
Listeria Outbreak: Review and Recommendations for Food Safety in Facilities*

***Health Authority administered or licensed facilities, licensed child care facilities, and residences registered by the Assisted Living Registrar**

January 2009

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Listeria outbreak: review and recommendations for food safety in facilities

Executive Summary

In response to a Canada wide outbreak of listeriosis the Provincial Health Officer established the BC Food Safety in Facilities Advisory Group in August of 2008. The mandate of this Group was **“to review the issue of food safety for residents in Health Authority administered or licensed facilities, licensed child care facilities, and residences registered by the Assisted Living Registrar, especially as it pertains to the provision of safe foods to vulnerable individuals; while recognizing the existing health protection, licensing, registration, food audits and other food safety programs”** (for complete terms of reference see Appendix 6.2).

During the listeriosis outbreak, there were five confirmed cases in BC, resulting in two deaths. Of these five cases, four of the individuals likely ate the contaminated meats while in hospital for other reasons, while the other individual likely consumed contaminated deli meat in the community. *Listeria monocytogenes* (“listeria”) and other food borne pathogens primarily affect individuals who are vulnerable due to an already weakened immune system, e.g. the elderly, persons with under treated HIV/AIDS or transplant patients (an increased risk of 10X, 865X, 2584X respectively). Although listeriosis is not a common infection in the healthy population, for vulnerable individuals symptoms can be severe, with a mortality rate of 20-30% in typical strains. Pregnant women are also at a greater risk of listeriosis (14X); their symptoms are usually mild, but there is a 20% risk of spontaneous abortion or fetal death.

This report summarizes published literature on listeria and other food borne pathogens, reviews food safety issues, protocols and policies and makes recommendations for facilities surrounding food safety. The report also examines other food safety issues such as allergies and choking for adults in care and for children in child care facilities. The recommendations in this report are specific to BC health care facilities and other licensed or contracted facilities and registered residences, they emphasize and build on the existing guidelines and regulations.

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.

Foods traditionally considered high risk with regards to listeria contamination have one or more of the following characteristics:

- Manufactured with no processing step (e.g. cooking) capable of destroying *L. monocytogenes*
- High risk of exposure to post process contamination (e.g. slicing)
- Product with little or no preservation factors (e.g. neutral pH, low salt, high moisture)
- Sold with long shelf life under chilled conditions
- Consumed as a ready-to-eat product

Reductions in illness due to listeria are difficult to achieve because of several barriers to its control. These barriers include:

- Listeria is commonly found in the environment, including food processing, distribution, and retail environments, in foods, in institutions, and in the home
- Listeria primarily affects only a small segment of the population that has heightened susceptibility, therefore contamination is often unrecognized
- Listeria can grow slowly in many foods during refrigerated storage
- Listeria is more resistant than most bacteria to the conditions and treatments used to control food borne pathogens

The primary food contaminants causing illness are viral and bacterial pathogens, with the contamination most often introduced through poor practices by food preparation workers. There are three key elements to a food safety strategy:

- 1) A food inspection and quality assurance program based on legislation, standards and guidelines
- 2) Food borne illness outbreak investigations, food seizure, and food recall programs
- 3) Food safety education programs, both for the food industry and the public

Food safety in BC is governed by a comprehensive set of acts, regulations and policies at the national, provincial and location level (see Appendix 6.5). Even with existing regulations and guidelines for food service safety, there are challenges with compliance. Challenges to compliance include the ability to keep up with the list of “at risk” foods, staff knowledge of food and safe-handling practices, trust issues related to food processing and biotechnology, facility staffing ratios, the unique nutritional requirements and food preferences of facility residents, and the constraints of working to budget. The ability to provide meals that are nutritious and appealing will be the subject of a future Provincial Health Officer report.

To address the issue of challenges to compliance with food handling guidelines, food safety controls should be in place along the entire food safety chain (i.e. on the farm, at the processing plant, within the food preparation facility, and at food service point of delivery). Upon review of food safety issues, additional recommendations were identified to supplement the existing ones, and assist in filling the gaps in safe food provision. These recommendations have been tailored for different groups, including the workers responsible for preparing the food and the vulnerable populations who consume meals in facilities. The vulnerable groups include persons who are immune compromised or have other medical conditions that increase their vulnerability (e.g. transplant patients, patients with chronic renal failure on dialysis), the elderly in facilities, and pregnant women in facilities.

The recommendations are:

1) Food Handling:

Facilities should ensure that:

- 1.1) All meat products be purchased from federally registered, provincially licensed or health authority approved processing plants.
- 1.2) If unfrozen foods frequently approach or exceed the expiry date before consumption, then smaller packages should be purchased.
- 1.3) When preparing eggs, they are cooked to pasteurization temperatures (minimum 63°C/145°F for at least 15 seconds). If this temperature will not be reached (e.g. soft boiled eggs) then only pasteurized eggs or egg products should be used. Dishes containing raw eggs should be cooked to a minimum temperature of 74°C/165°F.

2) Workers who Prepare, Serve or Handle Food:

- 2.1) All facilities should maintain records on staff completion of appropriate training as required by legislation.
- 2.2) An appropriate (e.g. an abbreviated version of FOODSAFE Level I), short, self-learning module should be developed in several languages and made readily available to all staff that prepare or handle food and are not otherwise required to have specific training. Facilities should be diligent in ensuring the module is completed by all staff.
- 2.3) Hepatitis A vaccination should be provided to all food workers who prepare or handle food.

- 2.4) Facility food preparation workers should be trained in preparing texture-modified foods for residents with choking risks.
- 2.5) Facility food preparation workers should be trained in preparing allergen-free meals, e.g. how to prevent cross-contamination of foods.
- 2.6) Those staff responsible for providing patient care during meals, or overseeing the activities of volunteers should maintain currency in allergy and choking response protocols.

3) Vulnerable People and Risk Reduction:

3.1) Guidelines for serving high risk foods should be consistent across Health Authorities for the different types of facilities, e.g. all acute-care hospitals should have consistent guidelines; all care facilities should have consistent guidelines, and all assisted living residences should have consistent guidelines appropriate to their status as a resident's home.

3.2) Upon admission to a residential care or assisted living facility, the resident assessment and care plan should specifically identify the individual's risk factors and/or vulnerability to food borne illness, in addition to existing assessments for risk of choking, and known allergies. For individuals admitted to facilities where individual nutrition plans are not possible, then high risk foods (see 4.1) should not be served at all in high risk settings (e.g. certain acute care wards such as prenatal wards).

3.3) When deli meats are served, they should be provided in moderation. A varied diet will decrease the likelihood of listeriosis, and can assist in improving the nutritional value of facility menus.

4) Immune Compromised Individuals and Individuals with Other Conditions:

4.1) Hospitals, residential care facilities, and assisted living residences should ensure that immune compromised individuals (i.e. patients/residents with bone marrow transplants, solid organ transplants, oncology patients and patients with haematological malignancies, chronic renal failure on dialysis, under treated HIV/AIDS) and individuals with other immunocompromising conditions (e.g. malnutrition, liver disease, iron overload disorders) are served a diet intended to reduce the risk of food borne illness.

This diet should exclude altogether the high risk foods such as:

- Raw (unpasteurized) milk (illegal in BC) or milk products.
- All soft cheese such as Brie, Camembert, feta, blue veined and Hispanic-style fresh cheeses.

- Hot dogs, luncheon meats, deli meats, unless they are heated to 74°C/165°F and served promptly. This heating recommendation applies to individual servings rather than bulk preparation. Safe heating of bulk quantities of ready-to-eat meats has not yet been evaluated, and ready-to-eat meats prepared in bulk offsite should not be heated, other than in individual portions, and served until further review has occurred.
- Refrigerated pâtés or meat spreads, unless from a canned source as the canning process pasteurizes the food.
- Smoked seafood and fish, unless in a cooked dish or from a canned source.
- Store-bought, pre-made sandwich fillings, such as ham salad, chicken salad, egg salad, unless the ingredients of concern are known to have been processed as recommended to reduce the risk of food borne pathogens.
- Raw or undercooked meat, poultry and fish.

4.2) If it is not possible to provide individual meal plans (e.g. in an acute hospital setting) then high risk wards, or the entire facility if necessary, should avoid the high risk foods listed above.

5) Facility Residents Over the Age of 65 (Non-immunocompromised):

5.1) When deli meats are served to elderly residents of facilities, they should be provided in moderation and in line with the recommendations for risk reduction. A varied diet will decrease the likelihood of listeriosis, and can assist in improving the nutritional value of facility menus.

5.2) While the literature suggests that persons over the age of 65 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, this review determined that it would be impractical for hospitals to attempt to deliver separate meal plans for people over 65 except for those referenced in 4.1, and it would not reduce their risk below that to which they are exposed in the community. Furthermore, a complete hospital ban on ready-to-eat deli meats from inspected, approved sources is also undesirable.

5.3) Given that facilities are the residents' home (i.e. residential care or assisted living), unless the resident is immunocompromised as in 4.1 above, complete avoidance of high risk foods is not recommended in order to maintain an acceptable quality of life for the residents. Additional considerations for these facilities are:

- 5.3.1) The recommendations under "Food Handling" should be followed to reduce the risk of food borne illness.
- 5.3.2) In the case of an outbreak of food borne illness, greater caution is warranted, i.e. high risk foods should be avoided altogether.
- 5.3.3) Residents may request to either eat, or avoid the high risk foods. Regardless of their immune status, if this type of dietary request is made, then the requested diet may be provided at the discretion of the facility ensuring that the resident is aware of the potential risk.

Note: The listeriosis risk to vulnerable groups could be further reduced were the Federal regulators to require that growth inhibitors be added to pre-packaged RTE meats or that irradiation be approved and mandatory for pre-packaged RTE meats served to vulnerable populations in institutions.

6) Pregnant Women in Facilities:

6.1) Pregnant women should not be served foods on the high risk list (see 4.1) unless the food is properly prepared to minimize the risk of listeria.

6.2) Women need to be informed of the risks of food borne illness to themselves and to their pregnancy. Consistent information and counselling should be provided to all pregnant women to inform them of the risks of listeria and how to avoid them.

Recommendations for maternity care providers should be developed by the BC Centre for Disease Control and the BC Perinatal Health Program (<http://www.bcphp.ca/>) in consultation with care providers (e.g. general practitioners, obstetricians, midwives) for food safety counselling to be provided to all pregnant women as part of their routine prenatal care.

7) Choking and Allergies for Adults in Care:

7.1) Upon admission to a facility, the resident assessment and care plan should consider the individual's need for diet modifications due to choking risks or food allergies.

Facilities should then provide texture modified and allergen free meal plans as required.

7.2) Those staff responsible for providing patient care during meals, or overseeing the activity of volunteers should maintain currency in allergy and choking response protocols.

8) Food borne Illness and Food Safety for Children:

8.1) Child care providers who supply meals and/or snacks to the children in their care should be trained in the safe preparation and handling of food. It is recommended that a short, appropriate, self-learning module be developed and made readily available to child care providers who would not otherwise be required to take FOODSAFE or equivalent training.

8.2) In the case of an outbreak of a food borne illness, any foods that are suspect should be held for testing or discarded, and parents should be informed of the facility's actions, as well as signs and symptoms to watch for in their children.

8.3) Child care providers who require parents to supply meals and/or snacks should inform parents as to safe packaging of foods. This information should be developed through the Child Care Licensing Branch to ensure consistency.

- Food should be packaged in containers or wraps that will prevent spillage and mixing of different foods items.
- Hot foods should be kept hot in thermoses.
- Cold foods should be refrigerated or packed with cold packs.

8.4) Canadian Paediatric Society (CPS) recommendations on food borne infections and food safety should be followed by all child care providers, for all children in care. CPS position statement notes are reviewed, revised, or retired as needed on a regular basis. See the "Position Statements" section of the CPS website (<http://www.cps.ca/english/publications/statementsindex.htm>) for current versions.

9) Allergies in Children:

9.1) Child care facilities should:

- Ask parents if their children have food allergies/intolerances on the registration forms when children are enrolled and annually thereafter.

9.2) If an allergic child is registered at the child care facility, the facility should:

- 9.2.1) Ensure care providers are trained on emergency response procedures, including administration of epinephrine.
- 9.2.2) Institute a policy of children not sharing food items if meals/snacks are supplied from home.

9.2.3) For facilities where foods are brought from home and there are highly allergic children, ensure washing of hands and tables before and after mealtimes to reduce the risk of cross-contamination.

9.2.4) If a highly allergic child attends the facility, it may be warranted to avoid the food of concern altogether.

10) Choking in Children:

10.1) Information packages on training staff about choking should be developed through the Child Care Licensing Branch and provided to child care facilities. Child care facilities should:

10.1.1) Educate caregivers/food preparation workers about foods more likely to cause choking in young children, e.g. nuts, grapes, hot dogs, popcorn.

10.1.2) Educate caregivers/food preparation workers about how to reduce choking hazards of foods, e.g. cutting grapes and hot dogs into small pieces.

10.1.3) Avoid entirely foods having a high risk of choking with little nutritional value, e.g. hard candies, chewing gum.

10.1.4) Ensure all staff receive training in choking emergency response for different age groups (e.g. infant, toddler, preschooler).

11) Food Safety Monitoring:

11.1) Facility inspections should include some that are conducted with no advance warning, to ensure inspectors are seeing conditions typical for that facility.

11.2) Consideration should be given to developing greater compatibility and partnership between the Steritech or other third party auditors and the EHO inspectors in order to develop a fuller picture of the food safety practices and level of risk.

11.3) Inspections and risk assessment tools used by environmental health and licensing officers should include review of the facility's food safety plans and provisions for precautionary diets for vulnerable residents. Where appropriate, these diets should be referred to the appropriate professional for review.

11.4) Provincial standards should be established for a self assessment process for facilities not currently assessed by provincial licensing authorities.

11.5) A provincial database for all inspection reports should be established and the results of facility inspections and self assessments should be made public.

12) Surveillance and Incident Reporting:

12.1) When it is suspected that a resident/patient/client of a facility has become ill as a result of a food served; this should be reported to the medical health officer. In addition, the facility should consult with Environmental Health Officers (EHOs) and all recommendations for outbreak response followed.

12.2) A single case of listeriosis in a person being cared for in a facility and occurring within the appropriate incubation period should be considered to be due to contaminated processed food consumed within that facility unless considered otherwise. This should trigger aggressive investigation of the source due to the vulnerability of facility populations, and, as with all listeria cases, be immediately reported to the medical health officer.

12.3) Food borne illness, an allergic response to food, and choking incidents that require medical attention should be defined as a specific “reportable incident” in the Adult Care Regulations and Child Care Licensing Regulations under the *Community Care and Assisted Living Act*.

12.4) A central, electronic and searchable database of “reportable incidents” should be established where all incidents can be entered such that cases of reported food borne illness, allergic responses, or choking incidents can be documented to facilitate tracking and quality assurance. This database should be linked to the proposed outbreak control module of the BC Public Health Information System.

12.5) Patient information (e.g. age, other illness or complicating factors), patient history (e.g. residence at a facility within the past 30 days), food consumption history, and presence of other individuals suspected to be sickened by the same food product should be included in electronic outbreak modules.

13) Local Food Procurement:

13.1) Regional Health Authorities should investigate the feasibility of sourcing local foods and of encouraging partnerships with local food producers.

13.2) Any suppliers of local foods must meet provincial food safety standards. This condition should be written into any contract tendered.

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Table of Contents

1.0	Introduction	1
2.0	Food and Concerns.....	3
2.1	Food borne illness	3
2.2	The food supply system	10
2.3	Food in facilities	13
2.3.1	Food and nutrition in care facilities	16
2.3.2	Choking and allergies in care facilities	17
2.4	Food security	17
2.5	Food in child care facilities	18
3.0	Main Findings	19
3.1	Literature Reviews	19
3.2	Documentation Review.....	21
4.0	Conclusions and Recommendations	30
4.1	Overall Food Safety	30
4.1.1	Food Handling	30
4.1.2	Workers who prepare, serve or handle food	32
4.2	Vulnerable People and Risk Reduction	33
4.2.1	Immune compromised and other conditions.....	33
4.2.2	Facility Residents Over the Age of 65 (Non-immunocompromised).....	35
4.2.3	Pregnant Women in Facilities.....	36
4.2.4	Choking and allergies for adults	36
4.2.5	Children.....	37
4.3	Monitoring and Surveillance.....	39
4.3.1	Monitoring	39
4.3.2	Surveillance and Incident Reporting.....	40
4.4	Local Food Procurement.....	41
5.0	References	42
6.0	Appendices	46
6.1	Hazard Entry Points for Foods (BCCDC 2008b)	47
6.2	Advisory Group Terms of Reference.....	53
6.3	Literature Reviews	55
6.4	Food Safety Recommendations for the General Public	74
6.5	Food Safety Legislation Framework.....	76

1.0 Introduction

In response to a Canada wide outbreak of listeriosis the Provincial Health Officer established the BC Food Safety in Facilities Advisory Group in August of 2008 (see Appendix 6.2 for Terms of Reference). The group was formed to support the preparation of this Provincial Health Officer report to examine issues and make recommendations pertaining to food safety in **facilities such as hospitals, long term care facilities, assisted living residences, and child care facilities.**

Food safety in facilities had become an issue of concern following an outbreak of *Listeria monocytogenes* ("listeria") in Canada that began in June, 2008. As of December 2008, there were 56 confirmed and 6 suspect cases of illness linked to the listeria outbreak, including 5 confirmed cases in British Columbia. Among the outbreak cases, there were 20 deaths (two from BC) where listeria was the underlying or contributing cause. (source Health Canada. Available at http://www.phac-aspc.gc.ca/alert-alerte/listeria/listeria_2008-eng.php). Of the five BC cases, four of these individuals likely ate the contaminated deli meats while in hospital for other reasons. The other individual likely consumed contaminated deli meat in the community. There were no BC cases of listeriosis reported from healthy adults or children during this outbreak.

