Guide to Epidemiological Assessments

This guide introduces and describes the recommended data and criteria to consider when assessing the weight of the epidemiological evidence for a specific food as the source of an outbreak. An Epi Assessment template has been developed to assist investigators with the assessment. A standardized approach to the Epi Assessment using the template provided will facilitate Health Canada's consideration of the epidemiological evidence in the HRA.

Epi Assessments need only present the evidence in enough detail to support their conclusion. Factors to consider are presented in the guide to assist with a comprehensive review of the evidence; responses need not be provided for all of these questions. If the information is already provided in another document (e.g., a comprehensive Epi Summary), the evidence need not be repeated; the reader can be directed to the document where the information can be found. A number of questions are also embedded in the guide for ease of completion.

Examples are included in this guide to assist with the completion of the Epi Assessment. In some instances, it may be apparent with few supporting statements that a food is the source of the outbreak illnesses. In other instances, a detailed review of the evidence may be required to come to a conclusion.

Details on Epidemiological Assessment Criteria
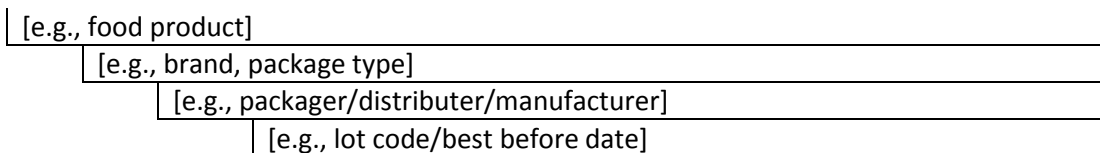
A. **BRIEF EPIDEMIOLOGICAL SUMMARY:**

   1) If a **line list** has not been provided throughout the course of the investigation, provide a line list of cases to help Health Canada to connect case-specific evidence from each of the three arms of the investigation (epidemiological, laboratory and food safety). The following variables, where available, should be considered for inclusion in the line list:
      * Case ID, case confirmation status, age, sex, onset, and any relevant laboratory, food exposure and purchase information. Include sufficient detail to allow a thoughtful review of the evidence (e.g., whether the food was fresh or frozen, location and date of purchase, etc.).

   2) Provide an **epidemiological summary** describing the status, size and severity of the outbreak and the characteristics of the population involved to inform Health Canada's risk assessment/risk characterization. Provide the following information where available:
      * Case definitions
      * Number of cases
      * Severity of illness indicators: hospitalizations, complications (e.g., HUS), deaths
      * Age and sex distributions
      * Geographic distribution by province/territory (P/T), regional/district/local health authority
      * Time distribution: include an epidemic curve based on onset date, optionally an exposure curve or gant charts for restaurant clusters
      * Other significant characteristics of population at risk (e.g., immune compromised, residents of long-term care homes, daycare population, etc.)
      * Exposure details pertinent to the suspect food and other plausible exposures (include interpretation of cases that do not report eating the suspect food or cases that are considered outliers relative to the rest of the cases).

3) Provide evidence that the outbreak described in the Epi Assessment represents a common source outbreak and not sporadic non-outbreak illnesses. Consider the following:
- Epidemiological indicators: are cases clustered in a specific and unusual time, place and/or population?
- Laboratory indicators: is the outbreak pathogen specific and unusual? Refer to Section B and consult microbiologist(s) on outbreak team.
- Based on a review of both epidemiological and laboratory data, is there evidence to indicate that this outbreak may involve multiple distinct pathogen sub-types?
- Are some cases meeting the outbreak case definition likely to be sporadic rather than outbreak illnesses?

B. FOOD UNDER ASSESSMENT:

Define the suspect food being assessed as the source of the outbreak. Consider different levels of specificity from general food type to specific product to lot codes if available from case interviews or other sources (e.g., shopper loyalty cards, inspection results).
1) **Suspect food:** The primary focus of the assessment should be on the suspect food defined at a level of specificity for which there is most likely to be sufficient evidence to implicate it as the source of the outbreak. For example, if a majority of cases report a common brand of the food, focus the assessment on the particular brand-food combination. Alternatively, if a majority of cases report a food type with limited specific product information, focus the assessment on the food type but also include the available product details.
2) **Other levels of specificity if applicable/information available:** For many outbreaks, it will also be helpful to consider the evidence available for different levels of specificity of the food**.** More specific product details, even if limited at the time of the Epi Assessment, can be combined with evidence from the laboratory and food safety evidence in the HRA to build strong evidence. Throughout the relevant sections of the assessment (i.e., consistency, strength, consideration of alternate hypotheses), also consider the evidence for the food defined more specifically as the source of the outbreak.

| [e.g., food product] |
| [e.g., brand, package type] |
| [e.g., packager/distributer/manufacturer] |
| [e.g., lot code/best before date] |

C. ASSESSMENT CRITERIA:

Assess the evidence for the suspect food as the source of the outbreak based on each of the criteria below. Weight the evidence in support of the statement for each criterion as strong, moderate or weak.

