



# **Fish Facts for Health Professionals: Methylmercury Exposure, Fish Consumption, and Health Risks/Benefits**

## **Workbook**



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## Introduction

Health professionals are often asked by their patients and families about the benefits and risks of fish consumption. Conflicting media messages about health risks and benefits related to fish consumption, coupled with limited health professional training, has led to confusion by health professionals about advising patients and families about safe fish consumption. *Building health professional capacity, fish consumption and health effects* is a collaborative effort between environmental, medical and nursing experts from across the country to develop an educational series for busy health professionals about the risks and benefits of fish consumption. This effort, informed through focus groups comprised of experts in the field, resulted in the development of a series of educational media modules entitled *Fish Facts*. This media series comprised of four, 3-5 minute media modules was designed for busy health professionals that are interested in learning more about the risks and benefits of fish consumption and methylmercury (MeHg) exposure. This workbook complements the media series and provides more in-depth information and resources for those seeking additional information.

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## **Directions**

The educational media module series, *Fish Facts* can be accessed at [www.fish-facts.org](http://www.fish-facts.org). In this workbook, each of the four modules includes the following information: Learning objectives, background, resources for learning more about the topic, and references. In addition, the appendices in this workbook include a sample dietary questionnaire that can be used in the clinical setting and a list of web-based resources for health professionals. After viewing *Fish Facts*, please share your opinion about this learning experience at [www.surveymonkey.com/s.aspx?sm=esBVc7qlPkdOomBblF9gqw\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=esBVc7qlPkdOomBblF9gqw_3d_3d).

### **Continuing Education Credit**

Nurses interested in viewing *Fish Facts* for continuing education credit should review the workbook, including learning objectives prior to viewing the series and take the Evaluation Survey that can be found at [www.surveymonkey.com/s.aspx?sm=0QCwdWebBBiWku6H4crvoQ\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=0QCwdWebBBiWku6H4crvoQ_3d_3d). Georgetown University School of Nursing & Health Studies will be coordinating the distribution of continuing education contact hours.

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## Module 1: Epidemiology and Toxicology

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### *Learning objectives*

After viewing this media module, the participant will be able to:

- Describe how people are most often exposed to methylmercury
- Identify human health effects of exposure to methylmercury
- Select populations most at risk for health effects

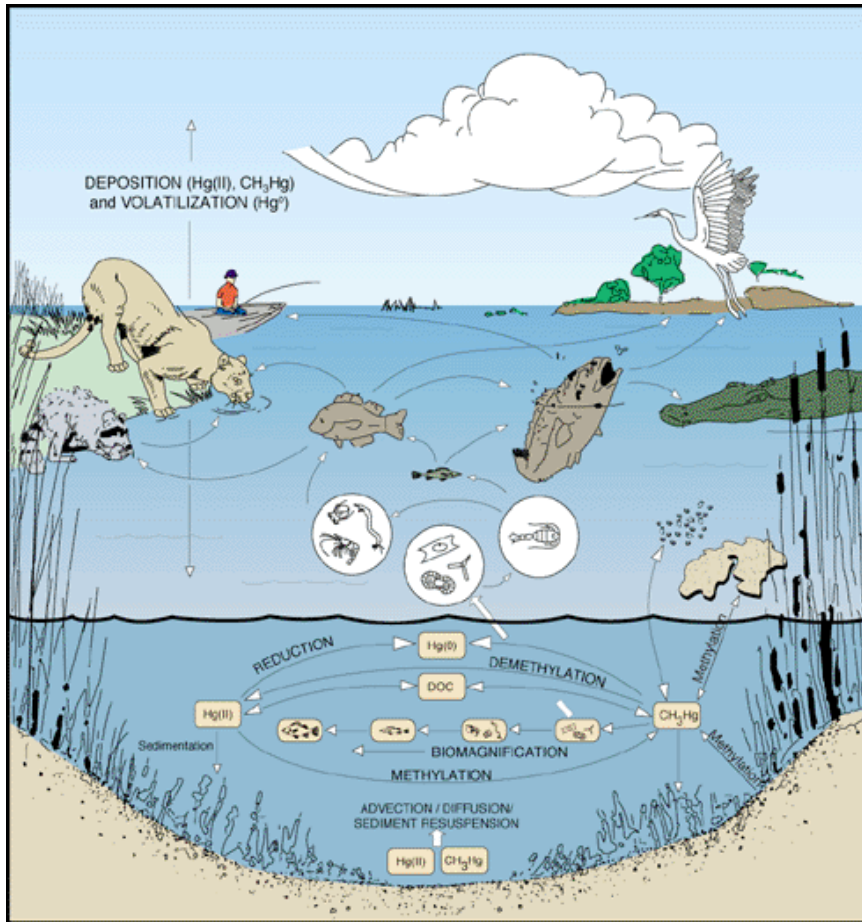
### *Background*

#### **Why is the relationship between methylmercury and fish consumption important for health professionals to understand?**