Prior to this outbreak Health Canada had produced and disseminated guidelines for listeria prevention that advised seniors, pregnant women and other vulnerable individuals to avoid consumption of higher risk foods. Questions that arose during the outbreak included whether such foods should be banned in BC health care facilities, and whether other prevention measures in facilities should be considered. As an interim measure, protective guidelines were established pending a full examination of these issues. The Provincial Health Officer issued interim guidelines on August 31, 2008, recommending that Health Authorities:

1. Reinforce the recommendation that pregnant women in health care facilities administered or licensed by Health Authorities should not be served "foods to avoid", as included in Health Canada's article (Health Canada 2008), "Listeria and Food Safety" ;
2. Continue to advise physicians on this issue including reminding them to make appropriate dietary recommendations for their immunocompromised patients, of

- any age, whether they are in acute or residential healthcare facilities, assisted living residences or are living in the community; and
3. Ensure immunocompromised individuals have individualized meal plans as recommended by their physician while in a facility administered or licensed by a Health Authority.

Foods to avoid (adapted from Health Canada's article, "Listeria and Food Safety"):

- Hot dogs, especially straight from the package without further heating. (The fluid within hot dog packages may contain more Listeria than the hot dogs.)
- Non-dried deli-meats
- Soft and semi-soft cheeses such as feta, Brie, and Camembert
- Refrigerated pâté and meat spreads
- Refrigerated smoked seafood and fish
- Raw or undercooked meat, poultry and fish
- All unpasteurized milk products

Listeria monocytogenes and other food borne pathogens primarily affect individuals who are vulnerable due to an already weakened immune system, e.g. the elderly, persons with an existing illness such as HIV/AIDS or cancer, infants and pregnant women.

L. 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. *L. monocytogenes* is transported to the liver where it multiplies until the infection is controlled by a T-cell mediated immune response. In immunocompetent individuals, 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 unrestricted in the liver and eventually invades the blood stream, the brain and the gravid uterus, leading to clinical disease (Vazquez-Boland *et al.* 2001). In pregnant women, the listeria bacteria can cross the placenta and infect the fetus, which can precipitate spontaneous abortion or fetal death.

This report summarizes published literature on listeria and other food borne pathogens, reviews food safety issues, protocols, and policies and makes recommendations for facilities with respect to food safety. The report also examines other food safety issues such as allergies and choking for adults in care and children in child care facilities.

The recommendations in this report are specific to BC health care facilities and other licensed or contracted facilities or registered residences, and are in addition to existing guidelines and regulations. No studies on the costs of implementing these recommendations were undertaken, but their value justifies a review of the resources required. This report does not make recommendations for the general public, but some of the recommendations are applicable to vulnerable individuals living at home. Appendix 6.4 contains food safety recommendations for the general public (BC PHO 2006).

2.0 Food and Concerns

2.1 Food borne illness

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. *Listeria* is an organism that is very prevalent in the environment and is also capable of growth at low temperatures (<4°C). Foods with an extended (usually refrigerated) shelf-life with no further micro-organism killing step are capable of supporting the growth of *L. monocytogenes* (Advisory Committee on the Microbial Safety of Food (ACMSF) 2008). It is therefore of particular concern in bulk, ready-to-eat foods of the kind that may be served to vulnerable, institutionalized populations. Foods considered high risk with regards to listeria contamination have the following characteristics (ACMSF 2008):

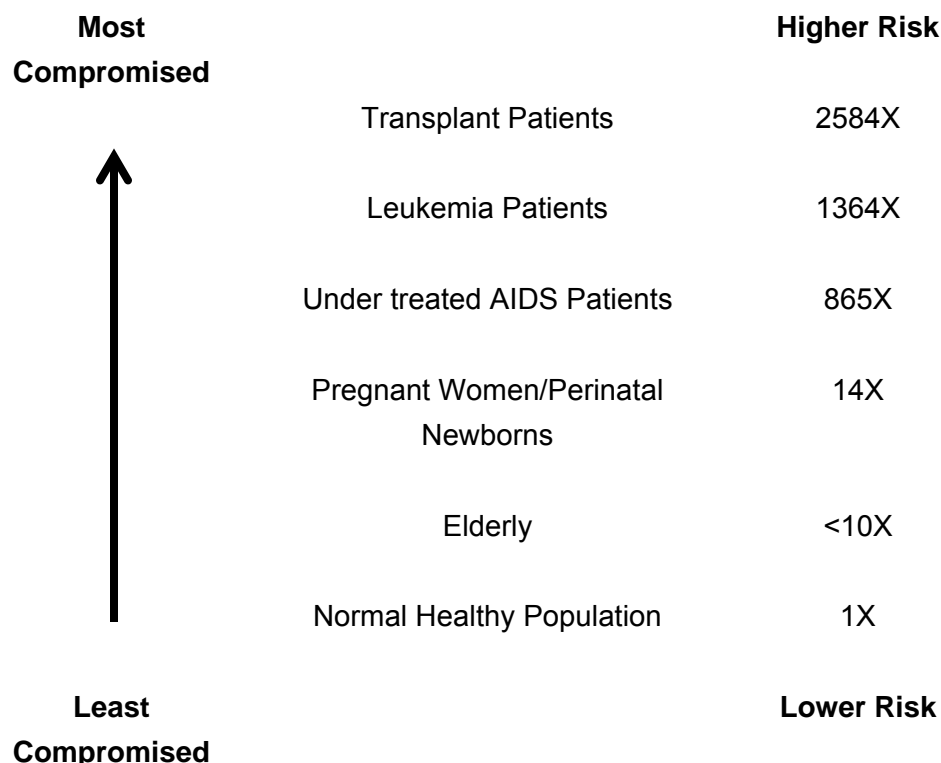
- Manufactured with no processing step capable of destroying *L. monocytogenes* (e.g. cooking);
- High risk of exposure to post process contamination (e.g. slicing);
- Product with little or no preservation factors (e.g. neutral pH, low salt, high moisture);
- Sold with long shelf life under chilled conditions;
- Consumed as a ready-to-eat product.

Healthy adults and children that come into contact with the listeria bacterium usually experience no symptoms, or, at worst, a febrile gastroenteritis. However, for vulnerable populations (Figure 1), including the elderly, the immune compromised, and pregnant women and their unborn babies, infection can be invasive, resulting in serious illness and even death. Although listeriosis is a relatively uncommon infection, it can seriously affect individuals who are already vulnerable, and when infection does occur, has a very high mortality rate, usually ranging from 20-30% (WHO 2004). In highly virulent strains, mortality can be as high as 50% (Galanis and Shyng 2008).

For the elderly and other people vulnerable to food borne illness, symptoms of an illness can include nausea, vomiting, cramps, diarrhea and fever. Acute gastroenteritis and diarrhea are of particular concern, as this can further compromise nutritional status. Dehydration can result from the loss of fluids, and, in the elderly, an age-related decreased sense of thirst. Dehydration in the elderly is associated with diminished cognition, debility and physical instability, thus increasing the risk of falls and other trauma (BCMHLs 2008a). People with poorer immune function, such as many elderly, are at much higher risk of the severe life-threatening form of listeriosis characterized by septic shock, meningitis and encephalitis. Less commonly, patients may have inflammatory gastroenteritis, endocarditis or joint infections.

Malnutrition in the elderly compromises their overall health, putting them at increased risk of infection. Malnutrition can occur even with elderly residents in long term care facilities, despite the provision of regular, prepared meals. Within Canada, New Brunswick and Saskatchewan reported a rate of malnutrition in elderly residents in long term care facilities of 40% each. In an Ontario study, the prevalence was 45.5% (BCMHLs 2008a). A significant number of elderly in long term care are not only frail, they are immunocompromised, factors that all add to the vulnerability of an individual. In the US, 30% of long term care residents die within the 1st year of admission and life expectancy in a US nursing home is approximately 2.2 years (BCMOHLS 2008).

Figure 1. Example Relative Risks of Listeriosis for Some Risk Groups (BCCDC 2008a)



The foods listed in Table 1 all carry a risk when consumed by persons from the vulnerable populations. Risk has several different aspects. “Absolute risk” refers to the risk of developing an illness over a specific time period, e.g. one year, while “relative risk” compares the risk between two different groups of people (www.patient.co.uk 2008).

Figure 1 lists the relative risk of listeriosis for different 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 2584 times more likely to contract listeriosis after consumption than the normal, healthy population. “Acceptable risk” refers to an event whose probability of occurrence is so small, or whose consequences are so slight, or whose benefits (perceived or real) are so great, that individuals or groups in society are willing to take or be subjected to the risk that the event might occur (enotes.com 2008 amended). In the context of public health, risk assessment is the process of quantifying the probability of a harmful effect to individuals or populations from a certain human activity, for example, use of specific chemicals or the operation of facilities such as power or manufacturing plants are limited if these will increase the risk of death or illness above a certain threshold.

This report and its recommendations considers the different aspects of risk and risk mitigation for vulnerable populations and evaluates them with respect to the potential cost savings and convenience frequently associated with many of the foods that are more likely to be contaminated, the enjoyment derived from many of the foods by the consumers and the potential costs and foregone benefits if foods are removed from the supply chain. In simple terms, as an example, does the absolute risk of listeriosis in the older population (13 reported cases in the 60-69 years age group between 2002 and 2007 in BC; Galanis and Patrick 2008) warrant the banning of corned beef sandwiches (and their replacement with other, not necessarily risk-free foods) in all BC residential care facilities and hospital wards?


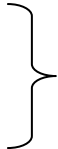
Some of the pathogens of concern are present in or on food at its source (e.g. Salmonella on egg shells), while others may be present in processing or preparation plants and contaminate the food product as it passes through (e.g. listeria in ready-to-eat deli meats). Further opportunities for introduction or growth may also be present in the institution itself. A number of identified higher-risk foods (e.g. bulk pre-packaged sliced meats) are fairly inexpensive and easy to serve, and so are commonly served in institutions (see Section 2.3.1 for a discussion of nutritional value of high risk foods). The risk associated with these foods should be mitigated through proper handling and further preparation; although for some foods the only sure way to prevent infection may be complete avoidance (Table 1).

Contaminated foods are known vehicles for more than 200 diseases caused by bacteria, viruses and parasites, as well as natural toxins and chemical and physical contaminants (BCMOH 2006a). Todd (1989) estimated that in the period 1978 to 1982, there were 2.2 million cases of food borne illness in Canada each year. By population, and extrapolating to 2003 (BC population of 4,155,370; Stats Canada 2003 estimates), the number of estimated cases of food borne illness in BC would be 288,200, or approximately 1 in every 14 residents each year (BCMOH 2006a).

There are costs associated with both prevention of food borne illness, and with medical treatments of affected individuals. Costs also include lost work time and productivity due to illness, investigation costs and legal costs. Based on the estimated numbers of food borne illnesses in BC, and Canadian cost estimates per case (\$988), the cost of food borne illness in BC ranges from \$206 million to \$644 million annually (BCMOH 2006a).

Ivanek *et al.* (2004) evaluated economic techniques used to determine the cost and benefit of *L. monocytogenes* control and estimated the economic optimum of related food safety measures. The level of food safety measures is optimal when the benefits and costs are equivalent. Estimates of benefit and cost of *L. monocytogenes* food safety measures, from available published literature, were derived from different methods of economic analysis (willingness to pay, cost of illness, cost function, and event study methods). Overall, it was determined that the estimated marginal benefit exceeds the estimated marginal cost, which implies that more food safety measures are warranted before the optimal level of food safety is reached (Ivanek *et al.* 2004). However, Ivanek *et al.* (2004) were not able to estimate the optimal level of *L. monocytogenes* food safety measures due to a lack of data. Another important factor in determining the appropriate cost and benefit of food safety measures is public perception. If the public sentiment is that listeria and other food borne pathogens are a priority for financial expenditure, then this increases the financial cost that is acceptable to society as a whole.

Table 1. Foods of Risk to Vulnerable Populations (Adapted from BCCDC 2008a)

Food Category / foods	Controls/mitigation steps	Pathogen(s)	Ref
Eggs <ul style="list-style-type: none"> • Caesar salad (made on site) • Hollandaise (made on site) • Mayonnaise (made on site) • Ice cream (made on site) • Egg nog (made on site) • Egg fortified beverages 	1. Use pasteurized whole, liquid or shell eggs 2. Cook dishes that contain raw eggs as an ingredient to an internal temperature of 74C/165F for 15sec	<i>Salmonella enteritidis</i>	FDA Food Code 2005
Ready-to-Eat Foods <ul style="list-style-type: none"> • Raw animal foods: raw fish; raw marinated fish; raw molluscan shellfish; steak tartare • Partially cooked animal foods: rare meat, soft-cooked eggs, lightly cooked fish • Raw seed sprouts 	 Do not serve	Examples: <i>E.coli</i> 0157 <i>Salmonella</i> <i>Vibrio</i> <i>Diphyllobothrium</i> , <i>Anisakis</i>	FDA Food Code 2005
Ready-to-Eat Foods <ul style="list-style-type: none"> • Deli-meats and hot dogs • Raw, unpasteurized milk • Soft-cheeses • Refrigerated pâtés or meat spreads • Refrigerated smoked seafood 	Do not serve unless they are reheated until steaming (individual servings)  Do not serve	<i>Listeria monocytogenes</i>	HHS/USDA
Unpasteurized Juices	Do not serve. These juices are required to have a warning label in the US ^a , but not in	Examples: <i>E.coli</i> 0157 <i>Cryptosporidium</i>	FDA Food Code 2005

Food Category / foods	Controls/mitigation steps	Pathogen(s)	Ref
	Canada.		
Juices prepared on site at the premise	Processed under a HACCP Plan		
Pre-packaged juices	Treated (i.e. through pasteurization) to ensure a 5 log reduction of pathogens.		
All Foods	Refrigerator temperatures should not exceed 6°C (set to 2°C to 4°C)	<i>Listeria monocytogenes</i>	Codex Alimentarius

^a - "WARNING (U.S. only): This product has not been pasteurized and, therefore, may contain harmful bacteria that can cause serious illness in children, the elderly, and persons with weakened immune systems."

Listeria was recognized in the United States as a food borne pathogen in the early 1980s after a series of food-related outbreaks. The US National Advisory Committee on Microbiological Criteria for Foods (NACMCF) composed an analysis and recommendations to minimize the presence of listeria in foods. Major efforts by industry and regulatory agencies during the early 1990s reduced the incidence of listeriosis by approximately 50% (USDA and FSIS 2001). However, further reductions in illness have been elusive, in part because of the unique challenges associated with controlling this pathogen. Several barriers to its control include:

- Listeria is commonly found in the environment, including food processing, distribution, and retail environments, in foods, in institutions, and in the home.
- It primarily affects only a small segment of the population that has heightened susceptibility, therefore contamination is often unrecognized.
- It can grow slowly in many foods during refrigerated storage.
- It is more resistant than most bacteria to the conditions and treatments used to control food borne pathogens.

Exposure models (USFDA and FSIS 2001) demonstrate that there are five factors that affect consumer exposure to listeria at the time of food consumption:

1. Amounts and frequency of consumption of a food.
2. Frequency and levels of listeria in ready-to-eat foods.
3. Potential to support growth of listeria in food during refrigerated storage.
4. Refrigerated storage temperature.
5. Duration of refrigerated storage before consumption.

These five factors are additive, i.e. each factor pertinent to a particular food increases the risk of listeria exposure. Some research has also demonstrated that for products that receive a treatment that inactivates the listeria bacterium (e.g. heating until steaming hot) the risk of listeriosis is determined largely by the potential for recontamination (USDA and FSIS 2001) but the current literature is inconsistent regarding the efficacy of this practice.

2.2 The food supply system

The primary food contaminants causing illness are viral and bacterial pathogens, with the contamination most often introduced through poor practices by food preparation workers (BCMOH 2006a). BCMOH (2006a) found that there are three key elements to a food safety strategy:

- 1) A food inspection program;
- 2) Food borne illness outbreak investigation, food seizure, and food recall programs; and
- 3) Food safety education programs, both for the food industry and the public.

