

SEQUOIAS E. COLI OUTBREAK

THE SEQUOIAS E. COLI O157:H7 OUTBREAK

The Sequoias is a large, upscale retirement facility that operates in several locations throughout California. One such location is in the Portola Valley in San Mateo County. This Sequoias facility sprawls over forty-two acres, housing a total of 315 people who receive varying levels of assistance. In ascending order of assistance required, 265 residents live in independent living, twenty require assisted living, and thirty require skilled nursing. Each group has its own living area.

Despite living separately, all residents take their meals from the same kitchen. Residents may use one of two dining halls or they may request tray service meals. Those who choose to dine at one of the two designated halls may request table service, but most use the self-service buffet. Food is also available from the kitchen by request, throughout the day.

Sequoias employees, however, are not involved in food service or kitchen management. Instead, the Sequoias contracts with Sodexho, an outside vendor, to perform all food service functions. As a result, it is Sodexho employees exclusively who obtain the food, and prepare and serve meals to Sequoias residents.

On Monday, October 13, 2003, the San Mateo County Health Services Agency (SMCHSA) commenced an investigation based on information that a resident of the Sequoias in Portola Valley had cultured positive for *E. coli* O157:H7. The resident had become symptomatic on October 9, and had been hospitalized at Stanford Hospital the next day. Several more Sequoias residents reported symptoms consistent with *E. coli* O157:H7 infections over the next few days.

The epidemiological investigation began with a questionnaire that addressed illness, symptoms, food history, medical care, social contacts, and other risk factors. See SMCHSA Final Report, attached as **Exhibit No. 1**. Interviews of Sequoias residents followed. These were conducted by nurses, epidemiologists, communicable disease investigators, and three UC Berkeley Public Health students. Food service employees also filled out questionnaires, with those who reported illness filling out a more extensive case-control questionnaire.

All employees at the facility, whether Sequoia or Sodexho, submitted stool samples. Ill employees were prohibited from working until they produced two samples, twenty-four hours apart, that tested negative for *E. coli* O157:H7. Stool samples were also collected from Sequoias residents who reported at least one episode of diarrhea since September 21. The samples were tested, and those with positive *E. coli* O157 isolates were sent to the California Department of Health Services (CDHS) Microbial Diseases Laboratory for confirmation and serotyping.

The initial case definition was “any resident or employee experiencing two or more episodes of diarrhea in a 24-hour period between 9/21/2003 and 11/3/2003.” During the case-control analysis, the case definition was narrowed to include only

laboratory-confirmed cases and probable cases, which were those without laboratory confirmation but that involved bloody diarrhea or hemolytic uremic syndrome. Controls were selected from the frequent dining partners of cases and, alternatively, at random from the resident roster.

The environmental investigation began on October 13. An inspection of the Sequoias kitchen on the same date noted that it met industry standards and was free from violations. Two days later, however, a follow-up investigation noted that several refrigeration units were above 41 degrees Fahrenheit, and a build-up existed on the ice machine. Corrections of these violations were completed by the next inspection, October 27. No food was tested during the investigation because no food samples were left over from the exposure period.

Sixteen confirmed and probable cases were ultimately identified. Of these, thirteen were culture-confirmed. All had onset between October 9 and 17, with 75 percent experiencing onset by October 12, and all cases were residents of “independent living” and “skilled nursing.” The CDHS subtyped all thirteen available isolates using pulsed-field gel electrophoresis (PFGE), and twelve had identical PFGE DNA fingerprint patterns. The lone non-identical pattern differed by just one band.

Analysis done of the sixteen “case” food histories identified only one food item that was associated with illness: raw spinach. The SMCHSA Final Report concludes, “[n]o other common exposures were found. No food handlers were identified with diarrheal illness during the exposure period and no employees cultured positive for enteric pathogens.” The contaminated spinach, which arrived at the facility pre-packaged, was served between October 3 and 5. The spinach was not washed by Sodexo staff in the kitchen prior to serving, thus exposing the vulnerable Sequoias residents to a deadly pathogen.

