Community Report for Cadmium, Lead, and Mercury

Fond du Lac Community Biomonitoring Study

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MINNESOTA MDH DEPARTMENT OF HEALTH

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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- The members of the FDL Biomonitoring Advice Council shared time, insights, and wisdom to ensure the project served the Community's interests.

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Crystal Greensky	Louis Wise

- Clinic Laboratory staff, Jaime Bjerkness, Geri Hunt, and Scott Bodin collected and processed blood and urine at Min No Aya Win and C.A.I.R.

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- MDH Public Health Laboratory staff provided supplies for blood and urine collection. They tested blood for cadmium, lead and mercury.

Guidance and support from the FDL Reservation Business Committee, leadership of the Human Services Division, and the FDL Institutional Review Board ensured protection of the Tribe's and study participants' interests.

Finally, we are indebted to the 491 volunteers who took part in the study so we may all better understand our relationship with the chemicals in the world around us.

Report Purpose

This report summarizes results for three chemicals (cadmium, lead and mercury) measured in blood samples collected for the Fond du Lac Community Biomonitoring Study. Additional community reports will present the results for all other chemicals tested as part of the study.

The intended audience of this report is the Fond du Lac Community, including members who took part in the study.

For more information about the project, call the Minnesota Department of Health at 651-201-4897 (toll free 1-800-657-3908) or send an email to health.hazard@state.mn.us.

Study Background

The Great Lakes are among the world's most important freshwater resources. The region's ecosystem is an invaluable environmental and economic resource. The lakes and the surrounding lands provide natural beauty and are vital to the lives of tens of millions of people.

A long history of careless practices contaminated the Great Lakes ecosystem and the Lake Superior watershed with numerous chemicals and byproducts of modern life. Sources of chemical releases into the environment include industrial discharges, spills, contaminated runoff, waste disposal, and even use of consumer products.

The Great Lakes Restoration Initiative (GLRI) was established under the stewardship of the U.S. Environmental Protection Agency in 2009. The GLRI aims to protect, restore and maintain the Great Lakes ecosystem. With GLRI support, the Agency for Toxic Substances and Disease Registry (ATSDR), within the Centers for Disease Control and Prevention, created a Great Lakes Biomonitoring Program. This program funds projects to gather baseline data on environmental chemicals in people in the Great Lakes Basin.

Biomonitoring is a tool used to understand exposures to environmental chemicals. It involves measuring the amount of specific chemicals in people's bodies (often in blood or urine).

In September 2010, ATSDR awarded funds to state health agencies in Minnesota, Michigan, and New York to conduct biomonitoring. From January through November 1, 2013, the Minnesota Department of Health (MDH) and the Fond du Lac Band (FDL) of Lake Superior Chippewa collected blood and urine samples from 491 people who took part in the Fond du Lac Community Biomonitoring Study.

Study Purpose

The purpose of the study Fond du Lac Community Biomonitoring Study is to identify:

- the amount of certain chemicals in participants' blood or urine;
- how the amounts found in participants compare to results from other studies;

- whether any groups, such as women or elders, have greater amounts of study chemicals in their bodies; and
- possible sources of chemicals that participants were exposed to.

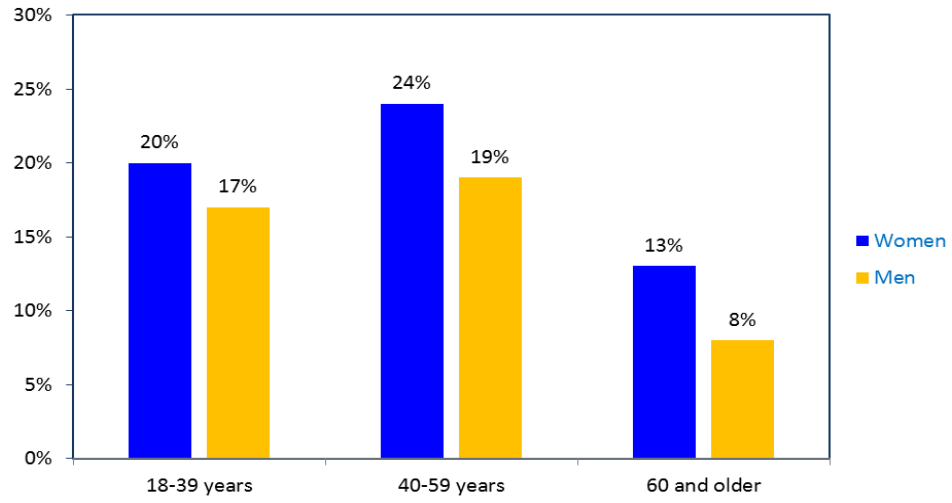
The results section for each chemical addresses these points under the headings ‘Amount Measured, ‘Comparison to Other Studies’, ‘Groups with Greater Exposure’, and ‘Sources’.

