

## Residential water heater temperature: 49 or 60 degrees Celsius?

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There are two opposing risks when it comes to water temperature inside domestic water heaters; exposure to *Legionella*, the bacteria responsible for Legionnaires' disease (pulmonary legionellosis), and the risk of scalding. In 1986, this dilemma was the subject of an editorial in the *Canadian Medical Association Journal* (1). A few months ago, Safe Kids Canada launched a media campaign aimed at preventing scalding by lowering domestic hot water temperature to 49°C at the tap (2). Among the means considered to reach this objective, Safe Kids Canada, with the support of some public health organizations, suggests and seems to favour lowering the temperature setting of domestic hot water heaters to 49°C.

Like other authors (3,4), including the World Health Organization (WHO) who published a recent monograph on the *Legionella* problem in drinking water (3), we believe that there is evidence for the transmission of legionellosis through the drinking water distribution systems in private homes. This is a serious illness associated with high death rates (up to 12%). Primary groups at risk (the elderly, smokers, the immunocompromised and patients suffering from chronic respiratory illnesses), are groups who include a large proportion of the population at home. Although we support prevention against tap water scalds, we are against setting water heater thermostats at 49°C because we believe this could facilitate proliferation of *Legionella* inside the tank and increase the risk of legionellosis.

Domestic water heaters, particularly electric devices, can certainly be contaminated by *Legionella*. In Quebec, a study of 211 homes (178 electric water heaters, 33 oil or gas water heaters) found *Legionella* contamination in 40% of electric water heaters. No water heaters using fossil fuels were contaminated (5). The authors concluded that, because of design variables, use of an electric water heater was the most significant factor leading to *Legionella* contamination in hot water (5) in the home.

The clinical and epidemiological significance of this finding is much debated. However, in a case-control study of sporadic cases of community-acquired legionellosis, Straus et al (6) concluded that the residential drinking water supply was responsible for a substantial proportion of sporadic cases of Legionnaires' disease. These findings are supported by Stout et al (7) in a study of 20 Pittsburgh patients with culture-confirmed Legionnaires' disease. A link with residential drinking water contamination was established for eight (40%)

patients. This included three private homes (one single dwelling, two multidwellings), two senior-citizen homes, two out-patient hospital clinics, and one industrial plant. The authors concluded that drinking water distribution systems were a significant source of transmission of Legionnaires' disease (7).

The importance of Legionnaire's disease is underestimated because it is difficult to diagnose and because it is reported through a passive surveillance system. In an active surveillance study of pneumonia requiring hospitalization in Ohio, the incidence of Legionnaire's pneumonia was estimated to be approximately seven cases per 100,000 people (8). With the observations from the Stout et al (7) study, if active surveillance was performed, an estimated two cases of Legionnaire's disease per 100,000 people per year could be attributable to potable water in private homes and senior-citizen residences. This is at least of the same order of magnitude as the annual rates of 0.45 per 100,000 for hospitalization and 0.043 for death due to scalding by tap water in Quebec (9).

The optimal temperature for *Legionella* proliferation in water varies between 32°C and 35°C, but it can easily proliferate at temperatures of up to 45°C. Usually, there is no growth above 55°C, and a temperature of over 60°C has a bactericidal effect. Thus, the WHO recommends that water be heated and stored at 60°C (3). However, studies in Quebec have shown, even when the thermostat is set at 60°C, a high percentage (approximately 40%) of electric water heaters remain contaminated because of the lower temperature, about 30°C to 40°C at the bottom of the tank. The probability of contamination will increase considerably if the temperature setting is lowered to 49°C. The risk of contamination is much lower for water heaters operating with fossil fuels, and is practically nonexistent for these heaters set at 60°C.

In our opinion, it is important to reduce both the risk of scalds and the risk of legionellosis associated with domestic water supplies (9). For water heaters servicing a single housing unit, electric water heater manufacturers need to market, as quickly as possible, water heaters resistant to proliferation of *Legionella*. At the least, all new water heaters must be preset at 60°C and equipped with antiscald devices to deliver water at 49°C to the entire household. Electric water heaters already installed should be set at 60°C to limit the risk of *Legionella* contamination. Gas or oil water heaters already installed

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should be set at 49°C, because the risk of scalding is greater with these devices. In fact, when there are repeated demands for hot water, gas or oil water heaters are likely to deliver water that is much hotter than the preset temperature, with a greater risk of scalding in some situations (10). Water heaters servicing multiple unit housing complexes equipped with more complex water distribution systems are more likely to be contaminated, and the recommendations from the WHO should apply no matter what type of water heater is used (3). These

recommendations state hot water must be stored at 60°C inside the water heater by ensuring, at least once a day, the temperature reaches at least 60°C in the entire tank. Moreover, water should reach the tap at a temperature of at least 50°C. Taps in these buildings, especially in the bath or shower where most scalds occur, should be equipped with antiscald devices to decrease the water temperature to 49°C or less. Such a strategy would minimize the risk of scalding and the risk of legionellosis for the population.

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