EXHIBIT 1

Final Report – December 22, 2003
**Outbreak investigation of *Escherichia coli* O157:H7 at The Sequoias Portola
Valley Retirement Community**

San Mateo County Health Services Agency (SMCHSA)
Division of Public Health
Disease Control and Prevention Unit

Introduction

An investigation of an *Escherichia coli* (*E. coli*) O157:H7 outbreak among residents and employees of The Sequoias Portola Valley retirement community in San Mateo County was initiated on Monday 10/13/2003 after SMCHSA Division of Public Health was alerted that a resident was culture positive for *E. coli* O157. This resident began experiencing symptoms of bloody diarrhea on 10/9/2003 and was hospitalized at Stanford University Hospital on 10/10/2003. The Sequoias' medical facility reported several other residents experiencing similar symptoms since 10/9/2003.

Background

The Sequoias Portola Valley is a large residential retirement facility spread over 42 acres. It consists of three living areas: independent living apartments; assisted living; and skilled nursing units. A total of 315 people live at The Sequoias: 265 residents in independent living; 20 residents in assisted living; and 30 residents in skilled nursing. The median age of residents is 84.9 years of age and 74% of residents are female. The community is highly active. In addition to the numerous community events, many of the social functions among independent living residents are self-organized. The assisted living and skilled nursing facilities maintain a monthly social activities calendar.

The main commonality between the three living areas is food service. Sodexo, an outside vendor contracted by The Sequoias, manages the kitchen and food service activities on The Sequoias' campus. The Sequoias has one kitchen, which prepares breakfast, lunch and dinner for two dining halls, as well as tray service meals. Food is also available from the kitchen, throughout the day, by request. Sodexo also works with residents to cater independent events. The main dining hall is located in the main building next to the kitchen; most residents who eat there reside in independent living. Residents can request to be served in the dining hall; however, most use the self-service buffet. Independent living residents can also request tray service to their rooms. A smaller dining hall is found in assisted living. Food from the kitchen is loaded onto carts and transferred to this dining hall. Assisted living residents can receive food from the buffet by dining hall staff or receive tray service. Skilled nursing residents mainly receive meals by tray service.

Methods

A. Epidemiological

Epidemiologists, using the California Department of Health Services *E. coli* O157 Case Report form, developed a questionnaire regarding illness, symptoms, food history, medical care, social contacts, and other risk factors. This case-control questionnaire included a three-week menu and calendar to aid documentation of activities and social functions. Persons were asked to recall their dining and social activities for seven days prior to onset of illness. The majority of interviews were conducted in person at The Sequoias Portola Valley between 10/14/2003 and 11/5/2003. San Mateo County public health nurses, epidemiologists, and communicable disease investigators, as well as three U.C. Berkeley Public Health students and an epidemiologist from CDHS Disease Investigations and Surveillance Branch administered the questionnaire.

A short face-to-face questionnaire was developed and implemented to evaluate illness among food service employees. Food service employees reporting illness were followed up with the more extensive case-control questionnaire and two food service controls were solicited and interviewed. A supplemental survey with emphasis on salad bar food items designed to capture general eating habits during the month of October was conducted on 11/5/2003 and 11/6/2003. This survey was completed for 15 cases and 46 controls.

Initially, the case definition was any resident or employee experiencing two or more episodes of diarrhea in a 24-hour period between 9/21/2003 and 11/3/2003. This definition was used for case finding. For the case-control analysis, the case definition was narrowed to laboratory confirmed cases and probable cases, those who did not have laboratory confirmation but reported bloody diarrhea or hemolytic uremic syndrome (HUS). Cases were identified by several modes including: hospitalization for diarrhea illness; *E. coli* O157 confirmed laboratory results; residents reporting illness to Sequoias medical staff or the health department. Cases were asked to provide the names of two frequent dining partners or social contacts who were not ill to serve as controls. If this could not be done, controls were picked at random from the resident roster and interviewed for the seven-day exposure period of the corresponding case.

To determine a possible vehicle for the point-source outbreak, we conducted a case-control study with five case-patients with onsets on the first 2 days of the outbreak and 27 controls (residents who were well during the entire outbreak period). We included all patients with food and social activity data available for the seven days prior to onset; unfortunately this information could not be elicited from several case-patients due to severe illness. We identified potential controls by soliciting the names of tablemates from case-patients and from the residence roster. Both case-patients and controls ate food from The Sequoias' kitchen each day from 10/3/2003 through 10/10/2003.