Study Participants

Study staff formally invited 1,343 people chosen randomly from the FDL Human Services 'client list' to take part in the study. Then they attempted to contact each person individually to find out if they were eligible and willing to be in the study. To be eligible, a person had to be at least 18 years old and live in the FDL clinics’ service area. Staff were able to reach 829 people, of whom 60 were not eligible and 278 declined.

Over ten months, starting in January 2013, 491 people gave a sample of blood and urine and completed a questionnaire. The participants came from Cloquet (52%), Duluth (31%), and 17 other surrounding communities and rural areas (17%). More women (57%) than men (43%) took part. Figure 1 shows the participants by age (age group) and gender.

Figure 1. Age and Gender of Study Participants*



* Fewer men and young adults participated than expected based on the full 'client list'.

MDH tested 490 blood samples for cadmium, lead and mercury -- one person could not give enough blood for the tests.

The Chemicals

Cadmium, lead, and mercury occur naturally and trace amounts are found in air, water, rocks and soil. They are released to the environment from a variety of human activities and natural processes (like fire and erosion). Once released, they remain in the environment.

Most people are regularly exposed to very small amounts of cadmium, lead, and mercury from a variety of sources without any obvious harm. Because laboratory testing can detect extremely small amounts of these chemicals, it is common to find them in people.

The health risk from these chemicals depends on how much gets into the body. In general, greater exposures increase the chance of more serious effects. The amount likely to cause health problems also depends on the person's age, health status, and other factors.

For each chemical, there is a brief description of major sources and health effects below. To learn about common sources, ways that people may be exposed, and practical advice on how to reduce exposures, contact Phil Defoe or Greta Nelson at (218) 878-2193.

Cadmium – Smoking cigarettes is the most common source of cadmium in people. In non-smokers, diet is usually the largest source. Tiny amounts are in a wide variety of food, especially shellfish and organ meats. Cadmium is used in many industries and products. Some work environments, such as battery manufacturing, metal soldering, plating, and welding may be sources of exposure.

Cadmium can damage the kidneys, lungs, and bones. It can affect brain development in babies and young children.

Lead – Lead comes from many sources. These include water pipes and lead-based paint in older homes, jobs and hobbies involving metals, building and construction materials, some hair dyes and cosmetics, and environmental contamination from burning coal, mining, and other industrial and waste disposal activities. Wild game can have fragments of lead ammunition in the meat that are too small to detect by sight or touch. Smoking cigarettes is also a source of lead.

Babies and young children are the most sensitive to lead. It can affect brain development and contribute to learning problems. Lead in adults can increase blood pressure, decrease kidney and brain function, and cause reproductive problems.

Mercury – People may be exposed to small amounts of mercury from silver dental fillings, broken thermometers and fluorescent light bulbs, or in a work place that uses mercury. However, most people are mainly exposed by eating fish, especially older, bigger predators.

Mercury can damage the nervous system. Unborn babies and young children are most at risk. Too much mercury can affect a child's behavior and lead to learning problems. In adults, the first sign of too much mercury is burning or tingling fingers and toes. At higher exposure, the ability to walk, talk, see, and hear may be affected.

Understanding Biomonitoring Results

The descriptions below will help readers understand the results that follow.

