

Acute Communicable Disease Control

Special Studies Report

2004



Los Angeles County
Department of Health Services
Public Health



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BIOTERRORISM AWARENESS EDUCATION FOR VETERINARIANS

BACKGROUND

Veterinarians play an important role in surveillance for possible bioterrorism as the majority of potential bioterrorist agents are zoonotic. Therefore we proposed to educate all LAC veterinarians about the importance of disease reporting using specially designed posters to educate them and increase disease reporting among Los Angeles County veterinarians.

POSTER CONTENT AND DISTRIBUTION

We selected posters from the Center for Food Security and Public Health at Iowa State University's College of Veterinary Medicine (www.cfsph.iastate.edu), part of the CDC's Center for Public Health Preparedness for Veterinary Medicine and Zoonotic Diseases. It is the only Center for Public Health Preparedness to focus on veterinary medicine and zoonotic diseases.

The posters list the disease agent, CDC category (A, B, or C), route of transmission, potential systems affected, incubation period, and prominent clinical signs for both humans and animals.

The posters prominently display both ACDC and Veterinary Public Health addresses, telephone numbers, and websites which can all be used for reporting. The poster also lists the Center for Food Security and Public Health contact information.

In addition livestock pathogens listed by the USDA as high consequence are listed. These are animal diseases not currently found in the U.S but whose presence would pose a severe threat to animal health. These diseases are also reportable to the State Veterinarian and the Federal Area Veterinarian in Charge.

Acute Communicable Disease Control (ACDC) purchased 800 Large (24 x 36) A, B, C Agents & Livestock Pathogens Wall charts, 1500 Small (10 x 15) A, B, C Agents & Livestock Pathogens Wall charts, Bioterrorism and Agroterrorism Awareness Education CD ROMs (10), and the Emerging & Exotic Animal Diseases book (10). The posters and a letter from the medical director of Communicable Disease Control Programs were mailed to 1,160 LA County veterinarians and over 630 veterinary clinics in November 2004. Bioterrorism and Agroterrorism Awareness Education CD ROMs and Emerging & Exotic Animal Diseases books were distributed to LAC-Veterinary Public Health veterinarians, LA City Animal Control, and LAC Animal Control. The current veterinarian and veterinary clinic address listing was obtained from the California Department of Consumer Affairs in 2004.

DISCUSSION

The mailing was deemed successful, as a number of veterinarians called for more posters. Veterinarians need to receive updates and incentives from DHS as a reminder to them of the importance of disease reporting. Additional incentives and updates will be mailed to LAC veterinarians in 2005 to remind them to report diseases to the local health department.

LINKS

www.cfsph.iastate.edu

www.cfsph.iastate.edu/Products/wallchartlivestock.htm

www.ladhs.org

www.dca.ca.gov

www.aphis.usda.gov/programs/ag_selectagent/ag_bioterr_toxinslist.html





MASS SMALLPOX VACCINATION CENTER EXERCISE

INTRODUCTION

On June 23, 2004 the County of Los Angeles Immunization Program (IP) in collaboration with other public and private organizations held the County's first full-scale bio-terrorism exercise. The exercise simulated a Los Angeles County Public Health response to a confirmed case of smallpox and smallpox release at a major sports arena in the area, by providing fictitious smallpox vaccinations to citizens at a mass smallpox vaccination center. Over 230 trained County employees staffed the exercise and over 1,000 volunteers participated as clients.

BACKGROUND

Los Angeles County's Strategic National Stockpile (SNS) Plan outlines the process of requesting, receiving, storing, staging, distributing, dispensing and recovering SNS materials. Incorporated in the SNS Plan is the Los Angeles County Smallpox Preparedness, Response, and Recovery Plan, which include guidelines for Mass Smallpox Vaccination Clinic Operations.

Beginning in the winter of 2002, IP was given the responsibility of coordinating the County's smallpox vaccination program as well as developing the *Mass Smallpox Vaccination Clinic Operation Guidelines*. These guidelines outline the logistical, administrative and clinical procedures used within a smallpox Dispensing/Vaccination Center¹ (DVC), are for use in either the context of bio-terrorism preparedness or as a response to a probable or confirmed case of smallpox, and outline Los Angeles County's post-event vaccination strategy, which includes:

- Quickly identifying and isolating smallpox cases
- Identifying and vaccinating household and close contacts
- Monitoring the vaccinated contact and instituting isolation if fever develops
- Vaccinating health care and public health workers who will be directly involved in evaluating, treating, transporting, and/or interviewing potential smallpox cases
- Vaccinating other response personnel who have a reasonable probability of contact with smallpox patients or infectious materials (e.g., selected law enforcement, emergency response, or military personnel)
- The possibility of a broader vaccination campaign to increase community immunity to smallpox

In October 2003, IP began planning a full-scale exercise of the smallpox DVC to fulfill the CDC's Cooperative Agreement on Public Health Preparedness and Response for Bioterrorism, fiscal year 03-04, grant requirements.

Goals of the exercise were to:

1. Evaluate the efficiency and effectiveness of the smallpox DVC model.
2. Quantify the logistical resources required to implement the smallpox DVC model.

Utilization of the DVC model focused on resource allocation, logistical planning, staffing patterns, time flows, and client and staff perceptions but also provided Los Angeles County the opportunity to evaluate the collaborative relationships of other County and City departments and local agencies involved in responding to a biological event.

¹ Dispensing/Vaccination Center (DVC) is the name given to the dispensing component that would be used to provide mass prophylaxis/vaccination to the 10 million residents of Los Angeles County in the event of a large scale public health emergency.



The exercise took place on June 23, 2004 at the Carson Community Center in Carson, California, ran for 7 hours, included staff briefings, full-scale DVC procedures, staff debriefings, both a qualitative and quantitative evaluation, utilized over 200 staff, and processed over 900 role-playing clients.

METHODS

Planning: Planning for the exercise began in October 2003, nine months before the actual exercise. During the initial meetings, goals for the exercise were developed and a site was chosen. Subsequent meetings were used to develop task lists, assign sub-groups to various tasks and develop exercise materials.

The planning process included bringing over 30 County, City and community organizations together in an Exercise Workgroup. This workgroup met every two months under the chairmanship of IP.

Exercise Site: Carson Community Center was chosen from over 100 potential DVC sites throughout the county, approved by County Public Health and the Emergency Medical Services (EMS) for use as a DVC. This site was able to accommodate large numbers of individuals, was close to major freeways and had experience in conducting emergency response exercises.

DVC Curriculum and Staff Training: Concurrent with the exercise planning, a DVC staff-training curriculum was developed in collaboration with IP, the Office of Organizational Development and Training (OD&T) and the SNS Coordinator.

Initial planning discussions determined that to be able to institute DVCs in the event of a large-scale emergency, a central core of County DHS personnel should be trained immediately. In response, eight (8) complete teams (117 staff per team) – one team from each of the eight (8) Los Angeles County Service Planning Areas (SPAs) along with teams from Long Beach and Pasadena Health Departments were identified and trained. These trainings occurred on June 8th, 9th and 10th, 2004, and enabled Los Angeles County to train over 1,000 employees on the DVC model, Incident Command Structure (ICS) and specific job functions within a DVC.

From the 1,000+ DHS staff trained in DVC functions, 230 were chosen (some from each of the 8 SPAs and Programs) to participate in the exercise. In addition, 800 local actors and 200+ community volunteers were used as clients.

Exercise Summary: The Mass Smallpox Vaccination Exercise was designed to be a half-day bioterrorism exercise. Exercise play focused on DVC operations including; Triage, Briefing/Orientation, Medical Screening, Vaccination, Contact Evaluation, Clinical Evaluation, Clinical Counseling and Post Counseling.

Participants were advised that the exercise was an “evaluated practice” which allowed both staff and clients to “play” their roles within a learning environment. At the same time, Evaluators and Controllers collected information to assess performance within each of the DVC areas and to assess client and staff perceptions of the exercise.

The scope of the exercise enabled the activation of the Los Angeles County Public Health Emergency Control Center (ECC) and the City of Carson’s Emergency Operations Center (EOC).

The exercise consisted of a half-day full-scale exercise. Time sequences are described below:

- Immunization Program staff reported to the exercise site at 0700 and reviewed the DVC set-up while the first shift staff were arriving and registering. (First shift staff and all volunteers were instructed to park at an off-site location and were bused to the exercise site.)
- At 0800 exercise staff began their briefing and exercise volunteers (clients) began registration. Volunteers then formed a “waiting line” outside the DVC triage area.
- At 0900 the DVC triage area opened and official exercise play commenced, the second shift of DVC staff also began arriving and registering for the exercise.



- The second shift's briefing began at 1000 and the second shift relieved the first shift staff between 1100 and 1130.
- The first shift's debriefing began at 1130. First shift staff was allowed to leave the exercise site following debriefing.
- At 1300 the exercise was stopped and all remaining volunteers (clients) were asked to complete evaluations before leaving the exercise site.
- Buses were available on a continuous basis to shuttle staff and volunteers between the exercise site and the parking area.
- A briefing was held for the second shift from 1330 until 1400.

Exercise Evaluation: An academic evaluation team and a team of experienced EMS personnel evaluated the exercise. Both teams were situated throughout the exercise site to observe and record exercise events. The EMS evaluators concentrated on evaluating the administration of the exercise including, Incident Command Structure (ICS), communication, exercise controller participation and other operational variables. The evaluation of the DVC model was conducted by an outside consultant and concentrated on both qualitative variables such as client and staff perceptions of the exercise and quantitative variables such as time flow throughout the DVC.

Feedback from the two staff debriefing sessions was organized with the EMS evaluation feedback into a "Lessons Learned" document and presented to the exercise workgroup at a follow-up meeting in July 2004.

Recommendations and a full evaluation report of the exercise are being finalized.

RESULTS

Evaluation Summary:

- 1,002 clients attended the exercise, 992 (99%) returned their time flow evaluation cards
- Four hundred thirty-four (434) clients (43%) completed the required DVC stations and were vaccinated
- Two hundred eighty-three (283) clients (28%) went through Clinical Counseling
- Forty-five (45) clients (5%) went through the Clinical Evaluation area
- Fifteen (15) clients (1.5%) went through the Contact Evaluation area
- Eight hundred eighty-one (881) clients (88%) completed a satisfaction survey
- Two hundred thirty-two (232) staff (100%) completed a satisfaction survey

Time Flow Study: Ten (10) DVC stations (Table 1) were evaluated for time flow during the exercise.

Table 1. DVC Stations Descriptions

| DVC Station | Description |
|--|---|
| 1. Volunteer Registration – Waiting Line | Volunteers are registered, provided fictitious medical history information, and given time flow evaluation cards. Clients are then directed to a waiting line for entrance to the DVC and are provided education materials on smallpox and the vaccine. The waiting line is the first time flow area to be evaluated. |
| 2. Triage | The official entrance to the DVC, clients are asked a series of screening questions based on the fictitious medical history form and are directed to the next DVC area. Non-symptomatic – Briefing / Orientation Symptomatic – Clinical Evaluation Contact of a case – Contact Evaluation |
| 3. Briefing/Orientation | Clients are given medical screening forms and watch the CDC's smallpox video. Clients then complete their screening forms and proceed to the forms review area. |



Table 1. DVC Stations Descriptions

| DVC Station | Description |
|------------------------|---|
| 4. Forms Review | DVC staff review the client's medical screening form and direct them to either Vaccination or Clinical Counseling (if contraindications/precautions to vaccination) |
| 5. Vaccination | Clients are given smallpox vaccination |
| 6. Post Counseling | Clients are given instruction on the care of their vaccination site and how to determine if the vaccination is successful or needs medical evaluation. |
| 7. Clinical Counseling | Medical personnel evaluate clients who have contraindications/precautions to vaccination and determine if vaccination is possible. |
| 8. Clinical Evaluation | Clients who present to the DVC with symptoms/signs of smallpox disease are evaluated by medical personnel and either cleared for vaccination or referred for additional evaluation/treatment. |
| 9. Contact Evaluation | Contacts of a confirmed smallpox case who present to the DVC are evaluated, given referral information and provided vaccination. |
| 10. Evaluation | After completing the DVC exercise, clients are asked to complete an evaluation survey. |

Volunteer clients were provided with fictitious medical history information to use during the exercise that would reflect health conditions and contact status proportionately consistent with CDC expectations. These conditions/statuses ensured a proportion of clients went to specialty stations such as; Clinical Contact, Clinical Evaluation and Clinical Counseling for evaluation and processing. The observed numbers of clients seen in those stations vs. the number of clients assigned to those stations is described in Table 2.

Table 2. Specialty Client Situations

| DVC Area | Expected # of Clients | Observed # of Clients |
|---------------------|-----------------------|-----------------------|
| Contact Evaluation | 10 | 15 |
| Clinical Evaluation | 30 | 45 |
| Clinical Counseling | 200 | 283 |

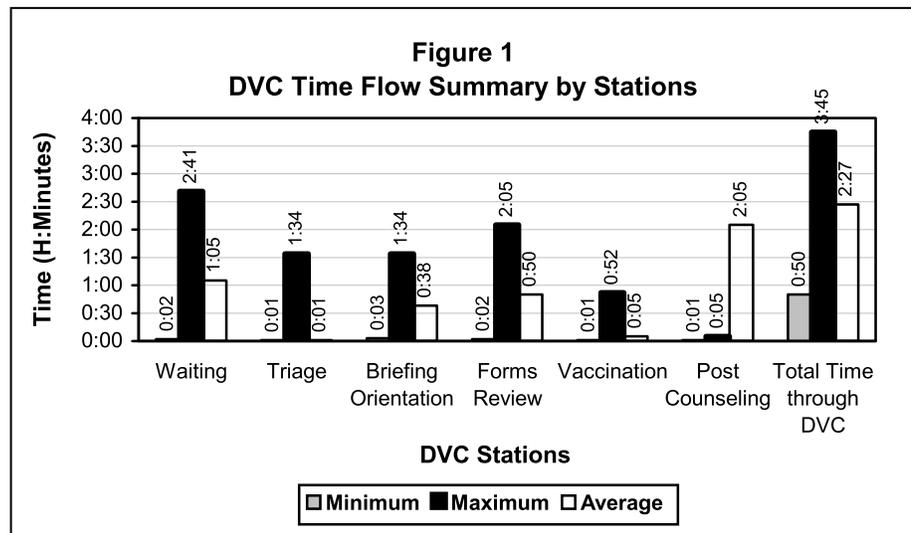
Although, exercise planners took great care in developing medical histories and contact status information for use by volunteer clients, some clients took it upon themselves to make-up illnesses or contraindications to vaccination.

These self-identified conditions/statuses caused some clients to be triaged to areas other than what was expected. DVC

staff also incorrectly identified some clients as having contraindications to vaccination and referred eighty-three (83) additional clients to Clinical Counseling – thus considerably slowing client progress through vaccination.

Minimum, maximum, and average lengths of time clients spent at the main DVC stations during the exercise and total time spent during the exercise are reflected in Figure 1.

Staff Evaluations: Staff was surveyed regarding their perception of their overall experiences, the training they received, and the organization of the exercise. Staff worked in two shifts, approximately





110 staff in each, and represented over 15 different Los Angeles County job classifications. Employees from Pasadena and Long Beach Health Departments also participated as DVC staff. A total of 232 surveys were collected (100%).

Overall experiences

- 65.6% rated their experience as “good” or “excellent”
- 70.2% disagreed that they felt stressed during the exercise
- 76.2% said they would be willing to volunteer in the event of an actual emergency
- 79.3% agreed that the exercise made them feel more prepared for an actual emergency

Training

- 64.0% felt they were well-trained for the exercise
- 70.6% felt the position resource guides developed for the exercise were easy to understand
- 76.8% felt they were able to accurately answer questions from clients
- 89.2% of the staff members felt that all the staff worked well together

Organization of the Exercise

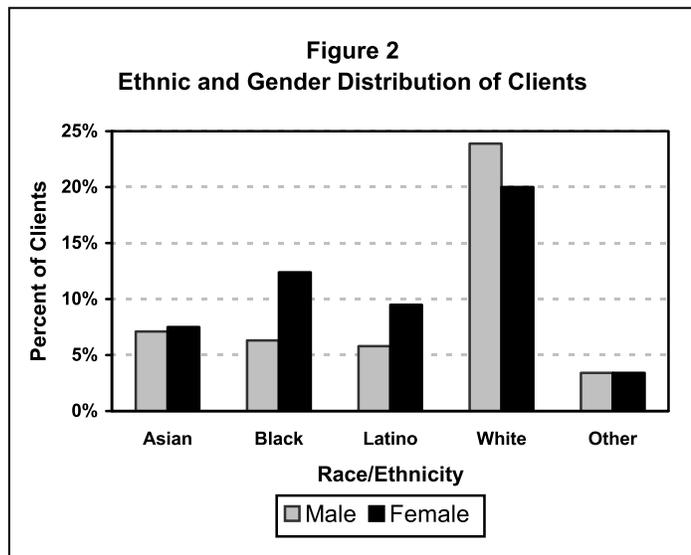
- 55.1% felt the floor plan for the exercise was easy to follow
- 63.8% felt that the stations were well-organized
- 71.5% felt staff was adequate
- 87.5% felt there was adequate space to perform their duties

Recommendations from staff included:

- A need for more ICS training – communication in ICS structure very different from normal communication structure
- More on-site training time

Client Evaluations: Client surveys were designed to determine client demographics, the clients’ overall experience of the exercise, the quality of education and educational materials they received and their perception of the exercise’s organization. Eight hundred eighty-one (881) surveys were collected (88%).

Client Demographics: The breakdown of client demographics, including ethnicity, gender and primary language spoken are shown in Figure 2.



Although English was the primary language of 88% of respondents, 34 other primary languages were reported including: Ethiopian, German, Czech, Hungarian, Fugani, Korean, Navaho, Portuguese, Cambodian, Indian, Greek, Arabic, Sindhi and Russian, in addition to those reported in the table to the right.

The diversity of languages within this client population accurately demonstrates a major factor in developing educational and directional information for an emergency response within Los Angeles County.

The exercise included 4 interpreters, but in no way covered all language needs.



Overall Experiences

- 69.4% of clients rated their experience as “Good” or “Excellent”
- 49.5% felt the exercise was tiring
- 73.3% felt the exercise made them more comfortable in the event there was a real emergency

Education

- 91.7% clients felt the forms provided were clear and understandable
- 88.3% felt the information they received was clear and understandable
- 84.2% reported that staff they encountered was knowledgeable and confident
- 87.9% felt they learned something new about smallpox.

Organization

- 79.4% of clients felt the exercise was well organized and ran smoothly
- 79.6% felt they had clear instructions regarding where to go next in the DVC

DISCUSSION

The accomplishment of the mass smallpox vaccination exercise and the development of the DVC staff-training curriculum was a monumental undertaking. Though faced with many challenges throughout the planning and execution of the exercise, a great many lessons learned were gained from the experience.