Questionnaire data were entered into a database and exported into SPSS10 for preliminary analysis. Questionnaire data selected for the case-control study data were entered into a series of Excel spreadsheets by menu date and simple analysis was

conducted in EpiInfo (v6.04b). Case-control analyses were interpreted using odds ratios and 95% confidence intervals (95% CI). Pearson's chi-squared results were also evaluated. For expected cell counts less than five, p-values from one-sided Fisher's exact tests were used.

B. Environmental

The Environmental Health Services inspection conducted on 10/13/2003 noted that operations in The Sequoias kitchen facility met industry standards. No violations were noted at that time. The follow up inspection 10/15/2003 noted several refrigeration units were above 41 degrees Fahrenheit and build up was observed on the ice machine lid and scoop holder. Immediate correction was ordered and completed by the follow up inspection on 10/27/2003. A facility inspection was conducted on 10/22/2003. Water samples were taken from the dining hall, swimming pool, spa, a sink in recreation parlor I, the boiler room, a kitchen sink in assisted living, a pantry dispenser and faucet in skilled nursing. Soil samples were collected from steer manure and chicken manure used in the gardens. Bacterial cultures for the water and manure specimens were all negative for *E. coli* O157:H7. An additional kitchen inspection was conducted on 11/3/2003 jointly with CDHS Food and Drug Branch. Preparation and handling practices were reviewed and information regarding produce and suppliers, employee's schedules, and product rotation were reviewed. No violations were noted during this inspection. No food was tested during the course of the investigation, as there were no available samples left from the suspected exposure period 10/3/2003 to 10/10/2003.

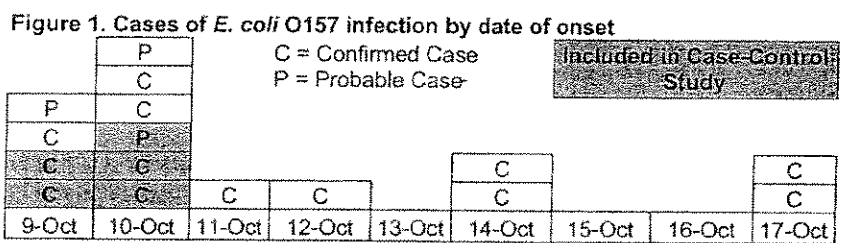
C. Lab and Clinical

Stool specimens were collected from all food handlers, regardless of illness, as well as from all Sequoia and Sodexo personnel who reported illness between September 21, 2003 and November 3, 2003. Employees reporting illness were withheld from work until they had two negative *E. coli* O157 stool cultures collected 24 hours apart and were free of symptoms for one week. Stool specimens were also collected for any resident reporting at least one episode of diarrhea since September 21, 2003. Specimens collected from 10/15/2003 to 10/19/2003 were tested for *E. coli* O157, *Salmonella*, *Shigella*, and *Campylobacter*. No other enteric pathogens were identified; thus, specimens collected after 10/19/2003 were tested for *E. coli* O157 only. Positive *E. coli* O157 isolates were sent to the California Department of Health Services (CDHS) Microbial Diseases Laboratory for confirmation and serotyping. To monitor shedding and the potential for secondary transmission, multiple stool specimens were collected on persons positive for *E. coli* O157 until at least one negative specimen was obtained.

Results

Sixteen confirmed and probable cases were identified with onsets between 10/9/2003 to 10/17/2003. These cases occurred among residents of both the independent living facility as well as the skilled nursing facility. No cases were identified from the assisted living facility. Seventy-five percent of case-patients had onsets from 10/9/2003 through 10/12/2003 (Figure 1); these cases were likely due to a point source exposure. Cases occurring after 10/12/2003 were most likely secondary cases. Thirteen of the 16 case-

patients had culture-confirmed infections; the three probable cases were in residents who had had bloody diarrhea (n=1) or developed hemolytic uremic syndrome (HUS) (n=2) during the outbreak period. The CDHS Microbial Diseases Laboratory subtyped the 13 (81.3%) available isolates using pulsed-field gel electrophoresis (PFGE); 12 had identical PFGE patterns and one differed by one band.



The median age of case-patients was 85 years (range=74-96 years). Thirteen (81.3%) case-patients were women, 15 were of white race, and one was Asian. Ten (62.5%) case-patients were hospitalized and discharged. Two (12.5%) case-patients died; one death was related to *E. coli* O157:H7 infection and the other death was determined to be unrelated to *E. coli* O157:H7 infection.

