

Training Health Care Providers about the Risks and Benefits of Eating Fish: Evaluation and Recommendations

Summary

Health care providers (HCPs) partnering in the EPA GLRI funded *Fish are Important for Superior Health (FISH)* Project needed training about the importance of reducing mercury exposures in women of childbearing age and the benefits of eating fish in order to fully participate in the planning, design, and implementation of the FISH Project. Three existing training courses were available that at least partially covered this content. Two of the courses had been developed with GLRI grant funding: one by the University of Illinois at Chicago (UIC) and one by Michigan State University (MSU). The third course was developed by Stony Brook University Gelfond Fund staff. Physicians and nurses from Sawtooth Mountain Clinic (SMC) and Grand Portage Health Service (GPHS) completed and evaluated the three training courses on the risks and benefits of eating fish. The goal was to determine if any of these three courses was suitable for future training of HCPs in Minnesota and other Great Lakes states or if a new course on fish consumption risks and benefits needed to be developed.

Results from the course evaluations and discussion during the training sessions suggest successful training courses for clinicians should assume participants will use a listen-and-apply approach: health care providers (HCPs) preferred summary information from a trusted source over detailed review of primary research. HCPs wanted the bottom-line: what is known, strength of the data/research, and what they should do (e.g. how it applies to their practice). HCPs also emphasized that having information on local fish with consumption recommendations specific to their communities would be helpful when working with patients.

Based on HCPs recommendations on course content, format, and length, MDH developed a new training course called ***FISH Project Risks and Benefits Training***. The new one-hour course was administered by MDH and evaluated by FISH Project HCPs prior to the start of the FISH Project. This course is available through the Minnesota Medical Association (MMA), which works with MN hospitals to offer courses for continuing education for HCPs. The course was also delivered to HCPs in Ashland, WI, partnering in a GLRI grant project (*South Shore Women Choose Wisely*) with the Wisconsin Department of Human Services.

Methods

FISH Project partners developed, implemented, and evaluated an in-clinic intervention in which HCPs screened women of childbearing age (WCBA) for mercury exposure at clinic visits and provided information they needed to choose to eat fish low in contaminants. MDH partnered with the Sawtooth Mountain Clinic (SMC), the Grand Portage Health Service (GPHS), Cook County North Shore Hospital (CCNSH), and Grand Portage Trust Lands.

In April and May 2013, MDH presented three existing training courses on fish consumption risks and benefits to two physicians and 8-12 nurses from GPHS and SMC (depending on the training session). Prior to presenting the three trainings, MDH assessed whether the content was consistent with the MDH and Consortium fish consumption advice (FCA). Inconsistencies were noted and discussed at the end of each course or module. Inconsistencies were shared with course developers for consideration in future versions. HCP participants completed an evaluation for each course and an overall evaluation at the conclusion of all three courses.

Training HCPs partnering on the FISH Project at the beginning of the design phase allowed their full participation in project design as trained/informed HCPs. In addition to the need to train FISH partners to enhance the Project design, MDH also wanted to obtain input from HCPs about their preferences for course content, presentation, and opinions on feasibility for in-clinic settings.

Description of the Three Existing Training Courses

The curriculum, forms, and course evaluations for each of the three courses are found in the Appendix.

- **UIC Course - Healthy Fish Choices.** This web-based CME course was developed by the University of Illinois at Chicago (UIC) with GLRI funding. Course included six modules - each module included a video presentation, case scenario and discussion, objectives and references, pre- and post-tests, and a course evaluation.

UIC was testing a draft of this training at the time MDH presented it to HCPs in April 2013. UIC shared the modules with MDH electronically so MDH could present them to FISH Project clinic partners as a group rather than each participant completing the modules online individually. MDH also used the pre- and post-tests and course evaluation questionnaire/assessment developed by UIC. The physicians from SMC earned CME credit through UIC for completing the course. Nurses earned CEU credit through the University of Minnesota. The final version of the training is available <http://cores33webs.mede.uic.edu/healthyfishchoices/index.html>

The UIC course evaluation was modified and used to assess the MSU and Stony Brook University trainings.

- **MSU Course - Eating Fish: Maximizing Benefits and Minimizing Risk.** This course was developed by Michigan State University (MSU) with GLRI funding. Course included a PowerPoint presentation, a brief post-test, and a course evaluation. MDH presented this course to HCPs in

May 2013. Course content focused on fish consumption benefits and risks, health outcomes, and raising awareness about local fish advisories. Course information can be found at <http://oem.msu.edu/FishMedicalEducation.aspx>

- ***Stony Brook University Course - Recognizing and Preventing Overexposure to Methylmercury from Fish & Seafood Consumption: Information for Physicians.*** This course consisted of a PowerPoint presentation developed by Stony Brook Gelfond Fund staff based on the publication *Recognizing and Preventing Overexposure to Methylmercury from Fish and Seafood Consumption: Information for Physicians* by Silbernagel et al, 2011. This course had a narrower focus: identification of high consumers. It was not focused on preventing exposures in the fetus. When presented to FISH Project HCPs, the course included the PowerPoint presentation, video segments from a Grand Rounds presentation at Stony Brook University Medical Center (described below), a brief post-test, and a course evaluation.

Excerpts came from the Grand Rounds presentation video called: “Medical Masquerade: One Man’s Experience with Methylmercury Poisoning”. The full one-hour video is about the clinical presentation of methylmercury poisoning and includes three parts: 1) the perspective of someone who experienced it himself, 2) clinical information from an expert in methylmercury poisoning, and 3) perspectives from a scientist who studies mercury in the marine environment. The video was made at a Grand Round presentation for the Department of Medicine at Stony Brook University Medical Center in November 2010 and is available online:

<http://www.stonybrook.edu/commcms/gelfond/physicians/cases.html>

Evaluation of the Three Existing Training Courses

Each course was evaluated by FISH partner HCPs upon completion. Responses to the **Individual Course Evaluations** and **pre- and post-test results** are in the Appendix.

- Knowledge attainment, desirability, ease of use in a clinical setting, and media preferences (online, PowerPoint, etc.) were evaluated for each course using:
 - **Pre- and post-tests for the UIC course**
 - **Course Assessment Tools/post-tests for MSU and Stony Brook courses**
 - Comments recorded during all training sessions

HCPs also completed an overall evaluation after all three courses were presented to look at how the courses compared to one another.

- **Overall Course Evaluation** administered at the end of May 2013 after all courses had been presented. Individual courses were compared and evaluated against each other. List of topics to rank was developed based on course content and discussion during course presentations. Results are discussed in the section below called *Evaluation Results of Training Courses*.

Development of New MN Training Course

Based on evaluation results of the three courses, a new fish consumption risks and benefits course was created by MDH. In May 2014, the new course was presented to all FISH Project HCPs – just prior to the start of FISH Project participant enrollment – including FISH partners HCPs. See the Appendix for the MN course curriculum and evaluation.

- ***MN Course – FISH Project Risks and Benefits Training.*** The one-hour course included a PowerPoint presentation, a video from Dartmouth Superfund Research Program, and an evaluation form.

The Dartmouth video (called *Mercury: From Source to Seafood*) was included as part of the training because it was shown at a previous meeting of the FISH Project partners, who recommended the video be part of the new course. Project partners really liked the video and thought the concepts of how fish get mercury, where mercury comes from, what can people do about mercury in fish, and why it's important to eat fish low in mercury were presented well. One caveat is that the video focused on ocean fish. The MN course included discussion of the Dartmouth video with a local freshwater fish context. The video can be found here:

<http://www.dartmouth.edu/~toxmetal/mercury-source-to-seafood/>

Evaluation of New MN Training Course

The MN course *FISH Project Risks and Benefits Training* was evaluated by SMC providers and nurses for practical application in a clinical setting. Knowledge attainment effectiveness of the course and media preferences (online, PowerPoint, etc.) were assessed using the evaluation form. In addition, the course was presented and evaluated by HCPs participating in the WI GLRI Project.

Evaluation Results for Training Courses

The results from the Overall Evaluation of the three existing courses and the MN course are below. Individual Course Evaluations are in the Appendix. *Note that all results are limited to the small number of doctors and nurses on the FISH Project team.*

Evaluation Results: Overall Evaluation for Three Existing Courses

In May 2013, seven HCPs took part in the Overall Evaluation to compare and assess the three existing courses (UIC, MSC, Stony Brook) on fish consumption risks and benefits. Questions focused on course information (format, content, topics) and course comparisons (how well existing courses covered specific topics). Respondents were asked to rate most questions on a scale of 1 to 5 points (with 5 being the highest score). In the following text, scores are given in parentheses where noted.

A summary of results follows. The detailed evaluation results are found in the Appendix.

Course Information

For course format, HCPs preferred a mix of PowerPoint and videos in a group setting (4.3 out of 5 points) followed by case studies read by individual learner or discussed by group (3.4 points). Comments from participants said a group setting/learning environment improved thoughtful questioning and reinforced understanding of the content. HCPs disliked course formats with PowerPoint only read by solo learner (1.6 points) where there is little interaction among course participants. Three out of seven HCPs indicated one hour as the preferred training course length.

Training Time	# Responses
One hour	3
One to two hours	2
Two to four hours	1
Four to six hours	
Other: 1 hour alone online or 1 to 2 hours with a group	1

For which topics/content are important to include in a course, HCPs gave the highest ratings to proven benefits (4.9 out of 5 points) and risks (4.9 points) of fish consumption as well as information on locally caught fish (4.6 points). Scientific basis for fish consumption “safe levels” advice (2.9 points) and risks (2.9 points) scored the lowest.

Course Comparisons

In general, HCPs preferred the Stony Brook course over both the MSU and UIC courses for content and format. Out of a possible 5 points, the Stony Brook course scored the highest (4.3) on clear, useful content while the UIC course was the lowest (2.9). Similar results were found for rating which course was sufficient for understanding and discussing benefits and risks of fish consumption with patients (Stony Brook = 4.0, MSU = 2.8, UIC = 2.7). One respondent noted the Stony Brook course was best in

terms of organization of information, providing context, and limiting content to clinically relevant material.

HCPs also looked at a list of specific course topics and decided if any of the three courses covered that particular content well. The topics about mercury in the environment (e.g. where mercury comes from, how mercury gets into fish, how mercury acts in the body) were marked most frequently as being covered well by all three existing courses with the Stony Brook course getting the most votes. *HCPs indicated that most topics in the existing courses needed improvement*, especially areas of mercury lab tests, accessing fish advisories, and information on locally caught fish. As a whole, none of the courses on their own received high marks as the “ideal training course” for clinical practitioners.

HCPs provided additional suggestions for a newly developed course, including:

- Reduce presentation of scientific evidence details (unnecessarily complicates learning of basics).
- Make it locally relevant. Keep it simple.
- Mix it up with visuals and stories.
- Clearly delineate risks versus benefits.

Personal Attitudes

HCPs were also asked one question on how they personally felt about nine statements about fish and health. Everyone agreed that fish is an important part of a healthy diet, pregnant women should eat fish, and eating fish is good for people with cardiovascular disease. Responses varied more for questions regarding fish oil supplements.

Evaluation Results: MN Course

Evaluation results from the MN Course *FISH Project Risks and Benefits Training* indicated that, overall, HCPs liked the content, format, and length of the new course. In March 2014, eighteen HCPs completed the course and evaluation. The same 5-point rating scale from the Overall Evaluation was used in the MN Course Evaluation. Questions were also similar.

A summary of results is below. The detailed evaluation results are found in the Appendix.

Course Information

HCPs gave the MN training a 4.6 out of 5 points for being sufficient in preparing them to understand and discuss the benefits and risks of fish consumption with women patients of childbearing age. Out of 18 course attendees, 17 agreed the one-hour course was about the right time length. HCPs were also asked which topics were the most important to include in this type of training course. Top-ranked topics included: proven benefits (4.9 points) and risks (4.8 points) of fish consumption as well as information on locally caught fish (4.8 points). Lowest-ranked topics were: which mercury lab tests to order (3.6 points) and how to interpret lab test results (3.6 points).

Personal Attitudes

At the end of the evaluation, HCPs were asked their personal attitude about seven statements on fish and health. Statements with the highest scores included:

- Benefits outweigh the risks if people eat fish low in mercury. (4.9 out of 5 points)
- Fish is an important part of a healthy diet. (4.9 points)
- Eating fish is beneficial for fetal development. (4.8 points)

Further Suggestions

HCPs had the opportunity to add additional comments or suggestions for the new course at the end of the evaluation. A few are listed below.

- The length of time was good. Info not overwhelming.
- Would be nice to have more specific comments on how babies "do better developmentally" in women who consumed fish. The comment is sort of generic, and I don't really know what it means.
- I liked the Dartmouth video - liked the questions to engage participants.
- Focus needs even more to go from the science of it all into the nuts and bolts of what I do in the office - how to ask, how to advise, when to test - and tools to use as I talk to patients. Don't need to convince us why as much as guide us how.

MN Course Evaluation Results: South Shore Women Choose Wisely (WI GLRI Project)

In May 2014, MDH presented the MN Course *FISH Project Risks and Benefits Training* to staff of the South Shore Women Choose Wisely project. Five HCPs evaluated the course.

Respondents agreed that the training prepared them to understand and discuss benefits and risks of fish consumption with women of childbearing age. HCPs also liked the content, format, and length of the course. Topics with the highest score (4.8 out of 5 points) were: benefits of fish consumption, guidance for patient communication, scientific basis for risks, where mercury comes from, how mercury gets into fish, and how mercury acts in the body. Of less importance were topics on mercury lab tests (when to test, which tests to order, how to interpret), and how to access fish advisory information.

The detailed evaluation results are found in the Appendix.

