Prevention of Listeriosis:
Considerations for Development of Public Health Messages

Prepared by the Listeria Working Group for the Council of Chief Medical Officers of Health
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# Prevention of Listeriosis:
Considerations for Development of Public Health Messages

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</tbody>
</table>
Purpose of Report

The summer of 2008 Canadian listeriosis outbreak and associated deaths, which were linked to deli-meats, raised concerns regarding food safety, the importance of the federal/provincial/territorial (FPT) partnership in reducing risks related to foodborne illnesses, and the need to develop public health messages regarding listeriosis prevention.

Recommendations of the *Report of the Independent Investigator into the 2008 Listeriosis Outbreak* relevant to this report are:

Chapter 5 – To protect vulnerable populations

“21. Organizations providing housing and/or food services to seniors and other vulnerable groups, including long-term care homes and hospitals, should be encouraged to adopt food safety practices aimed at vulnerable populations, including those most vulnerable to listeriosis.”

Chapter 8 – To increase consumer awareness

“42. To protect vulnerable populations, including the immunocompromised, older people and pregnant women, Health Canada should promote consumer education into the risks associated with *Listeria*. This could include targeted measures, such as precautionary labelling. This should be accomplished in collaboration with the Public Health Agency of Canada and in conjunction with provincial and territorial health partners.”

To assist in listeriosis prevention efforts the Council of Chief Medical Officers of Health (CCMOH) convened a working group on listeriosis (CLWG) to: i) identify priorities and gaps in public health messages on listeriosis; and ii) articulate clear and easily understood information on the causes and prevention of listeriosis that can be used to develop public health messages for the general population, vulnerable groups, and facilities that provide food services to vulnerable populations (see Annex 1 for the CLWG terms of reference).

As part of the development of this report a peer review was included. Along with providing editorial comments and materials for this document, the peer group also provided a number of suggestions that, while outside the scope of the report itself, provide suggestions for the development of public messages (see Annex 2 – also contains comments about messages regarding cheeses and smoked fish, and lists some public message websites).

This report to CCMOH offers basic information on foodborne listeriosis, and provides common sense prevention advice that may be used to develop communication vehicles for dissemination of key messages to the general public, vulnerable populations, and food services that serve food to vulnerable populations.
Background

Listeria

Listeria monocytogenes (commonly called Listeria) is a type of bacterium that is widespread in environment and can be found in the intestines of domestic and wild animals, soil, silage, as well as food\(^2\). Animals and humans can carry the bacterium without any symptoms. Plants and vegetables can become contaminated with *L. monocytogenes* from the soil and water. It can cause a rare but serious illness called listeriosis, more frequently among pregnant women or individuals with weakened immune systems. The risk of listeriosis also increases with increasing age\(^2\). In serious cases, it can lead to brain infection and even death\(^2\).

Pathophysiology

*Listeria monocytogenes* enters the host through the intestine. It is able to survive in macrophages and to invade nonphagocytic cells, such as epithelial cells, hepatocytes and endothelial cells. It spreads from cell-to-cell, sheltered from the humoral arm of the immune system. *Listeria monocytogenes* is transported to the liver where it multiplies until the infection is controlled by a T-cell mediated immune response\(^1\).\(^2\).

In immunocompetent individuals it is thought that the continual exposure to *L. monocytogenes* antigens ingested through contaminated food contributes to the maintenance of anti-*L. monocytogenes* memory T-cells and rapid clearing of the organism. In individuals with cell-mediated immunocompromising conditions (such as cancer, pregnancy and older age), *L. monocytogenes* multiplies in the liver and eventually invades the bloodstream, the brain and the gravid uterus, leading to clinical disease \(^1\).\(^2\). *Listeria monocytogenes* can cross the placenta and infect the fetus, which can precipitate spontaneous abortion or fetal death.

Epidemiology

Canada began a laboratory surveillance program for *L. monocytogenes* in 1987, with reporting from only four of ten provinces\(^2\). However, the incidence of listeriosis in Canada from 1987 – 1994 was estimated using data from Ontario alone. During this period, the annual number of cases was estimated to range from 44 to 109 nationally (1.7 to 4.5 cases per million). Subsequently, the national Listeriosis Reference Service (LRS) was instituted in 2001 to provide enhanced laboratory surveillance and to implement molecular subtyping in conjunction with PulseNet Canada\(^4\). From 2003 to 2007, there have been relatively few confirmed cases of listeriosis reported in Canada, i.e., 85, 96, 105, 128 and 140, respectively \(^5\).

Listeriosis is a disease that is particularly serious in some population subgroups. The vulnerable groups include persons of all ages who are immunocompromised or have other medical conditions that increase their vulnerability, including transplant patients, patients with
leukemia or chronic renal failure (on dialysis), the malnourished, and pregnant women. The risk of listeriosis also increases in adulthood with increasing age.\(^2\) Immunocompromised children and newborn babies also have an increased risk of listeriosis. Healthy children do not have an increased risk of listeriosis.

Figure 1 lists the relative risk of listeriosis for the specified groups, starting with the normal, healthy population at a relative risk of one (i.e., no increased risk). Transplant patients are at the highest relative risk, being approximately 2,600 times more likely to contract listeriosis than the normal, healthy population.

**Figure 1.** Relative Risks of Listeriosis for Some Risk Groups (adapted from reference 6)

<table>
<thead>
<tr>
<th>Most Compromised</th>
<th>Higher Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transplant patients</td>
<td>2584X</td>
</tr>
<tr>
<td>Leukemia patients</td>
<td>1364X</td>
</tr>
<tr>
<td>Undertreated AIDS patients</td>
<td>865X</td>
</tr>
<tr>
<td>Pregnant women/perinatal newborns</td>
<td>14X</td>
</tr>
<tr>
<td>People over 65 years old</td>
<td>&lt;10X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Least Compromised</th>
<th>Lower Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Healthy Population</td>
<td>1X</td>
</tr>
</tbody>
</table>
Figure 2 shows the rates of human listeriosis in Canada per million population, separated out by various age groupings. The U-type shaped curve and bar graphs show that the most susceptible populations are at the extremes of the age groupings, with a progressively increasing risk with age, particularly after age 60. For example, when compared to healthy individuals 40-59 years of age, these Canadian data show that the persons aged 65-69 years of age have a 4X increased risk, while those aged 75-79 years of age have a nearly 9X increased risk. Increasing age as a risk may be somewhat confounded by increased frequency of people with chronic medical conditions in older age groups that put them at increased risk listeriosis. The absolute risk due to age alone has not been differentiated in these data.

