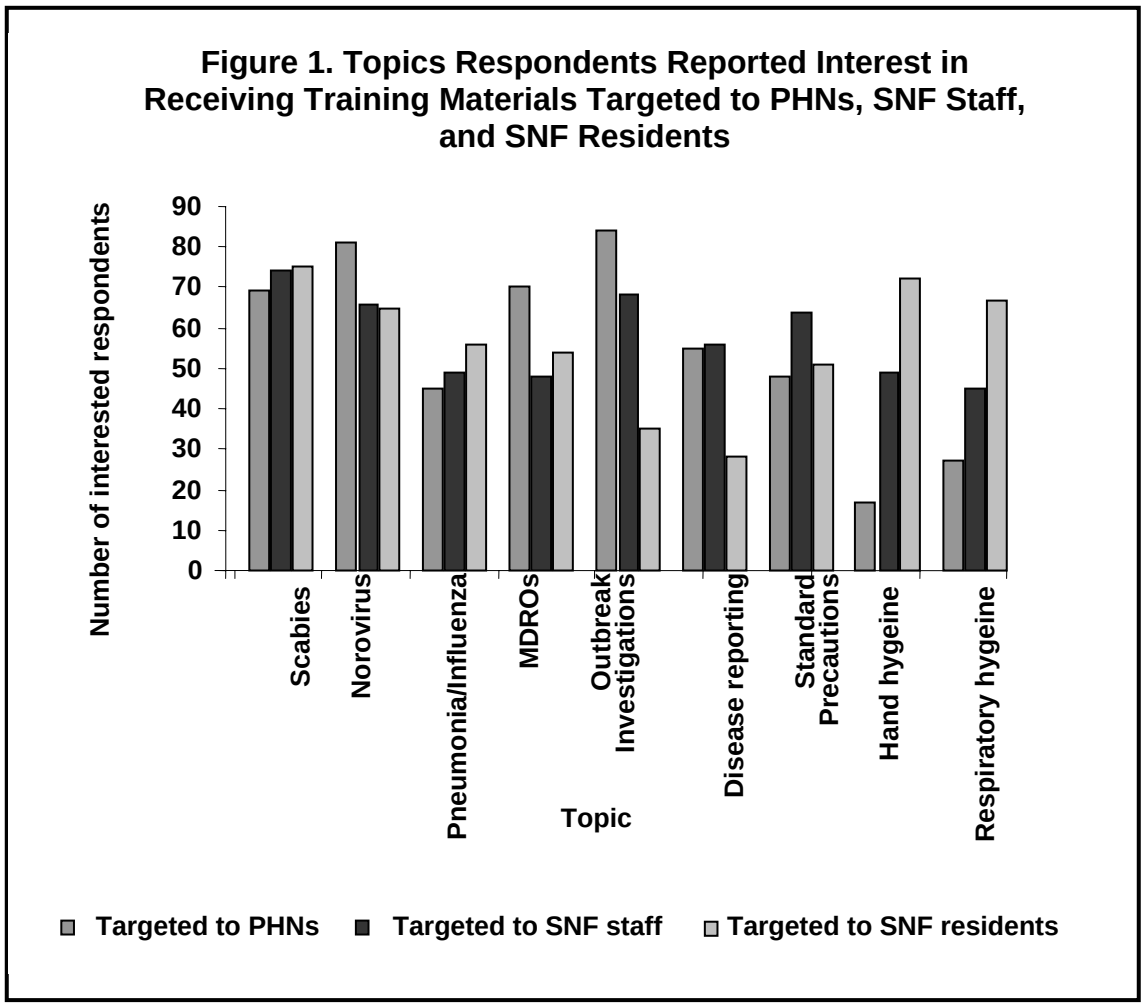
Training Areas

Respondents were interested in several training topics, including the role of DPH Health Facilities Inspection Division in outbreaks (93%), the role of ACDC in outbreak investigations (92%), outbreak investigation methods (92%), emerging infectious disease awareness (91%), infection control and prevention measures (89%), and disease reporting requirements (84%). Respondents were less interested in training on specimen collection (65%). Interests in specific training areas were similar when responses were stratified by the SPA in which respondents work or by frequency of their interactions with SNFs.

Respondents reported that they would be most interested in receiving materials targeted to PHNs on outbreak investigations, norovirus, and multi-drug resistant organisms (MDROs) (Figure 1). PHNS' were significantly more likely than PHNs to report interest in materials on pneumonia and influenza targeted to PHNs (71% versus 40%, respectively; $p<0.05$).

Respondents were most interested in receiving materials on scabies, outbreak investigations, and norovirus targeted for staff working in SNFs (Figure 1). PHNS' were significantly more likely than PHNs to be interested in materials on outbreak investigations (94% versus 64%, respectively; $p<0.05$) and materials on isolation and standard precautions (94% versus 58%, respectively; $p<0.01$) targeted to SNF staff.

Lastly, respondents wanted materials targeted for residents of SNFs on scabies, hand hygiene, and respiratory hygiene (Figure 1). PHNS' were significantly more likely than PHN's to express interest in materials on pneumonia and influenza (82% versus 53%, respectively; $p<0.05$) targeted to SNF residents.



Outbreak Investigation

The majority of respondents (n=71, 70%) agreed that SNF staff were cooperative during outbreak investigations. Most (n=59, 58%) reported that SNF staff implement disease control and prevention measures. Fifty-two (51%) reported that SNF staff communicate regularly with district personnel during an outbreak, but only 41 (41%) believed that SNF staff report disease outbreaks in a timely manner. In fact, 17 (17%) respondents felt that the greatest need that ACDC could address in the SNFs was an improved understanding of reporting outbreaks immediately.

Only 10 (10%) respondents reported that the H-1164 form (CD Outbreak Investigation-Healthcare Facility) did not need improvement. Fifty-seven percent agreed that the form should include more fill-in-the-blank options rather than space for free text, and 54% agreed that a line list to summarize respiratory disease outbreaks should be added.

DISCUSSION

As district staff are responsible for investigating outbreaks that occur in SNFs, ACDC performed a survey to evaluate their experiences interacting with SNFs. ACDC has used the information gathered from this survey for several purposes, including topic selection for the ACDC presentations given to district staff during November 2007 and for revision of the H-1164 form. In the future, ACDC plans to use the information gathered to prepare educational materials intended for PHNs, SNF staff, and SNF residents.

Several areas were identified that needed improvement. Respondents indicated that SNF staff had issues with communication and appropriate management of outbreaks. Through working with the SNFs, both on an individual basis and through group trainings, ACDC plans to address these areas.

This survey had several limitations. The response rate from several of the SPAs was poor. Therefore, the information gathered may not be representative of the public health staff who work in these SPAs. Many respondents reported that they interacted with SNFs infrequently or that they did not interact at all with SNFs. Thus, they may have a different perspective than district staff who are working with the SNFs on a regular basis.

The information gathered from this survey highlights several areas on which ACDC will focus in order to improve the working relationships between ACDC, CHS, and the SNFs. ACDC appreciates all who assisted with the coordination and completion of this survey.

THE IMPACT OF MODIFYING THE SURVEILLANCE DEFINITION OF ACUTE HEPATITIS A IN LOS ANGELES COUNTY, 2004-2005

Lindsey Hageman, MPH

BACKGROUND

In the United States, hepatitis A is one of the most frequently reported vaccine preventable diseases [1]. National rates have steadily declined from 12 cases per 100,000 in 1995, the year the first vaccine was introduced, to 1.5 cases per 100,000 in 2005 [2]. Despite the decline in acute hepatitis, surveillance remains important to describe previously unrecognized high risk groups and to target future prevention initiatives.

Surveillance for acute hepatitis A is labor intensive. The current case definition, developed by the Centers for Disease Control and Prevention (CDC) and Council of State and Territorial Epidemiologists (CSTE), includes the following criteria: a discrete onset of symptoms, jaundice or elevated liver function tests, and a positive hepatitis A IgM test (HAV IgM) or an epidemiologic link to a laboratory confirmed case [3]. For each hepatitis A report, a substantial amount of public health staff time must be used to interview the patient and retrieve appropriate clinical and laboratory information. The additional data are necessary to distinguish false-positive reports; a problem which has recently been documented [4, 5], where patients with a positive HAV IgM test and no clinical symptoms are classified as acute cases without further review.

Prior to 2005, annual incidence rates in Los Angeles County (LAC) were higher than rates reported in both California and nationwide [6]. However, a review of our data revealed that many cases occurred in older adults with normal liver function tests and no traditional risk factors for hepatitis A. We suspected that many of these individuals did not represent true cases of acute hepatitis A. Local health districts had autonomy to count cases as “acute” even with just a single positive test for HAV IgM. Therefore, beginning in January, 2005, we reviewed each completed hepatitis A case investigation form and determined the final status (acute or false) according to the CSTE/CDC surveillance definition. In this study, we evaluated the effect of utilizing a standard surveillance case definition and described the epidemiology and differences between acute and false positive cases of hepatitis A on a population level.

METHODS

Case Definition

Prior to 2005, local health districts in LAC were responsible for determining if the initial reports by healthcare providers and laboratories represented acute infection with hepatitis A virus; a standard definition was not used. Each investigated report was reviewed by a physician in one of the 24 local health districts to classify the report as “acute” or “false”. Reports closed as “false” after investigation included those patients who were asymptomatic or were unable to be interviewed. However reports closed as “acute” may have included both symptomatic and asymptomatic patients based on a single positive test for HAV IgM, even if the patient was unable to be interviewed.

Beginning in 2005, completed report forms were centrally reviewed by the Acute Communicable Disease Control Program (ACDC) of the LAC Department of Public Health (DPH) using both clinical and serological criteria as recommended by the CSTE/CDC (positive HAV IgM, jaundice or elevated liver function tests, and clinical symptoms). Reports were confirmed as acute hepatitis A if they met the CSTE/CDC definition, or in selected instances if the patient was unable to be interviewed, and if they had a positive test for HAV IgM and alanine aminotransferase (ALT) levels >300 IU/L. All other reports were designated as “false” regardless of a positive IgM test.

Data Collection and Analysis

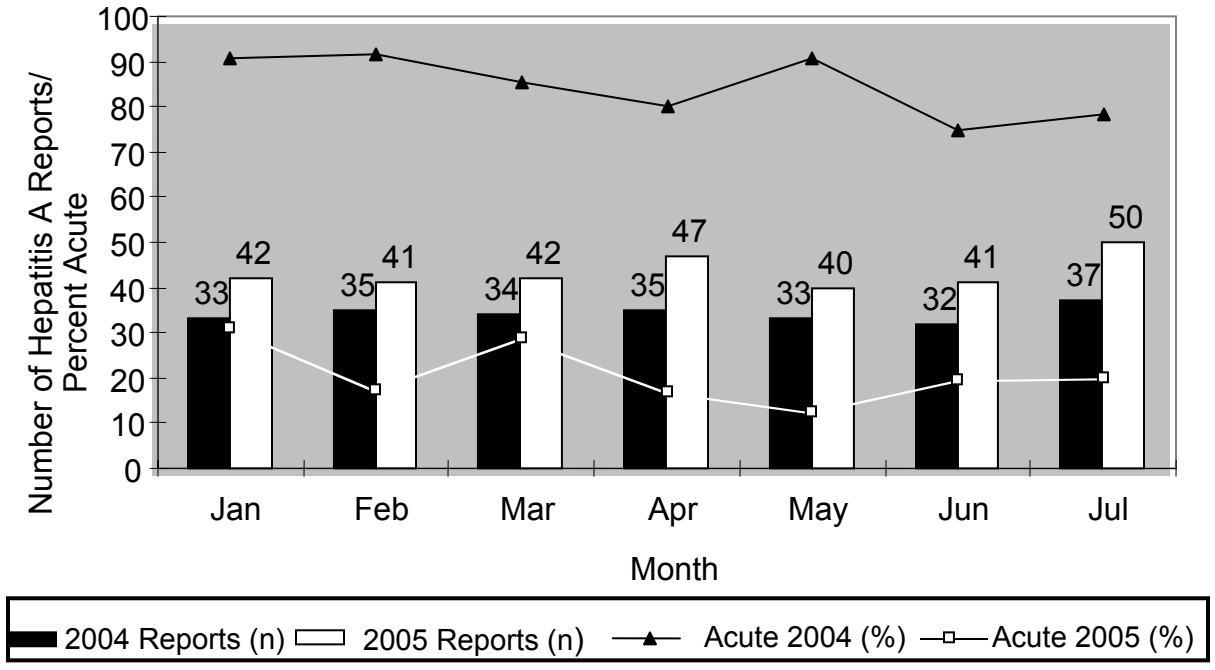
Hepatitis A reports submitted to LAC DPH were included in the study if at least one of the following events occurred between January 1, 2004 and December 31, 2005: onset, specimen collection, diagnosis, or report to LAC DPH. The month of onset was determined using the date of the earliest report of these events. Due to a county-wide outbreak, acute hepatitis A cases with onset after July 31, 2005 were excluded from the analysis and "2005" refers only to cases with onset within the January 1 through July 31, 2005 period. Uninvestigated reports, duplicate reports, and reports of out-of-county residents (including persons living in Long Beach and Pasadena) were excluded. While incarcerated persons had not been investigated and therefore were excluded in 2004 statistics, reports of such individuals were investigated and analyzed in 2005.

Reports of hepatitis A were retrospectively analyzed by demographic characteristics and risk factors, comparing reports from 2004 (baseline period) to the first seven months of 2005. Information from each report was entered into a Microsoft Access database (2002) and a statistical analysis was performed using SAS software version 9.1 (SAS Institute Inc., Cary, NC, USA). Frequency distributions were generated for categorical variables and the Chi-square or Student t-test was used to assess differences between acute 2004 and 2005 cases, as appropriate. Incidence rates were calculated using population estimates created by the Population Estimates and Projections System (PEPS), provided to LAC DPH by the LAC Service Integration Branch.

RESULTS

The percentage of reports closed as acute cases of hepatitis A decreased from 75% in 2004 to 21% in 2005, reducing the incidence rate by more than two-thirds (3.4 cases per 100,000 in 2004 versus. 1.1 cases per 100,000 in 2005). In 2004, LAC DPH received a total of 428 reports and closed 321 as acute. Approximately 36 cases were reported per month. During the first 7 months of 2005, the average number of hepatitis A reports increased to 43 per month (Figure 1) and a total of 303 reports were investigated, with just 63 closed as acute cases.

Figure 1. Number of Hepatitis A Reports by Month of Onset and Percentage of Reports Closed as Acute (confirmed), Los Angeles County, January - July, 2004-2005



Demographic characteristics among acute cases of hepatitis A shifted from 2004 to 2005, with the most dramatic decreases observed in the oldest age groups. Whereas the highest rate in 2004 was in persons older than 65 years (9.4 cases per 100,000), the highest rate in 2005 was in the 15 to 34 year age group (1.8 cases per 100,000). Among persons older than 65 years, the incidence rate decreased to 1.2 cases per 100,000 in 2005 as the percentage of reports closed as false in this age group increased from 32% in 2004 to 92% in 2005. Although acute cases were on average younger than false cases in both years, the greater age difference occurred in 2005 (21 years) compared to 2004 (8 years); acute cases in 2005 were more than 10 years younger than 2004 cases (mean 35 years versus 46 years) and false cases in 2004 were slightly older when compared to 2005 (mean 56 years versus 54 years). The rate was highest among Asians in 2004 (4.6 cases per 100,000) compared to Whites in 2005 (1.5 cases per 100,000).

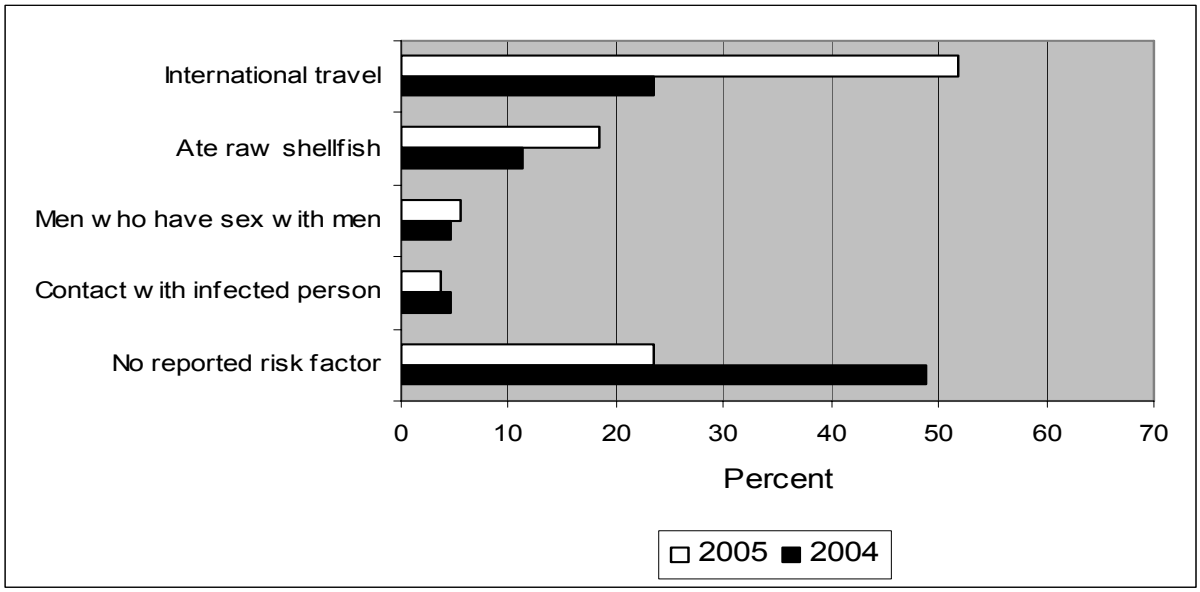
The percentage of acute hepatitis A cases with complete risk factor information increased from 82% in 2004 to 87% in 2005 (Table 1). The percentage of cases with documented risk factors also increased (51% in 2004 versus 76% in 2005). International travel was the most reported risk factor in both years, followed by eating raw shellfish (Figure 2). Other risk factors included male-to-male sexual contact (MSM) and having contact with an infected person.