Topics that arose from the time flow study as potential reasons for not meeting the goal of 1,000 clients in 4 hours include:

- Two shifts hampered the ability of staff to “get into a groove” and resulted in a large lag time for client processing between shifts
- Briefing/Orientation held clients up because of a mandatory CDC video on smallpox and vaccination. (Average - 38 minutes)
- Forms Review staff were confused and inconsistent on screening requirements and sent twice as many clients to Clinical Counseling (before being able to access vaccination) as planned.
- Vaccination staff were asked questions by clients which should have been answered earlier in the process and re-screened clients before providing vaccination. (Average of 5 minutes/client – expected was 2 minutes/client)

Strengths: Key strengths identified during this exercise included the following:

- Demonstration of excellent teamwork between all of the participating agencies
- Establishment of new cooperative relationships
- Success in the staging and operation of a DVC
- Quick reaction and correction of shortcomings in the DVC plan as they were uncovered
- Increased knowledge in emergency preparedness and smallpox vaccination gained by both staff and volunteers

In addition, several successful outcomes of the exercise not directly related to the model that should also be recognized include:

- This was the first full-scale exercise completed by the County of Los Angeles Department of Health Services (DHS), Public Health
- This was the first test of the County’s DVC model
- This was the first joint County of Los Angeles DHS, Emergency Medical Services (EMS), and Department of Mental Health (DMH) exercise
- The exercise provided “real-life” experience to over 200 trained County Public Health staff

Areas for Improvement: Throughout the planning and during conduction of the exercise, several opportunities for improvement in the DVC model and planning process were identified. Recommendations



for improvement include the following:

- Earlier identification of resources and procurement processes
- Expanded training in Incident Command Structure training for DVC staff
- Revised educational materials for clients
- Less client-generated forms

The planning, execution and evaluation of this exercise provided Los Angeles County with a realistic idea of the mechanisms necessary to coordinate and manage during a public health emergency. It also provided invaluable information on the DVC model and training used to prepare staff to operate a DVC. Over seventy (70) new forms were developed and tested, 1,000+ DHS employees were introduced to the County's Emergency Response Plans and members of health and safety agencies from across the County were able to develop working relationships and collaborations.

In the event of a smallpox outbreak, Los Angeles County will need to institute over 100 DVCs to vaccinate the 10 million county residents that will look to the Public Health Department for guidance and treatment, this exercise provided a solid first step in our ability to protect all Angelinos.

In addendum:

During the nationwide influenza vaccine shortage in the fall of 2004, Los Angeles County used the DVC model and many of the forms developed to provide 40,000 influenza vaccinations during a two-day vaccination campaign across the county. The results derived from using the DVC model proved extremely successful.





US POSTAL SERVICE BIOHAZARD DETECTION SYSTEM UPDATE

BACKGROUND

In response to the anthrax attacks of October 2001, the US Postal Service (USPS) contracted with Northrup-Grumman to develop the Biohazard Detection System (BDS). The BDS is an early warning system that regularly analyzes air samples, using polymerase chain reaction (PCR) methods, for the presence of anthrax. This system has been instituted at 102 large mail processing and distribution sites throughout the country in areas identified at high risk. The system collects samples at key “pinch points” in the mail processing system and collects samples each hour during mail processing (3:00 pm to 11:00 pm Monday through Saturday). The analysis takes 90 minutes to run and, if anthrax DNA is detected: 1) the system alarms, 2) all mail processing machines are automatically shut down, and 3) postal staff are instructed to evacuate the building. The false positive rate of BDS is 1/500,000 tests. To date, there have been no false positives, false negatives or true positives.

In June 2002, the first prototype BDS system was installed in the Baltimore Processing and Distribution Center (P&DC). Since that time, BDS has been established in 57 other facilities—starting first in the Northeast and then spreading throughout the rest of the country. Los Angeles County (LAC) has three P&DC sites that run BDS: Los Angeles (October 2004), City of Industry (November 2004), and Santa Clarita (December 2004).

METHODS/RESULTS

Response Planning: In the event of a BDS alert, the USPS will coordinate a response involving many different agencies using a Unified Incident Command Structure. This includes: the US Postal Inspectors, Terrorism Early Warning Group, LAC and LA City Fire and Hazmat Departments, LAC Sheriff Department, LA Police Department, Health Hazmat, FBI, and LAC DHS Public Health (PH).

USPS will be responsible for notifying PH and Emergency Medical Services (EMS), evacuating personnel from the facility, and providing an active personnel roster to PH. US Postal Inspectors will transport samples to the PH Laboratory and will contact appropriate law enforcement (for security and crime scene analyses). USPS Employee Assistance and Occupational Health staff will be called on scene to assist with providing counseling and securing assistance from the local Red Cross. USPS is responsible for risk communication and securing additional environmental testing of the facility and surrounding area. Hazmat teams will be responsible for decontamination of all those determined to be at risk based on the CDC Recommendations [1]. In terms of the Public Health response, PH is responsible for laboratory confirmation of anthrax (e.g., repeat PCR and culture) and provision of antibiotic prophylaxis. EMS is responsible for maintaining and transporting the USPS medication cache.

Current Status: ACDC’s Bioterrorism Preparedness and Response Section (BPRS) has met with the Public Health Medical Director and the Area Health Officers of the three SPAs with BDS sites. In the event of a BDS alert, the SPA Health Officer along with the Area Medical Director and Nurse Manager coordinate the staffing and dispensing of the 3-day prophylactic medications within 15 hours of the BDS alert. BPRS has met with the USPS Pacific Area and Los Angeles Area medical staff and also attended two 2-day training/drills. In addition, BPRS has conducted one prophylaxis drill at the Los Angeles P&DC in May of 2004 and a tabletop drill at the Santa Clarita site in November 2004 with a follow-up visit with representatives from the SPA and BPRS in December 2004. Once the PH plans have been finalized with each USPS facility in a formal memorandum of understanding, BPRS will be conducting trainings and drills for USPS and PH staff to assure prompt response in the event of a BDS alarm.

DISCUSSION

May 2004 Drill—Lessons Learned: The objective of a drill is to understand how to perform a function



better in the future, and this drill provided innumerable lessons to that effect. To begin with, it is essential that the drill's coordinator communicates early and often with all those involved in organizing and conducting the drill. Preparation of logistics (e.g., reference binders, clipboards) must be completed several days in advance. Participants in the drill should be those who might likely be called upon to perform the function in case of a real event. We expect that our next drill should be very much improved by these and many other lessons learned.

Conclusions: This project continues to be challenging considering LAC currently maintains three BDS sites. This requires complex coordination between several LAC DHS agencies as well as a range of other non-DHS agencies (e.g., FBI, Fire, Police, etc.). Moreover, a BDS alarm is likely to occur outside normal work hours (i.e., any time between 4:30 pm and 12:30 am Monday through Saturday) and can occur at any or all of the three sites. Public Health's goal is to establish dispensing teams capable of responding within four hours of the alarm.

Several projects are also in progress such as developing a BDS response manual and finalizing memorandums of understanding. However with the input from the USPS, CDC, State and local experts, continued progress is expected in the coming year.

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NOSOCOMIAL *BURKHOLDERIA CEPACIA* ASSOCIATED WITH EXPOSURE TO SUBLINGUAL PROBES

BACKGROUND

On August 11, 2004, the infection control professional (ICP) of a Los Angeles County (LAC) hospital reported a cluster of eight infant cases of *Burkholderia cepacia*. Cases occurred between June 14 and August 7, 2004. One case died. Several cultures (n=3) also grew *Stenotrophomonas maltophilia*. Five cases were identified solely by endotracheal cultures, two by both blood and endotracheal cultures, and one from nasopharyngeal culture.

Burkholderia cepacia is a Gram-negative rod often associated with nosocomial infections among intensive care unit patients; it can cause severe pulmonary infections in patients with cystic fibrosis and significant bacteremia in premature infants and others requiring prolonged hospitalization. It is a water- and soil-borne organism that can survive for prolonged periods when kept moist. Nosocomial spread has been associated with, among other etiologies, disinfectant solutions used to clean reusable patient equipment such as bronchoscopes and pressure transducers or to disinfect skin. Person-to-person spread has also been documented [1].

METHODS

Acute Communicable Disease Control (ACDC) undertook an investigation of this cluster. The case definition for inclusion in this outbreak was any infant with a positive culture of *B. cepacia* who was hospitalized in the cardiothoracic ICU between May and August 2004. Hospital staff collected information and enacted control measures including: hand asepsis, contact precautions, staff cohorting, environmental cleaning, surveillance cultures, and a review of respiratory therapy practices including a review of the methods for disinfection and sterilization and sources of water and medication.

The LAC hospital sent all remaining patient isolates to the Centers for Disease Control and Prevention (CDC) for molecular epidemiologic study. The hospital laboratory cultured the sublingual probes used in surgery; the resulting isolates and several unused probes were also forwarded to CDC.

RESULTS

On August 11, 2004, the CDC's Epidemic Information Exchange (Epi-X) posted, "Nosocomial *Burkholderia cepacia* Associated with Exposure to Sublingual Probes—Texas, 2004." The probes were Nellcor CapnoProbe Sublingual Sensors, Models SLS-1 and SLS1-S. Each FDA-licensed probe was packaged in a metal canister filled with a nonsterile, buffered saline solution. The canister was in a sealed foil envelope. Each disposable probe is used only one time. A culture of the saline from one opened probe canister was positive for *B. cepacia*. The probes had changed to a manufacturing plant in Mexico in February 2004. After querying the ICP at the LAC hospital experiencing the outbreak, it was revealed that the same sublingual probes used in Texas were also used as a part of an experimental protocol.

After further investigation, a total of 12 cases were identified from the cardiothoracic ICU with date of culture between June 17 and August 7, 2004. Eight of these cases used the sublingual probes. Two cases died; neither used the sublingual probes. The hospital microbiology laboratory cultured six unopened probes; all grew gram negative rods including *B. cepacia*, *Ochrobactrum anthropi* and *S. maltophilia*.

The use of the probes was subsequently discontinued at outbreak hospital and Nellcor announced a voluntary recall of all Capnoprobe™ sublingual sensors. On August 24, the FDA issued a medical device Class I recall of the sensors. On August 27, the CDC released a Morbidity and Mortality Weekly Report (MMWR) dispatch detailing the situation in Texas [2]. Results from the CDC demonstrated that the



majority of patient *B. cepacia* isolates from CA and TX were of the same PFGE-type. The other isolates of *O. anthropi* and *S. maltophilia* were also identical respectively by PFGE.

Surveillance continued for one month past the last date of onset. No new cases were identified and the investigation was closed.

Discussion

In this investigation, a common source was identified in what was determined to be a multi-state outbreak. The hospital ICP had been unaware of the use of the implicated sublingual sensors in her institution because they were a part of an experimental protocol. This protocol was set up by the principle investigators and funded by Nellcor, the product manufacturer. This highlights the need for better communication between healthcare professionals and hospital quality assurance and infection control staff. The sharing of information via Epi-X that resulted in identification of the source of the outbreak demonstrates that communication among multiple sources (i.e. local health department, and state and federal agencies) is valuable in disease investigation.

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AN OUTBREAK OF ENTEROTOXOGENIC *ESCHERICHIA COLI* ASSOCIATED WITH A CATERED EVENT

BACKGROUND

On October 4, 2004, the Acute Communicable Disease Control Program (ACDC) of the Los Angeles County Department of Health Services (LACDHS) received a foodborne illness (FBI) complaint associated with an event held at a local Buddhist temple on September 26th. The complainant was the event organizer, who had received several calls from attendees who reported becoming ill with diarrheal disease in the days following. An investigation was opened to establish the extent of the outbreak, the source of the infection, and to implement prevention measures if necessary.

METHODS

General Investigation: ACDC contacted the organizer of the event to ascertain details regarding the menu, food delivery, food set-up, and identification of attendees. The caterer, based in Orange County, was contacted to verify the menu items and inquire about other catered events from that weekend. On October 6, 2004 ACDC inspected the grounds where the event took place. A referral was made to Orange County Health Care Agency/Environmental Health to inspect the restaurant/caterer.

Case-control study: A case was defined as a person who attended the event at the temple, ate food provided by the caterer, and reported diarrhea (>2 loose stools/24 hrs) within 6–72 hours after eating or had other symptoms and a positive stool culture for *E. coli* O169:nonmotile. Individuals who attended the event but were asymptomatic were selected as controls.

Case finding: A list of attendees was obtained from the event coordinator. After conducting five preliminary interviews, a standardized questionnaire was developed that included demographics, information on attendees or household members sick prior to the investigation, food items eaten, illness onset after attending the function, symptoms and symptom duration, medical treatment, and specimens collected. Attendees were contacted by telephone to administer the questionnaire.

Frequency and distribution of symptoms were calculated and an incubation curve was constructed using Epi Info version 3.3. An unmatched case-control study was conducted using questionnaire data. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using Epi Info 2000 to determine the source of the illness.

Laboratory analyses: Ill attendees were asked if they would be willing to provide a stool sample. Stool specimens were tested in the Public Health Laboratory for the following: *Salmonella* species, *Shigella* species, *Campylobacter* species, *Vibrio* species, *E. coli* O157, presence of Shiga toxin, *Cryptosporidium* species, *Cyclospora* species, *Isospora* species, and Norovirus. One sample of leftover food, a vegetable dish that had been frozen, was submitted by an ill attendee for testing. No other food samples were available.

Orange County Environmental Health Inspections: On October 5, 2004 Orange County Environmental Health (OCEH) inspected the catering facility/restaurant. On October 19 OCEH and Orange County Health Care Agency/Epidemiology Unit returned to the restaurant for follow-up interviews regarding food preparation.

RESULTS

Approximately 600 individuals attended an anniversary celebration at a Buddhist temple in LAC. The attendees came from the following locations: Japan (56), Panama (2), Argentina (1), France (1), New York (20), Illinois (7), Georgia (7), Colorado (1), Washington State (2), Utah (2), Washington



D.C./Maryland (24), Hawaii (13), and Northern California (42), with the remaining from the Southern California area. The event coordinator provided ACDC with a partial list of attendees. The list contained 144 names. ACDC was able to contact and administer the questionnaire to 69 attendees (66 from Southern California, 2 from New York, and 1 from Utah). An epidemiologist from California Department of Health Services contacted 3 individuals from Northern California and 2 from Washington State.

Descriptive Analysis: In total, 76 interviews were completed, of whom 56 were ill cases and 20 were non-ill controls. The mean age for cases and controls was 44.4 years and 54.3 years, respectively. Among the 29 male interviewees, 22 were cases (75.9%) and among the 47 female interviewees, 34 were cases (72.3%) (See Table 1). No one reported illness themselves or in household members prior to the event. The main symptom presentations were as follows: non-bloody diarrhea (98.2%), abdominal cramps (85.7%), nausea (51.8%), fatigue (48.2%), headache (44.6%), body aches (30.4%), fever (26.8%), and vomiting (19.2%) (Table 2). The average duration of symptoms was 5.2 days with a range of <1 day to 11 days. The incubation period ranged from 10-67 hours with most onsets occurring 27 hours after the event (Figure 1). Six (10.7%) individuals sought medical care and none was hospitalized.

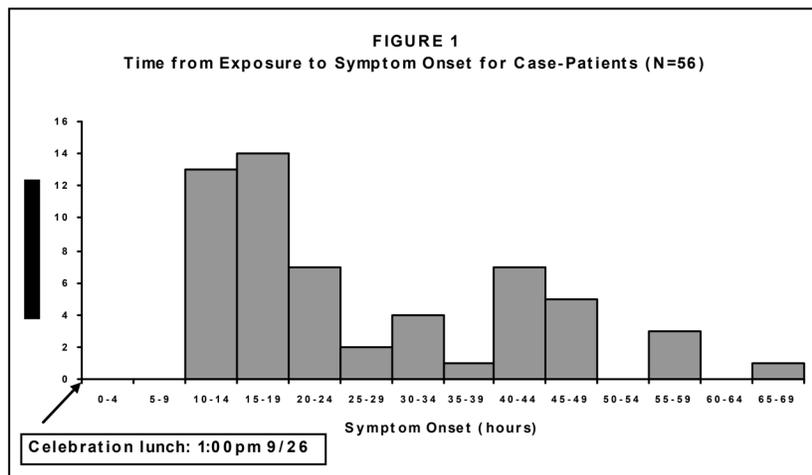


Table 1. Demographic Characteristics of Case-Patients and Controls

| Characteristic | Case Patients (N=56) | Controls (N=20) | All (N=76) |
|-----------------|----------------------|-----------------|------------|
| <u>Age</u> | | | |
| Mean | 44.4 years | 54.3 years* | 46.8 years |
| Range | --- | --- | 3-77 years |
| <u>Gender</u> | | | |
| No. (%) Males | 22 (75.9%) | 7 (24.1%) | 29 |
| No. (%) Females | 34 (72.3%) | 13 (27.7%) | 47 |

* Excludes three case-patients



**Table 2. Frequency of Symptoms
among Case-Patients**

| Symptoms | Case-Patients (N=56) | |
|------------------|----------------------|-----|
| | no. | % |
| Diarrhea | 55 | 98% |
| Abdominal Cramps | 48 | 86% |
| Nausea | 29 | 52% |
| Fatigue | 27 | 48% |
| Headache | 25 | 45% |
| Chills | 19 | 34% |
| Body aches | 17 | 30% |
| Fever | 15 | 27% |

Laboratory Analysis: Nine symptomatic individuals provided stool specimens. Six clinical specimens were positive for *Escherichia coli* with matching phenotypic profiles. Isolates were subsequently sent to the California Microbial Diseases Laboratory (CA-MDL) for toxin testing and forwarded to CDC for serotyping. Laboratory analysis revealed all six isolates were enterotoxigenic *E. coli* (ETEC), serotype O169:non-motile, ST positive. PFGE of the 6 isolates showed 3 isolates had indistinguishable patterns and 3 isolates had patterns that differed by 1-3 bands.

At the request of the CDC, a second specimen was collected from 7 of the 9 previous ill donors and an additional 4 specimens were collected from attendees who were not ill. None of the additional specimens grew *E. coli* with the outbreak phenotypic profile.

The frozen leftover food provided by an attendee consisted only of a vegetable dish. The frozen vegetable dish was negative for *E. coli*.

General Investigation

The event involved a ceremony followed by a catered lunch. The food was provided by a catering company located in Orange County specializing in Asian cuisine. The caterers prepared the food at an associated restaurant, also located in Orange County. Additional information on the inspection of the caterer was obtained through Orange County Environmental Health.

The food was delivered on two separate trucks. The first truck, containing beverages, set-up equipment, and supplies, arrived at the temple at 8:30am. The second truck, containing the hot and cold food items, arrived at 12:00pm. The cold food was temperature controlled with ice bags. The hot food was left at ambient temperature. The food was set up buffet-style in the temple parking lot. The luncheon was scheduled to begin at 12:00pm, but was delayed until 1:00-1:30pm due to late guest arrivals. Several attendees and the temple coordinators recalled that the hot food dishes were served in chaffing dishes without heating elements and were lukewarm or cold when served.

On October 6, an inspection of the temple grounds found that bathrooms were clean and in good working condition. At the time of the visit, there were two open dumpsters in the parking lot where the food was served on the day of the event. All food service took place in the parking lot. No electrical outlets for electric chaffing dishes were observed.

