

EDITORIAL

Legionella Surveillance: Political and Social Implications—A Little Knowledge Is a Dangerous Thing

Victor L. Yu

Veterans Affairs Medical Center and University of Pittsburgh,
Pittsburgh, Pennsylvania

In this issue of *The Journal of Infectious Diseases*, the Centers for Disease Control and Prevention (CDC) reports an outbreak of travel-associated legionnaires disease (LD; 2 cases) and concomitant Pontiac fever (PF)-like illness (22 cases) [1]. *Legionella pneumophila* serogroup 6 was isolated from a patient with confirmed LD and from a whirlpool spa at a hotel at which the patient had stayed. Molecular subtyping confirmed that the patient isolate and the environmental isolate were identical.

Patients with PF, unlike those with LD, have normal results of chest radiography, without evidence for pneumonia. Malaise, fatigue, and myalgia are the most frequent symptoms, occurring in 97% of the patients. Fever, often with chills, occurs in ~80%–90% of patients. Although pneumonia has never been documented, nonproductive cough and chest pain are common (30%–60% of patients) [2]. PF differs from LD in that the illness is self-limited; full recovery usually occurs within 1 week and without sequelae. Treatment is symptomatic, and antimicrobial agents are not needed. The diagnosis is confirmed by elevated antibody titers to *Legionella* species, usually *L. pneumophila*.

The fact that serologic confirmation was not required in the case definition for PF in the CDC study was an understandable shortcoming. The analysis of data from the case-control study could have been confounded easily by data from patients who had nonspecific symptoms and by recall bias associated with questioning of patients about whether they had been near a whirlpool spa—a well-publicized link for LD. In addition, in such cases, investigators may assiduously search for data that indicate that the whirlpool spa is a source but pay less attention to other potential sources. For the IgM test used in this report, serologic positivity was defined at a relatively low titer of 1:64. This appears to be an arbitrary definition, because no population-based data on the prevalence of a titer \geq 1:64 in a control population was available, and, in this study, 5 (56%) of the 9 patients with symptoms attributed to legionellosis did not meet even this low titer. Because of this uncertainty, the authors labeled the syndrome “PF-like illness.”

The environmental ecology of *Legionella* species is pertinent to the ultimate prevention of legionellosis. *L. pneumophila* can be found in natural aquatic bodies, including rivers, lakes, and thermally polluted waters. *L. longbeachae* has been isolated from soil, and the possibility exists that soil is the natural habitat for *Legionella* species [3]. Natural aquatic bodies contain only small numbers of the organism. In addition, because the organism is tolerant to chlorine, *Legionella* species survive the water-treatment process and pass into man-made distribution systems. Given favorable growth conditions, subsequent proliferation occurs in water-distribution systems; conditions that would favor proliferation include interactions with commensal water flora, physical shelter, nutrients within biofilms, and, most important, warm temperatures (~38°C–49°C). Large buildings provide a more hospitable environment than small buildings, including residential homes, because the more extensive piping network of a large building provides a greater surface area with lower temperatures, temperature stratification within the larger tanks is more variable, and biofilm accumulation is greater [4].

In their report [1], the CDC recommends initiation of surveillance of travel-associated legionellosis, an approach already used in Europe by the European Working Group for *Legionella* Infection (EWGLI). The immediate and obvious benefit of surveillance for travel-associated legionellosis is in public health. If the surveillance data could be expediently collected, an ongoing outbreak could be terminated. If the source could be localized to an aerosol-generating device, such as a whirlpool spa, subsequent disease could be prevented by disinfection of the source.

Surveillance for travel-associated diseases is inherently difficult, because clusters may go undetected for weeks or months, key diagnostic tests may not be performed at the time of maximum sensitivity, and the source of the organism may be disturbed (e.g., the whirlpool spa may be drained), so that an epidemiologic link cannot be made with confidence. For the traveler, this is compounded by the fact that the incubation period of LD is 2–10 days or longer, making it likely that the illness will be diagnosed in a geographic area other than that of the source of infection.

In the CDC report [1], a ready solution was available, because the source was a whirlpool spa, which could be disinfected if it was found to be colonized. However, the source in many cases of travel-associated legionellosis is the potable water supply,

Received 19 October 2001; electronically published 18 December 2001.

Reprints or correspondence: Dr. Victor L. Yu, Veterans Affairs Medical Center, Infectious Disease Section, University Drive C, Pittsburgh, PA 15240 (vly+@pitt.edu).