Figure 2.
In comparison to other foodborne or diarrheal infections, people are much less likely to contract listeriosis. Table 1 compares the rates of listeriosis with that of other diarrheal illnesses in Canada, and shows the increasing risk of listeriosis as people age. Table 2 shows the absolute risk of hospitalization for Listeria compared to other foodborne/diarrheal diseases, with listeriosis being much lower than Salmonella and verocytotoxigenic Escherichia coli (E. coli VTEC), and somewhat lower than Shigella.

Table 1: Rates of Selected Diseases in Canada

Rate of reported cases by age-group (per 100,000), 1995-2004 combined, National Notifiable Disease Reporting System

<table>
<thead>
<tr>
<th>Disease</th>
<th>Age Group</th>
<th>0-1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-19</th>
<th>20-24</th>
<th>25-29</th>
<th>30-39</th>
<th>40-59</th>
<th>60+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td></td>
<td>24.85</td>
<td>33.05</td>
<td>16.89</td>
<td>25.34</td>
<td>24.23</td>
<td>25.34</td>
<td>24.23</td>
<td>17.26</td>
<td>16.63</td>
<td>15.05</td>
</tr>
<tr>
<td>Salmonella</td>
<td></td>
<td>89.84</td>
<td>59.58</td>
<td>27.68</td>
<td>15.78</td>
<td>15.36</td>
<td>21.42</td>
<td>20.51</td>
<td>15.3</td>
<td>13.67</td>
<td>15.59</td>
</tr>
<tr>
<td>Shigella</td>
<td></td>
<td>4.93</td>
<td>12.05</td>
<td>5.72</td>
<td>2.41</td>
<td>2.37</td>
<td>4.29</td>
<td>5.3</td>
<td>4.35</td>
<td>2.92</td>
<td>1.54</td>
</tr>
<tr>
<td>E.coli VTEC</td>
<td></td>
<td>3.78</td>
<td>9.04</td>
<td>4.49</td>
<td>3.21</td>
<td>3.35</td>
<td>2.32</td>
<td>1.57</td>
<td>1.32</td>
<td>1.61</td>
<td>2.38</td>
</tr>
<tr>
<td>Listeria</td>
<td></td>
<td>1.08</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.03</td>
<td>0.06</td>
<td>0.10</td>
<td>0.12</td>
<td>0.19</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Note to Table 1: Data in the National Notifiable Disease Reporting System (NNDRS) database includes data that are collected on a mandatory basis by the local public health units/authorities. These data were reported through the provincial/territorial Ministries of Health to the Infectious Disease and Emergency Preparedness Branch of the Public Health Agency of Canada (PHAC) for inclusion in the NNDRS. Aggregate-level data are available from all provinces and territories in Canada. Information was aggregated by disease (e.g., salmonellosis), age group, sex, year and month, and no case level information was included. Age groups used in this analysis are specified by NNDRS and cannot be broken down further. Provincial/territorial counts reflected the introduction of Nunavut in April of 1999. All data were verified at the provincial/territorial level.

The data for Listeria was obtained from the NNDRS for the period 1995 to 1999. For the period 2000 to 2004, when listeriosis was not nationally notifiable, these data were obtained directly from the provinces and territories. Since listeriosis was not reportable in Quebec until 2004, Quebec provided case data for this year only. The same surveillance case definition was used nationally and by all provinces and territories throughout the time period.

Population estimates were obtained from Statistics Canada. For Listeria rates, the population of Quebec was excluded from denominators from 1995 to 2003.
Table 2: Reported rates of hospitalizations (per 100,000), 1995-2004, CIHI

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>3.82</td>
<td>3.29</td>
<td>2.64</td>
<td>2.95</td>
<td>2.43</td>
<td>2.68</td>
<td>2.78</td>
<td>2.84</td>
<td>2.35</td>
<td>2.28</td>
</tr>
<tr>
<td>E.coli VTEC</td>
<td>1.66</td>
<td>1.07</td>
<td>0.89</td>
<td>1.09</td>
<td>1.20</td>
<td>1.98</td>
<td>1.43</td>
<td>1.22</td>
<td>0.74</td>
<td>1.00</td>
</tr>
<tr>
<td>Shigella</td>
<td>0.74</td>
<td>0.40</td>
<td>0.32</td>
<td>0.72</td>
<td>0.35</td>
<td>0.33</td>
<td>0.30</td>
<td>0.25</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>Listeria</td>
<td>0.24</td>
<td>0.16</td>
<td>0.19</td>
<td>0.28</td>
<td>0.21</td>
<td>0.20</td>
<td>0.22</td>
<td>0.26</td>
<td>0.20</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Note to Table 2: The Hospital Morbidity Database (HMDB) from the Canadian Institute of Health Information (CIHI) captures administrative, clinical and demographic information on hospital inpatients from acute care facilities and some chronic care and rehabilitation facilities across Canada. For this summary, records were selected in which the following enteric pathogens were indicated in the first three diagnostic codes from the International Statistical Classification of Diseases and Related Health Problems, Ninth Revision and Tenth Revision (ICD-9 and ICD-10): Salmonella (003.0-003.9 and A020-A029), Shigella (004.0-004.9 and A030-A039), pathogenic E. coli (008.0 and A040-A044), and Listeria (027.0 and A32). The four digit diagnostic code required to specify Campylobacter was not consistently used over the time period — so hospitalizations for Campylobacter were not included. Records from CIHI are given by fiscal year but the data were analysed by calendar year.