Table 1. Selected Characteristics of Acute Hepatitis A Cases by Year, Los Angeles County, 2004 July, 2005.

	2004	January – July 2005	
Characteristic	No. (%)	No. (%)	P value
Closed as acute	321 (75)	63 (21)	<.0001
Sex (male)	151 (417)	36 (57)	0.18
Mean age, range	46, 2-91	35, 1-89	<.001
No reported risk factor*	126 (49)	13 (24)	<.001

*cases with missing risk factor information excluded (n=57 for 2004 and n=8 for 2005)

Figure 2. Reported Risk Factors of Acute Hepatitis A Cases, LAC, 2004 – July 2005



DISCUSSION

This is the first report to compare the demographic characteristics of confirmed and false cases of acute hepatitis A and to document the rate of disease before and after the use of a standard case definition. With consistent application of the CSTE/CDC hepatitis A case definition, the rate of acute hepatitis A fell by 72%. Along with the decrease in incidence, the demographics (age, gender, race, risk factors) of the acute cases shifted based on case definition. Applying the 2005 predictive value of acute cases to the 428 reports received during 2004, only 90 would be expected to be acute cases, which is significantly less than the 321 acute cases recorded during that year. This study suggests that the incidence of hepatitis A is overestimated using a case definition based on serological evidence alone. Whereas Los Angeles County previously had an incidence rate higher than both California and the United States [1], it was lower in the first seven months of 2005 with the application of the CSTE/CDC hepatitis A case definition.

With case investigations centrally reviewed using the new case definition of hepatitis A, only one in five reports were closed as acute cases. The significance of the application of a consistent case definition and protocol is the enhanced ability to estimate the true incidence of acute hepatitis A in LAC and also to compare rates of hepatitis A both internally, within the county, and externally, to other jurisdictions who utilize the CDC/CSTE definition. Accurately measuring the incidence of hepatitis A overall and by subgroup is important in identifying populations at risk and developing prevention strategies, including identification of pediatric populations not receiving recommended immunization and making additional recommendations for routine vaccination. With the improved surveillance case definition, males and working-age adults were shown to be at greater risk for acquiring the disease than had been previously appreciated while those aged 65 years and older were no longer the group at highest risk for hepatitis A.

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PILOT STUDY: WEEKLY REPORTING OF INFLUENZA-LIKE ILLNESS AMONG STUDENTS IN A SAMPLE OF LOS ANGELES COUNTY SCHOOLS

Lindsey Hageman, MPH

BACKGROUND

Influenza is a significant source of morbidity in healthy children, leading to excess hospitalizations and medical visits [1]. Epidemiological studies have shown that during an epidemic, influenza has the highest attack rate and occurs first in school-aged children, who subsequently spread the virus to their family members [2]. With the concern of pandemic influenza, there is an increased need to quickly identify influenza in the community and efforts have focused on creating syndromic surveillance systems to identify influenza-like illness (ILI) and other indicators of influenza in real-time. Several jurisdictions use or have attempted collecting student absenteeism as a proxy for influenza activity during the influenza season [2,3]. However, student absenteeism is non-specific as the reason for absence is not collected and there are certain times in the school year where a large percentage of students are absent, such as the week before and after holidays or during the first or last week of school [3]. To better assess influenza activity in school-aged children, the Los Angeles County Department of Public Health (LAC DPH) partnered with several schools to pilot a program where school nurses reported the weekly percentage of students in school presenting with ILI symptoms to the nurse's office.

METHODS

Participating schools were chosen based on geographic location, type of school (elementary, middle, or high school), and presence of a full-time nurse. Influenza-like illness (ILI) was defined as fever ≥100° F in addition to cough and/or sore throat. For this pilot program, the defined study period was from October 22, 2006 to March 24, 2007. During this time, the participating school nurses would report the weekly number of students with ILI and the total number of students who visited the nursing office during each school week (Monday through Friday). Data were extracted from an existing nurse data sheet used to categorize the primary reason for each student visit. Other categories listed on the form such as gastrointestinal illness or injury were not analyzed here.

ILI data were submitted to a nurse coordinator by Wednesday of the following week, who recorded and emailed the data in a Microsoft Excel spreadsheet to LAC DPH Acute Communicable Disease Control Program (ACDC). No information was collected during the four week winter break (12/10/06-1/6/07). Data were analyzed to determine completeness of reporting and ILI trends, both overall and by type of school. In addition, school based ILI was compared to other influenza surveillance systems in Los Angeles County, including sentinel and syndromic-surveillance systems.

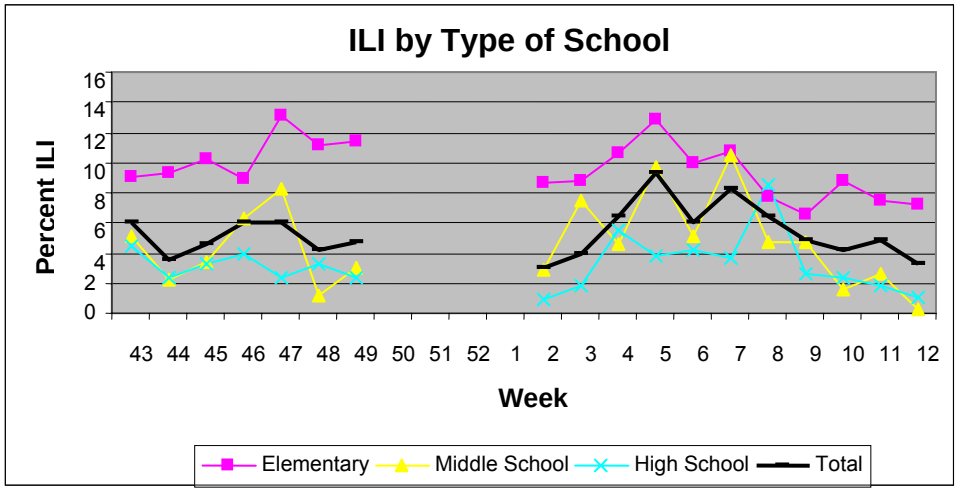
To thank the nurses for participating and to encourage further participation, each nurse was mailed a "Zebra Book" – Terrorism Agent Information and Treatment Guidelines for Clinicians and Hospitals, which is a comprehensive resource for clinicians on biological, chemical, and radiological agents. The books were mailed during the project in January, after the winter break period.

RESULTS

A non-random group of 24 schools were selected based on the location and type of school; one high school, middle school, and elementary school were chosen from eight local districts within the county. Twenty three nurses were assigned to these schools. Surveillance data was available for 18 weeks, excluding the weeks during winter break.

Influenza-like illness was highest among elementary school children (median= 9%) and decreased with increasing age (median = 5% and 3% for middle and high school students, Table 1). Two ILI peaks were observed during the study period (Figure 1)—a smaller peak during weeks 46 and 47 (11/12-11/25/06) followed by a larger peak in week 5 (1/28-2/3/07).

Figure 1. ILI by Type of School and Week, Excluding Winter Break (weeks 50-1)



During the peak in November (weeks 46 and 47), 6% of students presenting to the school nurse had ILI symptoms (Table 1). In week 46, ILI among high school students peaked at approximately 4%, followed by 8% in middle school students and 13% in elementary school students during week 47 (Table 1). The second, larger peak was observed during week five, where 9% of presenting students had ILI symptoms (Table 1). Interestingly, ILI among elementary school students who presented to the nursing office was highest during this peak (13%) while ILI among middle school students peaked during week 7 (11%) followed by high school students during week 8, where ILI peaked at 9% (Table 1).

Overall, reports were received from 92% of the schools (n=22). Nearly 40% of the school nurses reported data at least 75% of the time (n=9) and 50% reported data at least half of the time (n=12). Data was never received from two sites and nine school nurses stopped reporting after the winter break (Table 2).

Table 1. ILI by Type of School, by Week

WEEK	ES ILI	MS ILI	HS ILI	TOTAL
43	9.1	5.1	4.5	6.1
44	9.3	2.2	2.4	3.5
45	10.2	3.3	3.2	4.6
46	8.9	6.3	3.9	6.0
47	13.1	8.3	2.4	6.0
48	11.1	1.2	3.2	4.2
49	11.4	3.0	2.4	4.7
2	8.6	2.8	1.0	3.0
3	8.8	7.5	1.8	4.0
4	10.6	4.6	5.5	6.4
5	12.8	9.7	3.9	9.3
6	9.9	5.1	4.2	6.1
7	10.7	10.5	3.7	8.3
8	7.7	4.7	8.5	6.4
9	6.5	4.7	2.7	4.8
10	8.8	1.5	2.3	4.3
11	7.5	2.7	1.8	4.9
12	7.2	0.2	1.0	3.3

Notes: Winter break excluded (weeks 50-1)
Grey indicates <50% reporting

Table 2. Reporting Activity of Participating School Nurses		
Participation	**n**	**%**
>= 85%	4	17
>= 75%	9	38
>= 50%	12	50
>= 25%	22	92
Never	2	8
Quit After Break	9	38

DISCUSSION

Although the 2006-2007 influenza season was mild and a limited number of schools participated in the study, the second peak of ILI among school-aged children was consistent with other markers of influenza in LAC; including laboratory confirmed influenza in sentinel sites and reported cases of pediatric influenza (Figure 2). In particular, both ILI in school-aged children and cases of pediatric influenza peaked during week five. Laboratory confirmed influenza cases from sentinel sites (76% in children younger than 18 years) peaked during week four (Figure 2), somewhat unexpectedly, as other studies have shown that ILI in children precedes laboratory confirmed influenza [2,3]; however, compared to previous seasons, very few laboratory cases were reported and during the "peak" period, only six cases were reported. In a surrounding jurisdiction that utilizes more sentinel sites for influenza reporting, laboratory confirmed influenza peaked during week six [4]. Other markers of ILI activity in LAC, including persons with ILI presenting to emergency departments and total number of emergency department visits, peaked during week six; especially ILI in children aged five years and younger (Figure 3).

Figure 2. School ILI Versus Reported Cases of Pediatric Influenza and Positive Tests for Influenza by Sentinel Sites, Los Angeles County

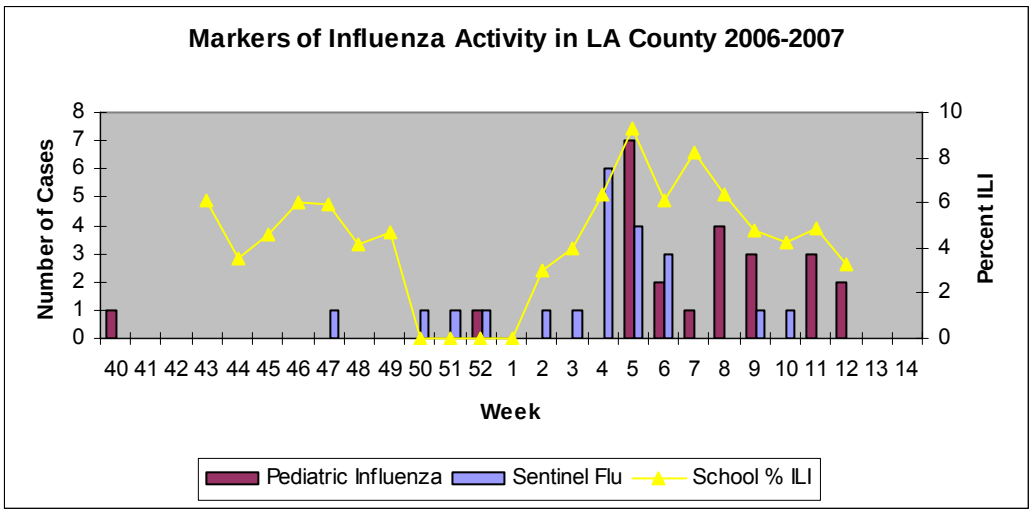
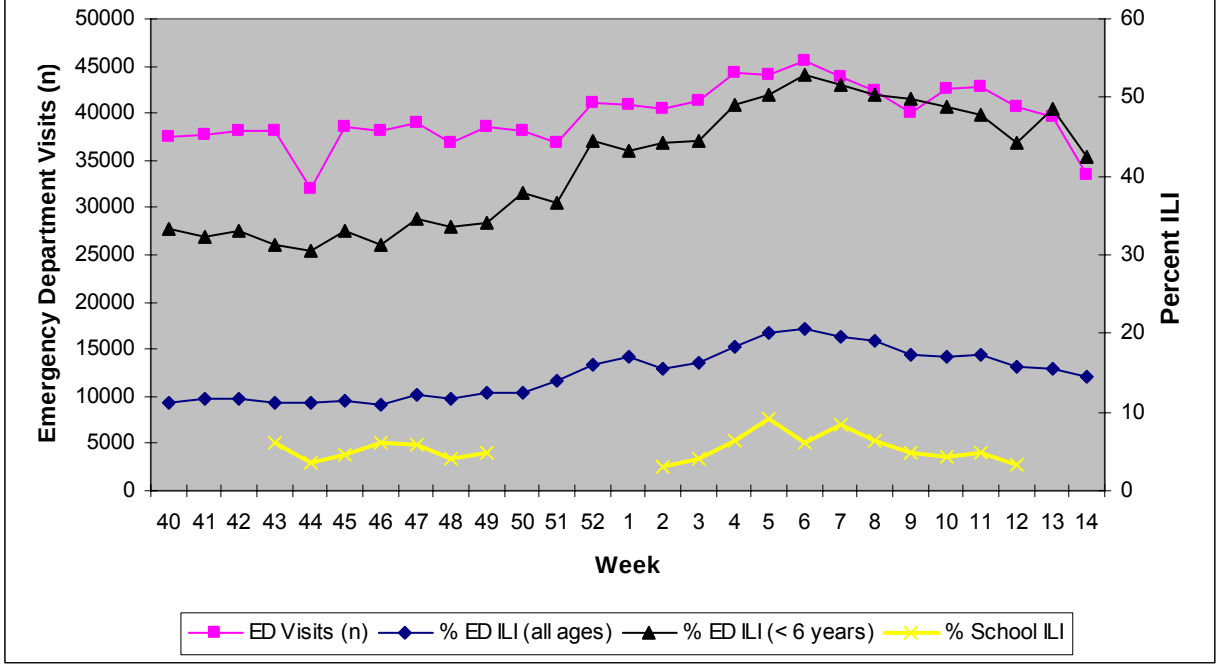


Figure 3. School ILI Versus Markers of Syndromic Surveillance
Los Angeles County, 2006-2007



Clinical information from student nurse visits provides a surveillance system for influenza detection that is more specific than absenteeism data alone. However, ILI may not indicate influenza as other viral or bacterial infections can cause similar symptoms. During the first observed peak of ILI activity in school-aged children, there were no other markers of influenza activity in LAC. The cause of this peak or the significance of the increase is unknown since there is no background rate for comparison. Another limitation is that no data is available during winter break, a period in which influenza activity is typically highest.

During this pilot study several challenges were identified, including issues of representativeness, timeliness, and acceptability. It is unlikely that 24 schools from one school district are an accurate representation of influenza activity in all LAC schools. Although data were reported on a weekly basis, ACDC did not receive the updated spreadsheet until the following week. In the future, the reporting system should be modified so that both the nurse coordinator and ACDC can access the data as it is being reported by the school nurses. In addition, participation in reporting was lacking, especially in middle and high schools after the winter break. Further investigation is needed to determine why this decrease occurred and feedback from the school nurses will be critical in understanding the lack of acceptability. Automated weekly reminders may be a useful tool to increase reporting.

Monitoring ILI in school-aged children provides a relatively simple and useful measure of influenza activity, especially when combined with other influenza surveillance systems. It may be particularly valuable in identifying influenza at the beginning, end, or outside the traditional season. In this study, ILI peaked first in elementary school children and reporting compliance was highest among elementary school nurses. Monitoring ILI in elementary schools alone may be a more effective and simpler alternative for conducting school-based ILI surveillance. In the future, a secure internet-based reporting system with automated reports can be designed to facilitate reporting and increase participation. This type of system would decrease the time for analysis and could be used to record ILI daily rather than on a weekly basis. Similar programs using electronic ILI reporting have been started elsewhere with success in predicting peaks of activity at least one week before they occur [5,6]. Further, an internet-based system could be applied in other settings such as laboratory or sentinel physician reporting.

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A PILOT STUDY ON THE FEASIBILITY OF MAKING HOSPITALIZED LABORATORY-CONFIRMED INFLUENZA A REPORTABLE DISEASE IN LOS ANGELES COUNTY

Ramon E. Guevara, Ph.D.

