

Shellfish Poisoning: Public Health Management Toolkit

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Background

Health Canada has established [biotoxin limits](#) in harvested shellfish, which are enforced by the Canadian Shellfish Sanitation Program (CSSP)¹. In BC, the highest levels of shellfish biotoxins have been found in mussels, clams, oysters, scallops, and crab, but they can also be found in cockles, whelks, prawns, squid, and other species that feed on plankton.² The **severity of illness is proportional to the individual level of biotoxin exposure**. Unlike *Vibrio parahaemolyticus* (Vp) and norovirus, shellfish biotoxins are not inactivated by cooking. In contrast, their concentrations *may be increased* by cooking.

This toolkit guides Regional Health Authorities in management of shellfish poisoning cases and provides additional details into investigations of shellfish biotoxin poisonings, as they can differ from other foodborne illness reports or outbreaks. Regardless, the [BC Foodborne Illness Outbreak Response Protocol](#) should be followed when outbreaks are identified.

Shellfish poisoning occurs following the ingestion of bivalve shellfish and other seafood that contain biotoxins and can be life-threatening. The type of poisoning depends on the biotoxins present, with the more common ones being [paralytic shellfish poisoning](#) (PSP; caused by saxitoxin and analogues), [amnesic shellfish poisoning](#) (ASP; caused by domoic acid), and [diarrhetic shellfish poisoning](#) (DSP; caused by okadaic acid and dinophysis toxins).

General shellfish poisoning (DSP, PSP and ASP) case definition

Confirmed case = Clinical illness within 48 hours* of eating at risk shellfish or contaminated seafood **AND** lab confirmation (detection of toxins or responsible organisms in seafood, urine**, stool**, and/or water)

Probable case = Clinical illness within 48 hours* of eating at risk shellfish or contaminated seafood, in the absence of other known causes.

*Specifically, within 12 hours for DSP, within 24 hours for PSP, and within 48 hours for ASP.

** Urine and stool testing is not available in Canada. Testing of the shellfish/seafood is most common.

Visit the BCCDC website for full [PSP](#), [ASP](#), and [DSP](#) case definitions.

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Epidemiology and Reportability

PSP, ASP, and DSP are all reportable conditions in BC. From 1793 to 2020, there have been 63 known outbreaks of PSP, no outbreaks of ASP, and one outbreak of DSP in BC³.

Clinical Information

The time from exposure to symptom onset varies based on the type and amount of biotoxin consumed. This typically ranges from 30 min to several hours but can be as long as 24-48 hours (for ASP).

Signs and symptoms are listed below. A detailed comparison of clinical presentations is available [here](#).

- **PSP:** paresthesia and paralysis involving the mouth and extremities, drowsiness, weakness, headache, discoordination, tachycardia, and difficulty with swallowing and speech. GI symptoms (nausea, vomiting, diarrhea, abdominal pain/cramps) are possible as well. Severe effects include respiratory failure and death.
- **ASP:** GI symptoms and neurologic symptoms including weakness, confusion, and loss of memory. Severe effects include hypotension, arrhythmia, pulmonary edema, seizures, coma, and death.
- **DSP:** GI symptoms, chills, and headache.

Diagnosis & Treatment: Clinical diagnosis is based on patient presentation and history. Diagnosis is confirmed by biotoxin detection in epidemiologically linked food. Urine and stool testing for shellfish biotoxins is **not available in Canada**. Norovirus and Vp infections can occur with undercooked and raw shellfish and may be ruled out with clinical lab testing. There is no cure or antidote for shellfish poisoning. Treatment is supportive (e.g., observation, oral rehydration, respiratory support) and severe cases require hospitalization. The illness is self-limited, and recovery time is typically hours to days but up to weeks in severe cases. Long-term sequelae are largely unknown.

Vulnerable groups: developing fetuses, pregnant people, neonates and infants, children, elderly, and those with pre-existing medical conditions.