Recommendations for HCP Fish Consumption Risk and Benefits Training

Overall, HCPs recommended that fish consumption risks and benefits training should be simple, provide the “bottom-line” summary information, and exist in a format that can be listened to and then applied directly to their practice. HCPs wanted to be aware if uncertainty existed within the literature about interpreting fish consumption benefits and risks but were not interested in reading the literature/research papers on their own to determine a course of action for patient care. (MDH compiled a current literature binder for HCPs to utilize at clinic sites. Discussions with HCPs found that this resource was not useful or important in their current practice.) HCPs also preferred training in a group setting using a mixture of media as the format (PowerPoint and video) to keep the training interesting. Specific suggestions include PowerPoint slide bullets appearing one at a time and using local case studies whenever possible. Other recommendations for future training courses included:

- Training course be 1-2 hours maximum using a variety of presentation media, schemes, and learning methods
- Content should include:
 - General information about mercury and other contaminants
 - Briefly describe mercury sources and which fish are likely to have contaminants
 - Local fish consumption guidelines
 - How much mercury and omega-3s are in fish
 - Summarize/provide the “bottom-line” of fish consumption risks and benefits (including the strength and uncertainties of these) along with guidance for patient communication

Knowledge Gained

These course evaluations allowed MDH to better understand the needs of HCPs and how they integrate environmental health issues into clinical settings. This knowledge helped shape the design and implementation of the FISH Project. Because these trainings and evaluations occurred prior to the Project, FISH partners were able to deeply engage in discussions to create specifically targeted participant and community education materials relevant to their communities. For example, the FISH screening questions for the Electronic Medical Record (EMR) was a joint effort with MDH and FISH partners after fish consumption risks and benefits training was complete. Engaging with local HCPs on community projects is key to developing sound and effective materials to meet the needs of the targeted population.

While this project focused specifically on training HCPs about fish consumption risks and benefits, many components can be taken away and applied to other training for HCPs, such as course length (1-2 hours), content (summary information, relevancy to current practice, local connections/case studies), and format (group setting, varied media, participant discussion).

Appendix

Course Information: Curriculum, Forms, and Evaluation Results

- **UIC Course - *Healthy Fish Choices***
 - Curriculum
 - Pre- and Post-test results
 - Individual Course Evaluation
 - Individual Course Evaluation results
- **MSU Course - *Eating Fish: Maximizing Benefits and Minimizing Risk***
 - Curriculum
 - Post-test results
 - Individual Course Evaluation
 - Individual Course Evaluation results
- **Stony Brook University Course - *Recognizing and Preventing Overexposure to Methylmercury from Fish & Seafood Consumption: Information for Physicians***
 - Curriculum
 - Post-test results
 - Individual Course Evaluation
 - Individual Course Evaluation results
- **Overall Evaluation (used to compare 3 Existing Training Courses)**
 - Form
 - Results
- **MN Course - *FISH Project Risks and Benefits Training***
 - Curriculum
 - Individual Course Evaluation results
 - Curriculum for *South Shore Women Choose Wisely* (WI GLRI Project)
 - Evaluation results from *South Shore Women Choose Wisely*

UIC Course Curriculum

UIC Healthy Fish Choices Curriculum

Course Overview

Welcome to Healthy Fish Choices, a CME course designed to enhance the care you provide to patients who are pregnant and breastfeeding, women of child-bearing age, and young children. This 12 credit course is divided into six short modules. You will progress at your own pace completing one module every week or two.

The knowledge content will cover the following areas: the health benefits of fish consumption, the health effects of exposure to contaminants in fish including mercury, polychlorinated biphenyls (PCBs), and pesticides, special populations at risk of high exposure to contaminants in fish, and fish advisories. Recommendations for your patients will build in a step-wise fashion, from a simple avoidance message in the first module to a multi-faceted risk-benefit assessment in the final module. We will also provide you with on-line resources and references for further reading and support. CME credits will be awarded when all modules and the final post-test have been completed. [For participants in the research phase, CME credits will be awarded after completion of the three-month post-test and course evaluation.]

Module 1 - The Importance of Healthy Fish Choices

Module 1 Overview Page

Helping Your Patients Make Informed Decisions about Healthy Fish Consumption

Module 1 - Pretest Questionnaire

Module 1 - Objectives Page Module 1 - Video Presentation Page (7:46 minutes)

Knowledge Objectives: Upon completion of this module, participants will be able to:

- explain how and why fish are sources of environmental contaminants
- list the major health benefits and risks of fish consumption
- state why several types of fish should be avoided by pregnant and nursing women, women of childbearing age, and children

Attitude Objectives: Upon completion of this module participants will demonstrate:

- an appreciation for why they need to know the health benefits and risks of fish consumption for their patients
- the recognition that they need to learn more about how to explain about fish consumption to their patients
- that they want to learn how best to screen patients for fish consumption
- that they want to learn how to advise patients about avoiding consuming high risk types of fish

Behavior Objectives: Upon completing this module participants will be able to:

- advise patients and parents about avoiding high risk fish consumption
- explain to patients and parents the reasons fish consumption is important and risks of eating species high in mercury

Module 1 - Problem Solving (Case Scenario) Case Module

Pregnant women and 5 year old son come in for her prenatal visit

Module 1 - Problem Solving (Case Discussion) Forum

In the Case 1 scenario, you are conducting a prenatal visit with a pregnant woman and her 5 y/o son. You learn that she loves swordfish and eats it at least once a week and have been asked to describe how you would proceed. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 1 - Planning for Action Forum

Module 1 - Posttest Questionnaire

Module 1 - References (Optional) Page

Module 2 - Benefits and Risks to Women and Children

Module 2 - Overview Page

Helping your patients who are pregnant or nursing, who are of child bearing age, or who have young children to make healthy fish choices

Module 2 - Pre-test Questionnaire

Module 2 - Objectives Page

Knowledge Objectives: Upon completion of this module, participants will be able to:

- track the exposure pathway from mother to fetus
- explain the scientific basis for the health benefits and risks of fish consumption during pregnancy and early childhood
- state the recommendations for DHA intake in pregnancy

Attitude Objectives: Upon completing this module participants will:

- appreciate why they need to know the health benefits and risks of fish consumption for their patients
- recognize the need to learn more about how to explain about fish consumption to their patients
- want to learn how best to screen patients for fish consumption
- want to learn how to advise patients about eating a variety of fish species

Behavior Objectives: Upon completing this module participants can:

- screen parents of young children and pregnant women about frequency and variety of fish consumption
- advise parents of young children and pregnant women about avoiding consumption of the five types of fish highest in mercury, eating fish twice per week, and eating a variety of fish species
- explain to parents of young children and pregnant women in lay terms the reasons fish consumption is important, the risks of eating too much of the wrong fish and of eating fish too frequently

Module 2 - Video Presentation Page (8:47 minutes)

Module 2 - Problem Solving (Case Scenario) Case Module

You are seeing a child about a well-child exam. You ask about the child's diet.

Module 2 - Problem Solving (Case Discussion) Forum

In the Case 2 scenario, you are seeing a young child for a well-child exam. While discussing the child's diet, her mother mentions that the child insists on eating tuna every day for lunch. You have been asked to describe the advice you would provide at this point. You will find your own response along with those of your colleagues who are participating in this course below. You are encouraged to elaborate on your approach and to comment on those of your colleagues.

Module 2 - Planning for Action Forum

You must complete both steps 1 & 2 to finish this exercise.

Step 1: Click "**Add a new topic**" and explain the steps you will take to help your patients learn about the benefits and risks of fish consumption and about the EPA guidelines suggesting two meals from a variety of fish per week.

Step 2: Identify a plan from one of your colleagues that you can build upon by clicking "**Discuss This Topic**" below their posting and add your comments.

Module 2 - Posttest Questionnaire

Module 2 - References (Optional) Page

Module 3 - Other At-risk Populations

Module 3 - Overview Page

The Absorption and Metabolism of Mercury Special Populations at Risk - Resources for Finding Mercury Levels in Fish

Module 3 - Pretest Questionnaire

Module 3 - Objectives Page

Knowledge Objectives: Upon completion of this module, participants will be able to:

- describe which populations are high fish consumers and may be at risk of contaminant exposure
- describe mercury absorption and metabolism in adults and children
- know how to obtain information about mercury levels in specific fish species

Attitude Objectives: Upon completion of this module participants will:

- appreciate the importance of screening all pregnant women and children for fish consumption
- want to learn how best to screen your patients who are among high risk populations for potential mercury exposure through fish consumption

Behavior Objectives: Upon completing this module participants can:

- be able to perform appropriate history and physical to screen patients about frequency and variety of fish consumption that helps you identify potential mercury exposure.
- be able to advise high fish consumption patients which species with higher mercury levels to avoid or eat in moderation and species with lower levels that can be eaten more liberally

Module 3 - Video Presentation Page (9:12 minutes)

Module 3 - Problem Solving (Case Scenario) Case Module

You are caring for an Asian woman and her young children. They live with her parents, who emigrated from China in the 1970's.

Module 3 - Problem Solving (Case Discussion) Forum

In Case 3, you are discussing fish consumption with an Asian woman and her young children. You are concerned about the family's mercury exposure, and you have been asked to describe the advice you would provide for the patient and her family. You will find your own response along with those of your colleagues who are participating in this course below. You are encouraged to elaborate on your approach and to comment on those of your colleagues.

Module 3 - Planning for Action Forum

Step 1: Click "**Add a new topic**" and describe the steps you will take to make sure that screening questions about fish consumption are included in your visits with patients from high fish consuming populations and draft a statement you might use to advise patients in your population about which species to consume in moderation and which can be eaten more freely.

Step 2: Identify a plan from one of your colleagues that you can build upon by clicking "**Discuss This Topic**" below their posting and add your comments or suggestions.

[Module 3 - Posttest Questionnaire](#)

[Module 3 - References \(Optional\) Page](#)

Module 4 - Benefits and Risks to Healthy Adults

[Module 4 - Overview Page](#)

Health Benefits of Fish Consumption in Adults

[Module 4 - Pretest Questionnaire](#)

[Module 4 - Objectives Page](#)

Knowledge Objectives: Upon completion of this module, participants will be able to:

- summarize the scientific basis for the health benefits of fish consumption in adults
- access resources that promote fish consumption for healthy adults and those with heart disease

Attitude Objectives: Upon completion of this module participants will:

- appreciate why they need to know the health benefits and risks of fish consumption for their patients
- recognize they need to learn more about how to explain about fish consumption to their patients
- want to learn how best to screen patients for fish consumption
- want to learn how to advise patients about frequency of fish consumption

Behavior Objectives: Upon completing this module participants can:

- screen patients about the frequency of fish consumption
- advise patients about eating fish twice per week
- explain to patients in lay terms the reasons fish consumption is important and risks of eating too much of the wrong fish

[Module 4 - Video Presentation Page \(6:45 minutes\)](#)

[Module 4 - Problem Solving \(Case Scenario\) Case Module](#)

You are performing an annual physical on a grandmother, who was recently hospitalized with a myocardial infarction. You wonder whether she is benefiting from the heart healthy aspects of the omega-3 fatty acids in fish.

[Module 4 - Problem Solving \(Case Discussion\) Forum](#)

In Case 4, you are caring for a large family and performing an annual physical on the grandmother, who was recently hospitalized with a myocardial infarction. After discussing fish consumption, you were

asked to describe how you would proceed. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 4 - Planning for Action Forum

Step 1: Click "**Add a new topic**" and describe how you plan to raise the topic of fish consumption with your adult patients and advise them to eat two fish meals per week.

Step 2: Identify a plan from one of your colleagues that you can build upon by clicking "**Discuss This Topic**" below their posting and adding your comments.

Module 4 - Posttest Questionnaire

Module 4 - References (Optional) Page

Module 5 - Recreational Anglers and their Families

Module 5 - Overview Page

Recreational Anglers and their Families

Module 5 - Pretest Questionnaire

Module 5 - Objectives Page

Knowledge Objectives: Upon completion of this module, participants will be able to:

- know the health effects of these fish contaminants: PCBs, dioxins, and pesticides.
- describe the increased risk of contaminant exposure when consuming recreationally-caught fish.
- know how to access and interpret accurately recommendations in local fish advisories

Attitude Objectives: Upon completion of this module participants will:

- appreciate the importance of recognizing health effects for fish contaminated by PCBs, dioxins, and pesticides
- want to learn about risks from consuming recreationally-caught fish
- want to access and interpret accurately recommendations in local fish advisories

Behavior Objectives: Upon completing this module participants can:

- screen patients who eat recreationally-caught fish
- advise patients who eat recreationally-caught fish about contaminants in local species
- advise pregnant women and children of which species of recreationally caught fish to avoid
- advise all adults about and which local recreationally-caught fish species are safe for adults to eat or should be avoided or eaten at most once per week

Module 5 - Video Presentation Page (11:02 minutes)

Module 5 - Problem Solving (Case Scenario) Case Module

An elderly African American gentleman comes in for his annual physical exam. It's summer time and you chat about his retirement.

Module 5 - Problem Solving (Case Discussion) Forum

In Case 5, you are caring for an elderly African American gentleman, who has come in for his annual physical exam. You find that he is an avid fisherman and eats the fish he catches every day. You were asked to describe how you would proceed. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 5 - Planning for Action Forum

Step 1: Click "**Add a new topic**" and describe how you plan to include a screening question about recreationally-caught fish consumption and how you can include advice on local fish advisories.

Step 2: Identify a plan from one of your colleagues that you can build upon by clicking "**Discuss This Topic**" below their posting and add your comments.

Module 5 - Posttest Questionnaire

Module 5 - References (Optional) Page

Module 6 - A Risk Management Approach to Fish Consumption

Module 6 - Overview Page

Helping Your Patients Balance Benefits and Risks

Module 6 - Pretest Questionnaire

Module 6 - Objectives Page

Knowledge Objectives: Upon completion of this module, participants will be able to:

- state the general information about health fish consumption needed by most patients
- describe how to keep current about local and national reports and scientific explanations concerning benefits and risks of fish consumption
- identify the key findings when screening patients for unhealthy fish consumption specific to the participant's patient population

Attitude Objectives: Upon completion of this module participants will demonstrate:

- an appreciation for the value of selectively providing information about fish consumption to individual patients
- the desire to keep current about local and national reports and scientific explanations concerning benefits and risks of fish consumption

- comfort in engaging in a conversation with patients about healthy fish consumption

Behavior Objectives: Upon completing this module participants will be able to:

- tailor information communicated to individual patients about fish consumption to help patients understand the balance between benefits and risks of eating fish
- screen patients for unhealthy fish consumption
- provide all patients basic fish consumption guidelines
- help patients who have unhealthy fish consumption practice to adjust their intake of fish
- identify the key findings when screening patients for unhealthy fish consumption
- obtain local current information about fish contamination

Module 6 - Video Presentation Page (8:07 minutes)

Module 6 - Problem Solving (Case Scenario A Preconception Patient - Annual Exam)

You ask about her diet. Do you eat fish? Sushi. Great, do you know about the risks? I thought fish were supposed to be good for me.