ABSTRACT

To prepare for a pandemic or large epidemic of influenza, the Acute Communicable Disease Control Program (ACDC) of the Los Angeles County Department of Public Health (LAC DPH) recruited five hospitals in different geographic areas of the county for a pilot study on surveillance of hospitalized laboratory-confirmed influenza cases. From September 2006 to April 2007, infection control professionals (ICPs) of participating hospitals filed reports of hospitalized laboratory-confirmed influenza cases through Public Health's web-Visual Confidential Morbidity Reporting (VCMR) system and faxed medical records, laboratory results, and epidemiology case forms to ACDC for entry and analysis. Two of five hospitals reported a total of 11 cases, most of which were children <18 years old (64%). With no deaths and few study cases, LAC's influenza experience of low virulence and low infectivity was reflective of rest of the United States (US). Seven (64%) study cases had indications for influenza vaccination. Of these seven, three (43%) cases reported being vaccinated for the current season. Hospital laboratory data helped determine that this surveillance system had a 64.7% sensitivity (11 cases reported of 17 laboratory-confirmed) of detecting study cases with 50% of the sites with cases reporting information. Sensitivity decreased in March 2007. The median number of days between hospital admission date and report date was four (range 1-12 days). Among the five hospitals, 2197 influenza tests were performed with 106 (4.8%) positive results. This pilot study provided important information to consider in developing a functional surveillance system for influenza during a large epidemic or pandemic.

BACKGROUND

Influenza viruses are a major concern in the current era of emerging infectious diseases. Historically, influenza has made global impacts with the pandemics of 1918-19, 1957-58, and 1968-69. The Spanish flu pandemic of 1918-19 caused an estimated 20 million to 50 million deaths worldwide [1]. While pandemics rarely occur, annual or near-annual winter epidemics of influenza occur with an average health impact of >20,000 excess deaths and >110,000 excess hospitalizations per year in the United States [2].

Surveillance on influenza continues and develops today in hopes of identifying highly infectious strains and preparing for the next pandemic. Traditionally, methods of surveillance involved searching for pneumonia and influenza International Classification of Diseases, Ninth Revision (ICD-9) codes (codes 480-487) on death data as well as hospitalization data. More recently, with the U.S. government's focus on preparedness of bioterrorism, syndromic surveillance of emergency department and outpatient data has been used to gauge influenza activity [3]. However, with better rapid tests for influenza available today, studies on influenza surveillance are focusing on hospitalized laboratory-confirmed cases to get a more accurate picture of the disease [4,5].

In 1998, a joint study by the LAC Department of Health Services, the California Department of Health Services (CDHS), and the Centers for Disease Control and Prevention revealed that the medical capacity to handle influenza outbreaks in LAC was diminishing as the number of licensed hospital beds was decreasing with the growing population [6]. With 10 million people, LAC needs the ability to detect influenza quickly as the disease is highly infectious. Moreover, timely preparation efforts to prevent and handle the disease can alleviate the additional pressures on the medical and healthcare systems during influenza season.

The following one-year pilot study was performed by ACDC of LAC, DPH to determine the feasibility of conducting passive surveillance for hospitalized influenza, particularly whether hospital ICPs were willing to report hospitalized laboratory-confirmed influenza through VCMR. Currently, pediatric influenza cases

involving intensive care or death are reportable to the CDHS. This study expanded the influenza study population to all hospitalized laboratory-confirmed influenza cases in order to give health officials a better gauge of influenza activity in the entire LAC population. In addition, this study sought to determine if the surveillance and analysis of surveillance data can operate on a real-time basis and identify high-risk population groups to help direct influenza immunization campaigns.

METHODS

Selection factors for sentinel sites included location, high number of beds, being a general hospital, and strong rapport with the Hospital Outreach Unit (HOU) of ACDC. Hospital recruitment began informally in late August 2006. One hospital declined because being understaffed. Ultimately five hospitals (Hospitals A through E) participated and represented north, west, south, central, and east areas of LAC.

Surveillance began in September and October of 2006 and lasted until April 30, 2007. For each site, the study end date was defined to be the date after February 15 when six weeks passed without a laboratory-confirmed influenza admission or until June 30, 2007, whichever was sooner. ICPs of the five sentinel sites reported hospitalized influenza cases through the VCMR system of LAC DPH. Cases were defined as patients who were LAC residents (excluding Long Beach and Pasadena) admitted to the hospital with a positive result by any recognized laboratory test for influenza during the surveillance period. One hospital continued to report influenza cases without hospital admission, such as Emergency Room (ER) admission only cases, but indicated “ER only” in the notes section of the VCMR report. ICPs faxed history and presentation, laboratory results, and epidemiology case forms to HOU Liaison Public Health Nurses (LPHNs) who scanned these documents into VCMR. PHNs and the epidemiologist reviewed all documents from ICPs and made updates when necessary. The epidemiologist entered the epidemiology case form into the user-defined form (UDF) in VCMR which included patient demographics, type of laboratory test and specimen, date of culture, influenza type, onset date, admission date, admission with respiratory illness, admission from the ER, admission to the Intensive Care Unit (ICU), date of death, receipt of flu vaccine, history of chronic illnesses, co-infections, chest x-ray confirmed pneumonia, and pregnancy status.

The evaluation of the surveillance system focused on timeliness, sensitivity, predictive value positive, acceptability, and representativeness. While the system demonstrated stability, flexibility, and simplicity, only anecdotes can support this as no measures were performed to assess these aspects of surveillance. These anecdotes will not be described.

Sensitivity was defined as the number of hospitalized influenza cases reported divided by this same number plus the number of hospitalized influenza cases not reported during the surveillance period. To calculate sensitivity, when surveillance ended ACDC requested the number influenza tests performed, the number of positive results, and a list of names, medical record numbers, and specimen collection dates for patients with positive tests from the laboratories of each sentinel site. Having the ICP from each sentinel site review the laboratory list of patients with positive results and indicate which ones were admitted to the hospital defined the numerator for sensitivity calculations.

Predictive value positive was defined as the number of hospitalized influenza cases reported divided by this same number plus the number of reports of hospitalized influenza cases that actually were false because the cases were not hospitalized.

Representativeness was assessed by mapping the sentinel sites against the 2006 LAC population density estimates of the LAC Office of Vital Records and using hospital discharge data from CDHS to compare the numbers and medians of hospitalized influenza cases during 2001-2003 among the sentinel sites to those of other hospitals during the same time period. The percentage of hospital discharges with influenza coded of the sentinel sites was calculated for the 2001-2003 period to estimate the representation of the sentinel sites for the study.

RESULTS

Two of the five sentinel sites reported 77 influenza cases. Hospital B reported 13 influenza cases but only 10 were actually hospitalized. Hospital A reported 64 influenza cases but only one of these was hospitalized. In total, surveillance found 11 hospitalized influenza cases for the 2006-2007 season.

Most of the cases were children (n=7, 64%), with age ranging from 0 – 9 years, and median age at three years. Among the three cases with age of zero years, only one had influenza within a month of birth; the other two cases acquired influenza within two and five months of birth. Although race was almost evenly distributed among white, black, and Hispanic race-ethnicity categories, most of the child cases were male (n=5, 71.4%).

Among adult cases (n=4, 36%), median age was 49 years (range 21-89 years), race-ethnicity was white (100%), and gender was evenly distributed.

None of the eleven hospitalized influenza cases died. Ten cases (91%) were admitted from the ER. All were admitted with respiratory illness. Five cases (45%) had chest x-ray confirmed pneumonia (median age of seven years with a range of 0-89, versus median age of 6 years with a range of 0-24 for cases without chest x-ray confirmed pneumonia). Two cases, ages 89 and three years, were admitted to the ICU. Interestingly, the older of these two cases received the influenza vaccine earlier in the influenza season.

Although occupation in a health care setting was not asked, seven (64%) of the eleven cases had health indications for influenza vaccine. These indications included age less than six years (n=2, 18%), age greater than 65 years (n=2, 18%), chronic medical conditions (n=5, 45%), and pregnancy (n=1, 9%) in the second trimester. The chronic medical conditions included kidney disease (n=3), lung disease excluding asthma (n=2), heart disease (n=1), diabetes (n=1), and sickle cell disease (n=1). Three (43%) of the seven cases with health indications for vaccination reported receiving the influenza vaccine. The one case who knew his vaccination date had a disease onset 102 days later.

Four (36%) of 11 hospitalized influenza cases reported getting the influenza vaccine for the current influenza season. One of the four cases who received the vaccine did not have any recognized vaccine indications reported. In fact, this case was five months old and received the vaccine on the day of hospital admission. Therefore, three (27%) of the 11 hospitalized influenza cases that were reported to have received the influenza vaccine were not protected from disease. All three of these cases had influenza type A.

None of the eleven cases reported the risk factors of residence in a nursing home, current smoker, and chronic medical conditions of asthma, cancer, cystic fibrosis, anemia, and immunological disorders. In addition, none of the cases had respiratory co-infections reported.

Regarding timeliness of the surveillance system, the median number of days between hospital admission and report date was four (range 1-12 days), hospital admission and specimen collection for first positive influenza laboratory test result was one (0-1 day), disease onset and report date was eight (range 3-19 days), and disease onset and receipt of the epidemiology case form by ACDC was eight (range 3-26 days) (Table 1).

Table 1. Days Between Clinical Events During Pilot Surveillance of Hospitalized Influenza Cases (N=11), Los Angeles County, 2006-2007

	Days between clinical events						
Case	Disease onset to admission	Hospital admission to laboratory test	Laboratory test to report of case to health department	Report of influenza case to report of epidemiology case form	Disease onset to report of case to health department	Disease onset to report of epidemiology case form	Hospital admission to discharge
1	7	0	3	16	10	26	1
2	6	1	3	4	10	14	6
3	2	1	2	1	5	6	3
4	2	1	2	0	5	5	10
5	2	1	1	0	4	4	7
6	*	1	6	0	*	*	1
7	10	0	9	0	19	19	3
8	1	1	4	0	6	6	1
9	2	0	1	0	3	3	3
10	9	0	11	0	20	20	1
11	0	0	12	-2	12	10	2
Median difference (days)	2	1	3	0	8	8	3
Range (days)	0-10	0-1	1-12	-2-16	3-19	3-26	1-10

*Unknown disease onset date.

Among the sentinel sites, 2197 influenza tests were performed with 106 (4.8%) positive results (Table 2). Among those testing positive for influenza, 17 (16.0%) were hospitalized. Testing for influenza was varied as Hospital B performed 1612 tests while Hospital C and Hospital D performed 38 and 22 tests, respectively.

Regarding sensitivity of the surveillance system, laboratory data and review by ICPs found six additional hospitalized influenza cases (Table 2). With six hospitalized influenza cases not reported, the overall sensitivity of the surveillance system was 64.7%. Sensitivity for individual sentinel sites was either 0% or 100%.

Table 2. Evaluation Measures of Pilot Surveillance System for Hospitalized Influenza Los Angeles County, 2006-2007.

Testing and hospitalization

Hospital	Influenza tests performed	Positive tests	% tests positive	Positives hospitalized	% of positives hospitalized
Hospital A	348	65	18.7%	1	1.5%
Hospital B	1612	29	1.8%	10	34.5%
Hospital C	38	3	7.9%	3	100.0%
Hospital; D	22	0	0.0%	0	Not applicable
Hospital E	177	9	5.1%	3	33.3%
OVERALL	2197	106	4.8%	17	16.0%

Sensitivity

	Hospitalized influenza cases			
Hospital	Reported	Not reported	Total	Sensitivity
Hospital A	1	0	1	100.0%
Hospital B	10	0	10	100.0%
Hospital C	0	3	3	0.0%
Hospital; D	0	0	0	Not applicable
Hospital E	0	3	3	0.0%
OVERALL	11	6	17	64.7%

Predictive Value Positive

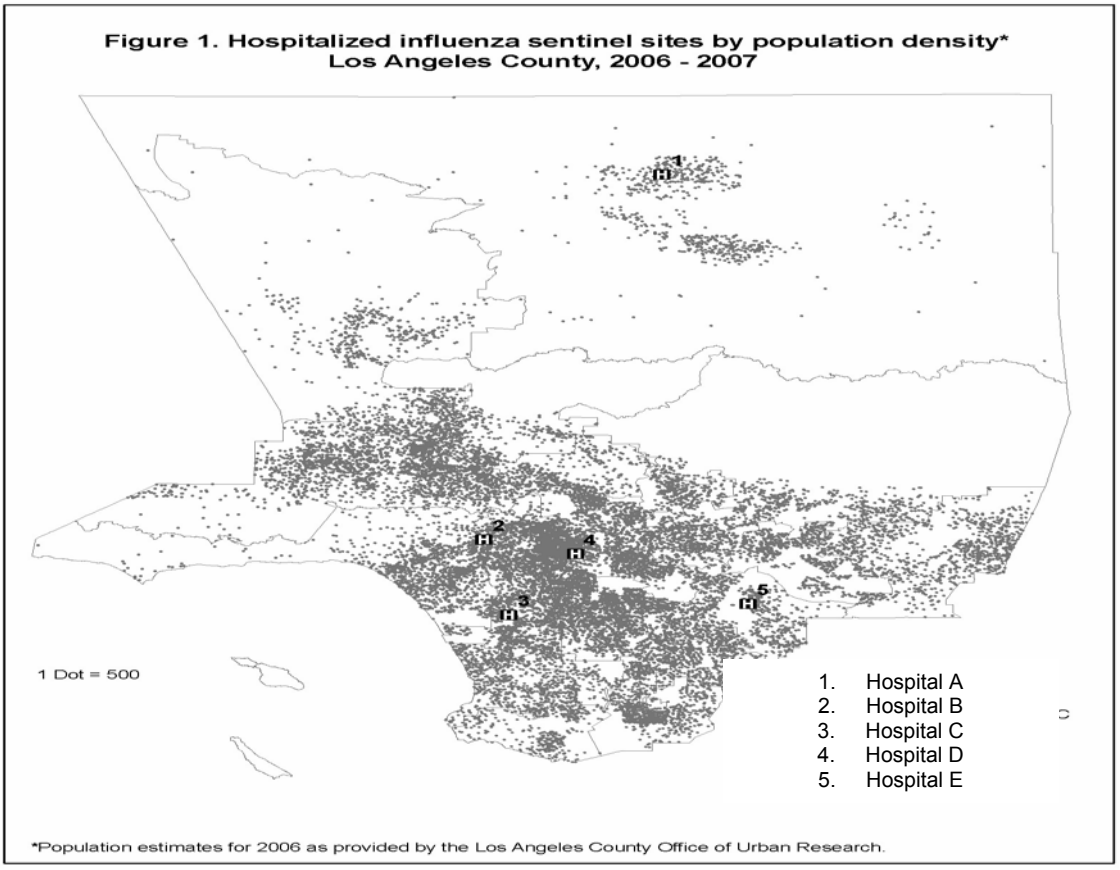
	Reported cases			
Hospital	Hospitalized	Not hospitalized	Total	Predictive Value Positive
Hospital A	1	63	64	1.6%
Hospital B	10	3	13	76.9%
OVERALL	11	66	77	14.3%

The predictive value positive of the surveillance system was low as only two sentinel sites reported cases that were not hospitalized. (Table 2). With 11 hospitalized influenza cases reported and 66 influenza cases reported but not hospitalized, the overall predictive value positive for the surveillance system was 14.3%. The predictive value positive for Hospital A was 1.6% but for Hospital B was 76.9%.

Acceptability was assessed for each sentinel site. The first consideration was sensitivity, which was 100% for Hospital A and Hospital B, but 0% for Hospital C and Hospital E. Hospital C had only 38 influenza tests performed but Hospital E had 177 influenza test performed. For either sentinel site, the low sensitivity suggests lower acceptability of ICPs to report hospitalized influenza cases. The second consideration was predictive value positive, which only Hospital A and Hospital B had because they reported cases. The low predictive value positive of Hospital A suggests a high willingness to report as the ICP reported 64 of 65 cases of laboratory-confirmed influenza. The predictive value positive of Cedars Sinai was 76.9% and in the beginning of the surveillance study the median number of days between hospital admission date and report date was three (range 2-4). After January 2007, the median number of days between hospital admission date and report date for Hospital B was eight (range 1-12). The decrease in timely reporting suggested a diminishing willingness to report, which might be due various reasons such as other hospital priorities and passing of the traditional peak of influenza season.

