

ANOTHER OUTBREAK OF ALFALFA SPROUT-ASSOCIATED SALMONELLOSIS

"In no affairs of mere prejudice, pro or con, do we deduce inferences with entire certainty, even from the most simple data."

The Narrative of A. Gordon Pym, E. A. Poe, 1838.

WHILE USUALLY OF little relevance to clinical practice, *Salmonella* serotyping has proven vital for epidemiological purposes. In general, serotyping is done only at public health laboratories; the taxpayer picks up the bill. From 1988 through 1998, at least 3,713 *Salmonella* isolates from Oregon patients were serotyped; 148 different serotypes were identified.* A handful of serotypes dominate the list. Typhimurium was by far the most common (33.9% of all isolates); the top five comprised 64.5% of all cases. Sixty-four serotypes were seen only once during this 11-year period.

Salmonella Mbandaka ranked 24th on the list of most common types, with 17 isolates over 11 years—an average of 1.5/year. The first Mbandaka isolate of 1999 was identified on January 26, and, frankly, didn't cause much of a stir. Routine follow-up of this Yamhill County patient elicited a story of a sick cat having diarrhea all over the child's bed—a suspicious coincidence to the parents. The second and third Mbandakas were confirmed on February 2, and the astute public health microbiologist advised epidemiologists to drop the cat theory and think instead about a possible common-source outbreak. An investigation was launched immediately, and a fourth isolate the following day heightened the sense of urgency.

Most outbreaks of non-typhoidal salmonellosis are caused by contaminated food, although water and person-to-person transmission are occasionally recognized. *Salmonella* is widely distributed in the animal world: mammalian, avian, reptilian, and amphibious sources are all common. Fecal contamination of inadequately processed food, temperature abuse, and

cross-contamination are recurrent themes.

In any outbreak investigation, an attempt is made to identify exposure or susceptibility factors that are disproportionately common to cases. In the Mbandaka investigation, the working hypothesis was some common food exposure. From initial interviews it was readily apparent that no single event (e.g., a shared restaurant meal) could explain the outbreak. The first four cases were from four different counties, and they had no overlapping travel histories. Neighboring states and the CDC were notified; no unusual Mbandaka activity was being reported elsewhere. By simple deduction, then, the source was a commercial product that was distributed widely in at least western Oregon, but not necessarily elsewhere. Additional cases were soon identified (see graph, part A), and a demographic pattern emerged. Of the first 10 cases identified, 7 (70%) were between 24 and 30 years old. (In contrast, only 11% of 1988–98 salmonellosis cases were in that range.)

Another pattern also emerged. Eight of the first 10 cases reported eating alfalfa sprouts in the 5 days before they got sick (or "recently" for two who could not recall an unambiguous onset date). Another denied eating sprouts, but noted that, as a short-order cook, he handled them all day long. We traced possible sprout sources for these cases by contacting first retail outlets and then produce wholesalers. While not every case had an unambiguous history, eight of the 10 reported eating or handling sprouts that came or could have come from Hydro Harvest—a sprout grower in Brush Prairie, Washington. We interviewed two age- and phone prefix-matched controls for each of the first 10 cases; none reported eating alfalfa sprouts. This is what epidemiologists call "guilt by association" ($p < 0.005$).

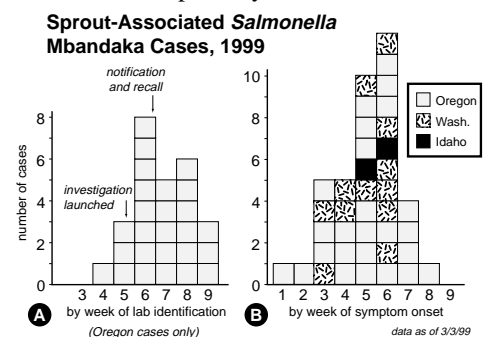
WHAT ABOUT SPROUTS?

Alfalfa sprouts had been considered a possible source from the outset of the investigation. Over just the past few years, contaminated alfalfa sprouts have

become recognized as the most common cause of North American salmonellosis outbreaks that fit this characteristic demographic profile. Over a dozen such outbreaks have been identified in the U.S., including a multinational outbreak of *Salmonella* Newport infections in 1995 and 1996 that included over 70 lab-confirmed cases in Oregon alone. Ironically, a report of that investigation¹ was published in JAMA on January 13, 1999—the same day the index case in the Mbandaka outbreak began to feel sick. *Salmonella* Mbandaka with an identical molecular fingerprint was eventually cultured from leftover sprouts recovered from this patient's refrigerator.

The problem with alfalfa sprouts is that seeds are sometimes (often?) contaminated with *Salmonella* and other enteric pathogens, including *Escherichia coli* O157:H7.² During the multi-day sprouting process, these bacteria can multiply by several orders of magnitude, potentially achieving infectious levels on even one or two sprouts.³ Traditional sprouting methods do not include a "kill step" that can inactivate these pathogens if they are present, and virtually all alfalfa sprouts are consumed uncooked. How widespread the problem of seed contamination is among related products is unknown. Outbreaks have also been traced to radish sprouts⁴ and bean sprouts.⁵

With the accumulating bad news, researchers have been scrambling to find safer alternatives to traditional practices. While abstinence is the only foolproof method to prevent sprout-transmitted diseases, some research indicates that seeds can be at least partially disinfected with



* out of >2,400 that have been described.

chlorine.³ Early recommendations called for a 5-minute soak with 2,000 ppm NaHOCl (aka ~1:50 dilution of household bleach). More recent research (in press, supposedly) suggests that a similar soak in a 20,000 ppm calcium hypochlorite solution may provide even better disinfection. The FDA and EPA granted fast-track approval for the use of this procedure last summer, although sprouts growers are not currently required to use either method.

