Legionella & Legionnaires’ Disease – Are You Informed?

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What do you know about Legionnaires’ disease? What do you know about Legionella? Are you at risk to contract Legionellosis? Who is? Where? When? How? Why? What can be done to minimize your risks? Do you need to know any of this?

These are not just questions to draw your attention to this article, but are legitimate questions concerning the awareness you have (or do not have) of your environment and your (potential) at-risk exposure to a real health concern.

Since the initial outbreak in 1976 that led to the discovery and identification of Legionnaires’ disease, much has been discovered about the bacteria (Legionella) that causes the disease and the disease itself. This includes how Legionnaires’ disease is contracted and how to minimize risk of disease contraction, as well as effective medical treatments for Legionnaires’ disease. However, guidelines for “100%” disease prevention and control remain at large, as well as any uniform consensus on the routine testing (monitoring) for Legionella in the water systems that may harbor the bacteria. Existing guidelines and statements, however, do provide substantial direction and information that can be adopted to effectively control and minimize legionellosis. The Association of Water Technologies (AWT) provides such in the recent release of their comprehensive update document on Legionella and Legionnaires disease. It is available from their Web site at www.awt.org as a free download (PDF) file.

Let’s begin here:
Legionnaires’ disease (LD) is a bacterial pneumonia (lung infection). The incubation period of LD is from two to ten days – this is the time it takes before symptoms of the illness appear after being exposed to the bacteria. The patient may feel tired and weak for many days. Most patients admitted to the hospital develop a high fever that is often greater than 39.5°C (103°F). Cough can be the first sign of a lung infection.
Gastrointestinal (stomach) symptoms are common with diarrhea being the most distinctive. Patients often present nausea, vomiting, and other stomach discomfort. Additional common symptoms include headaches, muscle aches, chest pain, and shortness of breath – many very flu-like symptoms.

Legionnaires’ disease is caused by a naturally occurring water bacterium from the family *Legionellaceae*, which (now) includes 48 species and over 70 serogroups. Approximately half of the Legionella species have been implicated in human (Legionellosis) disease. *Legionella pneumophila* alone, however, is responsible for approximately 90% of the infections – with most disease attributed to *Legionella pneumophila*, serogroup 1.

The discovery and identification of *Legionella pneumophila* bacteria followed an outbreak of illness reported to the Pennsylvania health authority that resulted in 34 deaths among 231 afflicted people. The outbreak occurred in 1976 around a Philadelphia hotel that was host to an American Legion Convention – thus, the illness became known as Legionnaires’ disease and the species *pneumophilia* was named for its Greek meaning, *lung-loving*.

**About Legionella:**
Legionella are readily found in natural aquatic bodies such as lakes, streams, rivers and ground waters. Some species have also been recovered from soils. The bacteria survive a wide range of conditions, including temperatures of 0° to 63°C and pHs of 5.0 to 8.5 in water. Legionella can escape water plant chlorination treatment and is thus found in the supplies to domestic (potable) water plumbing and other (commercial, industrial, process, HVAC, etc.) water-use systems. In many of these systems it finds favorable conditions to pose disease risk. Legionella and other microorganisms can readily attach themselves to surfaces in their aquatic environments forming a biofilm. Temperature is a critical determinant for Legionella proliferation. Colonization of hot water tanks is more likely if tank temperatures are between 40° and 50°C (104° to 122°F).

**Disease outbreaks, conditions and transmission:**
Outbreaks and/or incidences of Legionnaires’ disease are generally identified as nosocomial (hospital-acquired) or those occurring within the community at large (community-acquired). Major outbreaks (that require investigation and have larger numbers of cases) or high-profile incidences (as the Ford Motor Company) capture the headlines, yet a vast number of LD cases (and deaths) go undetected or unreported, as individual cases, and do not make the news.
Outbreaks of legionellosis are often blamed on the air conditioning (cooling tower) systems of large buildings and commercial or industrial complexes. However, it is just as well established that another common habitat for the disease-producing bacteria is within the hot water and potable plumbing systems of these same facility buildings. New research shows residential hot water pipes can also be a source of the bacteria (and disease). A recent EPA-sponsored study conducted environmental Legionella sampling on the residential (home) water systems of twenty-one Legionnaires’ disease (case) patients and linked five of the water systems to the disease bacteria. Other sources include mist machines, humidifiers, whirlpool spas, and hot springs.