BCCDC Resources

On the [Surveillance Forms \(bccdc.ca\)](#) page select *Enteric, Food and Waterborne* to access the *Vibrio/Seafood-related Illness* forms and resources:

- [Vibrio Follow-up Form](#)
- [Flowchart to assist in seafood-related illness](#)
- [Table to assist in seafood-related illness \(Clinical and exposure information\)](#)
- [Seafood-related Illness Follow-up Form](#)

Public Health Management



1. INITIAL CONSULTATION	
<p>Collect clinical history</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Signs & symptoms, onset, severity, need for medical care/hospitalization, allergies, other medical conditions, and most likely clinical diagnosis
<p>Screen for shellfish poisoning</p> <p>Resource: Table for Clinical and exposure information to assist investigation of seafood-related illness</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Was the patient exposed to shellfish? Note: Biotoxin poisoning is still possible with the consumption of some types of non-shellfish seafoods, such as, planktivorous fish, squid and others <ul style="list-style-type: none"> ➤ See resource: Flowchart to assist in the assessment of seafood-related illness <input type="checkbox"/> Are symptoms & onset suspicious for shellfish poisoning? Shellfish poisoning can present minutes to hours after exposure, whereas norovirus and Vp infections take many hours to days. PSP and ASP often have distinct neurological features, but DSP can present more similarly to norovirus and Vp infections <input type="checkbox"/> Was the shellfish cooked? Norovirus and Vp infection are more likely with undercooked/raw shellfish and DSP is more likely with cooked shellfish <div style="border: 1px solid black; padding: 5px; text-align: center; margin-top: 10px;"> <p><i>If shellfish poisoning is possible, continue with the steps below</i></p> </div>
<p>Collect exposure history, if possible</p> <p><i>This may be collected from the patient, healthcare provider, or proxy</i></p> <p><i>Not all the information may be available during the initial assessment</i></p>	<ul style="list-style-type: none"> ➤ Type(s) of food consumed: mussels, clams, oysters, scallops, crab, whelks, cockles, other seafood, and other foods <ul style="list-style-type: none"> <input type="checkbox"/> Best estimate of amount of food consumed (e.g., pieces or grams) <input type="checkbox"/> Weight of the individual(s) ➤ Food handling and preparation: raw, undercooked, or fully cooked, and food storage ➤ Exposure setting: home, food service establishment, event, etc. ➤ Other people exposed/potentially exposed: <ul style="list-style-type: none"> <input type="checkbox"/> Identification and contact information of others ill and/or exposed <input type="checkbox"/> If available, their demographic information and clinical and exposure history ➤ Availability of leftovers for testing: includes raw and cooked leftovers, unshucked shellfish still in their shells from the same batch, and/or broth <ul style="list-style-type: none"> <input type="checkbox"/> Location of leftovers <input type="checkbox"/> Individual/organization to contact to access these and contact information

1. INITIAL CONSULTATION	
	<ul style="list-style-type: none"> ➤ Degree of exposure: amount consumed and number of meals in last 24 h ➤ Travel history: within BC, Canada, and outside Canada during the exposure period
Collect source information	<ul style="list-style-type: none"> ➤ Type of source: Self-harvested, community-harvested, commercial harvester, retailer, or food service establishment <ul style="list-style-type: none"> <input type="checkbox"/> For shucked/tubbed oysters and other shellfish without tags collect lot #, best before date <input type="checkbox"/> Country of origin (if not BC/Canada) ➤ Date of harvest/purchase ➤ Location of harvesting area <u>AND/OR</u> landfill number and copy of shellfish tag, if available ➤ If shellfish was purchased or provided, name and/or contact of harvester, retailer, supplier, food service establishment, collect invoice, and purchase order details
Alternative explanations for symptoms	<ul style="list-style-type: none"> ➤ Suspicion of issues with food preparation, handling, storage, or sanitation? ➤ Exposure to ill contacts: Home, work, school, and other settings? ➤ Any other explanation aside from shellfish/seafood poisoning?