An outbreak with similar characteristics was reported to the Orange County Health Care Agency during the same time period. On September 25, a wedding with approximately 150 guests took place in Orange County, catered by the same company. Following the event, many attendees complained of diarrhea and abdominal cramps. Of the 55 attendees Orange County interviewed, 31 reported illness. Two other events catered by this company on the same weekend did not result in illness. Orange County's investigation found that the food served at their event was Korean dishes. Foods served at the three other events were Korean foods and were prepared separately, according to the caterer.



Environmental Health Investigation: The catering company prepared all the food with the exception of cream puffs and moon pies, which were prepared by a separate facility in Orange County. Most of the food was prepared the morning of the event at the Orange County restaurant. However, the beef for the dishes was cooked the day before the event and final preparation for those dishes was completed the following morning (see Table 3 for listing of food items).

Table 3. Case-Control Study Results—Food Item Specific Risk Factors for Illness

| Food Item Consumed | Case-Patients (N=56) | | Controls (N=20) | | Odds Ratio | (95% CI) |
|--------------------------|----------------------|-----|-----------------|-----|-------------|-------------------|
| | no. | % | no. | % | | |
| Any Beef ** | 45 | 80% | 5 | 25% | 12.3 | (3.7–41) |
| Beef/mushrooms | 31 | 55% | 2 | 10% | 11.2 | (2.3– 105) |
| Any Dessert*** | 50 | 89% | 9 | 45% | 10.2 | (3.0– 35) |
| Any Drinks | 52 | 93% | 13 | 65% | 7.0 | (1.5–36) |
| Beef/Bean Curd | 27 | 48% | 3 | 15% | 5.3 | (1.3–31) |
| Fruit | 38 | 68% | 6 | 30% | 4.9 | (1.6–15) |
| Eggrolls | 37 | 66% | 6 | 30% | 4.5 | (1.5–14) |
| Any Chicken**** | 39 | 70% | 7 | 35% | 4.3 | (1.5–13) |
| Creampuff | 37 | 66% | 7 | 35% | 3.6 | (1.2–11) |
| Gailan (green vegetable) | 36 | 64% | 7 | 35% | 3.3 | (1.2–10) |
| White Rice | 36 | 64% | 7 | 35% | 3.3 | (1.2–10) |
| Any Rice | 43 | 77% | 10 | 50% | 3.2 | (1.1–10) |
| Teriyaki Chicken | 23 | 41% | 3 | 15% | 3.9 | (1.0–23) |
| Any Vegetable | 54 | 96% | 16 | 80% | 6.8 | (0.9–79) |
| Chicken/cashew | 18 | 34% | 2 | 10% | 4.3 | (0.9–41) |
| Chicken/mushrooms | 20 | 36% | 3 | 15% | 3.1 | (0.8–19) |
| Any Pork | 38 | 68% | 9 | 45% | 2.6 | (0.9–7) |
| Ice | 41 | 73% | 11 | 55% | 2.2 | (0.7–6) |
| Cabbage/shrimp | 14 | 25% | 3 | 15% | 1.9 | (0.4–11) |
| Tempura Vegetables | 25 | 45% | 6 | 30% | 1.9 | (0.6–6) |
| Eggplant | 30 | 54% | 8 | 40% | 1.7 | (0.6–5) |
| Moon pie | 11 | 20% | 3 | 15% | 1.4 | (0.3–9) |
| Chow Mein | 31 | 55% | 10 | 50% | 1.2 | (0.5–3) |
| Cucumber salad | 22 | 40% | 7 | 35% | 1.2 | (0.4–3) |
| Fried Rice | 10 | 18% | 5 | 25% | 0.7 | (0.2–2) |
| Assorted Vegetarian | 8 | 14% | 0 | 0% | Ø* | (Ø*) |

*Ø=undefined.

** Includes beef with mushrooms, beef with bean curd

*** Includes cream puff, moon pie

**** Includes chicken cashew, chicken with mushrooms and teriyaki chicken

Orange County Health Care Agency (OCHCA) made their first inspection visit to the restaurant on October 5. They found no major violations. OCHCA made a second inspection on October 19. Workers were questioned about food preparation for the Buddhist temple event and the wedding that took place in Orange County. OCHCA collected stool specimens from 11 employees of the catering company and restaurant on November 12. No specimens had the outbreak strain of *E. coli*.

Case Control Study: A case control study was performed using 56 cases and 20 controls. Statistical analyses of the food items indicate the strongest association of illness was with eating any beef dish (OR=12.27, p<.0001) (Table 3). However, several food items were significantly associated with illness.

Orange County Outbreak: Orange County Health Care agency concluded that 31 persons became ill after attending an event catered by Dragon Palace catering. No etiologic agent was identified, but investigators



suspected a bacterial toxin may have been the etiology. From their case control study, the foods most strongly associated with illness were zucchini patties and fish patties. Neither of these dishes was served at the LAC event.

DISCUSSION

An outbreak of ETEC was associated with eating at a catered event on September 26, 2004. Symptom duration, incubation and low vomit/diarrhea ratio as well as laboratory results support ETEC as the etiology. Based on statistical analyses, consuming any dish containing beef was strongly associated with illness. However, because several other foods were also significantly associated with illness, the beef dishes may not have been the sole source of the outbreak. Other possibilities include cross-contamination between other foods, surfaces at the restaurant, or utensils. Exposure by food handlers or other uninvestigated sources also cannot be ruled out. The beef was prepared ahead of time at the restaurant and was held at the luncheon site within the bacterial danger zone of 40 to 140 degrees Fahrenheit. This outbreak was likely caused by improperly stored beef.

There was no common dish served at both the Orange County and LAC outbreaks, but overall foodhandling at the restaurant/caterer may have been suboptimal as they were cooking many different foods for 4 large parties, as well as serving regular restaurant patrons that weekend.

From 1975 through 2003, only 26 outbreaks of ETEC have been reported in the US. This is the second outbreak of ETEC reported by LAC. ETEC is recognized as a cause of diarrheal illness in developing countries and in travelers to those countries.

LIMITATIONS

Limitations of this investigation include a possible sampling bias caused by the limited number of attendees interviewed, the large proportion of ill versus non-ill, and poor recall by interviewed attendees regarding food items eaten, as food was set out buffet-style. Limited information was also collected on the food handlers and their stool specimens were not collected in a timely manner, almost 6 weeks after the event occurred. This limited our ability to rule out a food handler as the source of contamination.

RECOMMENDATIONS

The Los Angeles Department of Health Services recommends that the restaurant and caterer make all corrections as advised by Orange County Environmental Health. In addition, all restaurants should adhere to the following food handling practices: (1) Hot food should be held at 140 °F or warmer; (2) Cold food should be held at 41 °F or colder; (3) When serving food at a buffet, keep food hot with chafing dishes, slow cookers, or warming trays and keep food cold by nesting dishes in bowls of ice or use small serving trays and replace them often; and (4) Potential hazardous food should not be left out more than 2 hours at room temperature. ETEC is not detected by routine stool culture, so if suspected, specific testing of both clinical and environmental specimens must be requested from a public health reference laboratory.

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OUTBREAK OF HEPATITIS B IN RETIREMENT CENTER

BACKGROUND

On January 8, 2004, Acute Communicable Disease Control Program (ACDC) was notified by a hospital infection control practitioner about two patients from the same retirement center who had been diagnosed with acute hepatitis B on December 2003 (case A) and January 2004 (case B) in the hospital. Both patients were diabetic. ACDC subsequently learned that two more diabetic residents of this retirement center (cases C and D) had earlier been reported with acute hepatitis B. These cases had been investigated by public health nurses (PHNs) in two districts (Whittier district and El Monte district) in November and early December 2004. Case C, reported in November, was transferred by a family member to the hospital out of the residential district (El Monte district), so the retirement center had not been informed of this client's diagnosis. Case D was investigated as an individual case by the Whittier district, so an outbreak investigation was never initiated at that time.

ACDC launched an investigation to determine the source of acute hepatitis B among residents in the retirement center. The investigation included site visits, case findings through a serological survey, a case-control study to examine risk factors, and interviews with the retirement center personnel. The retirement center contracted with two different healthcare agencies to provide nurses for fingersticks and insulin injections in diabetic patients who could not self-administer these procedures.

METHODS

Laboratory Case Identification: To determine the hepatitis B status of residents, under ACDC direction in January 2004, the staff of the retirement center ordered hepatitis tests (IgM anti-HBc, HBsAg, HBc-Ab total, HBsAb, and transaminase levels) on all facility residents who had received fingersticks from May to December 2003. ACDC obtained blood specimens from diabetic patients who had been discharged from the retirement center before January 2004. ACDC also obtained results of previous testing for markers of hepatitis B (IgM anti-HBc, HBsAg, HBc-Ab total, HBsAb, and transaminase levels) from hospital and dialysis center records on selected patients. Agency nurses were tested for IgM anti-HBc, HBsAg, and transaminase levels at a LAC DHS Public Health Clinic. Additionally, blood samples from HBsAg positive cases were sent to specialty laboratories to determine the subtype of hepatitis B surface antigen and eAg status.

Case-Control Study: An acute case of hepatitis B was defined as a patient with a positive test for IgM anti-HBc or documented seroconversion to HBsAg+ during July to December 2003. Controls were defined as a patient who had been a resident of the retirement center anytime from May to December 2003, who received fingersticks, and who did not have serologic evidence or past or current infection or immunity to hepatitis B. Analyses excluded residents with a history of vaccination to hepatitis B (as evidenced by positive HBsAb) or a history of exposure to hepatitis B (positive HBc-Ab total), or who were chronic carriers of hepatitis B surface antigen (positive HBsAg).

ACDC staff reviewed medical charts of all diabetic patients who had fingersticks. Charts were obtained from the retirement center, hospitals, and dialysis centers. Information abstracted from patient charts included: date of all hepatitis tests, age, underlying diagnosis, use of insulin, podiatry and dentistry visits, length of time at the retirement center, and finger stick routine. ACDC also collected information about vaccination status of the agency nurses and of selected patients. For analysis, the diabetic patients were divided into three groups: 1) patient who receive fingersticks exclusively from home healthcare agency nurses, 2) patients who received fingersticks occasionally from the nurses (primarily to demonstrate blood sugar levels to the physician), or 3) patients who perform their own fingersticks and never received fingersticks from the nurses.



Evaluation of Infection Control: After cases A and B were reported, ACDC directed the district PHNs to ask specific questions when they made visits to the retirement center in January 2004 as part of investigating the cases. The district PHNs questioned the agency nurses about policies and procedures regarding fingersticks. ACDC staff also conducted several interviews with the agency nurses in January 2004 about policies and procedures regarding fingersticks and universal precautions. In February 2004, ACDC investigators toured the retirement center, re-interviewed the agency nurses about policies and procedures regarding performance of fingersticks and observed a demonstration of how the nurses prepared to fingerstick a patient.

A representative from the County of Los Angeles, Department of Health Services, Health Facilities Division, made a visit to the retirement center in February 2004 to interview the agency nurses about fingerstick procedures. The same representative made visits to the two home health agencies to determine whether those agencies maintain the community standard of care for infection control.

RESULTS

Serologic Study: Of the 25 patients identified as receiving fingersticks, hepatitis tests were obtained on 22 of them (88%). Fourteen had serologic markers to hepatitis B of which eight were determined to have acute hepatitis B (including cases A-D). All eight patients with acute hepatitis B were IgM anti-HBc+ and HBsAg+. Only three patients had evidence of prior immunization, and four had evidence of prior exposure to hepatitis B. No chronic carriers were identified. Six patients had no markers for acute or chronic hepatitis B and these were considered controls. Both nurses tested negative for markers of acute or chronic hepatitis B.

Of the eight cases, six (75%) samples of blood were available for surface antigen typing and testing for eAg status. All six were genotype A/subtype adw2—which accounts for most of the HBV infections acquired in the USA. In addition, all six were eAg+—which is an indication of acute disease and high transmissibility.

Case-Control Study: Eight patients were excluded from analysis because they had a history of vaccination or prior exposure to hepatitis B on sero-survey resulting in a study population of eight cases and six controls. Eight patients received twice-a-day fingersticks from agency nurses, five received occasional fingersticks, and one did not receive fingersticks from the agency nurses. All eight patients with acute hepatitis B received fingersticks twice a day from agency nurses. In contrast, we found no cases of hepatitis B among those who occasionally or never received fingersticks by the agency nurses. These differences are statistically significant ($p < 0.05$). There was no statistically significant association with podiatry or dentistry visits or any other collected risk factors.

The earliest onset of acute hepatitis B was determined to be in July of 2003—a dialysis patient, who had repeatedly tested negative for HBsAg, seroconverted to HBsAg+ at that time. Subsequently the patient tested positive for IgM anti-HBc in February 2004. Four more residents (cases A-D) were hospitalized in November through January with markers of acute hepatitis B. Three more asymptomatic cases with a positive HBc-IgM were identified by sero-survey in January 2004.

Infection Control: Investigation revealed several breaches of infection control. First, when interviewed by the district PHN in January during the investigation of one of the first reported patients, the agency nurses did not show a familiarity with universal precautions that can prevent cross-contamination (i.e., using gloves for all percutaneous procedures, changing gloves between patients, washing hands between patients, etc.). Moreover, at the site visit in February, agency nurses admitted seeing blood 2-3 times a week on their gloves after performing fingersticks. Fingersticks were performed in a common central living area and the Health Facilities investigation revealed that patients were gathered, three at a time, to have fingersticks around a non-sterile table. A common glucometer was used for all patients. There was no easily accessible sink for nurses to wash their hands between patients. Finally, the nurses reported being discouraged from wearing gloves as a means of decreasing the clinical or medical atmosphere at the retirement center. One nurse admitted that in a hurry, she would sometimes re-use a pen-like fingerstick



device from her personal kit on patients. Both agency nurses gave a history of incomplete hepatitis B vaccination.

DISCUSSION

Based on the findings of the sero-survey and the case-control study, twice-daily fingersticks from the agency nurses was highly associated with the acquisition of acute hepatitis B at the retirement center. An additional finding was that one out of eight acute hepatitis B patients had seroconverted in July. That patient may have acquired acute hepatitis B outside of the retirement center. That patient continued to test positive for eAg seven months after acquisition of hepatitis B—which indicates a high level of viremia. The infective dose of hepatitis B is very small and the virus can survive on surfaces for up to seven days. Cross-transmission could have occurred with contaminated equipment or healthcare workers hands.

Of the two patients that did not contract hepatitis B yet received fingersticks twice daily from the agency nurses, one was vaccinated and the other was discharged in August—potentially before transmission took place.

Reports of outbreaks of hepatitis B in diabetics in nursing homes and hospitals have been increasing and these have been associated with poor infection control or shared diabetic equipment (glucometers or fingerstick devices). Glucometers and fingerstick devices are clearly labeled by manufacturers for single patient use only because of the potential for cross contamination with bloodborne pathogens. The reuse of glucometers and fingerstick devices, even with a change of lancets between patients, has been associated with the transmission of hepatitis B.

Given the breaches of infection control identified in this investigation, it is reasonable to conclude that this outbreak was associated with breaks in infection control during the fingerstick procedure though we cannot rule out other methods of transmission. Each of the above factors created and facilitated the possibility of cross-infection with bloodborne pathogens. Furthermore, the practices were contrary to community standard for percutaneous procedures. However, at this time we cannot determine what single break in infection control led to the transmission of hepatitis B to the eight patients.

Recommendations: From the findings, the ACDC recommended that the retirement center follow the principles of infection control. The recommendations included:

- using a sterile, single-use finger-stick device (to protect healthcare workers from touching used lancets),
- using individual glucometers for each patient,
- developing a facility-specific procedure for testing diabetics,
- developing a competency tool to assess healthcare workers' knowledge of and compliance with the policy,
- using universal precautions, including changing gloves between patients and disinfecting hands, and
- reducing the number of finger sticks in residents who are non-insulin dependent.

ACDC also recommended that the retirement center and their home health agency's staff receive proper infection control and bloodborne pathogens training. They were required to show new policies and procedures for bloodborne pathogens and on-going in-service plan to ACDC and their appropriate licensing agencies (Health Facilities or Department of Social Services). Furthermore, ACDC recommended that the medical director of the retirement center notify each of the patients that tested positive for acute hepatitis B of their test results and that patients or their guardians should be counseled about the medical ramifications of acquiring acute hepatitis B. Tests for HBsAg were advised to be repeated in six months to determine if the patient has become a carrier of hepatitis B since this may have implications for further treatment and monitoring of their condition.

Conclusions: ACDC conducted an investigation that included case identification, a case control study, an evaluation of infection control, and providing hepatitis education information. ACDC provided letters to the retirement center and the home health agencies outlining the findings from the investigation and



recommendations for enhancing infection control. After ACDC reviewed their corrective action plan, ACDC made some comments and gave feedback. ACDC and district public health nurses educated the retirement center staff and home health nurses regarding hepatitis and emphasized the importance of good hand washing techniques and universal precautions. The results of the investigation emphasize the need to restrict use of fingerstick devices to individual patients and that, when invasive procedures are performed on multiple patients, gloves should be changed after contact with each patient. The agencies complied with our recommendations and their administrators and staff trained with an infection control practitioner regarding bloodborne pathogens. ACDC expects that the three agencies will provide yearly updates on bloodborne pathogen standards to their staff.

ACDC did not recommend the retirement center to provide all diabetic patients hepatitis B vaccine because the costs were high and most medical insurances did not cover for adult hepatitis B vaccine. Anyhow, not only did we work with the retirement center in controlling the conditions that facilitated the transmission of hepatitis B, we also contributed this outbreak to the CDC. In March, 2005, the CDC published a MMWR report on the transmission of hepatitis B virus among persons undergoing blood glucose monitoring in long term care facilities. The report included recommended practices for the performance of fingersticks in non-acute healthcare settings. Locally, it will be sent by the California Department of Social Services to all residential care facilities for the elderly (RCFE) in California this summer to provide them the knowledge to achieve the prevention of nosocomial hepatitis B.

ADDITIONAL RESOURCES

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OUTBREAK SITUATION INVOLVING *LISTERIA MONOCYTOGENES* IN PLATELETS

In October 2004, the American Red Cross (ARC) of Southern California reported platelet products testing positive for *Listeria monocytogenes*. The donor was an asymptomatic 58-year-old Hispanic male who had a long history of platelet donation. The contaminated platelets were destroyed and not released for transfusion. This was the first time ARC of Southern California had identified *L. monocytogenes* in a blood product.

Widely distributed, but rarely commensal among humans, *L. monocytogenes* is a cold-loving bacillus that can cause serious sporadic and epidemic foodborne disease, particularly among people with lowered immune systems, such as the elderly, immunocompromised, pregnant women, and neonates. Common signs and symptoms of listeriosis include fever, muscle aches, nausea, diarrhea, headache, stiff neck, confusion, loss of balance, convulsions, premature birth, and stillbirth. Reports of listeriosis usually describe hospitalization with sepsis or meningitis. Risk foods include raw milk, raw-milk products like soft cheese, raw fruits and vegetables, raw or undercooked meats and seafood, and ready-to-eat foods like bagged salads, hot dogs, and deli meats. Because the incubation period of *L. monocytogenes* ranges from 3 to 70 days with a median of 3 weeks, identifying the source of infection is often very difficult.