Your initial response is shown in the text field below.

- How did you address the key issues such as the frequency of consumption and the types of fish eaten?
- What about the information you can share about avoiding the five fish highest in mercury?
- Do you know of any sources of information about the level of mercury in sushi?
- What kind of general guidance about fish consumption did you provide?
- What additional information did you provide based on the patient's age group and gender?

Module 6 - Problem Solving (Case Scenario A Preconception Patient - Annual Exam) Discussion Forum

In Case Scenario A, you are caring for a young woman who has come in for her annual exam. You find that she loves to go out for sushi and you were asked to describe how you would counsel this patient. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 6 - Problem Solving (Case Scenario B Pregnant Patient - Prenatal Visit)

What environmental topics should you address? Alcohol, tobacco, fish consumption. Do you eat fish more than 2x per week?

Your initial response is shown in the text field below.

- Is there a handout you could create or find that would be helpful? What kind of information would it include?
- Are there any web sites that you might suggest she visit for information?
- What other types of resources might be helpful in this case?
- You are welcome to update your response.

Once you are satisfied, click "Submit Answer". Your response will be posted to the discussion board and shared with your colleagues.

Module 6 - Problem Solving (Case Scenario B Pregnant Patient - Prenatal Visit) Discussion Forum

In Case Scenario B, you are screening a young woman (who is pregnant) about environmental concerns. While talking about the health risks and benefits of fish consumption, she asks how she can know which fish are high in mercury and which are low. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 6 - Problem Solving (Case Scenario C Young Child - Regular Visit)

Young Child - Regular Visit infant and 4 year old boy

Your initial response is shown in the text field below.

- Did you make it clear that there is no straight forward direct correlation for an individual's specific level and his/her individual risk for adverse health outcomes so testing is reserved for cases of poisoning?
- Did you let mom know that the best approach is for her and the kids to eat fish twice each week, consuming a variety of fish, and choosing those species that are low in mercury?
- Be sure to tell her about the local fish advisories that can provide information about locally caught fish that may be carrying particularly high levels of contaminants and give advice on species to limit or avoid.

You are welcome to update your response. Once you are satisfied, click "Submit Answer". Your response will be posted to the discussion board and shared with your colleagues.

Module 6 - Problem Solving (Case Scenario C Young Child - Regular Visit) Discussion Forum

Module 6 - Problem Solving (Case Scenario D Recreational Angler - Native American)

Your initial response is shown in the text field below.

- Pulling up the local fish advisory for the lake the patient fishes from would be a helpful step.
- If the species the patient catches have advisories, how do you plan to advise the patient?
- It's important to recognize that major lifestyle changes, such as modifying one's eating habits, can be difficult if not impossible. Rather than advising the patient to stop eating the fish he catches all together, what might be a more promising strategy?

You are welcome to update your response. Once you are satisfied, click "Submit Answer". Your response will be posted to the discussion board and shared with your colleagues.

Module 6 - Problem Solving (Case Scenario D Recreational Angler - Native American) Discussion Forum

In Case Scenario D, you are caring for Native American grandfather, who loves to spend time fishing with his grandchildren. They eat the fish he catches almost every day. You have been asked how you would

counsel this patient. Your answer is posted below along with those of your colleagues. You are welcome to read and comment if you wish.

Module 6 – Post-test Questionnaire

General References and Resources

This section will include references from all modules and additional resources you may find useful in your practice. This section is not yet available.

Concluding Activities

Upon completion of the six modules, you will be asked to submit two course evaluations. The first will be available once you submit your Post-test for Module 6 and should be completed within one week. A follow-up evaluation will be sent to you three months after completion of the sixth module.

Course Evaluation

Patient Group	Benefits of Fish Consumption	Risks of Overconsumption of Fish	Patient Education
All	<ul style="list-style-type: none"> • High quality, low fat protein • High in polyunsaturated fatty acids (PUFAs) especially the omega-3 fatty acids EPA and DHA • Primary source of the anti-oxidant selenium 	<ul style="list-style-type: none"> • See risks for different sub-groups below 	<ul style="list-style-type: none"> • General adult population: Eat fish at least twice a week • See group-specific recommendations below
Pregnant women	<ul style="list-style-type: none"> • Increased birth weight • Increased duration of gestation • Increased IQ in offspring • Enhanced visual acuity in offspring 	<ul style="list-style-type: none"> • Increased preterm delivery • Decreased performance on neurologic testing in offspring 	<ul style="list-style-type: none"> • Eat a variety of fish no more than twice a week • Do not eat: swordfish, tile fish, king mackerel, and shark • Stick to chunk light tuna instead of larger tuna • If no fish consumption, consider supplement
Breastfeeding women and young children	<ul style="list-style-type: none"> • Improved neurodevelopment • Higher scores on Denver Developmental screening 	<ul style="list-style-type: none"> • Lower scores on neurologic tests 	<ul style="list-style-type: none"> • Eat a variety of fish no more than twice a week • Do not eat: swordfish, tile fish, king mackerel, and shark • Stick to chunk light tuna instead of larger tuna • If no maternal fish consumption, consider supplement with 650mg of DHA+EPA daily
Adults	<ul style="list-style-type: none"> • Lower coronary heart disease mortality • Lower blood pressure, lower triglycerides • Possible decrease in incidence of stroke, Alzheimer Disease, Type 2 Diabetes 	<ul style="list-style-type: none"> • Higher risk for myocardial infarction • Possible link to elevated blood pressure 	<ul style="list-style-type: none"> • Screen for fish consumption in at-risk populations: Asians, residents in coastal areas, tribal populations, recreational anglers • Patients without heart disease : eat a variety of (preferably fatty) fish at least twice a week • Patients with documented cardiac disease: consume 1 g of EPA+DHA per day preferably from fatty fish • Patients with elevated triglycerides: take 2 to 4 grams of EPA+DHA per day as capsules • Recreational anglers: follow local fish advisories

UIC Course Module Pre- and Post-tests

UIC Healthy Fish Choices - Module 1 Pre-Test

Name: _____ Date: _____

1. Do you discuss the benefits or risks of fish consumption with your patients?

____ Yes ____ No

If yes, go to Question 2. If no, skip to question 3.

2. Briefly, what do you discuss about eating fish when speaking with:

a. Pregnant women?

b. Parents of infants or young children?

c. Adults who catch fish to supplement their diet?

3. If you use resources for information on the benefits and risks of fish consumption, what are they?

4. What is your view about the value of discussing fish eating habits with your patients who are:

a. Pregnant women?

b. Parents of infants and young children?

c. Adults?

5. Which of the following are known benefits of omega-3 consumption in pregnancy?
- a. Fewer episodes of post-partum hemorrhage
 - b. Improved maternal cardio output
 - c. Higher scores on Denver development tests
 - d. Better muscle control in offspring
6. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
- a. Cardiomegaly
 - b. Renal failure
 - c. Cataracts
 - d. Myocardial infarction
7. Fetal exposure to methyl mercury has been shown to result in:
- a. Impaired hearing
 - b. Decreased performance on neurologic testing
 - c. Congenital heart defects
 - d. Autism spectrum disorder
8. Which one of the following types of fish accumulates the highest concentrations of pollutants?
- a. Small bottom feeders
 - b. Ocean fish
 - c. Fresh water fish
 - d. Large predatory fish
9. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
- a. Swordfish
 - b. Grouper
 - c. Lobster
 - d. Tilapia

UIC Healthy Fish Choices - Module 1 Post-Test

Name: _____ Date: _____

1. Which of the following are known benefits of omega-3 consumption in pregnancy?
 a. Fewer episodes of post-partum hemorrhage
 b. Improved maternal cardio output
 c. Higher scores on Denver development tests
 d. Better muscle control in offspring

2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
 a. Cardiomegaly
 b. Renal failure
 c. Cataracts
 d. Myocardial infarction

3. Fetal exposure to methyl mercury has been shown to result in:
 a. Impaired hearing
 b. Decreased performance on neurologic testing
 c. Congenital heart defects
 d. Autism spectrum disorder

4. Which one of the following types of fish accumulates the highest concentrations of pollutants?
 a. Small bottom feeders
 b. Ocean fish
 c. Fresh water fish
 d. Large predatory fish

5. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
- ___ a. Swordfish
 - ___ b. Grouper
 - ___ c. Lobster
 - ___ d. Tilapia

UIC Healthy Fish Choices - Module 2 Pre-Test

Name: _____ Date: _____

1. What is your view about the benefits of eating the appropriate amounts of fish?

2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?

- a. Cardiomegaly
- b. Renal failure
- c. Cataracts
- d. Myocardial infarction

3. Fetal exposure to methyl mercury has been shown to result in:

- a. Impaired hearing
- b. Decreased performance on neurologic testing
- c. Congenital heart defects
- d. Autism spectrum disorder

4. What is a reasonable recommendation for DHA + EPA intake in pregnancy?

- a. 150 mcg/day
- b. 650 mcg/day
- c. 150 mg/day
- d. 650 mg/day

5. Which is a potential benefit of DHA intake in pregnancy?

- a. Lower rates of morning sickness
- b. Less breast swelling
- c. Longer gestation
- d. Decrease cardiac anomalies

6. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?
- a. It accumulates in maternal bone
 - b. It crosses the placenta
 - c. It interferes with maternal oxygenation
 - d. It chelates essential nutrients
7. What is a potential adverse health effect when children eat fish more than twice a week?
- a. Decreased adult height
 - b. Psychomotor developmental delay
 - c. Menstrual disorders in puberty
 - d. Renal dysfunction
8. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
- a. Rarely
 - b. Twice a month
 - c. Twice a week
 - d. Daily

UIC Healthy Fish Choices - Module 2 Post-Test

Name: _____ Date: _____

1. Which one of the following types of fish accumulates the highest concentrations of pollutants?
 a. Small bottom feeders
 b. Ocean fish
 c. Fresh water fish
 d. Large predatory fish

2. What is a reasonable recommendation for DHA + EPA intake in pregnancy?
 a. 150 mcg/day
 b. 650 mcg/day
 c. 150 mg/day
 d. 650 mg/day

3. Which is a potential benefit of DHA intake in pregnancy?
 a. Lower rates of morning sickness
 b. Less breast swelling
 c. Longer gestation
 d. Decrease cardiac anomalies

4. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?
 a. It accumulates in maternal bone
 b. It crosses the placenta
 c. It interferes with maternal oxygenation
 d. It chelates essential nutrients

5. What is a potential adverse health effect when children eat fish more than twice a week?
- a. Decreased adult height
 - b. Psychomotor developmental delay
 - c. Menstrual disorders in puberty
 - d. Renal dysfunction
6. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
- a. Rarely
 - b. Twice a month
 - c. Twice a week
 - d. Daily

UIC Healthy Fish Choices - Module 3 Pre-Test

Name: _____ Date: _____

1. Briefly, what do you discuss about eating fish when speaking with:

a. Patients who have cardiovascular disease?

b. Patients who have Type 2 diabetes?

c. Adults who catch fish to supplement their diet?

2. What is your view about the value of discussing fish eating habits with your patients who are:

a. Patients who have cardiovascular disease?

b. Patients who have Type 2 diabetes?

c. Adults?

3. What is a reasonable recommendation for DHA + EPA intake in pregnancy?

- ___ a. 150 mcg/day
- ___ b. 650 mcg/day
- ___ c. 150 mg/day
- ___ d. 650 mg/day

4. What is the half-life of mercury in the human body?
- a. 12-24 hours
 - b. 10-20 days
 - c. 50-70 days
 - d. 10-12 months
5. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?
- a. White non-Hispanic
 - b. Pacific Rim Asian
 - c. African American
 - d. Latino
6. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
- a. Chunk light tuna
 - b. Albacore tuna
 - c. Sushi-grade tuna
 - d. Tuna steaks
7. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
- a. Eat meat instead of fish
 - b. Select species low in contaminants
 - c. Eat only farm raised fish
 - d. Avoid frozen fish

UIC Healthy Fish Choices - Module 3 Post-Test

Name: _____ Date: _____

1. Which of the following are known benefits of omega-3 consumption in pregnancy?
 - a. Fewer episodes of post-partum hemorrhage
 - b. Improved maternal cardio output
 - c. Higher scores on Denver development tests
 - d. Better muscle control in offspring

2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
 - a. Cardiomegaly
 - b. Renal failure
 - c. Cataracts
 - d. Myocardial infarction

3. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
 - a. Swordfish
 - b. Grouper
 - c. Lobster
 - d. Tilapia

4. Which is a potential benefit of DHA intake in pregnancy?
 - a. Lower rates of morning sickness
 - b. Less breast swelling
 - c. Longer gestation
 - d. Decrease cardiac anomalies

5. What is the ½-life of mercury in the human body?
- a. 12-24 hours
 - b. 10-20 days
 - c. 50-70 days
 - d. 10-12 months
6. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?
- a. White non-Hispanic
 - b. Pacific Rim Asian
 - c. African American
 - d. Latino
7. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
- a. Chunk light tuna
 - b. Albacore tuna
 - c. Sushi-grade tuna
 - d. Tuna steaks
8. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
- a. Eat meat instead of fish
 - b. Select species low in contaminants
 - c. Eat only farm raised fish
 - d. Avoid frozen fish

UIC Healthy Fish Choices - Module 4 Pre-Test

Name: _____ Date: _____

1. If you use resources for information on the benefits and risks of fish consumption, what are they?

2. What is your view about the benefits of eating the appropriate amounts of fish?

3. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?

- a. It accumulates in maternal bone
- b. It crosses the placenta
- c. It interferes with maternal oxygenation
- d. It chelates essential nutrients

4. What is the half-life of mercury in the human body?

- a. 12-24 hours
- b. 10-20 days
- c. 50-70 days
- d. 10-12 months

5. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?