Fish consumption is the primary route of exposure to MeHg. Because of the increasing popularity of fish as a source of dietary protein, largely due of its “heart healthy” benefits, a significant percentage of the US population may be at risk for methylmercury induced health problems. Ironically, emerging data indicates that eating fish may actually increase one’s risk for cardiovascular disease, since fish contains MeHg which has been linked to an increased risk of cardiovascular disease including heart attacks.<sup>1,2</sup> These health risks are important for health professionals to understand.

#### **What is mercury and methylmercury?**

Mercury is a metal that can be released into the environment for example, through coal-fired plant processes or hazardous waste incineration. It enters the atmosphere then drifts into water systems such as rivers, lakes, and wetlands. Once in the water, mercury is then converted by bacteria into methylmercury a neurotoxin (which means it causes damage to nerve tissue).<sup>3</sup> MeHg then accumulates through the food chain, so that smaller fish eat the plankton contaminated with MeHg, larger fish eat the smaller fish, and so on, so that fish that live long and eat other fish can accumulate high levels of methylmercury in their tissue.<sup>4</sup> The concentration of methylmercury in the top level of the food chain can reach a level a million times higher than the level in the water. It is therefore, important to consider the type of fish a person consumes when assessing exposure to MeHg.



The Mercury Cycle (www.epa.gov)

**What are the signs and symptoms of methylmercury toxicity?**

Low dose exposures in adults can result in symptoms such as ataxia, memory loss, paresthesias (“pins and needles”), blurry vision, and diminished hearing.<sup>5</sup>

Prenatal exposure to MeHg can cause lifelong adverse developmental and cognitive effects, even at low doses. This is because mothers that eat fish and shellfish during pregnancy expose the fetus to MeHg. Children who are exposed in the womb are at increased risk of poor performance on neurobehavioral tests such as those measuring attention, fine motor function, and language skills, for example.<sup>6</sup> MeHg can also impact the neurological system throughout childhood, particularly when children experience periods of growth and development. There is some evidence that early life exposure may also affect cardiovascular, immune, and reproductive health.<sup>7</sup> More severe health effects as a result of high poisoning events include cerebral palsy, mental retardation, deafness, and blindness which was evidenced in the sentinel case that occurred in the 1950s in Minamata Bay, Japan.<sup>8,9</sup>

## What do we know today about risks in the US?

It all started with Minamata Bay, since then we have found this is not just an isolated issue and MeHg is a concern even today. Since Minamata Bay a number of studies have been conducted to explore the impact of fish consumption and mercury toxicity. For example, a recent national study (NHANES) found that over 600,000 U.S. children are exposed to unsafe levels of MeHg as a result of prenatal exposure. This study also found that almost 16% of US women in childbearing age have high blood Hg concentrations; and of women who eat any fish at all, 50% consume more than safe levels.<sup>10-14</sup>

Also of concern are populations with high fish consumption, including many island and coastal communities and ethnic groups that can have MeHg exposures substantially higher than those reported among these national studies.

### *Interested in more information?*

Visit the Integrated Risk Information System (IRIS) Risk Information for Methylmercury (MeHg) at <http://www.epa.gov/iris/subst/0073.htm> and

ToxFaqs: Mercury CAS: 7439-97-6 at <http://www.atsdr.cdc.gov/tfacts46.pdf>

### *References*

1. Virtanen, J.K., Rissanen, T.H., Voutilainen, S., Tuomainen, T.P. (2007). Mercury as a risk factor for cardiovascular diseases. *J Nutr Biochem*, 18(2), 75-85.
2. Jyrki K. Virtanen, J.K., Voutilainen, S., Rissanen, T.H., Mursu, J., Tuomainen, T., Korhonen, M.J., Valkonen, V., Seppänen, V., Laukkanen, A., Salonen, J.T. (2005). Mercury, fish oils and risk of acute coronary events and cardiovascular disease, coronary heart disease, and all-cause mortality in men in eastern finland, *Arterioscler Thromb Vasc Biol*, 25, 228-233
3. US EPA. (2001). Integrated Risk Information System (IRIS) Risk Information for Methylmercury (MeHg) Retrieved March 9, 2009, from <http://www.epa.gov/iris/subst/0073.htm>.
4. Environmental Protection Agency (2009). *Mercury: Human Exposure*, Retrieved June 30, 2009 at <http://www.epa.gov/mercury/exposure.htm>.
5. Mahaffey, K. (2005). Mercury Exposure: Medical and Public Health Issues *Trans Am Clin Climatol Assoc.* 2005; 116: 127–154
6. Myers, G. J., & Davidson, P. W. (1998). Prenatal methylmercury exposure and children: Neurologic, developmental, and behavioral research. *Environ Health Perspect*, 106 Suppl 3, 841-847.