Although listeriosis is a much less frequent disease than other foodborne infections, for those who are vulnerable it can result in serious illness or death, with 20-30% mortality in outbreak situations. In the 2008 Canadian outbreak, in which much of the implicated deli-meats were distributed to health care facilities, the case fatality rate was 40%.

Table 3 shows deaths from selected diseases, demonstrating that the deaths due to *L. monocytogenes* are nearly as great as those due to Salmonella, and much greater than *E. coli* VTEC and Shigella.

Table 3: Number of deaths associated with selected diseases, 1995-2004, Vital Statistics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None or one case per year</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>E.coli VTEC</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Shigella</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Listeria</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>43</td>
</tr>
</tbody>
</table>

Note to Table 3: Statistic Canada’s Vital Statistics – Death Database was used to determine the annual number of deaths. They were defined as deaths for which ICD9 and ICD10 disease codes specified above were listed as the underlying cause of death.
With respect to absolute risk, Table 4 shows the estimated number of deaths of listeriosis for some common foods, on a per serving basis; the estimated risk per serving; and the estimated risk for a hypothetical 25 year consumption of one serving per week for people of intermediate and elderly ages. Deli meats are clearly the highest risk food, followed by smoked fish and then cheeses.

For all groups the risk of a death from a single serving is very low, with pregnancy resulting in the greatest risk of death to foetuses and neonates.

When risk is estimated over 25 years the risk increase substantially, but for people of intermediate age the risk remains very low. For those over 60 the risk estimated from deli-meats becomes much more important with an estimated risk of death of 1 in 9,620 for eating one serving of deli-meat per week for 25 years.

Although not directly comparable, the motor vehicle death rate for Canadians over 65 has been reported at 13.2/100,000\textsuperscript{18}. This equates to a risk of death of 1 in 7,600, which is in the range of the estimated risk of eating one serving of deli-meat per week for 25 years for a 60 year old.
### Table 4 Estimates of Absolute Risks of Listeriosis Death by Food Type

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Intermediate Age</th>
<th>Elderly</th>
<th>Perinatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deli Meats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths per serving</td>
<td>2.9E-09</td>
<td>0.0000008</td>
<td>0.00000026</td>
</tr>
<tr>
<td>Serving risk of death</td>
<td>1 in 345 million</td>
<td>1 in 12.5 million</td>
<td>1 in 3.85 million</td>
</tr>
<tr>
<td>25 year risk of death</td>
<td>1 in 265,000</td>
<td>1 in 9,620</td>
<td></td>
</tr>
<tr>
<td>Smoked Seafood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death per serving</td>
<td>1.9E-10</td>
<td>5.2E-09</td>
<td>0.000000018</td>
</tr>
<tr>
<td>Serving risk of death</td>
<td>1 in 5.260 million</td>
<td>1 in 192 million</td>
<td>1 in 55 million</td>
</tr>
<tr>
<td>25 year risk of death</td>
<td>1 in 4.05 million</td>
<td>1 in 148,000</td>
<td></td>
</tr>
<tr>
<td>Soft Unripened Cheese (&gt;50% moisture i.e. cottage cheese, cream cheese, and ricotta)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths per serving</td>
<td>5.2E-11</td>
<td>1.3E-09</td>
<td>4.4E-09</td>
</tr>
<tr>
<td>Serving risk of death</td>
<td>1 in 19,200 million</td>
<td>1 in 769 million</td>
<td>1 in 227 million</td>
</tr>
<tr>
<td>25 year risk of death</td>
<td>1 in 14.8 million</td>
<td>1 in 592,000</td>
<td></td>
</tr>
<tr>
<td>Soft Ripened Cheese (&gt;50% moisture i.e. brie, camembert, feta, and mozzarella)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths per serving</td>
<td>1.8E-13</td>
<td>5.9E-12</td>
<td>2.9E-11</td>
</tr>
<tr>
<td>Serving risk of death</td>
<td>1 in 5.560 billion</td>
<td>1 in 170,000 million</td>
<td>1 in 34,500 million</td>
</tr>
<tr>
<td>25 year risk of death</td>
<td>1 in 4.270 million</td>
<td>1 in 130 million</td>
<td></td>
</tr>
</tbody>
</table>
Notes to Table 4


2 The Intermediate-age group includes healthy and susceptible populations not captured in other groups, such as cancer, AIDS, and transplant patients, for whom there are insufficient data to consider as a separate population.

3 Elderly = United States population 60 years of age and older

4 The Perinatal population is a susceptible population that includes fetuses and neonates. Exposure occurs *in utero* from contaminated food eaten by the pregnant woman. (Estimates for the perinatal group can be made by multiplying the neonatal values by 2.5.) To estimate the number of servings in each food category for the perinatal group, the number of servings for the intermediate-aged population was multiplied by 0.0174 (fraction of pregnant women) and 3/12 (for exposure during the last three months of pregnancy).

5 Deaths per serving = Predicted median number of deaths from listeriosis per serving based on each food category and subpopulation (from Table A10-3 of risk assessment reference)

6 Serving risk of death = 1/ deaths per serving

7 25 year Risk of Death = Risk of death from listeriosis based on assuming one serving per week over 25 years (= 1300 servings); calculated as 1/predicted number of deaths over 25 years = 1/(1300 x deaths per serving)
The first reported Canadian outbreak of listeriosis occurred in the Maritime provinces in 1981\textsuperscript{7}. There were 41 cases and 17 deaths, all caused by \textit{L. monocytogenes} serotype 4b. The vehicle of infection was coleslaw made from cabbage contaminated at a farm after fertilization with raw manure from a flock of sheep. Recent outbreaks have occurred in Québec in 2002\textsuperscript{9} and 2008, in British Columbia in 2002, and across Canada in 2008 (see Table 5).

