



THE CHANGING EPIDEMIOLOGY OF SALMONELLOSIS IN LOS ANGELES COUNTY 1992–2001

BACKGROUND

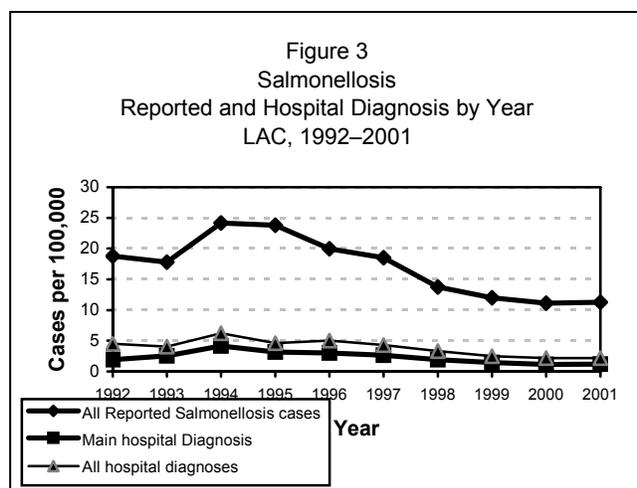
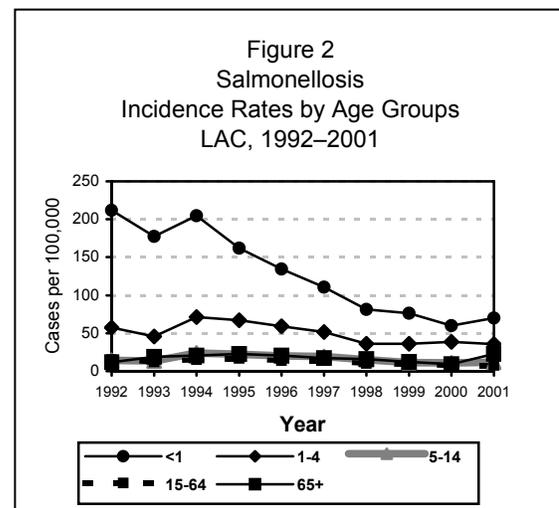
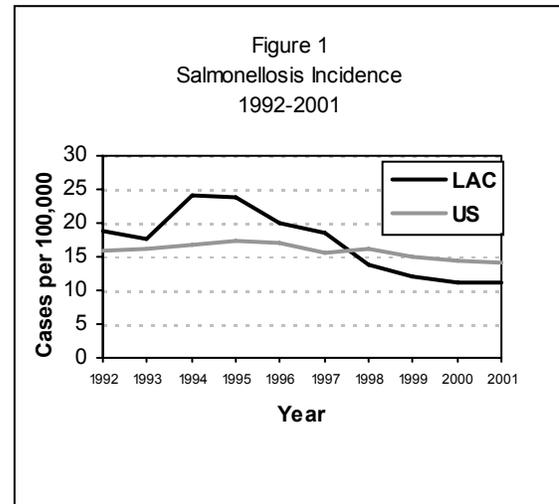
Nontyphoidal *Salmonella* species are one of the most frequent bacterial causes of foodborne illness in the US—and there are an estimated 4 million persons ill with nontyphoidal salmonellosis each year. Foodborne transmission causes more than 95% of human salmonellosis cases, with foods of animal origin being the most common source. While generally causing self-limited illness, for the very young, the very old and those with lowered immunity, salmonellosis can cause serious sequelae and death. Trends in *Salmonella* incidence, hospitalization rates and outbreak etiologies in Los Angeles County (LAC) from 1992–2001 are described.

METHODS

All persons diagnosed with salmonellosis and residing in LAC are required by California state law to be reported to the LAC Department of Health Services. A confirmed case is defined as an individual who had a culture-confirmed *Salmonella* isolate from stool, blood, urine, wound, CSF or other site. A presumptive case is defined as an individual who is epidemiologically linked to a culture-confirmed case, and has diarrhea (>2 loose stools/24 hours) and fever, or diarrhea and at least two other symptoms such as cramps, vomiting, or aches with negative or unknown culture results. Age, race, ethnicity, gender, hospitalization and outcome are all collected from routine salmonellosis case history forms used for interviews conducted on each reported case of salmonellosis.