2. IMMEDIATE ASSESSMENT AND CONTROL MEASURES	
Case assessment	<ul style="list-style-type: none"> <input type="checkbox"/> Do they meet the probable case definition for PSP, ASP, and/or DSP? <input type="checkbox"/> Is shellfish/seafood a likely source of illness? ➤ <i>If yes to both, continue to steps below. If no to either, investigate other more likely sources</i>
Assessment of further risk to the public	<ul style="list-style-type: none"> <input type="checkbox"/> Review shellfish harvesting map, if the harvesting location is known is it an opened or closed harvesting area? <input type="checkbox"/> Any other recent reports of shellfish/seafood-related illness? Is there a cluster? <input type="checkbox"/> Ascertain risk level to determine the urgency of next steps: <ul style="list-style-type: none"> <input type="checkbox"/> Low risk: self-harvested from a closed area for personal consumption <input type="checkbox"/> Moderate to high risk (any of the following): self-harvested from an open area, served at a food-service establishment, purchased from a harvester/retailer <u>AND/OR</u> single case but others have been exposed/may become exposed
Urgent consultations	<ul style="list-style-type: none"> <input type="checkbox"/> If exposure occurred in a different regional Health Authority (RHA), consult the MHO on call from corresponding RHA

2. IMMEDIATE ASSESSMENT AND CONTROL MEASURES	
	<p>If harvest or exposure occurred within a First Nations community, consult First Nations Health Authority (FNHA)</p>
<p>If moderate to high risk</p> <p><i>Consider notifications to key partners and/or to control risk (refer to BC FIORP contact list for public health partners)</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Notify the CFIA, if a commercial harvester or retailer was a potential source of illness. Urgency is higher when there is severe illness and/or the presence of a cluster <ul style="list-style-type: none"> ➤ Call 604-292-5780 (monitored until 2300) ➤ Email cfia.bclmfoodsafety-salubritedesaliments.acia@canada.ca and CC cfia.pacificshellfish-mollusquespacifique.acia@canada.ca <input type="checkbox"/> Notify the BCCDC to support food testing, providing historical biotoxin information, and assist with the investigation and coordination. Urgency is higher if there is a cluster or multiple health authorities are involved: <ul style="list-style-type: none"> ➤ Public Health Response: ezvbepi@bccdc.ca ➤ Environmental Health Services: fpinfo@bccdc.ca ➤ PHS Lab: bccdc_envmicseniors@phsa.ca ➤ Physician on-call: 604-875-2161 (after-hours) <input type="checkbox"/> Immediate notification of those with the same exposure: <ul style="list-style-type: none"> ➤ This may include others with same the exposure and whose contact information is known (e.g., family and friends, event participants) ➤ Call to screen for symptoms, notify about risk of illness, and seek medical attention in case of symptoms ➤ For harvest/event in the First Nations community, collaborate with FNHA Environmental Public Health Services for notifications <input type="checkbox"/> Immediate notification of food service establishments/suppliers suspected to be an exposure setting: hold and not serve shellfish linked to illness pending investigation <input type="checkbox"/> If self-harvested from an open area, consult the Department of Fisheries and Oceans (DFO) to determine if closure of the area is possible Call 604-607-4186 OR 1-800-465-4336
<p>If low risk</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Plan to sample leftovers including uncooked shellfish, cooked shellfish or broth. If consulted after hours, the subsequent steps can be deferred until the following business day

3. INVESTIGATION	
<p>Roles & responsibilities in investigation</p>	<ul style="list-style-type: none"> ➤ The RHA in which the exposure occurred is responsible for the primary investigation, including case reporting and interviews, inspecting food service establishments or suppliers, collecting leftover food samples,

