

Laboratory Guidance for Ontario Public Health Inspectors for Foodborne Outbreak Investigations

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OAHPP Public Health Laboratories: Role in Foodborne Outbreaks

- Support for Ontario public health inspectors and MOHLTC
- Achieved by
 - Laboratory testing
 - Testing of primary clinical samples in outbreak investigations
 - Confirmation and speciation of isolates from other laboratories
 - Environmental (e.g. food and water) testing
 - Fingerprinting for cluster identification
 - Support and education for specimen collection, transportation, prioritization and interpretation
 - Communication of results and interpretation to stakeholders



Overview of OAHPP Tools to Support Laboratory Investigation of Foodborne Outbreaks

- 1) Public Health Inspector's Guide to the Principles and Practices of Environmental Microbiology (2010)
- 2) Laboratory Guide for Gastroenteritis Outbreaks (2008)
- 3) Other related OAHPP documents (under revision)

Public Health Inspector's
GUIDE to the Principles and Practices
of Environmental Microbiology



Public Health Inspector's Guide to the Principles and Practices of Environmental Microbiology

March 2010

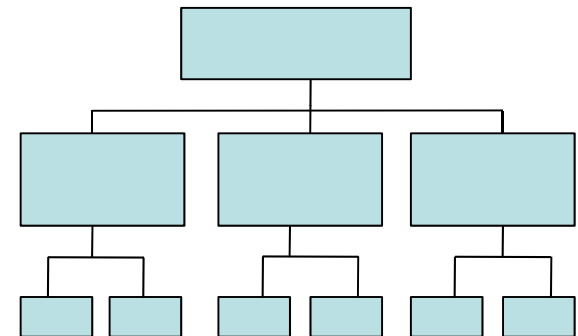


Public Health Inspector's Guide

- **Revision of previously well used Public Health Inspector's Guide developed by MOHLTC public health laboratories**
- **Integration of feedback from multiple stakeholders including PHIs from all 36 public health units**
- **Goals:**
 - **Enhance knowledge of food and environmental testing at OAHPP laboratories**
 - **Maximize source identification in foodborne outbreak investigations**
 - **Facilitate interagency transfer of information if required**

Organization of Public Health Inspector's Guide

- **Sections**
 - Food & environmental swabs
 - Water
 - *Legionella* testing
- **Each section**
 - Microbiological analysis test menu
 - Test requisition requirements
 - Collection and transportation instructions
 - Laboratory acceptance criteria
- **Interpretation guidelines**
- **Appendices**
 - Includes how to order supplies, sample test requisitions, general information about foodborne pathogens



Food Sample Analysis

Food – Microbiological Analysis Test Menu

Tables 1 to 4 provide an overview of food testing performed by the PHL – Environmental Microbiology section, the nature of each test, and the turn around time. Turn around time is defined as the number of working days to complete testing based on date of receipt in the laboratory.

Table 5 provides a list of food related tests which are referred out from the PHL.

Table 1: Indicator Bacteria

Test	Nature of Test	Turn Around Time
Aerobic Plate Count (Heterotrophic Plate count)	Bacterial culture	2 days
Total coliform count	Bacterial culture	2 days
Escherichia coli	Bacterial culture	3 days
Total Gram Negative Count	Bacterial culture	1 day

Table 2: Foodborne Pathogens

Test	Nature of Test	Turn Around Time
<i>Bacillus cereus</i>	Bacterial culture and toxin testing	2 – 4 days
<i>Campylobacter jejuni</i>	Bacterial culture	4 – 6 days
<i>Clostridium perfringens</i>	Bacterial culture	1 – 5 days
<i>Escherichia coli</i> O157:H7	Bacterial culture	2 – 9 days
<i>Listeria monocytogenes</i>	Bacterial culture	4 – 8 days
<i>Salmonella</i> species	Bacterial culture	4 – 6 days
<i>Shigella</i> species (not routinely performed)	Bacterial culture	4 – 6 days
<i>Staphylococcus aureus</i>	Bacterial culture Detection of bacterial toxins	2 – 4 days 2 days
<i>Vibrio</i> species	Bacterial culture	2 – 7 days
<i>Yersinia enterocolitica</i>	Bacterial culture	11 – 18 days

Indicator bacteria testing is performed on all food items, with the exception of heterotrophic plate count which is not performed on raw foods and cultured products e.g. cheese.

Pathogen specific analyses are determined based on clinical information obtained from submitters and food type. Provision of clinical information on the test requisition is critical in order for laboratories to provide the most appropriate testing for outbreak investigations.