METHODS

Through the Health Alert Network, ACDC alerted all infection control practitioners in LAC of the platelet findings and requested immediate reports of listeriosis cases not yet reported.

ACDC had a *L. monocytogenes* isolate from the platelets sent to the LAC Public Health Laboratory (PHL) for routine pulsed-field gel electrophoresis (PFGE) analysis using *AscI* and *Apal* enzymes. PFGE results are typically submitted to PulseNet, a national database, which the CDC oversee to detect possible outbreaks within 120-day periods.

Aside from collecting routine case data (e.g., clinical presentation, predisposing factors, and food and travel history), for all related cases ACDC developed a hypothesis-generating questionnaire to investigate history of blood transfusion, dental work, excavation around the home, travel, and food history specifics (e.g., purchase location, dates, frequency of consumption, food product brands and names).

RESULTS

In mid-November 2004 CDC informed the PHL of two subsequent cases, one in LAC and one in Colorado, with the same PFGE pattern. Including these three incidents, the pattern appeared only eight times (0.19%) in the national database of 4167 isolates analyzed by *AscI* and *Apal* enzymes. LAC had two other isolates with this pattern, one occurring in 2003 and one in 1999.

Case investigation focused on the two 2004 LAC cases. The platelet donor had no risk factors for listeriosis and reported eating only a few risk foods (e.g., hard and soft cheeses). Since 2001, he donated platelets only. The later 2004 LAC case was a 58-year-old Hispanic female who developed symptoms two days after the platelets were collected and died eight days later. Although her surviving relatives recalled her getting a blood transfusion for anemia two months before her illness onset, hospital and hospice records documented only the anemia and not the transfusion. This case had multiple risk factors and ate several risk foods. The only common food between the two cases was mozzarella cheese. The distance between the case residences, different brands of mozzarella, and lack of further cases with history of mozzarella consumption made the cheese an unlikely common source. Including information from the 2003 LAC case and the Colorado case, no epidemiological connections could be made between these four cases other than the PFGE pattern.



DISCUSSION

The most unusual factor revealed in this investigation was that the platelet donor was asymptomatic with no history of recent illness. Estimates of asymptomatic fecal carriage of *L. monocytogenes* among people are as high as 10% [1]. However, listeriosis cases with sepsis normally have fever or at least some other symptom. In a review of 1,036 listeriosis cases in LAC, only one other non-pregnant adult case had sepsis and was asymptomatic. Accordingly, the best explanation regarding the platelet donor is transient bacteremia. Bacterial contamination of blood products has been ascribed to transient bacteremia in the past [2–4]. Because CDC found two other cases with the same PFGE pattern around the same time frame and the PHL confirmed *L. monocytogenes*, environmental contamination, false-positive laboratory results, and skin contamination are unlikely explanations. Furthermore, the platelet donor's lack of predisposing medical conditions probably contributed to his lack of symptoms as the 2003 LAC case and the other 2004 LAC case had risk factors for listeriosis.

Listeriosis caused by transfusion has not yet been reported—at least in the literature. Reasons for not seeing *L. monocytogenes* as a blood contaminant clinically are the same as those for suspecting rates of transfusion-transmitted bacteremia to be higher. Observational bias and under-reporting can easily occur as the majority of listeriosis cases involve patients who are immunosuppressed, leukopenic, and chronically ill. Another reason may be that *L. monocytogenes* has a relatively longer incubation period. In addition, it is rare to see healthy people with asymptomatic bacteremia donating blood.

The critical event for this case report was ARC notifying the health department. Reporting by blood banks and health care facilities are necessary to determine the risks and boundaries of possible outbreaks, particularly if contaminated products are released for transfusion. While the contaminated products were not released in this case, the donation history of the platelet donor became important to determine if he donated RBC units that might have caused the subsequent 2004 cases. Because ARC had a question of the appropriateness of reporting the *L. monocytogenes*-positive platelets, health departments at all levels of government should ensure reporting requirements are clear for various reporting sources—especially now as some blood banks like those of the American Association of Blood Banks (AABB) have started to test all platelet component for bacterial contamination [3].

This investigation revealed that in conducting surveillance for listeriosis, blood-related issues need more scrutiny. While iron-overload has been established as a risk factor for listeriosis [5,6], measurement of this suffers from diagnostic bias because testing really only occurs for patients with repeated transfusions for severe or chronic anemias such as thalassemia major, myelodysplasia (including sideroblastic anemia), moderate aplastic anemia, and Diamond-Blackfan anemia [7]. Given published evidence of iron increasing the growth and lethality of *L. monocytogenes* [8–10], researchers should measure recent history of anemia, blood transfusions, and iron supplements as risk factors for listeriosis.

Conclusion: Although progress in improving blood product safety continues, the possibility of transfusion-transmitted infectious disease and the importance of reporting notifiable diseases to the health department should not be overlooked.

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OUTBREAKS OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* IN THE NEONATAL INTENSIVE CARE UNIT LOS ANGELES COUNTY, 2004

BACKGROUND

In the early 1980s, the first MRSA infection in a NICU was reported [1]. MRSA infections became a large problem in NICUs in the 1990s worldwide. Recent reports have been published throughout the United States, Israel, and Taiwan [2]. In Japan, 87% of major NICUs suffered from MRSA infections [3]. A study of 60 NICUs in Japan showed infant admissions had an average MRSA infection rate of 5.1%, with the most prevalent causative bacterium of hospital acquired infection being MRSA (41.9%) [4]. Los Angeles County Department of Health Services, Acute Communicable Disease Control (ACDC) has documented multiple MRSA outbreaks in neonatal intensive care units (NICU).

In 2004, ACDC received reports of nine NICU MRSA outbreaks, compared to one NICU MRSA outbreak reported in 2003. ACDC relies on a passive system of outbreak reporting. Once the report of an increase in MRSA disease is received, an investigation is initiated. This requires establishing a diagnosis and a case definition using consistent criteria.

METHODS

The case definition for inclusion as an outbreak in this investigation was the presence of positive cultures of MRSA from two or more infants residing in a NICU. An infant was determined to be infected when there was a positive MRSA test result from a sterile site, and the infant exhibited clinical signs and symptoms of infection with no other etiologic cause; an infant was determined to be colonized when there was a positive MRSA test result from a non-sterile site, and the infant did not exhibit clinical signs or symptoms of infection. A retrospective review of all 2004 NICU outbreaks was initiated. Los Angeles County has 104 licensed acute care hospitals with 26% (n=27) having a NICU with a total of 640 NICU beds. Basic information was gathered during the early stages of each investigation, e.g. patient identifier, culture site and date. As the investigation progressed, additional data were gathered; however, these data were not standardized from outbreak to outbreak. Significant gaps in essential information were filled with the assistance of public health nurses (PHN) by chart extraction or with the help of the hospital infection control professional (ICP).

When possible, isolates were sent to the Public Health Laboratory (PHL) for molecular analysis by pulsed-field gel electrophoresis (PFGE) (Table 1). Individual DNA fingerprint patterns were produced for isolates using the restriction enzymes *SmaI* and *EagI*. Standard criteria were employed to analyze the DNA fingerprints [5]. Isolates possessing indistinguishable PFGE patterns were assigned identical PFGE pattern designations. Isolates possessing different PFGE fingerprint patterns (>3 band differences from the outbreak strain) were assigned different PFGE pattern designations.

RESULTS

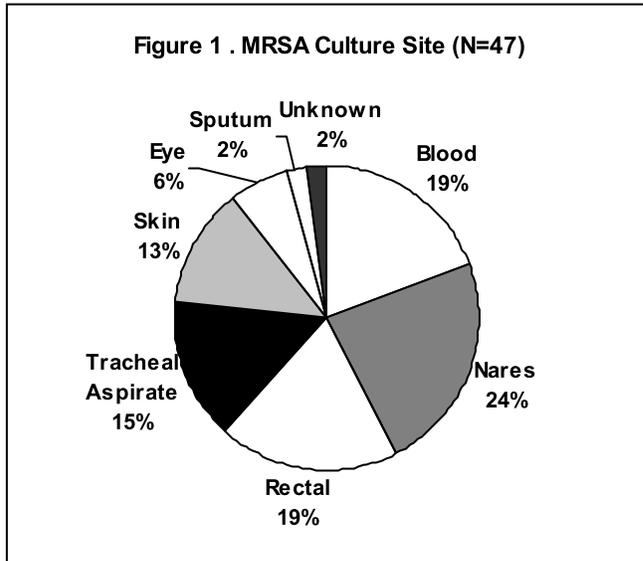
Case Characterization: The cases numbered 47 infants, 41 (87%) of which were hospitalized since birth. The remaining 6 were admitted from home to the pediatric facility. There were six sets of twins and one set of quadruplets. Of the 35 infants with delivery information, 27 (77%) were delivered by cesarean section (c/s) and 8 (23%) were delivered vaginally. Of the 27 infants who were delivered by c/s, fifty-nine percent (n=16) were from a single birth event (as compared to forty-one percent (n=11) delivered by c/s from a multiple birth event). Eighty-one percent (n=38) of NICU admissions were due to preterm birth¹.

¹ Preterm birth is defined as the birth of an infant before 37 weeks of gestation (at least 3 weeks before the "due date") as defined by CDC Maternal and Infant Health Branch and the March of Dimes.



Forty infants (85%) had either low birth weight² or very low birth weight³ upon admission. Twenty-five percent (n=12) of infants experienced respiratory distress at birth and needed mechanical ventilation to assist with breathing; 21 infants were on a ventilator at the time of MRSA diagnosis. Sepsis, rule out sepsis, and patent ductus arteriosus (PDA) were additional admission diagnoses. Eighty-three percent (n=39) of infants had a history of intubation, arterial lines or surgical procedures. Two of forty-seven infants died, one from MRSA sepsis and one from necrotizing enterocolitis.

Of the 47 MRSA positive infants 60% were colonized (n=28) and 38% were infected (n=18) (Table 1). Culture sites included tracheal aspirate, nasopharynx, umbilicus, blood, rectum, axilla, cheek, and breast milk (Figure 1). Blood, rectum, tracheal aspirate and skin accounted for 90% of the sites cultured. Six infants had positive cultures from skin infections.



The time from NICU admission to positive culture ranged from 2 to 151 days. The reason for culture varied. Most often, a culture was ordered when an infant became symptomatic. If positive, surveillance cultures were ordered on neighboring infants in the unit. At each facility, infants were housed in close proximity to each other. It was not uncommon for infants to be moved from bay to bay within the unit in order to accommodate staffing needs, especially on weekends and during the holiday season. The use of "float" nursing personnel also contributed to patients being relocated.

Table 1. Demographic Characteristics of MRSA Case-Patients (N=47)

| | n | % |
|--------------------------------------|----|-----|
| <u>Gender</u> | | |
| Male | 21 | 45% |
| Female | 25 | 53% |
| Unknown | 1 | 2% |
| <u>Gestation</u> | | |
| Term | 4 | 9% |
| Pre-term | 38 | 81% |
| Unknown | 5 | 10% |
| <u>Weight at birth</u> | | |
| Low birth weight | 12 | 25% |
| Very low birth weight | 28 | 60% |
| Unknown | 7 | 15% |
| <u>Invasive Procedures and Lines</u> | | |
| Present | 39 | 83% |
| Absent | 3 | 7% |
| Unknown | 5 | 10% |
| <u>Respiratory Distress at Birth</u> | | |
| Present | 12 | 25% |
| Absent | 4 | 9% |
| Unknown | 31 | 66% |
| <u>MRSA status</u> | | |
| Infection | 18 | 38% |
| Colonization | 28 | 60% |
| Unknown | 1 | 2% |

In addition, two mothers associated with infant cases were breast milk culture positive for MRSA in respective outbreaks. Mother 1 is a 35 year old gravida 2 para 1 who delivered quadruplets via c/s at 29 weeks gestation. She had in vitro fertilization with this pregnancy and the prior pregnancy two years previous. She reported a history of a rash and inflammation of her breasts one day after beginning milk production that reportedly progressed to a lump and was diagnosed as mastitis two weeks after the initial MRSA reports. She also had a methicillin-sensitive *Staphylococcus aureus* cesarean site infection. Four frozen breast milk specimens, one collected at the hospital on the day of discharge and three collected at home, were MRSA culture positive. Mother 2 is a 28 year old primigravida with an uneventful prenatal course. She was admitted with preterm labor, had spontaneous rupture of the membranes with foul

² Low birth weight is between 1501 grams to 2500 grams.

³ Very low birth weight is 1500 grams or less.



smelling green fluid and had a normal vaginal delivery at 29 3/7 weeks gestation. Breast milk collected the day of delivery was culture positive for MRSA.

MRSA Characterization: The PFGE strain from one of six outbreaks was indistinguishable from the prevailing Los Angeles County CA-MRSA strain, pulsed-field types (PFT) USA 300 (Table 2). At Hospital 1, the MRSA isolate pattern has not been seen previously in the United States and was not common to PFT USA 100-800 [6], but further subtyping at the Centers for Disease Control and Prevention (CDC) showed isolates contain the SCCmec IVc gene and PVL toxin. Isolate susceptibility/sensitivity patterns were available for 5 of the 9 outbreaks.

Seasonality: Four of the nine outbreaks had an onset date from September through December 2004.

Maternal Risk Factors: Of the available data, thirty-four comorbidities were identified and categorized as pregnancy-related conditions, infectious processes and general medical conditions. Half were pregnancy related, e.g. gestational diabetes, pregnancy induced hypertension, multiple gestation, and pre-eclampsia. Nine mothers (26%) had an infectious process, including group B Streptococcus infection (n=4), unspecified skin lesions (n=2), and surgical site infection. 8 of 34 had other medical conditions, such as hypertension, pleural effusion and chronic diabetes.

Table 2. Summary of PFGE results by MRSA Outbreak

| Hospital | No. NICU Beds | No. Cases | No. Infected | No. Colonized | No. Deaths | Strain Type | Comments |
|--------------|---------------|-----------|--------------|---------------|------------|-------------|---|
| 1 | 52 | 5 | 1 | 4 | 1 | A*, B | *New PFGE pattern in U.S. |
| 2 | 13 | 5 | 3 | 2 | 0 | C | PFGE Pattern indistinguishable to LAC CA-MRSA PFT 300 strain. |
| 3 | 33 | 6 | 3 | 3 | 0 | ----- | PFGE not performed |
| 4 | 15 | 6 | 5 | 1 | 0 | D | |
| 5 | 27 | 9 | 1 | 8 | 0 | ----- | PFGE not performed |
| 6 | 45 | 2 | 0 | 2 | 0 | ----- | PFGE data unavailable for pattern comparison |
| 7 | 9 | 7 | 4 | 3 | 0 | E | |
| 8 | 6 | 2 | 1 | 1 | 0 | F | |
| 9 | 10 | 5 | 3 | 2 | 1 | 3 G, 2 H | |
| Total | 210 | 47 | 21 | 26 | 2 | | |

Treatment/Decolonizations: Decolonization was conducted in only one outbreak (hospital 1). Although none of the household members was confirmed by culture to be colonized, decolonization treatment with mupirocin was completed (mother, father, sibling and cousin) at the request of the family.

Mode of Transmission: We believe that MRSA transmission occurred from mother to infant through breast milk in two outbreaks (Table 1, hospitals 1 and 2), as determined by PFGE testing. We were unable to determine the primary source of transmission in the remaining outbreaks.

Recommendations: All the NICUs implemented standard infection control measures for MRSA (cohorting, dedication of staff and equipment, staff education, contact isolation, strict hand hygiene, proper cleaning procedures, etc.) during the course of the outbreaks. Additional control recommendations included the use of single dose medication vials and dedicated ointments or creams. strict adherence to aseptic technique when doing invasive procedures, and proper cleaning and maintenance of equipment.

DISCUSSION

The number of reported outbreaks of MRSA within NICUs has grown dramatically in Los Angeles County. Since outbreaks are traditionally underreported [7, 8], we estimate that MRSA has become well



established in the NICU population. The literature has identified low birth weight, young gestational age and multiple gestation as risk factors for MRSA colonization and infection in this population [9].

Community-associated MRSA strains have emerged as a significant cause of infection in neonates in the NICU and have caused disseminated infection with substantial morbidity and mortality [10]. Of the four outbreaks reported with molecular subtyping, only one MRSA outbreak strain was indistinguishable from the CA-MRSA prevalent in Los Angeles County (LAC) in such populations as jail inmates and college sports teams. Another outbreak strain carried the PVL toxin and SCC*mec* IV markers consistent with CA-MRSA, though not the common LAC strain. The majority of neonates in the NICU are hospitalized since birth and represent a unique patient population with limited environmental exposure. In two of the reported outbreaks, the index cases probably acquired MRSA through their mothers' breast milk. It is unknown if the index cases in the other outbreaks acquired MRSA from their mother, visitors, or healthcare workers. Since breast milk feedings and skin-to-skin contact between mother and baby are encouraged in the NICU, and these neonates are a vulnerable population, risk factors for CA-MRSA should be assessed for all neonates and their mothers entering the NICU.

In all of the outbreaks described, regardless of the method of acquisition of the index case, the outbreak was probably propagated to other infants within the NICU through poor infection control practices, with the organism being spread by the hands of healthcare workers. Several areas needing improvement were identified including the use of multi-dose medication vials, lapses in asepsis, and improper cleaning of equipment. Proper hygiene procedures need to be emphasized.

Two ACDC recommendations, in collaboration with the ICPs, resulted in permanent hospital policy change. One facility implemented a policy and procedure on breast milk collection, storage, and utilization after breast milk was implicated as the source of transmission. Another facility initiated a review of its eye medication procedure during the outbreak investigation; it looked at multi-use solutions used to prepare the medication and changed the process from multi-use solutions to preparing individual doses.

CONCLUSION

This retrospective study describes nine MRSA outbreaks in NICUs within a twelve month period in Los Angeles County. It is the initial endeavor to document an emerging trend seen in this fragile population. Although the primary source of transmission was not identified in seven of nine outbreaks, research shows that subsequent transmission is usually the result of poor infection control practices by health care workers. Molecular epidemiological tests such as PFGE may characterize *S. aureus* strain patterns and help differentiate between hospital acquired and community-associated MRSA [11]. This distinction provides crucial guidance to clinical practitioners in diagnosis and treatment modalities, and directs future MRSA prevention efforts. Further studies that incorporate the complex factors that impact MRSA infection -- prenatal care and history of skin lesions, household history of skin lesions, labor and delivery, multiple gestation, post-partum infections, breast milk transmission, etc. -- are needed.