**Table 5: Listeriosis Outbreaks in Canada**

# Cases = invasive and diarrheal

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Food</th>
<th># Cases (deaths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>Nova Scotia</td>
<td>Coleslaw</td>
<td>41 (17)</td>
</tr>
<tr>
<td>1996</td>
<td>Ontario</td>
<td>Imitation crab meat</td>
<td>2</td>
</tr>
<tr>
<td>2001</td>
<td>Manitoba</td>
<td>Whipping cream</td>
<td>25</td>
</tr>
<tr>
<td>2002</td>
<td>British Columbia</td>
<td>Soft cheese (cheese ripening solution)</td>
<td>47</td>
</tr>
<tr>
<td>2002</td>
<td>British Columbia</td>
<td>Soft cheese (storage water)</td>
<td>86</td>
</tr>
<tr>
<td>2002</td>
<td>Quebec</td>
<td>Soft and firm cheeses (heat treated)</td>
<td>17</td>
</tr>
<tr>
<td>2008</td>
<td>Quebec</td>
<td>Cheese</td>
<td>38 (2)</td>
</tr>
<tr>
<td>2008</td>
<td>Seven provinces</td>
<td>Deli-meat</td>
<td>57 (23)</td>
</tr>
</tbody>
</table>
Listeria and Food Safety

Unlike most foodborne pathogens, *L. monocytogenes* can survive and sometimes grow on foods being stored in the refrigerator. Moreover, foods that are contaminated with this bacterium look, smell and taste normal. *Listeria monocytogenes* can be killed by proper cooking procedures.

While all foods are potentially susceptible to contamination with micro-organisms that can cause human illness, certain foods and beverages are either more susceptible to contamination, or are more likely to support subsequent growth. Many foods with an extended (usually refrigerated) shelf-life are capable of supporting the growth of *L. monocytogenes*. Foods considered high risk with regards to *L. monocytogenes* contamination have the following characteristics:

- Manufactured with no processing step (e.g., cooking) that is capable of destroying *L. monocytogenes*;

- Have a high risk of exposure to post-process contamination (e.g. during slicing). A recent risk assessment has estimated that there is a nine-fold higher relative risk of listeriosis illness and death from retail sliced deli-meats as compared to pre-packaged deli-meats;

- Contain intrinsic factors that support the growth of the organism (e.g., neutral pH, low salt, high moisture);

- Are refrigerated, ready-to-eat foods that have a long shelf-life;

- Are consumed as ready-to-eat products.
General Public: Message Considerations

Healthy adults and children who come into contact with the *L. monocytogenes* bacterium usually experience no symptoms, or, at worst, gastroenteritis with fever.

**General Advice**

The following are considerations for public messages to reduce the risk of contracting listeriosis, as well as other foodborne pathogens, in the general population.

- When shopping, pick up all refrigerated and frozen foods last. Refrigerate perishable/prepared foods, and put frozen foods in the freezer within two hours of purchase. When shopping on warm days or when the trip home will take more than one hour, use a cooler to store refrigerated and frozen foods during transport.

- Avoid consuming raw milk. Raw milk is milk that has not been pasteurized. Pasteurization heats the raw milk to kill any disease causing micro-organisms (germs) that may be present in the raw milk, much like how raw meat is cooked to make it safe.

- *Listeria monocytogenes* can grow on many ready-to-eat foods in the refrigerator, but the colder the fridge is, the slower the organism will grow. Refrigerators should be kept clean and at a temperature below 4°C (40°F). Freezers should be kept at -18°C (0°F).

- Installing a thermometer in refrigerators is recommended. Refrigerator thermometers are best placed in a visible area on the top half of the inside hinged-side wall of the refrigerator. Thermometers should be monitored to ensure the temperature stays below 4°C (40°F).

- Refrigerated foods should be kept cold before or while serving.

- Hands should be washed under warm soapy water before and after preparing food, between handling different food types (like meats and vegetables), and again before eating. This will help avoid many kinds of infections.

- Warm soapy water should be used to clean knives, cutting boards, utensils, and any surfaces (including hands) that have come in contact with foods, especially raw meat, poultry and fish. Diluted bleach solutions (half ounce = one teaspoon per gallon) should be used in washing utensils and surfaces in contact with raw meat.

- Fruits and vegetables should be washed under potable, running water. Before peeling or cutting produce with thick rinds, such as melons, first wash them with water and scrub using a clean produce brush, to avoid spreading bacteria from the surface into the flesh.
Never leave meats, poultry or seafood out on the counter for more than two hours.

Cooking and storage instructions should be followed for all foods.

"Best before" dates should be observed to ensure freshness. "Best before" dates apply to unopened packages only.

Always refrigerate deli-meats.

Once open, deli-meats should be used within four days, and preferably 2-3 days, even if this is before the "best before" date.

Deli-meats that are sliced at the grocer or institutional kitchen should be consumed within four days, and preferably within 2-3 days.

Cook foods until they reach an internal temperature of 74°C/165°F to destroy bacteria. Hot foods should be kept hot (above 60°C/140°F).

Verifying the internal cooking temperature and holding temperature of foods is important and using a good quality digital food thermometer is very important. For example, the inside colour of a hamburger and its juices are not reliable indicators of how well the burger is cooked.

After cooking, perishable/prepared foods should be refrigerated or frozen within two hours.

Rapid cooling of cooked foods is important. Chill rapidly from 60°C to 20°C in 2 hours, and from 20°C to 4°C in 4 hours. Cool large pots of soups, stews etc. rapidly by transferring into smaller containers.

Discard prepared foods that have been left at room temperature longer than two hours, including foods left in the car, leftover picnics, and foods (including leftovers) left on the counter.

Refrigerated leftovers should be consumed or frozen within four days of cooking.

Leftovers should be reheated to an internal temperature of > 74°C (165°F) before eating.

