

Prevention of scalding and legionellosis associated with hot tap water in private homes*

Michel Lavoie, M.D., M. Sc., FRCPC
Benoît Lévesque, M.D., M. Sc., FRCPC
Diane Sergerie, M. Sc.

SUMMARY WITH RECOMMENDATIONS



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PREAMBLE

This notice responds to a request from the *ministère de la Santé et des Services sociaux* (department of health) of Québec. It is the result of the concerted efforts of two teams within the *Institut national de santé publique du Québec* (national institute of public health): the “Biohazard, environmental and occupational risks” team wrote the “legionellosis” section, and the “Safety and injury prevention” team wrote the “scalding” section.

* This summary with recommendations comes from the report “*Prévention des cas de brûlures et de légionelloses associés à l’eau chaude du robinet dans les résidences privées*”. It is available in French on the Institut national de santé publique du Québec Web site: www.inspq.qc.ca.

SUMMARY

The Institute was mandated to assess risks of scalding and legionellosis associated with hot tap water in private homes in Québec and to propose measures to reduce these two risks.

Based on an analysis of the scientific literature and the data available in Québec, the Institute believes that preventing tap water scalds is as important as preventing legionellosis. These problems have similar consequences from a public health perspective and in both cases there are well-known, effective or promising prevention measures.

Two recent Institute studies estimate that tap water scalds result in approximately 33 hospitalizations and 3 deaths per year in Québec, which corresponds to an annual rate of 4.5 hospitalizations and 0.43 deaths per million inhabitants. The risk of tap water scalds is greater among children under 5, people over 60 and people with a physical or mental deficiency. In Québec, tap water scalds serious enough to result in hospitalization or death occur for the large part in the victim's home, more specifically in the bathtub.

Scientific literature indicates that water contamination from *Legionella* in private homes is a cause of legionellosis. Unfortunately, available data does not allow us to determine how many legionellosis cases are caused by this contamination. Based on a critical analysis of the relevant literature, the Institute considers this problem at least as important as tap water scalds in terms of public health. The literature also indicates that the risk of legionellosis is greater among

the elderly than among other age groups. Other risk factors associated with legionellosis include smoking, the presence of chronic lung disease, diabetes, and any medical condition associated with immune deficiencies. These risk factors are absent, however, in a not-insignificant proportion of legionellosis cases acquired in the community.

Preventively, the Institute believes the best strategy to decrease the risk of tap water scalds in private homes is to lower tap water temperature to 49°C or less. To reduce the risk of legionellosis, the Institute recommends limiting the public's exposure to *Legionella* via tap water. The Institute proposes these objectives be reached through a series of measures tailored to the type of water heater and the number of housing units that use it. Three situations were analyzed.

Electric water heater serving a single housing unit

In Québec, approximately 30% of electric water heaters are contaminated by *Legionella*, even when the thermostat is set at 60°C. Electric water heaters are more likely to be contaminated than gas or oil water heaters because of their design: water temperature in the lower part of the tank cannot be raised high enough to stop *Legionella* proliferation. This situation is disturbing, considering that over 90% of private homes in Québec use electric water heaters. The Institute recommends that the proper authorities require electric water heater manufacturers to find technological solutions that prevent *Legionella* from multiplying in these water heaters as quickly

as possible. As these modified water heaters have not yet arrived on the market, the Institute recommends setting the thermostat to 60°C on currently available electric water heaters. Setting these water heaters lower could raise the risk of legionellosis by increasing the contamination level of previously contaminated water heaters or increasing the number of contaminated water heaters. To reduce the risk of scalding, the Institute recommends installing an effective anti-scald device on the water heater outlet to lower the water temperature to 49°C. The Institute recommends these devices be installed on new water heaters upon manufacture. The application of this measure would be based on the fact that approximately half of all water heaters are replaced within a period of 5 years. Theoretically, installing an anti-scald device on an electric water heater outlet could increase the risk of *Legionella* tap contamination if, subsequently, water inside water heaters became contaminated. The Institute believes that the risk is rather low in single-family private homes, however, because the water distribution system is generally not complex. On the other hand, installing these devices on new water heaters upon manufacture would, within a few years, eliminate the risk of scalding for the majority of people receiving their hot water from this type of water heater, compared to only a minority of people if the anti-scald devices were installed near taps. In the latter case, only people living in a new house or in a home that has undergone major plumbing renovation would be protected from scalding.