The alfalfa seed implicated in the Mbandaka outbreak came from a farm in southern California. (Past outbreaks have been traced to both domestic and imported seed.) The Washington grower purchased 2,000 pounds of that lot and began to use it in early January—shortly before the first cases occurred. *Salmonella* Mbandaka was subsequently cultured from many samples collected at the facility, including ungerminated seed. With the assistance of several state and federal agencies, a recall of all Hydro Harvest brand alfalfa sprouts produced from this lot of seed was initiated on February 13.

Unfortunately, the news comes too late for many consumers. As of March 3, at least 43 lab-confirmed outbreak cases have been identified, including 26 in Oregon, 15 in Washington, and 2 in Idaho (see graph, part B). More cases are being confirmed daily. Almost all of the currently known cases were exposed before the recall announcement, but not everyone heard or acted on the warning. A rule of thumb in salmonellosis outbreaks is that for every lab-confirmed case, there are at least 20-100 other persons who became ill,^{6,7} suggesting that well over 1,000 persons may have become ill.

LESSONS LEARNED (OR NOT)

A number of interesting findings are emerging from this ongoing investigation. First, despite the exhortations of textbooks, pocket guides, and i.d. and public health experts, many Oregon physicians persist in recommending antimicrobials to patients with uncomplicated salmonellosis. Among the first 24 Oregon cases, antibiotics were prescribed for two-thirds of the adult patients (12/18) and one-third of the children (2/6). Only 3 patients (2 adults; 1 child) had any recognized indications for therapy. Antimicrobial therapy for uncomplicated salmonellosis is not associated with any decrease in symptom duration or severity. It is quite effective at increasing the duration of excretion, however, thereby increasing the risk of subsequent person-to-person transmission, and jeopardizing the work status of persons in certain occupations (e.g., food handlers, health care workers). So try to control the urge with your next patient.

Second, despite the recent publicity about links between alfalfa sprouts and foodborne illness, most consumers report that they haven't heard anything about it. In other words, people who eat sprouts aren't necessarily making an informed choice.

Third, many sprout growers are responding to the fact that seed contamination appears to be a fact of life. More and more growers are using approved methods of seed decontamination in an effort to reduce the risk to their customers. In fact, of the five growers who had already used some of the implicated seed lot before it was embargoed (3 in California, 1 in Florida, and Hydro Harvest in Washington), four reported using one of the two recommended soaking procedures; only Hydro Harvest

did not. Coincidentally, no Mbandaka cases have been identified in either California and Florida, where these other growers distribute sprouts. Tests on seed recovered from these other growers and from warehouses are pending in an effort to assess if this lot was uniformly contaminated. Poor record keeping may make it impossible to independently verify what decontamination methods were actually used, but if verbal accounts are accurate, this outbreak may have been something of a natural experiment that could help convince growers, regulators, and ultimately consumers that the risk of enteric infections from sprouts can be markedly reduced.

Until this hope can be better substantiated, however, we continue to advise all consumers to consider the risk of foodborne illness before consuming uncooked sprouts. The risk of serious, invasive salmonellosis is highest among the elderly, infants, and other immunocompromised individuals.

REFERENCES

1. Van Beneden CA, Keene WE, Strang RA, et al. Multinational outbreak of *Salmonella enterica* serotype Newport infections due to contaminated alfalfa sprouts. *JAMA* 1999; 281:158-162.
2. CDC. Outbreaks of *Escherichia coli* O157:H7 infection associated with eating alfalfa sprouts — Michigan and Virginia, June–July 1997. *MMWR* 1997; 46:741–744.
3. Jaquette CB, Beuchat LR, Mahon BE. Efficacy of chlorine and heat treatment in killing *Salmonella stanley* inoculated onto alfalfa seeds and growth and survival of the pathogen during sprouting and storage. *Appl Environ Microbiol* 1996; 62:2212-2215.
4. Watanabe H, Wada A, Inagaki Y, et al. Outbreaks of enterohaemorrhagic *Escherichia coli* O157:H7 infection by two different genotype strains in Japan, 1996 [letter]. *Lancet* 1996; 348:831-832.
5. O'Mahony M, Cowden J, Smyth B, et al. An outbreak of *Salmonella* saint-paul infection associated with beansprouts. *Epidemiol. Infect.* 1990; 104:229-235.
6. Chalker RB, Blaser MJ. A review of human salmonellosis: III. Magnitude of *Salmonella* infection in the United States. *Rev Infect Dis* 1988; 10:111-124.
7. Hennessy TW, Hedberg CW, Slutsker L, et al. A national outbreak of *Salmonella enteritidis* infections from ice cream. *N Engl J Med* 1996; 334:1281-1286.