In terms of representativeness of the surveillance system, Figure 1 shows that the sentinel sites are located in various densely populated parts of LAC. In addition, during 2001-2003, the sentinel sites had a

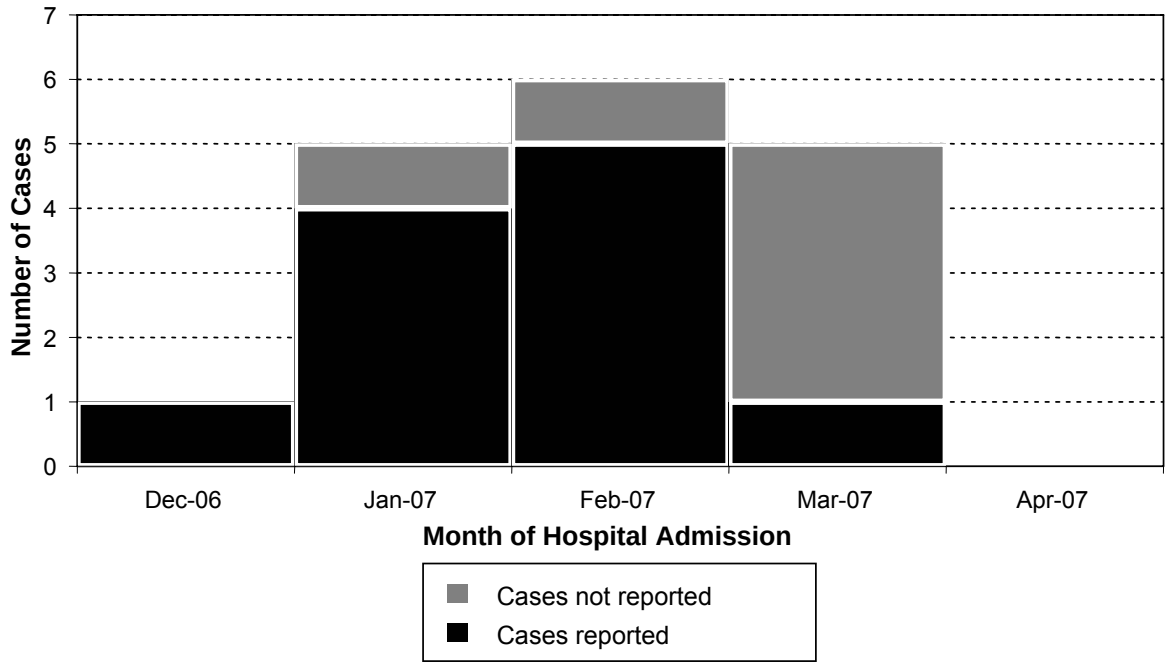
median number of 17 (range 8-79) hospitalized influenza cases while other hospitals reporting discharges with influenza had a median number of 11 (range 1-323) hospitalized influenza cases. The study sites represented 145 (7.3%) of 1982 hospital discharges coded with influenza during 2001-2003 among 95 hospitals in LAC.



Regarding accuracy of the surveillance system, three duplicates reports were submitted during the study. These were removed from the analysis but reflected the low incidence of influenza this season as well as the possibility of ICPs reporting old cases as new ones perhaps because of delayed reporting.

Figure 2 presents reported and non-reported hospitalized influenza cases during the surveillance study by month of admission. Hospitalization would have seemed to decrease dramatically in March if only reported cases were considered. However, March had as many hospitalized influenza cases as January.

Figure 2. Reported and Non-Reported Hospitalized, Laboratory-Confirmed Influenza (N=17) by Month of Admission, Los Angeles County, Influenza Pilot Study Sept. 2006 - April 2007.



DISCUSSION

This pilot study on making hospitalized laboratory-confirmed influenza a reportable condition in LAC showed that ICPs are willing to report these cases. While only two of five sentinel sites reported true cases, one site did not have any true cases, and two sites did not report any cases despite having a few. Of these two sites, Hospital C did not have an ICP during the time the cases were admitted so an assessment of willingness to report cannot be made with this site. However, this study may be biased in choosing sentinel sites with the best working relationships between the hospital ICPs and the HOU LPHNs. Therefore, when including all hospitals in LAC, the acceptability and sensitivity of the surveillance system might diminish.

Staffing issues as indicated by Hospital C and the hospital that had to be replaced during the recruitment phase of this study seem to be important in the sensitivity of detecting hospitalized laboratory-confirmed influenza cases through this surveillance system. With laboratory reporting developing with VCMR, another surveillance design might be more effective in detecting hospitalized laboratory-confirmed influenza cases.

The value of this surveillance system in detecting hospitalized laboratory-confirmed influenza in real-time can be seen from at least two perspectives. First, from hospital admission to first report of a hospitalized laboratory-confirmed influenza case usually took four days (range 1-12). Health officials need to decide if that's fast enough, particularly during an epidemic or pandemic. Second, determination of risk groups to target for vaccination from the information on the epidemiology case form will take longer than four days. Because the measure to calculate the time it took to investigate and complete the case epidemiology form was inaccurate or missing, only personal experience can attest that it usually took at least a week to get all the information for the epidemiology case form. Health officials need to decide if they will use the information from the epidemiology case form to formulate preventive efforts during a high-incidence influenza season. While the case epidemiology form might be omitted as part of a real-time surveillance

system, outcome of death, status and date of discharge, and vaccine status would not have been known if no case epidemiology form and follow-up were performed.

This pilot appears to have shown a fairly accurate picture of hospitalized laboratory-confirmed influenza in LAC, particularly because the incidence was low all around the United States this year. Unfortunately, the higher numbers of cases during a high-incidence year would have provided better estimations in evaluating making hospitalized laboratory-confirmed influenza a reportable condition.

Hospitalized laboratory-confirmed influenza is a specific condition and surveillance focused on this captures only the most serious cases to gauge how virulent the strain of influenza is for the current season. Health officials should recognize that this might not be the best way to assess the effect of influenza on the population, especially during a very high-incidence year as hospitals might reach bed-capacity or during a year of a highly infectious strain with low virulence. Alternatives to the surveillance system of this pilot study should be developed and explored. For example, one alternative is to make influenza laboratory reportable with demographic and residential address information and no follow-up. This is a very simple surveillance system with probably high acceptability if electronic laboratory reporting functions well in regards to timeliness and completeness and accuracy of data. While hospitalization admission would be unknown, the demographics of the population testing positive for influenza would be available to determine a strategy for prevention education and vaccination. While the surveillance system of this pilot study operated well during this season, it would be very resource intensive during a high-incidence season, mainly because of the work required to confirm hospital admission and complete the epidemiology case form.

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UNIVERSITY INFLUENZA SURVEILLANCE PROJECT SUMMARY 2003-2007

Alan Wu, MPH and Y. Silvia Walker, RN, PHN, MSN/MPH

BACKGROUND

The Los Angeles County Department of Public Health Acute Communicable Disease Control Program (ACDC) implemented the University Influenza Surveillance Project since 2003 until 2007. The project background and methods have been previously described in the 2003 ACDC Special Studies Report [1]. This report will summarize the project and present the final data. The objectives of the project were to: 1) describe the characteristics of respiratory illness in university students, 2) evaluate the feasibility of university student health centers as sentinel sites for influenza surveillance, 3) facilitate the identification of common and novel respiratory viruses in circulation, and 4) compare student viral surveillance with other respiratory illness surveillance systems.

RESULTS

A total of seven universities in Los Angeles County (LAC) participated in the project from 2003 to 2007. Participating universities varied by geographic location, student body size, and student characteristics (Table 1).

Table 1. University Demographics*

	University A	University B	University C	University D	University E	University F	University G
Student Body	> 30,000	5,000 – 10,000	> 30,000	< 5,000	> 30,000	5,000 – 10,000	10,000 – 15,000
Undergraduate	77%	71%	5O%	44%	70%	39%	71%
International Students	6%	8%	21%	26%	6%	5%	1%
Flu vaccination	Nominal Fee	Nominal Fee	Nominal Fee	Free	Free	Nominal Fee	Free
Type of School	Private	Private	State	State	Private	State	Private

* Data collected from university registrars/websites and student health center self-reports

Table 2 shows the types of residence of participants by year. A majority of students lived in either a dormitory or apartment. Dormitory residence had the largest percentages for three of the four flu seasons except for 2003-2004 (42%). The 2005-2006 season had the highest percentage of dormitory residence (63%).

Table 2. Participants' Residence by Year

	2003-04	2004-05	2005-06*	2006-07
Dormitory	5 (42%)	7 (58%)	10 (63%)	5 (38.5%)
Apartment	6 (50%)	4 (33%)	2 (13%)	5 (38.5%)
Fraternity/Sorority	0 (0%)	0 (0%)	1 (6%)	1 (8%)
Home	1 (8%)	1 (8%)	2 (13%)	2 (15%)

* 1 unknown

A total of 120 specimens were submitted by seven sites from 2003 to 2007. Of these, 53 (44%) were positive for influenza, 61 (51%) specimens tested negative, and 6 (5%) specimens were unknown for those respiratory viruses identifiable via complete viral culture test. Table 3 shows the breakdown of specimen results by university. Overall, 44% of the submitted specimens were positive for a respiratory virus. The universities had a range of 13% to 88% of submitted specimens testing positive for a respiratory virus.

Table 3. Summary of Specimens Results by University, 2003-2007

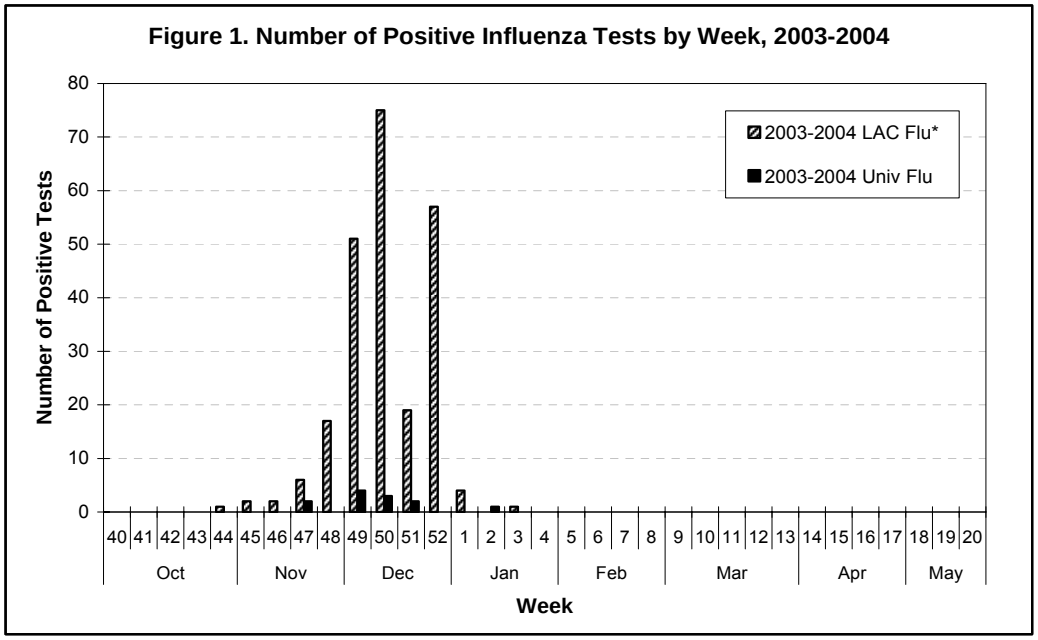
	No. Specimens Submitted	Positive	Negative	Unknown	Percent Positive
University A	5	2	3	0	40%
University B	38	12	24	3	32%
University C	15	2	13	0	13%
University D	8	7	1	0	88%
University E	16	9	6	1	56%
University F	23	14	8	1	61%
University G	15	8	6	1	53%
Total	**120**	**53**	**61**	**6**	**44%**

Table 4 below shows three major strains of influenza identified in this study including influenza A (H1N1 and H1N2), influenza A (H3N2) and influenza B. In both the universities and the U.S. specimens, influenza A (H3N2) had the largest percentage 70.6% and 44.8% respectively. No novel influenza strains were identified during the four seasons.

Table 4. Positive Specimens by Influenza Strain 2003-2007

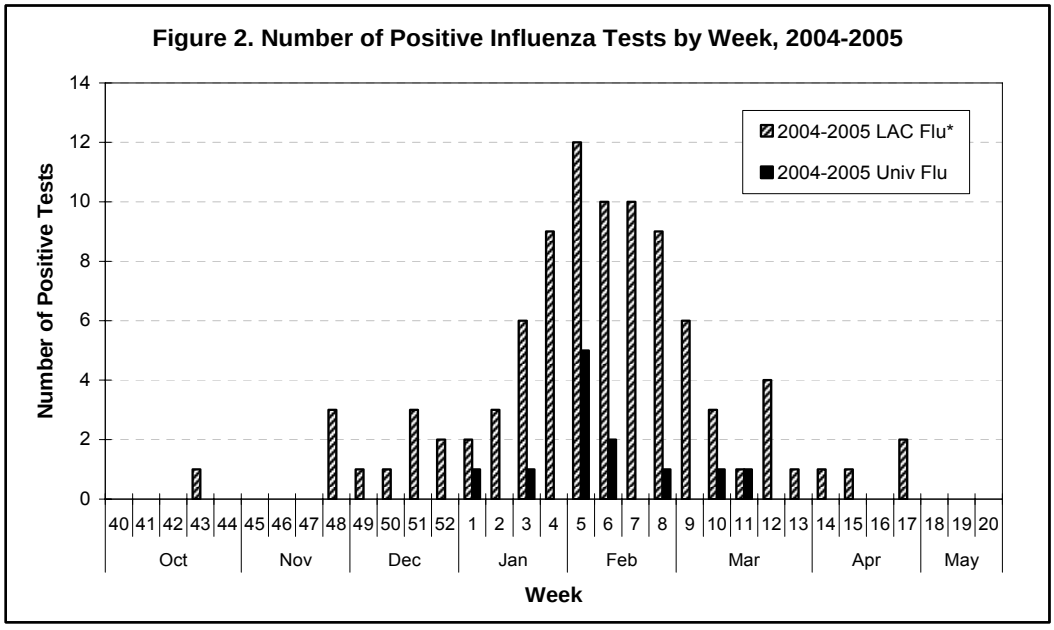
	Universities	United States
Influenza A (H1N1 & H1N2)	6 (11.7%)	14379 (16%)
Influenza A (H3N2)	36 (70.6%)	40252 (44.8%)
Influenza B	9 (17.6%)	13695 (15.2%)
Total	**51**[a]	**89928**[b]

[a] 1 positive case of parainfluenza and rhinovirus not included in universities' total.
[b] 21602 positive cases of Influenza A of unknown strain not shown above are included in U.S. total.



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

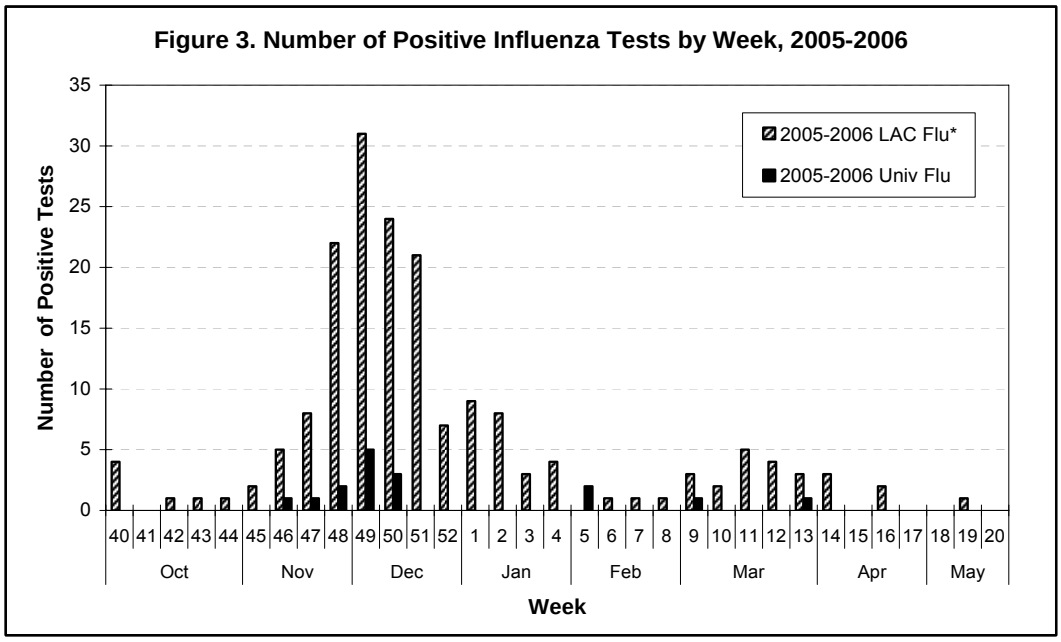
Figure 1 shows the number of positive influenza tests by week for all participating universities (n=12) and LAC (n=235) in 2003-2004. All participating universities had a peak number of positive tests in week 49. The university tests data was consistent with the peak number of positive tests occurring in week 50 reported by LAC. Among the universities the first positive case was detected in week 47 compared to week 44 in LAC.



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

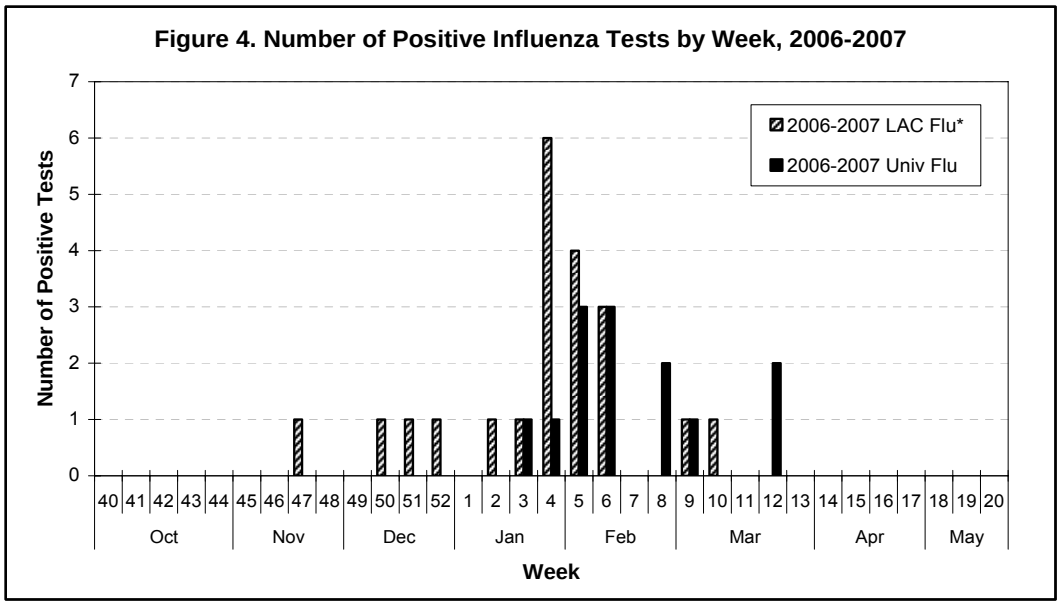
The above graph shows the number of positive influenza tests by week for all participating universities (n=12) and LAC (n=91) in 2004-2005. All participating universities had a peak number of positive tests in week 5. The university tests data was consistent with the peak number of positive tests occurring also in

week 5 reported by LAC. Among the universities the first positive case was detected in week 1 compared to week 43 in LAC.



