Legionnaires Disease in Hospitality

A New Face on a Familiar Problem

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Introduction to the Risk

Legionnaires Disease (LD) associated with the Hospitality and Leisure Industry, whether on land or water, has been reported often in recent years and has received significant media attention.

The disease (LD) and the bacterial agent most commonly associated with it (*Legionella pneumophila*) first received widespread recognition in 1976, when 34 deaths and an additional 221 illnesses occurred within the Bellevue Stratford Hotel Philadelphia at an American Legion Convention (hence the name Legionnaires Disease).

As with many other diseases, diagnosis of LD in patients has recently improved, and greater reporting of the disease is occurring.[1,2] There have also been recent advances in testing for *Legionella pneumophila* bacteria within water systems and water features of buildings. Once a patient is diagnosed with LD, it isn't difficult to trace the patient's two week history, which may have included travel and the associated interface with the Hospitality Industry.

In addition to heightened awareness, increased reporting, and improved diagnostics, is the ever-growing population of individuals who are especially susceptible to the disease. The aging baby boomer generation will remain mobile longer than generations before given medical advances in organ transplants and bone replacements. Although the boomers are healthy enough to travel and recreate, their aging immune systems may not be capable of fighting off the effects associated with the exposure to *Legionella*. With healthcare more available to seniors than ever before, the timely diagnosis of LD when it occurs is likely. Couple these dynamics with improved diagnosis of disease and the ease of documenting travel today (e-reservations, e-tickets, e-mail, etc.), families and lawyers will have ample evidence to file wrongful death or negligence cases.

As hospitality and leisure entities continue to compete for guests, the competition spurs innovative ways to use water to create the "WOW" experience: immense water features; spas and Jacuzzis in every hotel health club (and in some guest rooms); swimming pools; restaurant water features; and in-room wet bars and kitchens. All of these water sources, and of course the water supply lines into and within buildings, provide locations for *Legionella* growth and pathways for potential exposure to *Legionella* and contraction of LD.

Despite growing concerns about LD, the good news is that with the right practices and procedures, the presence of *Legionella* can be controlled and the occurrence of LD can be significantly reduced while still maintaining those "WOW" amenities and features that attract guests.[3, 4]

Developing a Risk Management Plan

A Well-Designed Risk Management Plan Can Assist in Obtaining Favorable Coverage

The entire life cycle of construction, engineering, and the operating and maintaining of buildings now is expected to include methods to reduce the risks of growth and contamination of water systems by *Legionella*, as well as an ongoing surveillance plan to detect changes in the population of *Legionella* within water systems. A well-designed Risk Management Plan can assist in obtaining favorable coverage from carriers and provide a measure of protection against worst case scenarios that may befall a property and its associated stakeholders.

When looking at the management of *Legionella* in the hospitality and leisure setting, lessons can be learned from the aggressive prevention of infections from *Legionella* among patient populations that is undertaken in healthcare-related properties. Infection Control and Risk Management Plans, which include the control of water temperature, pH, and chlorine content, are enforced daily within many hospital settings. Both the Healthcare and Hospitality and Leisure Industries share a clientele with many of the risk factors for disease.[11, 12]

A great deal of research continues on the dose, pathway, and development of *Legionella* growth and the development of LD. Health Departments, the Centers for Disease Control, and numerous other private and public agencies and organizations focus on these issues as well as the recognition, evaluation and control of *Legionella* growth within water systems.[5 – 10]

Dose-response relationships exist for many harmful agents. The actual dose (the nature and intensity of exposure) of *Legionella* species or other microorganisms, and the susceptibility of the exposed capable of causing disease or death, continue to be researched and debated. However, if a building is associated with a *Legionella* outbreak, and tied to a doctor's differential diagnosis of a patient, owners and management are sure to face the specter of defending the brand, company assets, and the ability to maintain operations.

The Bacteria and the Diseases

Legionella Bacteria Are Found Naturally in the Environment

Legionella bacteria are found naturally in the environment, in soil and in water. The bacteria grow best in warm water, like the kind found in hot tubs, cooling towers, hot water tanks, and extensive plumbing systems. People are exposed to *Legionella* when they breathe in a mist or vapor (small droplets of water in the air) that has been contaminated with the bacteria.

