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OUTBREAK INVESTIGATIONS IN OREGON, 1998–2003

In the consideration of the faculties and impulses—of the prima mobilia of the human soul, the phrenologists have failed to make room for a propensity which, although obviously existing as a radical, primitive, irreducible sentiment, has been equally overlooked by all the moralists who have preceded them.[1]

POE WAS WRITING of the impulsion to act in a manner ostensibly at cross-purposes with one's own self-interest. Despite some misgivings, then, we review herewith six years of outbreaks and outbreak investigations in Oregon. Since epidemiology first began its ascent from the primordial ooze, outbreak investigations have been considered a core function of public health practice.

What is an outbreak? According to one lexicographer,[2] outbreaks are synonymous with epidemics—just a less scary way of saying the occurrence of adverse health events "clearly in excess of normal expectancy." Most of what we investigate as outbreaks are in the subset of common-source, as oppposed to propagated source. Operationally, we usually classify clusters as outbreaks when we have two or more epidemiologically linked cases from multiple households.

RECOGNITION

Outbreaks are recognized in various ways. One of the most common is that someone calls the health department and says—in effect—"I'm calling to report an outbreak." The informant might be the mother of the bride reporting a high rate of illness subsequent to the wedding reception, a nursing home administrator reporting an apparent increase in deaths, or a physician calling to say he had seen a patient who reported being with several other people who had developed the same illness. For illnesses not covered by named laboratory reporting rules (e.g., Norwalk-like viral infections), this is essentially the only way we learn of clusters. For reportable infections (e.g., salmonellosis), most outbreaks are detected by the ongoing comparison of surveillance reports with "expected" levels. Expectations, of course, are based on experience: read, historical data. So when in March 2003 the Baker County Health Dept. received reports of 3 salmonellosis cases on a single day, this was compared with historical averages of about 0.8 cases/year to reach (pretty quickly) the conclusion that an outbreak had occurred. Many outbreaks are more subtle, particularly those with cases scattered across many weeks and perhaps several states. Subtyping of bacterial isolates is needed to discern some clusters, but getting these results (e.g., serotyping or molecular subtyping of *Salmonella* isolates) takes time—not least of which is time getting the isolate to the state's Public Health Laboratory. Outbreak identification also depends on the flow of surveillance data between public health agencies not only within Oregon but throughout the world.

PROCESS

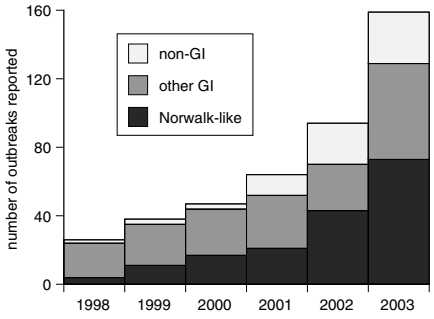
Public health agencies in Oregon investigate a lot of outbreaks—only a small fraction of which are actively brought to the public's attention. The vast majority of these involve communicable diseases. Epidemiologists in DHS's Acute and Communicable Disease Prevention (ACDP) office track outbreaks and offer technical and logistic support to local health departments as needed. Multiple agencies are typically involved, almost always including one or more local health departments and the ACDP, and (depending on the location, size, and nature of the outbreak) often the Food Safety Divison of the Oregon Department of Agriculture, other state health departments, CDC, the USDA, and the FDA.

While there are general principles to follow (case finding, assessing illness and often exposures through systematic data collection, data analysis, drawing conclusions, taking action—or not), each investigation is *sui generis*.

DATA

Data are most complete for outbreaks investigated since 1998, although during this period the resources devoted to collecting and tabulating summary information about investigations have greatly increased. Certainly the number of investigations logged has increased monotonically (see figure). By one reckoning,* we investigated at least 158 different clusters in 2003, closing out the year with the usual rash of holiday parties gone awry.

Reported Outbreaks, Oregon 1998–2003



During the 1998–2003 period we logged 427 outbreaks. Vomiting and diarrhea are our bread and butter; 354 of these outbreaks (83%) were clusters of acute gastroenteritis of one kind or another. The next most common syndrome was pertussis, with 20 recognized outbreaks (5%). Other clusters included varicella, influenza-like illness, hepatitis, and scombroid. For variety, during this 6-year period we also investigated single outbreaks of malaria (school kids gone to Africa), coccidioidomycosis (a church group gone to Mexico), ciguatera fish poisoning (shoppers gone to a Fijian

* There remain certain arbitrary if not subjective criteria in counting outbreaks. Until only a few years ago, little effort was made to track systematically how many outbreak investigations were done, making historical comparisons problematical.