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

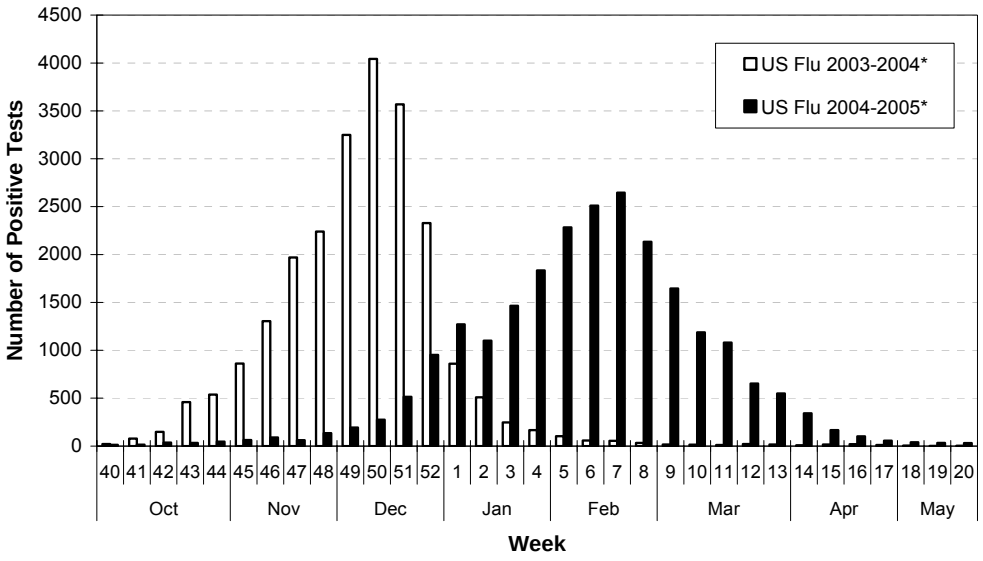
The above graph shows the number of positive influenza tests by week for all participating universities (n=16) and LAC (n=177) in 2005-2006. All participating universities had a peak number of positive tests in week 49. The university tests data was consistent with the peak number of positive tests occurring also in week 49 reported by LAC. Among the universities the first positive case was detected in week 46 in the universities compared to week 40 in LAC.



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

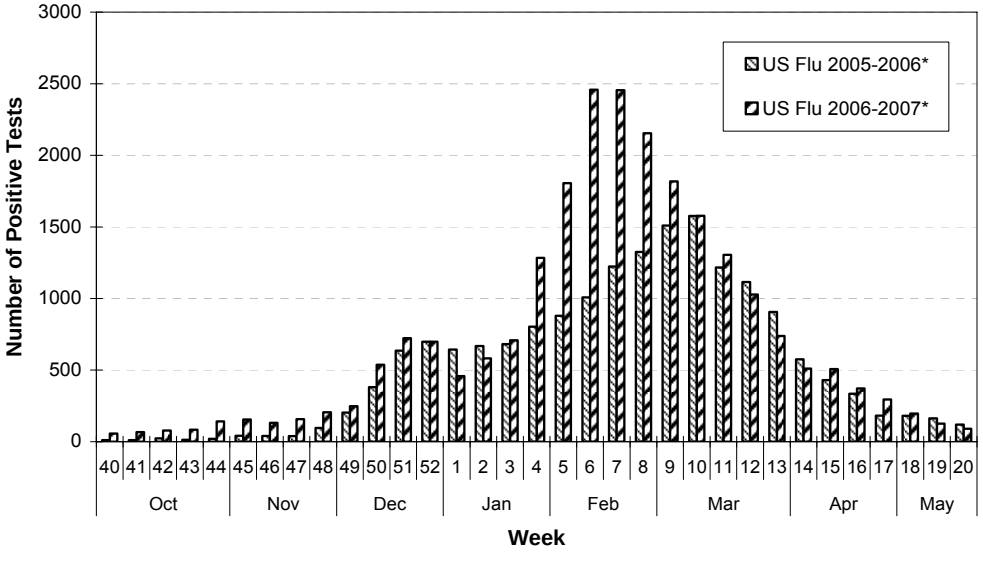
Figure 4 shows the number of positive influenza tests by week for all participating universities (n=13) and LAC (n=21) in 2006-2007. All participating universities had a peak number of positive tests in weeks 5 and 6. The university tests data was consistent with the peak number of positive tests occurring in week 4 reported by LAC. Among the universities the first positive case was detected in week 3 in the universities compared to week 47 in LAC.

Figure 5. Number of Positive Influenza Tests by Week, 2003-2005



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

Figure 6. Number of Positive Influenza Tests by Week, 2005-2007



*Does not include university influenza positive tests; data obtained from 5-7 surveillance hospitals including outpatient clinics and ERs.

The above two graphs (Figures 5 and 6) show the number of positive influenza tests by week for the U.S. from 2003 to 2007. The occurrence of peak number of positive tests at the universities is consistent with both the LAC and U.S. tests data (Table 5). However, in almost all cases positive influenza cases were detected earlier in the U.S. influenza tests compared to the universities and LAC. For all four influenza seasons, positive cases were detected first in week 40 in the U.S. tests (Table 6).

Table 5. Peak Number of Positive Tests by Week

	2003-2004	2004-2005	2005-2006	2006-2007
Universities	Week 49	Week 5	Week 49	Week 5 & 6
Los Angeles County	Week 50	Week 5	Week 49	Week 4
United States	Week 50	Week 7	Week 10	Week 6

Table 6. First Positive Tests by Week

	2003-2004	2004-2005	2005-2006	2006-2007
Universities	Week 47	Week 1	Week 46	Week 3
Los Angeles County	Week 44	Week 43	Week 40	Week 47
United States	Week 40	Week 40	Week 40	Week 40

DISCUSSION

In all four influenza seasons there was a delay in the detection of the first positive influenza case in the participating universities compared to the earlier detection in LAC and U.S. This can be attributed to two factors. First the total number of submitted specimens per year among the universities is much smaller, ranging from 19 to 46. A major limitation of this university study is the small sample size reflected in the low number of specimens submitted each year. Secondly, the positive university cases are a selective and unique population composed mainly of young healthy individuals ages 18 to 21 years. Due to the unique characteristics of the university population it is not a representative sample and was skewed toward a primarily young healthy population. In the LAC, positive cases are composed of individuals of all ages but a vast majority (90%) is young children under age 15 years.

Another weakness of the surveillance project is that students are not randomly selected to participate in the study. Increase in enrollment may occur or students may be selected in response to public fear and increased media attention and reports on influenza trends. Due to these limitations conclusions cannot be drawn from the data and greatly limit the type of statistical analyses that can be done.

In this project the first and fourth objectives to describe the characteristics of respiratory illness in university students and compare student viral surveillance with other respiratory illness surveillance systems were met. The third objective was also met by identifying common respiratory viruses in circulation and existence of no novel strains. The evaluation of the feasibility of university student health centers as sentinel sites for influenza surveillance were not formally done. However, the university participation was overall positive and good. Most universities utilized registered nurses, laboratory and/or administrative support personnel to participate in the project. Communication and understanding of the protocol were an important component of the project as there was some turnover in staff at the universities as well as at ACDC.

Although there were not many students who traveled to other countries during this project, monitoring students may be of significance in detecting novel strain for surveillance and response purposes. Given that the university population frequently travels to and from countries that may expose them to novel viral strains and often lives in close quarters in dormitories, conditions that can facilitate the spread of

respiratory illness, future surveillance efforts can focus specifically on detection of new and emerging strains in this population. Instead of testing throughout the influenza season, increased and active testing can occur following university holidays (spring, summer, and winter breaks) when students have often traveled. Existing resources can be redirected to active and increased testing during these time periods.

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SURVEILLANCE SYSTEMS USED TO MONITOR INFLUENZA ACTIVITY IN LOS ANGELES COUNTY DURING THE 2006-2007 INFLUENZA SEASON

Lindsey Hageman, MPH

BACKGROUND

Influenza is a vaccine-preventable disease, yet it is associated with approximately 36,000 deaths and 200,000 hospitalizations in the United States each year [1]. Since most influenza cases are not reportable in Los Angeles County (LAC) except for severe pediatric influenza and suspect avian influenza, influenza activity is monitored by the Los Angeles County Department of Public Health (LAC DPH) Acute Communicable Disease Control Program (ACDC) using a variety of surveillance methods (Table 1). Healthcare providers, hospitals, and laboratories play an integral role in providing influenza data, including reporting laboratory tests, participating in syndromic surveillance at hospitals, and reporting outbreaks. During the 2006-2007 influenza season, the LAC DPH ACDC used this information to publish a weekly electronic newsletter, *Influenza Watch*, created to inform health professionals of influenza activity in LAC. This report provides a brief summary of how several surveillance systems were used to characterize the 2006-2007 influenza season in LAC.

Table 1. Selected Surveillance Systems Used to Monitor Seasonal Influenza in Los Angeles County

SURVEILLANCE SYSTEM	DESCRIPTION
Positive Influenza Tests*	Seven sentinel laboratories serving L AC healthcare providers and institutions report the number of positive tests indicating influenza or respiratory syncytial virus in a weekly basis.
Severe Pediatric Influenza†	Children <18 years who are hospitalized in the Pediatric Intensive Care Unit (PICU) or die from laboratory confirmed influenza are reportable in LAC.
Emergency Department Visits**	Participating emergency departments (ED) (n=36) throughout LAC provide initial self-reported symptoms of patients presenting to the ED. Influenza-like illness (ILI) is categorized by symptoms such as: fever, congestion, sneezing, sore throat, runny nose, and cough. The proportion of ILI ED visits for all ages and for children < 6 years of age is analyzed weekly.

*** Sentinel Surveillance** – surveillance network where a sample of selected Los Angeles County hospitals and laboratories report cases

† **Population Based Surveillance (passive)**–all LAC hospitals and laboratories are required to report cases

**** Syndromic Surveillance** –surveillance using health-related data (e.g. ILI data) that precede diagnosis and signal a sufficient probability of a case or an outbreak to warrant further public health response

METHODS

A variety of surveillance systems were used to evaluate influenza activity in LAC during the 2006-2007 season, including the number of laboratory confirmed influenza tests, the number of severe pediatric influenza cases, and the percentage of patients presenting to the emergency department (ED) with symptoms of influenza-like illness (ILI) for all ages and for children five years and younger. Data from each surveillance system was analyzed by week, looking for peak activity and correlation with other systems. The influenza surveillance season begins during week 40 (usually October) of the calendar

year, continues through the end of the year (week 52), and ends during week 20 (May) of the following year. See Table 1 for a description of each surveillance system.

RESULTS

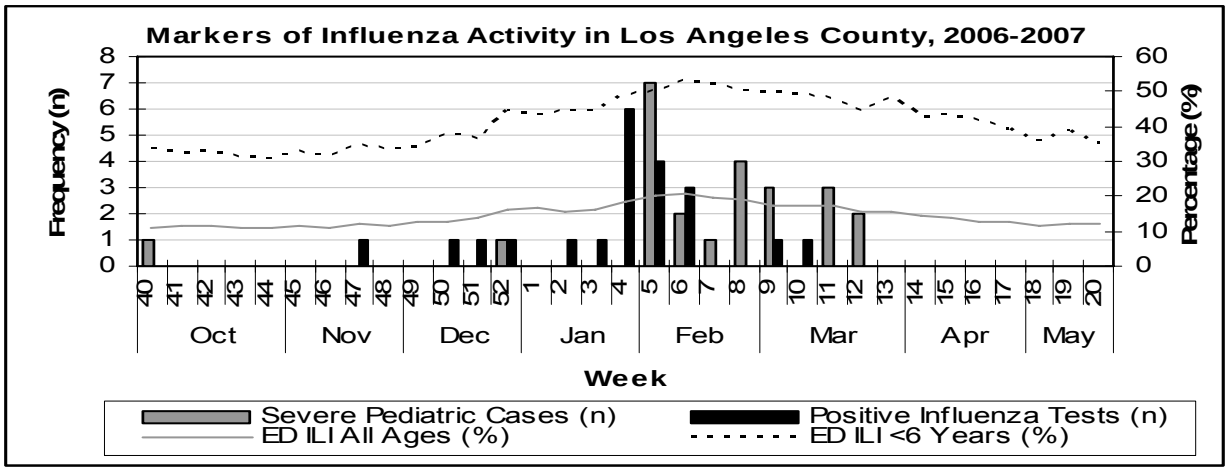
In total, sentinel sites reported 21 cases of laboratory confirmed influenza. The majority of these cases were influenza type A (91%). LAC DPH also received 24 cases of severe pediatric influenza, including one death. Laboratory-confirmed influenza cases (n=6) peaked during week four (Figure), from January 21-27, 2007. In the following week, a peak was observed in the number of severe pediatric influenza cases (n=7).

Syndromic data indicated that ILI in LAC was highest during week six (February) and remained above baseline for several weeks; especially in children aged five years and younger (Figure). ILI ranged from 11% to 21% in all ages and from 31% to 53% in children aged five years and younger.

DISCUSSION

Overall, LAC experienced a mild influenza season, consistent with state and national reports [2,3]. Each surveillance system peaked during a three-week period, from January 21 to February 10, 2007. Interestingly, laboratory-confirmed influenza from sentinel sites and severe pediatric influenza peaked before ED ILI. This was unexpected as other studies have shown that ILI in children precedes laboratory-confirmed influenza [4,5]. However, during weeks four and five, ILI was increasing in LAC (Figure).

Influenza surveillance is challenging, as individual cases are not reportable and the diagnosis is usually determined based on clinical symptoms rather than laboratory diagnosis. In addition, the severity and timing of the influenza season changes with each year. As a result, there is no “gold-standard” method of influenza surveillance and a combination of data sources are used to track influenza in LAC. Although the 2006-2007 influenza season was mild compared to previous years, all surveillance systems detected an increase in activity at approximately the same time. However, each surveillance system has distinct advantages. Laboratory-confirmed influenza verifies the clinical diagnosis and can also provide the type of influenza in circulation. Severe pediatric influenza is useful to monitor the severity of influenza each season and provides information about influenza-associated morbidity and mortality in children. Though less specific, syndromic data offers near real-time data and is useful in identifying trends from year to year. Taken as a whole, each surveillance system provides a picture of influenza activity in LAC.



To learn more about influenza in Los Angeles County, visit our dedicated website: http://lapublichealth.org/acd/Flu_Seasonal.htm. To sign up for *Influenza Watch* send an email to ListServ@ListServ.ladhs.org with SUBSCRIBE FLUWATCH in the **body** of the email, or visit http://lapublichealth.org/acd/Flu_Sea_Surveillance.htm

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NOROVIRUS ASSOCIATED OUTBREAKS, LOS ANGELES COUNTY 2006

Megan Jones, MPH

(To be added in the near future.)

REPTILE ASSOCIATED SALMONELLOSIS 1997 TO 2006

Roshan Reporter, MD, MPH; Curtis Croker, MPH; Rita Bagby, RN, PHN, MSN;
David E. Dassey, MD, MPH; Joan Sturgeon, MS; Laurene Mascola, MD, MPH

BACKGROUND

Salmonella causes up to four million infections each year in the US. While it generally causes a self-limited illness, it may also cause serious sequelae, including death. The main symptoms are diarrhea, abdominal cramps, fever, and malaise after an incubation of usually 16-48 hours (range 6 hours-5 days) and a duration of 3-4 days; although cases may shed for 1-4 months. Foodborne transmission accounts for >95% of US salmonellosis outbreaks, with the most common source being foods of animal origin and the uncommon source being foodhandler contamination.

Reptile-associated salmonellosis (RAS) has been documented in the US since the 1970's [1]. The Los Angeles County Department of Public Health (LAC DPH) received 990 reports of *Salmonella* infections from persons who had direct or indirect contact with reptiles (e.g., turtles, snakes, lizards) from 1997 to 2006, representing 9% of all reported salmonellosis cases. To reduce transmission of *Salmonella* spp. from reptiles to humans in Los Angeles County (LAC), a better understanding of the types of reptiles, populations affected, and trends over time is needed.

METHODS

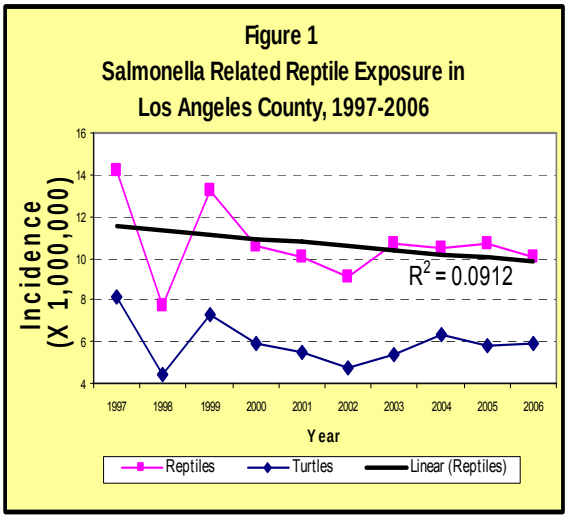
Cases were defined as persons residing in LAC with salmonellosis, from 1997 to 2006, which had direct contact with a reptile or lived or spent time in a place with a reptile in the four days prior to onset.