- a. White non-Hispanic
- b. Pacific Rim Asian
- c. African American
- d. Latino

6. What is primary potential cardiovascular health benefit of omega-3s?
___ a. Lower LDL cholesterol
___ b. Lower incidence of colon cancer
___ c. Reduced risk of chronic kidney disease
___ d. Reduced risk of non-fatal MI and ischemic stroke
7. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?
___ a. 500 milligram per day
___ b. 1 gram per day
___ c. 5 grams per day
___ d. 10 grams per day
8. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?
___ a. EPA-DHA is contraindicated
___ b. 0.5-1 gram per day
___ c. 2-4 grams per day
___ d. 5-10 grams per day
9. Which is a potential benefit of fish consumption for healthy adults?
___ a. Reduced frequency of migraine headache
___ b. Reduced incidence of macular degeneration
___ c. Reduced risk of Alzheimer's Disease
___ d. Reduced tremor with Parkinson's Disease
10. Which is a primary potential adverse health effect of fish consumption for healthy adults?
___ a. Higher risk of coronary atherosclerosis
___ b. Higher incidence of anovulation
___ c. Higher risk of cholecystitis
___ d. Higher risk of glaucoma
11. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
___ a. As often as they want
___ b. At least once a week
___ c. At least twice a week
___ d. Every day

UIC Healthy Fish Choices - Module 4 Post-Test

Name: _____ Date: _____

1. What is a potential adverse health effect when children eat fish more than twice a week?
 a. Decreased adult height
 b. Psychomotor developmental delay
 c. Menstrual disorders in puberty
 d. Renal dysfunction

2. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
 a. Eat meat instead of fish
 b. Select species low in contaminants
 c. Eat only farm raised fish
 d. Avoid frozen fish

3. What is a primary cardiovascular health benefit of omega-3s?
 a. Lower LDL cholesterol
 b. Lower incidence of colon cancer
 c. Reduced risk of chronic kidney disease
 d. Reduced risk of non-fatal MI and ischemic stroke

4. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?
 a. 500 mg per day
 b. 1 gm per day
 c. 5 gms per day
 d. 10 gms per day

5. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?
- a. EPA-DHA is contraindicated
 - b. 0.5-1 gm per day
 - c. 2-4 grams per day
 - d. 5-10 grams per day
6. Which is a potential benefit of fish consumption for healthy adults?
- a. Reduced frequency of migraine headache
 - b. Reduced incidence of macular degeneration
 - c. Reduced risk of Alzheimer's Disease
 - d. Reduced tremor with Parkinson's Disease
7. Which is a primary potential adverse health effect of fish consumption for healthy adults?
- a. Higher risk of coronary atherosclerosis
 - b. Higher incidence of anovulation
 - c. Higher risk of cholecystitis
 - d. Higher risk of glaucoma
8. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
- a. As often as they want
 - b. At least once a week
 - c. At least twice a week
 - d. Every day

UIC Healthy Fish Choices - Module 5 Pre-Test

Name: _____ Date: _____

1. What is your view about the value of discussing fish eating habits with your patients who are:

a. Pregnant women?

b. Parents of infants and young children?

c. Adults?

2. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?

___ a. 500 milligram per day

___ b. 1 gram per day

___ c. 5 grams per day

___ d. 10 grams per day

3. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?

___ a. EPA-DHA is contraindicated

___ b. 0.5-1 gram per day

___ c. 2-4 grams per day

___ d. 5-10 grams per day

4. Which body tissue primarily accumulates PCBs?

___ a. Adipose tissue

___ b. Muscle

___ c. Cortical bone

___ d. Hair follicles

5. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminants?
- a. Dioxins
 - b. Polycyclic aromatic hydrocarbons
 - c. Arsenic
 - d. Phthalates
6. Which health effect of PCBs has been found in offspring of exposed mothers?
- a. Limb defects
 - b. Lower birth weight
 - c. Gastroschisis
 - d. Pulmonary atresia
7. What is a primary source of PCB contamination?
- a. Power plant emissions
 - b. Electrical insulation waste
 - c. Agricultural pesticide run-off
 - d. Coal mining slag
8. What should be done when caring for patients who frequently eat recreationally caught fish?
- a. Check blood mercury levels periodically
 - b. Advise them to stop consuming recreationally caught fish
 - c. Consider chelation for accumulated mercury and other contaminants
 - d. Advise them to check the local fish advisory before eating recreationally caught fish

UIC Healthy Fish Choices - Module 5 Post-Test

Name: _____ Date: _____

1. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
 a. Rarely
 b. Twice a month
 c. Twice a week
 d. Daily

2. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
 a. Chunk light tuna
 b. Albacore tuna
 c. Sushi-grade tuna
 d. Tuna steaks

3. What is a primary potential cardiovascular health benefit of omega-3s?
 a. Lower LDL cholesterol
 b. Lower incidence of colon cancer
 c. Reduced risk of chronic kidney disease
 d. Reduced risk of non-fatal MI and ischemic stroke

4. Which is a primary potential adverse health effect of fish consumption for healthy adults?
 a. Higher risk of coronary atherosclerosis
 b. Higher incidence of anovulation
 c. Higher risk of cholecystitis
 d. Higher risk of glaucoma

5. Which body tissue primarily accumulates PCBs?
- a. Adipose tissue
 - b. Muscle
 - c. Cortical bone
 - d. Hair follicles
6. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminants?
- a. Dioxins
 - b. Polycyclic aromatic hydrocarbons
 - c. Arsenic
 - d. Phthalates
7. Which health effect of PCBs has been found in offspring of exposed mothers?
- a. Limb defects
 - b. Lower birth weight
 - c. Gastroschisis
 - d. Pulmonary atresia
8. What is a primary source of PCB contamination?
- a. Power plant emissions
 - b. Electrical insulation waste
 - c. Agricultural pesticide run-off
 - d. Coal mining slag
9. What should be done when caring for patients who frequently eat recreationally caught fish?
- a. Check blood mercury levels periodically
 - b. Advise them to stop consuming recreationally caught fish
 - c. Consider chelation for accumulated mercury and other contaminants
 - d. Advise them to check the local fish advisory before consuming recreationally caught fish

UIC Healthy Fish Choices - Module 6 Pre-Test

Name: _____ Date: _____

1. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
 a. As often as they want
 b. At least once a week
 c. At least twice a week
 d. Every day

2. Which body tissue primarily accumulates PCBs?
 a. Adipose tissue
 b. Muscle
 c. Cortical bone
 d. Hair follicles

3. Which health effect of PCBs has been found in offspring of exposed mothers?
 a. Limb defects
 b. Lower birth weight
 c. Gastroschisis
 d. Pulmonary atresia

4. What are the human factors that can affect the net risk/benefit ratio of fish consumption?
 a. The patient's frequency of fish consumption and cardiovascular risks
 b. The patient's frequency of fish consumption and history of gallbladder attacks
 c. The patient's cardiovascular risks and exposure to other heavy metals

5. What are the environmental factors that can affect the net risk/benefit ratio of fish consumption?
 a. The fish's Vitamin E content and global origin
 b. The fish's global origin and status of sustainability
 c. The fish's species and whether it's fatty or lean

6. Choose the following fish consumption scenario that will result in a net benefit to child neurodevelopment:
- a. Eating fish with high mercury and low omega-3 content
 - b. Eating only lean fish
 - c. Eating only fatty fish
 - d. Eating fish with low mercury and high omega-3 content
7. Which are good vegetarian sources of omega-3 fatty acids?
- a. Sunflower oil, almonds, whole wheat bread
 - b. Walnuts, flaxseeds, soybeans
 - c. Avocados, chocolate, tomatoes
 - d. Coconut milk, red wine, oats
8. What is your advice to a pregnant woman who enjoys eating sushi?
- a. Eat sushi liberally
 - b. Avoid all sushi
 - c. Eat sushi from certain regions only
 - d. Do not eat raw fish during pregnancy
9. What should you do for patients who request mercury testing for themselves or their children?
- a. Submit hair samples to a lab experienced in hair testing
 - b. Consult a medical toxicologist for cases of suspected poisoning
 - c. Submit post-prandial blood levels for mercury
 - d. Perform 24-hr urine for Hg/Cr ratio

UIC Healthy Fish Choices - Module 6 Post-Test

Name: _____ Date: _____

1. Which is a potential benefit of fish consumption for healthy adults?
 - ___ a. Reduced frequency of migraine headache
 - ___ b. Reduced risk of Alzheimer's Disease
 - ___ c. Reduced tremor with Parkinson's Disease

2. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminant?
 - ___ a. Dioxins
 - ___ b. Polycyclic aromatic hydrocarbons
 - ___ c. Arsenic
 - ___ d. Phthalates

3. What is a primary source of PCB contamination?
 - ___ a. Power plant emissions
 - ___ b. Electrical insulation waste
 - ___ c. Agricultural pesticide run-off
 - ___ d. Coal mining slag

4. What should be done when caring for patients who frequently eat recreationally caught fish?
 - ___ a. Check blood mercury levels periodically
 - ___ b. Advise them to stop consuming recreationally caught fish
 - ___ c. Consider chelation for accumulated mercury and other contaminants
 - ___ d. Advise them to check the local fish advisory before consuming recreationally caught fish

5. What are the human factors that can affect the net risk/benefit ratio of fish consumption?
- a. The patient's frequency of fish consumption and cardiovascular risks
 - b. The patient's frequency of fish consumption and history of gallbladder attacks
 - c. The patient's cardiovascular risks and exposure to other heavy metals
6. What are the environmental factors that can affect the net risk/benefit ratio of fish consumption?
- a. The fish's Vitamin E content and global origin
 - b. The fish's global origin and status of sustainability
 - c. The fish's species and whether it's fatty or lean
7. Choose the following fish consumption scenario that will result in a net benefit to child neurodevelopment:
- a. Eating fish with high mercury and low omega-3 content
 - b. Eating only lean fish
 - c. Eating only fatty fish
 - d. Eating fish with low mercury and high omega-3 content
8. Which are good vegetarian sources of omega-3 fatty acids?
- a. Sunflower oil, almonds, whole wheat bread
 - b. Walnuts, flaxseeds, soybeans
 - c. Avocados, chocolate, tomatoes
 - d. Coconut milk, red wine, oats
9. What is your advice to a pregnant woman who enjoys eating sushi?
- a. Eat sushi liberally
 - b. Avoid all sushi
 - c. Eat sushi from certain regions only
 - d. Do not eat raw fish during pregnancy

10. What should you do for patients who request mercury testing for themselves or their children?
- ___ a. Submit hair samples to a lab experienced in hair testing
 - ___ b. Consult a medical toxicologist for cases of suspected poisoning
 - ___ c. Submit post-prandial blood levels for mercury
 - ___ d. Perform 24-hr urine for Hg/Cr ratio

UIC Pre- and Post-test Results

UIC Healthy Fish Choices - Module 1 Pre-Test Results

N = 10

1. Do you discuss the benefits or risks of fish consumption with your patients?

____ Yes ____ No

If yes, go to Question 2. If no, skip to question 3.

2. Briefly, what do you discuss about eating fish when speaking with:

a. Pregnant women?

b. Parents of infants or young children?

c. Adults who catch fish to supplement their diet?

3. If you use resources for information on the benefits and risks of fish consumption, what are they?

4. What is your view about the value of discussing fish eating habits with your patients who are:

a. Pregnant women?

b. Parents of infants and young children?

c. Adults?

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

5. Which of the following are known benefits of omega-3 consumption in pregnancy?
 - a. Fewer episodes of post-partum hemorrhage = 0
 - b. Improved maternal cardio output = 1
 - c. **Higher scores on Denver development tests = 3**
 - d. Better muscle control in offspring = 2Not answered = 4

6. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
 - a. Cardiomegaly = 2
 - b. Renal failure = 4
 - c. Cataracts = 0
 - d. **Myocardial infarction = 3**Not answered = 1

7. Fetal exposure to methyl mercury has been shown to result in:
 - a. Impaired hearing = 0
 - b. **Decreased performance on neurologic testing = 8**
 - c. Congenital heart defects = 1
 - d. Autism spectrum disorder = 0Not answered = 1

8. Which one of the following types of fish accumulates the highest concentrations of pollutants?
 - a. Small bottom feeders = 0
 - b. Ocean fish = 0
 - c. Fresh water fish = 0
 - d. **Large predatory fish = 10**

9. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
 - a. **Swordfish = 10**
 - b. Grouper = 0
 - c. Lobster = 0
 - d. Tilapia = 0

UIC Healthy Fish Choices - Module 1 Post-Test Results

N= 10

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. Which of the following are known benefits of omega-3 consumption in pregnancy?
 - a. Fewer episodes of post-partum hemorrhage = 0
 - b. Improved maternal cardio output = 0
 - c. **Higher scores on Denver development tests = 7**
 - d. Better muscle control in offspring = 1
Not answered = 2
2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
 - a. Cardiomegaly = 0
 - b. Renal failure = 0
 - c. Cataracts = 0
 - d. **Myocardial infarction = 10**
3. Fetal exposure to methyl mercury has been shown to result in:
 - a. Impaired hearing = 0
 - b. **Decreased performance on neurologic testing = 10**
 - c. Congenital heart defects = 0
 - d. Autism spectrum disorder = 0
4. Which one of the following types of fish accumulates the highest concentrations of pollutants?
 - a. Small bottom feeders = 0
 - b. Ocean fish = 0
 - c. Fresh water fish = 0
 - d. **Large predatory fish = 10**
5. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
 - a. **Swordfish = 10**
 - b. Grouper = 0
 - c. Lobster = 0
 - d. Tilapia = 0

UIC Healthy Fish Choices - Module 2 Pre-Test Results

N = 10

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. What is your view about the benefits of eating the appropriate amounts of fish?

2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?