Hospital discharge data (version A) was obtained from the California Office of Statewide Health Planning and Development for 1992 through 2001. Discharge records containing the ICD9 code for nontyphoidal *Salmonella* infection (003, 003.0, 003.1, 003.2, 003.20, 003.21, 003.22, 003.23, 003.24, 003.29, 003.8, and 003.9) as principal or additional diagnosis were included as hospitalized cases. LAC Vital Records data were used to calculate rates.

In addition, LAC laboratories are required by state law to submit all *Salmonella* isolates to the local health department. Locally, these isolates are then confirmed, grouped and serotyped by the LAC Public Health Laboratory. In addition, pulsed-field gel electrophoresis (PFGE) has been





regularly performed on selected serotypes since 1999, and has been performed for outbreaks and special investigations on *Salmonella* isolates since 1995.

RESULTS

There were 15,174 cases reported and 1% resulted in death during the study period. Rates of salmonellosis have declined steadily from a high of 24/100,000 in 1994 to 10/100,000 for 2001 (Figure 1). LAC rates peaked in the mid-1990's, but have now fallen below the national rate.

The highest average rates for the ten year period were in those under age one year (100/100,000), followed by 1-4 year olds (45/100,000), and those over 65 years (18/100,000, Figure 2). Extremely high rates in infants have fallen steadily during the study period. One percent of cases (152) resulted in death and 49% of deaths were in persons >65 years old. The majority of these deaths occurred in persons with underlying medical conditions that decrease immunity.

There were 3160 hospitalizations for the study period; highest age group rates among those hospitalized were 19.0/100,000 for <1 year old and 9.8/100,000 for 65 years and older (Figure 3). The age group rates were based on the salmonellosis as any diagnosis on the hospital discharge data set.

The diamond line refers to all reported salmonellosis cases, whether hospitalized or not. The squares are those hospitalized persons with salmonellosis as the main diagnosis and the triangle line is those cases with salmonellosis as any hospital diagnosis.

From 1992–2001, *Salmonella* Enteritidis (SE) was the most frequent serotype isolated, followed by *S. Typhimurium*, *S. Heidelberg* and *S. Newport*, respectively (Figure 4). In LAC, the incidence of SE cases spiked in 1994, then dropped from 11.7/100,000 in 1994 to 2.6/100,000 in 2001, with a concurrent decrease in SE outbreaks. In addition, a lesser decrease was seen in the second most frequently isolated serotype, *S. Typhimurium* during this time. Investigations were conducted for 132 salmonellosis outbreaks; the etiology for 66 (50%) outbreaks was *Salmonella* Enteritidis (SE) and in 41% of SE outbreaks, shell eggs were implicated as the source. The proportion of cases that are due to outbreaks varies by year, depending on the size and nature of the outbreak (Figure 5). Beginning in 1997, 17 outbreaks of various serotypes associated with fresh produce occurred (Table 1). Sources were canteloupe (n=4), alfalfa sprouts (n=4), cilantro (n=4), unpasteurized orange juice (n=2), pre-cut melons (n=1), green grapes (n=1) and mango (n=1). Many of these outbreaks consisted of apparently sporadic cases in multiple jurisdictions and detection coincided with the initiation of PFGE in public health laboratories and the PulseNet surveillance system.

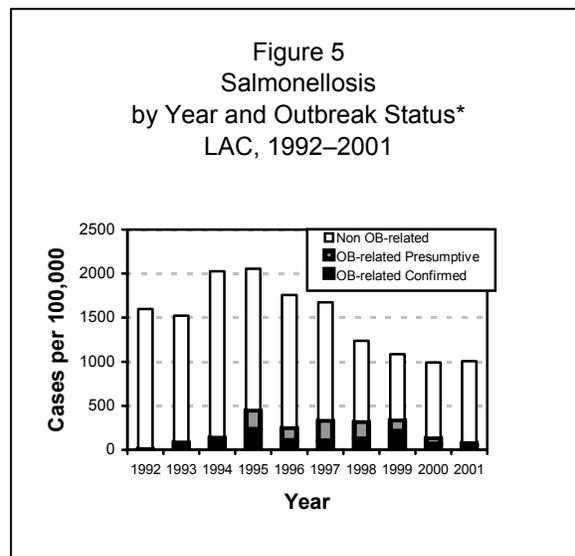
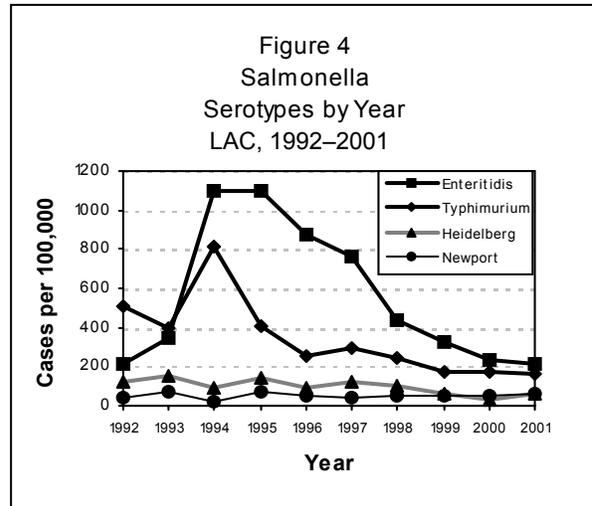