7. Goldman, L., & Shannon, M. (2001). American Academy of Pediatrics and the Committee on Environmental Health: Technical Report--Mercury in the environment: Implications for pediatricians. *Pediatrics*, *108*(1), 197-205.
8. Landrigan, P., Kimmel, C., Correa, A., & Eskenazi, B. (2004). Children's health and the environment: Public health issues and challenges for risk assessment. *Environ Health Perspect*, *112*(2), 257-265.
9. Harada, M. (1995). Minamata disease: methylmercury poisoning in Japan caused by environmental pollution. *Crit Rev Toxicol*, *25*(1), 1-24.
10. Mahaffey KR. *Update on recent epidemiologic mercury studies*. Proceedings of the 2004 national forum on contaminants in fish; 2004 Jan 25–28; San Diego: National Service Center for Environmental Publications, U.S. Environmental Protection Agency; 2004. p. 31-4. <http://www.epa.gov/waterscience/fish/forum/2004/proceedings.pdf>.
11. Bakir, F., Damluji, S. F., Amin-Zaki, L., Murtadha, M., Khalidi, A., al-Rawi, N Y., et al. (1973). Methylmercury poisoning in Iraq. *Science*, *181*(96), 230-241.
12. Davidson, P. W., Myers, G. J., Cox, C., Axtell, C., Shamlaye, C., Sloane-Reeves, J., et al. (1998). Effects of prenatal and postnatal methylmercury exposure from fish consumption on neurodevelopment: outcomes at 66 months of age in the Seychelles Child Development Study. *JAMA*, *280*(8), 701-707.
13. Salonen, J.T., Nyyssonen, Salonene, R. (1995). Fish intake and the risk of coronary disease. *N Engl J Med*, *333* (14), 937.
14. Murata, K., Weihe, P., Budtz-Jorgensen, E., Jorgensen, P.J., and Grandjean, P. (2004). Cardiac autonomic activity in methylmercury neurotoxicity: 14-year follow-up of a Faroese birth cohort, *Journal of Pediatrics*, *144*(2), 177-183.

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## Fish Module 2: Hazard Identification and Exposure Assessment

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### *Learning objectives*

After viewing this media module, the participant will be able to:

- Identify fish low in MeHg levels
- Identify fish high in MeHg levels
- Describe key factors to reduce risks associated with fish consumption and MeHg consumption

### *Background*

#### **What is hazard identification and why is important for health professionals to understand?**

Hazard identification is the process of determining whether exposure to a toxin can cause an increase in the incidence of specific adverse effects. In the case of methylmercury and fish, it is important for health professionals to understand the science behind the guidance they provide to families who are interested learning how to reduce risks, through safer choices of fish that they consume. <sup>1</sup>

#### **What do we currently know about methylmercury concentrations in different species of fish?**

Well, although levels of methylmercury can vary by region, we know that the larger the fish, the older the fish or if it consumes other fish, the more methylmercury is concentrated in the fish. So, for example swordfish, orange roughy, shark, and some types of tuna (big eye, ahi) are very high in methylmercury. We also know that smaller, younger fish that don't consume other fish are lower in methylmercury. These include anchovies, sardines, and clams, for example. It is important to avoid some fish altogether, particularly for pregnant women and children because of the risk of neurodevelopmental issues that might arise.<sup>2,3</sup> The [www.fish-facts.org](http://www.fish-facts.org) site provides a number of resources that list more detailed information about methylmercury concentrations in different species of fish.

#### **Are there other factors that can impact risk for families that eat fish?**

Yes, the **frequency of consumption and the portion size** can all impact risk. A typical portion of fish is about 4-6 ounces (the size of the palm of your hand). However, when people eat out

(such as "Friday night fish fries") they may be eating more than one serving of fish in one sitting. So, although they may be eating fish lower in methylmercury such as haddock, consumption of **large portions** of fish will increase risk, since the methylmercury found in the bio-accumulates in the human body. Also, the **frequency** of fish consumed is also important to consider. Eating a low mercury fish every day such as bluegill, will expose a person to methylmercury and because methylmercury bio-accumulates in the body could lead to a body burden that exceeds guideline values.<sup>3,4</sup>