3. INVESTIGATION	
	<p>obtaining tag information and receipts, and requesting that establishments/suppliers hold all implicated products</p> <ul style="list-style-type: none"> ➤ CFIA is responsible for conducting shellfish trace-back, inspecting fish and shellfish processing plants, testing samples for biotoxins, sending CFIA inspectors for specimen collection, and advising removal of implicated shellfish from distribution ➤ BCCDC coordinates testing requests including forwarding food samples to the CFIA, assesses the reporting forms for clusters, and can assist with investigation and coordination ➤ DFO closes harvesting areas and communicates with federal regulatory partners
Declaring an outbreak	<ul style="list-style-type: none"> <input type="checkbox"/> A single case of PSP, ASP or DSP warrants prompt investigation and response. Two or more linked cases of PSP, ASP, or DSP is considered an outbreak. When symptoms are non-specific (e.g., GI symptoms), the declaration of an outbreak may be delayed ➤ It is more concerning if there are two or more unrelated cases (do not live in a common household, exclusive of institutional event) with similar illnesses that can be epidemiologically linked to one another (source: BCCDC Definition of GI outbreak) ➤ The RHA/MHO can declare an outbreak and organize outbreak meetings. They may also request assistance from BCCDC for assistance with coordination
Epidemiological Investigation	<ul style="list-style-type: none"> <input type="checkbox"/> Use the BCCDC seafood illness-case report form, and the Initial Consultation checklist above for ongoing information gathering (or the Vibrio report form as indicated). All cases need their own case report form for reporting to the BCCDC <input type="checkbox"/> Fax/email completed case report forms to the BCCDC <ul style="list-style-type: none"> ➤ Email ezvbepi@bccdc.ca ➤ Fax (604) 707-2516 <input type="checkbox"/> Record the weight of case(s) and the weight or number of pieces of shellfish consumed
Food safety investigation & sampling	<ul style="list-style-type: none"> <input type="checkbox"/> Inspection of food service establishments: <ul style="list-style-type: none"> ➤ Inquire about illness reports received at the premises from customers or reports of ill employees (e.g., if cases have GI signs/symptoms), review illness and complaints tracking log ➤ Review food safety plans, sanitation plan, shellfish receiving and tracking logs ➤ Verify temperature control for coolers and freezers ➤ Potential for cross-contamination between products (e.g., storage in the same tank)

3. INVESTIGATION	
	<ul style="list-style-type: none"> <input type="checkbox"/> Collect shellfish identification: <ul style="list-style-type: none"> ➤ Determine the most likely lots of product that cases were exposed to ➤ Shellfish stock tag information: Processor name and registration #, original shippers’ certificate #, harvest date, process and/or shipping date, lot #, type of shellfish. An example of a shellfish tag is on page 4 of this document⁴ ➤ Collect invoices and/or receipts for shellfish/seafood ➤ Cross-examine invoices & tags to ensure the accuracy of the tag information <input type="checkbox"/> Collect samples of: <ul style="list-style-type: none"> ➤ All types of seafood served on that day to consumers ➤ Leftover food, including raw and cooked leftovers, unshucked shellfish, and/or broth ➤ Unprepared shellfish: the preferred sample is from the same batch or harvest area as the implicated product. Samples from a different harvest day or area are less preferable but can still be collected <input type="checkbox"/> Storage of samples: <ul style="list-style-type: none"> <input type="checkbox"/> Leftover cooked shellfish (or soup broth) and uncooked shellfish should be kept under original storage conditions (e.g. if originally refrigerated, DO NOT freeze). Consult BCCDC Lab for further information <input type="checkbox"/> Leftovers can be kept in any food storage container <input type="checkbox"/> Refrigeration is preferred for Vp and norovirus testing. Frozen is preferred for any sample that will need to be stored for over 2 days <input type="checkbox"/> Onsite actions: <ul style="list-style-type: none"> <input type="checkbox"/> Request food service establishment or supplier stop sale of and hold all potentially implicated product ➤ CFIA is responsible for inspection and sampling at retailers, processors, and harvesters <input type="checkbox"/> DFO may sample water in harvesting areas
Laboratory Investigation	<ul style="list-style-type: none"> <input type="checkbox"/> Email and/or call the BCCDC Lab for lab testing and guidance on sample submission. Public Health Response and Environmental Health Services will be notified if there is a lab request. <ul style="list-style-type: none"> ➤ Email PHSA Lab: bccdc_envmicseiors@phsa.ca ➤ Please provide all the shellfish stock tag information, the case report form, food preparation method, date of collection, sample size (number or total weight of shellfish), and storage condition

