

# Screening for Mercury Levels in the Perinatal Population

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## ABSTRACT

What to ingest during pregnancy and while breastfeeding is always a priority topic (Food and Drug Administration, 2021). Northwestern Ontario (NWO) is home to beautiful terrain, including streams, rivers, and lakes which can provide nourishment to those living around them (Government of Canada, 2021). However, the nourishment provided by such areas, such as fish, contain certain naturally occurring levels of mercury that are then ingested (Food and Drug Administration, 2021). Northern communities are more at risk of elevated mercury levels due to the higher reliability of fish as a nutritional source and the ecosystems that they are within (Fournier, Karachiwalla, & Shah, 2021). Long-term mercury exposure can cause damage to the liver and kidneys (Fournier, Karachiwalla, & Shah, 2021). Given the fact that eating fish also has tremendous benefits (Taylor et al., 2022) and the idea of not eating fish is implausible, especially in certain cultures, the healthcare system needs to look at high mercury level prevention in vulnerable individuals. The descriptive study looked at how often primary care providers (PCPs) (family physicians, midwives, and nurse practitioners) screened for elevated mercury levels in their patients. The study took place in NWO from June 1<sup>st</sup>, 2023, to October 1<sup>st</sup>, 2023, using Qualtrics. It was found that 58% of PCPs either never ask their patients about fish consumption or sometimes ask about fish consumption and 86% have never ordered a blood mercury level on their perinatal patients. Barriers to such screening include it not coming up in conversation, language, not appearing to be worth discussing, having no guidelines, lack of knowledge, and unsure if fish consumption is relevant to discuss. The participants requested a screening pathway, more accessible means of fish consumption guides, and education seminars. These recommendations can assist PCPs in screening for mercury more efficiently in their patient population.

**KEYWORDS:** mercury levels, perinatal population, primary care providers, screening for mercury levels, pregnancy and fish, breastfeeding

## Introduction

What to ingest during pregnancy and while breastfeeding is always a priority topic (Food and Drug Administration, 2021). Where one lives also has an impact on the available food sources for that individual (Government of Canada, 2021). Northwestern Ontario (NWO) is home to beautiful terrain, including streams, rivers, lakes, and mountains, all of which can provide nourishment to those living around them (Government of Canada, 2021). However, the nourishment provided by such areas, such as fish, contain naturally occurring levels of mercury that are then ingested (Food and Drug Administration, 2021). It is important to note that eating fish during pregnancy benefits the neurodevelopment of the fetus including the reduction in potential future allergies (Oken, 2022), which is why understanding the safety involving smart fish choices is critical for this population. Many fish consumption guidelines, including recommendations on the Canadian Government (2021) website mention fish found within the ocean and great lakes. This information is valuable, however, may not pertain to inland lakes found within the rural areas of the province, where many individuals live off the land and regularly eat fish (Food Guide Canada, 2022). Safe fish consumption should go hand in hand with understanding the dangers of mercury levels within the blood of perinatal individual. Mercury is passed through the placenta during pregnancy (Bonyata, 2018). Mercury is also transferred during breastfeeding, but on a lower level (Bonyata, 2018). Elevated mercury levels in a fetus or infant

can have detrimental effects (Government of Canada, 2021). Many people in NWO consume fish regularly, and for some, this is a way of life (Government of Canada, 2021). Mercury levels are bio-accumulated within the host, therefore the timeline in which the individual has consumed fish needs to also be explored (Fournier, Karachiwalla, & Shah, 2021; Mahmoudi et al., 2020). It is suggested that long-term or habitual ingestion of mercury from fish also poses a very serious risk to fetal development (Oken, 2022). This habitual consumption concept is very concerning given NWO has many residents who rely on fish as a main source of food year-round (Food Guide Canada, 2020). Elevated mercury levels are on the rise in Canada, and even more so in remote areas (Government of Canada, 2021). The question then becomes, to what degree are we screening for potentially high mercury levels in perinatal individuals?