Food production and processing is overseen by a number of different agencies in British Columbia including; BC Ministry of Healthy Living and Sport (BCMHLs), BC Ministry of Agriculture and Lands (BCMAL), the Canadian Food Inspection Agency (CFIA) (supported by Health Canada and the Public Health Agency of Canada), BC Centre for Disease Control (BCCDC) Food Protection Branch, and the BC Health Authorities (see appendix 6.5 for an overview of the Food Safety Regulatory Framework).

Food products in Canada go through several steps on their path from farm to facility fork. This path contains several points where food hazards can be introduced to the product. Appendix 6.1 contains a series of flow charts (BCCDC 2008b) illustrating the various hazard entry points for five food categories, as well as indicating where controls for these hazards could be instituted.

In British Columbia, the main components of the food safety system are (BCMOH 2006a, b):

- A food premises inspection program (Environmental Health Officer inspections and third party audits (up to this date conducted by Steritech)) where inspectors conduct routine inspections to evaluate a food premises under normal operating conditions;
- A meat inspection and licensing program for Class A and B licensed abattoirs that provide equivalency to federal standards. Abattoirs are inspected on behalf of the Province by the Canadian Food Inspection Agency (CFIA);
- Dairy and fish inspection programs, where inspection is provided by the Province;
- Food borne illness investigations, food seizures and recalls;
- Food safety education for food workers and consumers (e.g. provision of training such as FOODSAFETM); and
- Surveillance and ongoing evaluation of food safety.

Within long term care facilities, dieticians and food service managers are responsible for implementing food safety measures and for ensuring nutritionally adequate menus for residents.

Measures for Pathogen Control

New measures for pathogen control such as additional preservatives (sodium diacetate in conjunction with sodium lactate) were recently (September 2008) approved by Health Canada to control the growth of bacteria on meat, poultry and fish products. Sodium diacetate has been approved in the US by the USFDA as a microbial inhibitor in foods since 2002, and is also a generally permitted food additive in Europe.

Irradiation – the treatment of foods with ionizing radiation – is another procedure which can greatly limit bacterial growth (Health Canada 2002). Irradiation of foods in Canada is currently limited to onions, potatoes, wheat, flour, whole wheat flour and whole or ground spices and dehydrated seasonings, and would require a request by industry for wider federal approval before being applied to high risk foods. In the US, irradiation is also approved for meat and poultry, with an estimation that irradiation of 50% of the meat and poultry could annually prevent an estimated 900,000 cases of infection and 350 deaths due to infections with *E.coli* 0157, *Campylobacter*, *Salmonella*, *Listeria* and *Toxoplasma* (Nelson et al 2008).

Local Food Procurement

An emerging practice in health care is to support food purchasing decisions that can foster public and environmental health, and social and economic equity. Locally sourced food is often considered by the public to be safer, more environmentally friendly and more nutritious. Whatever the source, good food safety practices are essential and facilities are reminded to purchase food from approved sources, such as provincially licensed and inspected meat processors. BC has experienced outbreaks associated with locally produced food products as with imported food products. In addition, recent work on salmonella cases in BC has suggested that the entry of ungraded eggs into the food chain may pose a risk to health.

Established and successful models of local food procurement policies exist within Canada at some post secondary institutions, e.g. Mount Allison University where the university developed a local procurement policy and then incorporated the requirement into the Request for Proposal for the food service operation. Specific requirements worth noting were that suppliers had to be licensed and federally inspected as per the contract recipient's (Aramark) food safety requirements. Internationally, among other well recognized health institutions, Kaiser Permanente, the largest health maintenance organization (HMO) in the US, has distinguished itself since 2005 as a leader in recognizing the need for advancing and implementing a sustainable food system approach. Their policies apply to in-patient food, cafeterias, coffee carts, vending machines catering and farmer's markets.

Local procurement policies can influence the local food system including development of supply co-ops that would be able to meet both the demand and the stringent food safety standards. It is important to recognize that locally grown is not necessarily synonymous with safe, healthier foods, or safe farming practices. Ensuring the locally grown food meets and/or exceeds the minimum food safety standard is critical to support the long term sustainability of introducing this practice into health care.

Challenges to local food procurement include budget constraints, large product volume facility needs aligning with small local suppliers, reliability of supply, lack of administrative buy in, and lack of staff skill and support. With increased use of local foods, fewer processed foods will be used, meaning more "from scratch" preparation and cooking is required.

However, local food procurement is something that is worth further examination in the future as it has the potential, if economically viable and bacteriologically safe, to support local food production and employment while reducing environmental impacts. Hospitals and hospital systems can realize their ability to use their purchasing dollar to effect change in the marketplace and language can be written into contracts that support local procurement. Promoting transparency in food production practices and advocating for public policies that support a localized healthy food system is a current trend in health care. Moving in this direction is worth considering given the potential for offering more control over both the food and safety standards and practices in food production and distribution of the food that enters into the hospitals and other health care institutions.

2.3 Food in facilities

Facilities that serve food to the people under their care include hospitals, long-term care facilities (LTCF), assisted living residences and child care facilities. By their nature these facilities are serving food to vulnerable populations (Figure 1). Residence in a LTCF is a risk factor for food borne illness and diarrhea-associated mortality among the elderly (Nelson *et al.* 2008). However, facilities which prepare more foods with inherently low risk (e.g. canned foods) pose less risk than facilities that frequently serve foods requiring complex preparation with multiple steps or that serve inherently higher risk foods (Table 1).

In the United States, the U.S. Department of Health and Human Services has recommended that elderly persons avoid ready-to-eat processed meats (e.g. luncheon deli meats and hog dogs) unless they are heated until steaming, raw (unpasteurized) milk, and soft cheese made from unpasteurized milk. In addition, food safety measures including pasteurization and irradiation are recommended. Thermal pasteurization is commonly used, while irradiation has so far found limited use. Some food safety measures occur at the institution, e.g. heating until steaming hot, while others, such as irradiation, are conducted at the processing plant.

Despite these recommendations, a survey (Nelson *et al.* 2008) of 865 LTCFs in the United States revealed that only three LTCFs completely followed national recommendations for prevention of listeria contamination (use of pasteurized and irradiated foods as well as food handling protocols such as heating ready-to-eat deli meats until steaming hot before serving). Nine percent of LTCFs reported serving soft cheeses made from unpasteurized milk and few reported always heating deli meats until steaming hot before serving (19%, 13%, and 11% for those LTCFs serving roast beef,

turkey and ham, respectively) (Nelson *et al.* 2008). A similar survey has not been conducted for BC facilities.

European Union (EU) guidelines require that *L. monocytogenes* be at, or below 100 CFU/g during the shelf-life of ready-to-eat foods, while the British Sandwich Association Manufacturer Code of Practice recommends a target level of <10 CFU/g for listeria in sandwiches (Health Protection Agency 2008). In a study conducted in the North West of England examining the contamination of cooked meats sliced in retail stores, evidence demonstrated that *L. monocytogenes* was present in 7.3% (82/1127) of products tested on the day of purchase. Of these, five had levels ≥ 100 CFU/g of listeria. Of the 82 samples that had the bacterium present on the day of purchase, a further 26 had counts ≥ 100 CFU/g after storage at 6°C for 48 hours (range of 100-2000 CFU/g) (ACMSF 2008).

The Canadian policy (Health Canada 2004) on listeria contaminated foods is based on the principles of Hazard Analysis Critical Control Point (HACCP). In the policy, priority is placed on ready-to-eat foods which have been causally linked to listeriosis outbreaks and those that support growth of *L. monocytogenes* with refrigerated shelf-lives greater than 10 days. International experts participating in the World Health Organization's Informal Working Group on Food borne Listeriosis (WHO 1988) concluded that "the total elimination of *L. monocytogenes* from all food is impractical and may be impossible". This, combined with the presumed high minimum infectious dose for listeriosis has led Health Canada to conclude that there is little justification for taking general action against products in which listeria cannot grow if the level is at or below 100 CFU/g, and if the product is processed under good manufacturing practices (GMPs). Action levels for the detection of listeria depend on the risk of the food, and on the target consumer (Health Canada 2004). If the food is considered high risk, and is likely to be consumed by a vulnerable individual, then action levels may be lower than 100 CFU/g (Table 2).

Table 2. Compliance criteria for *L. monocytogenes* (Lm) in ready-to-eat (RTE) foods (Adapted from Health Canada 2004)

Category	Action level for Lm	GMPs Status	Nature of Concern
1. The list presently includes: soft cheese, liver pâté, unacidified jellied pork tongue, hot dogs/wieners, cold smoked rainbow trout, and process deli turkey meat.	Detected in 50g	n/a	Health Risk 1
2. All other RTE foods supporting growth of Lm with refrigerated shelf-life >10 days (e.g. vacuum-packaged meats, modified atmosphere packaged sandwiches, refrigerated sauces).	Detected in 25g	n/a	Health Risk 2
3. RTE foods supporting growth of Lm with refrigerated shelf-life ≤10 days (e.g. packaged salads) and all RTE foods not supporting growth (e.g. ice cream, hard cheese, dry salami, salted fish, breakfast and other cereal products).	≤ 100CFU/g	Adequate GMPs	Health Risk 3
	≤ 100CFU/g	Inadequate, absent or no information on GMPs	Health Risk 2
	> 100CFU/g	n/a	Health Risk 2

Health Risk 1: The health risk identified represents a situation where there is a reasonable probability that the consumption/exposure to a food will cause adverse health consequences which are serious or life-threatening, or where the probability of a food borne outbreak situation is considered high.

Health Risk 2: The health risk identified represents a situation where there is a reasonable probability that the consumption/exposure to a food will cause temporary or non-life threatening health consequences, or where the probability of serious adverse health consequences is considered remote.

Health Risk 3: This represents a situation where no health hazard has been identified and where there is a reasonable probability that the consumption/exposure to a food is not likely to result in any adverse health consequence. The situation identified may be an indication of a breakdown in Good Manufacturing Practices (e.g., sanitation, quality issues, etc.) or of some other relevant factor (e.g., food containing non-permitted nutrients or food additives, nutrients that do not meet label claim, health-related labelling infractions, etc.) which does not pose a health risk.

Numerous foods have been associated with food borne infections and the list is growing (BCMHLs 2008a). Recent studies have confirmed that there are challenges in complying with existing guidelines for food service safety. These challenges include the ability to keep up with the list of “at risk” foods, staff knowledge of safe food handling practices, trust issues related to food processing and biotechnology, cost limitations due to current meal day allowances, facility staffing ratios, and the unique nutritional requirements and food preferences of facility residents (BCMHLs 2008a).

2.3.1 Food and nutrition in care facilities

In addition to having some inherent risk (see Section 2.1), bulk ready-to-eat foods may also pose nutritional concerns, for example the sodium and nitrate contents of deli meats and other smoked or cured food products has prompted questions regarding their suitability for use with LTCF residents. The World Cancer Research Fund (2007) states that processed meat should be avoided. Such recommendations raise concerns over the nature of diets and nutrition in LTC facilities as it is recognised that malnutrition may be present in the frail elderly and may in and of itself further contribute to vulnerability.

BC specific data were not available for review; however evaluation of available data on LTCF menus in Ontario and Saskatchewan has revealed that most did not meet the Dietary Reference Intakes for many key nutrients such as calories and protein (BCMHLs 2008a). The Provincial Health Officer proposes to review residential nutritional care in a future report.

A wide variety of high quality foods is one way to ensure a better intake of micronutrients and to stimulate appetite of residents. In Ontario, however, the dollar allowance per patient meal day in LTCF was shown to place limitations on menu content and variety and, if generalized to other provinces, may be a factor in the reported prevalence of malnutrition in residential care (40%-45% based on data from Saskatchewan, New Brunswick and Ontario) (BCMHLs 2008a).

Some therapeutic diets may also contribute to poor nutrition intake of residents. The American Dietetic Association (Niedert 2005) has prepared a position promoting liberalization of therapeutic diets in LTCF. They state that “quality of life and nutritional status of older residents in LTCF may be enhanced by liberalization of the diet prescription”. The ADA also states that efficacy of using antihypertensive treatments in the elderly is in question, as is the use of severe sodium restriction in congestive heart failure.

In summary, with consideration of the degree of frailty and limited life span of elderly residents of LTCF, and moderate use of the foods in question, restriction of high sodium and nitrate-containing foods is considered of little or no benefit and limits residents' enjoyment and intake of food. Individual nutritional assessment by a dietitian should identify those residents who may require these restrictions, leaving the majority able to enjoy and benefit from more appealing and tasty foods (BCMHLs 2008a).

2.3.2 Choking and allergies in care facilities

Texture modifications are an essential part of menus in long term care facilities as many residents require either pureed (12%) or minced (21%) diets (BCMHLs 2008a). Chewing difficulties may be associated with poor dentition or cognitive problems, or swallowing problems secondary to stroke or neurodegenerative diseases such as Parkinsonism. Mincing or pureeing of menu items provides opportunities for recontamination of food if there is improper food handling techniques, and there have been reported cases of food borne illness associated with pureed foods and poor food handling (BCMHLs 2008).

Allergies are an additional possibility in adult residents of hospitals, assisted living, and long term care facilities, with one study of 109 people living in nursing homes/LTCFs finding specific IgE to food allergens in 24.8% of the group studied (Bakos *et al.* 2006). Issues with allergic residents include identification of food allergies in individuals who may be unable to recall or communicate their allergic status, and the frequently higher cost of food products for individuals with allergies and the preparation of allergy-free dishes for specific residents (e.g. milk-free mashed potatoes).

2.4 Food security

Food security is defined as the ability to obtain a safe, personally acceptable, nutritious diet and is important for individuals and families, whether they live independently or in care facilities. Removal of the suspect high-risk foods may limit familiar foods for residents, thus affecting their perceived food security. This concern has merit as food quality and variety contribute to residents' quality of life and satisfaction with their care. References to "fresh", "homemade", "comfort", and "familiar" foods are common when measuring quality of life. Elimination of these foods can have a significant negative impact on residents' intake and nutritional status (BCMHLs 2008a).

2.5 Food in child care facilities

Healthy children do not have an increased vulnerability to listeria infection (Table 1), and to date, there have not been any reports of healthy children affected by the recent outbreak. Immune compromised children and newborn babies do have an increased risk of listeriosis, as well as other food borne illnesses.

Children have other food safety issues unrelated to food borne pathogens. Allergies to food products, primarily nuts/peanuts, eggs, and dairy have been increasing in children (Gupta *et al.* 2008) and requires care to ensure allergic children do not consume the offending food, or food that may have been cross-contaminated with the allergen. Young children are also at increased risk of choking (MOH 2007a, b) from certain food groups, including:

- Whole grapes
- Whole hot dogs
- Peanuts and other whole nuts
- Popcorn
- Hard candy

The risk of choking generally decreases as the child gets older. In child care facilities with a range in age of the children in care, it can be difficult to prevent the younger children from consuming foods supplied to the older children.

Child care facilities have several options for meals and snacks:

- Requiring that parents send children with food for all snacks and meals;
- Providing all snacks and meals to all the children; or
- Some combination of the above (e.g. parents provide lunch, facility provides snacks).

There are advantages to each option. If the child care facility provides all food to all the children in their care, then they are able to control the type of food that is served and could, in theory, ensure that no foods are served that could be an issue for allergic children or for choking. However, this puts the responsibility for food safety onto the facility. If a child care facility requires the parents to send food for the child to consume, the parents assume responsibility for the safety and proper packaging of the food they send. However, the daycare now has to contend with the common practice of children sharing food, possibly resulting in a child consuming food to which they have an allergy or intolerance.

In BC, if a daycare has, or may have, served food to children which has been subsequently recalled, the licensee should advise the parents so that they may take appropriate steps with respect to their children's health. This could include contacting the local health authority for advice, taking the child to the doctor, or monitoring the child for signs of illness. It would also be appropriate for the licensee to advise the parents that all recalled food has been discarded or removed from the facility's food stocks.

3.0 Main Findings

3.1 Literature Reviews

A literature review (Galanis and Patrick 2008) (Appendix 6.3.1) examining the risk of listeriosis for different ages and conditions found three different categories that increased the risk.