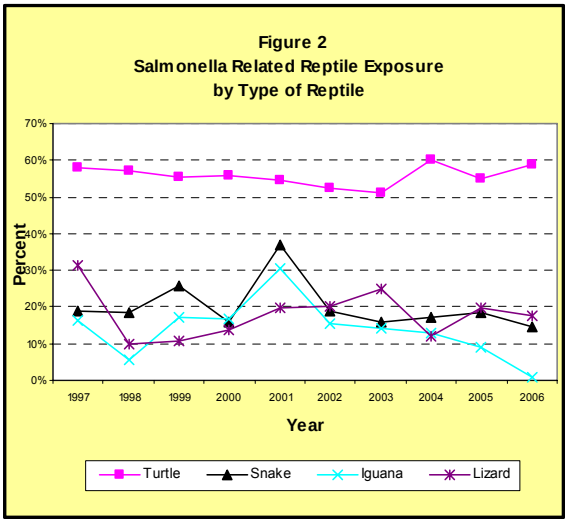
Salmonellosis is passively reported and each case is interviewed to obtain information on clinical illness, risk factors, and demographics information. Risk factor information and demographics are entered into a Microsoft ACCESS database and analyzed using SAS 9.1 software to examine the change in incidence of RAS cases over time. The generalized linear model (GENMOD) procedure was used specifying a Poisson distribution for rare disease events.

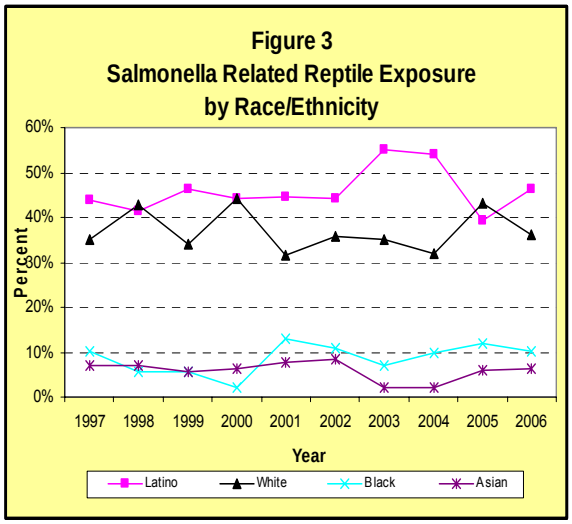
All *Salmonella* isolates submitted to the LAC Public Health Laboratory (PHL), as required by state regulation, were confirmed and serotyping was performed. Stools, skin swabs, or environmental swabs from reptiles associated with human cases during 2000 to 2006 were submitted for culture and serotyping when available.

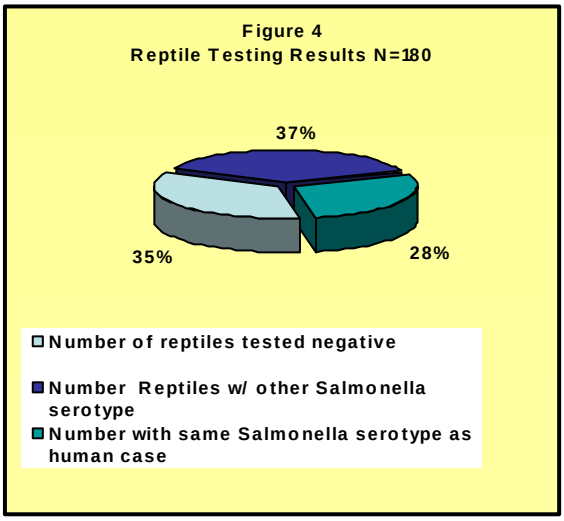
RESULTS

Overall, 990 cases (10%) of salmonellosis reported to LAC DPH were reptile-associated. There was no statistically significant change in the annual incidence rate of RAS cases from 1997 to 2006 (p=0.85) (average 10.7 per 1,000,000: range 7.7-14.1) (Figure 1). Turtles, mostly red-eared sliders, were the most commonly reported reptile (overall average 56% of cases annually, range 51-60%). Iguanas represented 30% of cases in 2001 but decreased to 1% of cases in 2006 (Figure 2). Most RAS cases were Latino (46%) and white (37%), while few cases were black (9%) or Asian (6%) (Figure 3). The mean case age, 16 years, has changed little over time (range 14-21). Most cases were children 10 years of age and under (58.5%) and younger than five years old (38.6%). From 1998 to 2006, 17.1% of RAS were hospitalized, with an estimated cost of $199,568 per year, based on the USDA Foodborne Illness Cost Calculator: *Salmonella* [8].









Reptile culture was obtained for 27% of RAS during 2000-2006; of 180 cultures, 65% were positive for *Salmonella* spp. and human and reptile isolates were the same serotype in 28% (Figure 4). Human cases were deemed likely to be reptile associated even when the pet reptile cultures were negative if the human suffered from a reptile-associated serotype.

DISCUSSION

Nationally, 74,000 cases of RAS are estimated to occur yearly, accounting for 6% of total salmonellosis cases. The rate of 10% in LAC is higher, possibly because reptiles are more popular as pets in LAC than in other parts of the US. *Salmonella*, often multiple serotypes, are present in up to 90% of reptiles, but may shed intermittently, especially when the reptiles are stressed.

Turtles are commonly kept in early childhood education settings, such as pre-schools and day care facilities, where young children may have contact with them [2]. In infants and young children, *Salmonella* infection may result in invasive disease, thus they should have no contact with reptiles. In 1975, federal and state laws were enacted to prevent salmonellosis from small turtles, and recently the FDA has re-issued a warning to the public regarding the risk of salmonellosis from these pets [3, 7].

Families with limited resources, crowded living quarters, with no knowledge of RAS are likely to find small turtles appealing as pets for their children [4]. Recent local cases have tended to reside in apartments where small turtles may be considered affordable, easy pets for children who may put hands or even the

turtle itself into their mouths. Despite the federal ban on small (less than four inches or 10 cm) turtles, they are routinely sold in swap meets, street markets, and outdoor markets in LAC [5, 6].

LIMITATIONS

Interviewees may not have recalled other risk factors for salmonellosis, such as high risk foods or travel. A few cases were likely foodborne rather than reptile-associated, based on serotype. Untimely interview of cases, sometimes weeks after the incubation period may lead to recall bias. Late stool collection from reptiles reduced successful culture and many reptiles were no longer available for testing at the time of the case interview.

CONCLUSIONS

The LAC incidence of RAS has remained unchanged for 10 years. Turtles are the most commonly reported reptile; the majority being the small red-eared sliders. Despite warnings in press releases and pamphlets, as well as periodic sweeps of areas where reptiles are sold, turtles remain popular pets and many persons are not aware of the salmonellosis risk or the laws that govern their sale. Turtles are a source of preventable *Salmonella* infection. We recommend further research into knowledge, attitudes, and behavior of people who buy these reptiles, sources of these reptiles, better education of reptile sellers and buyers, and increased enforcement of legislation regulating turtle sales to reduce RAS.

REPTILE SAFETY TIPS

- Always wash hands thoroughly with soap and water after handling reptiles or their cages and equipment
- Owners and potential purchasers of reptiles should be educated about the risk of acquiring salmonellosis from these animals
- Persons at increased risk for infection, such as children less than five years old and immune compromised persons, should avoid both direct and indirect contact with reptiles
- Reptiles are inappropriate pets for households with children less than five years old and immune compromised persons. If expecting a new child, remove pet reptiles from the home before the infant arrives and thoroughly clean the home
- Reptiles should not be kept in child daycare centers

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THE UNUSUAL DEATH SURVEILLANCE SYSTEM: REAL TIME MONITORING OF DEATHS USING CORONER'S DATA, 2003 – 2006.

Ashley Peterson, MPH and Dawn Terashita, MD, MPH

BACKGROUND

Developed in 2001 by the collaboration between Los Angeles County Departments of Coroner (DC) and Public Health Acute Communicable Disease Control (ACDC), the Unusual Death Surveillance System (UDSS) functions to identify possible acts of bioterrorism and emerging infectious disease events in Los Angeles County (LAC). Funding from the Centers for Disease Control and Prevention (CDC) Emergency Preparedness and Response Cooperative Agreement allows the two departments to collaborate in real time review of coroner case data. UDSS uses tandem manual and computer aided reviews of coroner case data to identify reportable disease death events which would not otherwise have been detected.

METHODS

The California Government Code (Section 27491) defines which of the approximately 60,000 deaths in LAC each year will be surveyed by UDSS. This code defines 14 situations in which the DC has jurisdiction over a death in LAC (Table 1) and results in approximately 18,000 coroner's cases per year. The definitions most important to the purpose of UDSS are:

1. any homicide, suicide, or accidental death, or any case in which the cause or mode of death cannot be determined
2. sudden or unusual death
3. deaths due to a possible diagnosed or undiagnosed contagious disease constituting a public health hazard

Of the 18,000 coroner's cases each year, approximately 8,000 receive an investigation and/or autopsy and it is on these 8,000 cases which UDSS is focused.

To search for deaths of interest, ACDC obtains from the DC a 42-variable dataset for each coroner case. The variables contain demographic information such as age, sex and race, residential information, information concerning the circumstances of the death (e.g., date, time, location), information on who reported the death and when, and most importantly, the investigator or first responder's description of the death scene. Causes of death are also included when they become available.

This data file is sent to ACDC on a daily basis which includes all cases from the previous day. Deaths of interest are selected in two ways. The first approach, and the most time intensive, involves two public health nurses, the Coroner's Liaison Public Health Nurse (LPHN) funded by the CDC cooperative agreement and their supervisor, who reviews the entire file manually. The second approach uses the statistical software package, SAS, to search for specific character strings within the death event description fields.

Table 1. Coroner Case Definitions

The jurisdiction of the coroners in California is described in the California *Government Code* (Section 27491). The following list outlines cases that the coroner is responsible for.

1. **Any homicide, suicide, or accidental death, or any case in which the cause or mode of death cannot be determined.** An injury causing death may be either old or new.
2. **Therapeutic misadventures.** A patient who dies within 24 hours of surgery or anesthesia should be reported to the coroner because of the possibility of therapeutic misadventure. Patients who die as a consequence of therapy, such as those with drug reactions, or patients who die unexpectedly during minor procedures, should also be reported.
3. **Sudden or unusual death.** If the attending physician can certify the cause of death as natural disease, the case need not be reported. However, all cases of sudden unexpected death in infants (under 1-year of age) are the coroner's cases.
4. **Any death related to self-induced or criminal abortion.**
5. **Deaths related to drug addiction or drug overdose.** A death from consequences of drug use, such as acquired immunodeficiency syndrome, endocarditis in an intravenous drug user, or death from acute alcohol poisoning is a coroner's case; however death from consequences of chronic alcoholism is not.
6. **Aspiration.** Depending on the underlying cause of the aspiration, deaths from terminal aspiration of gastric contents or aspiration pneumonia may be coroner's cases. Deaths from choking on food are coroner's cases.
7. **Deaths while in custody or under sentence.** Any person who dies in jail or while under arrest is a coroner's case; this includes deaths during involuntary 72 hour or 14 day psychiatric hospitalization.
8. **Deaths due to a possible undiagnosed contagious disease constituting a public health hazard.** Contagious diseases constituting a public health hazard are those diseases which are required to be reported to the health department. Cases where the contagious disease has been diagnosed need **not** be reported to the coroner.
9. **Deaths from occupational disease or occupational hazard.** Deaths which occur while at work should generally be reported to the coroner. A death due to consequences of an occupational disease, such as asbestosis, is an accidental death and should be reported.
10. **Deaths in state hospitals.** Any death which occurs in a hospital operated by the State Department of Mental Health or the State Department of Developmental Services is a coroner's case.
11. **Deaths due to criminal acts of another.** When there are reasonable grounds to suspect the death was due to the criminal acts of another person, the case should be reported.
12. **Deaths involving rape or sodomy.**
13. **Unattended fetal deaths.**
14. **Human remains discovered outside a dedicated cemetery.**

The syndromic SAS algorithm is complex and continuously evolving. Searching within the death event description fields, the algorithm will classify each case into one of seven syndrome categories if a character string is recognized and can assign up to two syndrome categories per case. Deaths containing recognized character strings are printed in a report which is then manually reviewed by epidemiologists, public health nurses, and physicians within ACDC. A summary of some of the algorithm's character strings and evolutions thereof can be found in Table 2.

Table 2. Examples of Character Strings Recognized by the SAS Syndromic Algorithm and Their Associated Syndrome Categories

Respiratory Syndrome	Fever Syndrome	Rash Syndrome	Neurological Syndrome
•*SARS*	•*Fever*	•*Rash* WITHOUT:	•*Enceph*
•*Flu*	•*Temp* WITHOUT:	• *Trash*	•*Seizure*
•*Respiratory*	•*Attempt*	• *Thrash*	•*Meningi*
•*Pneumon*		• *Crash*	•*West Nile*
•*Cough*	GI Syndrome	•*Necrotizing fa*	•*Guill*
•*SOB*	•*Naus*		
•*Breath* WITH:	•*Vomit*	Disease Specific Syndromes	Death on an Airplane
•*Difficulty*	•*Diar*	•*Tuberculosis*	•*LAX*
•*Short of*	•*Diah*	•*HIV*	•*Airplane*
•*Shortness of*	•*Food Poisoning*	•*AIDS*	•*Airport*

Deaths selected from the SAS report are combined with the results from the manual review creating a list of all deaths of interest to be followed up by the LPHN.

ACDC can either actively or passively perform follow up. Active follow up is reserved for those cases of particular interest and require immediate action, including deaths on an airplane and any cases in which the death event description field mentions any mandatory reportable disease. ACDC notifies the appropriate public health program (e.g., Tuberculosis Control, HIV Epidemiology) or follows up internally for diseases such as hepatitis or meningitis. LAC's electronic infectious disease report database is also consulted to determine if the disease event has already been reported. The DC may also be contacted directly to determine if an investigation and autopsy have been ordered or are underway, and, if they are already complete, the records are requested and reviewed. On rare occasions, ACDC may contact the previous provider or hospital if the death occurred in a hospital to gather additional information.

Passive follow up is much less time intensive and is used for the majority of the coroner's cases of interest. In these instances, ACDC waits for the final cause of death to be submitted by the DC. On a weekly basis, a data file from the DC containing all cases in the previous week is sent to ACDC and used to update the previous week's cases. Additionally, on a monthly basis, a data file from the DC containing all cases opened in the previous six months is sent to ACDC and used to update the previous six month's follow-up cases. The monthly files are also subject to a second reportable disease SAS algorithm searching within the final cause of death field. This program also uses character string recognition; however, it only searches for words from a list of all reportable diseases. Any cases with infectious disease final causes of death, not already selected for follow up, are added to the follow-up cases. Upon receipt of the final cause of death for each followed case, if it is infectious disease related, ACDC forwards the case findings to the appropriate public health program for additional follow up and/or standard investigation.

RESULTS

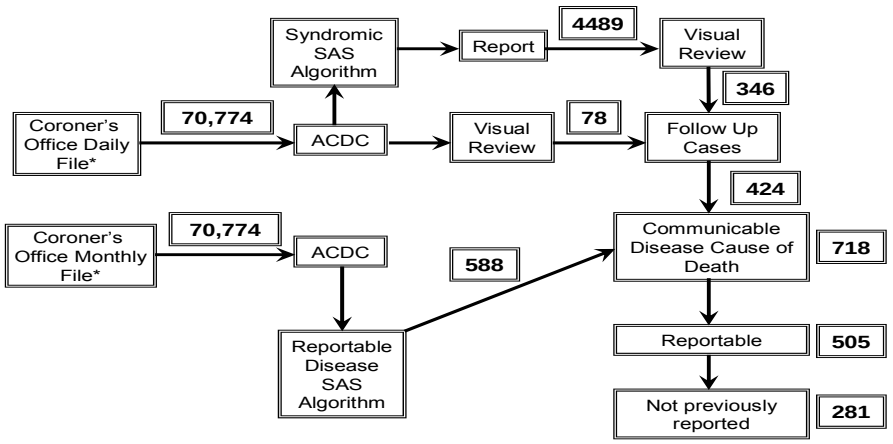
To date, there have been no events of bioterrorism or emerging infectious disease threats to be identified by UDSS. However, between 2003 and 2006, the DC sent ACDC a total of 70,774 case reports; 32,444 of which received an investigation and/or autopsy. The SAS algorithm generated reports with a total of 4,489 cases. Upon visual inspection of the SAS reports, ACDC selected 346 cases for follow up. Seventy-eight cases were not picked up by SAS but were selected by visual inspection of the raw data, giving a total of 424 follow-up cases or approximately 100 each year. Once final causes of death were

supplied to ACDC by the DC, 130 of the follow-up cases were determined to have infectious disease causes of death. Additionally, ACDC identified 588 coroner's cases which had an infectious disease cause of death from the final cause of death field alone; yielding a total of 718 coroner's cases with infectious disease causes of death. Of these, 505 were reportable conditions and 281 of the 505 (56%) would not otherwise have been reported to the Department of Public Health (Figure 1). Most of the 281 reportable conditions were hepatitis and necrotizing fasciitis; however UDSS did capture some more unusual deaths including several cases of West Nile virus and a case of rabies (Table 3).