### **What is exposure assessment and why is this important for health professionals to understand?**

Exposure assessment refers to methods for estimating the magnitude, frequency, and duration of exposure to a toxin like methylmercury. It is important for health professionals to understand that some groups of people are more at risk for methylmercury toxicity, based on their exposure to this toxin. For example, because methylmercury is a neurotoxin, children are particularly vulnerable to health effects from exposure because of their developing neurological system. For example, a 45 pound child that eats one can of albacore tuna per week will be 3.6 times above recommended levels set by the EPA. To stay within EPA guidelines, albacore tuna intake cannot exceed one can per month for children<sup>4</sup>

Other populations with high fish consumption and therefore exposure, such as island and coastal populations, or those eating fish for a "heart healthy" diet, can have MeHg exposures substantially higher than those reported in national surveys. In 2004, the Wisconsin Department of Health Services surveyed residents about fish intake and measured MeHg levels through hair sampling, and found that men were significantly more likely to have higher levels of MeHg than women. In addition, average hair mercury levels were significantly correlated with monthly fish consumption estimates (the more fish eaten the higher the levels of methylmercury in hair).<sup>5</sup>

No, monitoring for MeHg exposure can be accomplished through the measurement of the total mercury content of blood, hair or toenails. Hair measurements are less invasive and can also be used to establish the timing of exposure to MeHg. MeHg in the mother's blood is correlated with exposure to the fetus. The National Resources Defense Council provides an online tool that can calculate a person's approximate risk, based on weight and fish consumption habits, including type of fish, frequency of consumption and portion size ([www.nrdc.org](http://www.nrdc.org)).

### ***Interested in more information?***

Visit the Risk Assessment Portal at <http://www.epa.gov/risk/hazardous-identification.htm>.



Community screening program for MeHg using hair samples

### *References*

1. Environmental Protection Agency. (2008). *Risk Assessment Portal*. Retrieved June 30, 2009, from <http://www.epa.gov/risk/hazardous-identification.htm>
2. Ginsberg, G.L. and Toal, B.F. (2009). Quantitative approach for incorporating methylmercury risks and omega-3 fatty acid benefits in developing species-specific fish consumption advice. *Environ Health Perspect*, 112(2).
3. Institute of Medicine of the National Academies. (2006). *Seafood choices: Balancing benefits and risks*. Washington, DC: The National Academies Press.
4. Natural Resources Defense Council. (2008). *Mercury contamination in fish: A guide to staying healthy and fighting back*. Retrieved June 30, 2009, from <http://www.nrdc.org/health/effects/mercury/index.asp>
5. Knobeloch, L., Anderson, H. A., Imm, P., Peters, D., & Smith, A. (2005). Fish consumption, advisory awareness, and hair mercury levels among women of childbearing age. *Environ Res*, 97(2), 220-227.

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## Module 3: Clinical Perspectives

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### *Learning objectives*

After viewing this media module, the participant will be able to:

- Describe the most important intervention by health professionals to screen for methylmercury exposure from fish consumption
- Identify populations sensitive to the neurodevelopmental effects of MeHg
- Describe pathways of MeHg exposure in infants

### *Background*

**The general public is often confused and concerned about fish consumption and potential health effects. What are the key points for health care professionals to consider when assessing for methylmercury toxicity?**

Fish consumption is the primary source of methylmercury exposure so it is essential that health care providers screen for methylmercury exposure by taking a thorough dietary history.

Important populations to screen and counsel to reduce health risks related to methylmercury include: children and women of childbearing age since methylmercury can pass through the placenta and breast milk. <sup>1</sup> Mercury exposure in utero or early childhood has the potential to impact the developing brain. <sup>2,3</sup>

**The dietary history should address:**

- 1) the type and size of fish consumed (for example, large predatory fish such as swordfish are high in mercury) as well as
- 2) portion size and frequency of consumption. One easy tip to share with families is that a 4 ounce fish serving is approximately the size and thickness of a deck of cards.

Health care providers should routinely take an environmental history that includes daily fish intake. The most important piece of counseling to families is to eat fish but choose wisely. The goal for families is to maximize the benefits of omega 3 fatty acids found in fish while reducing potential exposures to methylmercury.

### **Advice to share with families:**

Pregnant women, women of childbearing age, nursing mothers and young children should completely avoid fish known to be high in mercury. This includes: shark, tilefish, swordfish and king mackerel.<sup>4</sup>



*Rule of thumb: The smaller the fish, the safer the fish*

### **Families often ask, “should I have a test for mercury performed?” What is recommended?**

This should be decided on a case by case basis in consultation with a health professional or environmental health specialist. Often times, the most important intervention is educating families about the recommended guidelines on dietary intake of fish. Diagnostic testing using blood or hair from a reliable laboratory can be conducted but is not always needed.