- The ***median*** is a kind of an 'average' used in this report. Half of the people tested have a value less than the median and half are greater. The median is a common way to compare results of one study with other studies.

- The ***Level of Health Concern*** is a precautionary value that helps put the biomonitoring results into a health context. An amount of a chemical that is below the Level of Health Concern is unlikely to harm most people. Some people may experience effects if their exposure is above the Level of Health Concern. The likelihood of harm increases the farther an exposure is above the Level of Health Concern.
- ***First Nations*** biomonitoring data were collected in 2010-2012 by the Assembly of First Nations. A total of 503 people in 13 communities across Canada took part. Results are at www.afn.ca/uploads/files/afn_fnbi_en_-_2013-06-26.pdf.
- ***U.S.*** biomonitoring data collected through the National Health and Nutrition Examination Survey represent the general U.S. population. The most recent (2009-2010) results for cadmium, lead, and mercury are at www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Sep2013.pdf.
- The study ***questionnaire*** collected participants' answers about activities (such as work, hobbies, recreation, and smoking for example), items they consume (certain food, dietary supplements), and personal care products use. We combined participants' responses with their biomonitoring results to look for possible explanations for the amounts and the sources of chemicals measured in their blood.

Cadmium Results

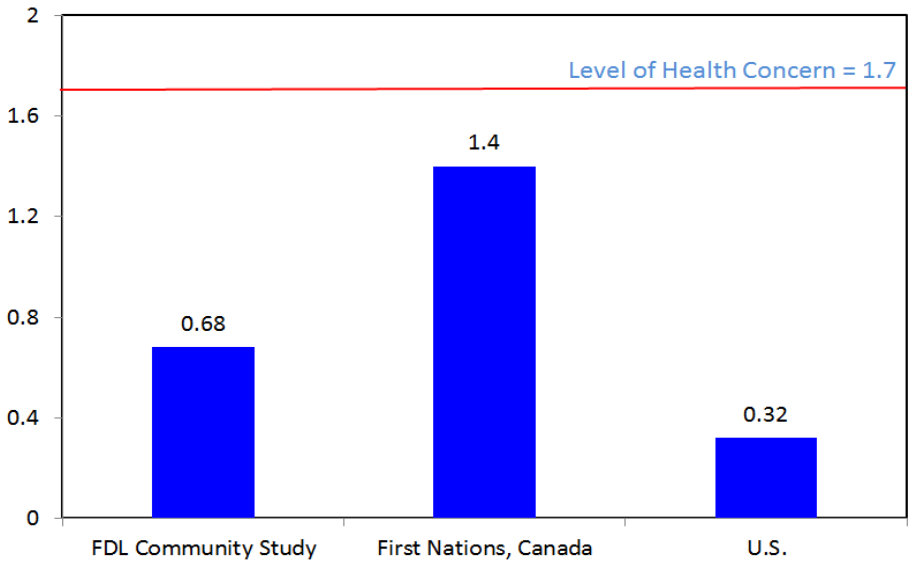
Amount Measured

We found a measurable amount of cadmium in the blood of 67% of the participants. Cadmium was above the Level of Health Concern for 43 people.

Comparison to Other Studies

The median cadmium concentration for study participants was 0.68 micrograms per liter. This is less than the median for the First Nations study, but more than the median for the U.S. general population (see Figure 2).

Figure 2. Median Cadmium Results and Comparisons
(results are shown in micrograms of cadmium per liter of blood)



Groups with Greater Exposure

Women had slightly greater amounts of cadmium compared to men.

People who smoke cigarettes had higher amounts of cadmium in their blood. The median amount for smokers was almost three times greater compared to people who never smoked cigarettes or those who quit. Of 43 people whose results were above the Level of Concern, 42 were current smokers and one was a former smoker.