Several conditions and factors must occur for Legionella to cause disease – there is a need for sufficient quantity and/or virulent form of the bacteria made transmittable to a susceptible host. Transmission occurs when a host inhales tiny water droplets (mists or aerosols) containing Legionella or aspirates such laden sources of water during the drinking (swallowing) process. This provides entry of the infectious Legionella into the deeper parts of the lungs where they take over and promote the pneumonia.

Legionella grow well and amplify in warm water environments and systems that provide favorable conditions for bacterial growth and the formation of biofilm. The optimum temperature range for growth is 90 to 105 degrees Fahrenheit. The subsequent use or release of water from such systems harboring Legionella, i.e., through faucets, shower sprays, humidifying, aerosolizing (misting) devices or other operational spray or drift mechanisms of the system, may transmit the potential disease-causing bacteria to susceptible hosts.

When Legionella enter the mouth or nasal passage, the organism is normally prevented from going into the lung by cilia on the cells of the respiratory tract. Cilia are hair-like structures which sweep back and forth and keep the respiratory tract clear of particles including bacteria. In patients who smoke cigarettes or in ill patients, this process is impaired and it is easier for bacteria to bypass the gag reflex and the ciliary process and fall into the respiratory tract (aspiration). Legionella can also stick or adhere onto the cells of the respiratory tract, and then enter and multiply within cells of the respiratory tract.

Once the Legionella enters into the lung, defensive white blood cells (macrophages) will migrate to the Legionella in an attempt to engulf (phagocytose) and kill them. The alveolar macrophages engulf the Legionella, but Legionella are adapted to live and multiply within the macrophage, instead of being digested (killed). The bacteria multiply and grow until the macrophage (cell) ruptures. This releases the Legionella (now in greater numbers) back into the lung only to be engulfed by other cells, and the cycle of phagocytoses, multiplication, rupture and release repeats. Other white blood cells are recruited from the blood. However, the Legionella escape their killing defenses by
hiding in the respiratory tract cells or alveolar macrophages – that is why *Legionella* is called an intracellular pathogen.

The intracellular location of *Legionella* is also important in therapy. Many antibiotics effective against pneumonia are ineffective against *Legionella* because they do not penetrate the respiratory tract cells or alveolar macrophages (where the *Legionella* hide). The newer antibiotics belonging to the macrolides, such as azithromycin, or to the quinolones, such as ciprofloxacin, levofloxacin, gemifloxacin and moxifloxacin, do penetrate cells and can then effectively kill *Legionella*. Thus, it is very important to diagnose and confirm Legionnaires’ disease as soon as possible to implement the appropriate (effective) medical treatment.

**Disease susceptibility:**
Fortunately, less than 5 to 6 percent of the general population is considered to be susceptible hosts or at greatest risk to contract Legionnaires’ disease upon exposure to the bacteria. People considered at high risk include the elderly, the very young and those with underlying health problems such as chronic obstructive pulmonary disease (COPD), diabetes, congestive heart failure and sickle cell anemia. Patients taking corticosteroids or other immunosuppressant drugs, undergoing cancer therapy or organ transplantation, or those that have conditions or diseases which impair the immune system (such as AIDS), asthma or other chronic illnesses are particularly vulnerable.

Legionnaires’ disease is not contagious – it is not transmitted by infected persons. Thus, it differs from SARS and influenza or other communicable diseases where masks must be worn and special precautions must be taken.

**Hospital-Acquired Legionnaires’ disease:**
The nosocomial (hospital acquired) cases of Legionnaires’ disease are of increasing concern within the healthcare community. Potable hot water plumbing systems present a favorable habitat for *Legionella* and pose an associated disease risk to the large "at risk" population within a healthcare facility. Thus, there is a major emphasis on the risk assessment, control and management of these systems and their associated water disseminating equipment or systems to prevent disease.

Accordingly, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) issued a new standard that became effective January 1, 2001. The standard (EC1.7) requires each JCAHO accredited facility to have in place a management program to "reduce the potential for organizational-acquired illness." It holds the healthcare facility responsible for "managing pathogenic biological agents in cooling towers, domestic hot water, and other aerosolizing water systems" – i.e., *Legionella* among others.
It is estimated that Legionella is responsible for 15,000 to 30,000 of the 600,000 pneumonia cases in the U.S. each year requiring hospitalization. Specialized laboratory tests are necessary to confirm Legionnaires’ disease and unfortunately, may not be available in many hospitals. Therefore, the disease remains largely undiagnosed or diagnosed without confirmation and subsequently goes unreported. Legionella is and should be considered an environmental (pollution) health issue and you should be as aware of it as you can.

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