If you have questions about methylmercury exposure, a free resource available to health care providers and families are Pediatric Environmental Health Specialty Units that have teams of health professionals who are knowledgeable in the field of environmental health.<sup>5</sup> The local Poison Control Center is also an excellent resource if concerned about the diagnosis of acute symptoms of mercury poisoning which is very rare in the US.

**Case Study:** The educational media module provides a dramatic representation of an actual case that occurred in which a middle-aged woman experienced mercury poisoning as a result of eating two cans of Albacore tuna each day over two weeks (she was trying to lose weight). By ceasing consumption of the tuna and beginning a regimen of Vitamin B Complex, she was able to reverse her symptoms of ataxia, memory loss, blurry vision, and loss of appetite.

### *Interested in more information?*

Review *Fish consumption to promote good health and minimize contaminants: A quick reference guide* at <http://www.arhp.org/publications-and-resources/quick-reference-guide-for-clinicians/fish-and-health/summary>. See Appendix A for a sample dietary history questionnaire;

*Mercury contamination in fish: A guide to staying healthy and fighting back* \at [www.nrdc.org/health/effects/mercury/index.asp](http://www.nrdc.org/health/effects/mercury/index.asp); and the

*Pediatric Environmental Health Specialty Units: A Network of Experts in Children's Environmental Health*. Retrieved August 1, 2009 from <http://www.aoec.org/PEHSU.htm>

### *References*

1. Agency for Toxic Substances and Disease Registry, Centers for Disease Control. (1999). ToxFaqs: Mercury CAS: 7439-97-6. Retrieved June 30, 2009 from <http://www.atsdr.cdc.gov/tfacts46.pdf>.
2. Landrigan, P., Kimmel, C., Correa, A., & Eskenazi, B. (2004). Children's health and the environment: Public health issues and challenges for risk assessment. *Environ Health Perspect*, 112(2), 257-265.
3. Dovydaitis, T. (2008). Fish consumption during pregnancy: An overview of the risks and benefits. *J Midwifery Womens Health*, 53(4), 325-330.
4. Natural Resources Defense Council. (2008). *Mercury contamination in fish: A guide to staying healthy and fighting back*. Retrieved December 30, 2008, from <http://www.nrdc.org/health/effects/mercury/index.asp>
5. Association of Occupational and Environmental Clinics. (2009). *Pediatric Environmental Health Specialty Units: A Network of Experts in Children's Environmental Health*. Retrieved August 1, 2009 from <http://www.aoec.org/PEHSU.htm>

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## Module 4: Risk Communication and Fish Advisories

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### *Learning objectives*

After viewing this media module, the participant will be able to:

- List agencies responsible for providing fish advisories
- Describe whether geographical location impacts the level of MeHg contamination in fish
- Identify key areas of knowledge needed for effectively communication risks and benefits regarding MeHg and fish consumption

### *Background*

**In previous media modules, we've learned about how mercury enters the food chain, ways to evaluate for mercury exposure and strategies to reduce exposure. Preventing exposure to methylmercury is best accomplished through health information messages specifically adapted for local populations. We know that health care providers, who are trusted by consumers and patients, play an important role in the dissemination of health information.**

**What is *risk communication* and why it is important for health care providers to understand risk communication when working with patients and consumers?**

Risk communication is defined as an exchange of information among interested people about the magnitude, significance, or control of a risk.<sup>1</sup> For example, the risk is for MeHg exposure related to fish consumption and ways to reduce one's health risks.

Unfortunately, despite efforts to inform the public of methylmercury risks and safe fish eating guidelines, there is considerable evidence that messages have not reached important vulnerable populations.<sup>2,3</sup>

In order to be effective in risk communication or messaging, you need a credible, respected third party to help carry out the message: health care providers are very trusted and excellent sources of health information for consumers and patients.<sup>4</sup>

### **What methods are currently used to inform the public about health risks from certain types of fish, in certain geographical areas?**

One important method is through national, state, and local fish advisories. Most fish advisories are posted on websites, distributed through fishing license brochures, or advisory signs near bodies of water.