- 1) **Age:** The risk of listeriosis increases with age, starting around age 65 or 70 years. In BC the risk increases 20-fold in people aged 70 years or older. Even with the increased relative risk, the absolute risk of listeriosis is very low as compared to most other food borne diseases (see Table 3).
- 2) **Pregnancy:** The risk of maternal listeriosis increases during pregnancy, particularly in the third trimester. As compared to the general population, pregnancy increases the risk of listeriosis by 2 to 17-fold. Most infected pregnant women have mild illness unless they have another underlying illness. However, about 20% of cases result in spontaneous abortion or neonatal death. About 2/3 of surviving infants develop neonatal listeriosis (presenting as sepsis or meningitis).
- 3) **Immunocompromising conditions and medications:** Medical conditions and medications that decrease T-cell mediated immunity increase the risk of listeriosis. The incidence of listeriosis among individuals with cancer or receiving corticosteroids can be high, with an increased risk anywhere from 2 to 2584-fold. Transplants and blood-related cancers confer the greatest risk. HIV/AIDS seems to rarely lead to listeriosis since the advent of Highly Active Anti-Retroviral Therapy (HAART) and trimethoprim-sulfamethoxazole prophylaxis. Pre-HAART, HIV/AIDS increased the risk of listeriosis by 865-fold. Other cancers, dialysis, liver disease and diabetes all confer a moderate risk of infection, greater than that caused by advanced age and pregnancy.

Table 3. BC Enteric Disease Rates (per 100,000 population) 2006 Annual Summary

Disease	BC Rate (all ages)	BC Rate (60 years+)
Campylobacteriosis	36.9	37.6
Listeriosis	0.3	1.3
Salmonellosis	16.4	11.6
Shigellosis	4.0	2.3
Verotoxigenic E. coli	3.5	3.9
Yersiniosis	17.2	21.2

Source: 2006 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, publication date July 2007.

A second review (Appendix 6.3.2) summarized important food borne illnesses for health care facilities (McIntyre 2008). This review states that food can be contaminated at the place of pre-processing before it arrives at a health care facility or it can be contaminated within a facility (usually by kitchen staff). Care facilities in BC that are required to have a food premises permit need to develop food safety plans that focus on critical control points in the processing of food – points at which a hazard can be prevented, minimized or eliminated. Loss of control at these points will result in an unacceptable risk of a hazard being created with no further opportunity to control the risk (i.e. no kill step or other pathogen control step at a later point). With facilities commonly using cook-serve and cook-chill-reheat menu items, the critical control points generally begin with the first cooking stage. With foods that will not receive cooking, every step in processing is a critical control point. Foods that are ready-to-eat (RTE) are identified as presenting a greater risk of a health hazard for vulnerable population groups, primarily because there is opportunity for contamination to occur and no opportunity for a “kill step” (e.g. heating) before consumption.

Listeria monocytogenes is present throughout the environment and up to 5% of humans may carry this organism in their intestinal tract without any symptoms. The minimum dose required to cause listeriosis is not known, but it is not considered to be low, even for vulnerable populations. However, listeriosis is a concern because the organism is capable of growing in a fairly wide range of conditions (e.g. range of pH, higher salt concentrations, and wide temperature range) and mortality rates can exceed 25% among susceptible groups.

3.2 Documentation Review

This section contains a summary of various existing policies, findings, recommendations, and/or legislation.

- a. Steritech audits, Environmental Health Officer inspections

Steritech Audit

Steritech is an independent company hired under a term certain contract by the Regional Health Authorities (RHAs), beginning in 2006, to measure the levels of food safety and sanitation practices being carried out within health authority-operated hospitals and long term care food service facilities using a standardized tool. This tool was designed to establish a province-wide and uniform benchmark for measuring the potential risk associated with food borne illness (Steritech 2006). Each facility audited by Steritech is awarded a score out of 100 based on three classifications categorized by the level of risk of the particular deficiency. These classifications are as follows:

- Critical (worth 5 points) – identifies the most important items requiring *immediate* corrective actions to maintain proper food safety practices and reduce the risk of food borne illness
- Critical support (worth 3 points) – identifies the most important items directly related to the presence of equipment and procedures that support the critical issues identified within the audit and also require *prompt* corrective actions
- Non-critical issue (worth 1 point) – identifies the most important items directly related to food service operations maintenance and cleanliness issues which require *prompt* corrective actions.

Each facility starts the audit process with a “perfect” score. If a line item is deficient, then the points for the item are subtracted from the score. The score results are then placed into one of three category ratings; excellent, good, or fair. In the 2006 evaluations, 149 facilities were audited. Five of the six health authorities averaged scores greater than 90%, i.e. an “excellent” rating. The fifth health authority (Northern Health) scored 89.1%, marginally below “excellent” (Steritech 2006).

An analysis (BCCDC 2008c) of the Steritech Public Audit Report (Steritech 2006) indicates that the risk ranking of the line items generally reflects an accurate level of risk if the line item is deficient. However, an analysis of some line items did suggest that some of them should be re-classified into a different risk ranking. For example, Line Item 210; food products not held or sold past expiration date. Service of date-expired meats to immune compromised populations constitutes a high risk and

should under those circumstances be classified as a critical deficient food safety item. In general, however, the various lists' respective line items reflect a relatively accurate level of risk if the line item is deficient. Analysis of the risk rankings found some should be re-classified. As such, it would be prudent to conduct a line by line re-evaluation of all line items regarding their level of risk. As well, altering the scope of the audit program should be considered to include other hazards into the audit tool, such as serving of high risk foods, allergen control, and choking hazards.

The review (BCCDC 2008c) also found that, depending on the circumstances, the scoring system may underestimate the actual level of risk. For example, Line item 112; potentially hazardous foods cooked to proper internal temperatures, if the auditor finds a potentially hazardous food is not being cooked to a proper internal temperature, then 5 points are not added to the final score (out of a potential total of 225). A lowering of 5 points represents 1.96% diminution of final score. If this were the only deficit a final score of 98+% could be achieved- a very high Excellent Score. However if the facility was cooking raw animal foods at temperatures well below those required to destroy pathogens, then from a risk based food safety perspective, this facility would be considered extremely high risk. This suggests that deficiency in certain critical line items should result in audit failure, not just reduction in score.

Current policy is for Steritech auditors to notify facility operators in advance of the audit. This policy has advantages and disadvantages, and is to allow the operator to be present during the audit, ensuring consistency between facility inspections and allowing for a valid comparison of scores between facilities and between RHAs.

The Steritech tool, like many other inspection tools, provides a food safety “snap shot” of the facility for a single day of the year. It is not necessarily reflective of the other 364 days of the year. As the tool is currently designed, there is a potential inherent weakness with regard to measuring the true level of risk of a facility. The simple number of deficiencies in a facility is not necessarily a true measurement of risk for the facility but rather a point in time assessment of food safety compliance. A deficiency in a single line item can, depending on the circumstances, result in an imminent health hazard. Conversely, deficient line items may not necessarily indicate a high risk situation. To accurately measure the risk of a facility, it is necessary to provide more than a “count” of the deficiencies. It is necessary to perform an analysis of the deficiencies that are found to determine whether they are “very high risk” or conversely “very low risk”. The current audit tool does not permit

the auditor to put more or less “weight” on a deficient item depending on the situation.

Environmental Health Officer Inspections

Environmental Health Officers have powers under the Health Act and are employed by the health authorities to conduct routine inspections of food premises under normal operating conditions. The inspection assesses compliance with legislated health and safety standards which is required for facility managers to maintain operating permits (BCMOH 2006a). Since 1998, public health inspectors have been using a risk-based inspection approach with food premises. Like the Steritech audit, this is a snapshot of activity in the facility kitchens.

The RHAs are also using a risk assessment tool to identify which food premises have a higher “inherent” risk rating, to assign inspection frequencies. The intent is to determine which facilities (or other food service establishments) pose a higher risk because of the nature of the food they prepare, the attitude and abilities of staff working in them, and the population served. For example, facilities which prepare only foods with inherently low risk (e.g. canned foods) receive a lower risk score. Those facilities which prepare inherently higher risk foods (meats, custards) receive a higher risk score. Also, complex food preparation with several critical control points is inherently higher risk than very simple food preparation processes (e.g. microwave reheating of canned foods).

Steritech audit results are routinely shared with Environmental Health Officers, but the two systems of inspection operate independently of each other.

b. Policy Documents

A number of policy documents were also reviewed that outline the expectations for ensuring food safety. These included licensing and health inspection policies.

Delivery of Safe Food Standards and Procedures for Recreation Therapy Departments (VIHA 2008) and Delivery of Safe Food Standards and Procedures for Nursing Departments (VIHA 2007)

The purpose of these policies is to minimize potential risks of food borne illness by following safe food handling methods as outlined in the Food Premises Regulation and HACCP guidelines. The recognized standards for the production of safe food from all VIHA operations and departments include, but are not limited to:

- Use of professional, qualified personnel;
- Provision of safe, quality food and meal service;
- Individual food texture considerations;
- Establishing and maintaining food safety standards;
- Appropriate serving temperature;
- Daily maintenance of all appropriate food quality and food safety audits;
- Developing specifications of quality foods purchased
- Ensuring there is appropriate equipment and space to safely store, prepare, cook and serve food;
- Planning food delivery systems that ensure the taste, temperature and texture of food is maintained during the delivery and service process;
- Developing systems to ensure that food waste is handled safely and appropriately; and,
- Planning a dining program that meets the nutritional and social needs of residents.

Policies for VIHA staff and volunteers who will be handling food include:

- All VIHA staff and volunteers who prepare or serve food must be trained and qualified or must be supervised by trained and qualified persons.
- All persons handling food for client consumption must follow certain personal hygiene guidelines, e.g. all personnel must be free from communicable diseases and infections, hair and clothing must be clean and tidy, personnel must avoid indiscriminate coughing and sneezing, scratching and picking, and putting fingers in hair, mouth, ears or nose.
- Personnel involved in food preparation must possess FOODSAFE Level 1 certification, or operate under the supervision of a staff member possessing FOODSAFE Level 1.

- When a facility wishes to prepare and serve a high risk food, a food safety plan must be developed and followed.
- All food waste must be disposed of in a safe and appropriate manner. Any high risk foods left over after staff events or donations from families must be disposed of at the conclusion of the event.
- Any department or persons providing meals or food to residents are also responsible to ensure all diets are followed. This includes, but is not limited to, food allergies, textures, therapeutic diets, dislikes and the provision of special therapeutic plates and utensils.

Community Care and Assisted Living Act. Adult Care Regulations

These regulations are designed to protect the health and safety of people being cared for in licensed facilities. Nutrition and food service content includes:

- Community care facilities must develop a nutrition care plan for each new person in care within 2 weeks of admission;
- A licensee must ensure that meals and snacks are nutritious, of adequate caloric value and fulfil the requirements of the person in care's nutrition care plan and of any therapeutic diet ordered by the person's primary health care provider;
- A licensee must ensure that staff responsible for food services have the training necessary to ensure that food is safely prepared and handled, and that they receive on-going education regarding food services, nutrition, and, where required, assisted eating techniques.

c. Other BC/Canadian Policies

Meals and More Manual (Health Protection 2008)

This manual includes recommendations for licensed residential homes (providing care to 24 or fewer persons) on:

- Proper food storage, e.g. using chilled ingredients and keeping refrigerators and freezers at the proper temperatures.
- Thawing foods, i.e. in the refrigerator whenever possible.
- Food preparation; handle and cook food properly, use proper hand washing and sanitation practices.
- Ensure that meats and poultry are adequately cooked when initially prepared.
- Serve hot foods hot and cold foods cold.
- Minimize the risk of cross-contamination at all steps.

- Education of food workers: FOODSAFE may be recommended but is not mandatory for small group homes.

d. Food Safety for Children

BC Health Planning (2003) booklet on Preventing Illness in Child Care Settings

Recommendations include:

- All staff consider taking FOODSAFE or equivalent education.
- Wash hands before preparing food and after changing diapers or going to the toilet.
- Perishable foods must be refrigerated at or below 4°C; refrigerator temperature must be monitored.
- Cooked foods must be served immediately or kept above 60°C.
- Thoroughly cook all foods derived from animal sources.
- Thaw meat in the refrigerator, not on the counter.
- Wash and sanitize all cutting boards, counters, and utensils to prevent cross-contamination.

Canadian Paediatric Society (2008)

This 2008 publication by the CPS contains many valuable recommendations for feeding children in child care settings. A selection is presented here; for the complete list of recommendations see the CPS reference.

Feeding recommendations include guidelines for children.

Food allergies:

- An allergic reaction can be very sudden and severe, even life threatening.
- It is critical to take every reasonable precaution against exposure to the trigger food, and to be ready to respond to an allergic reaction.

Choking:

- Minimize the risk of choking by sitting down for snacks and meals and supervising children while eating.
- Foods that may cause choking especially for children under 4 years old are hard and/or round foods (e.g. hard candies, whole grapes), foods with pits, seeds, bones, sticky foods (e.g. peanut butter), chewy foods, any foods served with toothpicks or skewers.
- Reduce the risk of choking by grating raw vegetables, slicing grapes, removing pits or seeds, gently cooking or steaming hard vegetables, spreading sticky foods thinly on cracker or toast, cutting wieners lengthwise and into small pieces.

Preventing food borne illnesses:

- Four essential steps to prevent food contamination; Clean, Separate, Cook and Chill.
- Ensure proper food storage, including foods provided by parents.
- Certain foods require special care when prepared, served and stored because they are particularly susceptible to microbial growth (raw and cooked meats, meat spread, processed meats, fish and shellfish, canned meats or fish, poultry and eggs, sprouts, leafy greens, whipped cream, milk and milk products, dressings, mayonnaise, gravies and sauces).
- Do not serve unpasteurized milk or cheeses or any home-canned or “preserved” foods in a child care setting.

Food Flair for Child Care (BCMHLs 2008b)

This publication is a resource for early learning practitioners and includes recommendations regarding food safety, choking and allergies for children.

Food Safety:

- Buy food from approved sources such as commercial retail suppliers. Check packages and use food before the “best before” date.
- Follow the four steps to reduce the risk of food borne illness; Clean, Separate, Cook and Chill.
- Ensure good hand washing both by child care providers and by the children before eating.

Food Allergies:

- Gather information about new children and any potential allergies by asking the parents if their child has any known food allergies, and whether they’ve ever eaten foods that commonly trigger allergies (e.g. eggs, peanuts).
- Complete an anaphylaxis emergency plan for each child with severe food allergies.
- Make sure new staff and volunteers are informed about children’s food allergies.
- For children with severe food allergies, avoid exposing the child to allergens through cross-contamination of their foods, or of utensils and toys.
- Ensure epinephrine is kept in easily accessible locations and all staff and care providers know where it is kept and how to administer it.

Choking:

- All care providers should have training in CPR, which provides information on what to do if a child chokes.
- Never feed babies using propped bottles.
- Insist that young children sit down to eat and drink. Never feed a child who is laughing or crying.
- Always supervise young children when eating, and cut food into pieces that are safe for the smallest child.

e. Other policies and practices

US Department of Agriculture and US Department of Health and Human Services (2001)

US goals are to further decrease the amount of listeria in food products.

Recommendations to industry and regulatory agencies include:

- The need for strategies to decrease the rates of recontamination during the manufacturing and marketing of ready-to-eat foods
- Industry and regulatory agencies should identify the key aspects of sanitation standard operating practices, good manufacturing practices, and other process control and process verification systems, such as HACCP, that prevent the recontamination of ready-to-eat foods, particularly those that support the growth of *L. monocytogenes* at refrigerator temperatures.

US Food and Drug Administration 2001 Food Code

The US Food Code is a reference document for regulatory agencies that ensures food safety in food service establishments, retail food stores, other food establishments at the retail level, and care facilities, such as nursing homes and child care centres. This code introduced new precautions for vulnerable populations, including elderly residents of LTCFs. One of the recommendations was to substitute pasteurized shell eggs or egg products for raw shell eggs in the preparation of foods such as Caesar salad, hollandaise sauce and mayonnaise. In addition, pasteurized shell eggs or egg products are to be used in recipes in which more than one egg is broken and eggs are combined, except when: the raw eggs are combined immediately before cooking for one consumer's serving at a single meal, or when the raw eggs are combined as an ingredient immediately before baking and are then cooked thoroughly. This would reduce the chance of food borne illness in connection with breaking and combining a large quantity of eggs in preparation for individual servings of egg products as consumers order a meal.

In LTCFs, the use of pasteurized eggs has reduced the number of deaths due to infection with *Salmonella*.

US Food and Drug Administration 2005 Food Code and Supplement to the 2005 Food Code (October 2007)

Sections of the 2005 Food Code relevant to this report includes (note that not all exceptions and/or subcategories have been reproduced here):

- Potentially hazardous food (time/temperature control for safe food) that is cooked, cooled, and reheated for hot holding shall be reheated so that all parts of the food reach a temperature of at least 74°C (165°F) for 15 seconds;
- When potentially hazardous food is reheated in a microwave oven for hot holding, all parts of the food must reach a temperature of at least 74°C (165°F) and the food is rotated or stirred, covered, and allowed to stand covered for 2 minutes after reheating;
- Ready-to-eat food taken from a commercially processed, hermetically sealed container, or from an intact package from a food processing plant that is inspected by the food regulatory authority that has jurisdiction over the plant, shall be heated to a temperature of at least 57°C (135°F) for hot holding;
- A food establishment that packages potentially hazardous food using a reduced oxygen packaging method shall ensure that there are at least two barriers in place to control the growth and toxin formation of *Clostridium botulinum* and the growth of *Listeria monocytogenes*;
- Ready-to-eat food held using time only as the public health control can be served at any temperature upon a consumer's request;
- Information to explain the four separate time-temperature storage options available for food packaged using cook chill or sous vide packaging without a variance, using the growth parameters of the pathogens of concern as the basis for limitations.