Food item consumption was analyzed for each day from 10/3/2003 through 10/10/2003. An association was found between illness and raw spinach consumption from 10/3/2003 to 10/5/2003 but not on subsequent days. Odds ratios for the association between *E. coli* O157:H7 infection and consumption of raw spinach on each day ranged from 18.75 to 39.00 with statistical significance (p < 0.05). The results of the analysis of raw spinach consumption on any of the three dates are in Table 1. No other food items were associated with illness. The spinach was prewashed and prepackaged, and was not washed again by kitchen staff at The Sequoias prior to serving.

Table 1. Selected case-control results for food consumption on any day 10/3/2003-10/5/2003

Food item	Cases (n=5)	Controls (n=27)	Odds Ratio	95% CI	p-value
Raw spinach	3/5 (60.0%)	3/27 (11.1%)	12.00	0.86-179.02	0.03

Discussion

Ten persons were hospitalized as a result of *E. coli* O157 infection. Nine were subsequently discharged to The Sequoias and one patient expired in the hospital as a result of complications due to *E. coli* O157 infection. Of the nine individuals released back to The Sequoias, one was readmitted to the hospital and subsequently expired. The San Mateo County Coroner's office evaluated the death and reported: "A

relationship of the *E. coli* isolation on 10/13/2003 to the death from congestive heart failure on 10/28/2003 cannot be established from the available data."

The results of the case-control study suggest that consumption of prewashed and prepackaged raw spinach between 10/3/2003 and 10/5/2003 was associated with the *E. coli* O157:H7 infections. Prepackaged prewashed spinach has not been associated with *E. coli* O157:H7 infection outbreaks previously per scientific and medical literature; however, recent laboratory studies indicate that internal contamination of raw spinach is plausible¹. No other common exposures were found. No food handlers were identified with diarrheal illness during the exposure period and no employees cultured positive for enteric pathogens. After reviewing the results of San Mateo County's case-control analysis and conducting their own review of the food handling practices at The Sequoias, CDHS Food and Drug Branch in coordination with the U.S. Food and Drug Administration and CDHS Disease Control and Investigation Branch, have decided to conduct a trace-back investigation of the spinach. The results of this investigation will be independent of San Mateo County's report and are forthcoming.

San Mateo County Disease Control and Prevention Unit worked closely with Sodexo and The Sequoias administration, staff, and medical personal to communicate information and infection control recommendations. Several town hall meetings were held to update and inform residents about the investigation and to respond to their concerns. These sessions were held in a meeting hall and broadcast to all resident's apartments as well as the skilled nursing and assisted living areas. Written updates from The Sequoias administration were disseminated via mailboxes. Updates regarding the outbreak were also posted on the San Mateo County Health Services Agency website. Calls from the media were referred to San Mateo County Health Services' Public Information Officer.

Infection control recommendations included cohorting of confirmed cases in the skilled nursing unit and assigning dedicated healthcare staff. Any staff person reporting illness was withheld from work until two negative stool specimens at least 24 hours apart were obtained. Residents were also requested to forgo all activities that involved food and intimate social gatherings until the end of the outbreak, defined as two incubation cycles out from the last confirmed case. Residents were also requested to stay on campus and postpone off-campus activities and appointments for the duration of the outbreak. Additional facility recommendations included closing the pool, closing ice machines, and cancellation of fitness classes. Operational changes made by the kitchen and dining staff included moving from a self-service salad and food bar to service by dining hall staff and removing or individually wrapping open food items such as cookies and fruit. Hand washing, infection control, and informational question and answer inservices were given to all staff in both English and Spanish. Other explorations by the Disease Control and Prevention Unit included a review of the laundry system as well as gardening and flower cutting activities by the staff and residents. The above activities helped limit the second wave of the outbreak and prevent further person-to-person transmission. Restrictions at The Sequoias were lifted on November 3, 2003; however, monitoring continued well into December to insure no further incidence.

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1. Warriner, K., F. Ibrahim, M. Dickinson, C. Wright, and W. Waites. 2003. Interaction of *Escherichia coli* with Growing Salad Spinach Plants. *Journal of Food Protection*. 66(10):1790-1797.