- a. Cardiomegaly = 1
- b. Renal failure = 0
- c. Cataracts = 0

d. **Myocardial infarction = 9**

3. Fetal exposure to methyl mercury has been shown to result in:

- a. Impaired hearing = 0

b. **Decreased performance on neurologic testing = 10**

- c. Congenital heart defects = 0
- d. Autism spectrum disorder = 0

4. What is a reasonable recommendation for DHA + EPA intake in pregnancy?

- a. 150 mcg/day = 1
- b. 650 mcg/day = 4
- c. 150 mg/day = 3

d. **650 mg/day = 1**

Not answered = 1

5. Which is a potential benefit of DHA intake in pregnancy?

- a. Lower rates of morning sickness = 0
- b. Less breast swelling = 0

c. **Longer gestation = 2**

- d. Decrease cardiac anomalies = 8

6. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?
- a. It accumulates in maternal bone = 0
 - b. It crosses the placenta = 10**
 - c. It interferes with maternal oxygenation = 0
 - d. It chelates essential nutrients = 0
7. What is a potential adverse health effect when children eat fish more than twice a week?
- a. Decreased adult height = 0
 - b. Psychomotor developmental delay = 7**
 - c. Menstrual disorders in puberty = 0
 - d. Renal dysfunction = 1
- Not answered = 2
8. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
- a. Rarely = 1
 - b. Twice a month = 2
 - c. Twice a week = 6**
 - d. Daily = 0
- Not answered = 1

UIC Healthy Fish Choices - Module 2 Post-Test Results

N= 10

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. Which one of the following types of fish accumulates the highest concentrations of pollutants?
 - a. Small bottom feeders = 0
 - b. Ocean fish = 0
 - c. Fresh water fish = 0
 - d. **Large predatory fish = 10**
2. What is a reasonable recommendation for DHA + EPA intake in pregnancy?
 - a. 150 mcg/day = 0
 - b. 650 mcg/day = 3
 - c. 150 mg/day = 1
 - d. **650 mg/day = 5**
Not answered = 1
3. Which is a potential benefit of DHA intake in pregnancy?
 - a. Lower rates of morning sickness = 0
 - b. Less breast swelling = 0
 - c. **Longer gestation = 8**
 - d. Decrease cardiac anomalies = 2
4. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?
 - a. It accumulates in maternal bone = 0
 - b. **It crosses the placenta = 10**
 - c. It interferes with maternal oxygenation = 0
 - d. It chelates essential nutrients = 0
5. What is a potential adverse health effect when children eat fish more than twice a week?
 - a. Decreased adult height = 0
 - b. **Psychomotor developmental delay =10**
 - c. Menstrual disorders in puberty = 0
 - d. Renal dysfunction = 0

6. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
- a. Rarely = 0
 - b. Twice a month = 0
 - c. **Twice a week = 10**
 - d. Daily = 0

UIC Healthy Fish Choices - Module 3 Pre-Test Results

N = 5

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. Briefly, what do you discuss about eating fish when speaking with:

a. Patients who have cardiovascular disease?

b. Patients who have Type 2 diabetes?

c. Adults who catch fish to supplement their diet?

2. What is your view about the value of discussing fish eating habits with your patients who are:

a. Patients who have cardiovascular disease?

b. Patients who have Type 2 diabetes?

c. Adults?

3. What is a reasonable recommendation for DHA + EPA intake in pregnancy?

a. 150 mcg/day = 1

b. 650 mcg/day = 1

c. 150 mg/day = 1

d. **650 mg/day = 2**

4. What is the half-life of mercury in the human body?
- a. 12-24 hours = 1
 - b. 10-20 days = 1
 - c. **50-70 days = 1**
 - d. 10-12 months = 1
- Not answered = 1
5. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?
- a. White non-Hispanic = 1
 - b. **Pacific Rim Asian = 4**
 - c. African American = 0
 - d. Latino = 0
6. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
- a. **Chunk light tuna = 5**
 - b. Albacore tuna = 0
 - c. Sushi-grade tuna = 0
 - d. Tuna steaks = 0
7. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
- a. Eat meat instead of fish = 0
 - b. **Select species low in contaminants = 5**
 - c. Eat only farm raised fish = 0
 - d. Avoid frozen fish = 0

UIC Healthy Fish Choices - Module 3 Post-Test Results

N = 10

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. Which of the following are known benefits of omega-3 consumption in pregnancy?
 - a. Fewer episodes of post-partum hemorrhage = 0
 - b. Improved maternal cardio output = 1
 - c. **Higher scores on Denver development tests = 8**
 - d. Better muscle control in offspring = 0Not answered = 1

2. Consumption of methyl mercury in fish has been linked to which one of these adverse effects in adults?
 - a. Cardiomegaly = 0
 - b. Renal failure = 0
 - c. Cataracts = 0
 - d. **Myocardial infarction = 10**

3. Which of the following should be avoided during pregnancy, breastfeeding, and in early childhood?
 - a. **Swordfish = 9**
 - b. Grouper = 0
 - c. Lobster = 0
 - d. Tilapia = 0Not answered = 1

4. Which is a potential benefit of DHA intake in pregnancy?
 - a. Lower rates of morning sickness = 0
 - b. Less breast swelling = 0
 - c. **Longer gestation = 8**
 - d. Decrease cardiac anomalies = 2

5. What is the ½-life of mercury in the human body?
 - a. 12-24 hours = 1
 - b. 10-20 days = 0
 - c. **50-70 days = 9**
 - d. 10-12 months = 0

6. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?
- a. White non-Hispanic = 0
 - b. **Pacific Rim Asian = 10**
 - c. African American = 0
 - d. Latino = 0
7. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
- a. **Chunk light tuna = 9**
 - b. Albacore tuna = 0
 - c. Sushi-grade tuna = 0
 - d. Tuna steaks = 0
- Not answered = 1
8. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
- a. Eat meat instead of fish = 0
 - b. **Select species low in contaminants = 9**
 - c. Eat only farm raised fish = 0
 - d. Avoid frozen fish = 0
- Not answered = 1

UIC Healthy Fish Choices - Module 4 Pre-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. If you use resources for information on the benefits and risks of fish consumption, what are they?

2. What is your view about the benefits of eating the appropriate amounts of fish?

3. Why is the fetus vulnerable to the effects of maternal methyl mercury ingestion during pregnancy?

- a. It accumulates in maternal bone = 0
b. **It crosses the placenta = 9**
c. It interferes with maternal oxygenation = 0
d. It chelates essential nutrients = 0

4. What is the half-life of mercury in the human body?

- a. 12-24 hours = 0
b. 10-20 days = 0
c. **50-70 days = 8**
d. 10-12 months = 0
Not answered = 1

5. Which social/ethnic population has been shown to have higher mercury levels due to fish consumption?

- a. White non-Hispanic = 0
b. **Pacific Rim Asian = 8**
c. African American = 0
d. Latino = 0
Not answered = 1

6. What is primary potential cardiovascular health benefit of omega-3s?
- a. Lower LDL cholesterol = 3
 - b. Lower incidence of colon cancer = 0
 - c. Reduced risk of chronic kidney disease = 0
 - d. **Reduced risk of non-fatal MI and ischemic stroke = 6**
7. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?
- a. 500 milligram per day = 0
 - b. **1 gram per day = 9**
 - c. 5 grams per day = 0
 - d. 10 grams per day = 0
8. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?
- a. EPA-DHA is contraindicated = 0
 - b. 0.5-1 gram per day = 2
 - c. **2-4 grams per day = 5**
 - d. 5-10 grams per day = 0
 - Not answered = 2
9. Which is a potential benefit of fish consumption for healthy adults?
- a. Reduced frequency of migraine headache = 0
 - b. Reduced incidence of macular degeneration = 0
 - c. **Reduced risk of Alzheimer's Disease = 8**
 - d. Reduced tremor with Parkinson's Disease = 1
10. Which is a primary potential adverse health effect of fish consumption for healthy adults?
- a. **Higher risk of coronary atherosclerosis = 5**
 - b. Higher incidence of anovulation = 1
 - c. Higher risk of cholecystitis
 - d. Higher risk of glaucoma
 - Not answered = 3
11. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
- a. As often as they want = 0
 - b. At least once a week = 1
 - c. **At least twice a week = 8**
 - d. Every day = 0

UIC Healthy Fish Choices - Module 4 Post-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. What is a potential adverse health effect when children eat fish more than twice a week?
 - a. Decreased adult height = 0
 - b. Psychomotor developmental delay = 8**
 - c. Menstrual disorders in puberty = 0
 - d. Renal dysfunction = 0Not answered = 1
2. As a healthcare provider caring for populations with high fish consumption as a way of life, which would you recommend?
 - a. Eat meat instead of fish = 0
 - b. Select species low in contaminants = 9**
 - c. Eat only farm raised fish = 0
 - d. Avoid frozen fish = 0
3. What is a primary cardiovascular health benefit of omega-3s?
 - a. Lower LDL cholesterol = 1
 - b. Lower incidence of colon cancer = 0
 - c. Reduced risk of chronic kidney disease = 0
 - d. Reduced risk of non-fatal MI and ischemic stroke = 8**
4. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?
 - a. 500 mg per day = 0
 - b. 1 gm per day = 8**
 - c. 5 gms per day = 1
 - d. 10 gms per day = 0
5. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?
 - a. EPA-DHA is contraindicated = 0
 - b. 0.5-1 gm per day = 1
 - c. 2-4 grams per day = 8**
 - d. 5-10 grams per day = 0

6. Which is a potential benefit of fish consumption for healthy adults?
- a. Reduced frequency of migraine headache = 0
 - b. Reduced incidence of macular degeneration = 0
 - c. **Reduced risk of Alzheimer's Disease = 9**
 - d. Reduced tremor with Parkinson's Disease = 0
7. Which is a primary potential adverse health effect of fish consumption for healthy adults?
- a. **Higher risk of coronary atherosclerosis = 9**
 - b. Higher incidence of anovulation = 0
 - c. Higher risk of cholecystitis = 0
 - d. Higher risk of glaucoma = 0
8. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
- a. As often as they want = 0
 - b. At least once a week = 0
 - c. **At least twice a week = 9**
 - d. Every day = 0

UIC Healthy Fish Choices - Module 5 Pre-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. What is your view about the value of discussing fish eating habits with your patients who are:
 - a. Pregnant women?

 - b. Parents of infants and young children?

 - c. Adults?

2. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with heart disease?
 - a. 500 milligram per day = 0
 - b. **1 gram per day = 8**
 - c. 5 grams per day = 1
 - d. 10 grams per day = 0

3. What is the AHA-recommended dose of fish oil supplement (EPA+DHA) for patients with elevated triglycerides?
 - a. EPA-DHA is contraindicated = 0
 - b. 0.5-1 gram per day = 1
 - c. **2-4 grams per day = 8**
 - d. 5-10 grams per day = 0

4. Which body tissue primarily accumulates PCBs?
 - a. **Adipose tissue = 6**
 - b. Muscle = 1
 - c. Cortical bone = 0
 - d. Hair follicles = 2

5. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminants?
 - a. **Dioxins = 8**
 - b. Polycyclic aromatic hydrocarbons = 1

- c. Arsenic = 0
 - d. Phthalates = 0
6. Which health effect of PCBs has been found in offspring of exposed mothers?
- a. Limb defects = 3
 - b. **Lower birth weight = 2**
 - c. Gastroschisis = 0
 - d. Pulmonary atresia
- Not answered = 4
7. What is a primary source of PCB contamination?
- a. Power plant emissions = 1
 - b. **Electrical insulation waste = 4**
 - c. Agricultural pesticide run-off = 3
 - d. Coal mining slag = 0
- Not answered = 1
8. What should be done when caring for patients who frequently eat recreationally caught fish?
- a. Check blood mercury levels periodically = 0
 - b. Advise them to stop consuming recreationally caught fish = 0
 - c. Consider chelation for accumulated mercury and other contaminants = 0
 - d. **Advise them to check the local fish advisory before eating recreationally caught fish = 8**
- Not answered = 1

UIC Healthy Fish Choices - Module 5 Post-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. How often should pregnant and nursing women, women of childbearing age, and young children eat fish?
 - a. Rarely = 0
 - b. Twice a month = 1
 - c. **Twice a week = 7**
 - d. Daily = 0Not answered = 1
2. Which type of tuna may be eaten as frequently as twice a week during pregnancy?
 - a. **Chunk light tuna = 9**
 - b. Albacore tuna = 0
 - c. Sushi-grade tuna = 0
 - d. Tuna steaks = 0
3. What is a primary potential cardiovascular health benefit of omega-3s?
 - a. Lower LDL cholesterol = 0
 - b. Lower incidence of colon cancer = 0
 - c. Reduced risk of chronic kidney disease = 0
 - d. **Reduced risk of non-fatal MI and ischemic stroke = 9**
4. Which is a primary potential adverse health effect of fish consumption for healthy adults?
 - a. **Higher risk of coronary atherosclerosis = 9**
 - b. Higher incidence of anovulation = 0
 - c. Higher risk of cholecystitis = 0
 - d. Higher risk of glaucoma = 0
5. Which body tissue primarily accumulates PCBs?
 - a. **Adipose tissue = 8**
 - b. Muscle = 0
 - c. Cortical bone = 0
 - d. Hair follicles = 1

6. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminants?
- a. **Dioxins = 9**
 - b. Polycyclic aromatic hydrocarbons = 0
 - c. Arsenic = 0
 - d. Phthalates = 0
7. Which health effect of PCBs has been found in offspring of exposed mothers?
- a. Limb defects = 0
 - b. **Lower birth weight = 9**
 - c. Gastroschisis = 0
 - d. Pulmonary atresia = 0
8. What is a primary source of PCB contamination?
- a. Power plant emissions = 1
 - b. **Electrical insulation waste = 7**
 - c. Agricultural pesticide run-off = 1
 - d. Coal mining slag = 0
9. What should be done when caring for patients who frequently eat recreationally caught fish?
- a. Check blood mercury levels periodically = 0
 - b. Advise them to stop consuming recreationally caught fish = 0
 - c. Consider chelation for accumulated mercury and other contaminants = 0
 - d. **Advise them to check the local fish advisory before consuming recreationally caught fish = 9**

UIC Healthy Fish Choices - Module 6 Pre-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. How often should patients without heart disease consume fish (preferably fatty fish) according to the American Heart Association?
 - a. As often as they want = 0
 - b. At least once a week = 2
 - c. **At least twice a week = 7**
 - d. Every day = 0
2. Which body tissue primarily accumulates PCBs?
 - a. **Adipose tissue = 8**
 - b. Muscle = 0
 - c. Cortical bone = 0
 - d. Hair follicles = 1
3. Which health effect of PCBs has been found in offspring of exposed mothers?
 - a. Limb defects = 0
 - b. **Lower birth weight = 9**
 - c. Gastroschisis = 0
 - d. Pulmonary atresia = 0
4. What are the human factors that can affect the net risk/benefit ratio of fish consumption?
 - a. **The patient's frequency of fish consumption and cardiovascular risks = 9**
 - b. The patient's frequency of fish consumption and history of gallbladder attacks = 0
 - c. The patient's cardiovascular risks and exposure to other heavy metals = 0
5. What are the environmental factors that can affect the net risk/benefit ratio of fish consumption?
 - a. The fish's Vitamin E content and global origin = 0
 - b. The fish's global origin and status of sustainability = 0
 - c. **The fish's species and whether it's fatty or lean = 9**