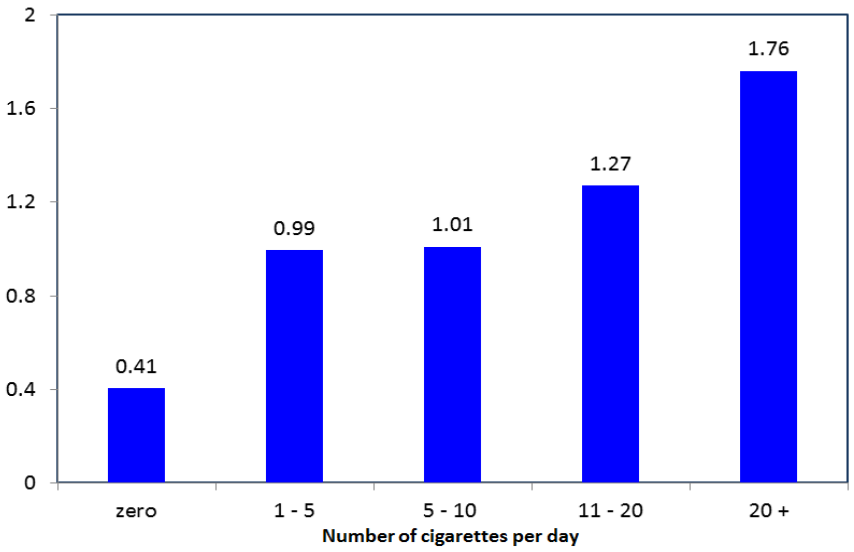
Among people who reported they currently smoke cigarettes, those in the older age groups had more cadmium in their blood compared to the younger groups.

Cadmium Sources

Smoking cigarettes had a large effect on the amount of cadmium in people's blood. The amount of cadmium also increased as the number of cigarettes smoked rose (see Figure 3).

Figure 3. Median Cadmium Results by Daily Smoking Amount

(results are shown in micrograms of cadmium per liter of blood)



Cadmium results did not appear to be related to other possible sources asked about in the questionnaire such as hobbies or dietary supplements. Cadmium results were not associated with eating wild game or organs, although very few people said they ate organ meats (where cadmium might build up).

Lead Results

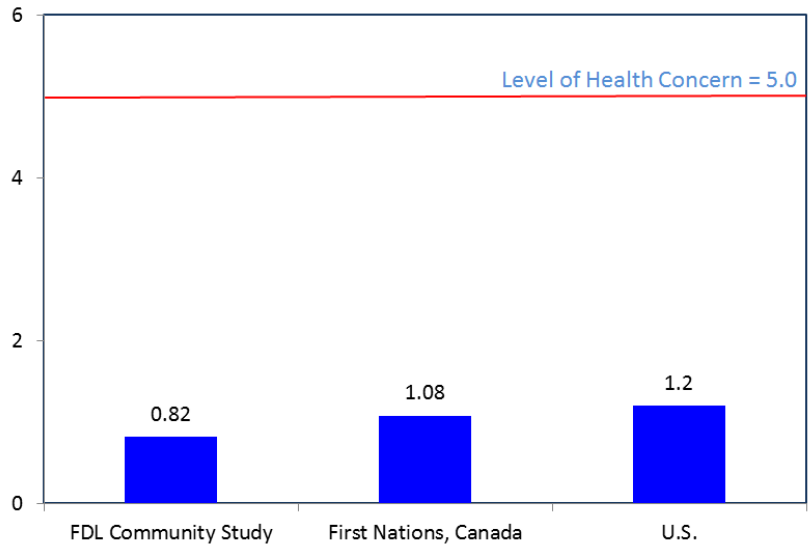
Amount Measured

We found a measurable amount of lead in 91% of blood samples. Three people's results were above the Level of Health Concern for lead.

Comparison to Other Studies

The median lead concentration for all study participants was 0.82 micrograms per deciliter. This is below the medians for both the First Nations study and the U.S. general population (see Figure 4).