3. INVESTIGATION	
	<ul style="list-style-type: none"> ➤ Collect clinical samples to rule in/out norovirus and Vp if GI symptoms occur following consumption of raw or lightly cooked shellfish ➤ The BCCDC/PHSA Lab will request CFIA to test for biotoxins <input type="checkbox"/> Turnaround time for biotoxin results are not prescribed as these are special requests based on CFIA capacity. If needed, consult the BCCDC Environmental Health Services for assistance with interpretation of biotoxin results and to identify confirmed cases <input type="checkbox"/> Email Environmental Health Services: fpinfo@bccdc.ca
Integrated analysis	<ul style="list-style-type: none"> <input type="checkbox"/> Hypothesize the cause(s)/source(s) of illness, based on all information gathered <input type="checkbox"/> Due to individual differences in sensitivity, some people may still experience illnesses with toxin levels below the regulatory amounts (PSP, ASP, and DSP) <ul style="list-style-type: none"> <input type="checkbox"/> Depending on the severity of illness and cluster size, public health actions (below) may be warranted before test results are available

4. IMMEDIATE ASSESSMENT AND CONTROL MEASURES	
Mitigation actions	<ul style="list-style-type: none"> <input type="checkbox"/> Isolate suspected shellfish/seafood product, lot(s), and harvest area(s) <input type="checkbox"/> RHAs will request that establishments/suppliers to hold, stop sale of, and discard the implicated products ➤ The CFIA will: <ul style="list-style-type: none"> ➤ Facilitate shellfish recalls, including requesting and advising removal of implicated shellfish from distribution. ➤ Based on their investigation, they may request that the DFO close a harvest area
Public health notices/ general information/ recalls and advisories	<ul style="list-style-type: none"> <input type="checkbox"/> RHAs may choose to issue directed and/or general public health notices and education around shellfish poisoning and harvesting. Joint advisories and education can be created and released with the BCCDC. <input type="checkbox"/> RHAs should collaborate with FNHA for notices and information to First Nations communities when exposure and/or harvesting occurred in their communities ➤ CFIA will issue recalls, advisories and alerts ➤ BCCDC will write shellfish public advisory and can also send bulletins to industry for proper storage, transport, and handling ➤ DFO will post closure notices at implicated harvest areas and maintain closure notices on their website
Public Health Orders	<ul style="list-style-type: none"> <input type="checkbox"/> In situations for which a harvester or processor continues to distribute the implicated product, MHOs have the authority to issue a public health order

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	to cease distribution from the harvest site. Letter templates are available on the Public Health Act Guidance Notes and Templates - Province of British Columbia (gov.bc.ca)
Ongoing reporting & notifications	Consider notifying the Office of the Provincial Health Officer of an outbreak or follow BC FIORP
Criteria for declaring an outbreak over <i>Based on Health Canada FIORP</i>	<input type="checkbox"/> There are no more reported cases of PSP, ASP, or DSP <input type="checkbox"/> The last time that individuals may have been exposed to the implicated source has been identified or estimated <input type="checkbox"/> Sufficient time has lapsed for potentially exposed individuals to become ill and be reported to investigating public health authorities

References:

- Canadian Food Inspection Agency, Government of Canada. Canadian Shellfish Sanitation Program (CSSP) manual [Internet]. 2018 [cited 2024 Sep 5]. Available from: <http://inspection.canada.ca/en/food-guidance-commodity/fish/canadian-shellfish-sanitation-program>
- Lee MJ, Henderson SB, Clermont H, Turna NS, McIntyre L. The health risks of marine biotoxins associated with high seafood consumption: Looking beyond the single dose, single outcome paradigm with a view towards addressing the needs of coastal Indigenous populations in British Columbia. *Heliyon* [Internet]. 2024 Mar [cited 2024 Sep 5];10(5):e27146. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2405844024031773>
- McIntyre L, Miller A, Kosatsky T. Changing trends in paralytic shellfish poisonings reflect increasing sea surface temperatures and practices of Indigenous and recreational harvesters in British Columbia, Canada. *Mar Drugs*. 2021;19(10):568. Available from: <https://www.mdpi.com/1660-3397/19/10/568>
- BCCDC. Guide for Restaurant Operators Serving Raw Oysters and Bivalve Shellfish. June 2019. Available from: <http://www.bccdc.ca/resource-gallery/Documents/Educational%20Materials/EH/FPS/Fish/GuideForRestaurantsServingRawOystersAndBivalveShellfish.pdf>