Any source of a mist—spas, shower heads, faucet aerators, fountains, cooling towers—is a source of potential exposure. In addition, *Legionella* contaminated water or ice can be aspirated into the lungs by susceptible individuals, such as those over 50, smokers, those who are intoxicated, and those subject to acid reflux.

Exposure to *Legionella* bacteria can cause two diseases: Pontiac Fever or Legionnaires Disease. Pontiac Fever is not serious. Symptoms usually last for two to five days and may include fever, headaches, and muscle aches; however, there is no pneumonia. Symptoms subside on their own without treatment and without causing further health issues. Outbreaks can occur, but isolated cases may go unreported because the symptoms are the same as common influenza.

Conversely, Legionnaire's Disease can be very serious and can even cause death. It can have symptoms like many forms of pneumonia, making it difficult to diagnose at first. Signs of the disease can include: high fever, chills, and a cough. Some people may also suffer from muscle aches and headaches. Symptoms usually begin two to 14 days after exposure to the bacteria. Chest X-rays are needed to find the pneumonia caused by the bacteria, and sputum (phlegm), blood, or urine tests are conducted to find evidence of *Legionella* bacteria in the body.

Most cases can be treated successfully with antibiotics, and healthy people usually recover from infection. People who have weak immune systems from diseases like cancer, diabetes, or kidney failure are more likely to get sick from *Legionella* bacteria and experience more severe effects. People who take drugs that suppress (weaken) the immune system (like after a transplant operation or chemotherapy) are also at higher risk.

The bacteria are not spread from one person to another person. *Legionella* cases are classified as outbreaks when two or more people become ill in the same place at about the same time, such as patients in hospitals or guests in hotels. Outbreaks have been linked to aerosol sources in the community or on cruise ships. Some sources of *Legionella* exposure have been whirlpool spas, cooling towers, decorative fountains, and water used for drinking and bathing. Travel-related illnesses and outbreaks are typically the most publicized and most damaging to the Hospitality Industry. For example, in the first quarter of 2012, newspapers and the web featured three deaths and multiple hospitalizations related to a resort hotel in Spain, a death in one casino hotel in Las Vegas in late 2011, and an outbreak of Legionnaires Disease in another casino hotel in Las Vegas in mid-2011. In late 2012, two deaths and ten total confirmed LD cases were reported at the JW Marriott in Chicago, with spa fountains and pools cited as the underlying cause.[13 – 15]

Tracking the Diseases

Physicians are Required to Report Confirmed Cases

Physicians are required by the Centers for Disease Control (CDC) to report confirmed cases of Legionnaires Disease or Pontiac Fever to their local health department. The local report is transmitted to the state health department and then to CDC through the National Notifiable Disease Surveillance System (NNDSS). Confirmation of the disease requires a compatible clinical history (e.g., X-ray diagnosis of pneumonia for Legionnaires Disease) and biological testing. *Legionella* infection can be confirmed by the detection of *Legionella* species in culture, the detection of *Legionella* pneumophila serogroup one antigen in urine, or four-fold or greater rise in *Legionella* pneumophila serogroup one-specific serum antibodies.

The physician is also required to document any travels of the patient in the two weeks prior to the onset of the symptoms. The CDC has a second program specific to *Legionella*, the Supplemental Legionnaires Disease Surveillance System (SLDSS) designed specifically for tracking travel-related illness. Legionellosis cases have annually increased 217% from 2000 through 2009 under the use of NNDSS and SLDSS.[16]

Legionella in the Water

Legionella occurs naturally in the environment, and it can be found in soil, ponds, and lakes. Outdoor reservoirs of water such as fountains and cooling towers can be contaminated naturally with *Legionella* through settling of windborne dusts or mists. *Legionella* is present in some public and private portable water systems as well. If there is no or little (< 0.5 ppm) residual chlorine in the water supply as it enters the building, then the presence of *Legionella* should be presumed.