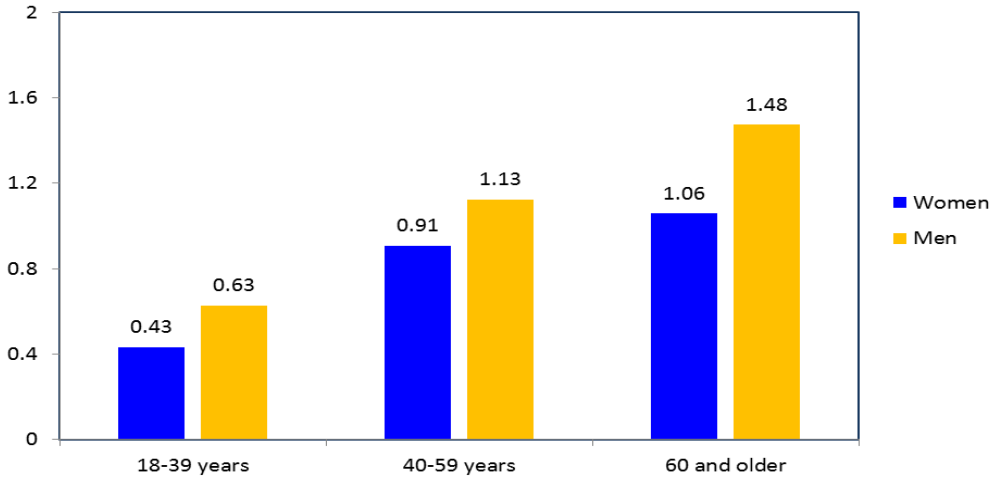
Figure 4. Median Lead Results and Comparisons
(results are shown in micrograms of lead per deciliter of blood)



Groups with Greater Exposure

Men had greater amounts of lead than women did. Lead results were also higher among the older age groups (see Figure 5).

Figure 5. Median Lead Results by Age and Gender
(results are shown in micrograms of lead per deciliter of blood)



Lead Sources

Two of the results above the Level of Health Concern were likely due to lead exposure on the job.

The amount of lead was greater among participants who currently smoke cigarettes compared to people who don't smoke.

We examined whether eating wild game had any relationship with lead in participants' blood because people can accidentally swallow tiny pieces of lead ammunition. Many participants reported they ate game (63% deer) in the past 12 months. This did not appear to affect the amount of lead in participants' blood. However, our ability to relate lead to eating wild game

was limited because we did not collect information on how much time passed between when people ate game and when they gave their blood sample.

Lead results did not appear to be associated with other possible sources asked about in the questionnaire such as hobbies, dietary supplements, cosmetics or city versus private water supply.

Mercury Results

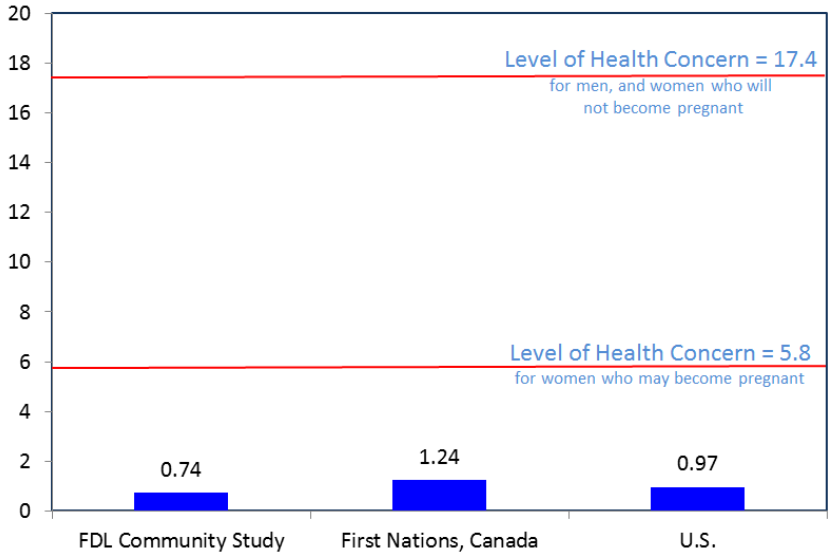
Amount Measured

We found a measureable amount of mercury in the blood of 82% of participants. All results were less than the Level of Health Concern. *Note: the Level of Health Concern is lower for women who are, or may become, pregnant, to protect the fetus.*

Comparison to Other Studies

The median mercury concentration for all participants was 0.74 micrograms per liter. This is less than the medians for the First Nations study and the U.S. population (see Figure 6).