However, the responsibility to provide fish advisories and fish consumption guidance is split between federal and state agencies which in some instances have resulted in inconsistent messages about health risks. The US Food and Drug Administration (FDA) oversees commercial fish in stores and restaurants, state environmental and public health agencies are responsible for sport-caught fish, and the US Environmental Protection Agency (EPA) has advisories for all sport-caught freshwater fish not covered under local advisories. Further confusion on recommended fish consumption guidelines is created when information presented by the popular media, not necessarily consistent with state or national advisories, is broadcast. There is an initiative by several states to integrate sport fish and commercial fish advisories and increase collaboration and the sharing of federal resources to allow the more active local agencies to disseminate more comprehensive advisories.<sup>5</sup>

### **Is there a source where health care providers can begin to become informed about state and national fish advisories?**

Yes, the federal government, through the EPA's National Listing of Fish Advisories (NLFA), maintains a database of states, tribes, and territories issuing fish advisories and safe-eating guidelines are a good place to begin.<sup>6</sup> This website can be found in the materials posted in the [www.fish-facts.org](http://www.fish-facts.org) website.

It is important for the health care provider to also become familiar with local advisories and materials that may be available that address the needs of sensitive subpopulations such as ethnically diverse groups. In some communities, language barriers, cultural practices, and complex or contradictory risk messages may prevent some populations from receiving essential information. For example, Native Americans who fish on home reservations are not required to purchase a fishing license and therefore may not receive advisory messages included in license brochures. Similarly, advisory signs near bodies of water would not likely be effective for urban Latinos who primarily buy their seafood from local markets. These materials can be accessed through many state or local health departments.

### **What is important information to enable health care providers to be effective in their risk messaging with patients?**

There are three key areas that health care providers should know:

- First, be informed regarding both risks and benefits of fish consumption, including current recommendations related to fish species (type of fish consumed and average levels of MeHg).
- Second, become aware of your state's fish monitoring and advisory programs which provide local and regional fish consumption advisories;

- Third, become familiar with the specific needs of vulnerable subgroups including socio-cultural perceptions, specific risks, and language barriers, and design your fish advisory messages using cultural and linguistic appropriateness.

Determining and then communicating the risks and benefits of fish consumption effectively with vulnerable populations can be daunting even for the most experienced provider. Best approaches will incorporate clinical practice recommendations, current research, and an awareness of local resources and advisories.<sup>7</sup>

### *Interested in more information?*

There are a variety of brochures and other resources available to health professionals. Be sure to check local public health agencies for specific information on your area. Some examples can be found at [www.nrdc.org](http://www.nrdc.org) (wallet card and mercury calculator) or at <http://dhfs.wisconsin.gov/eh/Fish/FishFS/MercryBrchre.pdf>.

For more information on tips for communicating risk, *A Primer on Health Risk Communication* can be found at <http://www.atsdr.cdc.gov/risk/riskprimer/index.html>.

The National Listings Fish Advisories by the EPA can be accessed at <http://www.epa.gov/waterscience/fish/advisories/>.

### *References*

1. Agency for Toxic Substances and Disease Registry, Centers for Disease Control. (2009). *A Primer on Health Risk Communication*. Retrieved, July 5, 2009 at <http://www.atsdr.cdc.gov/risk/riskprimer/index.html>.
2. Burger, J., Gochfeld, M., Powers, C. W., Waishwell, L., Warren, C., & Goldstein, B. D. (2001). Science, policy, stakeholders, and fish consumption advisories: Developing a fish fact sheet for the Savannah River. *Environ Manage*, 27(4), 501-514.
3. Dellinger, J. (2004). Exposure assessment and initial intervention regarding fish consumption of tribal members of the Upper Great Lakes Region in the United States. *Environ Res*, 95, 325-340.
4. Peters, R. G., Covello, V. T., & McCallum, D. B. (1997). The determinants of trust and credibility in environmental risk communication: an empirical study. *Risk Anal*, 17(1), 43-54.
5. Anderson, H., Hanrahan, L., Smith, A., Draheim, L., Kanarek, M., & Olsen, J. (2004). The role of sport-fish consumption advisories in mercury risk communication: A 1998-1999 12 state survey of women age 18-45. *Environ Res*, 95, 315-324.
6. Environmental Protection Agency. (2009). *National Listings Fish Advisories*. Retrieved July 15, 2009 from <http://www.epa.gov/waterscience/fish/advisories/>.

7. Association for Reproductive Healthcare Professionals [ARHP], & Physicians for Social Responsibility [PSR]. (2008, September). *Fish consumption to promote good health and minimize contaminants: A quick reference guide*. Retrieved July 15, 2009, from <http://www.arhp.org/publications-and-resources/quick-reference-guide-for-clinicians/fish-and-health/summary>.