☞ *Gas or oil water heater serving a single housing unit*

The risk of *Legionella* contamination in these water heaters is lower than in electric water heaters. The Institute believes the risk for contamination is low if the thermostat is set at 49°C, and probably non-existent when set at 60°C. The scientific literature does not allow us to determine at exactly what level the thermostat of these water heaters must be set to prevent the proliferation of *Legionella*. According to industry specialists, it seems that the water temperature inside gas or oil water heaters increases by several degrees above the thermostat setting due to repeated demands for hot water. Due to this “thermal runaway” phenomenon, the risk of scalding remains even if the thermostat is set at 49°C, necessitating an anti-scald device. Based on this information, to prevent both legionellosis and scalding, the Institute recommends setting gas or oil water heater thermostats to 60°C while equipping them with effective anti-scald devices. Although it may not be necessary to set water heater thermostats to 60°C to prevent *Legionella* proliferation inside the tank, a study would have to be carried out to determine the appropriate temperature level. This type of study would probably indicate the necessity of setting the thermostat to a level above 49°C. Even if such a study determined the appropriate level to be 49°C, an anti-scald device would still be needed to counter the overheating associated with thermal runaway. The Institute believes setting thermostats to 60°C and installing efficient anti-scald devices must be considered as joint measures. To promote the application of these

two measures, the Institute recommends making them mandatory for all new water heaters being manufactured. Water heaters previously installed in housing units that are not equipped with efficient anti-scald devices must nevertheless be set at 49°C to prevent scalding.

↪ *Gas, oil or electric water heaters serving a multi-unit housing complex*

In this type of building, the water heater must meet significant hot water needs. For this reason it is difficult to lower the water temperature to 49°C in the tank or at the water heater outlet. To reduce the risk of legionellosis in this type of building, where the distribution system is often complex, the Institute adopted the recommendations published in the World Health Organization's (WHO) monograph on legionellosis. The monograph recommends storing water at 60°C or higher, with the water temperature reaching at least 60°C no less than once a day in the entire tank, including the lower part. It is also recommended that the water be distributed to the taps at temperatures of at least 50°C. Scalding must be prevented by the installation of devices near the taps to lower the water temperature to 49°C or less. If this cannot be done, an efficient anti-scald device must be installed at the bathtub and shower taps, at the very least. Another alternative would be to install a single anti-scald device for the water inlet of each housing unit. This measure must first prove to be practical, economical and feasible and not increase the risk of

Legionella contamination through the distribution system inside the housing units.

This analysis and the recommendations that follow will be presented to the *ministère de la Santé et des Services sociaux* (department of health) of Québec, the *Régie du bâtiment* (housing board) of Québec, the organization in charge of building regulations, plumbing and fire prevention in the province of Québec, as well as to the Canadian Commission on Building and Fire Codes, the organization in charge of the reforms underway in Canada regarding the National Building, Plumbing and Fire Codes of Canada.

SUMMARY OF RECOMMENDATIONS

The Institute based its recommendations on the five following principles:

1. Reduce both the risk of scalding and legionellosis;
2. Use actions based on product safety instead of behavioural changes;
3. Promote inexpensive and easily applicable measures for the entire population (e.g. to prevent scalding, when possible, promote the installation of an anti-scald device at the water heater outlet instead of near each tap);
4. Use interventions that target the entire population (people at risk for scalding or legionellosis represent a significant percentage of the population, and a considerable proportion of victims present no risk factors);
5. Take into account types of water heaters and number of housing units served by each water heater (an electric water heater serving a single housing unit; a gas or oil water heater serving a single housing unit and electric, gas or oil water heaters serving several housing units).