Table 1. Suspected Sources Of Outbreaks by Year

Year	Number of Outbreaks	Number of Outbreaks by Suspected Source of Infection				
		Eggs	Poultry	Carrier	Produce	Unknown
1992	3	0	0	2	0	1
1993	11	2	1	2	0	6
1994	13	3	2	3	0	5
1995	17	3	8	3	0	3
1996	10	4	2	1	0	3
1997	17	4	3	0	1	9
1998	22	8	5	1	2	6
1999	21	3	3	2	6	7
2000	8	0	1	2	2	3
2001	10	0	0	0	6	4
TOTAL	132	27	25	16	17	47
%	100%	20%	19%	12%	13%	36%

DISCUSSION

Rates of *Salmonella* infections have fallen by half since 1995. This reduction is mostly due to a decrease in *S. Enteritidis* and to a lesser degree to a decrease in *S. Typhimurium*. *S. Enteritidis* rates have been falling since an dramatic increase in SE associated with eggs was recognized in 1994. Local and state public health and agriculture agencies worked with the egg industry to develop a prevention strategy, and as of 2002, more than 99% of the eggs produced in California are from farms that participate in the California Egg Quality Assurance Program. It is possible that these measures also impacted other serotypes of *Salmonella* found in poultry, including *S. Typhimurium*.

Demographic trends in salmonellosis are similar to those found in the rest of the US. The very young and old are at risk for hospitalization and the elderly have greater mortality. Most of these deaths are in persons with underlying medical conditions such as cancer, cardiovascular disease, or immunocompromising conditions. In the very young, increased food safety knowledge by parents may be responsible for the decrease in salmonellosis in those under one year of age.

While most outbreaks of salmonellosis of proven etiology are foodborne, there has been a shift from long-established sources such as meat, poultry, eggs and dairy products toward fresh produce as the source vehicle for transmission. As *S. Enteritidis* due to eggs has fallen, so have outbreaks due to *S. Enteritidis*. As better control of meat and dairy products decreases salmonellosis from these sources, new sources have been discovered, such as imported produce from areas that do not have the same standard of living and hygiene that we have in the US. Demand for fresh fruits and vegetables year-round have led to increasing imports of fresh produce from around the world. These widely-distributed products, if contaminated, can lead to sporadic cases occurring over a large geographic area, in different health jurisdictions. In the past, these sporadic cases would have been investigated as individual cases, but now, because of various Web boards, such as PulseNet and listservs, such as FoodNet, these sporadic cases can be linked together by serotype and PFGE pattern type and investigated together as an outbreak.

Our definition of outbreaks is changing from classic point source events to include sporadic cases of the same strain type. Many of these outbreaks involved widely-distributed products such as imported produce, processed meat or spices. Case-control studies are then conducted to attempt to find the associated food source. These studies are more difficult than the classic point source investigation, and may involve several lengthy interviews of each case. Because of the increase in produce-related outbreaks, public education regarding uncooked produce as an additional source of foodborne illness



should be expanded. Health care providers should educate elderly patients and those who use steroid medication or have chronic illness regarding food safety. Local, state and federal regulators from farm to table need to enforce food safety regulations to ensure that foods produced in the US and those imported are free of pathogenic bacteria.

ADDITIONAL RESOURCES

For frequently asked question about salmonellosis:
www.admin.lapublichealth.org/wwwfiles/ph/PH/PHN/Salmonellosis.PDF

General information about salmonellosis:
www.cdc.gov/ncidod/diseases/submenus/sub_salmonella.htm

General information about foodborne illness and reporting information in LAC:
www.lapublichealth.org/acd/food.htm

Information on salmonellosis and reptiles: www.lapublichealth.org/acd/docs/PetReptile%20Brochu.pdf

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