☐ Strong – There is clear and convincing evidence in support of this criterion.
☐ Moderate – There is substantial evidence in support of this criterion but additional evidence is required to make it strong.
☐ Weak – There is some evidence in support of this criterion but there are important gaps.

Provide as much evidence as you feel is required to support the assessment of each criterion (e.g., brief responses, references to sections of the Epi Summary, detailed narrative – see Examples in Appendix 3 and 4).

1) **Plausibility: The food is a plausible vehicle of infection.**

Plausibility is usually assessed in the early stages of the outbreak investigation to develop hypotheses. Investigators typically refer to the history of the pathogen and past outbreaks for this purpose (e.g., outbreak reports, microbiological studies or surveillance of food, environment, food-producing animals).

Consider the following:
- Is the food a known vehicle of infection for the outbreak pathogen?
- Has the pathogen been previously identified in the food type?

If the answer is yes to either of the above two questions, additional detail need not be provided. There is no need to document the evidence in detail or provide references to literature when the food in question is a well-known risk factor for infection with the outbreak pathogen. However, if the answer is no to both of these questions, please provide any available evidence to support the food as a plausible vehicle of infection for this outbreak. For example, is the food item farmed/prepared/manufactured in a way that is similar to food items that have been implicated in past outbreaks or is it plausible that the pathogen could grow in the food considering the need for certain conditions (e.g., pH, amount of moisture, etc.). Also note that Health Canada will conduct a detailed review of available science regarding growth and survival of the outbreak pathogen in the suspect or similar foods as necessary.

2) **Temporality: Cases report eating the food within their period of exposure.**

To establish causality, the exposure must precede the illness and should fall within a period of exposure consistent with the incubation period of the pathogen. This is typically accounted for during case interviews which focus on exposures within this timeframe.

Consider the following:
- What was the time period used to assess case exposures during interviews (e.g., 7 days, 10 days, etc.)?
- Do any cases only report eating the suspect food outside of this time period?

If exposures occur outside the expected timeframe for more than one or two cases, reasons for this should be explored (e.g., food is not the cause of the illness, unclear estimate of illness onset, difficulties recalling time of exposure, changes in pathogenesis, etc.).

3) **Consistency: The distribution of cases in time and place is consistent with the shelf life and distribution of the food.**

Temporal and/or geographic clustering of cases that correlates with the availability and/or distribution of a particular product provides stronger evidence. Describe the distribution of cases relative to what is known about the distribution and shelf life of the food.

Consider the following:
- What is the shelf life of the suspect food?

- When was/is the suspect food available to consumers (i.e., consistently or variably over time/season)?
- Is the epidemic curve consistent with the shelf life and availability of the suspect food?
- Where was/is the suspect food distributed?
- Have cases/case food purchases been identified where the suspect food was/is distributed?
- Are there any cases reporting exposure/purchases outside the time or area of the distribution of the suspect food?

Reasons for any inconsistencies should be explored (e.g., origin, pattern or frequency of food contamination, involvement of additional products containing suspect food as ingredient, etc.).

4) Consistency: The food exposure is consistently reported among cases.

The higher the number and proportion of cases who report eating the suspect food, the stronger the evidence. The evidence is also strengthened by demonstrating that the cases and/or case clusters reporting the exposure are otherwise unrelated (e.g., same food suspected based on two independent restaurant clusters). Summarise the number and proportion of cases exposed to the suspect food.

Consider the following:
- How many cases reported eating the food?
- What proportion of cases reported eating the food?
- Is the food exposure reported by a majority of cases in multiple independent clusters?
- What number and proportion of cases provided the same or similar more specific details on the origin of the food (e.g. common product details, purchase location, purchase dates, package type, brand, packager/distributor/manufacturer, lot code/best before date, etc.)?
- What are possible explanations for cases who report not eating the suspect food (e.g., hidden ingredient, difficulties noted in recalling food history, does eat suspect food but can't recall eating it in exposure period, secondary transmission, cross-contamination, etc.)?