## Background and Literature Review

Various studies have been conducted on the effects of elevated mercury levels in pregnancy and the detrimental effects it can have on the fetus (Bonyata, 2018; Ramirez et al., 2000). Other studies suggest that if the mercury level is only moderately elevated, that eating fish and obtaining the nutritional benefits outweigh the risk of exposure (Taylor et al., 2016, & Oken, 2022). The government of Canada outlines various gaps within the realm of mercury levels and fish consumption (Health Canada, 2007). The Canadian Government (2007) suggests the need for more information on mercury levels in Canadians to serve as an index of

potential exposure including the recommendation to survey demographics and socioeconomic information regarding fish consumption. These suggestions support the need to screen for potentially elevated mercury levels in pregnant and breastfeeding individuals of NWO. In 2011, the Canadian government conducted a biomonitoring initiative and found alarmingly high levels of mercury within the indigenous population (Stuart et al., 2011). Various fish consumption guidelines are available through reputable sources such as Canadian government websites, Food Guide Ontario, and the Guide to Eating Ontario Fish, however, some data is lacking, and it must be pointed out that mercury levels in fish vary from lake to lake and species to species (Bhavsar et al., 2011). It should also be noted that some correlation between silver/amalgam dental fillings and mercury exposure exist (Bonyata, 2018) and should be monitored if applicable. Greger (2012) recommends those contemplating becoming pregnant who eat fish should get tested for mercury given the increase of mercury found in fish such as tuna, however, there does not seem to be a follow-up to this American recommendation.

## Rationale and Purpose

The Canadian government in partnership with Health Canada (2007) has an equation for exposure assessment and acceptable fish intake, however the main sources of fish and data for these equations do not include the popular fish species found within the inland lakes of NWO (Bhavsar et al., 2011). Mercury levels differ from lake to lake, and from fish to fish (Government of Canada, 2021), therefore it is difficult to simply rely on generic safe fish consumption guidelines. Mercury levels in specific fish species of the Great Lakes may differ from the levels found in smaller lakes within the same species of fish (Bhavsar et al., 2011). There are helpful resources such as the Guide to Eating Ontario Fish (Ontario, 2023), however, some lakes do not have data available. This can be attributed to the vast number of lakes within Ontario and the financial and human resource costs associated with surveying them. Clinicians are not expert in the mercury levels of lakes in their area, and therefore the responsibility of safe consumption lies in the hand of the individual ingesting the source. This, however, can be extremely difficult without access to the resources to determine what is safe and what is not, or if there is no current data available on that specific lake or species of fish. Given the fact that eating fish has tremendous benefits (Taylor et al., 2022) and the idea of not eating fish is implausible, especially in certain cultures, the healthcare system needs to look at high mercury level prevention and promotion of safe consumption in assisting vulnerable individuals.

Health Canada (2022) suggests that a safe level of mercury within the body is under 20 ng/mL and 8 ng/mL for pregnant individuals or those under 18 years of age. In New York it is suggested that a safe mercury level is under 5 ng/mL and anything higher must be reported to the health authorities (New York State Health Department, 2018). However, unless one is tested specifically for mercury, these values would remain unknown. There is a gap in the literature surrounding the need for screening of high mercury levels in pregnant and breastfeeding individuals within NWO. A fetus shares the same level of mercury as the mother, whereas that value is cut down to 1/3 when breastfeeding (Bonyata, 2018). Although there does not seem to be a large transference amount through breast milk, it should still be explored (Bonyata, 2018). Based on the Canadian acceptable levels, transference through breast milk to a baby of mercury levels above 30 ng/mL would be significant, or 15 ng/mL if looking at the New York State guidelines (Health Canada, 2007; New York State Health

Department, 2018). The notion of randomly testing everyone for mercury is unrealistic and unfeasible therefore proper screening of individuals should be conducted prior.

## Research Question

Are primary care providers (PCPs) and midwives screening for potentially high levels of mercury in their antenatal and postpartum (breastfeeding) patients?

## Research Method

The purpose of this study is to explore the extent to which PCPs of NWO are screening for levels of mercury in their antenatal and postpartum breastfeeding patients.