4.0 Conclusions and Recommendations

4.1 Overall Food Safety

As a result of this review and the data available on episodes of food borne illness in facilities, the conclusion is that the vast majority of foods consumed in BC health care institutions and licensed and registered facilities are safe for the vast majority of patients, residents and attendees for the vast majority of the time.

However, some foods that are considered high risk foods for vulnerable individuals should not be served, or served only if they have been subject to food preparation steps that will ensure safety. Specific details are in the following sections.

In addition, those responsible for food acquisition, preparation and service should ensure adherence to existing regulations and guidelines for the provision of safe food.

4.1.1 Food Handling

In British Columbia, there are extensive guidelines and regulations designed to ensure that the general public and persons in hospitals, and residents in assisted living residences and long term care facilities receive safe food (See Appendix 6.5). However, recent studies (BCMHLs 2008a) have confirmed that there are challenges to compliance with the guidelines. These challenges include the ability to keep up with the increasing number of “at risk” foods, staff knowledge of food and safe-handling practices, the unique nutritional requirements and food preferences of the residents and the constraints of working to a budget.

To address the issue of challenges to compliance with food handling guidelines, food safety controls should be in place along the entire food safety chain (i.e. at the farm and processing plant, at distribution centres, and within the food preparation facility, and food service protocols). Upon review of food safety issues, additional recommendations were identified to supplement and emphasize the existing ones, and assist in filling the gaps in safe food provision. These recommendations are listed in the following sections.

Facilities should ensure that:

- All meat products are purchased from federally registered, provincially licensed or health authority approved processing plants.
- If unfrozen foods frequently approach or exceed the expiry date before consumption, then smaller packages should be purchased.
- When preparing eggs, they are cooked to pasteurization temperatures (minimum 63°C/145°F for at least 15 seconds). If this temperature will not be reached (e.g. soft boiled eggs) then pasteurized eggs or egg products should be used. Dishes containing raw eggs should be cooked to a minimum temperature of 74°C/165°F.

Purchase and use of foods (meat, poultry and fish products) treated with recently approved preservatives (sodium diacetate in conjunction with sodium lactate) needs further study before widespread adoption as there are concerns about increasing the sodium-based food additives to the food supply.

If irradiation is approved for use in ready-to-eat (RTE) foods, use of treated foods would greatly decrease the pathogens present. There may, however, be resistance by the general public to consumption of food items that have been irradiated due to the negative association with “radiation”.

The listeriosis risk to vulnerable groups could be further reduced were regulators to require that growth inhibitors be added to pre-packaged RTE meats or that irradiation be approved and mandatory for pre-packaged RTE meats served to vulnerable populations in institutions.

4.1.2 Workers who prepare, serve or handle food

The food preparation, serving, and handling workers are essential to food safety as they are directly responsible for preparing and providing food to facility clients/patients.

- All facilities should maintain records of staff completion of appropriate food safety training as required by legislation.
- An appropriate (e.g. an abbreviated version of FOODSAFE Level I), short, self-learning module should be developed in several languages and made readily available to all staff that prepare or handle food and are not otherwise required to have specific training. Facilities should be diligent in ensuring the module is completed by all staff.
- Hepatitis A vaccination should be provided to all food workers who prepare or handle food.
- Facility food preparation workers should be trained in preparing texture-modified foods for residents with choking risks. (existing expectation)
- Facility food preparation workers should be trained in preparing allergen-free meals, e.g. how to prevent cross-contamination of foods. (existing expectation)
- Those staff responsible for providing patient care during meals or overseeing the activity of volunteers should maintain currency in allergy and choking response protocols.

4.2 Vulnerable People and Risk Reduction

Guidelines for serving high risk foods should be consistent across health authorities for the different types of facilities, e.g. all acute-care hospitals should have consistent guidelines; all care facilities should have consistent guidelines, and all assisted living residences should have consistent guidelines appropriate to their status as a resident's home.

Upon admission to a residential care or assisted living facility, the resident assessment and care plan should specifically identify the individual's risk factors and/or vulnerability to food borne illness, in addition to existing assessments for risk of choking and known allergies. For individuals admitted to facilities where individual nutrition plans are not possible, then high risk foods, (see 4.1) should not be served at all in high risk settings (e.g. certain acute care wards such as prenatal wards).

When deli meats are served, they should be provided in moderation. A varied diet will decrease the likelihood of listeriosis, and will assist in improving the nutritional value of facility menus.

4.2.1 Immune compromised and other conditions

Immune compromised individuals have an increased risk of listeriosis ranging from 865X (under treated AIDS patient) to 2584X (transplant patients), making them an extremely vulnerable group. In addition, nutrition for these vulnerable groups is critical, as adequate nutrition helps to strengthen the body and its immune defences.

Other medical conditions may increase vulnerability to food borne illness. These conditions include liver disease and iron overload disorders (see Appendix 6.3.1, Tables 4, 5).

Hospitals, residential care facilities and assisted living residences should ensure that immune compromised individuals (i.e. patients/residents with bone marrow transplants, solid organ transplants, oncology patients and patients with haematological malignancies, chronic renal failure on dialysis and undertreated HIV/AIDS) and individuals with other immunocompromising conditions (e.g. liver disease, iron overload disorders) are served a diet intended to reduce the risk of foodborne illness. This diet should exclude altogether the high risk foods such as:

- Raw (unpasteurized) milk (illegal in BC) or milk products
- All soft cheese such as Brie, Camembert, feta, blue veined and Hispanic-style fresh cheeses
- 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, and ready-to-eat meats prepared in bulk offsite should not be heated, other than in individual portions, and served until further review has occurred.
- Refrigerated pâtés or meat spreads, unless from a canned source as the canning process pasteurizes the food.
- Refrigerated smoked seafood and fish, unless in a cooked dish or from a canned source.
- Store-bought, pre-made sandwich fillings, such as ham salad, chicken salad, egg salad, unless the ingredients of concern are known to have been processed as recommended to reduce the risk of foodborne pathogens.
- Raw or undercooked meat, poultry and fish

If it is not possible to provide individual meal plans (e.g. in an acute hospital setting) then high risk wards, or the entire facility if necessary, should avoid the high risk foods listed above.

4.2.2 Facility Residents Over the Age of 65 (Non-immunocompromised)

As an individual ages, their risk of listeriosis increases. When compared to healthy individuals younger than 60 years of age, BC data indicates that persons aged 60-69 years have a 10X increased risk, while those aged 70-79 years have a 20X increased risk.

When deli meats are served to elderly residents of facilities, they should be provided in moderation and in line with the recommendations for risk reduction. A varied diet will decrease the likelihood of listeriosis, and can assist in improving the nutritional value of facility menus.

While the literature suggests that persons over the age of 65 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, this review determined that it would be impractical for hospitals to attempt to deliver separate meal plans for people over 65 except for those referenced in 4.2.1, and it would not reduce their risk below that to which they are exposed in the community. Furthermore, a complete hospital ban on ready-to-eat deli meats from inspected, approved sources is also undesirable.

Given that facilities are the residents' home (i.e. residential care or assisted living), unless the resident is immunocompromised as in 4.2.1 above, complete avoidance of higher-risk foods is not recommended in order to maintain an acceptable quality of life for the residents. Additional considerations for these facilities are:

- The recommendations in Section 4.1.1 should be followed to reduce the risk of foodborne illness.
- In the case of an outbreak of foodborne illness, greater caution is warranted, i.e. high risk foods should be avoided altogether.
- Residents may request to either eat, or avoid, the high risk foods. Regardless of their immune status, if this type of dietary request is made, then the requested diet may be provided at the discretion of the facility, ensuring that the resident is aware of the potential risk.

4.2.3 Pregnant Women in Facilities

Pregnant women, especially in the third trimester, are particularly susceptible to infection with listeria, exhibiting a 14X increased risk. Although symptoms may be mild, and resolve without therapy in the woman, outcomes such as miscarriage, stillbirth, or illness in the newborn may occur (Taylor *et al.* 2008). For most women, avoiding listeria may mean avoiding foods that they enjoy, however, pregnancy is a finite period of time, and the risk associated with consuming these foods is substantial. Most cases of listeriosis in pregnancy could be prevented by avoiding consumption of certain foods and contact with certain animals, as well as proper food preparation (Taylor *et al.* 2008).

Pregnant women should not be served foods on the high risk list described in Section 4.2.1 above unless the food is properly prepared to minimize the risk of listeria.

Women need to be informed of the risks of foodborne illness to themselves and to their pregnancy. Consistent information and counselling should be provided to all pregnant women to inform them of the risks of listeria and how to avoid them. Recommendations for maternity care providers should be developed by the BC Centre for Disease Control and the BC Perinatal Health Program (<http://www.bcphp.ca/>) in consultation with care providers (e.g. general practitioners, obstetricians, midwives) for food safety counselling to be provided to all pregnant women as part of their routine prenatal care.

4.2.4 Choking and allergies for adults

When meals are provided for adults in care, it is the responsibility of the care facility to ensure the food is appropriate for the consumer, including texture and allergen modifications.

Upon admission to a facility, the resident assessment and care plan should consider the individual's need for diet modifications due to choking risks or food allergies. Facilities should then provide texture modified and allergen free meal plans as required.

Those staff responsible for providing patient care during meals, or overseeing the activity of volunteers, should maintain currency in allergy and choking response protocols.

4.2.5 Children

Food borne illness

Healthy children do not have any increased risk of listeria infection. However, precautions are still warranted to reduce the likelihood of any food borne illness.

Child care providers who supply meals and/or snacks to the children in their care should be trained in the safe preparation and handling of food. It is recommended that a short, appropriate, self-learning module be developed and made readily available to child care providers who would not otherwise be required to take FOODSAFE or equivalent training.

In the case of an outbreak of a foodborne illness, any foods that are suspect should be held for testing or discarded, and parents should be informed of the facility's actions, as well as signs and symptoms to watch for in their children.

Child care providers who require parents to supply meals and/or snacks should inform parents as to safe packaging of foods. This information should be developed through the Child Care Licensing Branch to ensure consistency.

- Food should be packaged in containers or wraps that will prevent spillage and mixing of different food items.
- Hot foods should be kept hot in thermoses.
- Cold foods should be refrigerated or packed with cold packs.

Canadian Pediatric Society (CPS) recommendations on foodborne infections and food safety should be followed by all child care providers, for all children in care. CPS position statement notes are reviewed, revised, or retired as needed on a regular basis. See the "Position Statements" section of the CPS website (<http://www.cps.ca/english/publications/statementsindex.htm>) for current versions.

Allergies

Food allergies and intolerances are an increasing concern for parents and child care providers. It is necessary to educate the parents, the child care providers, and the children about food allergies/intolerances and the care that should be taken to prevent reactions.

Child care facilities should:

- Ask parents if their children have food allergies/intolerances on the registration forms when children are enrolled and annually thereafter.

If an allergic child is registered at the child care facility, the facility should:

- Ensure care providers are trained on emergency response procedures, including administration of epinephrine when indicated.
- Institute a policy of children not sharing food items if meals/snacks are supplied from home.
- For facilities where foods are brought from home and there are highly allergic children, ensure washing of hands and tables before and after mealtimes to reduce the risk of cross-contamination.
- If a highly allergic child attends the facility, it may be warranted to avoid the food of concern altogether.

Choking

Children under the age of three years are at increased risk of choking from hard or whole food items.

Information packages on training staff about choking should be developed through the Child Care Licensing Branch and provided to child care facilities. Child care facilities should:

- Educate caregivers/food preparation workers about foods more likely to cause choking in young children, e.g. nuts, grapes, hot dogs, popcorn.
- Educate caregivers/food preparation workers about how to reduce choking hazards of foods, e.g. cutting grapes and hot dogs into small pieces.
- Avoid entirely foods having a high risk of choking with little nutritional value, e.g. hard candies, chewing gum.
- Ensure all staff receive training in choking emergency response for different age groups (e.g. infant, toddler, preschooler).

4.3 Monitoring and Surveillance

4.3.1 Monitoring

Facility inspections should include some that are conducted with no advance warning, to ensure inspectors are seeing conditions typical for that facility.

Consideration should be given to developing greater compatibility and partnership between the Steritech or other third party auditors and the EHO inspectors in order to develop a fuller picture of the food safety practices and level of risk.

Inspections and risk assessment tools used by environmental health and licensing officers should include review of the facility's food safety plans and provisions for precautionary diets for vulnerable residents. Where appropriate, these diets should be referred to the appropriate professional for review.

Provincial standards should be established for a self assessment process for facilities not currently assessed by provincial licensing authorities.

A provincial database for all inspection reports should be established and the results of facility inspections and self-assessments should be made public.

4.3.2 Surveillance and Incident Reporting

When it is suspected that a resident/patient/client of a facility has become ill as a result of a food served, this should be reported to the medical health officer. In addition, the facility should consult with Environmental Health Officers (EHOs) and all recommendations for outbreak response followed.

A single case of listeriosis in a person being cared for in a facility and occurring within the appropriate incubation period should be considered to be due to contaminated processed food consumed within that facility unless considered otherwise. This should trigger aggressive investigation of the source due to the vulnerability of facility populations, and, as with all listeria cases, be immediately reported to the medical health officer.

Food borne illness, an allergic response to food, and choking incidents that require medical attention should be defined as a specific “reportable incident” in the Adult Care Regulations and Child Care Licensing Regulations under the *Community Care and Assisted Living Act*.

A central, electronic and searchable database of “reportable incidents” should be established where all incidents can be entered such that cases of reported food borne illness, allergic responses, or choking incidents can be documented to facilitate tracking and quality assurance. This database should be linked to the proposed outbreak control module of the BC Public Health Information System.

Patient information (e.g. age, other illness or complicating factors), patient history (e.g. residence at a facility within the past 70 days), food consumption history, and presence of other individuals suspected to be sickened by the same food product should be included in electronic outbreak modules.

4.4 Local Food Procurement

Regional Health Authorities should investigate the feasibility of sourcing local foods and of encouraging partnerships with local food producers.

Any suppliers of local foods must meet provincial food safety standards. This condition should be written into any contract tendered.