Caregivers who prepare meals and/or snacks to high risk individuals in their care should be trained in the safe preparation and handling of food. A short, appropriate, self-learning module should be developed and made readily available to these providers.

Visitors to hospitals or other care facilities should check with the facility about what food gifts are safe to bring to people who are vulnerable to contracting listeriosis.
Vulnerable Populations: Message Considerations

Following are message considerations for immunocompromised individuals, pregnant women, people over the age of 60, and for the organizations who provide food to them. See also Annex 2 that contains considerations for communicating these messages, and some particular comments regarding messages about cheeses and smoked fish.

Immunocompromised Individuals

Immunocompromised individuals have an increased risk of contracting listeriosis, ranging from 865X (undertreated AIDS patient) to 2584X (transplant patients), making them a very vulnerable group.

Nutrition for these vulnerable groups is critical, as adequate nutrition helps to strengthen the body and its immune defenses. This includes both provision of an adequate diet, as well as attention to adequate absorption of nutrients, as this can be compromised with increasing age.

Immunocompromised individuals include those who have:

- received bone marrow transplants
- received solid organ transplants
- cancer or are being treated for cancer
- haematological malignancies
- chronic renal failure
- undertreated HIV/AIDS
- malnutrition
- chronic liver disease
- iron overload disorders
- autoimmune disorders and/or disorders requiring immune suppressive pharmacological therapies
- chronic alcoholism
General Advice
The following are considerations for the development of public messages for immunocompromised individuals. These are in addition to those found in General Public Message Considerations (page 14).

To reduce the risk of contracting listeriosis, immunocompromised individuals should:

- Avoid raw (unpasteurized) milk.

- Avoid pasteurized and unpasteurized soft cheeses such as Brie, Camembert, and Hispanic-style fresh cheeses (e.g., Queso Fresco, Queso Blanco, Queso Panela, Halloumi cheese, etc.) as well as unpasteurized semi-soft cheeses (e.g., Roquefort, Stilton), unless the cheeses are baked or cooked into dishes, and have reached 74°C (165°F) during cooking.

- Avoid hot dogs, luncheon meats and deli-meats, unless they are heated to steaming hot, to an internal temperature > 74°C (165°F), and served promptly. This heating recommendation applies to individual servings rather than bulk preparation.*

- For individuals who choose not to heat deli-meats before consumption, prepackaged sliced deli-meats are estimated to be less risky than store sliced deli-meats†.

- Avoid refrigerated pâtés or meat spreads, unless from a canned source as the canning process renders the food commercially sterile.

- Avoid refrigerated seafood and fish that has been smoked using a cold-smoke process, unless in a cooked dish with an internal temperature > 74°C (165°F) or processed to government approved standards.

- Avoid raw or undercooked meat, poultry, fish and shellfish.

- It is recognized that aboriginal peoples and others harvest raw meat and fish that may be eaten immediately after harvesting. There is no indication that there is a greater risk of listeriosis from consuming these foods. If raw meat or fish is not used for immediate consumption, they should be prepared in accordance with the advice given in the General Public section, page 14.

* See “Food Services to Vulnerable Populations” for bulk food preparation considerations.
Pregnant Women
Because of the changes to their bodies during pregnancy, pregnant women are at greater risk of developing listeriosis than other healthy adults, and the disease presents significant danger to the unborn child\textsuperscript{12}.

Pregnant women, especially in the third trimester, are particularly susceptible to infection with \textit{L. monocytogenes}, exhibiting a 14X increased risk\textsuperscript{5}.

A woman who develops listeriosis during the first three months of pregnancy may miscarry. If she develops the infection later in the pregnancy, she can pass the infection on to her fetus, resulting in premature delivery, stillbirth or neo-natal infection.

For most pregnant women, avoiding \textit{L. monocytogenes} may mean avoiding certain high-risk foods, as there are greater risks associated with becoming ill from consuming such foods, and by practicing proper food preparation\textsuperscript{13}.

Considerations for messages for pregnant women is the same as for the general public (page 14) and for immunocompromised people (page 17).

Women need to be informed of the risks of foodborne illness to themselves and the potential impact on their babies. Consistent information and counselling should be provided to all pregnant women to inform them of the risks of \textit{L. monocytogenes} and how to avoid them.

Pregnant women who contract listeriosis often have only mild self-limiting flu-like symptoms. Women who develop fever in the third trimester of pregnancy should seek medical advice, and if there is no other apparent reason for the fever, listeriosis should be suspected. When a listeriosis infection occurs during pregnancy, antibiotics given promptly to the pregnant woman can often prevent infection of the fetus or newborn.

Older Adults
As individuals age, their risk of contracting listeriosis increases as depicted in Figure 2. For example, when compared to healthy individuals 40-59 years of age, Canadian data show that the persons aged 65-69 years of age have a 4X increased risk, while those aged 75 to 79 years of age have a nearly 9X increased risk.

General Advice
The following are considerations for the development of public messages for older adults. These are \textit{in addition} to those found in General Public Message Considerations (page 14).
To reduce the risk of contracting listeriosis, adults over the age of 60 may wish to follow the advice below:

- Avoid raw (unpasteurized) milk.

- Avoid or limit intake of pasteurized and unpasteurized soft cheeses such as Brie, Camembert, and Hispanic-style fresh cheeses (e.g., Queso Fresco, Queso Blanco, Queso Panela, Halloumi cheese, etc.), as well as unpasteurized semi-soft cheeses (e.g. Roquefort, Stilton), unless the cheeses are baked or cooked into dishes, and have reached 74°C (165°F) during cooking.

- Avoid or limit intake of hot dogs, luncheon meats and deli-meats*, unless they are heated to steaming hot, with an internal temperature > 74°C (165°F) and served promptly. This heating recommendation applies to individual servings only, rather than bulk preparation*.

- For individuals who choose not to heat deli-meats before consumption, prepackaged sliced deli-meats are estimated to be less risky than store sliced deli-meats.

- Avoid or limit intake of refrigerated pâtés or meat spreads, unless from a canned source, as the canning process renders the food commercially sterile.