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specialty market), and auricular chondritis caused by *Pseudomonas aeruginosa,* subsequent to ear piercing (kids gone to the mall).

Most clusters that we investigate appear to be small; the median reported size was 12 cases. Understand, however, that the reported size typically counts only cases identified in some kind of study or (at least) a line listing. While sometimes this is the entire group, it may be only a sample—and sometimes only a tiny fraction of the number of people affected. The rule of thumb for many salmonellosis outbreaks, for example, is that reported cases are only 1–10% of the total sickened—the missing ones being those undiagnosed and unreported, including people who did not seek medical attention. We averaged 21 reported cases in each of the 43 salmonellosis outbreaks investigated during this period. If we assume that to be 5% of the total, then we are talking about almost 18,000 infections. In general, the smaller the cluster, the harder it is to identify the source. Clusters of only 2 or 3 cases may be self-evident, and often corroborated by highly specific lab markers, but without good luck they are almost certain losers from an investigative standpoint.

Smaller outbreaks are also less likely to be reported, and less likely to merit a full work-up. If we consider only outbreaks with 10 or more reported cases, we may get a less biased picture of our experience. During this period, 227 (53%) of 427 clusters were at least that big. Of these, 206 (91%) were GI outbreaks, and at least 124 (60%) of those were caused by Norwalk-like viruses. This is a lower bound; 46 (22%) were classified as having an "unknown" etiology. The next most common causes of these larger GI outbreaks were various *Salmonella* serotypes and (presumptive) *Clostridium perfringens*: 12 (6%) each. *E. coli* O157:H7 was the cause of 4 outbreaks with 10 or more cases.

An area of ongoing concern are outbreaks in nursing homes, assisted-living centers, and similar residential settings for the elderly. Overall, 95 (22%) of all outbreaks occurred in such settings,[†] but 74 (33%) of the 227 larger outbreaks. Again, most of these outbreaks were of gastroenteritis. Many nursing home outbreaks seem to be primarily occurring by person-to-person (as opposed to, say, foodborne) spread, but it isn't always easy to tell. Reporting is often delayed, and data collection can be challenging. Unlike restaurants, delis, and similar food service establishments, nursing home kitchens are not inspected by environmental health specialists in Oregon.

PURPOSE

Why do we investigate outbreaks? The most obvious and immediate impetus to investigate is to identify and mitigate immediate threats to the public health, be they a SARS "superspreader," fecal waste leaching into a drinking water supply, or *Salmonella*-contaminated alfalfa sprouts on your grocer's shelves. Realistically, only public health agencies are positioned to connect reports emanating from different clinicians, institutions, counties, or states, and are granted the legal access to otherwise confidential medical information.[‡] Second, identification of an ongoing problem and dissemination of investigative findings can sometimes facilitate diagnosis and proper treatment or prophylaxis by clinicians. Third, we are charged to learn what we can from these unnatural experiments, and to share this knowledge with the medical and lay public in hopes of reducing the likelihood of recurrences. This means identification and characterization of new pathogens (SARS, *Cyclospora*) and risk factors for infection (undercooking meat and poultry, for example), stimulation of research (how does *Escherichia coli* O157:H7 survive in mayonnaise?), and provision of the science behind public policy (Should raw meat be screened for pathogens...?). Although outbreak cases are a biased subset of all cases, and must be understood as such, outbreak investigations loom disproportionately large in furthering our understanding of disease transmission and basic epidemiology.[3]

Not all investigations are successful. Small sample sizes and delayed reporting are common problems. Some people are not eager to cooperate. But we keep trying and occasionally come up with nuggets that make it all worthwhile. We close with the usual benediction: please report (immediately) any and all suspicions about unusual cases of "Potential Public Health Significance" and suspected common-source outbreaks to your local health department.

[†] This includes outbreaks with exposures in multiple settings.
[‡] Stand down, HIPAA officer!

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2. Last JM. A dictionary of epidemiology. 2nd edition. New York: Oxford University Press, 1988.
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