The Journal of Infectious Diseases 2002;185:259–61

© 2002 by the Infectious Diseases Society of America. All rights reserved.
0022-1899/2002/18502-0016\$02.00

and the solution is then more complex. Data from the EWGLI surveillance of travel-associated legionellosis show that the source of the infection is most often linked to large buildings, including hotels (77.1%) and apartment buildings (6.7%) (C. Joseph and F. Lever, written communication). Although a whirlpool spa was found to be the source in this outbreak, the CDC should anticipate that potable water systems in hotels may well be the culprits in most cases [5, 6].

Host susceptibility plays a critically important role in development of infection. Patients with immunosuppressive illnesses and chronic lung diseases are more likely than immunocompetent individuals to acquire LD. Hospitals and nursing homes commonly experience endemic legionellosis in their residents. On the other hand, in hotels that house a younger and healthier population, the risk for contracting LD is correspondingly lower. Keep in mind, however, that the defining outbreak of LD occurred in a hotel at the 1976 American Legion Convention, at which at least 188 individuals contracted pneumonia, with a noteworthy mortality rate.

If the outbreak investigation resulting from surveillance reveals that the source of the infecting *Legionella* is the hotel water-distribution system, what are possible courses of action? Engineering guidelines and building codes emphasize cleanliness and regular preventive maintenance of the water-distribution system. Public health agencies have promulgated the unproven view that proper maintenance can prevent *Legionella* colonization. Not only is this view unsupported by scientific evidence, but studies have documented that *Legionella* colonization is independent of maintenance measures [7]. Elevation of hot-water temperature, a method we developed, is ineffective unless distal outlets are flushed, and even then it is effective only for several months [8].

Although disinfection of the water-distribution system may be cost-effective in hospitals, given the large population at risk, it is unclear whether it is a cost-effective measure for hotels. Disinfection requires long-term, constant vigilance to ensure that the level of disinfectant (e.g., copper/silver ions) remains higher than the minimum recommended levels [9]. Furthermore, routine environmental cultures for *Legionella* species are necessary to confirm the efficacy of disinfection [9]. Monitoring of disinfection systems in hospitals is less disruptive and more efficient than in hotels, because an infection-control support staff is present in hospitals. In a low-risk environment, it is possible that monitoring of and maintenance measures for these disinfection systems may become less stringent over time, compromising their efficacy.

Scapegoating, which results in negative media publicity and medicolegal problems for hotels that have *Legionella* species in the water supplies, should be anticipated. Lawsuits directed at hotels have occurred already and will become more frequent when discovery of LD occurs in guests of more hotels at which *Legionella* species have been found in the potable water supply. The Philadelphia hotel closed its doors after the 1976 American

Legion outbreak (although it has since reopened). EWGLI's voluntary surveillance of travel-associated legionellosis was threatened when a Dutch journalist published the names of hotels at which LD had occurred [10].

Surveys have shown that large buildings are often colonized by *Legionella* [11–13]. Information is needed to establish the relative risk for LD in large buildings, such as apartment buildings, dormitories, and hotels, that mainly house immunocompetent individuals. Rational recommendations cannot be made for the hotel industry when the fundamental questions on risk remain unresolved. A little knowledge can be a dangerous thing. At our Web site, www.legionella.org, we are inundated with questions on approaches to prevention of the spread of legionellosis from water sources yielding *Legionella* species in office buildings, gymnasiums, college dormitories, manufacturing plants, and public schools.

Surveillance, as the CDC proposes, may lead to a solution. Collection of CDC surveillance data for LD is now directed at calculation of incidence rates and compilation of demographic information. However, given the present dilemma, I propose that surveillance for travel-associated legionellosis should be expanded to address crucial issues of risk assessment. The current CDC surveillance forms for *Legionella* should be updated. For example, presence of renal failure (a late complication of severe legionellosis) is tabulated, but detailed information on exposure to water sources is not. Mode of transmission should be evaluated. One point that is not well known to laypersons is that *Legionella* species can be contracted from potable water via aspiration [14]. Thus, environmental cultures of all water sources to which patients with LD have been exposed should be performed, especially the potable water. The host susceptibility of those residing at the source (be it hotel or cruise ship) should also be evaluated. For instance, surveillance should track whether those exposed at the source are young, healthy high-school athletes or elderly military veterans who are heavy cigarette smokers with comorbid cardiopulmonary illnesses.

