**Epidemiological Assessment**

**Lead public health authority:** OMD-PHAC

**Version Date:** 2014-08-02

**Version Time:** 19:30 EST

**Outbreak number and title:** 2014-175 Multi-provincial *E. coli* O157:H7 outbreak

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| **Brief Epidemiological Summary:** |
| A.1 | Has a line list been provided to investigative team members including Health Canada (e.g., case ID, case confirmation status, age, sex, onset, food exposure and purchase details)? | [x]  Yes [ ]  No |
| A.2 | Has an epidemiological summary been provided to investigative team members including Health Canada ? | [x]  Yes [ ]  No |
| A.3 | How strong is the evidence indicating that cases represent a common source outbreak?*Provide supporting evidence:*Clinical isolates for cases included in this outbreak have indistinguishable genetic fingerprints as defined by pulsed-field gel electrophoresis (PFGE). The PFGE pattern combination is rare, and, prior to this outbreak, has only been seen four times in the past six years in Canada. Given the rarity of the PFGE pattern, the distribution of the of cases in Western Canada over a three-week period, this is likely a common source outbreak.  | [x]  Strong[ ]  Moderate[ ]  Weak |
| **Food Under Assessment:** |  |
| B.1 | Suspect food: Frozen beef hamburgers  |
| B.2 | Other levels of specificity if applicable/information available (e.g., common product details, purchase location, purchase dates, package type, brand, packager/distributor/manufacturer, lot code/best before date, etc.): Two different brands of frozen beef hamburgers produced at one facility in a specific time interval: Happy Burger (one lot code) and Farmer Fred’s (two lot codes). Both brands were produced during the same week (June 2-8, 2014) at one facility. |
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| **Epidemiological Assessment Criteria and Considerations**  |
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| C.1 | **Plausibility: The food is a plausible vehicle of infection.** *Provide supporting evidence:* | **[x]  Strong** **[ ]  Moderate** **[ ]  Weak** |
| * Is the food a known vehicle of infection for the outbreak pathogen?
 | [x]  Yes [ ]  No  |
| * Is there literature to indicate that the pathogen been previously identified in the food type?
 | [x]  Yes [ ]  No |
| There have been numerous outbreaks of *E. coli* O157:H7 outbreaks associated with ground beef in Canada and the world. 1,2,3 |
| C.2 | **Temporality: Cases report eating the food within their period of exposure.** *Provide supporting evidence:* | **[x]  Strong** **[ ]  Moderate** **[ ]  Weak** |
| * What was the time period used to assess case exposures during interviews?

Note: median incubation period for *E. coli* O157:H7 is 3-4 days, with a maximum of 10 days. | 7 days  |
| * Do any cases only report eating the suspect food outside of this time period?
 | [ ]  Yes [x]  No  |
| *If Yes, please explain.* |
| C.3 | **Consistency: The distribution of cases in time and place is consistent with the shelf life and distribution of the food.** | **[x]  Strong** **[ ]  Moderate** **[ ]  Weak** |
| *Provide supporting evidence:*The distribution of the cases (BC=2, AB=4, MB=6, SK=5) correlates with the distribution of both implicated brands of frozen hamburgers. The two brands have been distributed in Saskatchewan, Manitoba, Alberta, British Columbia, Northwest Territories and Yukon. No cases have been reported outside of provinces where the products have been distributed.The hamburgers were packaged in early June (June 2-8, 2014), and shipment to distribution centres (and subsequently grocery stores) started on June 9, 2014. The onset of illness of the first case in this outbreak was on June 28, 2014.  |

| C.4 | **Consistency: The food exposure is consistently reported among cases.** | **[x]  Strong** **[ ]  Moderate** **[ ]  Weak** |
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| *Provide supporting evidence:*A majority [11/12 (91.7%)] of cases interviewed in four provinces have reported consuming hamburgers prior to onset of illness.  |
| C.5 | **Strength of association: A higher than expected proportion of cases report the food exposure.***Provide supporting evidence:** Has an analytical study been conducted?
* Do data exist that estimate the proportion of the general population who eat the food or similar foods (e.g., Foodbook, FoodNet Canada, FoodNet USA, other)?
 | **[ ]  Strong** **[x]  Moderate** **[ ]  Weak**  |
| [ ]  Yes [x]  No[x]  Yes [ ]  No |
| Nesbitt’s food consumption survey conducted in Waterloo, ON, 2006 found that hamburgers were consumed by 35.9% of the general population in the previous 7 day period.4 Among interviewed outbreak cases, 91.7% (11/12) of cases reported eating hamburgers in the 7 days before symptom onset. When the proportion of cases reporting hamburger consumption in this investigation is compared to the 2006 Waterloo, ON estimate of hamburger consumption4, the difference in proportions is significant (p<0.05). The population data may not accurately represent food consumption patterns among the outbreak population (historical data, different geographic area, different season) but are the best available data. |