## Methodology

The objective of this descriptive study was to determine how often PCPs are screening for high mercury levels, their current knowledge level on *The Guide to Eating Fish in Ontario*, and what (if any) resources would be beneficial to their learning in regard to assisting them in such screening and to support the clinicians/bring awareness to the implications high mercury levels have on their perinatal patients.

## Participant Selection & Recruitment

A total of 28 participants were recruited via a virtual flyer that encompassed the inclusion criteria (PCP within NWO) and exclusion criteria (any other healthcare professional outside the NWO jurisdiction). The participants self-screened and were able to click on the survey link that was embedded within the flyer. Consent was gathered through the survey itself in which the participants either consented and commenced the survey or were able to decline. The flyer was disseminated to key stakeholders, social media platforms for PCPs, and from colleague to colleague.

## Instrumentation & Software

A virtual flyer was used to promote the study and obtain participants. A survey was utilized with 16 questions, 2 being questions regarding the participant's demographics (type of provider and region). The survey platform was conducted using Qualtrics. Data analysis was also conducted using Qualtrics data analysis software.

## Deliverables and Topics

- 1) A determination of how often/if primary care providers and midwives are screening for potentially elevated mercury levels in their patients.
- 2) A determination of how often/if PCPs are ordering mercury levels on their patients.
- 3) A determination of what type of education regarding elevated mercury levels and screening material, if any, would be beneficial for PCPs.

## Significance

Considering the many lakes, rivers, and streams within NWO and the reliance on these bodies of water for nutritional needs, it is important to screen for potential increased mercury levels in the perinatal populations. Many exposures to mercury occur through eating fish (Fournier, Karachiwalla, & Shah, 2021). People in Northern areas, especially Indigenous populations in Canada, are vulnerable to high mercury levels (Fournier, Karachiwalla, & Shah, 2021). Northern communities are more at risk due to higher latitudes in these areas, the higher reliability of

fish as a nutritional source, and the ecosystems that are within (Fournier, Karachiwalla, & Shah, 2021). Long-term exposure over time to this mercury can cause damage to the liver and kidneys (Fournier, Karachiwalla, & Shah, 2021). This is especially significant to NWO as Canadian Indigenous populations have higher rates of, or risk factors that contribute to chronic kidney disease (CKD) (Komenda et al., 2016). Some risk factors include an increased risk of diabetes, metabolic syndrome, and immune-mediated kidney diseases (Komenda et al., 2016). Another significant impact is the large increase in rural Indigenous populations of kidney failure which requires dialysis (Komenda et al., 2016). The damaging effects on the kidneys of mercury exposure and the increased prevalence of kidney problems can significantly affect the health of NWO populations. According to Taylor and colleagues (2016), high levels of mercury can lead to neurological issues such as neuromuscular alterations, memory loss, renal, and thyroid disorders. In the perinatal population, it is significant because mercury crosses the placenta and if the mother has elevated levels, the fetal levels are higher than the mother's (Taylor et al., 2016). When fetuses are exposed to excessive mercury, it has been associated with microcephaly, blindness, and other physical disabilities (Taylor et al., 2016).

## Results

The study took place from June 1, 2023, to October 1, 2023, with a total of 28 participants. Of the 28 participants, 59% were physicians or nurse practitioners, and 41% were midwives. Of the 28 participants, 78% identified as being from the Northwest Local Health Integration Network (LHIN), and 22% were from the Northeast LHIN.

### Data Collection & Analysis

Data was collected using the Qualtrics survey platform from June 1, 2023, to October 1, 2023. Data analysis was conducted using Qualtrics CoreXM analysis software.

### Results

It was identified that many PCPs were not familiar with the *Guide to Eating Ontario Fish*. 8% of respondents were very familiar with using this resource. In contrast, 39% of respondents were not familiar with this guide. 23% were moderately familiar and 31% were slightly familiar with the guide. Another significant result was that 69% of healthcare providers never refer to the *Guide to Eating Ontario Fish*. Not one PCP always refers to the guide, 26.92% sometimes refer to it, and only one stated they use the guide most of the time. The most common barrier to PCPs reference to this guide was a lack of knowledge of the guide and how to use it. Other barriers mentioned include "not being a part of routine topics list" and "it does not come to mind and the clinic is often busy".