Table 3: Physicochemical tests

Test	Nature of Test	Turn Around Time
pH	Hydrogen ion measurement with ion selective electrode	1 day
Phosphatase	Measurement of alkaline phosphatase in dairy products by fluorometric assay	1 day
Water Activity – Aw	Measurement of unbound water in food by chilled-mirror dewpoint technique	1 day

Table 4: Molecular typing

Test	Nature of Test	Turn Around Time
Pulsed field gel electrophoresis (PFGE)	Molecular typing	3 – 5 days

Table 5: Referred tests

Test	Referral Laboratory
<i>Clostridium botulinum</i>	Testing performed at: Botulism Reference Service Health Canada Room D457, Sir Frederick G. Banting Building Building 22, Tunney's Pasture, PL2204E 251 Sir Frederick Banting Driveway Ottawa, ON K1A 0K9 Telephone: (613) 957-0002
<i>Cryptosporidium</i> <i>Cyclospora</i> <i>Giardia</i> Hepatitis A Norovirus Prion disease <i>Toxoplasma</i> <i>Trichinella</i>	The tests listed may be referred to other testing facilities. Please contact the Toronto PHL, Medical Microbiologist at 416.526.5441 or the Environmental Laboratory at 416.235.5716.

Information Required for Interagency Transfer and Potential Recall

- Submitter Identification
- Outbreak Number
- Purpose of Collection
- Type of sample
 - part of meal/ control sample/ follow up
- Epidemiological information
 - Incubation period, symptoms, causative agent
- Sample description/ identification
- Sample unique identifier
- Product information and details needed to facilitate recall
- Photo of package to be kept by PHI, if possible



Collection and Transportation Instructions

- Epidemiological and risk based food sample collection
- Containers for sampling and submission of foods
- Steps for sample collection
- Sample storage
- Sample transportation requirements

Food – Collection and Transportation Instructions

Table 6 provides information and sampling instructions for food.

Table 6: Food – Collection and Transportation Instructions

Epidemiological and Risk Based Prioritization of Food Sample Collection in Foodborne Outbreaks ²	
<ul style="list-style-type: none"> • Selection of food items for collection and submission in a foodborne outbreak should be based on all available epidemiological and laboratory information related to the outbreak. • Epidemiological analyses, such as the calculation of attack rate, will facilitate prioritization those food items that are most likely to be involved. • If attack rates are unavailable, incubation period, clinical syndrome and basic demographic information about related cases should be used. 	<ul style="list-style-type: none"> • The integration of information about the clinical pathogen, if known, should also facilitate prioritization of food items to be collected and tested. Pathogen specific high risk foods are presented in Appendix C. • If risk stratification of food sources is not performed by the submitting public health inspector, and there is an abundance of specimens submitted for testing, prioritization will be determined by the head technologist and medical microbiologist of the PHL. Environmental Microbiology section. The communication of all available clinical, epidemiological microbiological information to the PHL is of great importance in guiding these decisions.
Containers for Sampling and Submission of Foods	
<ul style="list-style-type: none"> • Sterile plastic sample bags with round wire closure or whirl-pak bags are the preferred sample container. When used properly, these bags are suitable for all sample types. • Food samples found in the original container can be submitted in the original packaging provided that the container is air-tight and will not leak during transit. • If the original container has been opened or if the packaging is fragile and may be damaged during transit, samples should be transferred from the original container to a whirl-pak bag. 	<ul style="list-style-type: none"> • Styrofoam and box-board packaging used for fast-food products are examples of containers that are not suitable for bacteriological sampling. They are not air tight and may leak causing cross contamination of samples and/ or external contamination into the sample. These containers should not be put inside a whirl-pak bag since the outside surfaces will be contaminated by handling and the sample may be compromised in transit. • If sampling closed or intact samples, please consult with the CFIA prior to submission.
Preparation	
<p>As part of good aseptic technique, the time taken for the physical collection of the sample can be minimized by ensuring the following:</p>	<ul style="list-style-type: none"> • Ensure all materials required are available. • Label sample bags before sample collection. • Investigate before sampling to determine plan of action that will minimize sampling time. • Complete requisition(s) before or after, never during, sample collection.

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² For full details please consult Foodborne disease outbreaks: guidelines for investigation and control. World Health Organization 2008. http://whqlibdoc.who.int/publications/2008/9789241547222_eng.pdf Accessed February 14, 2010.

Collection and Transportation of Food Samples

Table 6: Food – Collection and Transportation Instructions *continued...*

Collection of Sample(s)

- Aseptic technique
- Minimize cross contamination
- Prioritization using pre-test probability
- Sampling plan based on food item
- Transport to maintain conditions

should be collected in approximately equal amounts and will be tested as one sample.