6. Choose the following fish consumption scenario that will result in a net benefit to child neurodevelopment:
- a. Eating fish with high mercury and low omega-3 content = 0
 - b. Eating only lean fish = 0
 - c. Eating only fatty fish = 0
 - d. **Eating fish with low mercury and high omega-3 content = 8**
- Not answered = 1
7. Which are good vegetarian sources of omega-3 fatty acids?
- a. Sunflower oil, almonds, whole wheat bread = 1
 - b. **Walnuts, flaxseeds, soybeans = 7**
 - c. Avocados, chocolate, tomatoes = 1
 - d. Coconut milk, red wine, oats = 0
8. What is your advice to a pregnant woman who enjoys eating sushi?
- a. Eat sushi liberally = 0
 - b. Avoid all sushi = 1
 - c. Eat sushi from certain regions only = 0
 - d. **Do not eat raw fish during pregnancy = 7**
- Not answered = 1
9. What should you do for patients who request mercury testing for themselves or their children?
- a. Submit hair samples to a lab experienced in hair testing = 5
 - b. **Consult a medical toxicologist for cases of suspected poisoning = 1**
 - c. Submit post-prandial blood levels for mercury = 1
 - d. Perform 24-hr urine for Hg/Cr ratio = 0
- Not answered = 2

UIC Healthy Fish Choices - Module 6 Post-Test Results

N = 9

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. Which is a potential benefit of fish consumption for healthy adults?
 - a. Reduced frequency of migraine headache = 0
 - b. Reduced risk of Alzheimer's Disease = 0
 - c. **Reduced tremor with Parkinson's Disease = 9**
2. Local fish advisories typically cover mercury, PCBs, chlordane, DDT, and which of the following contaminant?
 - a. **Dioxins = 9**
 - b. Polycyclic aromatic hydrocarbons = 0
 - c. Arsenic = 0
 - d. Phthalates = 0
3. What is a primary source of PCB contamination?
 - a. Power plant emissions = 0
 - b. **Electrical insulation waste = 9**
 - c. Agricultural pesticide run-off = 0
 - d. Coal mining slag = 0
4. What should be done when caring for patients who frequently eat recreationally caught fish?
 - a. Check blood mercury levels periodically = 0
 - b. Advise them to stop consuming recreationally caught fish = 0
 - c. Consider chelation for accumulated mercury and other contaminants = 0
 - d. **Advise them to check the local fish advisory before consuming recreationally caught fish = 9**
5. What are the human factors that can affect the net risk/benefit ratio of fish consumption?
 - a. **The patient's frequency of fish consumption and cardiovascular risks = 9**
 - b. The patient's frequency of fish consumption and history of gallbladder attacks = 0
 - c. The patient's cardiovascular risks and exposure to other heavy metals = 0

6. What are the environmental factors that can affect the net risk/benefit ratio of fish consumption?
- a. The fish's Vitamin E content and global origin = 0
 - b. The fish's global origin and status of sustainability = 0
 - c. **The fish's species and whether it's fatty or lean = 9**
7. Choose the following fish consumption scenario that will result in a net benefit to child neurodevelopment:
- a. Eating fish with high mercury and low omega-3 content = 0
 - b. Eating only lean fish = 0
 - c. Eating only fatty fish = 0
 - d. **Eating fish with low mercury and high omega-3 content = 9**
8. Which are good vegetarian sources of omega-3 fatty acids?
- a. Sunflower oil, almonds, whole wheat bread = 0
 - b. **Walnuts, flaxseeds, soybeans = 8**
 - c. Avocados, chocolate, tomatoes = 1
 - d. Coconut milk, red wine, oats = 0
9. What is your advice to a pregnant woman who enjoys eating sushi?
- a. Eat sushi liberally = 0
 - b. Avoid all sushi = 1
 - c. Eat sushi from certain regions only = 0
 - d. **Do not eat raw fish during pregnancy = 7**
- Not answered = 1
10. What should you do for patients who request mercury testing for themselves or their children?
- a. Submit hair samples to a lab experienced in hair testing = 5
 - b. **Consult a medical toxicologist for cases of suspected poisoning = 1**
 - c. Submit post-prandial blood levels for mercury = 1
 - d. Perform 24-hr urine for Hg/Cr ratio = 0
- Not answered = 2

UIC Individual Course Evaluation for Nurses

University of Illinois Healthy Fish Choices Evaluation (nurses)

Name: _____

April 2, 2013

Course Content

Part 1 - Content of the Modules

1. Was the content clear and useful?

Yes No

Comment - explain your reasons

2. Was the material credible with adequate science literature cited?

Yes No

Comment - explain your reasons

3. Was the content presented at an appropriate level to your expertise?

Yes No

Comment - explain your reasons

4. Was there additional information you wish had been included?

Yes No

Comment - explain your reasons

Part 2 - Technical Matters

5. Were the pretest questions clear and useful?

Yes No

Comment - explain your reasons

6. Did the pace of the clinical scenarios work for you?

Yes No

Comment - explain your reasons

7. Did you think the case scenarios were a useful exercise?

Yes No

Comment - explain your reasons

8. Were the graphics helpful?

Yes No

Comment - explain your reasons

9. In general, how do you feel about the medium (video, powerpoint, etc) used for this training?

- good or generally good way to learn
- adequate or generally adequate way to learn
- inadequate of generally inadequate way to learn

Comment - explain your reasons

10. You have participated in this course at no cost. Would you recommend this course to a colleague if there were a reasonable and customary fee associated with participation?

Yes No

Comment - explain your reasons

11. Please enter any additional comments on the course in the space below

Part 4 – Training Outcome (Part 3, Providers Only)

As a result of participating in this activity, do you agree the following objectives were met?

19. Participant is able to describe the benefits of poly-unsaturated fatty acids
 Agree
 Disagree
 No answer
20. Participant is able to identify the contaminants in fish and their effects on human health.
 Agree
 Disagree
 No answer
21. Participant is able to describe the scientific basis for how contaminants occur in fish.
 Agree
 Disagree
 No answer
22. Participant is able to identify patients who are at-risk of health effects from contaminants of fish due to high consumption.
 Agree
 Disagree
 No answer
23. Participant is able to access national and local fish advisories.
 Agree
 Disagree
 No answer
24. Participant is able to appreciate why everyone - especially pregnant women and children - needs to adopt a healthy fish consumption strategy.
 Agree
 Disagree
 No answer

UIC Individual Course Evaluation for Providers

University of Illinois Health Fish Choices Evaluation (providers)

Name: _____

April 2, 2013

Course Content

Part 1 - Content of the Modules

1. Was the content clear and useful?

Yes No

Comment - explain your reasons

2. Was the material credible with adequate science literature cited?

Yes No

Comment - explain your reasons

3. Was the content presented at an appropriate level to your expertise?

Yes No

Comment - explain your reasons

4. Was there additional information you wish had been included?

Yes No

Comment - explain your reasons

Part 2 - Technical Matters

5. Were the pretest questions clear and useful?

Yes No

Comment - explain your reasons

6. Did the pace of the clinical scenarios work for you?

Yes No

Comment - explain your reasons

7. Did you think the case scenarios were a useful exercise?

Yes No

Comment - explain your reasons

8. Were the graphics helpful?

Yes No

Comment - explain your reasons

9. In general, how do you feel about the medium (video, powerpoint, etc) used for this training?

- good or generally good way to learn
- adequate or generally adequate way to learn
- inadequate of generally inadequate way to learn

Comment - explain your reasons

10. You have participated in this course at no cost. Would you recommend this course to a colleague if there were a reasonable and customary fee associated with participation?

Yes No

Comment - explain your reasons

11. Please enter any additional comments on the course in the space below

Part 3 - CME Evaluation Instrument

12. Please print your name as it should appear on your CME certificate.

13. Please print your degree as it should appear on your CME certificate.

14. Please print the postal address to which you would like your CME certificate to be mailed.

15. The specialties that were identified as target audiences for this activity include pediatricians, family physicians, obstetricians, and nurse midwives. Please indicate your specialty in the space below.

Disclosure of Commercial Interest

16. Speakers are required to disclose whether or not they have commercial interests which may bias their presentations. Was such disclosure made by each speaker?

Yes

No

No Answer

17. Did you detect any bias in presentations in favor of or against any commercial product or service? Bias means that information about a product or service is presented without evidence from research that is conducted under generally accepted principles and/or reference to other similar products or services in the same class.

Yes

No

No Answer

18. If Yes, please describe the bias that you detected.

Part 4 – Training Outcome

As a result of participating in this activity, do you agree the following objectives were met?

19. Participant is able to describe the benefits of poly-unsaturated fatty acids
 Agree
 Disagree
 No answer
20. Participant is able to identify the contaminants in fish and their effects on human health.
 Agree
 Disagree
 No answer
21. Participant is able to describe the scientific basis for how contaminants occur in fish.
 Agree
 Disagree
 No answer
22. Participant is able to identify patients who are at-risk of health effects from contaminants of fish due to high consumption.
 Agree
 Disagree
 No answer
23. Participant is able to access national and local fish advisories.
 Agree
 Disagree
 No answer
24. Participant is able to appreciate why everyone - especially pregnant women and children - needs to adopt a healthy fish consumption strategy.
 Agree
 Disagree
 No answer

UIC Individual Course Evaluation Results

University of Illinois (UIC) Healthy Fish Choices Evaluation Results, Nurses, N= 7

Course Content

Part 1 - Content of the Modules

1. **Was the content clear and useful?**

Yes No Yes and No No Answer

- No. *Some content was confusing. Risks and benefits of fish consumption were flipped too often.*
- No. *I think size, kind and what is 1gm of fish oil in the context of serving size.*
- Yes and No. *Good info but I wanted more, clear, black and white info – too circular a conversation for me.*
- Yes and No. *Content fairly clear from the outline and presentation, but marginally useful in my community.*
- No Answer. *Most of the material was clear and useful although it could be condensed and the most important emphasized and streamlined.*
- No answer. *Not always clear – Risks and benefits could be separated more.*
- No answer. *Somewhat. I did learn new/useful info but there was a lot of wordy scientific explanation that could have been included in the credits (references).*

2. **Was the material credible with adequate science literature cited?**

Yes No Yes and No No Answer

- Yes. *The science and literature was cited but often un-useful for the clinic setting, in relationship to giving info to our patients.*
- Yes. *However they included so many useless statistics.*
- No Answer. *I would have to watch again and verify credits.*
- Yes. *Shouldn't include the selenium information.*

3. **Was the content presented at an appropriate level to your expertise?**

Yes No Yes and No No Answer

- Yes. *But it was difficult to transfer the info to our clinic pts.*
- Yes and No. *At times I felt there were too many statistics.*
- No Answer. *Condensing the info is helpful.*

4. **Was there additional information you wish had been included?**

[5] Yes [1] No [] Yes and No [1] No Answer

- Yes. *What is the portion that gets you 1 gm weekly.*
- Yes. *What is a serving size? How much Omega 3 and 6 daily?*
- Yes. *Locally caught and purchased fish in my community – fresh water, not seafood.*
- No Answer. *More positive spin on info..*
- Yes. *A little more about benefits to adults, i.e., dm2 prevention.*
- Yes. *Area-specific fish.*

Part 2 - Technical Matters

5. **Were the pretest questions clear and useful?**

[3] Yes [] No [1] Yes and No [3] No Answer

- No answer. *Open ended questions were unclear, especially when using, “What is your view.”*
- Yes and No. *It showed me the areas where I am unclear.*
- Yes. *Post-test questions not necessarily relevant to specific module, tend to be repetitive. Might not know the answers to some questions in the post-test and no way to find out without going through modules again.*
- No Answer. *Pre-test can help focus my attention.*
- Yes. *Redundant.*
- No answer. *Reviewing test answers would have been helpful.*

6. **Did the pace of the clinical scenarios work for you?**

[5] Yes [2] No [] Yes and No [] No Answer

- Yes. *I thought the doc had some of the more practical information.*
- No. *Would have been just as easy to read through scenarios. Reading balloon conversations attached to poor artwork was unnecessary and distracting. How about caption under pictures of real people?*
- No. *I didn't think scenarios were useful.*
- Yes. *Short and sweet.*
- Yes. *Very obvious scenarios. Time may have been better spent with more info.*

7. **Did you think the case scenarios were a useful exercise?**

[2] Yes [5] No [] Yes and No [] No Answer

- No. *They seemed unrealistic and the “peoples” features were distracting.*
- No. *I didn’t feel they were realistic.*
- No. *Not realistic in terms of conversations with actual clients.*
- No. *Scenarios seemed more about how to present than what to present.*
- Yes. *Put it into perspective – added patient care perspective.*
- No. *Obvious.*

8. **Were the graphics helpful?**

[1] Yes [3] No [] Yes and No [3] No Answer

- No answer. *Some were, some not. The human body graphics moved too fast and didn’t say how much you needed to consume to have those body parts affected.*
- No. *Too hard to see. Too much information.*
- No answer. *Some graphics OK but overuse of charts and graphs not that helpful to me as a clinical provider.*
- Yes. *I like graphs – they bullet-point info. I am a visual learner.*
- No. *Some were distracting.*
- No answer. *Actual people or photos would have been better.*

9. **In general, how do you feel about the medium (video, powerpoint, etc.) used for this training?**

[3] good or generally good way to learn
 [4] adequate or generally adequate way to learn
 [] inadequate or generally inadequate way to learn

10. **You have participated in this course at no cost. Would you recommend this course to a colleague if there were a reasonable and customary fee associated with participation?**

[] Yes [4] No [] Yes and No [3] No Answer

- No answer. *Maybe – I would have to compare it with similar courses first.*
- No answer. *Would want to see other products before recommending this – free or not.*
- No answer. *I’d have to see the finished product.*
- No. *Maybe with adjustments – need more info regarding local situation.*

11. Please enter any additional comments on the course in the space below. (No comments added)

Part 4 – Training Outcome (Part 3 is for Providers Only)

As a result of participating in this activity, do you agree the following objectives were met?

N=5. Two out of seven learners did not complete this section.