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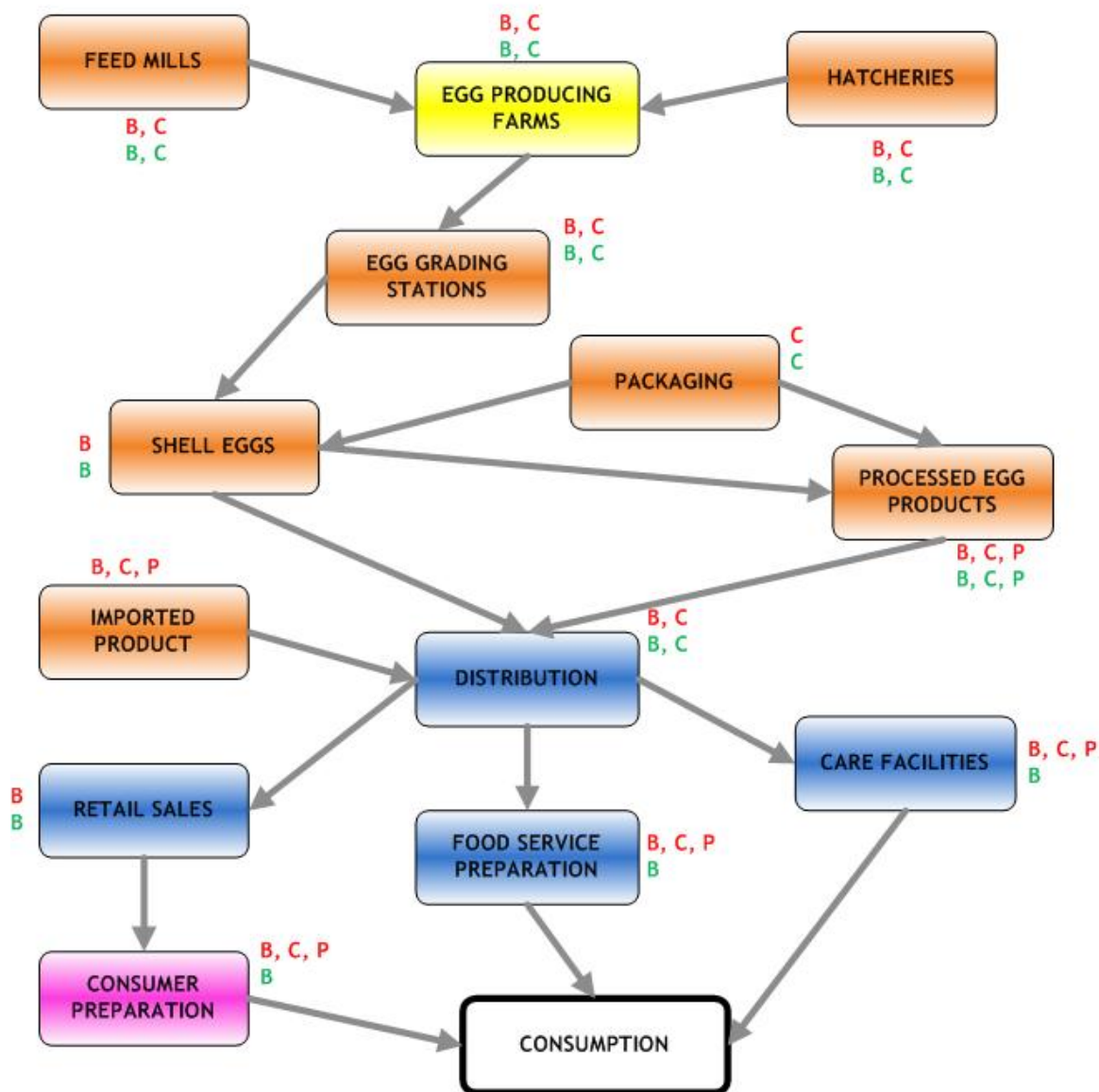
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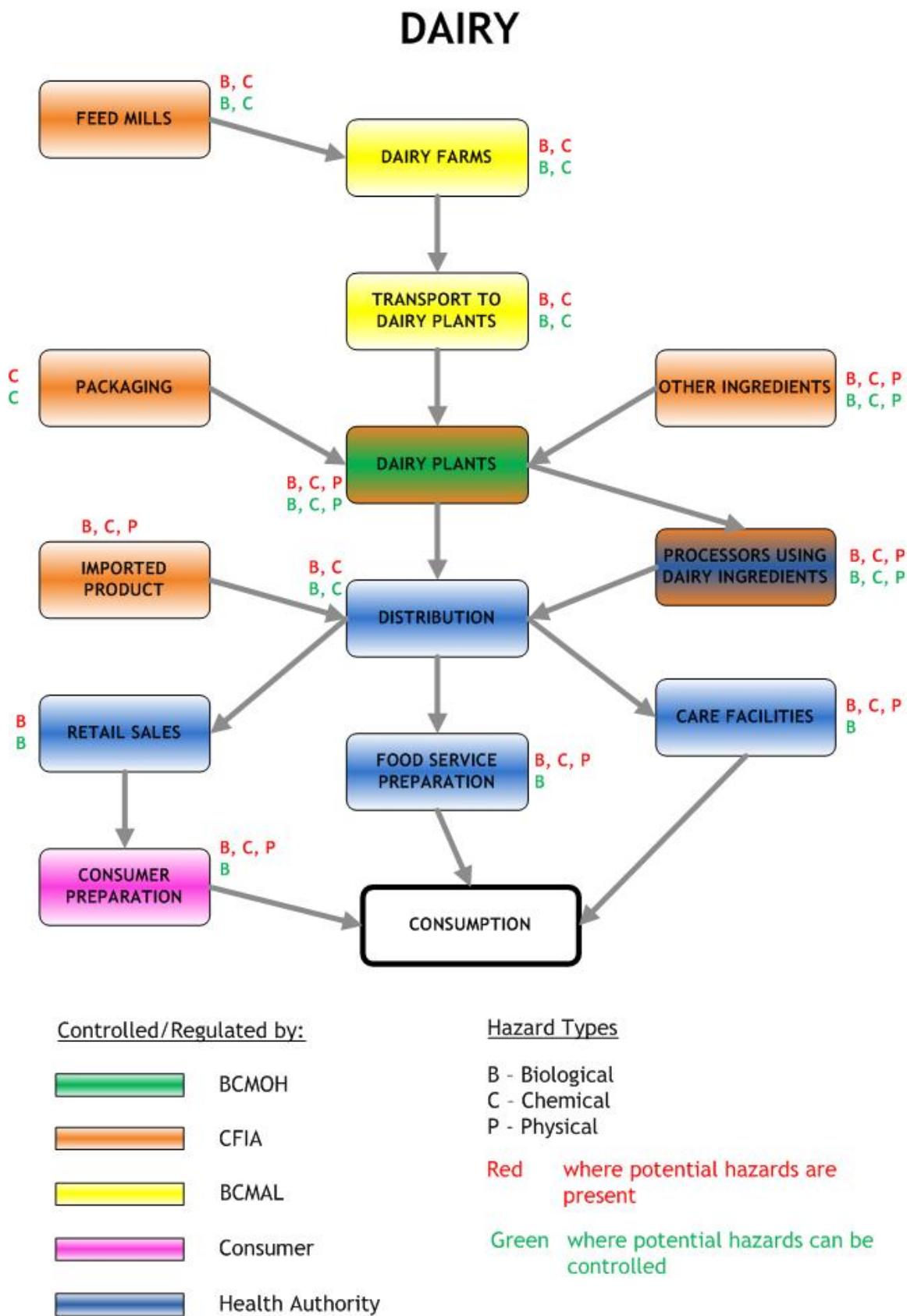
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6.0 Appendices

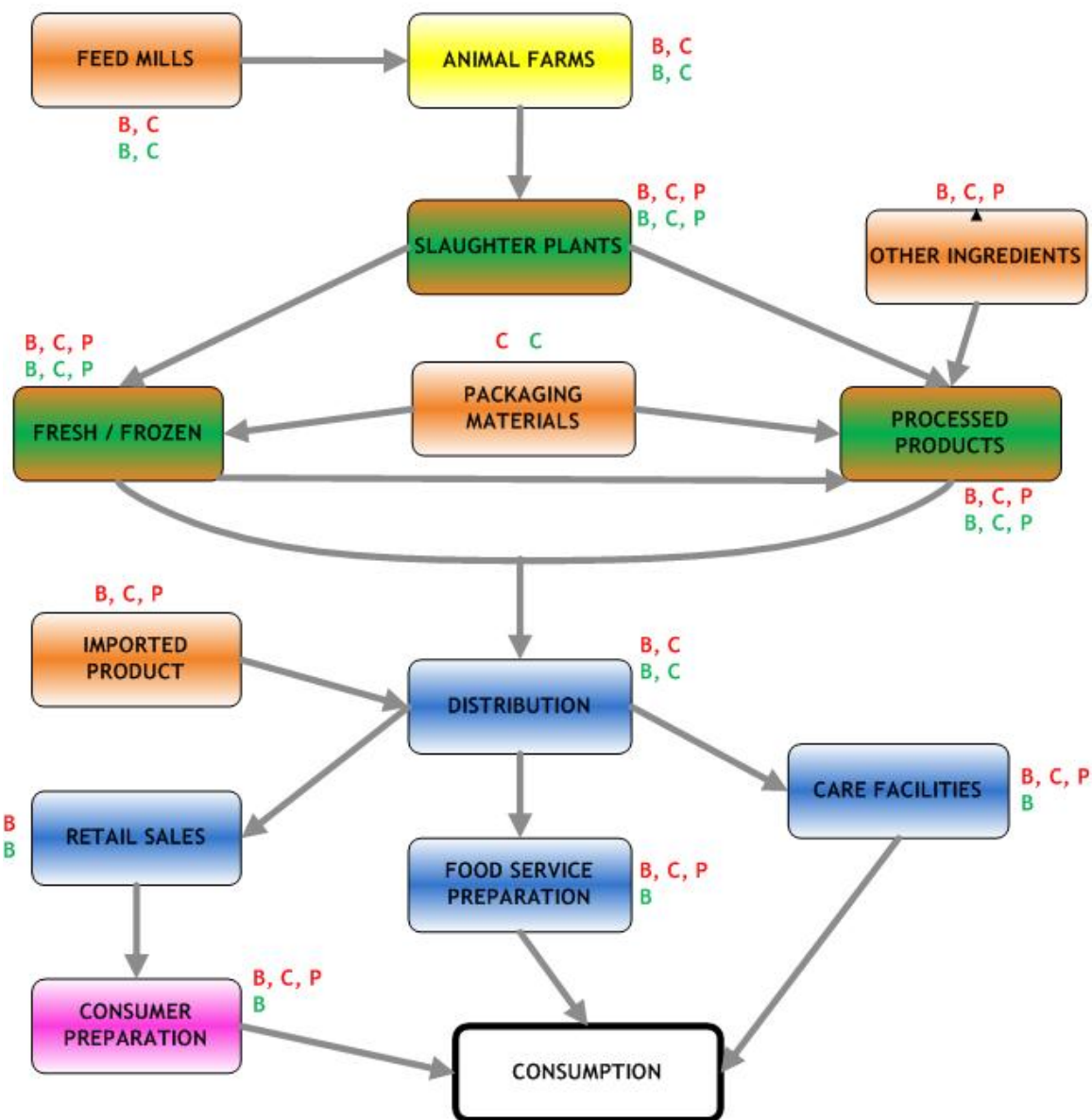
6.1 Hazard Entry Points for Foods (BCCDC 2008b)

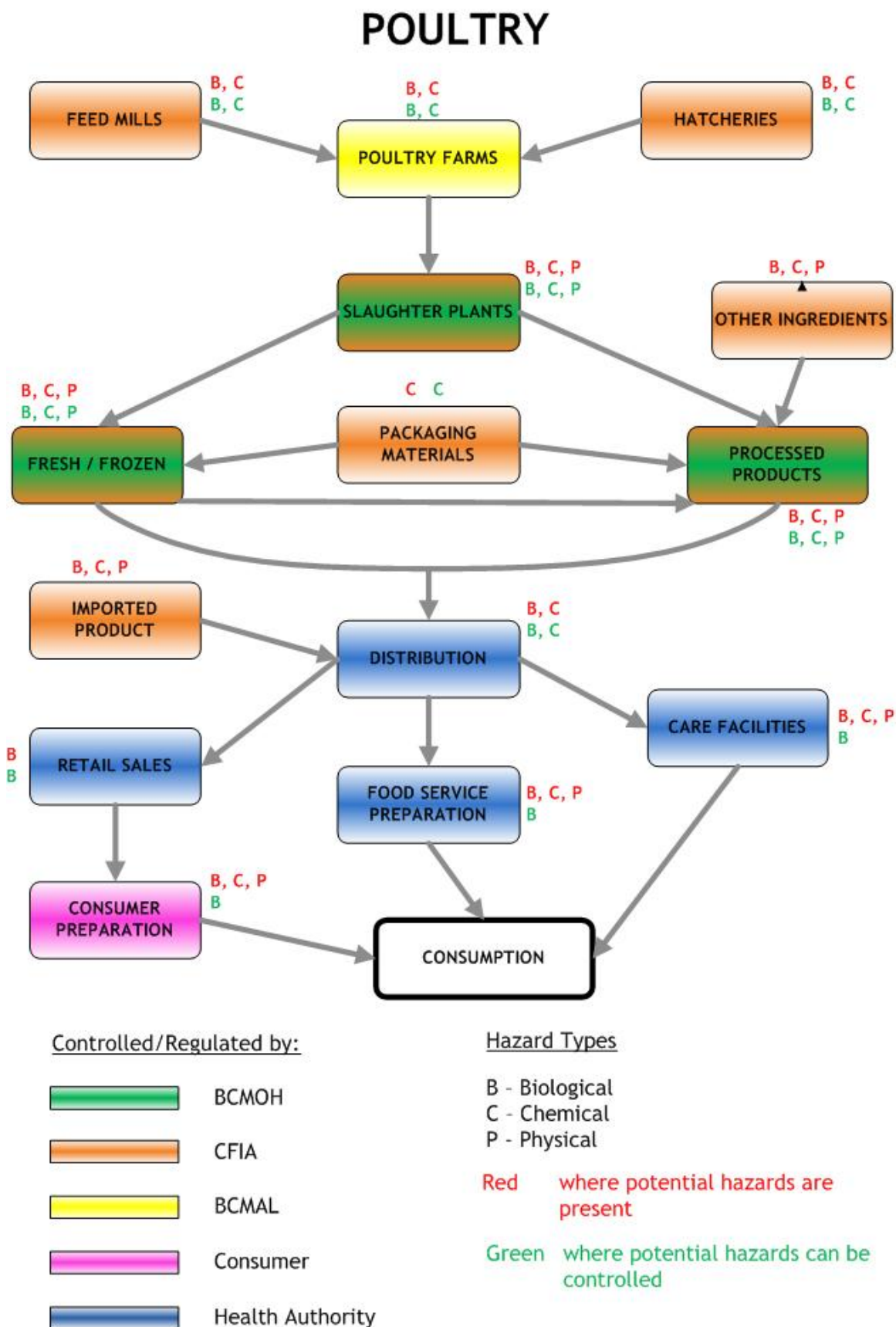
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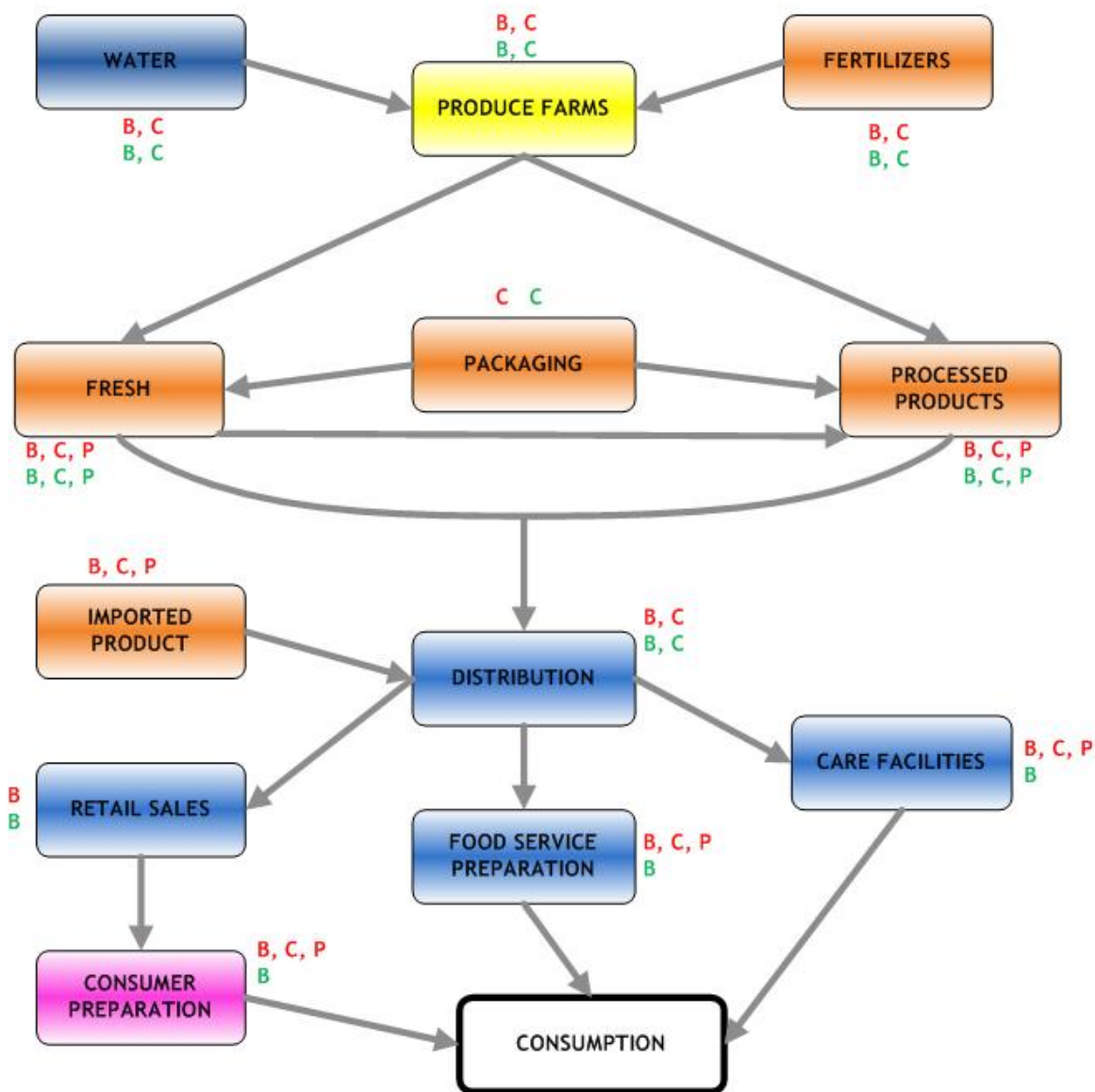


MEAT










PRODUCE



Controlled/Regulated by:

	BCMOH
	CFIA
	BCMAL
	Consumer
	Health Authority

Hazard Types

B - Biological
C - Chemical
P - Physical

Red where potential hazards are present

Green where potential hazards can be controlled

6.2 Advisory Group Terms of Reference

Food Safety in Facilities – Provincial Health Officer Advisory Group

Terms of Reference

The mandate of the Advisory Group is:

To review the issue of food safety for residents in Health Authority administered or licensed facilities, licensed child care facilities, and facilities registered by the Assisted Living Registrar, especially as it pertains to the provision of safe foods to vulnerable individuals; while recognizing the existing health protection, licensing, registration, food audits and other food safety programs.