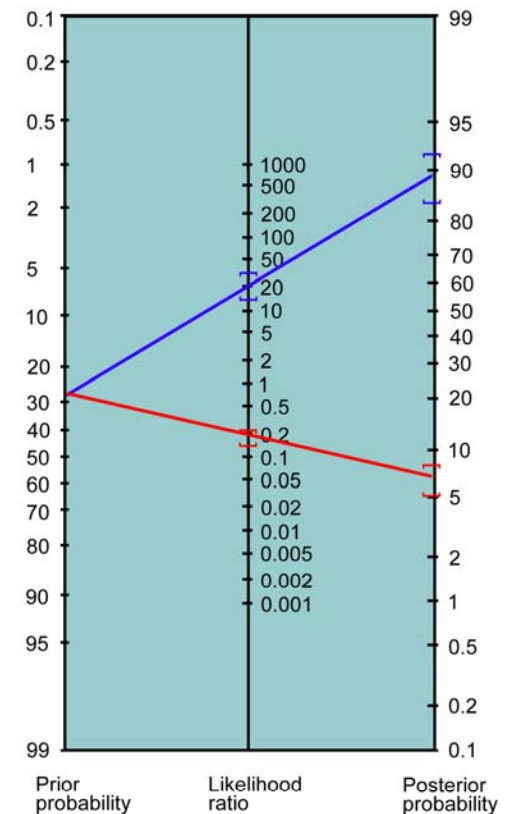
- Foods that contain multiple items (e.g. meat and gravy, sandwiches) may be collected as a single sample.
- Separation of meals or mixed foods must be performed at the sampling stage. The laboratory will not separate components of a sample received in the laboratory.

little sample left. In food poisoning cases, small samples will be processed by the laboratory, but complete analysis may not be possible. If you suspect, or have a confirmed etiological agent, indicate the information on the requisition form and the specific analysis will be given priority.

- In the absence of such information, the laboratory will exercise judgment and will perform analyses that will most likely provide useful information.

Collection of Specimens & Pre-test Probability

- **Pre-test probability**
Definition: probability that a food item is the vector of foodborne illness before a diagnostic test result is known
- **Can be determined based on attack rates, case control studies, cohort studies, information about pathogen**
- **Final test result interpretation is dependant on pre-test probability**



For more details on pre-test probabilities, see the Centre for Evidence Based Medicine @ <http://www.cebm.net/>

Using Pre-test Probability

- Concept adopted from clinical medicine and diagnostics
 - CT scans for pulmonary embolism
- Important for:
 - Interpretation of results
 - E.g. *E coli* in lettuce, *Listeria* in unpasteurized milk
 - Prioritization of testing in foodborne outbreak
 - Increase sampling of items of high pre-test probability
- Will be increasingly important with the introduction of molecular diagnostics for food testing

Laboratory Interpretation Guidelines

Table 17: Interpretation of environmental microbiological results *continued...*

Analysis	Sample Type/Source	Reporting Limits	Acceptable Limits
<i>Legionella</i> species	Taps/sinks/spas/ showers	Presence/Absence	Significance interpreted per investigation in consultation with medical microbiologist
<p>Laboratory Test Interpretation</p> <p>Except for high risk populations, routine environmental monitoring for <i>Legionella</i> is not recommended.</p> <p><i>Legionellae</i> have predilection for sediments, slimy deposits and rubber fittings in water distribution systems.</p> <p>Recovery of <i>Legionellae</i> from >30% of different sampling sites is considered to indicate a hazard.</p>			
<i>Listeria monocytogenes</i>	Food (high risk foods, or in outbreak investigation)	Presence/Absence	Present in 50 grams
<p>Laboratory Test Interpretation</p> <p>Reference Food Directorate, Health Canada Policy on <i>Listeria monocytogenes</i> in Ready-to-eat Foods, FD-FSNP-048, July 5, 2004.</p>			
pH	Food	1.00 to 14.00	
<p>Laboratory Test Interpretation</p> <p>Foods with a pH of <4.00 will not support the growth of bacterial foodborne pathogens</p>			
Phosphatase (Alkaline phosphatase)	Dairy	Presence/Absence	Absent
<p>Laboratory Test Interpretation</p> <p>The detection of residual alkaline phosphatase indicates a reduction in pasteurization temperature of at least 1.5°C; a 5 minute reduction in holding time; or the presence of ≥ 0.3% raw milk.</p>			