19. Participant is able to describe the benefits of poly-unsaturated fatty acids
20. Participant is able to identify the contaminants in fish and their effects on human health.
21. Participant is able to describe the scientific basis for how contaminants occur in fish.
22. Participant is able to identify patients who are at-risk of health effects from contaminants of fish due to high consumption.
23. Participant is able to access national and local fish advisories.
24. Participant is able to appreciate why everyone - especially pregnant women and children - needs to adopt a healthy fish consumption strategy.

Learner	Q19.	Q20.	Q21	Q22	Q23	Q24
N2	Agree	Agree	Agree	Agree	Agree	Agree
N4	No answer	No answer	Agree	Agree	No answer	Agree
N5	Agree	Agree	Agree	Agree	Agree	Agree
N6	Agree	Agree	Agree	Agree	Agree	Agree
N7	Agree	Agree	No answer	Agree	Disagree	Agree

University of Illinois (UIC) Healthy Fish Choices Evaluation Results, Physicians, N= 2

Course Content

Part 1 - Content of the Modules

1. **Was the content clear and useful?**

Yes No Yes and No No Answer

- No. *Too many facts/studies without unifying theme. Main message gets lost in the fog of studies.*
- No Answer. *Mostly. I think occasionally there was blurring of benefits and risks of fish use and need more emphasis of evidence what is stronger vs. weaker dose.*

2. **Was the material credible with adequate science literature cited?**

Yes No Yes and No No Answer

- Yes. Too much.

3. **Was the content presented at an appropriate level to your expertise?**

Yes No Yes and No No Answer

4. **Was there additional information you wish had been included?**

Yes No Yes and No No Answer

- Yes. *Want to see counseling of patients – real people – cartoons are awful.*
- Yes. *More local info. More info about sources of mercury.*

Part 2 - Technical Matters

5. **Were the pretest questions clear and useful?**

Yes No Yes and No No Answer

- No. *"What is your view about the value" questions very confusing.*
- No Answer. *Too many tests. Make sure questions are asking important take-home messages.*

6. **Did the pace of the clinical scenarios work for you?**

Yes No Yes and No No Answer

7. **Did you think the case scenarios were a useful exercise?**

Yes No Yes and No No Answer

- No Answer. *I am unsure of value of scenarios.*

8. **Were the graphics helpful?**

Yes No Yes and No No Answer

- Yes. *Some were too detailed. Listing of websites on video not helpful.*
- No. (referring to case scenarios) *Distractingly weird/grotesque*

9. **In general, how do you feel about the medium (video, powerpoint, etc) used for this training?**

good or generally good way to learn
 adequate or generally adequate way to learn
 inadequate of generally inadequate way to learn

10. **You have participated in this course at no cost. Would you recommend this course to a colleague if there were a reasonable and customary fee associated with participation?**

Yes No Yes and No No Answer

- No answer. *Oh, I don't know. So many things for colleagues to know.*

11. **Please enter any additional comments on the course in the space below.**

- *In general, found the lecture portions poorly organized – a listing or random facts from studies without overarching goal clear and very little summary statement. Tell me what we know for sure about risks/benefits. Tell me how to discuss it with my patients. Don't take me on a tour around the world/US with studies that aren't conclusive.*

Part 4 – Training Outcome

As a result of participating in this activity, do you agree the following objectives were met?

- 19. Participant is able to describe the benefits of poly-unsaturated fatty acids
- 20. Participant is able to identify the contaminants in fish and their effects on human health.
- 21. Participant is able to describe the scientific basis for how contaminants occur in fish.
- 22. Participant is able to identify patients who are at-risk of health effects from contaminants of fish due to high consumption.
- 23. Participant is able to access national and local fish advisories.
- 24. Participant is able to appreciate why everyone - especially pregnant women and children - needs to adopt a healthy fish consumption strategy.

Learner	Q19.	Q20.	Q21	Q22	Q23	Q24
D1	Disagree	Agree	Agree	Agree	Agree	Agree
D2	Agree	Agree	Agree	Agree	Agree	Agree

MSU Course Curriculum



Eating Fish

Maximizing Benefits & Minimizing Risks

Kenneth D. Rosenman, M.D.

Professor of Medicine

Michigan State University

Funding - Great Lakes Restoration Initiative EPA GL-00E00461



Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources



AHA 2006 Diet and Lifestyle Recommendations for Cardiovascular Disease Risk Reduction

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
- Consume a diet rich in vegetables and fruits.
- Choose whole-grain, high-fiber foods.
- Consume fish, especially oily fish, at least twice a week.
- Limit your intake of saturated fat to <7% of energy, *trans* fat to <1% of energy and cholesterol to <300 mg per day.
- Minimize your intake of beverages and foods with added sugars.
- Choose and prepare foods with little or no salt.
- If you consume alcohol, do so in moderation.
- When you eat food that is prepared outside of the home, follow the AHA Diet and Lifestyle Recommendations.

(Circulation 2006; 114:82-96)

Major Classes of Fatty Acids

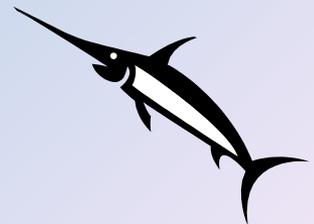
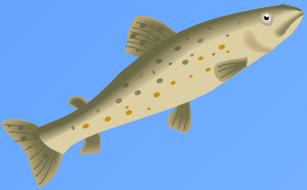
FAMILY	FATTY ACIDS	FORMULA	SOURCE
Omega-9	Oleic acid	C18:1	Most vegetable oils (canola, olive); animal fats
Omega-6	Linoleic acid	C18:2	Many vegetable oils (corn, safflower, soybean)
	Arachidonic acid	C20:4	Poultry, meats
Omega-3	α -linolenic acid	C18:3	Selected vegetable oil (flaxseed, canola)
	EPA	C20:5	Marine oils and fish
	DHA	C22:6	Marine oils and fish
Saturated fats	Palmitic acid	C16:0	Animal and vegetable fats
	Stearic acid	C18:0	Butter, palm oil, kernel oil, coconut oil, and animal fats

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid.
 (*J Am Coll Card* 2009;54:585-594)



Oily Fish

Salmon	Swordfish
Trout	Bloater
Mackerel	Cacha
Herring	Carp
Sardines	Hilsa
Pilchards	Jack Fish
Kipper	Katla
Eel	Orange Roughy
Whitebait	Pangas
Tuna (fresh only)	Sprats
Anchovies	



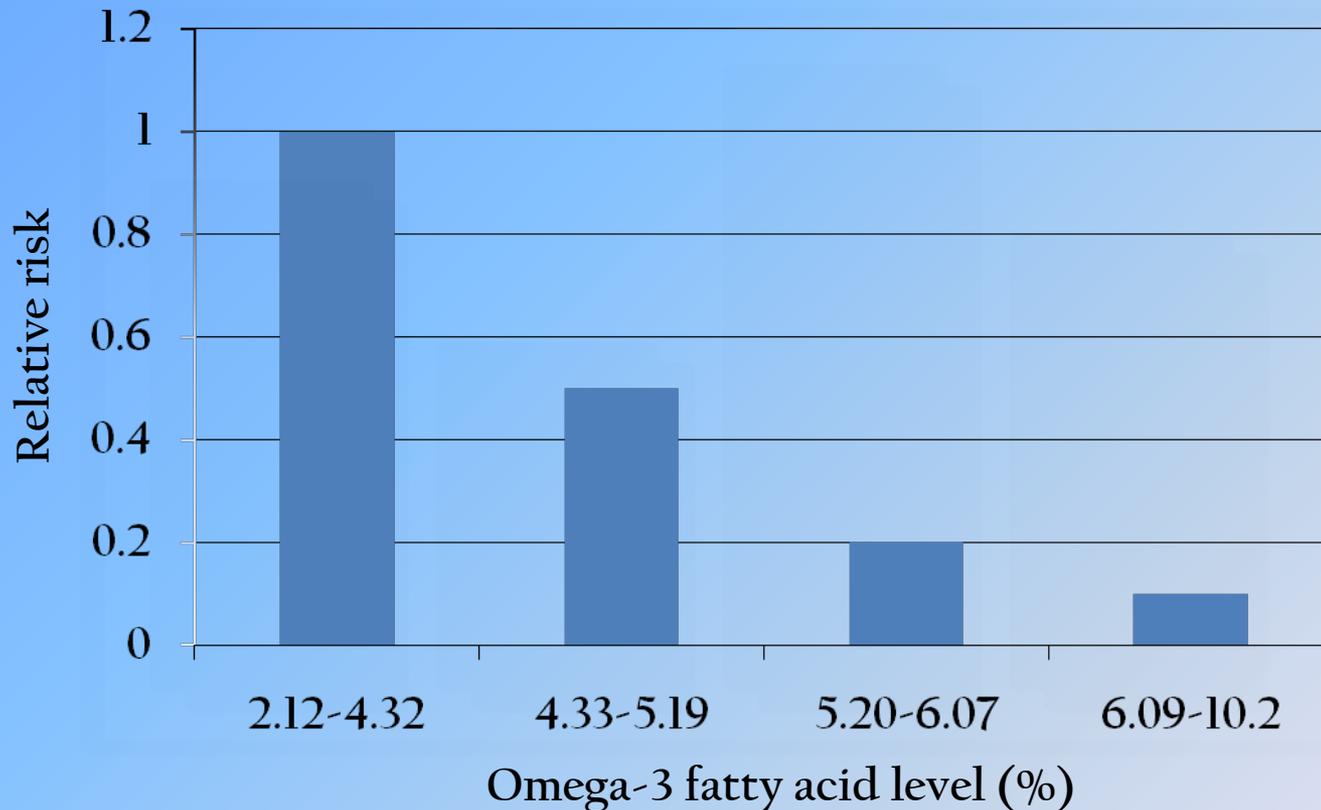
Potential EPA and DHA Effects

- Anti-arrhythmic effects
- Improvements in autonomic function
- Decreased platelet aggregation
- Vasodilation
- Decreased blood pressure
- Anti-inflammatory effects
- Improvements in endothelial function
- Plaque stabilization
- Reduced atherosclerosis
- Reduced free fatty acids and triglycerides
- Up-regulated adiponectin synthesis
- Reduced collagen deposition

(J Am Coll Card 2009;54:585-594)

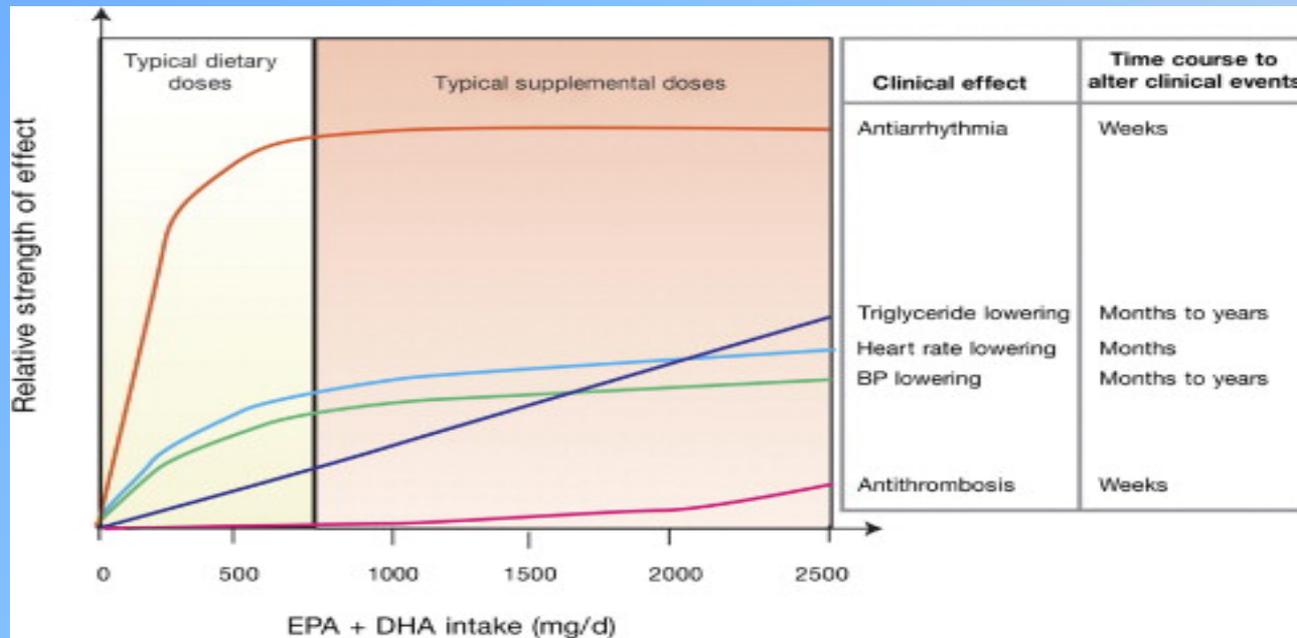


Relative risk of sudden cardiac death (SCD) according to baseline blood levels of omega-3 fatty acids as percentage of total fatty acids.



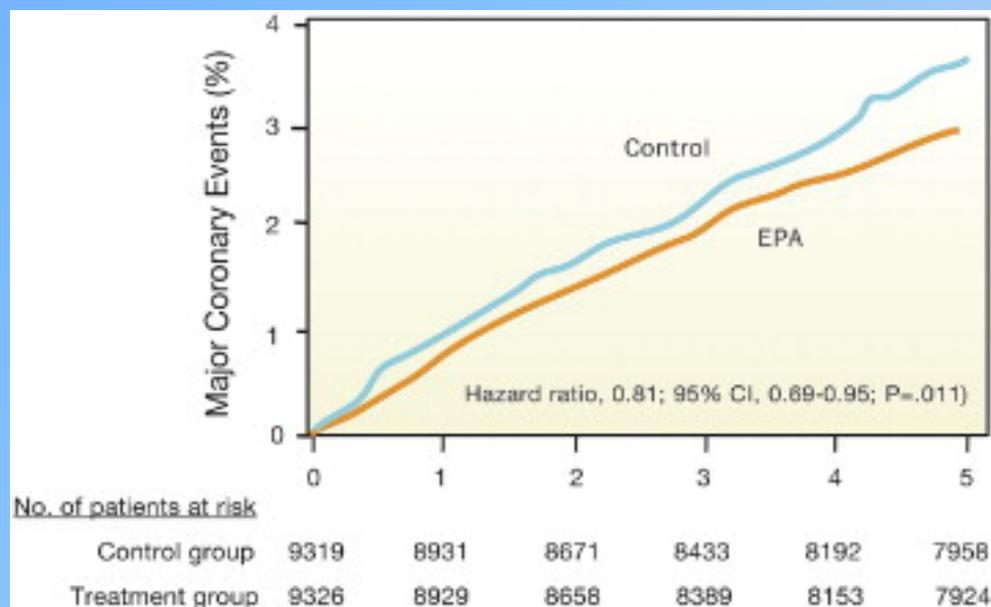
(J Am Coll Card 2009;54:585-594 (Data from Albert et al. originally printed Lee et al.))

