Editorials

Balancing the risks: *Legionella pneumophila* pneumonia and tap water scalds in the home

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The disease produced by *Legionella pneumophila*, a ubiquitous water-related organism, was first recognized in people exposed to air produced by contaminated temperature regulating devices in buildings: cooling towers, commercial air conditioning systems and evaporative condensers.[1,2] Subsequently, in the United States and the United Kingdom the organism was found to be responsible for illness in hospitalized immunocompromised patients, and the source of the outbreaks was traced to the institutions' water supply systems.[1,2]

As with other diseases, the probability of becoming ill is a function of the host's susceptibility, the virulence of the strain and the dose of the inoculum.[1] Control measures have focused on the factor most amenable to modification — the inoculum.[1] The most probable source of infection is contaminated aerosolized water particles 5 μm or less in diameter.[3] This droplet size is readily generated not only by temperature regulators in buildings, as in the original outbreaks, but also by shower heads, tap water outlets and whirlpools.[1] As well, water with a temperature above 35°C is more likely to contain *L. pneumophila*,[4] and multiplication is enhanced when the temperature is between 55°C and 60°C.[5] However, temperatures above 60°C reduce the numbers of bacteria.[1]

Stout and colleagues[6] proposed that rather than regarding *L. pneumophila* as a "contaminant" we acknowledge its ecologic niche in the environment. This concept is supported by the frequency with which the organism can be found in institutional water supply systems.[7] Consequently, control measures can likely only curtail the organism's propagation, not eradicate it.[8]

For hospitals and other health care facilities, it has been suggested that the hot water temperature should be maintained above 60°C and that the plumbing systems should be flushed at even higher temperatures every 2 months.[8] Stagnant areas in plumbing fixtures will, however, still allow for multiplication of the organism.[1] When these areas are flushed they release a substantial amount of inoculum, as evidenced by the significantly higher disease rates in first users of hotel showers compared with subsequent users in Benidorm, Spain.[9] In addition, this approach is not without significant risk, since precautions must be taken to avoid hot tap water scalds on geriatric, pediatric and psychiatric wards.[1] Increased chlorination of institutional water is an alternative approach that has been successful in some outbreaks[1] but not in others.[8] The potential risk of long-term effects of chlorination has recently been raised.[10]

As observed with institutional plumbing systems,[1] water temperatures above 60°C are correlated with fewer residential isolations of *L. pneumophila*.[11] Moreover, the design of some home hot water tanks may foster propagation of the organism.[12] But should the temperature setting of domestic hot water tanks be raised above 60°C in an attempt to reduce a potential health risk?

Seroepidemiologic studies have shown that a substantial proportion of the general population have antibodies to *L. pneumophila*, which suggests frequent adult contact with the organism, in both industrial and recreational settings.[13] In addition, although a 2-year prospective study of childhood pneumonia did not identify *L. pneumophila* as a causal agent, a fourfold or greater rise in the titre of

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antibody to the organism was noted in 52% of the subjects during routine annual serologic testing.[14] The authors suggested that *L. pneumophila* infections are clinically inapparent in the first years of life and that *L. pneumophila* is not a common cause of lower respiratory tract illness in early childhood. Other surveys have established that the organism is quite common in domestic hot water supplies and that its presence has not resulted in disease or been associated with elevated antibody levels.[11,15] Finally, serious doubts have been raised that showering is a significant mode of transmission of *L. pneumophila*.[16]

Some investigators, however, have reported cases of community-acquired *L. pneumophila* pneumonia, primarily in adults with underlying predisposing factors such as smoking, chronic respiratory disease and cardiovascular problems.[7,17]

A general recommendation to the public to raise the temperature setting of domestic hot water tanks may be not only a waste of energy but also dangerous. Water at a temperature of 60°C can cause a full-thickness third-degree burn in 6 seconds or less.[18] Hot water tank thermostats in Canada are currently preset at this temperature at the factory, and this regulatory standard is associated with hundreds of serious hot tap water scalds among Canadian children every year.[19] American data suggest that hot tap water also poses a significant threat to the disabled[20] and the elderly.[21,22]

Given the wide distribution of *L. pneumophila* in the environment[11,15] and its apparently insignificant effects on healthy children[14] and adults,[11] there is little justification for setting home hot water tank thermostats any higher than 54°C. This energy-saving temperature not only provides adequate quantities of hot water for the average household but also allows a 30-second safety margin before serious scalds occur.[19]

For immunosuppressed people[23] and those with significant predisposing factors such as chronic respiratory disease, residential hot water tank thermostats could be maintained at 60°C or higher to reduce the amount of inoculum,[11] since chlorination is not an alternative in domestic settings. Because of the increased risk of scalds in these selected households, mixing valves or other temperature regulating devices could be attached to plumbing fixtures that supply hot water for washing and bathing.[24] These devices could also be used on designated "high-risk" hospital wards[1] to prevent burns.

These recommendations are based on current knowledge of the differing risks associated with *L. pneumophila* pneumonia and tap water scalds. Institutions will have to select the most appropriate method or combination of methods to safely minimize the amount of inoculum. Raising the temperature setting of residential hot water tanks may currently be appropriate for only a very select group of people. For the general public, reducing the temperature to 54°C or less is still a sound suggestion from the perspective of both safety and energy conservation.[19]

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