Appendices

- Appendix A
Supplies
- Appendix B
Laboratory Submission Forms
- Appendix C
Major Foodborne Diseases:
General features

Table 18: Major Foodborne Diseases: clinical features, mode of transmission and associated high risk foods

Etiologic Agent	Incubation period	Symptoms
<i>Bacillus cereus</i> (Bacterial toxin)	a) Diarrheal syndrome: 8 – 16 hours b) Emetic syndrome: 1 – 5 hours	a) Diarrheal syndrome: acute diarrhea, nausea and abdominal pain. b) Emetic syndrome: acute nausea, vomiting and abdominal pain and sometimes diarrhea.
<p>Mode of Transmission and Associated Foods</p> <p>Ingestion of food that has been stored at ambient temperatures after cooking, permitting the growth of bacterial spores and toxin production. Many outbreaks (particularly those of the emetic syndrome) are associated with cooked or fried rice that has been kept at ambient temperature.</p> <p>Foods involved include starchy products such as boiled or fried rice, spices, dried foods, milk, dairy products, vegetable dishes, and sauces.</p>		
<i>Campylobacter jejuni</i>	Typically 2 – 5 days (range 1 – 11 days)	Fever, severe abdominal pain, nausea and diarrhea which can vary from slight to profuse and watery sometimes containing blood or mucus.
<p>Mode of Transmission and Associated Foods</p> <p>Principally through ingestion of contaminated food. Main food sources are raw milk and raw or undercooked poultry. Spread to other foods by cross-contamination or contamination with untreated water; contact with animals or birds. Other sources of transmission are contact with live animals (pets and farm animals). Person-to-person transmission occurs during the infectious period that ranges from several days to several weeks.</p> <p>Foods involved include raw milk, poultry, beef, pork and drinking-water.</p>		
<i>Clostridium botulinum</i>	12 – 36 hours (range several hours to 8 days)	Vomiting, abdominal pain, fatigue, muscle weakness, headache, dizziness, ocular disturbance (blurred or double vision, dilated pupils, unreactive to light), constipation, dry mouth and difficulty in swallowing and speaking, and ultimately paralysis and respiratory or heart failure.
<p>Mode of Transmission and Associated Foods</p> <p>Ingestion of toxin pre-formed in food. This may occur when raw or under-processed foods are stored in anaerobic conditions that allow growth of the organism. Most outbreaks are due to faulty preservation of food (particularly in homes or cottage industries), e.g. canning, fermentation, curing, smoking, or acid or oil preservation.</p> <p>Examples of foods involved include vegetables, condiments (e.g. pepper), fish and fish products, meat and meat products, honey, fruit and vegetable juices. Several outbreaks have occurred as a result of consumption of unviscerated fish, garlic in oil, and baked potatoes.</p>		

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Laboratory Guide for Gastroenteritis Outbreaks

*Public Health Laboratories Branch
Ontario Agency for Health Protection and Promotion*

March 2008

OAHPG Gastrointestinal Outbreak Guide


- **Scope focused on investigation of human illness**
- **Includes**
 - **Overview of agents associated with gastrointestinal outbreaks**
 - **Clinical specimens in GI outbreaks**
 - **Guidelines for prioritization**
 - **Collection and transportation instructions**
 - **Kits for clinical specimens**
 - **Food and environmental testing (abbreviated)**
 - **Communication during outbreaks**
 - **Laboratory contacts**
 - **Testing flowcharts**



OAHP Public Health Laboratories Forms Under Revision

- Environmental Microbiology Laboratory Requisition
 - Outbreak Notification Form