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METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* INFECTION FROM BREAST MILK, TWO CASE REPORTS LOS ANGELES COUNTY, 2004

BACKGROUND

First identified in the 1960s [1], methicillin-resistant *Staphylococcus aureus* (MRSA) is now a ubiquitous organism. Approximately 25 to 30% of the population is colonized in the nose with staphylococcal bacteria at a given time [2]. The number of people colonized with MRSA ranges from 0.12% to 13.6% [3]. The areas of colonization include the nares, axilla, vagina, pharynx, and damaged skin surfaces, such as traumatized nipples in lactating women [4–7]. Colonization with MRSA is a risk factor for developing sepsis [8].

Transmission is from person-to-person usually through direct contact via hands. Hands become contaminated by contact with: a) colonized or infected patients, b) colonized or infected body parts, or c) devices, items, or environmental surfaces contaminated with MRSA [9].

Increasing prevalence of MRSA is a worldwide problem. MRSA infections became a large problem in newborn intensive care units (NICU) in the 1990s. Recent reports revealed that 87% of major NICUs in Japan suffered from MRSA infections. A study of 60 NICUs in Japan showed infant admissions had an average MRSA infection rate of 5.1% with the most prevalent causative bacterium of hospital acquired infection being MRSA (41.9%) [10]. LAC has documented multiple MRSA outbreaks in neonatal intensive care units (NICUs).

RESULTS

Case Report 1: On January 6, 2004, premature quadruplets (gestational week 29) were delivered by Cesarean section to a 35-year old (G2P1) Algerian mother. Baby Girl C, birth weight 1180 grams, of this set of quadruplets died from MRSA sepsis on January 22, 2004. The other three siblings had signs of worsening apnea requiring increased respiratory support. They were subsequently found to be colonized with MRSA detected on nasopharyngeal cultures. Blood cultures were negative. All four siblings were located in the neonatal intensive care unit (NICU) Nursery A, which contains 12 beds. The mother was admitted to the hospital January 6 and discharged 4 days later. The mother collected milk in the hospital by electric breast pump starting the day after delivery (single-use disposable collection equipment and common motor); at home, she had her own equipment. The infant A, C, and D were fed breast milk starting on January 12. Infant B started on January 13. Collected milk was frozen for hospital storage. Frozen breast milk specimens were cultured, including one collected in the hospital on the day of discharge (January 10) and three collected at home (January 12, 15, and 22). All were MRSA culture positive. Antibiotic susceptibility patterns for all available isolates were the same.

The mother reported a history of a rash and inflammation of her breasts one day after beginning milk production that reportedly progressed to a lump. It was diagnosed as mastitis by her obstetrician two weeks after the initial MRSA reports and treated with dicloxacillin. No cultures were performed. She also had a Caesarian-section site infection due to methicillin-sensitive *Staphylococcus aureus* (MSSA) that was diagnosed January 23. Both mother and father had skin-to-skin contact with the infants through the isolette ports but were unable to hold them.

Both parents immigrated to the US from Algeria nine years ago. The mother had in vitro fertilization with her prior pregnancy two years prior and in vitro fertilization with this pregnancy. She was admitted to the hospital December 8, 2003 to rule-out preterm labor and was discharged the next day. The quadruplets' 2-year old sibling had a history of "pimples" in December of 2003, but the child was not seen by a physician nor was a culture obtained.



In response to the MRSA associated death, the staff of the hospital cultured the remaining five infants in NICU Nursery A at the time of Baby C's illness onset. The three colonized siblings were cohorted by location and by nursing/respiratory staff, placed on contact precautions, and treated with antibiotics.

On January 30, 2004, a 19-day old NICU infant was MRSA positive from a nasopharyngeal culture obtained during a routine sepsis workup. This infant was also diagnosed with coagulase negative *S. aureus* in the blood. On review, this infant was exposed to the quadruplets in NICU nursery A from the day of birth (January 11), and then was transferred to NICU Nursery D on January 22. Surveillance nasopharyngeal cultures were performed on a total of 18 other NICU infants in the nursery exposed to cases in Nursery A and D.

A total of five confirmed cases colonized or infected with MRSA were identified among neonates. All cases were treated with IV antibiotics including vancomycin, cefotaxime, and clindamycin. All concurrently received intranasal mupirocin. No family members were tested; however, the mother, father, 2-year old sibling, and father's nephew who lives in the house, completed decolonization procedures. After treatment, no follow up cultures were obtained.

Pulse field gel electrophoresis (PFGE) was performed on MRSA isolates from the quadruplets, the fifth case, the mother's breast milk, and the mother's nares. Results from the five infants and breast milk were identical; the maternal N/P isolate obtained 17 days after delivery (differed by a total of 8 bands) indicating a different source. In comparison with the pulsed-field types at CDC (USA 100 through USA 800), there did not appear to be any matches with our set of isolates. Further subtyping at the Centers for Disease Control and Prevention (CDC) showed isolates contain the SCCmec IVC gene and PVL toxin, indicating community associated MRSA (CA-MRSA).

Case Report 2: On March 15, 2004, a 1,199 gram male infant (gestational week 29) was delivered vaginally to a 28-year old African American mother (G1P0). He developed MRSA sepsis on March 23. On April 1, MRSA was cultured twice from maternal breast milk including one collected on the day of delivery. The infant was fed breast milk starting on day one. The mother collected breast milk in the hospital using a manual/spring express pump, then took the breast pump home and pumped. The breast milk was frozen and stored at the hospital. The mother had no symptoms of mastitis; however, she did report multiple "spider bites" a couple of months before delivery, including lesions two weeks prior to delivery. No lesions were reported around the breast area. The mother, sought treatment for these bites, but did not finish the antibiotics as prescribed. No cultures were available from the mother. The infant was kept in an open air warmer in the NICU. The only contact between mother and infant occurred with the mother holding the infant after a 3-minute hand scrub while wearing a gown.

Two other MRSA infections were subsequently identified: one infant had MRSA isolated from an axillary pustule and this infant's twin had MRSA isolated from eye discharge. Surveillance cultures, performed on the nares, umbilicus, and groin from the remaining 10 NICU babies identified another set of twins found colonized in the nares. Isolates from the breast milk and the five cases appeared indistinguishable to one another by PFGE with both Smal and EagI enzymes. This PFGE pattern appears to be indistinguishable to that common among CA-MRSA isolates from LAC.

DISCUSSION

In these case reports, the index cases probably acquired MRSA from their mothers' breast milk. In both situations, identical strains of MRSA were identified in breast milk and corresponding cases. The infants were all exposed to the breast milk before infection or colonization. None of the infants were breastfed. There are a few risk factors to consider. The first case occurred after an undiagnosed and untreated case of mastitis. The second case might represent a situation where a mother was colonized with MRSA on her breasts, which caused the organisms to appear in the breast milk. This could occur directly from contact with the skin, or colonization within the mammary ducts or glands. The mother had a history of "spider bite" infections. In Southern California, CA-MRSA infections are often misdiagnosed as spider bites [11].



Pregnant women and neonates in the NICU are unique risk groups. A wide range of maternal staphylococcal infections, including MRSA, may occur in the postpartum period such as mastitis, abscesses, caesarean scar infections, boils and other skin infections [12,13]. Mastitis occurs in 2-33% of breastfeeding mothers, and *S. aureus* is the most frequently identified organism in milk culture [14]. There is a general consensus to continue lactation despite a history of staphylococcal infection, and women with mastitis are often encouraged to continue breastfeeding [14]. Even in healthy women, breast milk is not a sterile fluid. Studies have shown that breast milk from healthy mothers usually contains bacteria representative of normal skin flora. MRSA contamination was found in 11% of 500 expressed frozen breast milk samples at a Brazilian milk bank [15]. *S. aureus* is the most frequently isolated pathogenic bacteria and is strongly associated with a poor outcome [16]. The same study also identified sore nipples as being strongly associated with presence of potentially pathogenic bacteria in breast milk.

Given the close contact between mothers and infants, it is not surprising that MRSA can be passed between them. There have been case reports of *S. aureus* vertical transmission from mother to infant via colonized genital secretions and placental transmission, including a case report of transmission in a set of quadruplets attributed to contact between mother and infant [17–19]. Breastfeeding, maternal carriage, and number of siblings, have been shown to be a risk factor for infant carriage of MRSA [20]. Another study specifically linked *S. aureus* and MRSA transmission between healthy, lactating mothers and their infants by breastfeeding [21].

Other studies have demonstrated breast milk to be protective against MRSA. Breastfeeding is a mechanism for the infant's gastrointestinal tract to become colonized. Precolonization of alpha-Streptococcus has been shown to inhibit the settling of MRSA in the noses and mouths of newborns [22]. The colonization rate of MRSA in the mouths of extremely low birth weight infants could be significantly lowered by spreading the mother's breast milk over and into the mouths of such infants immediately upon entering the NICU [23]. However, the studies represented above do not address breast milk that is already contaminated with MRSA.

We acknowledge that we do not know conclusively that breast milk was the method of transmission in these cases. We cannot rule out that the infants did not become colonized with MRSA during birth or through contact with the mother after birth. We also cannot rule out that the breast milk did not become contaminated from a source other than the mother. In case report #1, the mother was colonized in the nares with a different strain of MRSA. The mother in case report #2 was never cultured. It is possible that the breast milk could have become contaminated during storage and handling.

The role of breast milk transmission of MRSA from mother to infant needs further study. It is common for breast milk to contain organisms that are normal flora to the mother. It is generally believed that a mother's normal flora will not be harmful to infant. However, this theory predates the rise of MRSA and is an important point for further research especially in the NICU setting. Because of the vulnerable nature of the NICU population and the virulence of MRSA, we propose that all breast milk fed to neonates in the NICU be cultured and screened for MRSA.

In both outbreaks, other infants within the NICU became colonized or infected with MRSA. This most likely represents poor infection control practices, with the organism being spread by the hands of healthcare workers. Proper hygiene procedures need to be emphasized.

Additionally, we propose that all labor and delivery wards should include surveillance for MRSA by:

- Screening all delivering mothers for skin lesions.
- Culturing any suspicious lesions (i.e. pustules, boils, abscesses, insect bites) for MRSA.
- Referring family members with suspicious lesions for MRSA to their private providers.

Conclusion: The role of breast milk in the transmission of MRSA from mother to infant remains unclear. Hospitals, especially NICUs, should consider screening all mothers and family members at delivery for skin lesions in the preceding two weeks, obtaining cultures on breast milk, and continuing good hand hygiene.



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INVASIVE PNEUMOCOCCAL DISEASE IN CHILDREN YOUNGER THAN 2 YEARS LOS ANGELES COUNTY, 2004

BACKGROUND

Invasive pneumococcal disease (IPD) is a leading cause of bacterial illness in young children and causes considerable illness and death in the elderly. The infectious agent, *Streptococcus pneumoniae*, also has become increasingly resistant to antibiotics during the last decade. ACDC has conducted (IPD) surveillance for IPD since late and the Los Angeles County Department of Health Services (LAC DHS) added IPD to its list of reportable diseases in October 2002.

IPD can be prevented by two types of available vaccines: the 23-valent pneumococcal polysaccharide vaccines (Pnu-Imune[®]23 and Pneumovax[®]23), which are effective for adults and children over age 2 years; and the heptavalent pneumococcal conjugate vaccine (Prenar[®]), which was approved in February 2000 for use in infants and protects against the seven most common strains of *S. pneumoniae* in infants. The Advisory Committee on Immunization Practices (ACIP) recommends that infants receive four doses as part of their routine vaccinations at 2, 4, 6, and 12–15 months [1]. Since the introduction of Prenar[®], a significant reduction in the number of IPD cases has been seen in children less than 5 years old in Los Angeles County (LAC) as well as in other populations [2]. Until March 2005, the Respiratory Diseases Branch of the Centers for Disease Control and Prevention (CDC) had been monitoring IPD cases in this age group to identify possible vaccine failures. When pneumococcal vaccine histories could be obtained and isolates were available, ACDC reported these cases to the CDC through a pneumococcal conjugate vaccine failure case report form and forwarded the isolates for serotyping. The data obtained was utilized for monitoring distribution of serotypes, host risk factors, and vaccine lot effectiveness.

In 2004, a nationwide shortage of Prenar[®] resulted in ACIP recommending a suspension of the fourth dose beginning mid-February and later the third dose beginning March. A mid-year review of cases through May 2004 in LAC showed a rise in IPD cases among those less than 5 and especially less than 2 years old. There were 22 reports of IPD in children less than 2 years old from January through May 2004 compared to 6 reported cases during the same time period in 2003. ACDC was concerned that the shortage was leading to increases in IPD, through vaccine failures or a replacement of serotypes not covered by Prenar[®], and initiated an investigation of cases occurring in children less than 2 years old from January through May 2004.

METHODS

Cases were defined as children less than 2 years old reported to LAC DHS with a positive culture for *S. pneumoniae* in a normally sterile site dated between January and May 2004. ACDC is notified of cases through a standardized IPD reporting form that includes variables for age, gender, residence, race/ethnicity, hospitalization, outcome, culture site and date, antibiotic susceptibility results, and vaccination status. Penicillin non-susceptible *S. pneumoniae* (PNSP) strains are defined as strains that are determined to be intermediate or resistant by the reporting facility's antibiotic susceptibility testing. All data from the case report forms initially submitted to ACDC were abstracted. ACDC investigators contacted the infection control professionals and/or medical records units of the reporting facilities by telephone to request the cases' discharge summaries and to obtain contact information of the primary physician and the parent/guardian. If the reporting facility could not provide the primary physician information, the parent/guardian of the cases was requested by telephone or letter to provide the name of the physician or clinic that vaccinated the child. The primary physician or clinic was then contacted by telephone and asked to provide the vaccination history of the child.

Vaccination histories were reviewed to determine if the case children had received the age-appropriate number of doses of Prenar[®] as recommended by the ACIP before the date of culture and if any missed doses coincided with the period of shortage. For this report, the first, second, and third doses were



considered late if they were given more than 1 month after the recommended ages of 2, 4, and 6 months, respectively; the fourth dose was considered late if not given by 13 months of age. Available medical records, including discharge summaries and history and physicals (H&P), were reviewed for risk factors and missing demographic and hospitalization data. The ZIP codes of the cases' reported residences were mapped using ArcView.

The laboratories used by the reporting facilities were contacted to request available isolates to be forwarded to the LAC Public Health Laboratory. Isolates were sent for serotyping through the California Department of Health Services to the CDC's Respiratory Disease Branch.

RESULTS

None of the 22 IPD cases reported to ACDC initially included immunization status. Complete vaccination histories were obtained for 20 of 22 cases. In the two cases where the histories were not obtained, medical records and case reports did not list a primary physician and the parents could not name the physician or clinic that vaccinated the child. Discharge summaries or other medical records were received for 16 cases and 6 were not available.

The median age of all cases was 12.5 months and ranged from 1 to 21 months. Most (57%) were Latino and most (59%) were male. Mapping of cases did not show any geographic clustering. In six cases *S. pneumoniae* was cultured from cerebrospinal fluid (CSF) or blood and CSF while the rest were culture positive in blood. Half (50%) were hospitalized, but all cases survived the infection. A few of the cases (14%) were infected with PNSP strains.

All but one child, who was younger than the recommended age for the first dose, had at least one dose of Prevnar[®] by the date of positive culture. 7 of 19 (37%) children were late with their Prevnar[®] vaccinations. Nevertheless, when their vaccinations were administered, they occurred within a month of the recommended ages for routine administration of currently licensed childhood vaccinations (i.e. 2,4,6, and 12–15 months) [3]. Of these seven, only one child's last dose was withheld due to the shortage. Another's was withheld because she was on chemotherapy. Two children, one of whom had been born premature (gestational age 27 weeks), had late vaccinations as a result of receiving the first dose at 4 months. The remaining three had visited their physicians for scheduled immunizations several months before the shortage without receiving Prevnar[®] and became ill before the next scheduled immunization. They had no risk factors for pneumococcal disease.

Isolates were available for only 6 cases. Serotyping results for 5 of the 6 isolates indicate that the strains were not covered by Prevnar[®]. The sixth isolate could not be typed.

DISCUSSION

This study did not reveal anything unusual about this cohort of IPD cases nor did it show an association between the Prevnar[®] shortage and the increase of cases seen in the beginning of 2004. The demographics of the children were representative of the population of children <2 years old in LAC. Almost all were vaccinated despite the shortage, many of them appropriately for their age, and the majority had no risk factors for pneumococcal disease. One child may have received his vaccinations 2 months late due to a premature birth at 27 weeks. However, it is important to reiterate that Prevnar[®], as well as other childhood vaccinations, should not be delayed because of prematurity.

The rate of PNSP strains is slightly lower than the overall rate for cases of all ages (22%) through May 2004. However, this is to be expected if the children were indeed protected by Prevnar[®] against the more resistant strains of *S. pneumoniae*. Moreover, continued surveillance after May showed a characteristic seasonal drop in IPD cases in children less than 2 years old to baseline levels.

Nevertheless, this study indicates that there is good pneumococcal vaccination coverage in LAC—all children were eventually vaccinated with at least 2 doses by the time of data collection and the majority of children were appropriately vaccinated for their age at the time of their illness. It also demonstrates that



national vaccine failure surveillance had been severely limited in case identification as all 22 cases were reported to ACDC with unknown vaccination status. The CDC requested through February 2005 that IPD in children less than 5 years old with at least one dose of Prevnar[®] be reported as a potential vaccine failure. Because active follow-up is not routine, the 20 cases eventually found to be vaccine failures would have slipped through normal surveillance procedures.

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A LARGE RESTAURANT-ASSOCIATED OUTBREAK OF *SALMONELLA* HEIDELBERG

BACKGROUND

On March 4, 2004, ACDC received a Food-Borne Illness Report (FBIR) from a local resident stating that he had been hospitalized for salmonellosis. He believed that his illness was connected to dining at a restaurant, Manhattan Beach, California (Restaurant C). Over the next few days, two additional FBIRs were received by ACDC implicating the same restaurant. The potential for a wide-scale outbreak was heightened since Restaurant C serves over 1,000 customers daily.

METHODS

The Food and Milk (FM) Program of the Environmental Health Division of the Los Angeles County Department of Health Services (LACDHS) responded to the initial FBIR with a restaurant inspection on March 5, 2004. On March 9, ACDC initiated an epidemiological investigation to determine the extent of the outbreak, risk factors for disease acquisition, and steps necessary to control and prevent further infections. For case finding, a press release was issued on March 11 notifying the public of the *Salmonella* outbreak and requesting that patrons who dined at the restaurant between February 25, 2004 and March 5, 2004 and became ill contact ACDC. Public callers, their dining partners and identified ill individuals were interviewed for a case-control study.

Case-Control Study—Outbreak Case Definitions and Case Finding: A case-patient was defined as: 1) a person who ate at or ate food from Restaurant C from February 25, 2004 to March 5, 2004, and 2) who developed diarrhea (>2 loose stool over 24 hrs) and fever, or diarrhea and at least two other symptoms (abdominal cramps, vomiting, nausea), within 6–72 hours after eating. Culture-confirmed case-patients had stool specimens positive for *Salmonella* with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern to the outbreak strain. All other case-patients were considered as presumptive. Case finding was conducted through notification of the public via the press release or media reports, review of *Salmonella* positive cultures from local laboratories, and interview of ill patrons to identify their dining partners. Reservation lists or credit card receipts were unavailable as these records were either not kept or not accessible.