| C.6 | **Consideration of alternate explanations: Have other plausible hypotheses been adequately ruled out?** | **[ ]  Strong** **[x]  Moderate** **[ ]  Weak** |
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| *Provide supporting evidence:*Eight cases reported early in their outbreak completed a hypothesis-generating questionnaire which addressed common risk factors for *E. coli* O157:H7 (beef, leafy greens, sprouts, fruit, unpasteurized dairy products, travel, animal contact, etc.). No common water, travel or zoonotic exposures were found in the hypothesis generating interviews. Exposures reported by at least half of cases that completed the hypothesis generating questionnaire were compared to reference levels4,5 and assessed for statistical differences using binomial probability. The food items identified above expected levels were: romaine lettuce, red bell peppers, mushrooms, strawberries and hamburgers. Seven of the cases (7/8, 87.5%) reported eating hamburgers. A cluster of cases reported in Saskatchewan (n=4) in the early part of this investigation reported eating hamburgers as well as romaine lettuce. A trace-back of the romaine lettuce was conducted by CFIA and linked back to a single farm in Saskatchewan (Farm A), product is not distributed outside the province. As none of the cases from other provinces have traveled to Saskatchewan, romaine lettuce was deemed an unlikely the source of the outbreak. Four subsequent cases were then interviewed with a focused questionnaire: all four (100%) of the interviewed cases report eating hamburgers. Each of the other sources examined (romaine lettuce, red bell peppers, mushrooms, and strawberries), were only reported by 25% (one of the four) cases. |
| **Conclusion** |
| D | **Is there strong epidemiological evidence that the [suspect food] is the vehicle of infection for this outbreak?**  | **[x]  Yes** **[ ]  Additional evidence needed** |
| **State any additional conclusions that can be made regarding specific details of the suspect food (e.g., product, purchase locations, purchase time periods, origin of the food):**Of the three cases with hamburger brand information, two reported eating Happy Burger brand hamburgers, and one reported eating Farmer Fred’s hamburgers. Brand and lot information was verified through opened boxes of leftover product for two cases. These two brands have been linked to the same production facility, and the implicated lot numbers were produced during the same week. |
| **Briefly highlight any important gaps in the evidence:** Receipt and/or shopper/loyalty card information to confirm brand names is being sought for cases. |
| E | **Additional considerations:** Samples of leftover frozen hamburgers in open, labelled packages have been collected from the homes of two cases. Laboratory results are pending on these samples. Environmental samples from the facility, as well as samples of the implicated products, products produced before and those produced after the implicated time frame have been obtained. Laboratory results for all of these samples are also pending. |
| **Appendix** |
|  | **References:**1. Rangel et al. Epidemiology of Escherichia coli O157:H7 Outbreaks, United States, 1982–2002. Emerg Infect Dis. 2005 April; 11(4): 603–609.
2. Bell et al. A multistate outbreak of Escherichia coli O157:H7-associated bloody diarrhea and hemolytic uremic syndrome from hamburgers. The Washington experience. JAMA. 1994; 272: 1349–53.
3. Heymann D, ed. Control of Communicable Diseases Manual 19th Edition. Washington DC: American Public Health Association, 2008; 498-508.
4. Nesbitt et al. Food consumption patterns in the Waterloo Region, Ontario, Canada: a cross-sectional telephone survey. BMC Public Health, 2008. 8:370 doi:10.1186/1471-2458-8-370

<http://www.biomedcentral.com/1471-2458/8/370> 1. Centers for Disease Control and Prevention (CDC). Foodborne Active Surveillance Network (FoodNet). Population Survey Atlas of Exposures. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2006-2007. <http://www.cdc.gov/foodnet/PDFs/FNExpAtl03022011.pdf>
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