		<h2>Outbreak Notification Report</h2>	
Instructions: Complete Entire Form. FAX to your local Public Health Laboratory. PHL Helpdesk: Telephone 1-800-640-7221 For further information: www.oahpp.ca			
<input type="checkbox"/> Initial Notification <input type="checkbox"/> Update <input type="checkbox"/> Final (Closed)		<input type="checkbox"/> Respiratory <input type="checkbox"/> Enteric <input type="checkbox"/> Food borne illness <input type="checkbox"/> other	
FROM:			
Health Unit/Institution			
Contact Person		Title	Telephone
EPIDEMIOLOGICAL DATA		PREDOMINANT CLINICAL FEATURES	
Outbreak Coordinator:	Telephone ()	Respiratory symptoms <input type="checkbox"/> Fever <input type="checkbox"/> Flu-like Symptoms Respiratory Congestion <input type="checkbox"/> URT <input type="checkbox"/> LRT <input type="checkbox"/> Sore Throat <input type="checkbox"/> Cough <input type="checkbox"/> Headache <input type="checkbox"/> Myalgia <input type="checkbox"/> Chills <input type="checkbox"/> Other (specify)	Enteric symptoms <input type="checkbox"/> Nausea <input type="checkbox"/> Vomiting <input type="checkbox"/> Abdominal Cramps Diarrhea <input type="checkbox"/> Watery Diarrhea <input type="checkbox"/> Bloody Diarrhea <input type="checkbox"/> Dehydration <input type="checkbox"/> Headache <input type="checkbox"/> Other (specify)
Health Unit Outbreak No:	(Health Unit # / YYYY / Outbreak #)		
Location of Outbreak: Name of Institution/Event/Source			
Address:			
Postal Code:			
Date of Onset (Index Case):	(YYYY/MM/DD):	Incubation Period: (hours/days)	Median: _____ Range: _____
No. of Residents/persons:		Duration of Illness: (hours/days)	Median: _____ Range: _____
Ill: _____	at risk/exposed: _____	hospitalized: _____	
Number of Fatal Cases: _____		Travel History:	
Suspected Etiological Agents:			
Facility Type/ OB Location:		<input type="checkbox"/> Community/ Family Gathering (specify) _____ <input type="checkbox"/> Correctional Facility <input type="checkbox"/> Day Care <input type="checkbox"/> Long-Term Care Home <input type="checkbox"/> Military Base <input type="checkbox"/> Retirement Home / Seniors' Residence	
<input type="checkbox"/> Camp <input type="checkbox"/> Clinic <input type="checkbox"/> Food Supplier/Distributor <input type="checkbox"/> Hospital <input type="checkbox"/> Psychiatric Hospital <input type="checkbox"/> Restaurant/ Eatery <input type="checkbox"/> School <input type="checkbox"/> Other (Specify) _____			
Shaded area for laboratory use only			
Notification Received By:		Telephone: ()	

Future Directions

- **Biannual review planned**
- **Merging of Gastrointestinal Guide and PHI Guide**
 - Detailed clinical and environmental testing for foodborne outbreaks
- **Links to information describing testing methodologies and interpretation**
 - e.g. Pulsed field gel electrophoresis (PFGE)
- **Broadening scope to include information beyond laboratory testing for public health inspectors**
 - Requires ongoing partnership with MOHLTC and public health units
- **Standardization of protocols for sampling, transportation and interpretation across provincial and federal levels**

Contact Directory

Please refer to the OAHPP website for more information and up-to-date contact information for the OAHPP Public Health Laboratories: <http://www.oahpp.ca/services/public-health-laboratories.html>

OAHPP Public Health Laboratory, Toronto

81 Resources Road
Etobicoke, ON M9P 3T1
Hours of Operation: Monday to Friday, 8:00 AM – 5:00 PM

Telephone 416-235-6132
Fax 416-235-6103
Toll-free Helpline
(Monday to Friday 8:00 am – 5:00 pm) 1-800-640-7221
After-hours Emergency Response Line
(5:00 pm – 8:00 am, weekends) 416-605-3113

Contact Directory *continued...*

OAHPP Public Health Laboratories, Regional

Hours of Operation: Monday to Friday, 8:00 AM – 5:00 PM
After-hours Emergency Response Line: 416-605-3113

Regional Laboratory		Telephone #	Fax #
Hamilton	250 Fennell Avenue West, P.O. Box 2100 Hamilton ON L8N 3R5	905-385-5379	905-385-0083
Kingston	181 Barrie Street, P.O. Box 240 Kingston ON K7L 4V8	613-548-6630	613 547-1185
London	St. Joseph's Regional Mental Health Centre, 850 Highbury Avenue, 5th Floor, P.O. Box 5704, Postal Station 'A', London ON N6A 4L6	519-455-0310	519-455-3363

Please phone us if there are any questions, concerns, requests for diagnostic guidance....

Program Coordinator Drinking Water Testing	519-455-9310	519-455-3363
Clinical and Environmental Microbiology Office	416-235-5712	416-235-5951
Manager, Clinical and Environmental Microbiology	416-235-5988	416-235-5951

Sudbury	1800 Paris Street, Suite 2 Sudbury ON P3E 6H3	705-564-6017	705-564-6018
Thunder Bay	336 South Syndicate Avenue Thunder Bay ON P7E 1E3	807-622-6449	807-622-5423
Timmins	67 Wilson Avenue Timmins ON P4N 2S5	705-267-6633	705-360-2006
Windsor	3400 Huron Church Road, P.O. Box 1616 Windsor ON N9A 6S2	519-960-4341	519-973-1481

Thank you.
Any questions?