An unmatched case-control study was conducted using a standardized, telephone-administered questionnaire. Asymptomatic persons who ate at the restaurant during the outbreak period and called ACDC were included as controls. Employees, including food handlers, were also interviewed and included in the study. Participants were questioned about their demographics, dining exposure, symptoms, and treatment. The Fisher's Exact Test was used to calculate odds ratios (OR) and 95% confidence intervals (95%CI). Only culture-confirmed case-patients were included in the analysis. "Case-patients" hereafter will only refer to culture-confirmed individuals.

Laboratory Study: Callers who were still ill were offered stool cultures. Stool specimens were also collected from all food handlers regardless of symptoms—persons who handled food products or food utensils (e.g., cooks, dishwashers, etc.). Environmental samples from Restaurant C were collected for culture as well. Cultures were tested in the LAC Public Health Laboratory (PHL) or retrieved from local laboratories for additional analysis. *Salmonella* isolates from case-patients and food handlers were serotyped by the PHL. In addition, isolates were characterized by pulsed-field gel electrophoresis (PFGE) using the restriction enzymes Xba1 and Bln1 to determine genotypic relatedness. Antibiotic susceptibility patterns were also reviewed.



RESULTS

Restaurant Inspection: The inspection by FM revealed two main problems. First as reported by the restaurant manager, the slow-cooking Alto Sham[®] oven, which is used primarily for cooking turkey breast meat, had malfunctioned. The thermostat was not correlating with internal cooking temperature, causing the staff to arbitrarily set the oven temperature for cooking. This turkey meat was used in all dishes containing turkey in the restaurant. During the inspection, FM did not check the oven's temperature; however, the recorded temperature of the turkey meat in the holding compartment of the oven at the time of the inspection was 96–111°F. Second, at the time of the inspection an electric slicer was crusted with debris. This slicer was used to cut both meats and produce and in close proximity to food preparation areas for other food products such as produce.

Descriptive Epidemiology: In response to the press release, over 80 case-patients were identified by ACDC. As of June 4, 2004, 23 culture-confirmed case-patients and 55 presumptive cases were identified. Case-patients resided in Los Angeles, New York, Chicago, Canada, and Wales. The majority of case-patients (n=21, 91%) and 39 controls completed the questionnaire. The median age for case-patients was 33 years (range 12–67) and about half (52%) were male (Table 1). The median age for controls was 37 years (range 2–72) and a little more than half (56%) were male. Most cases dined in the restaurant (71%) versus taking food out (29%). Four cases reported eating leftovers from their meals. Related to this incident, health care providers evaluated 17 cases for gastrointestinal symptoms and 14 of these cases gave stool specimens for culture. Other individuals submitted stool specimens upon request of ACDC. Diarrhea was the most common complaint (100%), followed by abdominal cramps (91%), fever (81%), vomiting (52%), nausea (52%), and headache (33%, Table 2). All case-patients ate at the restaurant during February 25 through March 1, 2004, but this did not differ from the control group (Figure 1). Only one case-patient ate at the restaurant on more than one occasion (on February 27, 28, and 29); the onset of his symptoms occurred on March 1. Most case-patients (81%) had onset of symptoms within one day of eating at Restaurant C (range 1–8 days).

Table 1. Characteristics of Case-Patients and Controls

| Characteristic | Case-Patients* (N=21) | | Controls (N=39) | |
|------------------------------|--------------------------|-----|--------------------|-----|
| | no. | % | no. | % |
| Sex, Male | 11 | 52% | 22 | 56% |
| Underlying chronic illness | 1 | 5% | N/A | – |
| Eat in | 15 | 71% | 31 | 80% |
| Take out | 6 | 29% | 5 | 13% |
| Ate leftovers | 4 | 19% | 2 | 5% |
| Seen by health care provider | 17 | 81% | N/A | – |
| Stool cultured by provider | 14 | 67% | N/A | – |

* Excluded two case-patients: one not available for interview, other did not complete questionnaire.

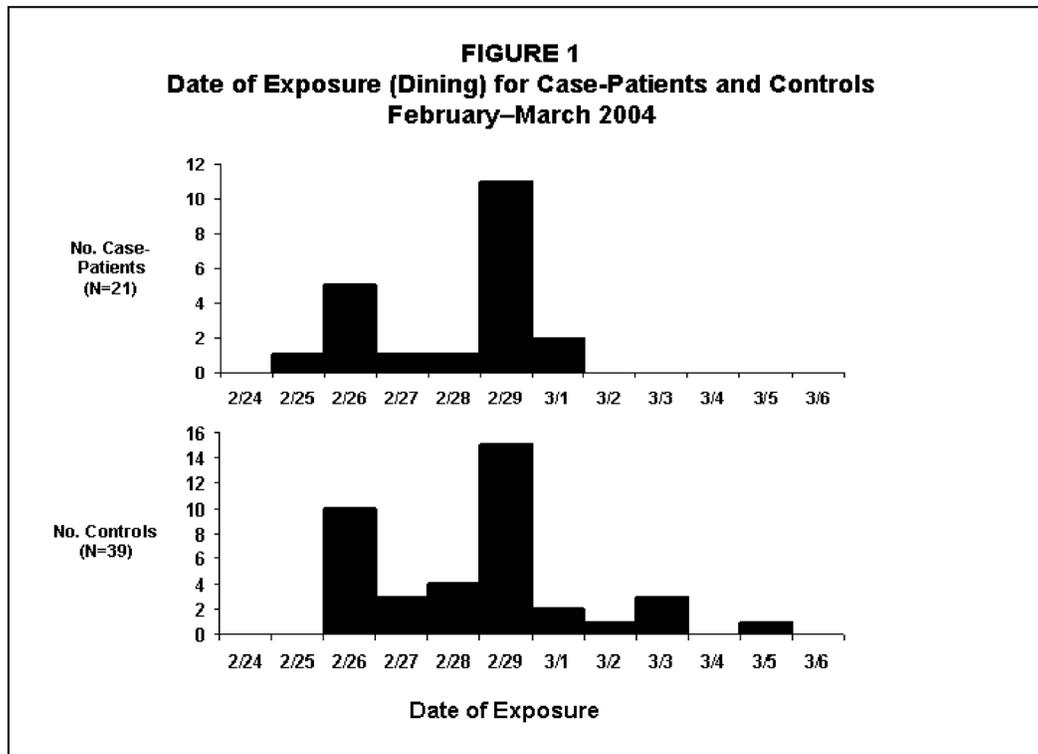
Table 2. Frequency of Symptoms among Case-Patients

| Symptoms | Case-Patients (N=21) | |
|------------------|----------------------|------|
| | no. | % |
| Diarrhea | 21 | 100% |
| Abdominal Cramps | 19 | 91% |
| Fever | 17 | 81% |
| Vomiting | 11 | 52% |
| Nausea | 11 | 52% |
| Headache | 7 | 33% |

In addition, 68 employees, including 19 food handlers, were interviewed. Two food handlers (FH-A and FH-B) reported diarrheal illnesses during February 23 to March 2. FH-A was a male dishwasher who



developed diarrhea and abdominal cramps on March 1. He reported no ill contacts. FH-B was a male cook who developed fever, diarrhea, abdominal cramps, and vomiting on March 1. He also reported no ill contacts. Both had eaten food at the restaurant prior to their onsets of illness, but since only FH-B's illness was culture confirmed, only this worker was counted as a case.



Case-Control Study: Ultimately, 21 of 23 culture-confirmed case-patients and 39 controls were included in the study. One case-patient was not available for interview; the other did not complete the questionnaire. Both were excluded. The most common food items consumed by case-patients were the Cobb salad (29%) or turkey sandwich (29%, Table 3). Analyses showed that the consumption of the Cobb salad (OR=Undefined, 95%CI: 2.6–undefined), or the turkey sandwich (OR=Undefined, 95%CI: 2.6–undefined) were statistically associated with illness. Among dishes consumed by case-patients were several salads and sandwiches containing turkey breast, including the chopped salad, Cobb salad, club sandwich and Reuben sandwiches. Consumption of any turkey-containing dish was strongly associated with illness (OR=27.4, 95%CI: 5.5–171).

Table 3. Case-Control Study Results—Food Item Specific Risk Factors for Illness

| Food Item Consumed | Case-Patients (N=21) | | Controls (N=39) | | Odds Ratio | (95% CI) |
|------------------------|----------------------|-----|-----------------|-----|------------|-----------|
| | no. | % | no. | % | | |
| Turkey breast meat** | 18 | 86% | 7 | 18% | 27.4 | (5.5–171) |
| Cobb salad | 6 | 29% | 0 | 0% | Ø* | (2.6– Ø*) |
| Turkey sandwich | 6 | 29% | 0 | 0% | Ø* | (2.6– Ø*) |
| Club sandwich | 4 | 19% | 2 | 5% | 4.4 | (0.5–51) |
| Bran muffin | 2 | 10% | 1 | 3% | 4.0 | (0.2–242) |
| Chopped salad | 2 | 10% | 3 | 8% | 1.3 | (0.1–12) |
| Steak fries | 3 | 14% | 4 | 10% | 1.5 | (0.2–10) |
| Turkey-walnut sandwich | 0 | 0% | 1 | 3% | 0 | (0–72) |
| Reuben sandwich | 0 | 0% | 2 | 5% | 0 | (0–10) |

* Ø=undefined.

** * Includes chopped/Cobb salads, club/turkey/turkey-walnut/Reuben sandwiches—all contain turkey breast meat.



Laboratory: All 23 *Salmonella* isolates from case-patients were serotyped as *S. Heidelberg* with indistinguishable PFGE. Antibiotic susceptibilities reports were received on 17 isolates—all displayed sensitivity to the tested antibiotics and showed no multi-drug resistance patterns. Only 1 of the 19 stool cultures from food handlers was positive for *Salmonella*—it belonged to FH-B.

On March 10, 2004, ACDC accompanied FM on a repeat inspection. Environmental samples were obtained from: plastic containers used to defrost turkey meat, electric slicer, produce boxes, and a magnetic knife holder. In total, nine samples were collected. None of the cultures was positive for *Salmonella* species.

Interventions: The investigated restaurant was not closed because control measures were implemented as soon as the outbreak was recognized and there was no indication that the outbreak was ongoing. Many infection control improvements were implemented: use of the malfunctioning oven was discontinued, the contaminated slicer was disassembled and cleaned, a new slicer was purchased for future use, the slicers were relocated away from food preparations areas, and produce was re-washed. Remaining turkey meat that had been prepared in the malfunctioning oven was disposed of. In addition, there was increased adherence to cleaning protocols in the kitchen and preparation of meat products was moved to a separate location away from produce preparation sites. The manager held meetings to discuss food safety protocols including checking internal food temperature and related issues with the entire staff.

DISCUSSION

A food-borne illness outbreak due to *S. Heidelberg* occurred at a restaurant in LAC during February to March 2004. We confirmed that 23 individuals who dined the restaurant during that time period subsequently developed salmonellosis. In addition, 55 more persons developed clinical symptoms compatible with salmonellosis and were considered presumptive cases. Our investigation indicates that the most likely contaminated food item was turkey breast meat and dishes containing turkey meat. Although several employees reported gastrointestinal illnesses, they likely became ill after consuming food from the restaurant and were not the source of the outbreak. Contributing factors assumed to have facilitated this outbreak include the malfunctioning oven, which may have resulted in under-cooked turkey meat, and cross contamination from the electric slicer. Our investigation was limited by the lack of implicated turkey meat prepared during the outbreak period for laboratory testing. In addition, documentation (i.e., reservations or credit card receipts) was not available to confirm exposure dates, so reporting and recall biases may have occurred among interviewees. The restaurant management demonstrated improved adherence to proper food preparation protocols such as checking internal temperature of the turkey meat and other improvements to resolve unhygienic food handling practices.



LIAISON PUBLIC HEALTH NURSING PROJECT IN THE HOSPITAL OUTREACH UNIT

BACKGROUND

Reporting of communicable diseases is fundamental to the prevention, control, and monitoring of diseases in Los Angeles County (LAC). Data from disease reporting is also useful for planning and evaluating public health interventions and in setting priorities for the allocation of financial resources. In light of the potential threat of bioterrorist activity, severe acute respiratory syndrome (SARS), West Nile virus, and other emerging infectious diseases, the need for prompt and thorough disease reporting is now especially important. Delay or failure to report may contribute to secondary transmission of disease and is a misdemeanor (Health and Safety Code §120295). Yet despite state and local laws requiring medical providers to report communicable diseases to the local public health department, reporting is incomplete.

Numerous studies have cited complacency on the part of providers, due to lack of knowledge as to what diseases are notifiable and how to report these to the proper authority, and physicians' concerns such as their time involvement and patient confidentiality. In addition, providers that do report are often frustrated to find that there is no way to follow up on case reports that they have submitted and that there is no active process for feedback or follow-up [1, 2].

Ensuring proper and prompt disease reporting is especially difficult in LAC due to the large size of our jurisdiction. The LAC Department of Health Services (LACDHS) is the largest public health jurisdiction on the Pacific Coast and the second largest in the US. Two cities, Long Beach and Pasadena, operate their own public health departments; yet depend on LACDHS for indigent medical care, including hospitalization. The LACDHS Personal Health Services provides ambulatory and inpatient medical care for the uninsured (estimated at 2.7 million) through its four hospitals, comprehensive health centers, and district health centers. In 2004, there were 104 acute care hospitals, 77 with fully staffed emergency departments.

Origins of the Liaison Public Health Nurses Project: During the SARS epidemic in early-2003, the Liaison Public Health Nurses (LPHN) assisted with managing suspect SARS cases and working with the hospitals to ensure infection control was maintained. After the SARS situation had passed, it became clear that there was a need for a new hospital unit in ACDC. In November 2003, ACDC instituted the Hospital Outreach Unit (HOU). This unit would liaison with all hospitals in LAC to increase traditional disease reporting as well as enhance emerging infectious disease preparedness. The mission of the HOU is to enhance emerging infectious disease preparedness and response efforts and improve hospital disease reporting by hospitals in LAC through strengthened communications, collaboration, and consolidation of resources. In order to accomplish HOU mission, the liaison public health nursing project was developed and began implementation to enhance outreach and collaboration activities. In this project, five LPHNs have been assigned to collaborate with all acute care hospitals in LAC.

One of many goals of LPHN project is to open lines of communication and establish good working relationships between healthcare providers and public health authorities. These are essential to a robust system of surveillance and effective implementation of disease investigation and response activities.

The 2004 objectives of LPHN project included:

Objective 1: By the end of 2004, LPHNs will conduct site visits to all hospitals in LAC including Pasadena and Long Beach.

Objective 2: By mid-2004, LPHNs will identify strengths and weaknesses of targeted hospitals and identify barriers to disease reporting.



Objective 3: By mid-2004 and on an ongoing basis, LPHNs will promote improved disease reporting in targeted hospitals and the use of emerging technology systems and other resources sponsored by the health department.

Objective 4: By mid-2004 and on an ongoing basis, LPHNs will evaluate needs and, as appropriate, provide consultation to hospitals in developing plans, response protocols, and drills for urgent communicable diseases including emerging infectious diseases and potential bioterrorist threats.

METHODS

Regional Emerging Infectious Disease Preparedness Meeting: During December 2003, the HOU conducted four regional meetings. The purpose of these meetings were to: introduce the unit to the 120 hospitals of LAC, detail objectives for collaboration between the hospitals and public health, and assess how the hospitals were responding to respiratory illness preparedness. In addition, evaluations were collected and assessed at the end of each meeting. These meetings served as the basis for the following tasks conducted during 2004.

LAC Hospital Visits: Based on regional meetings and preliminary assessments, the first seventy-seven 911 -receiving hospitals were selected for needs assessment. Meetings with key personnel from identified hospitals were scheduled by LPHNs. In these meetings, the LPHNs explained the purpose of the program and sought support from hospital administration and Infection Control Professionals (ICP). After the hospital ICPs agreed to participate, the LPHNs initiated hospital visits as routinely and as needed.

Analysis of all LAC Hospitals: During 2004, the LPHNs met with ICPs, nurse managers, lab personnel, medical records personnel, and other health care providers and key hospital personnel at each assigned hospital. During their meetings, assessment of the knowledge, attitudes and practices (KAP) regarding disease reporting was conducted. LPHNs also performed assessments of various units (lab, emergency room, med-surgical floor, ICU, etc.). Through this assessment and additional discussions with the ICP, problems relating to disease reporting were identified.

Provider Education and Health Teaching: During 2004, the LPHNs provided information to hospitals on: 1) disease reporting, 2) regulations surrounding discharge of clients with communicable diseases to continuing care facilities, 3) clinical manifestations of relevant diseases, and 4) the role of public health through training sessions and/or informational materials. LPHNs disseminated educational and informational materials including posters, brochures, telephone stickers with disease reporting numbers, pocket cards with the list of reportable diseases, pens, and other social marketing tools. In addition, LPHNs provided focused and tailored outreach to educate hospital health care workers on urgent disease reporting requirements through lectures or one-on-one training sessions, as appropriate. The LPHNs also promoted and trained interested healthcare personnel on the use of online reporting, and communications systems. LPHNs have played an important role in referring to appropriate resources as needed.

Consultation: ACDC is viewed as the authoritative source of information, advice, and recommendations regarding the recognition and management of communicable diseases and other issues of public health importance. As such, LPHNs provide consultation in the development of plans, protocols, drills and exercises, and on going issues related acute communicable diseases including emerging infectious disease. LPHNs continuously attend various meetings (i.e., Association for Professionals in Infection Control, Infection Control Committees, conferences and seminars) as requested to provide information and recommendations on various issues.

Outbreaks and Investigation of Unusual Diseases: As needed, LPHNs assist other ACDC staff by expediting the exchange of information and performing health investigation, as requested, by reviewing and extracting information from hospital records, interviewing and obtaining epidemiologic data from clients, family members and health care providers. Under certain circumstances, LPHNs have interacted with hospital laboratory personnel to ensure that isolates are sent to the Public Health Laboratory as needed. In addition, LPHNs direct providers to key resources within DHS in order to address specific situations. LPHNs also provided guidance on proper infection control practices.



Promoting ACDC-Related Projects: LPHNs also promote and assist with many ACDC-related projects that require hospital participation.