# Appendix A



## SAMPLE: Fish & Mercury Dietary Questionnaire

1. Today's Date: Enter month/date/year (e.g., 01/01/1966)
2. \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
3. Name \_\_\_\_\_
4. Address \_\_\_\_\_ (include zipcode)
5. How old were you on your last birthday?  
Select one:
  - child (18 years of age and under: assent needed)
  - adult (19 years of age and over: consent needed)
6. What is your gender?
  - Female
  - Male
7. Which of the following best describes your race or ethnic background? (*check all that apply*)
  - African American
  - Asian
  - Native Hawaiian or other Pacific Islander
  - Hispanic or Latino
  - Native American/Native Alaskan
  - White
  - Other (please specify \_\_\_\_\_)
8. Do you or any one in your household work around toxic chemicals?  Yes  No  Not sure
  - a. If so, do they shower and change clothes before returning home from work?  Yes  No  Not sure
9. Do you or anyone in your household have arts, crafts, ceramics, stained

glass work or similar hobbies?

Yes  No  Not sure

10. Are you aware of any recent exposure to mercury at work or at home? (if yes, please explain)

Yes  No  Not sure

a. If yes, please explain \_\_\_\_\_

\_\_\_\_\_

11. Do you include fish or seafood in your diet?

Yes  No

a. If no, what is the main reason you **DO NOT** eat fish? (*Check one*)

I don't like fish.

I am a vegetarian.

I am concerned about the safety of fish.

It has never been part of my family's diet.

Other reason (*please specify below*):

\_\_\_\_\_

12. Estimate about how many ounces of fish you eat **AT EACH MEAL**:  4 ounces or less  4 ounces or more

13. Which **TYPES** of seafood do you normally eat? (*Check all that apply*)

**Total ounces *per month* (4 ounces is approx. size of deck of cards)**

Albacore Tuna   4 ounces or less  4 ounces or more

Bass   4 ounces or less  4 ounces or more

Bluegill   4 ounces or less  4 ounces or more

Carp   4 ounces or less  4 ounces or more

Catfish   4 ounces or less  4 ounces or more

Chilean Sea Bass   4 ounces or less  4 ounces or more

Cod, Perch, Haddock   4 ounces or less  4 ounces or more

Crappie   4 ounces or less  4 ounces or more

- |  |   |   |
|--|---|---|
| Flatfish and Flounder <input type="checkbox"/>       | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| King Mackerel <input type="checkbox"/>               | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Orange Roughy <input type="checkbox"/>               | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Perch <input type="checkbox"/>                       | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Pike <input type="checkbox"/>                        | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Tile Fish <input type="checkbox"/>                   | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Salmon <input type="checkbox"/>                      | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Shark <input type="checkbox"/>                       | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Shellfish (shrimp, lobster) <input type="checkbox"/> | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Swordfish <input type="checkbox"/>                   | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |
| Walleye <input type="checkbox"/>                     | <input type="checkbox"/> 4 ounces or less | <input type="checkbox"/> 4 ounces or more |

Other (Please list: \_\_\_\_\_)

14. Have you heard anything about limiting fish consumption because of mercury contamination?

- Yes  No

15. Have you or any family member had a diagnosis of any of the following? (**Check all that apply**)

- Autism  Learning disability  Developmental delay  Heart disease  High blood pressure

If yes, which family member? (**List all members and specify condition**)

\_\_\_\_\_

16. Do you or any family member suffer from any of the following recurrent symptoms? (**Check all that apply**)

- Cough  Headaches  Fatigue  Unexplained pain  Ataxia  Blurring vision  
 Dizziness  Memory loss

17. Blood pressure reading today: (systolic: \_\_\_\_\_ diastolic: \_\_\_\_\_)

## Appendix B

### Web Sites Containing Information on Mercury and Health

This listing is not in any special order but describes some of the web sites available to health professionals and the general public describing information on methylmercury, health effects and special concerns for pregnant women and children.