Regarding asking their antenatal patients about fish consumption, 29% of PCPs never asked whether they eat fish and or how much they consumed. Of the respondents, 29% sometimes asked about fish consumption, 11% asked about half the time, and another 11% asked most of the time. Only one provider always asked about fish intake. There are many barriers to discussing fish consumption that the participants identified. These barriers included that it did not come up in conversation, language barriers, that it does not appear to be worth discussing, a lack of guidelines, a lack of knowledge, and being unsure if fish consumption is relevant to discuss.

It was also found that 82% of participants never ordered blood work on mercury levels, and only 7% sometimes ordered blood work. There was not one primary care

provider that always checked mercury levels. With respect to antenatal patients, 86% of respondents never ordered mercury blood tests and only 3.5% sometimes ordered blood work. The PCPs also reported that 79% of them are not at all confident with reading and interpreting mercury levels. Only three PCPs reported being somewhat confident. No PCP who answered the survey was confident with analyzing high mercury levels. Some barriers that prevent these PCPs from ordering blood work include not knowing when to order these levels or how to interpret the levels, a lack of resources to draw blood, that they felt it was not within their scope, and not having recommendations to do so.

A barrier to mercury screening is that it did not come up in conversation. The participants were asked what education or resources would be beneficial to help them screen for and identify elevated mercury levels. Some useful resources that were suggested included in-service education, lunch and learn presentations, handout, development of a screening pathway or guideline, a medical directive to order mercury-level blood work, and an educational webinar. From these results, specific recommendations have been noted. The participants feel knowledge of mercury testing is viable, but more education and awareness are needed. The following section will discuss recommendations and limitations of the study.

### Limitations

Access to this study was limited to PCPs who had access to the flier. The study was voluntary in nature with no incentive to participate other than bringing awareness to the topic. During the period in which data was collected, a news article relating mercury exposure to attempted suicide in children and youth was released, on July 19, 2023 (DeFlaviis, 2023). Prior to publication of the Grassy Narrows article 25 participants participated in the study, a participant engagement rate of 0.6 participants per day. After the Grassy Narrows article was published, the participant engagement rate dropped to 0.04 participants per day. The article focused on Indigenous individuals from Grassy Narrows and Wabaseemoong reserves who were exposed to mercury waste that was dumped into the surrounding river system (Fournier, Karachiwalla, & Shah, 2021). As this event negatively impacted individuals in NWO, it is important to note this circumstance and consider the limitation it created for this study, as healthcare providers may have chosen to not participate in the survey due to possible negative implications. In terms of attrition, One participant dropped out of the study, while another only provided some information. Other limitations include the small sample size, although a wide geographic range was surveyed.

### Recommendations

There are several recommendations that can flow from this study. First, a screening pathway would be beneficial giving healthcare professionals a specific guide to screening for mercury, providing guidance on when to screen and order levels, and how to interpret the levels. A second recommendation would be to make mercury a standardized test. The current perinatal screening form has other categories where mercury could be easily incorporated, and this could incorporate asking about fish intake. The participants mentioned that education on mercury screening could be done via an in-service presentation or lunch and learn. Lastly, expanding the scope of midwives in Ontario would be beneficial to the patient and the healthcare system itself (reducing duplication of service providers being involved).

## Conclusion

The health effects associated with elevated mercury levels can have a serious and chronic impact on the individual or fetus. Our PCPs in NWO are well-positioned to monitor and screen for such a toxin, however they have mentioned barriers preventing them to do so. A screening pathway, more accessible fish consumption guides, and education on the subject would assist PCPs in screening for mercury more efficiently in their patient population.

**Role of the Researcher & Ethics** – The primary researcher works at Confederation College in the School of Health, Negahneewin and Community Services, and the secondary researcher is a Nursing Student at Lakehead University in Collaboration with Confederation College. Ethics approval was obtained through the researcher's academic institution's Research Ethics Board (#0113). There are no conflicts to note. Confidentiality and anonymity of the participants were maintained throughout the study.

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