Legionella can also enter the plumbing system during construction and repairs. Prior to delivery or on the construction site, sections of plumbing can become dirty with soil or runoff. Dirty sections of pipe must be disinfected and flushed prior to bringing them into service to avoid contaminating clean sections of pipe and entire water systems.

Legionella Sources and Growth

Legionella Grow Best in Warm Water

Legionella grow best in warm water. The optimum temperature range for *Legionella* growth is 95°F to 115°F, but *Legionella* can grow between 68°F and 122°F. At lower temperatures, *Legionella* is dormant. At higher temperatures, *Legionella* will die, but only at water temperatures above 140°F will *Legionella* die quickly.

Legionella can grow in cold water systems as well. The water in stagnant or low-flow sections of cold water pipe can attain the temperature of the surroundings, which may exceed 68°F. Poorly insulated parallel runs of cold and hot water pipes can cause cold water temperatures to exceed 68°F.

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Hot water is often stored or delivered at less than 122°F. Delivering water at less than 122°F reduces the risk of scalding and encourages thorough hand washing. However, building codes and food codes may require water delivery temperatures not to exceed 120°F. As such, domestic hot water systems are a major concern for *Legionella* growth.

Infrequent use of fixtures can effectively add “dead legs” to a water system. The water leading to an infrequently used faucet, shower, or spa may sit in a pipe at *Legionella* growth temperature for days or weeks and bacteria growing in the dead leg can be shed into the flowing stream. Infrequent use of plumbing fixtures, like in a hotel luxury suite for example, encourages *Legionella* bacteria to live in biofilms (and even in other microorganisms such as amoebae) where they can obtain nutrients and be protected from disinfectants.

Cooling towers typically have a reservoir of recirculated water at a temperature in the *Legionella* growth range and are significant mist producers. Rooftop workers can be exposed directly to mists, and mists can be entrained into the building air supply if an outdoor air intake is near cooling tower mists. Routine chemical treatment and monitoring is required to control bacterial growth and biofilm development in cooling towers. The scope of routine treatment and monitoring should specifically include *Legionella* control.

Operating and Maintaining Water Systems

Develop a Water Management Plan

Building operators are encouraged to develop a water management plan to address *Legionella* risk management specifically. The *Legionella* plan may be part of a comprehensive water management plan that addresses all risks related to water systems.

Recently, ASHRAE has proposed the new Standard 188P, *Prevention of Legionellosis Associated with Building Water Systems*. The novelty of ASHRAE 188P is the requirement that building managers develop a Hazard Analysis and Critical Control Point (HACCP) plan for water management to prevent Legionnaires Disease and Pontiac Fever. ASHRAE recently completed its third public comment period based on public review of the June 2011 document.[17] The HACCP approach to risk management is already required and practiced in the food industry to prevent food borne illnesses. However, building engineers and facility managers are not likely to be familiar with the HACCP approach.

Whether HACCP or another approach is taken to develop a water management plan for *Legionella*, the first step in the plan development is the identification of qualified individuals to work together to develop the plan. The next step is to survey the current conditions and assess existing potential risks of all water systems, including cold and hot domestic water systems, pools, spas, cooling towers, and water features. Some of the specifics to be employed in the operations and maintenance activities of in-house and retained consultants include:

A. Controls—Domestic Water Systems—Cold Water
   1. Keep water temperatures below 68°F.
      a. Insulate pipes.
   2. Assure residual chlorine (≥ 0.5 ppm) in source water before distribution.
   3. Maintain residual chlorine (≥ 0.1 ppm) at every outlet.
   4. Install *Legionella* filters where needed.
   5. Maintain filters on ice machines and drinking water lines.
   6. Develop specific procedures for safely reactivating out-of-service or infrequently used pipes and fixtures.