To make recommendations, based on a review of evidence and best practices to:

- improve current food safety policies and practices;
- identify and protect vulnerable individuals;
- propose a process for ongoing assessment and renewal of safe food practices for vulnerable individuals; and
- make any ancillary recommendations regarding a safe and healthy food supply that is considered germane.

The recommendations will be made no later than December 2008.

Key Responsibilities and Deliverables:

- Examine issues of “vulnerability” and “hazards” (e.g., bacterial contamination, allergies, choking), in relation to food safety without compromising nutrition integrity/quality;
- Conduct a literature review; and
- Make recommendations on food safety policies and practices.

Membership:

- Dr. Perry Kendall, Provincial Health Officer, Chair
- Andrew Hazlewood, ADM, Ministry of Healthy Living and Sport (Executive Lead)
- Wendy Hill, ADM, Ministry of Health Services, (or designate) (Leadership Council Member Lead)
- VCHA: Dr. Patty Daly
- NHA: Dr. David Bowering, Lucy Beck

- PHSA: Larry Copeland (BCCDC), Lynn Wilcott (BCCDC), Dr. Eleni Galanis (BCCDC)
- VIHA: Dr Richard Stanwick
- FHA: Dr. Roland Guasparini
- IHA: Dr. Rob Parker
- Lisa Forster-Coull, Provincial Nutritionist (MHLS)
- Patricia King, Manager Residential Services, (VIHA)
- Anna Bozac, Senior Director, Operations, Business Initiatives & Support Services (FHA & VCH) (Dietician)
- Alan Davies, Food Services Director, (IHA)
- Ken Cooper, CPHI(C), Senior Environmental Health Specialist (BCCDC – Epidemiology)
- Garry Gibson, Food Safety Specialist, VIHA

Links with other experts as required, including:

- Ted Patterson, A/Ex. Dir., Patient Safety Council
- Susan Adams, Assisted Living Registrar
- Sue Bedford, A/Director of Licensing
- Bruce Gamage, PicNet
- Stephen Buchanan, Ministry of Agriculture and Lands

Secretariat:

Bev Muller, Executive Coordinator, Ministry of Healthy Living and Sport

Patricia Ruth, Manager Strategic Policy, Ministry of Healthy Living and Sport

Dr. Brian Emerson, Medical Consultant, Ministry of Healthy Living and Sport

Term:

To December 31, 2008

Meeting dates, times and locations:

At the call of the Chair

Approved: September 30, 2008

6.3 Literature Reviews

6.3.1 (Galanis and Patrick 2008) Risk of listeriosis associated with age, pregnancy and various conditions

Prepared by Eleni Galanis and David Patrick, BCCDC
For the BC Food Safety in Facilities Advisory Group
On September 30 2008

Age (Tables 1 and 2)

The risk of listeriosis increases with age. This has been credited to the decrease in cellular immunity that comes with advancing age.

The risk seems to increase around age 65 or 70 years. In BC, the risk increases 20-fold in people aged 70 years or older (2002-2007). International reports show increases of 2 to 7-fold in people aged 60 or 65 years and older, respectively. The difference in risk between BC and these reports may be due to small and unstable numbers and/or the increasing incidence reported in most developed countries in the last 5-10 years which has mostly affected the elderly. Even in this age group, the actual incidence remains low as compared to most other foodborne diseases.

Listeriosis also rarely occurs in neonates infected in utero.

Pregnancy (Table 3)

The risk of listeriosis increases in pregnancy, particularly in the third trimester, associated with the decline of cell-mediated immunity. The incidence rate is higher than in the general population but this remains a rare disease in this population. There are very few cases in non-pregnant women of childbearing age. As compared to the general population, pregnancy increases the risk of listeriosis by 2 to 17-fold. It is not clear why the incidence and relative risk varies substantially between the 2 sources identified.

Most infected pregnant women have mild illness unless they have another underlying illness. About a fifth of cases result in spontaneous abortion or neonatal death. About 2/3 of surviving infants develop neonatal listeriosis.

Immunocompromising conditions and medications (Tables 4 and 5)

Medical conditions and medications that decrease T-cell mediated immunity increase the risk of listeriosis. Most of these diseases and medications are relatively rare except for cancer and corticosteroids. However, the incidence of listeriosis among people with these conditions can be high and they increase the risk of listeriosis anywhere from 2 to 2584-fold. Transplants and blood-related cancers confer the greatest risk. HIV/AIDS seems to rarely lead to listeriosis since the advent of HAART and trimetoprim-sulfa prophylaxis. Other cancers, dialysis, liver disease and diabetes all confer a moderate risk of infection, greater than that caused by advanced age and pregnancy.

Much of literature on this topic is based on case reports. A relative ranking of conditions and associated risks was conducted for a WHO/FAO risk assessment based on a population-based comparison of risk factors in France in 1992

Table 1. Risk of listeriosis associated with different age categories, BC, 2002-2007.

Age groups	Incidence rate (per 100,000 per year)	Relative risk	Comments	References
0 to 9y	0	1 (reference pop)	0 cases between 2002-2007	(1) (2)
9 to 19y	0		0 cases between 2002-2007	(1) (2)
20 to 29y	0.03		1 case between 2002-2007	(1) (2)
30 to 39y	0.14		5 cases between 2002-2007	(1) (2)
40 to 49y	0.05		2 cases between 2002-2007	(1) (2)
50 to 59y	0.23		8 cases between 2002-2007	(1) (2)
60 to 69y	0.59	7.7	13 cases between 2002-2007	(1) (2)
70 to 79y	1.73	22.3	27 cases between 2002-2007	(1) (2)
≥80y	1.46	18.9	14 cases between 2002-2007	(1) (2)
overall	0.28		70 cases between 2002-2007	(1) (2)

Table 2. Risk of listeriosis associated with different age categories, international.

Age groups	Incidence rate (per 100,000 per year)	Relative risk	Comments	References
0 to 4y	0.4		EU 2006 (approximate)	(3)
5 to 14	0.02		EU 2006 (approximate)	(3)
15 to 24	0.05		EU 2006 (approximate)	(3)
25 to 44	0.1		EU 2006 (approximate)	(3)
45 to 64	0.3		EU 2006 (approximate)	(3)
≥65	1.1		EU 2006 (approximate)	(3)
Overall	0.3		EU 2006	(3)
neonates	12.7		USA 1986	(4)
60-69y	1.5		USA 1986 (approximate)	(4)
70 plus	2.8		USA 1986 (approximate)	(4)
Overall	0.7		USA 1986	(4)
0 to 19	0.1		Iceland 1978-2000	(5)
20-29	0		Iceland 1978-2000	(5)
40-59	0.5		Iceland 1978-2000	(5)
60-79	1		Iceland 1978-2000	(5)
>80	5		Iceland 1978-2000	(5)
Overall	0.4		Iceland 1978-2000	(5)
neonates		14	USA (compared to "intermediate age population" assumed to be between neonate and 59y)	(6)
≥60y		2.6	USA (compared to "intermediate age population" assumed to be between neonate and 59y)	(6)
>65y		7.5	France 1992 (compared to <65y with no underlying condition)	(7)

Table 3. Risk of listeriosis associated with pregnancy

	Incidence rate (per 100,000 per year)	Relative risk	Comments	References
Pregnancy	0.58		6 cases in BC 2002-7 among women of childbearing age (15-44y)	(1) (2)
Pregnancy		undef	RR=IR in pregnant women of childbearing age /IR in non-pregnant women of childbearing age=0.58/0 (BC)	(1) (2)
		2.1	RR=IR in pregnant women of childbearing age /IR in general population=0.58/0.28 (BC)	
Pregnancy	0.19-0.62		USA 1996-2003	(8)
Pregnancy		17	Rate in pregnant women (12/100,000) divided by rate in general population (0.7/100,000) in US in early 1990s.	(9)

Table 4. Risk of listeriosis associated with various immunocompromising conditions and medications

Condition	Incidence rate of listeriosis (per 100,000 per year unless otherwise stated)	Relative risk of listeriosis (as compared to general pop unless otherwise stated)	Comments	References
HIV pre-HAART		280	approximate	(10) (11)
HIV pre-HAART	52	65		(12)
AIDS pre-HAART	115	145	higher risk when CD4<50 cells/mm3, potential lower risk when on TMP-SMZ	(12)
AIDS post-HAART and on TMP prophylaxis	rare		One review in 1985-2001 identified 3 cases of LM infection among 903 cases HIV with all cases occurring prior to 1998.	(13) (14)
Chronic lymphocytic leukemia treated with fludarabine	0-7% of CLL cases		Mixed end point of listeria or PCP, incidence dependant on prior cancer treatment and whether prednisone was also used	(15)
Cancers, all	96 (1970-1979) to 14 (1985-1997) per 100,000 new admissions		Listeriosis occurred most often in individuals receiving antineoplastic therapy and systemic corticosteroids. Advanced liver disease may have increased the risk of systemic listeriosis.	(16)
Cancers, all	42 cases per 100,000 cancer admissions		191/100,000 admissions for hematological malignancy, 21/100,000 admissions for solid tumors and 381/100,000 for those who had received marrow transplant (based on a review of hospitalised patients at one US centre)	(17)
Renal dialysis	case reports			(18) (19)
Transplant, renal	465 cases/100,000 renal transplant-related admissions		Based on a review of hospitalised patients in one US hospital (1986-94)	(20)
Transplant, renal	case reports			(21) (22)

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Condition	Incidence rate of listeriosis (per 100,000 per year unless otherwise stated)	Relative risk of listeriosis (as compared to general pop unless otherwise stated)	Comments	References
Transplant, blood and marrow	456.3		Based on a review of hospitalised patients in one US hospital	(23)
Transplant, marrow	390			(24)
OKT3	case report		Immunosuppressant given to transplant recipients	(25)
Gastric acid suppression		2.2	cases had 2.2 times the odds of having taken antacids or cimetidine as compared to controls (p=0.4)	(26)
SLE	uncommon unless pregnancy, renal failure or prednisone			(27) (28)
Ulcerative colitis	case report		Only 4 case reports published	(29)
Cirrhosis	case report		24 cases published between 1966 and 1998.	(30)
		OR=5.7	Case control study: In a multivariate analysis, cirrhotic patients had 5.7 times the odds of LM meningitis as compared to non-cirrhotic patients.	(31)
Iron overload disorders (e.g. hemochroma-tosis)	case reports			(32) (33)
TNF inhibitors	case reports		used to treat inflammatory diseases (e.g. RA, Crohn's)	(34) (35) (36) (37) (38) (39)
	15.5 per 100,000 patients infliximab			(40)

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Condition	Incidence rate of listeriosis (per 100,000 per year unless otherwise stated)	Relative risk of listeriosis (as compared to general pop unless otherwise stated)	Comments	References
	1.8 per 100,000 patients etanercept			(40)
Corticosteroids			Multiple reports but none provide IR or RR. Most patients on corticosteroids also have other immunocompromising conditions (e.g. cancer, transplant).	(16) (17) (24)

Table 5. Ranked risk of listeriosis by various conditions (adapted from Marchetti 1996 in WHO/FAO 2004)

Condition	Incidence rate (per 100,000 unless otherwise stated)	Relative risk as compared to general pop unless otherwise stated)	Comments	References
Transplant, any		2584		(7)
Cancer, blood		1364		(7)
AIDS pre-HAART		865		(7)
Dialysis		476		(7)
Cancer, lung		229		(7)
Cancer, GI and liver		211		(7)
Liver disease		143		(7)
Cancer, bladder and prostate		112		(7)
Cancer, GYN		66		(7)
Diabetes		25-30		(7)
Alcoholism		18		(7)
No underlying condition, aged <65y		1		(7)

*Note that data for individuals aged >65 years with no underlying condition is listed in Table 2.

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6.3.2 (McIntyre 2008) Control Measures for Foods associated with Food-borne Disease

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
BACTERIA Primary Source: Livestock, Poultry	<i>Campylobacter jejuni/coli</i>	<ul style="list-style-type: none"> Raw, undercooked poultry unpasteurized milk 	<ul style="list-style-type: none"> on-farm control^c slaughtering control^c food handler education 	<ul style="list-style-type: none"> cook meat pasteurize milk <i>C. jejuni/coli</i> are not likely to multiply in food due to high temp (>32°C), microaerophilic & other conditions for growth X-contamination of other ready-to-eat foods is a concern 	G	✓			
					C		✓		
					E		✓		✓
					X			✓	✓
	<i>Salmonella</i> (non-typhoid)	Many different foods such as: eggs, poultry, frozen processed poultry (chicken nuggets), chocolate, peanuts, almonds, sprouted seeds	<ul style="list-style-type: none"> on-farm control^c select food & ingredients from suppliers with control systems food handler education 	<ul style="list-style-type: none"> cook meat pasteurize milk acidify irradiate combine control methods (pH, a_w, low temp storage, preservatives) minimize X-contamination 	G	✓	✓		
					C		✓	✓	✓
					E	✓	✓	✓	✓
					X		✓	✓	✓
					P		✓		
	<i>E.coli</i> pathogenic	<ul style="list-style-type: none"> Undercooked ground beef Raw produce Unpasteurized juice Sprouts Untreated water Ruminant contact 	<ul style="list-style-type: none"> on-farm control^c slaughtering control shown to reduce but not eliminate select food & ingredients from suppliers with control systems food handler education GAPs for crop production Avoid untreated water & contact with livestock 	<ul style="list-style-type: none"> cook pasteurize wash & disinfect produce multiplication in many foods may occur, but does not appear to be a significant factor survival & low infective dose among sensitive populations more important 	C		✓	✓	✓
					E				✓
					G	✓	✓	✓	

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
BACTERIA Primary Source: Livestock, Poultry	<i>Yersinia enterocolitica</i>	<ul style="list-style-type: none"> Raw, undercooked pork Untreated water Milk 	<ul style="list-style-type: none"> Improve slaughter hygiene (seal off rectum in plastic bag) 	<ul style="list-style-type: none"> cook minimize contact of ready-to-eat foods with raw pork 	C		✓	✓	✓
	<i>Staphylococcus aureus</i>	<ul style="list-style-type: none"> Cooked foods contaminated with <i>S. aureus</i> & held at conditions permitting enterotoxin production. <i>S. aureus</i> does NOT compete well against normal flora assoc'd with raw agricultural commodities and these are rarely involved Human contamination 	<ul style="list-style-type: none"> Food handler hygiene (prevent food handlers with boils, infected cuts from handling food) Select food & ingredients with lower initial numbers (certified, traceable) 	<ul style="list-style-type: none"> cook pasteurize acidify note: Staphylococcal enterotoxin is very stable & cannot be reduced by normal food preparation methods control temperature & time of holding cooked perishable foods use inhibitory factors (smoke, preservatives, a_w) control manufacture conditions of certain cheeses & dry sausages where growth during fermentation / pressing is important 	C			✓	✓
					P		✓	✓	
					L			✓	✓
					H		✓	✓	✓
	Brucellae	<ul style="list-style-type: none"> Unpasteurized milk & cheese Contact with infected livestock (cattle, goats) 	<ul style="list-style-type: none"> Eradicate brucellosis from domesticated animals Avoid cheese made from unpasteurized milk 	<ul style="list-style-type: none"> Pasteurize milk Brucellae do not increase during cheese manufacture or subsequent storage 	C		✓	✓	
					G	✓			
	<i>M. bovis</i>	<ul style="list-style-type: none"> Unpasteurized milk 	<ul style="list-style-type: none"> Eradicate bovine TB 	<ul style="list-style-type: none"> Pasteurize milk <i>M. bovis</i> cannot increase during storage of milk or milk-containing foods 	C		✓	✓	
					G	✓			
PARASITES Primary Source: Livestock, Poultry	<i>Taenia</i>	<ul style="list-style-type: none"> Raw or undercooked pork and beef 	<ul style="list-style-type: none"> meat inspection animal husbandry break epi chain at final 	<ul style="list-style-type: none"> cook to 60°C freeze at -10°C for 6 days <i>Taenia</i> cannot increase during 	G	✓			