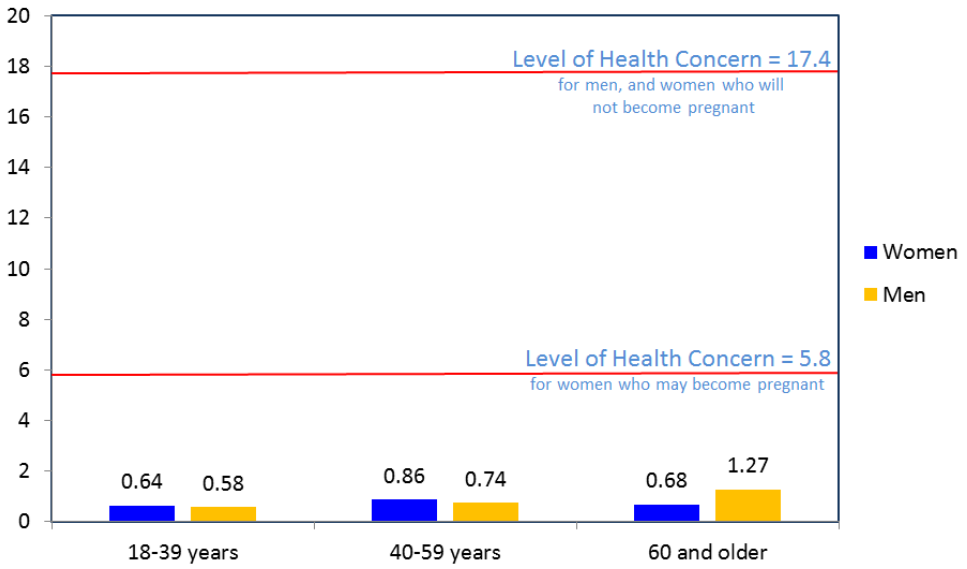
Figure 6. Median Mercury Results and Comparisons
(results are shown in micrograms of mercury per liter of blood)



Groups with Greater Exposure

Figure 7 shows the median amounts of mercury for men and women in the different age groups. Although the median for older men is higher than the other groups, practically speaking this difference is very small and well below the Level of Health Concern. No important differences were noted among the sexes and age groups.

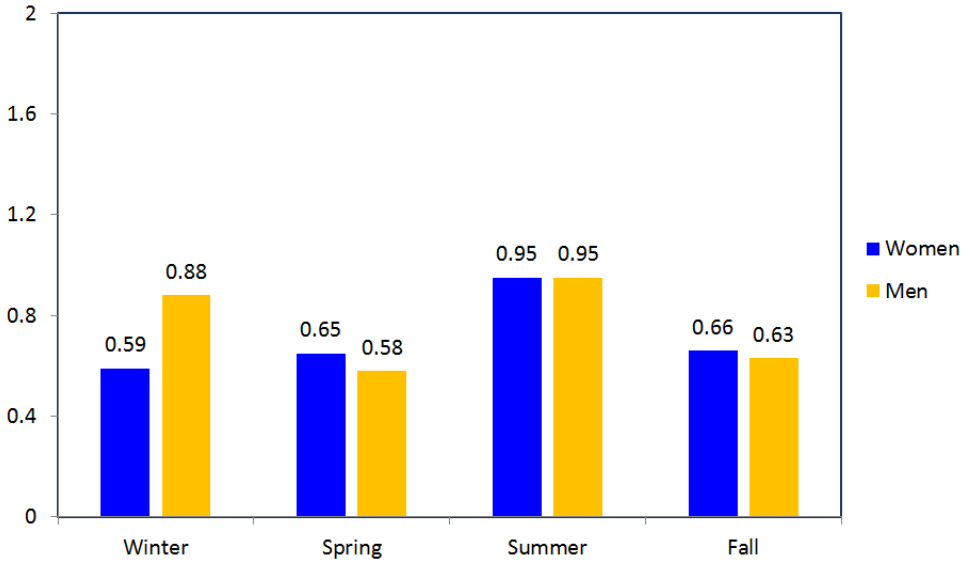
Figure 7. Median Mercury Results by Age and Gender
(results are shown in micrograms of mercury per liter of blood)