B. Controls—Domestic Water Systems—Hot Water
   1. Keep water heater and water storage temperatures above 130°F, preferably above 140°F.
   2. Provide water at distal points at or above 124°F.
      a. Insulate pipes.
      b. Eliminate dead legs.
      c. Flush low-use pipes frequently.
   3. Use mixing valves (to mix hot and cold) to provide water delivery temperatures to prevent scalding and encourage hand washing.
   4. Maintain residual chlorine (≥ 0.1 ppm) at every outlet.
   5. Use point of use heaters to provide hot water at the tap from the cold water supply.
   6. Develop specific procedures for safely reactivating out-of-service or infrequently used pipes and fixtures.

C. Controls—Pools and Spas
1. Maintain pools and spas according to local codes and national/international standards and guidelines. For example, the 2012 International Pool and Spa Code.
2. Document all maintenance and disinfection activities.
3. Require maintenance contractors to provide their written procedures and all documentation of their maintenance activities.
4. Develop specific procedures for safely reactivating out-of-service or infrequently used pools and spas.

D. Controls—Cooling Towers
1. Install cooling towers to minimize direct personal exposure to mists and to prevent entrainment of mists into outdoor air intakes.
2. Maintain cooling towers according to local codes and national/international standards and guidelines. For example: Cooling Technology Institute—Legionellosis Guideline: Best Practices for Control of *Legionella* (WTP-148).[8]
3. Document all maintenance and disinfection activities.
4. Require maintenance contractors to provide their written procedures and all documentation of their maintenance activities.
5. Develop specific procedures for safely reactivating out-of-service cooling towers.

E. Controls—Water Features
1. Maintain water features according to local codes and national/international standards and guidelines.[18]
2. Document all maintenance and disinfection activities.
3. Require maintenance contractors to provide their written procedures and all documentation of their maintenance activities.
4. Develop specific procedures for safely reactivating out-of-service water features.

F. Testing for Efficiency and or Contamination
1. Testing procedures are ultimately the only way to show whether temperature, disinfection, chlorination, or other methods of controlling *Legionella* are actually working.
2. Testing methods are typically integrated in a strategic manner depending on critical control points within the building, and will depend on the speed, cost, and specificity of the questions being asked with respect to exposure or contamination. Laboratories performing the test shall be proficient in the CDC's Elite Program[19] in order to support the validity of the testing regimen.
3. DNA methods have emerged in recent years and may prove extremely useful in evaluating *Legionella* species present, and in shortening the time between sampling and the receipt of laboratory reports, and are specific.

Protection as Building Activities Ramp Up

Protection of Plumbing From Contamination During Construction is Critical

Architects and engineers typically do not consider the prevention of *Legionella* growth in water systems in the design of new buildings or the renovation of existing buildings. Protection of plumbing from contamination during construction is critical. Disinfection and flushing of new plumbing systems by the plumbing contractor may be required by the specification before commissioning, but an independent assessment of the adequacy of the disinfection and flushing has often been lacking. New buildings have been occupied with water systems that harbor *Legionella* and present a risk of exposure from day one.

During the recession, building plans were put on hold, half-completed buildings were surrounded by fences, and some original developers and contractors abandoned projects. The restart of these building and renovation activities as the economy has moved out of recession requires special attention to the possibility of *Legionella* colonization during the idle period.

Documenting Progress

Documentation Has Typically Been Lacking

In our experience, a typical hospitality and leisure facility today will have routine servicing of pools, spas, cooling towers, and water features, often through contracts with outside water treatment companies. Similar servicing is expected on cruise lines. Whether the servicing is provided in-house or through an outside contractor, the documentation of the servicing has typically been lacking, and the adequacy of the treatment has rarely been assessed overall and specifically for *Legionella*. In addition, it is not uncommon to find that the domestic hot and cold water systems within the facility have not been surveyed or assessed for the potential risk of *Legionella* growth or for the adequacy of specific controls that may exist.

Conclusion

Just as a doctor differentially diagnoses and documents individuals with potential illness, indoor air quality professionals can assist building owners in doing the same sort of effort with their assets, and protect human health in the process. While the evolving landscape of *Legionella* management in buildings presents significant risks to owners and operators, there is an opportunity for those with the right knowledge and perspective to protect occupant health, preserve business continuity, and ultimately enhance the guest experience.

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