- Web-based Confidential Morbidity Report (Web CMR): Web CMR is offered to all LAC hospitals including hospitals in Long Beach and Pasadena jurisdictions. The goals are to shorten response time, increase standardization and accuracy of CMR information, and create a secure, user-friendly, and effective environment that will encourage health professionals to comply with the state regulations on reporting communicable diseases. LPHNs have been educating healthcare providers about available web-based communication and training resources and have been providing trainings upon request. LPHNs have also been responsible for enrolling healthcare personnel, obtaining critical emergency contact information, and maintenance of personnel information from respective facilities. LPHNs will continue to educate ICPs and other hospital personnel on using the Web CMR and promote its continuous use. Currently, 130 ICPs in 77 hospitals utilize Web CMR and plans to enroll additional hospitals are underway. Half of the enrolled hospitals regularly report diseases and others report occasionally via Web-CMR. We expect that at least 80% of hospitals will regularly utilize Web-CMR by mid-2005.
- Sentinel West Nile Virus Surveillance: During 2004, an enhanced West Nile virus (WNV) Surveillance project was conducted. LPHNs recruited hospitals in the eastern part of LAC, the area most impacted by WNV, and selected as sentinel surveillance sites for encephalitis focusing on WNV infection. LPHNs facilitated the laboratory testing process, communications with hospitals and physicians and conducted more than 140 cases of patient interviews.
- Employee/Occupational Health Surveillance: The LPHN project established contact with employee/occupational health in hospitals in LAC and provided recommendations regarding worksite planning and the connection between employee absenteeism and disease surveillance. During 2004, an employee health surveillance letter was sent to all hospitals in LAC. Hospital employee health surveillance project promotion will be a continuous process.
- Emergency Department Syndromic Surveillance: ACDC conducts daily syndromic surveillance with emergency departments in sentinel hospitals in LAC. The Hospital Outreach Unit (HOU) is in the preliminary stages of assessing the timeliness and completeness of disease reporting from four syndrome categories: rash, gastrointestinal, respiratory, and neurological. The data from these assessments will provide a baseline of the current state of disease reporting in LAC and can be used to target resources to make improvements to the disease reporting system. In addition, the results from the assessments can be presented to providers and other mandated reporters to stress the importance of timely and complete reporting. Currently nine large hospitals participate in the daily syndromic surveillance. When an aberration or signal is detected, LPHNs follow-up and validate alarms and determine if further investigation is necessary. If further investigation is needed, LPHNs contact the ICPs and emergency departments to facilitate obtaining patient information. LPHNs conduct site visits, review medical records, and investigate the situation. All signals are investigated collaboratively by LPHNs and physicians in ACDC and acted upon appropriately.
- Coroner's Case Investigation: Daily, ACDC analyses the electronic data of unusual deaths received from the Coroner's Office. LPHNs investigate suspect deaths and review the data for diseases that may not have been reported through other sources. From November 1, 2003 through March 23, 2005, the LPHNs followed-up on 131 coroner cases.

DISCUSSION

Many notable accomplishments have been achieved by the LPHN project. During the initial phase of the project, hospital visits allowed for the creation of hospital profile and baseline assessment databases. The hospital profile database contains current general hospital information (e.g., addresses, phone numbers, and bed capacities), ICP information, and other key department directors' contact information. At any time there is a change of hospital and/or ICP information, hospital profile database is updated to reflect the changes. Any portion of the hospital profile can be shared with ACDC staff and other LAC programs under the discretion of HOU. The baseline assessment database contains a survey of questions to



identify knowledge, attitude and practices related to disease reporting. In general, ICPs are highly knowledgeable of disease reporting mandates, ICPs' attitude regarding disease reporting is often determined by their previous experiences with report receiving programs and units, and their disease reporting practices are sometimes affected (negatively and positively) by their previous experiences.

Through the baseline assessment, strengths and weaknesses of hospitals and barriers to disease reporting also were determined. Remarkable strengths are: 1) hospital ICPs and laboratories are knowledgeable of the disease reporting mandates, 2) ICPs interface with many hospital departments which makes the ICPs optimal contacts at hospitals, 3) ICPs identify reportable cases through several methods (e.g., rounds, lab reports, admission list) and 4) ICPs often are actively involved in staff and patient education. Prominent weaknesses and barriers relating to disease reporting are: 1) unclear disease reporting procedures (e.g., to which jurisdiction to report, which diseases to report, what constitutes as an outbreak), 2) difficulty with faxing documents repeatedly to different LAC departments/units, 3) most hospital departments, including some outpatient clinics, heavily rely on the ICPs to report cases which often overwhelms the ICPs, and 4) lack of knowledge of resources from LAC programs.

The initial hospital visits have been completed by the end of 2004 and follow-up visits will be conducted in 2005. Evaluation of the LPHN program will be a continuous process. As gaps are identified, interventions will be modified to resolve these issues. Regular feedback to hospitals are provided through a variety of resources (e.g., the Health Alert Network (HAN), monthly meetings with ICPs, etc.). Hospitals with good reporting practices will be acknowledged. Best practices will be identified and shared.

An analysis of the impact of LPHN Project on reporting rates and timeliness of reporting in targeted hospitals will be conducted a year after the LPHNs have been implementing interventions in targeted hospitals. Knowledge, attitudes, and practices of ICPs and other health care providers will be evaluated through surveys conducted prior to implementation of the program and repeated one year after implementation.

Inadequate disease reporting and lack of positive relationships between public health and hospitals may lead to: the propagation of disease throughout the county, ineffective interventions, delayed recognition of a possible bioterrorism event and ineffective response or other public health emergency. In efforts to increase efficiency of responding to a potential bioterrorism event and controlling spread of infectious diseases, LPHN project will attempt to enhance the traditional mandatory reportable disease system through education and process improvements in hospitals in LAC. LPHNs will continue to promote implementation of electronic interfaces relating to disease reporting and potential bioterrorism event response systems. LPHNs will also continue to establish relationship with hospitals by active involvement and communication with ICPs and other hospital personnel.

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CANINE RABIES IMPORTATION INTO LOS ANGELES COUNTY

Acute Communicable Disease Control (ACDC), Los Angeles County Department of Health Services (LAC DHS) was notified by Veterinary Public Health (VPH) LAC DHS, on November 1, 2004 of a positive rabies canine case. The specimen was tested at LAC DHS Public Health Laboratory (PHL).

A couple adopted a 4-6 month old dachshund puppy on the roadside in Baja, Mexico in August 2004. The puppy was seen at a LAC veterinary clinic "A" on 09/07/04, for clinical signs compatible with a diagnosis of tracheobronchitis. The puppy returned for a follow up appointment on 09/15/04 with improvement. During the office visit the puppy was vaccinated for canine distemper. A second vaccine was given on 10/06/04. During the second visit the dog showed signs compatible with canine distemper.

In the interim, the puppy was also taken on 09/25/04 to second veterinary clinic "B" for bloody diarrhea. Antibiotics were prescribed. The puppy returned to the same clinic on 10/30/04 with shaking and spasms. An unfavorable prognosis was given and the owner elected to have the dog euthanized. The owner confirmed the puppy had never been vaccinated for rabies.

LA-DHS-PHL ran a 10 minute fixation assay on brain tissue on 11/01/04. 3 of 4 slides were positive for rabies. The fluorescent structures and their relative sizes looked correct for rabies, however the staining pattern was sparse. A duplicate set (confirmatory test) was fixed overnight and tested the next day. Results obtained on 11/2/04 were negative.

Since the 10 minute assay and overnight assay yielded conflicting results and did not show a classic staining pattern for rabies, the samples were referred to the State lab for additional testing. This case was reported to California Department of Health Services (CA-DHS) by telephone on 11/01/04. The Centers for Disease Control (CDC) at Los Angeles Airport (LAX) Quarantine Station was notified 11/02/04 and California Office of Border Health (COBH) were also notified so that an investigation could be done in Mexico.

The two veterinary clinics and the owners were notified of the preliminary results. Clinic "A" reported non-bite saliva exposures to one veterinarian and one technician. Clinic "B" reported non-bite saliva exposures to one veterinarian and three assistants. Neither clinic reported any of their staff had ever received pre-exposure prophylaxis.

The owner's family reported that seven family members were exposed to the dog's saliva; the dog had not bitten anyone to their knowledge. The situation was complicated by the fact the owners had purchased another puppy from a private street vendor out of a shopping cart in Los Angeles and that dog died in their backyard on 10/25/04. The dog was thrown in the trash. None of the dogs on the property had proof of rabies vaccination.

Recommendations were made to administer post exposure prophylaxis (PEP) to exposed family members and those employed at the two veterinary clinics.

The puppy had also attended puppy training classes at a pet store on 10/09/04 and 10/16/04. VPH notified the class attendees and discussed the need for rabies vaccine and possible quarantine. VPH quarantined the puppies that were in attendance with the suspect dog at the puppy classes. Each dog was evaluated on a case by case basis.

Since the dog initially presented with clinical signs on 10/27/04 the earliest date possible for Mexican canine strain virus transmission was suggested to be 10/20/04. To add an extra safety cushion for exposures CA-DHS recommended adding one extra week (10/13/04) for contacts. Dogs have been known to incubate rabies virus for over two months so it could have been possible this dog was infected in Mexico.



On November 10, 2004 CA-DHS Viral & Rickettsial Disease Laboratory (VRDL) reported inconclusive results on the DFA (direct fluorescent antibody) assay as they saw the same unusual pattern as the LA-DHS PHL did (focal staining in one area only with a pattern and distribution that is not typical for rabies).

VRDL did not think this was rabies and chose to report it as inconclusive. PCR was also performed and was reported negative on 11/10/04. PCR does not hold the same weight as the FA Test (which is the gold standard test) but it usually is quite sensitive and agrees well with the FA methodology. If PCR was positive, we can be confident that it is positive, if the PCR is negative, we cannot definitively rule-out rabies.

Recommendations were made to continue vaccination in those persons that had already started receiving PEP. Samples were sent to the Centers for Disease Control (CDC) for additional testing.

Since testing was inconclusive (and probably negative) and exposure was 11 days prior to onset, the risk that the other dogs were actually exposed to rabies was low and probably did not require further quarantine.

On 11/22/04 the CDC samples were reported negative. Recommendations were made to discontinue rabies PEP for those who had not yet completed the series of vaccinations. The VPH puppy training class quarantine was lifted when the final test results obtained.



DESCRIPTION OF WEST NILE VIRUS PEDIATRIC CASES LOS ANGELES COUNTY, 2004

BACKGROUND

West Nile virus (WNV, *Flavivirus, Flaviviridae*) has emerged as a major public health problem in the US. In 1999, New York City public health officials documented the first entry of WNV into the western hemisphere. During that first year, public health officials recorded 59 cases including seven fatalities from meningoencephalitis [1]. Since then, public health officials have documented the spread across North America from the Atlantic to the Pacific coasts [2] and from Canada [3] into Mexico [4]. In 2003, 9,862 human cases of WNV infections were reported nationwide to the CDC from 45 states and 46 states reported non-human WNV surveillance activity [5]. While one case of WNV infection was confirmed in a LAC resident in 2002, no environmental source was found. WNV was subsequently detected in California (CA) in July of 2003, when the virus was isolated from mosquito pools of *Culex tarsalis* near El Centro in Imperial County [6]. Subsequently, three human cases of WNV infection (two meningitis cases and one case of WNV fever) were confirmed in Southern CA [7]. In 2004, the state of CA reported the greatest number of WNV cases in the US with 828 confirmed WNV cases as of January 28, 2005; LAC reported 283 WNV symptomatic and 23 asymptomatic infections from blood donors, the greatest number of any CA jurisdiction [8].

Over the past four years, the clinical conditions associated with WNV infection have been well described: WNV fever (WNF) and neuroinvasive disease (NID), which includes encephalitis, meningitis, and acute flaccid paralysis (AFP) [9–11]. Despite the large number of adult cases reported, published information regarding the clinical presentation of WNV in children is limited [12, 13]. Generally, the clinical conditions associated with pediatric WNV infection are milder with most cases being WNV fever [12]. The CDC reported 150 (4%) and 763 (8%) pediatric cases nationwide in 2002 and 2003 respectively in children and adolescents under age 18 [14]. In this report, we describe a population based case series of 11 WNV-infected children reported during the LAC 2004 WNV season.

METHODS

Case Finding: In May of 2004, the LAC Public Health Department alerted all licensed physicians and infection control practitioners (ICP) to the risk of WNV infection in the coming months and the necessity and availability of free WNV serologic testing for suspected cases of WNV fever, viral meningitis, encephalitis, and AFP through the LAC Public Health Laboratory (PHL). In July of 2004, the LAC Health Officer made human cases of West Nile Virus infection reportable within one working day.

Case Definitions: WNV encephalitis was defined as fever ($>38^{\circ}\text{C}$), depressed or altered mental status, lethargy, or personality change lasting ≥ 24 hours and additional evidence of acute central nervous system inflammation, including cerebral spinal fluid (CSF) pleocytosis with ≥ 5 white blood cell (WBC)/ mm^3 and positive acute IgM WNV serological results in the CSF and/or serum; WNV meningitis cases had clinical signs of meningeal inflammation, including nuchal rigidity, Kernig or Brudzinski sign, or photophobia, and additional evidence of acute infection including fever, ($>38^{\circ}\text{C}$) headache without altered mental status, and CSF pleocytosis with ≥ 5 WBC/ mm^3 and positive acute WNV IgM serological results in the serum and/or CSF; WNV fever cases had two of three symptoms including fever ($>38^{\circ}\text{C}$), headaches, and rash and a positive acute serum WNV IgM.

Laboratory Testing: All commercial positive WNV serologic results were confirmed at either the LAC PHL or the CA Department of Health Services Viral and Rickettsial Disease Laboratory (VRDL). All confirmed cases had WNV positive serum and/or CSF IgM for WNV by two different serologic methodologies: IgM by antibody capture enzyme-linked immunosorbent assay (ELISA) (PANBIO; Windsor, Australia) and immuno-fluorescent antibody (IFA) slide test kit (PANBIO; Windsor, Australia). Plaque reduction neutralization tests (PRNT) were completed on selected pediatric cases by VRDL. LAC public health staff



administered a standardized WNV case report form (including patient demographics, clinical information, and WNV prevention practices) by telephone interview with the parent or legal guardian of the case. Additionally, hospital and emergency room medical records were reviewed. In cases where there was missing information, a physician contacted the patient's primary physician by telephone.

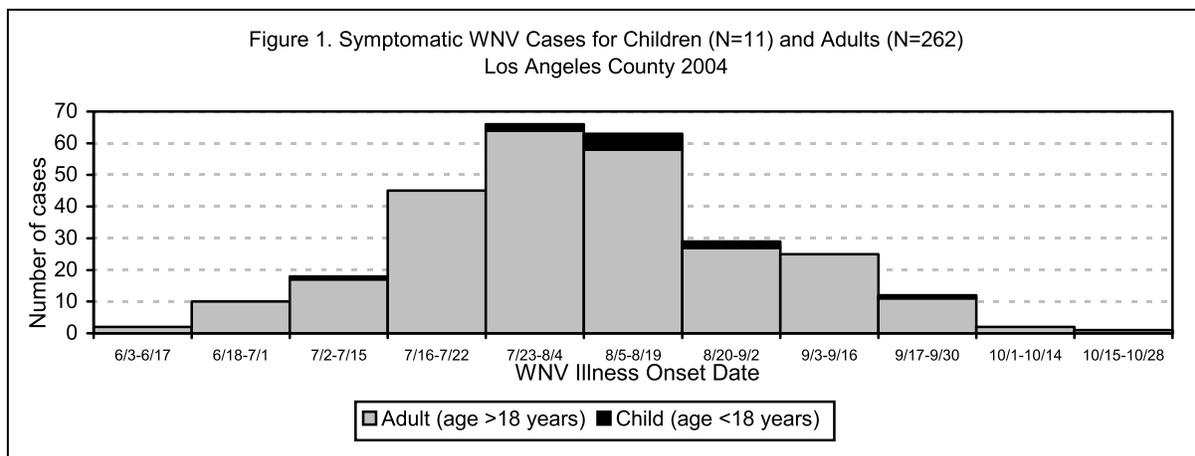
RESULTS

Of 283 reported and laboratory-confirmed symptomatic cases of WNV in LAC in 2004, 11 (3.9%) were pediatric cases under age 18 years (Table 1). The 11 pediatric cases included: eight with WNV fever (73%), two meningitis cases (18%), and one encephalitis case (9%). The median age was 10 years (range: 5-14 years). Ten were males; nine cases were Hispanic, one was White, and one was Asian. The symptom onset dates ranged from July 5 through September 27, 2004 (Figure.1). Complete medical and epidemiologic information was available for all 11 cases and is described in the case series.

Table 1. Characteristics of children with West Nile virus infection in Los Angeles County, 2004

| Case | Age in years | Sex | Diagnosis | SO to C ¹ | Duration of Illness | Fever | Headache | MW ² | Rash | GI ³ | WBC ⁴ | PRNT ⁵ | ME ⁶ |
|------|--------------|-----|--------------|----------------------|---------------------|-------|----------|-----------------|------|-----------------|-------------------|-------------------|-----------------|
| 1 | 14 | M | Fever | 2 days | 7 days | Yes | Yes | Yes | Yes | Yes | 15.4 | Yes | ER ⁷ |
| 2 | 6 | M | Fever | 3 days | 2 days | Yes | No | No | Yes | No | 3.6 | Yes | OP ⁸ |
| 3 | 9 | M | Fever | 7 days | 8 days | Yes | No | No | Yes | Yes | 4.2 | Yes | ER ⁷ |
| 4 | 10 | M | Fever | 5 days | 3 days | Yes | Yes | No | Yes | Yes | 4.0 | No | ER ⁷ |
| 5 | 11 | M | Fever | 2 days | 21 days | Yes | Yes | No | Yes | Yes | 12.6 | No | IP ⁹ |
| 6 | 14 | M | Fever | 2 days | 7 days | Yes | Yes | Yes | Yes | Yes | 12.6 | Yes | ER ⁷ |
| 7 | 12 | M | Fever | 8 days | 14 days | Yes | Yes | Yes | Yes | No | n/d ¹⁰ | Yes | OP ⁸ |
| 8 | 14 | F | Fever | 3 days | 3 days | Yes | Yes | Yes | No | Yes | 14.3 | Yes | IP ⁹ |
| 9 | 8 | M | Meningitis | 19 days | 21 days | Yes | Yes | Yes | Yes | Yes | 6.7 | No | ER ⁷ |
| 10 | 5 | M | Meningitis | 3 days | 7 days | Yes | Yes | Yes | Yes | Yes | 13.3 | No | IP ⁹ |
| 11 | 6 | M | Encephalitis | 4 days | 5 days | Yes | Yes | Yes | No | Yes | 20.9 | No | IP ⁹ |

1. Number of days from symptom onset to collection of specimens.
2. Muscle weakness.
3. Gastrointestinal symptoms.
4. White blood cell count (WBC x ³/mm³).
5. Plaque reduction neutralization test.
6. Location of medical evaluation.
7. Emergency room.
8. Outpatient.
9. Inpatient.
10. Not done.





Clinical Features—WNV Fever: There were eight confirmed cases of WNF with a median age of 11 years (range: 6-14 years). The most common presenting symptoms included: fever (n=8, 100%), macular-papular rash (n=7, 88%), headache (n=6, 75%), nausea and vomiting (n=6, 75%), and muscle pain and weakness (n=4, 50%). The median duration of illness was 7 days (range: 2-21 days). All eight cases had positive acute serum IgM WNV capture-ELISA and IFA tests; additionally six cases had confirmatory PRNT completed (Table 1). The median duration between symptom onset and acute serum collection was three days (range: 2-8 days). Six of the eight WNV fever cases had additional laboratories tests which were within normal range, including serum chemistries and urine analyses, and negative blood and urine cultures. Of the seven WNF cases with peripheral white blood cell counts (WBC), three had a low total peripheral WBC, two were elevated, and three were within normal limits.