Table 3. Number and Types of Cases of Reportable Infectious Disease Captured Via UDSS From 2003 to 2006

Reportable Disease	Number Captured
Coccidioidomycosis	1
Coccidioidomycosis – AIDS	1
Coccidioidomycosis - Meningitis	1
Cysticercosis	4
Encephalitis	14
Encephalitis – AIDS	1
Encephalitis – Measles	1
Haemophilus influenzae	4
Hantavirus	1
Hepatitis	118
Kawasaki Syndrome	2
Meningitis	26
Meningitis – AIDS	4
Meningitis – HIV	1
Meningitis – *S. pneumoniae*	4
Meningitis – Tuberculosis	1
Necrotizing Fasciitis	34
Necrotizing Fasciitis - *S. pneumoniae*	2
Invasive Pneumococcal Disease	1
Rabies	1
Rubella	1
Shigellosis	1
Streptococcus (IGAS and *S. pneumoniae*, Invasive)	49
Toxoplasmosis	5
Toxoplasmosis – AIDS	2
West Nile Virus	1
Total	281

Figure 1. A Diagram of the Flow of Data Through UDSS as Well as the Amount of Data UDSS Processes



*Total Case reported from DC to ACDC. 2003 – 2006

DISCUSSION

As a bioterrorism event detection tool, UDSS, is difficult to assess – no such events have occurred in Los Angeles County – however, this surveillance system has proved useful in other ways. UDSS successfully captures reportable infectious disease death events along with enough information to allow follow up and reporting. For some diseases such as viral hepatitis, the annual number of reported cases will not be significantly influenced by the additional cases captured via UDSS. However, UDSS has demonstrated its value by bringing to the health department's attention several more unusual cases such as Kawasaki Syndrome, cysticercosis and hantavirus.

UDSS does have limitations. ACDC can only review those deaths which become coroner's cases and so misses almost 2/3 of all Los Angeles County deaths each year. However, the several broad definitions of coroner's cases listed earlier do include exactly the types of deaths UDSS is intended to survey. ACDC also relies completely on the coroner investigators' initial descriptions of the decedent and the circumstances of the death in identifying cases for follow up. These descriptions are predominantly helpful in eliminating deaths obviously not infectious in nature. For example, if there is mention of drug paraphernalia at a scene or witnesses describing the decedent to be alcoholic, non-infectious disease causes of death are more likely. However, in some instances, there is not much of a case history available or the description is limited, making ACDC's assessment difficult. Additionally, the timeliness of the passive follow-up system depends upon the speed of the DC to complete its investigation and assign a final cause of death. With some cases requiring more than a month to receive a final cause of death, the passive follow-up system is not timely.

What the system is possibly most important for, however, is able to be displayed in a table or graph and that is the enhanced relationship formed between the DC and ACDC. Due to the requisite contact between the ACDC LPHN and the DC in following up cases of interest, there now exists an open line of communication between these two departments. Staff at ACDC have clear contacts with DC and have built relationships with DC staff allowing for immediate and reliable flow of information. With established open communication in place, in the event of a bioterrorist attack or emerging infectious disease event, the astute DC medical investigator or examiner will be able to easily contact an appropriate member of ACDC.

Additionally, ACDC staff working on UDSS has become familiar with the procedures and case flow of the DC, learning specifically how cases are presented to the DC, how they move through the DC, what occurs during investigations and autopsies, and finally, how they are released from the DC. In the event of a public health emergency, ACDC will work more efficiently and effectively with the DC due to a basic understanding of the DC's operational structure.

The next steps for this system include utilizing retrospective knowledge of an actual public health infectious disease event to establish the sensitivity and specificity of the algorithms. In the absence of such an actual event, retrospective knowledge of a natural disaster or other public health event may be used as a proxy. The data collected by UDSS are also useful in other more data driven analyses. By using the demographic variables in the datasets to analyze infectious disease related death trends in LAC, ACDC will enhance its understanding of the impact of infectious disease on LAC residents.

USE OF SYNDROMIC SURVEILLANCE IN MONITORING HEALTH EFFECTS OF SOUTHERN CALIFORNIA WILDFIRES IN OCTOBER 2007

Akbar Sharip, MPH; Emily Kajita, MPH; Bessie Hwang, MD, MPH

INTRODUCTION

October 20, 2007 marked the beginning of a series of wildfires in Southern California that destroyed thousands of homes within a few days [1]. Stretching from Santa Barbara County to the U.S. Mexico border, the extent of the fires almost paralleled that of the October 2003 fires, which were considered to be the biggest in California's history. While causing the sky to become visibly murky even hundreds of miles away, the increased concentration of smoke, ash, and dust particles caused the air quality across Southern California to deteriorate as well [2]. Most areas of Los Angeles experienced unhealthy-sensitive air (Air Quality Index (AQI) of 101 to 150), whereas areas close to the wildfire experienced unhealthy air (AQI of 150 to 200) [3]. Air pollution is a major cause of respiratory stress and is especially harmful to the elderly, people with lung or heart problems, and children, whose lungs are still developing. On October 22, 2007, Los Angeles County (LAC) Department of Public Health Acute Communicable Disease Control Program's (ACDC) syndromic surveillance team was requested to rapidly assess the health impacts caused by the wildfires. Within a few hours, after making minor modifications to pre-existing syndromes, an automatic system to monitor respiratory syndromes related to poor air quality was implemented as an addition to the syndromic surveillance system. Daily analysis results were sent to ACDC and other stakeholders for one week, until a declaration of improved air quality was made for LAC. Air quality was reported to have returned to normal levels in the first week of November [4].

OBJECTIVE

Determine if the poor air quality resulting from the wildfires could be monitored in the general population by respiratory symptoms in the participating Emergency Departments (EDs).

METHOD

Using ED admission data from 33 LAC EDs, overall respiratory illness visits (respiratory syndrome) and subcategories of the respiratory syndrome category were analyzed using ACDC's syndromic surveillance system. Since previous studies indicate patients with asthma and chronic obstructive lung disease (COPD) are most sensitive to respiratory stress [5,6,7], a new asthma syndrome category was created and utilized as the primary focus of analysis. This category included patients with chief complaints, diagnosis and ICD-9 codes such as "asthma", "COPD", "wheezing", and "breathing difficulties." The Centers for Disease Control and Prevention (CDC) Early Aberration Reporting System (EARS) [8] was utilized for calculating and analyzing daily counts and rates (per 1000) of ED visits. A threshold based on the cumulative sum (CUSUM) algorithm with three standard deviations was used for detecting significant aberrations from normal levels.

Analysis was extended until the first week of November to further quantify the change in ED visit frequency resulting from the poor air quality. This included using SatScan [9] to analyze spatial-temporal clusters as well as purely temporal aberrations. In addition, counts and rates of asthma-related ED visits were compared one week before (October 14-20) and after (October 21-27) the fires using *t* tests.

RESULTS

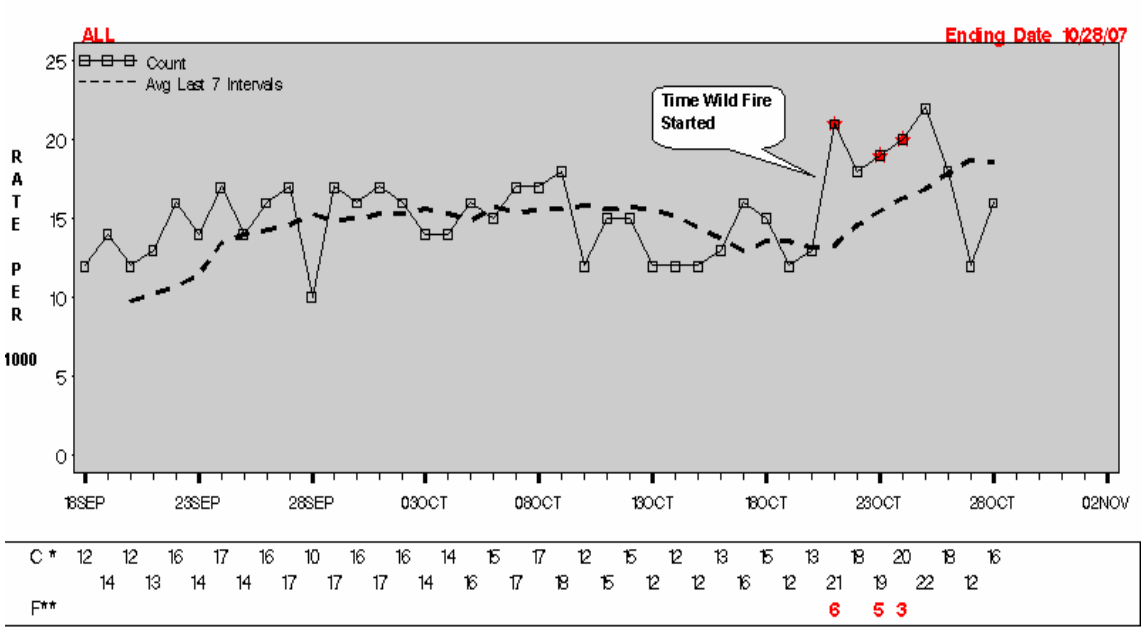
Upon reviewing 152,028 ED visits, the overall number of daily ED visits did not change significantly during the wildfire period (p=.0.95). However, both respiratory (overall) and asthma syndrome visits significantly increased during the fire. Overall respiratory syndrome visits significantly increased and generated three consecutive CUSUM signals from October 22 to October 25. Both daily counts and rates of asthma syndrome visits significantly increased, and three CUSUM signals were generated during October 21 to 24 as well (Figure 1). Asthma syndrome trends returned to the baseline levels one week

after the fire started, which was the same time that the air quality was reported to have improved. Retrospective space-time scan statistics did not detect significant hot spots during the fire (p=0.86). However, retrospective purely temporal scan statistics showed a very significant increase (p=0.001) in asthma syndrome visits between October 21 to 25. The average asthma syndrome related daily ED visits for the week changed from 69 in the week before the fires began, to 87 during the week after the fires began (p=0.0115). Similarly, average rates of asthma syndrome related visits changed from 1.4% (14 per 1000) to 1.8 % (18 per 1000) (p=0.01).

CONCLUSIONS

The syndromic surveillance system results support that wildfire induced air pollution caused a temporary increase in respiratory and asthma related ED visits. While the number of overall ED visits remained relatively stable, the system quickly detected aberrations in respiratory illness related visits. This information provided certain evidence of wildfire induced health impacts on the general population, and it offered guidance towards LAC DPH's decision to declare a county-wide smoke advisory. These results demonstrate the utility of syndromic surveillance in assessing the health-related impacts of natural disasters in near real-time. Despite the limitations in this study, which include potential syndrome misclassification due to the lack of definitive diagnosis data for most of the EDs, the possibilities for using syndromic surveillance system for objectives, beyond the early warning of infectious diseases or bioterrorism outbreaks, is promising.

Figure 1. Asthma Syndrome Rate Trend from September 18 to October 28, 2007



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THE HISTORY OF TULAREMIA IN LOS ANGELES COUNTY

Curtis Croker, MPH and Roshan Reporter, MD, MPH

BACKGROUND

Tularemia is a rare, but potentially serious illness that occurs naturally in the United States (US) [1]. The disease was first described in 1911 in Tulare County, California, but since then cases have been reported from all states except Hawaii and from many countries in the Northern Hemisphere [2,3,4]. The number of reported cases in the US, peaked in 1939 with 2291 cases, but has steadily fallen to under 200 cases per year since the 1960s. Most cases are reported from the states of Arkansas, Missouri, and Oklahoma. Seventy-three cases have been reported from Los Angeles County (LAC) since the 1930s, representing <1% of cases reported in the US.

Tularemia is caused by the bacterium, *Francisella tularensis,* found in many animals, especially rabbits, hares, and rodents. A person may develop tularemia after handling infected animal carcasses, exposure to the bite of an infected insect, eating or drinking contaminated food or water, or inhaling the organism. Symptoms usually appear three to five days after exposure and the onset is often sudden, influenza-like, with high fever, chills, fatigue, body aches, headaches, and nausea [4]. Other symptoms such as ulcers on the skin or mouth, swollen and painful lymph glands, ocular swelling and pain, and throat irritation, depend on route of exposure (laceration, ingestion, or ocular exposure). Inhalation of the bacteria can lead to the more serious respiratory form of the illness, where persons may experience breathing difficulty that can lead to respiratory failure. The case fatality rate for the untreated respiratory form is 5-15% with the more virulent subspecies (Jellison Type A) [5]. Tularemia is not known to be spread from person to person.

Even though tularemia is a rare illness, it is a very infectious, aerosolizable organism, and only a small number of bacteria (10-50 organisms) can cause disease. *F. tularensis* is classified as a category A bioterrorism agent by the Centers for Disease Control and Prevention (CDC). If used as a weapon, the bacteria would likely be made airborne for exposure by inhalation. In early 2007 the bacteria was detected during routine environmental sampling for airborne contaminates by the federal government. No recent human cases had been identified in LAC and the detection of the bacteria was not perceived as threat to the public; more likely due to a natural source in the environment. As a result of this event it was determined that a better understanding of the history of tularemia in LAC was needed.

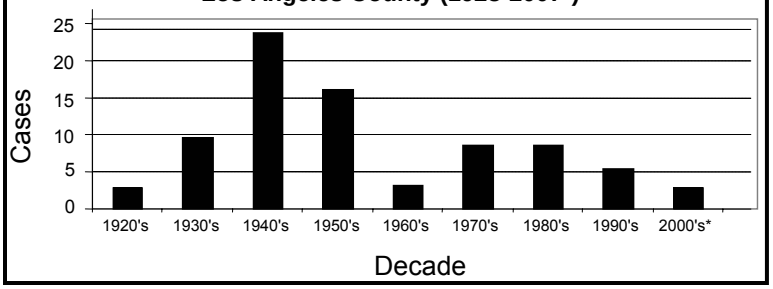
METHODS

Morbidity reports were reviewed for annual case counts of reported tularemia in LAC from the first recorded case through December 31, 2006. Epidemiological case history forms were reviewed from January 1, 1968 through December 31, 2006 for demographics, types of exposure, exposure locations, disease characteristics, and disease trends. County animal testing records were reviewed to determine the prevalence of animals infected with the disease.

RESULTS

In LAC there were 73 cases of tularemia reported to the health department from 1928 to 2007 [3] (Figure 1). A bulk of the cases occurred in the 1940s, with 22 cases (30%) reported in that decade. Four deaths were reported (5% mortality), with the last death occurring in 1953.

Figure 1.
Reported Cases of Human Tularemia,
Los Angeles County (1928-2007*)



Demographics for tularemia cases reported from 1968 to 2007 in LAC are shown in Table 1 (N=24). A majority of cases are male (75%), white (68%), and between the ages of 20-59 years (62%) with an average age of 40 years. Cases resided in all Service Planning Areas (SPAs) except SPA 1 (Antelope Valley), with SPA 8 (South Bay) reporting the most cases (25%, 6) (data not shown).

Risk factor information was available for 20 of the 24 cases that were reported from 1968 through 2006 (82%) (Table 2). Most cases reported exposures occurring outside of LAC (65%). The most common exposure reported was skinning rabbits (45%, n=9), followed by insect bites (25%, n=5). Rabbit exposures included jackrabbit (20%, n=4), cottontail (10%, n=2), and unspecified types (15%, n=3). Arthropods exposure included ticks (5%, n=1), deerfly (5%, n=1), and unspecified types (15%, n=3). Outside exposures included landscaping (10%, n=2), gardening (5%, n=1), and swimming (5%, n=1).

Table 1. Tularemia Demographics
Los Angeles County
1968-2007, N=24

Demographic	%	n
Gender		
Male	**75**	18
Female	25	6
Race [N=22]		
White	**68**	15
Black	18	4
Latino	14	3
API	0	0
Age		
0-19	17	4
20-39	29	7
40-59	33	8
60+	21	5
	Mean	**Range**
Mean Age (years)	40	5-80

Note: Main frame data used for 1968-1992, AVIS data used for 1992-1997, VCMR data used 1997-2008

Table 2. Reported Exposure of Tularemia Cases
Los Angeles County,
1968-2006, N=20

	%	n
Reported Exposure	**100**	**20**
Rabbit	45	9
Arthropod	25	5
Outside Activity	20	4
Other	10	2
LAC Reported Exposure	35	7
Rabbit	57	4
Arthropod	0	0
Outside Activity	43	3
LAC Exposure Location		
SPA 5	10	2
SPA 1	10	2
SPA 3	5	1
Unspecified	5	1
Outside LAC Exposure	65	13
In CA	30	6
Outside CA	35	7

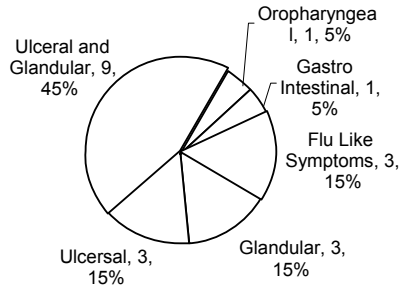
Seven cases reported having an exposure in LAC (35%). Cities in LAC where exposures occurred include Diamond Bar (1972, rabbit), Lancaster (1968, 1982, rabbit), Culver City (1987, rabbit), Encino (1997, animal bite), Whittier (2003, gardening), and one other undetermined location in Los Angeles. No insect exposures were reported.

