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AT A GLANCE

Clinical Evaluation for Mercury Exposure: A Simplified Approach

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Introduction

This document is for physicians and other licenced primary care providers (e.g., nurse practitioners) who require more information on identifying and managing potentially clinically relevant metals exposure in the community setting. This is a brief guide, and not intended to be comprehensive. It should not supersede specialist or urgent care referral, where clinical judgement dictates.

Public Health Ontario (PHO) has also developed documents for cadmium exposure and lead exposure.

Step 1: Enquire About Relevant Exposures

An **exposure history** should capture potential exposure in the home, community, and at the workplace:

- Organic mercury exposure is most common and occurs almost exclusively via fish consumption.[1,2]
- Exposure to elemental and inorganic forms is more commonly related to industrial/electro-mechanical industries, or use of certain cosmetic products (e.g., skin lightening creams).[3]
- Exposure to elemental mercury from dental amalgams is generally negligible.[1] The presence of amalgams is not an indication for testing. Removal of amalgams as a means to reduce mercury exposure is not recommended.[4]

Step 2: Assess for Expected Clinical Outcomes

Three relevant forms of mercury include elemental (quicksilver), inorganic, and organic (methylmercury), and each differ in where they are found, route of exposure, and expected health effects.

The central and peripheral nervous systems as well as the kidneys are the primary targets; health effects occur in a predictable dose-dependent manner (see Table 1 and Table 2).

Organic mercury

- Peripheral/perioral paresthesias
- Peripheral vision loss
- Tremors, spasticity and ataxia

Inorganic/elemental mercury

- Erethism (pathological shyness), neurobehavioural changes
- Acrodynia (painful red extremities), erythroderma, desquamation
- Gingivostomatitis
- Renal dysfunction

Step 3: Determine What Testing Should be Performed

- Organic mercury (methylmercury) is best measured using a blood mercury level.[3]
- Inorganic and elemental mercury are best measured using urine mercury levels.
- Hair testing is not generally recommended for any form of mercury exposure.[3]
- Testing after administration of a chelating agent (provoked testing) is not scientifically validated and does not provide interpretable results.[5,6] In these circumstances, a mercury level should be ordered no sooner than 21 days after chelation.

Step 4: Interpreting Results

Reported laboratory reference ranges represent population averages, not levels of toxicity. Toxic effects differ between forms of mercury, as shown in Table 1 and Table 2.

- Identification and cessation of exposure is the first step.
- An elevated blood mercury below 200 nmol/L is most likely due to fish consumption (in the absence of occupational and environmental sources) and warrants discussion on selection of low mercury fish species. Comprehensive lists of high-risk species can be found online, but examples of high risk fish include fresh/frozen tuna, shark, swordfish, escolar, marlin, and orange roughy.[7] Online advice should be available from your public health unit, or for locally caught fish, the Ontario Government provides a Guide to Eating Ontario Fish.[8]
- Blood levels greater than 200 nmol/L (or greater than 100 nmol/L in children, pregnant, or potentially pregnant females), warrant specialist referral.[9-11]
- If a worker is thought to be exposed to mercury in an Ontario workplace where a control program exists for Designated Substances (under Ontario Regulation 490/09), physicians who conduct tests and examinations related to this exposure must follow the Ontario Codes for Medical Surveillance for Designated Substances.
- Chelation therapy is reserved for acute high-dose exposures under specialist supervision and is contraindicated in chronic low-concentration exposure, as it may redistribute soft-tissue stores of mercury to the central nervous system.[13,14]

Mercury Concentrations Associated with Individual and Population Level Effects

These tables show measured levels and individual or population level effects.

Table 1a: Blood Mercury (Indicator for Methylmercury, or MeHg) Reference and Guidance Values

Blood Mercury Concentration (µg/L)	Blood Mercury Concentration (nmol/L)	Reference and Guidance Values
0.77	3.9	50th percentile in Canadians aged 3–79, 2018–19[15] (total mercury, expected from normal exposure in the community)
3.8	19	95th percentile in Canadians aged 3–79, 2018–19[15] (Total mercury)
8	40	Health Canada upper limit of normal acceptable range in children (≤18), women of childbearing age (19–49), and pregnant women.[16]
20	100	Health Canada upper limit of normal acceptable range for the general adult population[10]
44.4	222	Mean level in frequent (>4/week) fish consumers (from several studies)[17]
>100	>500	Health Canada "at risk" range[9,10]
200	820	Level observed in some frequent fish consumers in one review[18]

Table 1b: Blood Mercury Level and Expected Population or Individual Effects

Blood Mercury Concentration (µg/L)	Blood Mercury Concentration (nmol/L)	Population or Clinical Effect
58	288	Earliest observed population-level health effect (Lower 95 percentile confidence limit on 85 µg/L cord blood mercury associated with a 5% increase in the prevalence of an abnormal Boston Naming Test later in childhood, one metric used to measure cognition[19,20])
100–200	497–994	Earliest observed clinical effect of subtle tremors, ataxia, paresthesias[11,19-22]

Table 2: Urinary (Inorganic/Elemental) Mercury Level and Expected Clinical Effects[3]

Urine Mercury Concentration (µg/L)	Urine Mercury Concentration (nmol/L)	Clinical Effect
2.2	11	95th percentile in Canadians age 3–79, 2014–2015[23]
<20	<100	None
20–100	100–500	Subtle tremors
100–500	500–2500	Neuropsychiatric disturbances (depression, irritability, memory loss), tremor, earliest signs of renal dysfunction
>500–1000	>2500–5000	Gingivostomatitis, tremors, paresthesias, ataxia

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