Surveillance should also be complemented by education of the public and the lay media. The public must be informed that *Legionella* species are common colonizers (as are *Pseudomonas* species) of man-made water-distribution systems that are rarely pathogenic for immunocompetent hosts and that LD is not a contagious disease. Ignorance leads to panic, and panic leads to irrational actions. The response of a hotel to discovery of a case of travel-associated legionellosis should be scientifically based. We have observed the implementation of emergency measures that are expensive, are logistically tedious, and have little impact on the risk of acquiring LD.

Finally, confidentiality should be maintained for implicated hotels and business establishments. As has been discussed, from an ecologic perspective, *Legionella* species more resembles a commensal water flora bacterium than a contaminating pathogen in potable water. Scapegoating occurs because the public assumes that the hotel harboring *Legionella* species is

derelict in its responsibility. Legal penalties can be invoked in the United Kingdom that may discourage active environmental surveillance for *Legionella* species, especially when potable water is involved [15].

Surveillance of travel-associated legionellosis, if conducted thoughtfully, should provide information on risk that not only will be useful for prevention in hotels but also can be extrapolated to hospitals, rehabilitation centers, geriatric facilities, and nursing homes. If a little knowledge is a dangerous thing, one solution is to expand our body of knowledge.

Acknowledgments

We thank Janet E. Stout and Maddalena Castellani Pastoris for their review of this editorial.

References

1. Benin AL, Benson RF, Arnold KE, et al. An outbreak of travel-associated legionnaires disease and Pontiac fever: the need for enhanced surveillance of travel-associated legionellosis in the United States. *J Infect Dis* **2002**; 185:237–43 (in this issue).
2. Vergis EN, Yu VL. Legionellosis. In: Fishman AP, Elias JA, Fishman JA, Grippi MA, Kaiser LR, Senior RN, eds. *Fishman's pulmonary diseases and disorders*. New York: McGraw-Hill, **1998**:2235–46.
3. Ross IS, Mee BJ, Riley TV. *Legionella longbeachae* in Western Australian potting mix [letter]. *Med J Aust* **1997**; 166:387.
4. Stout JE, Yu VL, Best M. Ecology of *Legionella pneumophila* within water distribution systems. *Appl Environ Microbiol* **1985**; 49:221–8.
5. Joseph C, Morgan D, Birtles R, et al. An international investigation of an outbreak of Legionnaires disease among UK and French tourists. *Eur J Epidemiol* **1996**; 12:215–9.
6. *Legionella* from guests of Welsh hotel indistinguishable from humidifier isolates. *Commun Dis Rep CDR Wkly* **2000**; 10:141.
7. Vickers RM, Yu VL, Hanna SS, et al. Determinants of *Legionella pneumophila* contamination of water distribution systems: 15-hospital prospective study. *Infect Control* **1987**; 8:357–63.
8. Zacheus OM, Martikainen PJ. Effect of heat flushing on the concentrations of *Legionella pneumophila* and other heterotrophic microbes in hot water systems of apartment buildings. *Can J Microbiol* **1996**; 42:811–8.
9. Lin YE, Vidic RD, Stout JE, Yu VL. *Legionella* in water distribution systems. *J Am Water Works Assoc* **1998**; 90:112–21.
10. EU may name hotels in Legionnaires' outbreaks. *Reuters Health*, 14 September **2001**. Available at <http://www.reutershealth.com>. Accessed 19 October 2001.
11. Hung LL, Copperthite DC, Yang CS, Lewis FA, Zampello FA. Environmental *Legionella* assessment in office buildings of continental United States. *Indoor Air* **1993**; 4:349–53.
12. Zacheus OM, Martikainen PJ. Occurrence of legionellae in hot water distribution systems of Finnish apartment buildings. *Can J Microbiol* **1994**; 40:993–9.
13. Zietz B, Wiese J, Brengelmann F, Dunkelberg H. Presence of Legionellaceae in warm water supplies and typing of strains by polymerase chain reaction. *Epidemiol Infect* **2001**; 126:147–52.
14. Yu VL. Could aspiration be the major mode of transmission for *Legionella*? *Am J Med* **1993**; 95:13–5.
15. Health and Safety Commission. The control of legionella bacteria in water systems—approved code of practice and guidance published. Health and Safety Executive Press release C002.:01-4 January 2001. 9 January **2001**. Available at <http://www.hse.gov.uk/press/c01002.htm>. Accessed 19 October 2001.