- Avoid or limit intake of refrigerated seafood and fish that has been smoked using a cold-smoke process, unless in a cooked dish with an internal temperature > 74°C (165°F) or processed to government approved standards.

- Avoid raw or undercooked poultry.

- Avoid or limit intake of raw or undercooked meat, fish and shellfish.

- It is recognized that aboriginal peoples and others harvest raw meat and fish that may be eaten immediately after harvesting. There is no indication that there is a greater risk of listeriosis from consuming these foods. If raw meat or fish is not for immediate consumption, they should be prepared in accordance with the advice given in the General Public section, page 11-12.

* See "Food Services to Vulnerable Populations" for bulk food preparation considerations.
Food Services to Vulnerable Populations

Facilities and services that serve food to vulnerable populations include hospitals and residential care facilities; and soup kitchens, community organizations, non-profits etc. serving food to homeless populations.

People who live in residential care facilities are at increased risk for foodborne illnesses, and have a greater diarrhea-associated mortality compared to other people over 60 years of age 14.

Nutrition for these vulnerable groups is critical, as adequate nutrition helps to strengthen the body and its immune defenses.

While persons over the age of 60 are at increased risk for listeriosis, and while a large percentage of acute care hospital beds are occupied for short periods of time by persons in this age group, it may be impractical for hospitals to attempt to deliver separate meal plans for people over 60. It may also not reduce their risk below that to which they are exposed in the community.

There are also community service groups and organizations (such as Meals on Wheels) that provide food services to at risk people. Some of the following suggestions may be pertinent to these organizations, but will require further analysis by those organizations to determine feasibility.

General Advice
The following are considerations for the development of public messages for food service providers. These recommendations are in addition to those found in General Public Message Considerations (page 11).

To reduce the risk of contracting foodborne listeriosis:

1. Facilities that serve food to vulnerable populations should have guidelines in place to ensure the safety of the food that they provide. These guidelines should be continually maintained and followed.

2. Facilities should ensure that:
   - All food products are purchased from sources that are either federally registered, provincially licensed or approved by the local public health or equivalent authority that is qualified to approve safe handling of food. Sourcing local food products that meet these standards, while not necessarily safer, may offer added benefits of
supporting local food system sustainability, employment, and reducing environmental impacts.

- Unfrozen foods are rotated quickly. Rather than allowing foods to reach their "best before" dates, it is preferable to purchase smaller packages and use them quickly.

3. To reduce risk, health-care facilities may choose to purchase refrigerated ready-to-eat foods such as deli-meats which contain recently approved preservatives (i.e., sodium diacetate in conjunction with sodium lactate), as these preservatives can potentially reduce the growth of *L. monocytogenes*, and thus lower the risk for residents. In addition they may choose products that have been manufactured using high pressure processing or other advanced technologies to eliminate the presence of *Listeria*. These approved high pressure processes are effective in enhancing food safety for a population that is at a higher risk of foodborne illness, and also help to extend the shelf life of some products\(^5\). Deli-meats that are pre-sliced by the manufacturer are safer choices than those sliced in a store or facility kitchen, where there is a greater risk of cross-contamination.

4. Guidelines to ensure food safety should be consistent across health regions/districts for the different types of facilities (e.g., consistent guidelines for all acute-care hospitals, for all residential care facilities, etc.)

5. Facilities should provide guidance to family and visitors regarding gifts of food they bring to vulnerable patients.

6. Upon admission to a hospital or residential care facility, it is desirable that immunocompromised people and pregnant women have a nutrition care plan designed to consider the individual’s risk factors and vulnerability to foodborne illnesses.

7. If individual nutrition care plans for immunocompromised people and pregnant women are not feasible for a particular facility, then high-risk foods defined below should not be served at all in settings where immunocompromised people and pregnant women are likely to be admitted (e.g., acute care wards, cancer care faculties, pre-natal wards).

8. Residential care facilities are the residents’ homes. In order to provide them with an acceptable quality of life, avoidance of high-risk foods (as described in #11 below) is recommended only if the resident is immunocompromised. Serving of deli-meats to other residents should be infrequent.

9. Regardless of their immune status, residents may request to eat, or to avoid eating, high-risk foods. The facility will need to decide in advance how to act on such requests.

10. Hospitals and residential care facilities should not serve the following high-risk foods to immunocompromised people and pregnant women:

- Raw (unpasteurized) milk.
▪ Pasteurized and unpasteurized soft cheeses such as Brie, Camembert, and Hispanic-style fresh cheeses (e.g., Queso Fresco, Queso Blanco, Queso Panela, Halloumi cheese, etc.), as well as unpasteurized semi-soft cheeses (e.g. Roquefort, Stilton) unless the cheeses are baked or cooked into dishes, and have reached 74°C (165°F) during cooking.

▪ Hot dogs, luncheon meats and deli-meats, unless they are heated to 74°C (165°F) and served promptly. This heating recommendation applies to individual servings only, rather than bulk preparation. Safe heating of bulk quantities of ready-to-eat meats has not yet been evaluated. Ready-to-eat meats should not be heated in bulk off-site until it has been established that bulk off-site heating can ensure food safety.

▪ Refrigerated pâtés or meat spreads, unless from a canned source, as the canning process renders the food commercially sterile.

▪ Refrigerated seafood and fish that has been smoked using a cold-smoke process, unless in a cooked dish with an internal temperature > 74°C (165°F) or processed to government approved standards.

▪ Raw or undercooked meat, poultry, fish and shellfish. All meats, poultry, fish and shellfish should be heated to reach an internal temperature of > 74°C (165°F).

▪ Sandwiches supplied from outside health care facilities have been found to be a source of listeriosis\textsuperscript{16, 17}. Food service providers should either make sandwiches in-house or, only purchase from reputable suppliers having a validated quality control system, i.e., incorporating “Good Manufacturing Processes” and HACCP.