It is not necessary to duplicate evidence that will be submitted to Health Canada by the CFIA. However, public health and/or provincial/territorial food safety authorities may have information that may more specifically pinpoint the common food source (e.g. common product details, purchase location, purchase dates, package type, brand, packager/distributor/manufacturer, lot code/best before date, etc.). There may be too few cases reporting specific details to implicate a particular product but this information is important as it will be combined with available traceback evidence in the HRA.

5) Strength of association: A higher than expected proportion of cases report the food exposure.

The gold standard epidemiologic evidence is a well-designed analytical study (e.g., case-control, cohort, case-case) demonstrating a strong and statistically significant association between the suspect food and the outbreak illnesses. In many instances, an analytical study is not feasible (e.g., due to time or resource constraints, difficulty identifying appropriate controls, difficulty ascertaining exposure because suspect food is an ingredient) and/or not warranted given the weight of other evidence available. Although less methodologically rigorous, investigators can also compare against the proportion of the general population that eats the food in question if these data exist (e.g., Foodbook, FoodNet Canada (formerly C-EnterNet), FoodNet USA, other).

Consider the following:

- Has an analytical study been conducted? If so, summarise design, results, limitations and conclusions or attach study documentation containing this information.
- Do data exist that estimate the proportion of the general population who eat the food or similar foods (e.g., Foodbook, FoodNet Canada (formerly C-EnterNet), FoodNet USA, other)? If so, indicate reference population data source and summarise the comparison, limitations and conclusions or attach documentation containing this information. Consider calculating the binomial probability of observing as many or more cases eating the suspect food by chance alone given the population food exposure frequency (e.g., using EpiInfo or Oregon Public Health's binomial probability MS Excel worksheet) or conducting a statistical test for a difference in the proportions (e.g., chi-square test, z-test) if feasible.
- If no general population data exist, is there a reasonable estimate of the proportion of the general population who eat the food? If yes, describe the methodology used to make the estimate and summarise the comparison, limitations and conclusions or attach documentation containing this information.

6) **Consideration of Alternate Explanations: Other plausible hypotheses have been adequately ruled out.**

In establishing the suspect food as the source of the outbreak, it is critical to demonstrate that other plausible hypotheses have been explored and ruled out. Detailed case interviews, particularly at the outset of an outbreak investigation, help to ensure this, as well as thorough review of information for cases who report not eating the suspect food.

Consider the following:

- How many cases were interviewed regarding other exposure sources?
- What type of interview tool was used (e.g., open ended food history, routine enteric follow up, extensive hypothesis-generating questionnaire, etc.)?
- Approximately how many other exposures were explored during case interviews?
- Have foods other than the suspect food, reported by a large (>50%) proportion of cases been ruled out? If so, briefly describe on what basis, particularly for foods that are also plausible vehicles of infection.
- Among cases that report not eating the suspect food, were there any other foods identified in common? If so, have these been ruled out as possible sources?
- Are there any cases with restricted diets or cases that never report eating certain foods?
- What foods may be commonly consumed at the same time or place as the suspect food or by the same people who eat the suspect food? Have these been ruled out as possible sources?
- If applicable, consider the possible role of food handlers in transmission via cross-contamination at implicated establishment(s) (e.g., restaurant, retail outlet) and of secondary person-to-person transmission. Interpret this information relative to the source of the outbreak, if applicable. This may explain transmission in some cases and can also explain observed inconsistencies in the evidence for a food as the source of the outbreak.

D. EPI ASSESSMENT CONCLUSION:

Based on an assessment of the epidemiological evidence, conclude that there is either strong evidence that the suspect food is the vehicle of infection for this outbreak or that there is a need for additional evidence.

Whenever possible, interpret the evidence for additional levels of specificity of the suspect food. Among cases reporting more specific details (e.g., common product details, purchase location, purchase dates, package type, brand, packager/distributor/manufacturer, lot code/best before date, etc.) what additional conclusions can be drawn? For example, there may be few cases that provided specific product details but of those who did, do the majority or a significant proportion indicate a common brand/supplier/etc.? Additionally, the purchase locations and time periods are critical for the traceback investigation and determining the scope of the implicated product.

Briefly highlight the most important gaps in the evidence to focus further investigation and evidence gathering as needed.

This information combined with findings from the laboratory, traceback and food safety investigation will inform timely and appropriate actions to control the outbreak.

E.   ADDITIONAL CONSIDERATIONS:
Comment on any relevant food samples, such as samples collected from case homes, that have laboratory results pending or in which the outbreak pathogen has been detected. Assess the information using the criteria outlined in the laboratory section and through consultation with laboratory experts on the outbreak team as appropriate.

Outline any additional evidence (including circumstantial evidence, information from outlier cases, etc.), outstanding questions or pending information that may influence the assessment of the epidemiological evidence.