Seventy-five percent of cases (n=15) reported either ulceration (12) or glandular swelling (12). All these cases reported either skinning a rabbit (11/15), insect bite (4/15), or were exposed to an animal bite (1/15) (Figure 2). One gastrointestinal case was associated with eating undercooked rabbit meat and one oropharyngeal infection was associated with drinking water from a lake in Nevada. Three cases reported flu-like symptoms and were more associated with outdoor activities, such as gardening or landscaping.

The last reported death from tularemia was reported in a 62-year old man in 1953. After camping in Palm Springs he was admitted to hospital with non-productive cough, fever, confusion, and progressing to pneumonia with a fever of 104 F after four days. He was treated with penicillin on the 6th day, but continued to decompensate, developing small red spots on his chest before expiring on the 11th day after onset of symptoms. Three additional deaths were reported from 1931 to 1953.

Very little animal testing data for LAC is available. In 2006, 21 indigenous rodents were tested in City of Santa Clarita (kangaroo rat, woodrat, rabbit, California ground squirrel, California vole). Test results for all 21 rodents were negative for *F. tularensis* [6]. These tests were initiated after a gibbon, held at the Gibbon Conservation Center in Santa Clarita, sero-converted, and tested positive for *F. tularensis.* Another study for the presence of *F. tularensis* antibodies in animal populations in Northern California, in the 1970's, found that black tailed jack rabbits (2%, 1/51), black tailed deer (3%, 1/33), and California ground squirrels (14%, 4/29) tested positive for antibodies. In addition, *F. tularensis* was isolated from 1 of 53 tick pools that were collected from the environment and tested (*D. occidentalis*) [9].

Figure 2.
Tularemia Symptoms
LAC, 1968-2007 (N=24)



DISCUSSION

The gender distribution of reported cases of tularemia in LAC, from 1968 to 2006, resembled that found in an earlier study of California cases, from 1927-1951 [7] (73% versus 75% male). Age distributions for both studies revealed a broad distribution of cases. Exposures described in this earlier study revealed a higher prevalence of rabbit exposures than that found in our study (81% versus 45%) and fewer insect exposures (9% versus 25%) [8]. Both studies found more exposures related to jack rabbits (18% and 20%) than cottontail (5% and 10%).

The earlier California study found occupational exposure to tularemia, "not to play a significant part in the epidemiology of the disease in California". However, our study found that 15% of cases appear to be related to occupational exposure, such as landscaping. A recent study conducted in Martha's Vineyard found that landscapers were nine times more likely to be sero-positive for *F. tularensis* as compared to the general population, with a sero-prevelance of over 9% [9]. These later occupational and recreational exposures to tularemia may reflect a change in the disease risk factors or in improving disease knowledge that facilitates identification of cases that may have earlier been overlooked.

The results of this study are limited by the use of retrospective records, missing records, underreporting of cases, and the possible under diagnosis of earlier environmental exposures.

CONCLUSION

Tularemia in LAC remains a very rare disease, and most cases reported from 1968 to 2006 acquired the disease outside of the County. Epidemiological evidence supports a locally acquired infection in seven of these cases, with exposures occurring in various regions in the County. Later cases reveal a higher prevalence of exposures related to occupations and recreational activities. These occupational exposures such as landscaping and environmental exposure to untreated water sources may represent a change in the risk factors for naturally acquired disease from the more classical exposure to an infected rabbit carcass.

RECOMENDATIONS

Epidemiologists performing surveillance for bioterrorism events should consider natural exposures, such as rabbits or outdoor activities when evaluating cases, before presuming exposure due to a bioterrorism attack.

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VARICELLA ACTIVE SURVEILLANCE PROJECT (VASP) 2006 SUMMARY ANTELOPE VALLEY, CALIFORNIA

Rachel Civen, MD, MPH and Tina Carbajal, BA

BACKGROUND

While usually a mild childhood disease, varicella tends to be more severe in adults, neonates, and immuno-compromised persons with complications that may include secondary skin infections, pneumonia, encephalitis, and rarely death. Prior to 1995, about four-million cases of varicella occurred annually in the United States (US). Of these cases, there were approximately 11,000 hospitalizations and 100 deaths (CDC, unpublished data, 1999). When the varicella vaccine was approved for use in the US in 1995, the Los Angeles County (LAC) Department of Public Health (DPH) and the Center for Disease Control and Prevention (CDC) entered into a cooperative agreement to establish active surveillance for varicella in Antelope Valley, California. The Varicella Active Surveillance Project (VASP) has collected baseline data on varicella incidence, varicella outbreaks, and varicella vaccine coverage by age group since 1995. In 2000, surveillance was enhanced with the addition of herpes zoster (HZ). In 2006, an adult herpes zoster vaccine for the prevention of HZ and post-herpetic neuralgia (PHN), Zostavax®, was approved for use by the Food and Drug Administration for adults aged 60 years and over. In 2006, VASP initiated adult HZ and PHN surveillance for those aged 50 years and over to gather baseline incidence data.

METHODS

Population demographics

The Antelope Valley (AV) is a well defined geographic area of approximately 2,000 square miles located in the northern-eastern section of LAC and covers more than 35 communities. In 2006, there were an estimated 350,000 residents: 51% white, 30% Hispanic, 18% African American, and 4% Asian.

Case definitions

A *varicella case* is defined as an illness with acute onset of a diffuse papulovesicular rash without other known cause diagnosed or reported by a healthcare provider, school nurse, or parents/guardians. A *breakthrough varicella* case has had documented varicella vaccine at least 42 days prior to onset of varicella. A *HZ* case is defined as a unilateral macular-papular or vesicular rash, involving at least one dermatome, diagnosed by a licensed healthcare provider. The presence of a *PHN* in an adult HZ case is defined as pain or discomfort, that may be sustained or intermittent, lasting three months from rash onset. Each HZ or varicella case with a completed case interview and/or chart review, which validates the case definition and resides within the surveillance area, is considered a *verified case.* If a reporting site reports a HZ or varicella case that cannot be verified by either a case interview or chart review, this case is considered a *probable case*.

Data collection

In 2006, VASP had 317 surveillance sites that participated in the project. Site types include: public and private schools, day care centers, public health clinics, pain management clinics, long term care facilities, adult day care, hospitals, private practice physicians (pediatrics, family practice, neurology, dermatology, and internal medicine), health maintenance organizations, and correctional facilities. Nearly 100% of identified reporting sites participate in the project. All reporting sites submit the varicella/zoster surveillance case logs to VASP on a bi-weekly basis and applicable reporting sites submit a varicella vaccine log on a monthly basis (which is a report of all administered varicella doses given that month).

A structured telephone interview is conducted with each case or their parent/guardian by a member of VASP. Detailed demographic, clinical, and health impact data are collected and additional cases or susceptible contacts within the household are identified. For a verified case of adult HZ, a follow-up pain

inventory questionnaire is administered to those patients who are experiencing persistent pain or discomfort at the time of initial case interview, to assess for the presence of PHN. The pain inventory questionnaire or follow-up interview is administered four months after the date the case reported that their HZ rash has "healed" or began to crust over. HZ cases are also queried to determine if there are additional varicella cases in the household, their previous history of varicella and HZ disease, and prior varicella vaccination. Previous varicella vaccine exposure is documented by one of three methods: provider documentation, vaccine card, or school vaccine records. Data entry for varicella and HZ is entered into a Microsoft Access database and analyzed with SAS 9.1. Completeness of reporting is estimated using capture-recapture methods for varicella disease.

RESULTS

Varicella Disease

Since the start of surveillance in 1995, the number of verified varicella cases declined by 87% with 2,934 and 394 cases reported in 1995 and 2006, respectively. Accordingly, overall varicella incidence has also declined from 10.3 per 1000 to 1.1 per 1000 population in 1995 and 2006, respectively. From 2001 through 2003, the overall varicella incidence remained relatively unchanged (1.2 per 1000 population), however, in 2004, varicella incidence increased to 1.9 cases per 1000, then declined to 1.05 per 1,000 and 1.1 per 1,000 population in 2005 and 2006, respectively. Since 1995, the 5-9 year-old age group consistently had the highest varicella incidence of any age group. In 2006, the incidence of varicella among 5-9 year olds was 6.3 cases per 1,000. The 10-14 year old age group has been second with regards to incidence—3.7 per 1000 population in 2006. The mean age of cases was unchanged in 2005 and 2006, 10.1 years (range: 6 months-62 years; median: 9 years).

Since 1995, the hospitalizations due to varicella infection have declined significantly. In 1995, six hospitalizations due to varicella were reported. In contrast, from 2000 to 2006, between zero to three hospitalizations were documented annually; two hospitalizations were reported in 2006. In 2006, 10 self-reported complications (diagnosed by a physician) within two weeks of onset of varicella were reported which included: three infected skin lesions, one case of conjuctivitis, three cases of otitis media, one case of pharyngitis, and two cases of pneumonia. This was significantly more than the previous surveillance year, where only one complication of varicella was reported.

The proportion of reported verified breakthrough (BT) varicella cases has steadily increased over the project, with 1% in 1996 to 59.6% of cases in 2006. The cumulative BT cases as a percentage of the cumulative varicella vaccine doses remained relatively stable with 2.0% and 2.4% reported in 2005 and 2006. The mean case age at breakthrough disease has steadily increased with each surveillance year; the mean age was 5.7 and 8.2 years in 2000 and 2006, respectively.

The number of documented varicella outbreaks has shown a consistent decline from 1995 (81 reported) through 2003 (7 reported). However, in 2004, the number of outbreaks increased dramatically with 25 documented. In 2006, 11 outbreaks were documented, totaling 117 outbreak-related cases (OBC). The proportion of BT cases among all reported OBCs has steadily increased; in 1995, <1% of OBC cases were BT and in 2006, 74% were BT.

Herpes zoster surveillance children and adolescents aged less than 20 years

Both verified HZ cases and HZ incidence rates, for children and adolescents under 20 years of age, have steadily decreased from 2000 to 2005 and then increased in 2006. The overall incidence among those less than 20 years of age was 67 per 100,000 in 2000 and increased to 72 per 100,000 in 2006. In children under 10 years of age, HZ incidence has declined most significantly with 78 and 28 cases per 100,000 reported in 2000 and 2005, respectively. In 2006, the incidence rate (IR) among those <10 years old increased to 37 per 100,000 but remained significantly less than the IR reported in 2000. In contrast to those <10 year-old age group, both the number of cases and the incidence of HZ increased significantly in those 10 years and older. In 2006, 64 (78%) cases were documented in children over 10 years, whereas, in 2000, 35 (45%) of cases were reported in 2006. The IR increased from 2000 to 2006

from 58 cases to 97 cases per 100,000 in those from 10-19 years old, respectively. This increase was most notable among those in the 10-14 year old group; the IR nearly doubled from 64 to 116 per 100,000 in 2005 and 2006, respectively. As in prior years, most 2006 HZ cases have been unvaccinated. In 2006, 47 (57.3%) cases were unvaccinated and had a history of varicella. However, the proportion of cases reporting varicella vaccination only increased in 2006 from 4 cases (5.2%) to 12 cases (14.6%). Only one HZ case was hospitalized in 2006.

Herpes zoster surveillance adults aged 50 years and over

In 2006, 424 HZ cases were reported in persons aged 50 years and greater from surveillance sites. Of these,108 were excluded due to alternative diagnosis or because they lived outside of the surveillance site and 316 were verified HZ cases. Among the 316 verified HZ cases, 107 (34%) were between 50-59 years, 93 (29%) were between 60-69 years, and 116 (37%) were aged 70 years and older. The mean and median age of HZ cases was 66 and 65 years, respectively, with a range from 50 to 100 years. As expected, the incidence of HZ increased incrementally within the 10 year age groups. Individuals aged 70 years and older had the highest age-specific incidence, 6.1 per 1000, followed by those 60-69 years, 4.5 cases per 1000, and those 50-59 years, 2.6 cases per 1000. Only 4 (1.3%) adult HZ cases required hospitalization in 2006.

The clinical presentation of HZ cases was consistent with the classic clinical presentation; over 90% of cases reported unilateral rash in a single dermatome and had complaints of pain. Approximately 90% of cases either reported pain or had it documented upon chart review. On a scale of 1-10, 43% reported their pain between 5-8 and 37% reported their pain as excruciating on a scale of 9 to 10. The mean and median pain score reported by a case of HZ reporting pain was 7.6 and 8.0, respectively. Overall, 72 (25%) cases were contacted for follow-up interview, which assessed the duration of their pain or discomfort, and reported pain or discomfort lasting at least 3 months from HZ rash onset, consistent with PHN.

SUMMARY AND DISCUSSION

After thirteen years of surveillance, it is apparent that implementation of the national varicella vaccine program has resulted in a dramatic decrease in the number of varicella cases in the Antelope Valley (AV). However, despite clear reductions in morbidity associated with varicella, eleven varicella outbreaks (OBs) were documented in 2006 with a mean of 11 children and a mean duration of 52 days for each OB. The VASP will continue population-based active surveillance for varicella and HZ, using a methodology that includes all identified sampling units within the AV. Although the majority of surveillance sites, especially schools, have maintained an excellent level of interest and cooperation; some large private pediatric practices have begun to show reporting fatigue. It will be a challenge for our project to work with this small group of providers to encourage continued participation in reporting varicella, HZ, and vaccine doses.

California passed legislation, implemented in July 2001, requiring proof of varicella immunity at preschool and kindergarten entry. Such school laws had a dramatic impact on the epidemiology of the disease. Further reduction of morbidity and complications from varicella are expected to continue as vaccine coverage increases and the second varicella vaccine, recommended for children from four to six years and catch-up vaccination in children ages 13 years and younger, are implemented as recommended by the Advisory Committee on Immunization Practices (ACIP) in 2006. However, the second varicella vaccination is not a part of the school entry policy at this time which may impede its full implementation. The Immunization Program of the LAC DPH has worked to strongly support the second dose policy by communicating with medical providers and school health officials

Further questions on the disease and vaccine impact arise as varicella coverage rates continue to increase in adolescents and new ACIP guidelines are put into place. Investigation of vaccine BT cases and vaccine failures will continue to be of interest, and may not only involve clinical description of such cases, but viral characterization as well. Additional work needs to be done to address the important issue of potential serious morbidity as a cohort of children not vaccinated as infants reach adolescence, without experiencing disease.

Additionally, a recently completed knowledge, attitudes, and practices survey concerning varicella vaccination practices among participating surveillance site among medical practitioners in AV, in 2005, indicated that approximately 55% of physicians agreed that parents would accept a varicella booster dose. In 2007-2008, we will continue to monitor the acceptance of a second dose of varicella vaccine. Another challenge will be the diagnosis of BT varicella infection, especially now that the two dose policy has been recommended by ACIP. It should be expected that varicella infection will continue to display milder symptoms, that will be more difficult to diagnose, and clinicians will have less clinical experience. Laboratory confirmation of infection will therefore, become more essential for accurate diagnosis.

In June 2004, Oxman et. al. published the results of a large multi-centered randomized double-blind trial of an adult zoster vaccine, based on the OKA varicella vaccine. This vaccine trial showed a statistically significant decrease in both HZ incidence and duration of PHN in HZ cases among vaccinated individuals aged 60 years and older compared to those who received the placebo vaccine. In 2006, the Food and Drug Administration approved this vaccine (Zostavax®) for adults aged 60 and older. In 2008, VASP will also follow Zostavax® doses administered among our surveillance sites. Obtaining baseline surveillance data on adult zoster and PHN will be critical to assessing baseline incidence of this disease in a community setting. With the Zostavax ® licensure and increasing use, monitoring HZ incidence and PHN follow-up will also be essential.

In 2006, the first year of adult HZ surveillance was completed. In all, 316 verified cases were identified. Our incidence rates were highest in the older age groups (70+) compared to those between 50-59 years, consistent with prior epidemiology studies. None of our HZ cases reported a history of vaccination with Zostavax ®. Pain was considerable among our adult HZ cases with 90% of patients reporting pain. The median pain score on a scale of 1-10 was 8 and 37% of HZ reported excruciating pain (pain scale 9-10). Interestingly, approximately 41% patients also reported that opioid pain medication was prescribed by their medical provider for pain management. Of the 265 patients that were interviewed, 80 had persistent pain at time of interview, and 70 (26%) had follow-up interviews documenting persistent pain or discomfort lasting at least 3 months from onset time. Our project observed a much greater proportion of PHN (26%) compared to that reported by Oxman et al., 12.5 % in unvaccinated participants, who utilized a multi-center randomized double blind design to evaluate the effectiveness of Zostavax® for the prevention of HZ and PHN. However, it should be pointed out that the vaccine study was conducted at a facility where the majority of the study population was Caucasian males in contrast to our surveillance project which had a majority of female HZ cases and a significantly greater proportion of Hispanic patients, consistent with the population of the Antelope Valley.

In 2007-2008, we plan to analyze our HZ data more thoroughly to understand the risk factors for PHN within our surveillance project. Additionally, we plan on enhancing adult HZ surveillance with additional surveillance sites that are not currently participating in the project such as internal medicine practices. An evaluation of two years of adult HZ data collection will be completed by comparing our incidence of HZ among Health Maintenance Organizations (HMOs) that report electronically versus those sites that do not. VASP will also track Zostavax ® doses by age of recipient for vaccine providers beginning January 2008.

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