Note: The Listeria Working Group is unsure of the extent of reliance on outside prepared sandwiches in health care facilities in Canada. The working group recommends that each jurisdiction determine the extent of this practice and develop their own detailed recommendations to reduce risk.

▪ It is recognized that aboriginal peoples and others harvest raw meat and fish that may be eaten immediately after harvesting. There is no indication that there is a greater risk of listeriosis from consuming these foods. If raw meat or fish are not for immediate consumption, they should be prepared in accordance with the advice given in the General Public section, page 14.
**Food Service Workers**
Workers who prepare, handle and serve food are essential to ensuring food safety, as they are in direct contact with foods served to vulnerable populations.

**General Advice**
For facilities that employ foodservice workers:

- All facilities should be diligent in ensuring that all staff members preparing or handling food have completed appropriate food safety training.

- A short and appropriate self-learning module on food safety should be developed in several languages. The module should be made readily available to all staff who prepare or handle food, and who are not otherwise required to have specific food preparation training.

- Facilities should be diligent in ensuring the module is completed by all staff.

- Supervisors should monitor staff to ensure that recommended food safety practices are followed.
References


5) Public Health Agency of Canada, 2008a, personal communication.


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Annex 1

Terms of Reference

COUNCIL OF CHIEF MEDICAL OFFICERS OF HEALTH

Listeria Working Group

BACKGROUND

The recent listeriosis outbreak and the deaths associated with it have raised concerns regarding food safety, the importance of the federal, provincial and territorial partnership in reducing risks related to food-borne illnesses, and public health messages that should be provided regarding listeriosis prevention.

MANDATE

The mandate of the Council of Chief Medical Officers of Health (CCMOH) Listeria Working Group (CLWG) is to identify priorities and gaps in public health messages on listeriosis relevant to the broader issues of food safety. CLWG will then collaboratively articulate congruent public health messages which may be directed to key target populations.

Public health messages regarding Listeria standards in food, food testing recommendations, and other related regulatory issues are out of scope of this working group.

DELIVERABLES

- Proposed public health messages about prevention of listeriosis which may be directed to:
  - Specific higher risk groups - pregnant women, elderly, people with weakened immune systems
  - Health care workers
  - Health care facilities - acute care and long term care
  - General public
- The working group will terminate upon approval and acceptance of the final document of public health messages about prevention of listeriosis.

MEMBERSHIP

Members are two (2) representatives from CCMOH; delegates from the Centre for Foodborne, Environmental and Zoonotic Infectious Diseases (CFEZID) and Communications from the Public Health Agency of Canada (PHAC); and delegates from the Bureau of Microbial Hazard, Communications and the Office of Nutrition, Policy and Promotion from Health Canada (HC).

Additional members may be added at the discretion of the working group.
CHAIRS
The Working Group will be co-chaired by Brian Emerson on behalf of the CCMOH and co-chaired by Jeff Farber from Health Canada.

ROLES AND RESPONSIBILITIES
The Co-Chairs shall develop and approve agendas, coordinate and preside over meetings and review action items for completion prior to meetings.

Members shall make a commitment to be actively involved in the work of the working group and shall make attendance at meetings and fulfilment of activities a priority.

REPORTING STRUCTURE
CLWG will report to the CCMOH.

OPERATIONS
CCMOH Secretariat will provide secretariat functions for the working group. If external consulting services are required, the Centre for Foodborne, Environmental and Zoonotics Infectious Disease (CFEZID) will provide resources for these services.

The working group will meet via teleconference. Specific dates will be confirmed with the members of the working group.

All members of the CLWG have equal status during discussions.

Minutes and/or record of decision will be provided to all members following each meeting of the CLWG.

SCHEDULING AND DURATION OF MEETINGS
Scheduling and duration of future meetings will be decided at the end of each meeting, and as issues arise. Proposals for this can be advanced by any member of the working group, and will be decided upon by the Co-Chairs.

Meetings will be cancelled if quorum (no less than 50% of WG members are in attendance) is not reached.

TERMS OF REFERENCE
Amendments to the TOR are subject to ratification by CLWG members and subsequent approval by CCMOH.
Prevention of Listeriosis: Key Considerations for the Development of Public Health Messages

Communications Recommendations

In the fall of 2009, the Listeria Working Group for the Council of Chief Medical Officers of Health conducted a peer review of the draft document Prevention of Listeriosis: Key Considerations for the Development of Public Health Messages.

Along with providing editorial comments and materials for the development of the LWG document, the peer group also provided a number of suggestions that, while outside the scope of the report itself, do present some options and ideas for the strategies for the ultimate use of the report: the development of public messages.

In order to preserve these ideas and suggestions, they have been captured and provided informally below.

Most, but not all of these suggestions are specific to the prevention of listeriosis among vulnerable populations. They are all relevant to public messages regarding food safety. Some of them may require research into processes and delivery systems of organizations.

As outlined in the LWG’s report, the people at highest risk for listeriosis are those who have received organ or bone marrow transplants, leukemia and oncology patients, etc. The peer group pointed out that these people are receiving intensive medical treatment and oversight, and if they are in a high-risk group they are most likely hospitalized. Thus the incidence of listeriosis among these people is low.

However, many people who are at risk of infection are not in hospital care, including many immunocompromised individuals, healthy pregnant women, and the elderly.

1. Suggestions were received regarding targeting communications

This peer review comment outlines the need to target communications to specific vulnerable populations:

“Studies indicate that members of the various vulnerable populations prefer a message designed specifically for them. Cancer patients, HIV/AIDS, and transplant patients and pregnant women each want their own information sheet, even though the advice is virtually the same. (See publications by Mederios, Kendall, and Hiller and their grad students at Ohio State, Iowa State and Washington State in JFD or JADA, which have been adopted in a
number of USDA food safety education programs, and which should be added to the reference list.”