- A. [www.nrdc.org](http://www.nrdc.org) : Contains a wallet card with recommended levels of fish consumption and a number of articles on mercury and related health effects
- B. [www.epa.gov/ost/fish](http://www.epa.gov/ost/fish) : contains up to date information on recommended fish intake for pregnant women and children
- C. [http://www.sierraclub.org/mercury/factsheets/feeding\\_mercury.pdf](http://www.sierraclub.org/mercury/factsheets/feeding_mercury.pdf) : General information to fish consumers about mercury and health effects
- D. <http://dnr.wi.gov/org/water/fhp/fish/pages/consumption/hookintohealthyfish04.pdf> : This site provides information on the selection of sports fish for safer levels of mercury
- E. [www.environmentaldefense.org](http://www.environmentaldefense.org) Contains link that describes safe fish guidelines
- F. [http://www.focusonenergy.com/data/common/dmsFiles/V\\_ER\\_RESE\\_Knobeloch\\_report%20.pdf](http://www.focusonenergy.com/data/common/dmsFiles/V_ER_RESE_Knobeloch_report%20.pdf) : *Population-Based Methylmercury Exposure Assessment* (August 2005) Lynda Knobeloch, Research and Toxicology Supervisor; Henry Anderson, Chief Medical Officer; Wisconsin Department of Health and Family Services, Division of Public Health, Bureau of Environmental and Occupational Health. This study identifies subpopulations in Wisconsin that consume fish several times a week and populations that had elevated levels of mercury in their bodies. Comparison of hair mercury levels with the types and quantities of fish they consumed provides important information on dietary exposure to methylmercury.
- G. [www.environmentaldefense.org](http://www.environmentaldefense.org) : This site provides a range of information including an Ocean's Alive site that highlights issues surrounding fish sustainability (overfishing) as well as safe fish consumption=<http://www.oceansalive.org/eat.cfm?sitecode=edhp2>
- H. [www.ewg.org](http://www.ewg.org): Environmental working group has information on fish consumption and health, specifically tuna
- I. [www.sierraclub.org](http://www.sierraclub.org) : This group provides hair testing for mercury levels for \$25.00 and information about safe fish consumption (including a wallet card)
- J. [www.usgs.gov/themes/factsheet/146-00](http://www.usgs.gov/themes/factsheet/146-00) : The U.S.Geological Society provides information on safe fish consumption
- K. [www.psr.org](http://www.psr.org) : Physician's for Social Responsibility provides information on health effects of mercury and how to reduce risks through changes in fish consumption
- L. [www.iceh.org/LDDI](http://www.iceh.org/LDDI) : This organization, the Institute for Children's Environmental Health has information regarding learning and developmental disabilities and has information on the hazards of mercury exposure on children's growth and development, along with a brochure produced through the Learning Disabilities Association of America, the National Education Association, and the Arc of the United States.

## Appendix C

### Fish Facts: Continuing Education Evaluation

#### Survey and Answers

(access at [www.surveymonkey.com/s.aspx?sm=0QCwdWebBBiWku6H4crvoQ\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=0QCwdWebBBiWku6H4crvoQ_3d_3d))

#### Fish Facts Module 1: Epidemiology and Toxicology

**1. People are MOST OFTEN exposed to methylmercury through which of the following? (Select ONE answer):**

- Thermometers
- Dental Amalgams
- Fish Consumption

**2. Methylmercury causes which of the following health effects in adults? (Select ALL that apply):**

- Paresthesias
- Memory Loss
- Ataxia
- Weight gain

**3. Which group of individuals is MOST VULNERABLE to the neurotoxic effects of methylmercury exposure? (Select ONE answer):**

- Elderly
- Women
- Children
- Ethnic Minorities

## Fish Facts Module 2: Hazard Identification and Exposure Assessment

**1. Which of the following seafood items are generally considered LOW in methylmercury? (Select ALL that apply):**

- Anchovies
- Shark
- Shrimp
- Albacore tuna

**2. Which of the following seafood items is generally considered HIGH in methylmercury and should be consumed in limited amounts? (Select ALL that apply):**

- Shark
- Shrimp
- Albacore Tuna
- Swordfish
- Clams

**3. When counseling patients, what key factors should be considered to reduce risk? (Select ALL that apply):**

- Frequency of fish consumed
- Type of fish consumed
- Amount of fish consumed
- Time of day fish is consumed

### **Fish Facts Module 3: Clinical Perspectives**

**1. What is the MOST IMPORTANT intervention for health care professionals to conduct, that will support patients who are concerned about methylmercury exposure? (Select ONE answer):**

- Conduct blood test for mercury
- Conduct dietary assessment for fish consumption
- Evaluate cardiovascular status
- None of the above

**2. Sensitive populations to screen and counsel to reduce neurodevelopmental health risks related to methylmercury include (Select ALL that apply):**

- Men over the age of 40 years
- Childbearing women
- Pregnant women
- Children

**3. Methylmercury can pass through the placenta and breast milk and has the potential to impact the developing brain.**

- True
- False

## **Fish Facts Module 4: Risk Communication and Fish Advisories**

**1. The provision of fish advisories to the public is the responsibility of the following agency (ies)? (Select ALL that apply):**

- Food and Drug Administration (FDA)
- Environmental Protection Agency (EPA)
- Local Hospitals
- State Public Health Agencies

**2. Does geographical location impact levels of methylmercury contamination in fish?:**

- True
- False

**3. To be effective in risk communication, it is important that health care providers be knowledgeable in the following areas (Select ALL that apply):**

- Risks and benefits of fish consumption
- Chelation methods
- Local, regional, and state fish consumption advisories
- Specific information needs of vulnerable subgroups