Case 1. This healthy 14 year-old Hispanic male presented to the emergency room (ER) with a 2-day history of anorexia, fever (39.5⁰C), headache, malaise, and a macular-papular rash on his extremities lasting one day. The patient stated that mosquitoes bit him 3-4 days prior to seeking medical care. The patient received intravenous fluids, acetaminophen, and ibuprofen in and was started on ceftriaxone 1gm IV every 12 hours for presumptive bacterial sepsis. His initial peripheral WBC was 15,400/mm³ with mostly neutrophils; electrolytes were normal. His clinical status improved and he was discharged home from the ER without subsequent sequelae. At follow-up, the acute serum WNV IgM was positive.

Case 2. This healthy 6 year-old Hispanic male presented to his primary medical doctor (PMD) with an acute onset of a diffuse macular-papular rash distributed on his arms, leg, face and trunk followed by 2 days fever without headache. A few days prior to development of the rash, the patient was swimming at a cattle ranch in Riverside, CA where there was free standing water, however, he did not recall getting bitten by mosquitoes. Given the recent media attention surrounding WNV, the parents were concerned and took their child to their PMD for WNV testing. This patient had a borderline-low WBC of 3,600/mm³ and normal hematocrit and platelet count. He was seen as an outpatient and at 2-week follow-up his rash and all WNV-associated symptoms had resolved and serum WNV IgM was positive.

Case 3. This 9 year-old Hispanic male was seen by his PMD for abrupt onset of fever to 39.4⁰ C and an erythematous macular-papular rash on his extremities. The patient had been playing outside 5 days before the onset of the rash but did not recall getting bitten by mosquitoes. He was sent by his PMD in the ER for further work-up. At the ER, the physician recommended a lumbar puncture but his mother was concerned about the risks and took the child home against medical advice. Peripheral WBC was 4,200/mm³, electrolytes and urine-analysis were normal. Follow-up with his PMD nine days later revealed that he was completely asymptomatic and serum WNV IgM was positive from the ER visit.

Case 4. This healthy 10 year-old Asian male presented to the ER with a 5-day history of fever and a 3-day history of vomiting and rash on his arms and face. At the ER, the patient was febrile to 39.3⁰C and CBC was borderline-low with 4,000/mm³ with normal hemoglobin and platelets, urine analysis, chest x-ray and abdominal x-ray were normal. The patient was given acetaminophen and discharged home from the ER. At follow-up his symptoms had resolved and serum WNV IgM was positive drawn during his ER evaluation.

Case 5. This 11 year-old Hispanic male presented to the ER with acute onset of abdominal pain, chills, vomiting, headache and fever. He was given supportive care and discharged home from the ER with a diagnosis of viral gastroenteritis. At home the patient continued to have 3 days of abdominal pain, chills, vomiting, and headache with intermittent fever, so his mother brought him to a local hospital for evaluation. At this ER visit, the patient was febrile to 38.3⁰C with chills, rigors, vomiting, diarrhea and presented with an erythematous macular-papular rash over his abdomen. His peripheral WBC was 12,600/mm³. According to the parents, the patient had recent close contact with their dog that had died of a probable viral infection. The patient was admitted with a diagnosis of viral gastroenteritis. A computer tomogram (CT) scan of the abdomen was negative but the patient was admitted to rule out appendicitis. The patient was started on Ceftriaxone, which was switched to cefotaxime during his 3-day hospital admission. Urine-analysis, blood and stool cultures were negative. The patient improved clinically and was discharged on hospital day 3. A WNV serologic test was ordered after discharge and was subsequently positive.



Case 6. This 14 year-old Hispanic male presented to the ER with a 7-day history of nausea, vomiting, muscle weakness, fever and erythematous macular-papular rash on his upper and lower extremities. Laboratories including WBC, serum chemistries, and urine analysis were normal, and discharged home for follow-up with his PMD. His PMD obtained WNV serology the following day, which was subsequently positive.

Case 7. A 12 year-old Hispanic male who presented to his PMD with a 1-day history of rash, fever, headache, body aches. The boy recalled mosquito bites 2 weeks prior to symptom onset. A WNV serologic test was obtained with no other additional laboratory testing. The patient's symptoms resolved within 7 days.

Case 8. This 14 year-old Hispanic female reported 3 days of fever, headache, body aches and muscle weakness to her PMD. The PMD obtained a WNV serologic test that was subsequently positive and CBC was elevated at 14,300/mm³.

West Nile Virus Meningitis: There were two cases of viral meningitis in an 8-year and a 5 year-old boy. Presenting symptoms included: headache, rash, vomiting, and fever. Both cases had CSF findings showing pleocytosis, acute serum WNV IgM positive, and normal peripheral WBC count. One case was evaluated in an ER and discharged home and one case was hospitalized for 3 days. The duration of illness was 21 and 7 days respectively for a full recovery.

Case 9. This 8 year-old white male had a 9-day history of headache with intermittent fevers, rash and limited vomiting, he was seen at a community hospital ER. The patient's WBC was 6,700/mm³, and a chest x-ray and CT of the head were both normal. A lumbar puncture revealed CSF that was consistent with viral meningitis WBC of 150 cells/mm³ with lymphocytic predominance; CSF glucose and total protein were within normal range. The patient was discharged from the ER to home and an acute serum WNV IgM titer was positive.

Case 10. This 5 year-old Hispanic boy presented to the ER with acute onset of a diffuse erythematous macular-papular rash over most of his body, abdominal pain, neck pain and fever. At the ER, the patient was confused and was febrile to 39.3°C. A CBC revealed a WBC count of 13,300/mm³ and the patient was given ceftriaxone while further studies pended. A CT of the head was negative and a lumbar puncture was consistent with viral meningitis: WBC of 200 cells/mm³ with a normal CSF total protein and glucose. An acute serum WNV IgM titer was positive. The patient was transferred to another facility for higher level of care. At the receiving facility he was found to be febrile with a headache and noted to have petechiae. His blood cultures and CSF cultures were negative and the patient was discharged home after 2 days without sequelae.

West Nile Virus Encephalitis:

Case 11. This is a previously healthy 6 year-old Hispanic male who presented to the ER with a 3-day history of headache, fever, lethargy and vomiting. On ER evaluation, the patient had a violent shaking episode but did not lose consciousness. At the ER, the admitting physical on the patient noted a fever of 39.9°C, did not note a rash present, and reported a normal neurological examination with laboratories showing a WBC of 10,700/mm³ and normal serum chemistries. Chest x-ray and CT of the head were both normal. A lumbar puncture revealed CSF that was consistent with viral meningitis (WBC = 460 cells/mm³ with a lymphocytic predominance) and normal CSF protein and glucose levels. The patient was started on cefotaxime. On the second day of admission the patient was described by clinical staff as being lethargic with ataxia and dysmetria on neurologic exam. Neurology was consulted; magnetic resonance imaging (MRI) of his brain and electroencephalography (EEG) were performed and were both interpreted as normal. The lumbar puncture revealed CSF that was IgM positive for WNV and the cefotaxime was discontinued. Physical therapy was consulted to help with the ataxia, which eventually resolved during the hospital course. By hospital day 5, the patient's temperature normalized, his mental status and ability to ambulate returned to baseline and he was discharged home.



DISCUSSION

Our case series of 11 laboratory-confirmed WNV cases documents that WNV in children and adolescents is generally a mild acute infection. The relatively few documented cases in children and adolescents within LAC, approximately 4% of all symptomatic WNV cases, is a smaller percentage that was reported nationwide by the CDC of approximately 8% in 2003 for children and adolescents [14]. The overall median age of our pediatric WNV cases was 10 years of age, notably the youngest age in our series was 5 years old. Most of our pediatric cases had WNF (n=8, 73%) and only three cases (37%) had evidence of NID. Of the NID cases, only one had encephalitis. It is notable that all of our cases were healthy children without history of underlying chronic illness or immunocompromising conditions. All cases had an excellent recovery with no neurologic sequelae. Although few pediatric cases were documented, it is highly likely many more children were infected with the WNV. Such children were either asymptomatic or experienced mild symptoms and were not tested for WNV infection.

Distinguishing characteristics of the pediatric cases compared to the adults cases (ages ≥ 18) reported to LAC in 2004 include: the high frequency of an erythematous macular-papular rash on the extremities (n=9, 82%), compared to just 35% of symptomatic adult cases. In addition, children tend to exhibit a high frequency of gastrointestinal symptoms; specifically, vomiting was also noted in 8 of 11 cases. Recent clinical descriptions of WNV fever from WNV outbreaks in Illinois in 2002 and Israel in 2000 reported rash and vomiting present in 57% and 22% and vomiting present in 28% and 31% in each of their respective WNF outbreak case series reviews [15–17]. In both previously noted case series, WNF cases were mainly adults with only 4 cases noted to be less than 25 years of age in the Illinois series and the Israeli case series had a median age to be 65 years. In our series, rash pruritis was not queried in our standardized case report. However, chart review did not reveal this in our 11 cases and also did not show that any of the children were on antibiotics prior to rash onset. It has been recently suggested that rash may be linked to overall favorable clinical outcome [18]. This would be consistent with our finding of a high percentage of rash observed in our pediatric WNV cases (9 of 11 cases) which had generally uncomplicated illnesses. In contrast to our pediatric cases, 18% of LAC adults with WNV NID and 48% of WNF cases presented with rash, which had more complicated and prolonged illnesses overall compared to children. Fever was common in both adults and children with 100% of our pediatric cases reporting fever and 90% of our adult symptomatic cases reporting fever. Altered level of consciousness was rare in our series, with only one of 11 pediatric cases reporting compared to the high frequency of 42% in our symptomatic adults ≥ 18 . In contrast to a recent WNF follow-up study involving adults from Illinois, which noted prolonged symptoms (e.g., fatigue, muscle weakness, difficulty concentrating, and fever noting median durations of 36, 28, 14, and 10 days respectively) [15], our total median duration of overall illness was only 7 days (range: 3-21). We did not query the specific symptoms and their duration in our case series.

Most of our pediatric cases were male (n=10, 91%) and Hispanic (n=9, 82%) which was a larger proportion of the population compared to our adult symptomatic cases with 61% of symptomatic male cases and 35% Hispanic. The symptom onset of our cases was noted to range from July 29 to September 27, 2004 and area of likely WNV acquisition was also consistent with the adult case data for LAC (Figure 1).

It is also notable that of our 11 pediatric cases, only three were diagnosed at their primary medical office visit, and eight were seen in an ER with three subsequently admitted to the hospital. The high rate of ER evaluation may speak to the fever and rash presentation that made these cases appear very ill. It was also interesting that in four cases WNV testing was performed upon strong parental urging.

The diagnosis of WNV infection was based on clinical symptoms consistent with WNV fever, meningitis, and encephalitis and accepted WNV laboratory testing. The most common method for diagnosis of WNV infection utilized the serum IgM capture ELISA. The WNV ELISA is Food and Drug Administration approved with demonstrated sensitivities of 90% to 100% demonstrated, whereas specificity has been reported at 92% due to cross-reactivity among flaviviruses and enteroviruses [13]. It is notable that only acute serologies were obtained for our cases and convalescents specimens were not obtained which is a



weakness in this case series. However, in six of the cases, PRNT was carried out as the accepted gold standard of WNV testing [10].

Although a massive public information campaign was cooperatively put in place by the LAC Public Health Department, the State of CA Department of Health Services, and the local mosquito abatement districts, upon questioning the parents of these cases, none of them admitted to mosquito repellent usage or encouraging their children to wear long sleeved clothing. It's possible the message about using DEET-based repellents did not reach these parents.

Public Health Implications: In July of 2004, WNV was added to the list of reportable diseases to the LAC Department of Health Services. In LAC reporting of dead birds, mosquito breeding sites and areas with water accumulation are strongly encouraged. The LAC Public Health Department has established a hotline to encourage the public to report dead bird sightings directly to the LAC Veterinary Public Health Section. In addition, local mosquito and vector control programs in LAC collect mosquitoes for speciation and WNV and other arboviral disease infection. Through these measures, it may be possible to improve WNV surveillance. It is predicted that WNV will remain endemic in most areas of the US, thus it is important that all clinicians become aware of the clinical presentation of WNV infection in children so that accurate diagnoses can be made and appropriate reporting can be done.

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WEST NILE VIRUS EDUCATION PROJECT LOS ANGELES COUNTY, 2004

BACKGROUND

West Nile virus (WNV) was first identified in 1937 in a febrile person in the West Nile district of Uganda, and since then, it has significantly spread throughout the world. The first WNV presence in the United States was documented 62 years later (1999) in New York City. In 2004, LAC experienced its first big year of locally acquired WNV activity with 309 positive human cases and 13 deaths (see WNV in the Disease Report section for specifics).

As only a few WNV cases were reported in LAC prior to 2004, the medical and public populations had little first hand knowledge of the disease. To combat this knowledge gap, a broad-based health education program was launched. The campaign looked to first update medical providers and laboratories on WNV prevention, treatment, and reporting; and second, increase the public's awareness of the disease and knowledge of prevention behaviors to lower the risk of WNV infection. A variety of approaches and materials were utilized to get pertinent information to these two groups.

METHODS/RESULTS

Healthcare Provider Information (Physicians and Laboratories): In anticipation of human WNV cases, at the beginning of June 2004 the LAC Department of Health Services (LAC DHS) took great strides to update physicians and laboratory directors about WNV. This included information about: the disease, case definitions, treatment, prevention protocols, and disease reporting. Since surveillance activities rely heavily on the participation of physicians and laboratories, they were deemed priority groups for WNV education and awareness. The effective involvement with these groups allows for more accurate monitoring of WNV disease activity and deployment of prevention resources. Hence, a mailing to over 35,000 licensed LAC physicians and laboratories sent a WNV instructional CD-ROM, updating physicians on the latest information and resources available to them.

Part of the education outreach to physicians and laboratory directors was to highlight expanded reporting requirements for WNV. As of July 1, 2004, LAC DHS added WNV to the list of mandated reportable diseases and conditions in LAC (California Code of Regulations, Title 17, Sections 2503 and 2505). Physicians and laboratories must report patients with a positive WNV test to DHS within one (1) working day using a standard Confidential Morbidity Report (CMR).

During the peak of the 2004 WNV season, a second mailing was sent to physicians in identified WNV "hot spots" of activity—updating them on the latest resources and health education materials available to them through LACDHS. In addition, public health nurses, in Service Planning Areas 3 and 4 (San Gabriel and Whittier area) where most of the initial cases were reported, distributed WNV prevention education literature to individual physicians, clinics, and hospitals for further distribution to their patients.

Printed Materials for the Public: LACDHS launched an aggressive education campaign targeting the public through various mechanisms of communication. A variety of WNV prevention materials were made available to community organizations, city officials, and other community partners to distribute to the public. A letter to the 88 City Mayors within LAC was sent advising them of the health education materials available to them and their constituents through LACDHS.

The health education message drafted for the general public and those at high-risk for WNV infection and complications focused on aspects of WNV transmission—specifically: 1) personal mosquito abatement tips for the home (i.e., the removal of sources of stagnant water that could serve as areas where mosquitoes might breed), 2) home protection with the use of well-maintained screens on windows and doors, and 3) personal protection from bites with the use of long sleeves or pants and/or the use of



effective mosquito repellent. In addition to these key steps the public could do to reduce their overall risk to infection; the public was educated and asked to participate in dead bird surveillance. Dead bird monitoring and testing is a critical piece of information that the WNV prevention agencies can use to identify potential “hot spots” of WNV disease activity and pinpoint abatement activities.

WNV information palm cards targeting the general public were distributed in nine different languages; English, Armenian, Cambodian, Chinese, Farsi, Korean, Russian, Spanish and Vietnamese. In addition, English and Spanish booklets (“Mosquito Control in Los Angeles County”) were distributed through LACDHS’s Binational Border Program to LAC Parks and Recreation, Public Libraries, and the Latin American Consulates—by the end of the season, over 150,000 booklets were distributed to the public. Since it was an area of increased incidence, a mass mailing of a WNV information card was sent to residents in the First Supervisory District; this information was sent directly from the Supervisor’s office.

Press Releases/Conferences: A WNV press conference with appropriate personnel was held early in the season to develop an interest in WNV activities. During the peak season of WNV, a press conference was coordinated as part of a DEET education campaign to the public; demonstrating the proper use of insect repellent with DEET. This event was held in a senior center to highlight the older age group’s increase risk for more severe outcome to infection. Press releases were issued throughout the season to highlight disease activity milestones, (e.g. the first positive bird, the first human case, the first death, etc)

Radio/Television: Public Service Announcements via the English and Spanish radio and television stations were broadcasted, with over 150 radio spots delivered throughout the summer months.

Internet: Regularly updated WNV information was made available online through the LACDHS Public Health web page. Case summary information was updated and posted on this site twice a week. The WNV web page also had health education materials available in multiple languages for immediate downloading and printing and links to other appropriate websites were provided.

Telephone: A toll free general WNV information line (1-800-975-4448) was established to provide basic WNV information and prevention strategies to the general public in five languages; English, Spanish, Korean, Mandarin and Cantonese. West Nile virus prevention messages were recorded providing answers to commonly asked questions, such as “how is WNV transmitted to humans?”

Presentations: LACDHS staff were trained through the Speakers Bureau on WNV and conducted over 150 presentations throughout the county to community centers, schools, and other agency partners.

Survey: In September of 2004, a Knowledge, Attitude, and Perception (KAP) telephone survey was commissioned by LACDHS. The survey was designed to reveal one’s level of understanding regarding WNV, and in an indirect way, it also highlighted the effectiveness of current health education efforts and identified areas of improvement. Survey results showed that both community knowledge about WNV as a potential health risk and knowledge that WNV was transmitted by the bite of a mosquito were extremely high. Levels of public concern in LAC were also elevated in 2004 with 61% of the respondents either ‘very’ or ‘somewhat’ concerned that they themselves, or someone they know, may become sick with WNV. Study participants correctly identified the elderly (77%) as a vulnerable risk group. At the same time, 76% were either ‘very’ or ‘somewhat’ confident that the Health Department could protect the public. However, the survey also showed areas of improvement in the public’s self-reported actions for personal protection against WNV. The survey revealed that only 50% respondents had changed their behaviors due to WNV; only 48% reported draining areas of standing water around their home, 38% reported wearing protective clothing, and only 20% reported using repellent more than previously.

When asked about sources of WNV information, respondents gave the standard media outlets as their main source of WNV health information—65% television, 15% newspaper, and 6% radio. In comparison, the internet accounted for only 2% of the respondents.



DISCUSSION

The goal for 2005 will be to continue to reinforce the public's WNV knowledge base of this emergent infectious disease in Los Angeles, and work on improving the public's level of confidence in the combined agencies working on WNV prevention to protect them. Changing of human behaviors for the benefit of their own health has always been crucial, yet, difficult to obtain. Promotion of personal behaviors the public can take to minimize the risk of being exposed to WNV is a critical part of the public health message.