To access related information on the USDA Web site, please see

- **Older Adults.** Communications with the “elderly” may need special targeting based less on age and more on state of health. This peer comment sums it up:

  “Should a person who has an immune suppressive disorder be approached educationally as a member of that vulnerable group (e.g. more restrictive guidance) regardless of age, and should the healthy elderly be approached with less restrictive, more precautionary advice – since that is all they will listen to. Without the motivating threat of disease, consumers in general are very resistant to advice that asks them to change their traditional behaviors. The healthy elderly do not perceive themselves to be “old” and are offended by suggestions otherwise.”

The peer review also recommends using large size fonts in communications designed for older people.

- **Pregnant women** need to be informed of the risks of foodborne illness to themselves and the potential impact on their babies. Consistent information and counselling should be provided to all pregnant women to inform them of the risks of *L. monocytogenes* and how to avoid them.

- **Gifts of food: hospital visits to at-risk people.** The LWG report suggests that hospitals and/or residential care facilities provide take-home information for visitors, family and friends of at risk patients. If targeted information is developed for each vulnerable populations (see first bullet), then these information sheets may also be appropriate for distribution by hospitals or residential care facilities.

2. Some suggestions were received that apply to organizations that provide food services to adults who may be vulnerable to listeriosis, particularly to seniors but also to people who are homebound by disability or illness (e.g. Meals on Wheels, senior daycare centres). Messages tailored for these situations should be considered.

- The peer suggestion is that a short and appropriate self-learning module on food safety be developed for these organizations.

- While basic training is a requirement, supervisors should monitor to assure that food safety practices are followed.
3. While healthy children are not among the groups most vulnerable to listeriosis, several suggestions were received regarding facilities that provide snacks or meals to children (e.g. daycare centres). These suggestions may apply also to senior day care centres (see #2).

- Child care providers who require parents to supply meals and/or snacks should inform parents as to the safe packaging of foods. Consistent information for child care providers should be developed.

- All snacks and lunch box items should be stored at proper temperatures to ensure freshness.

- Hot foods should be kept hot (above 60°C/140°F) in thermoses.

- Cold foods should be refrigerated (below 4°C/40°F) or packed with cold packs.

4. The use of graphs, charts and graphics to accompany text will help get readers’ attention and increase comprehension.

5. Suggestions were received regarding lifestyle recommendations for people who are vulnerable to listeriosis.

- Messages need to be aimed at those vulnerable populations who are eating food prepared at home or away from home, where safe food is not a given or a reasonable expectation.

- In addition to the recommendations in the LWG report regarding heating and cooking to internal temperatures to safely destroy bacteria, additional information needs to be developed, if possible, outlining microwaving methods that would achieve safe temperatures (e.g. xx minutes at medium). The peer comment: “For example, when microwaving there is often lots of steam but not thorough heating. Note that 70 degrees Celsius for 2 minutes has also been seen in publications.”

- If possible, the development of materials that provide safe grilling and broiling times for different types of foods (e.g. deli-meat sandwiches) would be useful.

- All peer reviewers strongly recommended that public messages include the installation and monitoring of thermometers in refrigerators. This recommendation is in the LWG report (along with the target temperature), but was doubly stressed by reviewers.
Comments on Wording Regarding Cheese and Smoked Fish

In the document the following guidance for messages regarding cheese is provided for vulnerable people:

- Avoid (plus add “or limit intake of” for older adults) pasteurized and unpasteurized soft cheeses such as Brie, Camembert, and Hispanic-style fresh cheeses (e.g., Queso Fresco, Queso Blanco, Queso Panela, Halloumi cheese, etc.) as well as unpasteurized semi-soft cheeses (e.g. Roquefort, Stilton), unless the cheeses are baked or cooked into dishes, and have reached 74° C (165° F) during cooking.

Alternative considerations for wording are below, but before using this or variations on this wording consultation it is important to consult with experts in listeriosis:

- Avoid (plus add “or limit intake of” for older adults) soft and semi-soft cheeses (from pasteurized and unpasteurized sources), unless the cheeses are baked or cooked into dishes, and have reached 74° C (165° F) during cooking. OR

- Avoid (plus add “or limit intake of” for older adults) soft and semi-soft cheeses unless the cheeses are baked or cooked into dishes, and have reached 74° C (165° F) during cooking.

Comments on Wording Regarding Cheese and Smoked Fish

In the document the following guidance for messages regarding smoked fish is provided for vulnerable people:

- Avoid (plus add “or limit intake of” for older adults) refrigerated seafood and fish that has been smoked using a cold-smoke process, unless in a cooked dish with an internal temperature > 74°C (165°F) or processed to government approved standards.

Alternative considerations for wording are below, but before using this or variations on this wording consultation it is important to consult with experts in listeriosis:

- Avoid (plus add “or limit intake of” for older adults) refrigerated smoked seafood and fish, unless in a cooked dish with an internal temperature > 74°C (165°F) or processed to government approved standards.
National public communication websites that were encountered in the course of this review:

Advice from Canada's Chief Public Health Officer on Food Safety:
http://www.phac-aspc.gc.ca/media/cpho-acsp/080919-eng.php

Listeria – Protecting Your Pregnancy

Safe Food Handling For Pregnant Women:

Listeriosis – Protecting the Health of Senior Citizens:

Listeria and Food Safety – It’s Your Health:

Food Safety Facts on Listeria:

At Risk Populations Fact Sheets:
http://www.foodsafety.gov/keep/groupofpeople/index.html

Food Safety for Specific Groups of People:
http://www.fsis.usda.gov/factsheets/At_Risk__Underserved_Fact_Sheets/index.asp

Special Handling for Ready-to-Eat, Refrigerated Foods:
Reducing the Risks of Foodborne Listeria - Easy as . . .
http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm079667.htm

To Your Health! Food Safety for Seniors:
http://www.fda.gov/Food/ResourcesForYou/Consumers/Seniors/ucm182679.htm

Listeriosis
http://www.cdc.gov/nczved/divisions/dfbmd/diseases/listeriosis/#reduce_risk