The first two recommendations set objectives to prevent both legionellosis and scalding. They must be considered as joint recommendations.

No. 1 To decrease the risk of tap water scalds in private homes, the Institute recommends lowering

the water temperature to 49°C or less at all tap outlets.

No. 2 To reduce the risk of legionellosis in private homes, the Institute recommends decreasing the public's exposure to *Legionella* via tap water.

The following recommendations focus on measures to reach these two objectives. In order to do this, the Institute believes it is useful to take into account three specific situations.

Situation 1

Electric water heater serving a single housing unit

No. 3 The Institute recommends that the proper authorities make it mandatory for electric water heater manufacturers to make available water heaters that prevent the proliferation of *Legionella*, as soon as possible.

When such water heaters are available, the Institute recommends more appropriate measures to prevent scalding, taking into account modifications made so that water distributed to taps is at a maximum temperature of 49°C.

While waiting for electric water heaters that prevent the proliferation of *Legionella* to arrive on the market:

No. 4 The Institute recommends setting thermostats to 60°C on current electric water heaters.

Setting these water heaters at lower temperatures could increase the risk of legionellosis by increasing either the contamination level of previously contaminated water heaters or by increasing the number of contaminated water heaters.

No. 5 To reduce the risk of scalding, the Institute recommends installing an effective anti-scald device at the outlet of current water heaters to lower the water temperature to 49°C. The Institute recommends having these devices installed on new water heaters upon manufacture. This practice would protect the majority of people receiving their hot water from this type of water heater within a few years, compared to protecting only a minority of people with anti-scald devices placed at the taps.

The Institute considers recommendations No. 4 and No. 5 as joint recommendations.

Situation 2

Gas or oil water heater serving a single housing unit

No. 6 To reduce the risk of legionellosis, the Institute recommends setting the thermostat on this type of water heater to 60°C. It may not be necessary to set the thermostat to 60°C to prevent the proliferation of *Legionella* inside the tank, but proper studies are needed to determine the appropriate setting.

No. 7 To reduce scalding risk, the Institute recommends installing an effective anti-scald device at the outlet of these water heaters to lower the water tem-

perature to 49°C. These devices are especially necessary to counter overheating associated with thermal runaway. The Institute recommends installing anti-scald devices on new water heaters at the plant. This practice would protect a majority of people receiving their hot water from this type of water heater after a few years, compared to protecting a minority of people if anti-scald devices are placed at the taps.


The institute considers recommendations No. 6 and No. 7 as joint recommendations. Gas or oil water heaters previously installed in housing units not equipped with effective anti-scald devices should be set at 49°C to avoid increasing the risk of scalding.

Situation 3

Electric, gas or oil water heaters serving several housing units

No. 8 To reduce the risk of legionellosis, the Institute recommends hot water be stored at 60°C or higher in the water heater and that the water temperature reach at least 60°C no less than once a day in the entire tank, including the lower part. The Institute also recommends not installing the anti-scald device at the water heater outlet in order for the water to reach at least 50°C at the tap.

No. 9 To reduce the risk of scalding, the Institute recommends installing an anti-scald device near each tap in order to lower the water temperature to 49°C or less, and making bathtub and shower taps a priority. An alternative could consist of installing an anti-scald device at the water inlet of each housing



unit, if it is deemed more practical, economical and feasible than installing one near each tap. One must first make sure that this measure does not raise the risk of *Legionella* contamination in the distribution system inside each housing unit.

The Institute considers recommendations No. 8 and No. 9 as joint recommendations.

**PREVENTION OF SCALDING AND LEGIONELLOSIS
ASSOCIATED WITH HOT TAP WATER IN PRIVATE HOMES**

Authors:

Michel Lavoie, M.D., M. Sc., FRCPC

Benoît Lévesque, M.D., M. Sc., FRCPC

Diane Sergerie, M. Sc.

In collaboration with

Pierre Maurice, M.D., M.B.A., FRCPC

Marc Dionne, M.D., M.P.H., CSPQ

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