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
			host (man) or intermediate host (cattle; pigs) • treat sewage sludge	processing or storage	C F		✓ ✓	✓ ✓	✓ ✓
PARASITES Primary Source: Livestock, Poultry	<i>Trichinella spiralis</i> ; <i>T. nativa</i> (in BC wild game meat)	Raw or undercooked pork, wild game (bear), horse meat	<ul style="list-style-type: none"> meat inspection animal husbandry break epi chain at final host (man) or intermediate host (cattle; pigs) treat sewage / sludge 	<ul style="list-style-type: none"> cook game meat to internal temp 71°C minimum freeze at –25°C for 10 to 20 days (<i>T. nativa</i> is resistant to freezing) <i>T. spiralis</i> cannot increase in food 	G	✓			
					C		✓	✓	✓
					F		✓	✓	✓
BACTERIA Primary Source: Soil	<i>Listeria monocytogenes</i> Sources: soil & environment of FSEs, homes, raw agricultural commodities, animals, including humans	Perishable ready-to-eat foods, concern where growth can occur (soft cheeses, milk, cooked meats & poultry, smoked seafood)	<ul style="list-style-type: none"> Subject foods to kill step (depends on process) Control ready-to-eat environment to minimize contamination Educate consumers about foods to avoid 	<ul style="list-style-type: none"> cook pasteurize milk pasteurize in container formulate foods with additives/ create listeriocidal conditions (acidification, dehydration) Wash, disinfect Store perishable foods at LOW temp (<6°C) Minimize X-contamination of ready-to-eat with raw foods or contaminated surfaces Use controlled fermentations that prevent growth 	G C X N P E	✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓
	<i>Bacillus cereus</i>	• Rice	Control measures cannot ensure absence of this	• Cook to kill vegetative cells	C			✓	✓

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
		<ul style="list-style-type: none"> Cereal products Some dairy products Sauces, cooked pasta, vegetable or meat dishes 	pathogen in the foods commonly involved	(does not destroy spores) <ul style="list-style-type: none"> Cool rapidly (2h from 60°C to 20°C; 4h from 20°C to 4°C) Discard foods out of temperature control (emetic toxin is heat stable) 	L		✓	✓	✓
	<i>Clostridium botulinum</i> (type B, non-proteolytic)	<ul style="list-style-type: none"> Salt cured meats Seafood 	Control measures cannot ensure absence of this pathogen in the foods commonly involved	<ul style="list-style-type: none"> Apply thermal process sufficient to kill spores (retort <0.1'@100°C, <0.001') Temp, Aw, pH, etc. controls to prevent toxin production (<3°C, <0.97, <5.0, 3.5% NaCl, fermentation & packaging) 	C P		✓ ✓		✓ ✓
BACTERIA Primary Source: Soil	<i>C. botulinum</i> (type A, B, (proteolytic)	<ul style="list-style-type: none"> Low-acid foods Meats Home canned vegetables Low-acid fruits 	Control measures cannot ensure absence of this pathogen in the foods commonly involved	<ul style="list-style-type: none"> Apply thermal process sufficient to kill spores (retort 25'@100°C, 1-2'@ 121°C) Temp, Aw, pH, etc. controls to prevent toxin production (<10°C, <0.94, <4.6, 10% NaCl, sodium nitrite in cured meats) 	C P		✓ ✓	✓	✓
	<i>Clostridium perfringens</i>	<ul style="list-style-type: none"> Cooked, uncured meat or poultry Meat pie Stew Gravy ? in BC, home-made tomato salsa 	Control measures cannot ensure absence of this pathogen in the foods commonly involved	<ul style="list-style-type: none"> Cook to kill vegetative cells Retort to kill spores Cool rapidly (2h from 60°C to 20°C; 4h from 20°C to 4°C) Discard foods out of temperature control 	C L		✓ ✓	✓ ✓	✓ ✓
BACTERIA Primary Source: Seafood	<i>Clostridium botulinum</i> (type E, non-proteolytic)	<ul style="list-style-type: none"> Seafood Meat from marine mammals 	<ul style="list-style-type: none"> Avoid traditional fermented foods (muktuk, stink eggs) Gut all fish (avoid fish with dried intestines) Consumer education 	<ul style="list-style-type: none"> Apply thermal process sufficient to kill spores (retort <0.1'@100°C, <0.001') Temp, Aw, pH, etc. controls to prevent toxin production (<3°C, <0.97, <5.0, 3.5% NaCl, control fermentation and 	C P E		✓ ✓	✓	✓ ✓

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
				packaging) •					
	<i>Vibrio parahaemolyticus</i>	<ul style="list-style-type: none"> Raw seafood (oysters, mussels) Recontaminated cooked seafood 	<ul style="list-style-type: none"> Harvest under CFIA-Vp guidelines (when water temp is <15°C, temp control to <10°C as specified) Harvest in approved areas Consumer education 	<ul style="list-style-type: none"> Cook Maintain cold-chain of raw products Avoid recontamination Consumer education of risk 	C N X E	✓	✓	✓ ✓	✓ ✓ ✓
	<i>Vibrio vulnificus</i>	<ul style="list-style-type: none"> Raw seafood 	<ul style="list-style-type: none"> Avoid wounds to hands when handling Consumer education 	<ul style="list-style-type: none"> Cook 	C E H		✓	✓ ✓	✓ ✓ ✓
TOXIN Primary Source: Seafood	Scombrototoxin	<ul style="list-style-type: none"> Tuna, mackerel, mahi mahi Fish sauces 	<ul style="list-style-type: none"> Cold chain from harvest to plate Histamine level cannot be reduced after harvest Illness may occur >50mg100g⁻¹ 	<ul style="list-style-type: none"> Cool fish rapidly and maintain at low temp (<8°C or lower) to prevent histamine formation and increase 	N	✓	✓	✓	✓
	Ciguatera	<ul style="list-style-type: none"> Tropical reef fish 	<ul style="list-style-type: none"> Avoid tropical reef fish Toxin cannot be reduced after harvest - toxin is stable 	<ul style="list-style-type: none"> Toxin cannot increase 	E				✓
	Shellfish toxins PSP, DSP, ASP, NSP	<ul style="list-style-type: none"> Bivalves 	<ul style="list-style-type: none"> Monitor shellfish harvesting areas for toxic phytoplankton: suspend harvesting if necessary 	<ul style="list-style-type: none"> Toxin cannot increase 	G	✓	✓		

Listeria Outbreak: Review and Recommendations for Food Safety in Facilities

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
			<ul style="list-style-type: none"> PSP<80 µg 100g⁻¹; ASP/DSP<20 µg 100g⁻¹ Toxin cannot be reduced after harvest - toxin is stable 						
PARASITES Primary Source: Seafood	<i>Anisakis simplex</i> , <i>Pseudoterranova decipiens</i>	<ul style="list-style-type: none"> Salmon, cod, herring 	<ul style="list-style-type: none"> Inspect and discard infected fish 	<ul style="list-style-type: none"> Cook Freeze (-20°C minimum of 7 days OR -35°C minimum of 15 hours) Combination NaCl & acetic acid 	C		✓	✓	✓
					F		✓	✓	✓
					P		✓		✓
	<i>Diphyllobothrium</i> spp.	<ul style="list-style-type: none"> Fresh-water trout Salmon 	<ul style="list-style-type: none"> Inspect and discard infected fish 	<ul style="list-style-type: none"> Cook Freeze (-20°C minimum of 7 days OR -35°C minimum of 15 hours) Combination NaCl & acetic acid 	C		✓	✓	✓
BACTERIA Primary Source: Human	<i>V. cholerae</i> , <i>S. typhi</i>	<ul style="list-style-type: none"> Foods contaminated by infected foods handlers, or, Untreated water 	<ul style="list-style-type: none"> Treat waste-water Provide potable drinking water for food prep Educate food handlers in personal hygiene 	<ul style="list-style-type: none"> Cook 	C		✓	✓	✓
					H		✓	✓	
					E		✓	✓	
	Shigellae	<ul style="list-style-type: none"> Foods contaminated by infected foods handlers, or, Untreated water 	<ul style="list-style-type: none"> Educate food handlers in personal hygiene Exclude food handlers from high risk positions (e.g., food prep, day cares) 	<ul style="list-style-type: none"> Cook 	C		✓	✓	✓
					H		✓	✓	
					E		✓	✓	

Group	Pathogen	Vectors: Animals, Foods	Control Measures		Summary of Controls				
			Initial Control of Pathogen	Reduction & Control of Pathogen	Type ^a	Farm	Factory	Retail/FS ^b	Consumer
VIRUS Primary Source: Human	Hepatitis A	<ul style="list-style-type: none"> • Ready-to-eat foods contaminated by infected food handlers • Shellfish 	<ul style="list-style-type: none"> • Educate food handlers in personal hygiene • Treat waste-water & Provide potable drinking water for food prep • Avoid bivalves from contaminated waters 	<ul style="list-style-type: none"> • Cook • Vaccinate 	C		✓	✓	✓
					H		✓	✓	
					E		✓	✓	✓
	Norovirus	<ul style="list-style-type: none"> • Ready-to-eat foods contaminated by infected food handlers • Shellfish 	<ul style="list-style-type: none"> • Treat waste-water • Provide potable drinking water for food prep • Educate food handlers in personal hygiene & cleaning to avoid 2^o transmission • Avoid bivalves from contaminated waters 	<ul style="list-style-type: none"> • Cook 	C		✓	✓	✓
					H		✓	✓	
					E		✓	✓	✓

Source: Food Protection Services, BCCDC (adapted from ICMSE, Microorganisms in Food, Volume 7).

Note: table does not include fungal agents of food-borne disease or their controls.

^a Food Processing Control Codes: **C** cook, pasteurize or retort; **F** freeze; **G** practice Good Manufacturing or Agricultural Practices; **L** cool; **E** education; **H** food handler hygiene; **N** maintain cold chain of product; **P** combine processing controls; **X** avoid cross-contamination.

^b FS: Food service establishments

^c On-farm controls: effective on-farm control measures have either not been identified, or not shown to be effectively demonstrated.

6.4 Food Safety Recommendations for the General Public

Food safety recommendations are appended below from Chapter 7 (pages 112-114) of the Provincial Health Officer's Annual Report (2005), *Food, Health and Well-Being in British Columbia*.

Steps to Address Food Safety

What can individuals do?

- Choose foods processed for safety, i.e. pasteurized products over unpasteurized.
- Cook foods thoroughly. Use a meat thermometer to ensure that the internal temperature reaches at least 71°C (160°F) for ground beef and meat and 74°C (165°F) for poultry.
- Store cooked foods promptly and carefully.
- Reheat cooked foods thoroughly.
- Do not allow any contact between raw food or its traces and cooked food.
- Wash hands repeatedly.
- Keep all kitchen surfaces clean.
- Protect food from insects, rodents and other animals.
- Use safe water.

What can communities do?

- Encourage all food handlers to obtain the FOODSAFE certification course.
- Encourage all food handlers to get hepatitis A vaccinations to prevent outbreaks in the community.

What can industry, governments, and agencies do?

The food production and distribution system is complex and involves many participants and all levels of government. The present food safety system has gaps and inconsistencies and needs to be better coordinated. Essential elements of a modernized food safety management system could include the following:

- A clear definition of roles and responsibilities for all key partners in accomplishing the objectives of the provincial management strategy.
- Implementation of surveillance systems which effectively monitor and identify existing hazards throughout the food continuum, and which can also serve as an early warning system for emerging trends and diseases.
- Development of strategies for best practices to ensure BC's food industry is in line with nationally and internationally recognized food safety systems such as Hazard Analysis and Critical Control Point (HACCP).

- Development of crisis preparedness response protocols and agreements to ensure provincial preparedness in the event of emergencies affecting the food supply.
- Support for the implementation of food safety as a core public health program.

6.5 Food Safety Legislation Framework

At the National Level Health Canada is primarily responsible for setting general policy and standards for food safety. These standards cover a variety of food safety related items including:

- Standards for microbiological hazards including indicator organisms as well as pathogenic organisms
- Standards for levels of chemical residues including:
 - o Industrial environmentally sourced chemicals (eg. Dioxins, PCB's)
 - o Chemicals associated with the production of food (eg. antibiotics, pesticides, hormones)
 - o Chemicals associated with the processing of food (eg. preservatives, food colorings)
 - o Natural toxins (eg. aflatoxin, botulinum toxin, allergens)
 - o Naturally occurring metals (eg. mercury, arsenic, lead)
- Standards for physical hazards that could be found in food such as glass, metal, wood, bone fragments, etc..

The majority of these standards are embodied in the Canadian *Food and Drug Act and Regulations*.

The Canadian Food Inspection Agency (CFIA), an agency of Agriculture and AgriFood Canada, is responsible for providing the inspection service to federally registered processing plants. These are processing plants which distribute food interprovincially and/or export food outside of the country and includes food commodities such as dairy, meat, fish, egg, and produce processing plants. The CFIA is also responsible for monitoring, inspecting and testing all food that is imported into Canada. Regarding food recalls, the CFIA is the lead agency responsible for initiating and verifying the effectiveness of food recalls. The CFIA also has responsibilities under the Health of Animals Act and regulations which respect the control of diseases and toxic substances that may affect animals or humans.

At the provincial level, the respective provincial ministries of agriculture are primarily responsible for the production of safe food at the farm level. In British Columbia, the agency with this responsibility is the BC Ministry of Agriculture and Lands (BCMAL). The BCMAL provides a variety of services related to monitoring the production of safe food, some of which include:

- Providing or delegating a program inspection service at the farm level for several commodity types including dairy, egg, red meat, poultry, farmed fish, and produce
- Monitoring the health of animals for various zoonotic (and potentially human) diseases and taking control measures as appropriate
- Monitoring and testing various primary foods for pesticide and other chemical residues

In BC, the Ministry of the Environment, in conjunction with the BCMAL, is also responsible for monitoring the quality of irrigation water to ensure it is not a potential source of contamination.

For food processed (or prepared) and distributed intraprovincially, the provincial government is primarily responsible for ensuring food is kept safe. In BC, this function is delegated by the province to a number of agencies. For example, for provincially licenced dairy and meat plants, the BC Center for Disease Control, a division of the Provincial Health Service Authority, is responsible for providing the inspection service to these processing plants per the *BC Milk Industry Act/Regulations* and *Meat Inspection Regulations* respectively. For other types of intraprovincial food manufacturers and food premises including food service establishments, the Regional Health Authorities are responsible for monitoring and providing the inspection service. The Ministry of Healthy Living and Sport also provides consultative, technical and legislative support to the provincial agencies with regard to food safety and related issues.

Legislation Impacting Care Facilities

The primary piece of legislation that regulates food safety in care facilities which prepare food in British Columbia is the *BC Food Premises Regulation*. The *BC Food Premises Regulation* is a regulation under the *BC Health Act*. There are a number of requirements and standards in the *BC Food Premises Regulations* which help ensure that the food served in care facilities is safe to consume. Some of the more critical requirements and standards related to food safety in this regulation are as follows:

Section 10- FOODSAFE Training: Requires that every operator of a food service establishment has successfully completed the FOODSAFE training program or its equivalent. As well, in the operator's absence, at least one employee must also have completed the program. Studies have shown that food safety knowledge is critical in ensuring that food is prepared safely.

Section 11- Food from Approved Source: Requires that all food on a food premises is obtained from a source that is approved. This is defined as a source that is approved by the government of Canada, the government of another province or territory, or an official or agency of any of those governments under whose authority food safety standards are established and enforced. In Canada, depending on the food type and the location of the food in the farm to fork continuum, there are a number of government agencies which are responsible for regulating the production of safe food. A brief description of these regulatory agencies and their responsibilities is as follows:

Section 23 and 24- Written Food Handling and Sanitation Procedures: These sections require that food service establishments provide written procedures for how food will be prepared safely and how the premises, its equipment, and its personnel will be maintained in a clean and sanitary manner. These written requirements use the British Columbia Ministry of Health (1997) "The Risk Based Inspection Approach: A HACCP Guide to Food Safety" manual as their primary guidance document which in turn is based on the principles of the Hazard Analysis Critical Control Point (HACCP) system. The primary principle behind this system is the prevention of food safety problems before they occur.

There are also a number of other sections in the BC Food Premises Regulation which provide various prescriptive requirements and standards regarding the safe handling of food. Some of the more major requirements include items such as temperature control (freezing, refrigeration, and hot hold temperatures), the prohibition of contaminated food, minimum standards for equipment and construction materials, standards for premises and equipment maintenance, basic employee hygiene, and the prohibition of persons suffering from a communicable disease working in a food premises.

Summary of Provincial Acts, Regulations and policy documents that govern food safety in BC:

- The Health Act;
- The Food Safety Act;
- The Fish Inspection Act and Regulations;
- The Food Premises Regulation;
- Sanitary Regulations and Meat Inspection Regulation;
- The Milk Industry Act and Regulation; and municipal health bylaws;
- The Core Public Health Functions document approved by the Ministry of Health;
- The Performance Agreements currently in place with each health authority;
- The Strategic Directions of the Ministry; and,
- The rolling “Services Redesign Plan” for each health authority.

Other Acts relevant to food safety:

Ministry of Agriculture and Lands

- Agricultural Produce Grading Act
- Agri-Food Choice and Quality Act
- Animal Disease Control Act
- Bee Act
- Food Products Standards Act
- Game Farm Act
- Livestock Act
- Plant Protection Act
- Shell Egg Regulations

Ministry of Environment

- Environmental Management Act
- Integrated Pest Management Act
- Water Act