Mercury Sources

In general, participants who ate larger amounts of fish that contain greater amounts of mercury had more mercury in their blood. For example, women ate greater amounts of fish known to have higher amounts of mercury during the summer months and the amount of mercury in blood samples collected in the summer also increased (see results for women in Figure 8). However, all results were below the Level of Health Concern for mercury.

Figure 8. Median Mercury Results by Season of Blood Collection
(results are shown in micrograms of mercury per liter of blood)



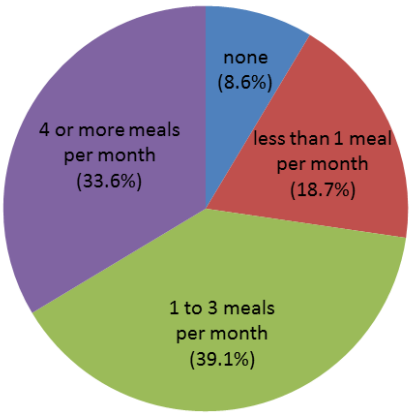
Because eating fish is usually the main source of mercury exposure for most people, it is important to consider the amount and kinds of fish participants said they ate. For example:

- Most participants (about 92%) reported they ate fish in the 12 months before they gave their blood sample.
- About one third of people (about 34%) reported eating at least one serving per week and most people ate less (see Figure 9).

- More people (89%) reported they ate fish bought from a store or restaurant compared to 52% who ate fish that they, or someone they knew, caught. About one half (49%) ate fish from both sources.
- Shrimp and canned tuna were the most popular. Walleye was the most popular fish that was caught by a participant or someone they knew.

The amount of mercury measured in people's blood did not appear to be related to other possible sources such as hobbies asked about in the questionnaire.

Figure 9. Average Number of Fish Meals Eaten in 12 Months Before Blood Collection



Conclusions and Recommendations

We expected to find some cadmium, lead and mercury in participants' blood samples because most people are regularly exposed to small amounts of these chemicals.

Cadmium – The median of cadmium results for study participants was less than the median for the First Nations study, but higher than the median for the U.S. population. These differences are likely due to different smoking habits. Compared to the FDL study participants, smoking rates were higher in the First Nations study and lower in the U.S. general population.

Most people whose cadmium results were more than the Level of Health Concern smoked cigarettes. Because smoking is a major source of cadmium, we advised participants with high cadmium results to protect their health by avoiding commercial tobacco products.

Lead – Most people in the study had less lead in their blood compared to biomonitoring results for the First Nations study and the U.S. population. Only a few results were above the Level of Health Concern for lead.

Lead is a major health hazard. We recommend that people stay aware of common sources of lead and avoid exposures wherever possible. This is especially important if small children are in the home. Basic lead prevention tips are available at www.cdc.gov/nceh/lead/tips.htm. Information for hunters is at www.dnr.state.mn.us/hunting/lead/index.html.

Mercury – Study results showed the majority of participants had less mercury in their blood than people tested in the First Nations study and the U.S. population. No mercury results were above the Level of Health Concern.

The FDL Band did not net from Lake Mille Lacs in spring 2013. Typically, this harvest is shared widely in the community. If participants ate less fish or less from Minnesota waters than usual, the study's mercury results are likely lower than they might have been if netting occurred. We recommend community members eat one to two servings of low mercury fish per week by following guidelines for safely choosing and preparing fish.

Contact Nancy Schuldt at (218) 878-7110 for questions about eating fish safely. Guidance on specific Minnesota waters is available at www.health.state.mn.us/divs/eh/fish/index.html.