Fish Oil Dosing and Cardiovascular Impact



(J Am Coll Card 2009;54:585-594 (Reprinted, with permission, from Mozaffarian and Rimm))

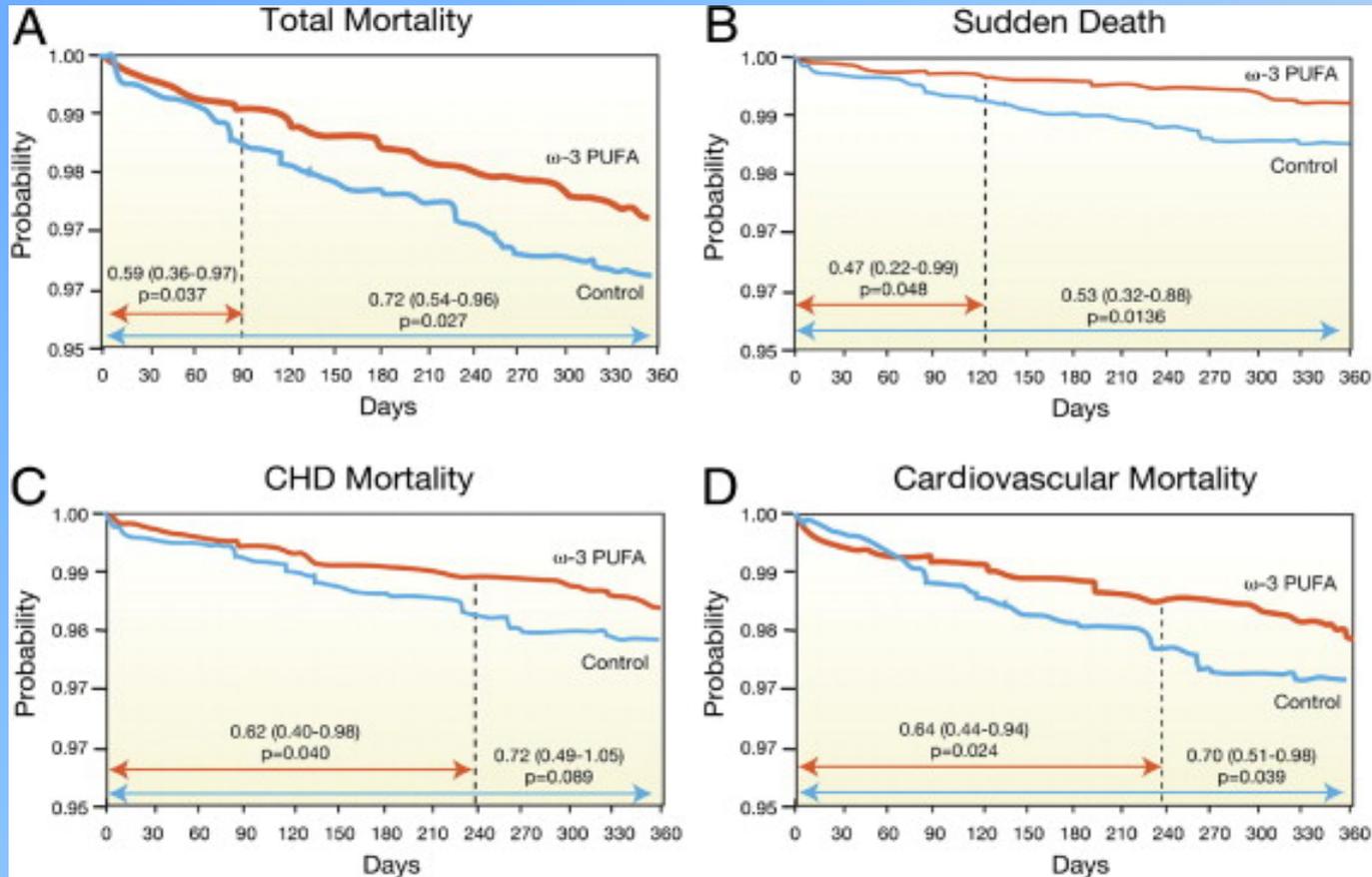
EPA in Primary Prevention 1.8 g/day Reduced the Incidence of Major Adverse Coronary Events in the JELIS (Japan EPA Lipid Intervention Study) Trial by 19%



(J Am Coll Card 2009; 54: 585-594 (Reprinted from Yokoyama et al.))

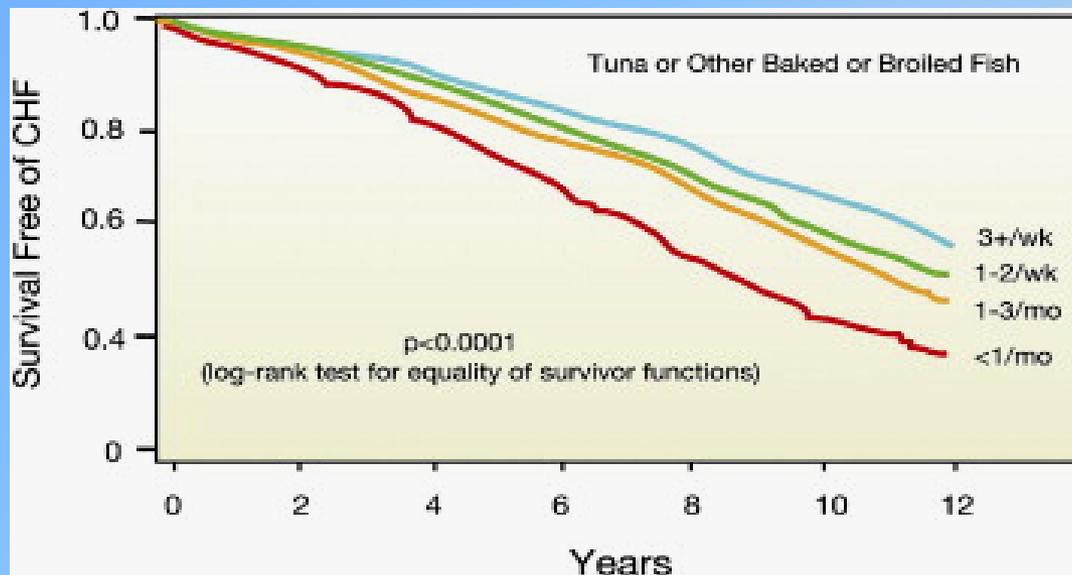


Fish Oil and Post-MI Prognosis Early benefit of omega-3 polyunsaturated fatty acid therapy on total mortality, sudden death, coronary heart disease mortality, and cardiovascular mortality



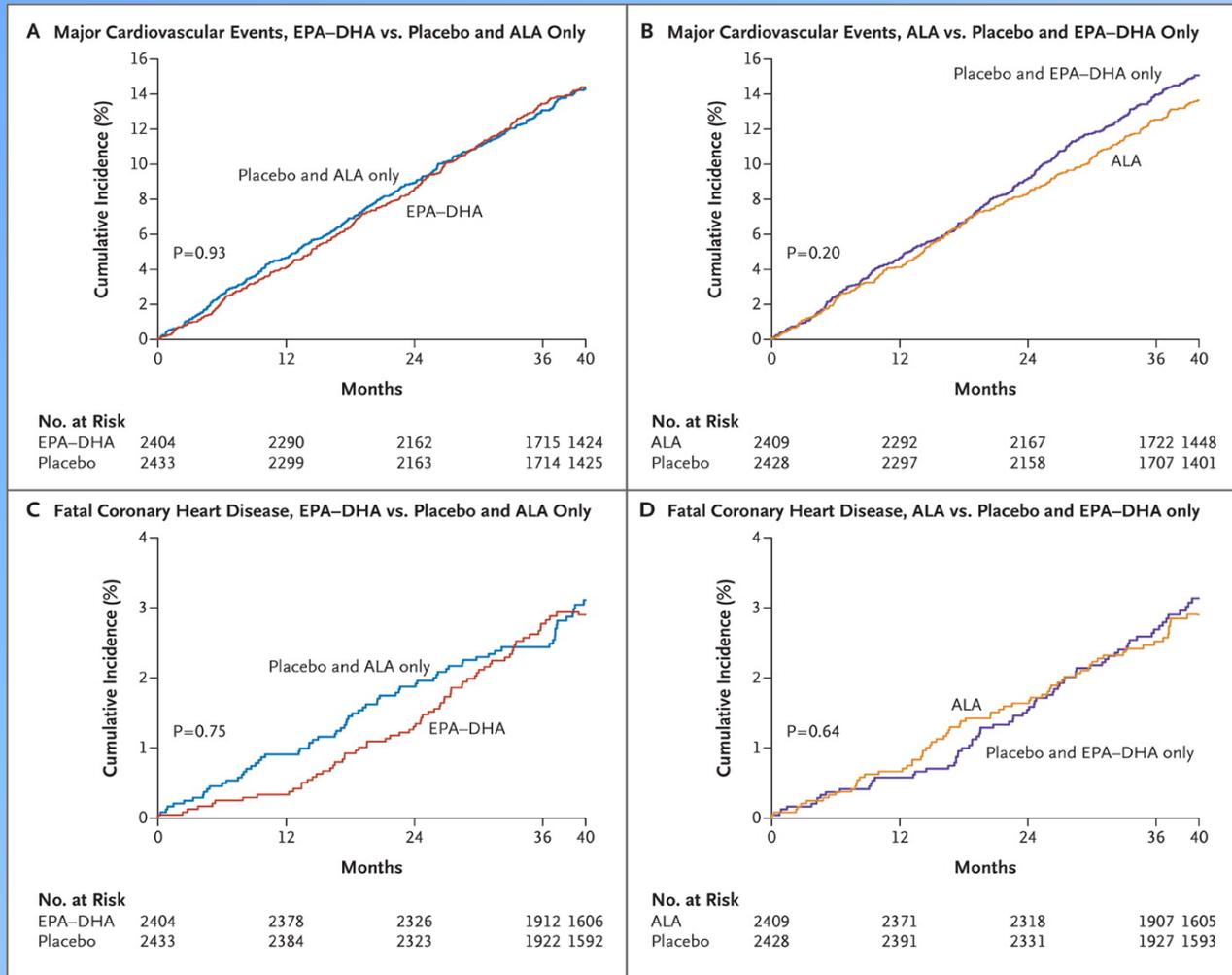
(J Am Coll Card 2009;54:585-594 (Reprinted, with permission, from Marchioli et al.))

Fish Intake and CHF Survival free of Congestive Heart Failure According to Consumption of Tuna or Other Fish that are High in EPA and DHA



(J Am Coll Card 2009; 54:585-594 (Reprinted, with permission, from Mozaffarian et al.))

Kaplan–Meier Curves for Primary and Secondary End Points



(Kromhout D et al. N Engl J Med 2010;363:2015-2026)

Summary of Cardiovascular Benefits of Ingesting Fish/Fish Oil

Primary Prevention

19% Reduction in CV Events

S/P MI

23% Reduction

Arrhythmias

30% Reduction Risk of Atrial FIB

CHF

5-10% Reduction Mortality

Triglycerides

30-40% Reduction (FDA Approved 4gm/day)



Gestational Benefits

Benefits to Mother

Reduce Pre-Eclampsia - 7.5 fold decrease

Reduce Incidence Pre term delivery - 1.9% vs. 7.1%

Reduce Post-Partum Depression

Benefits to Child

Reduction allergic disease

Improved eye and hand coordination

Enhanced cognitive and behavioral function

Improved sleep behavior

Decreased risk of Type 1 diabetes

Decreased risk cerebral palsy

Improved IQ at 4 years of age

(Genuis SJ. Reproductive Toxicology 2008; 28: 81-85)



Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources





Mercury Poisoning Episodes & Symptoms

Minamata, Japan, 1943-1961

Ingestion of fish from bay with mercury pollution

Iraq, 1961 & 1971

Ingestion of mercury fungicide contaminated grain

Adults

Ataxia, memory loss, paresthesias, blurred vision and hearing loss

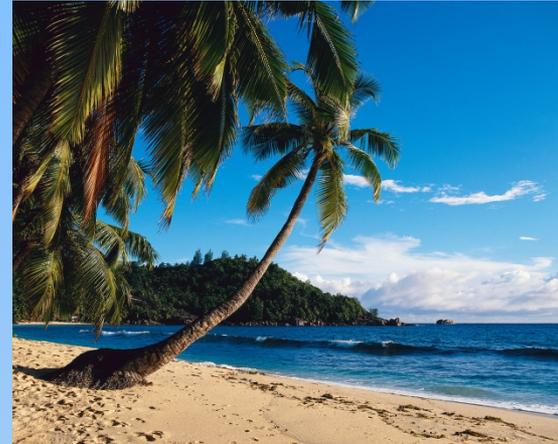
Children

Mental retardation, cerebral palsy, deafness blindness and dysarthria after exposure in utero

0.1 $\mu\text{g}/\text{kg}\text{-day}$ (EPA 2005)

Studies of Fish Eating Populations

Seychelles
Faroe Islands
New Zealand



Decreased Performance on neuropsychological tests



0.1 $\mu\text{g}/\text{kg}\text{-day}$ (EPA 2005)

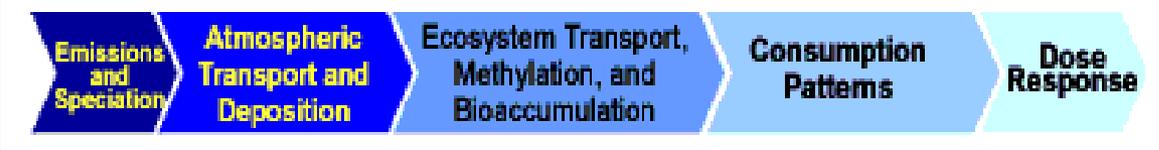
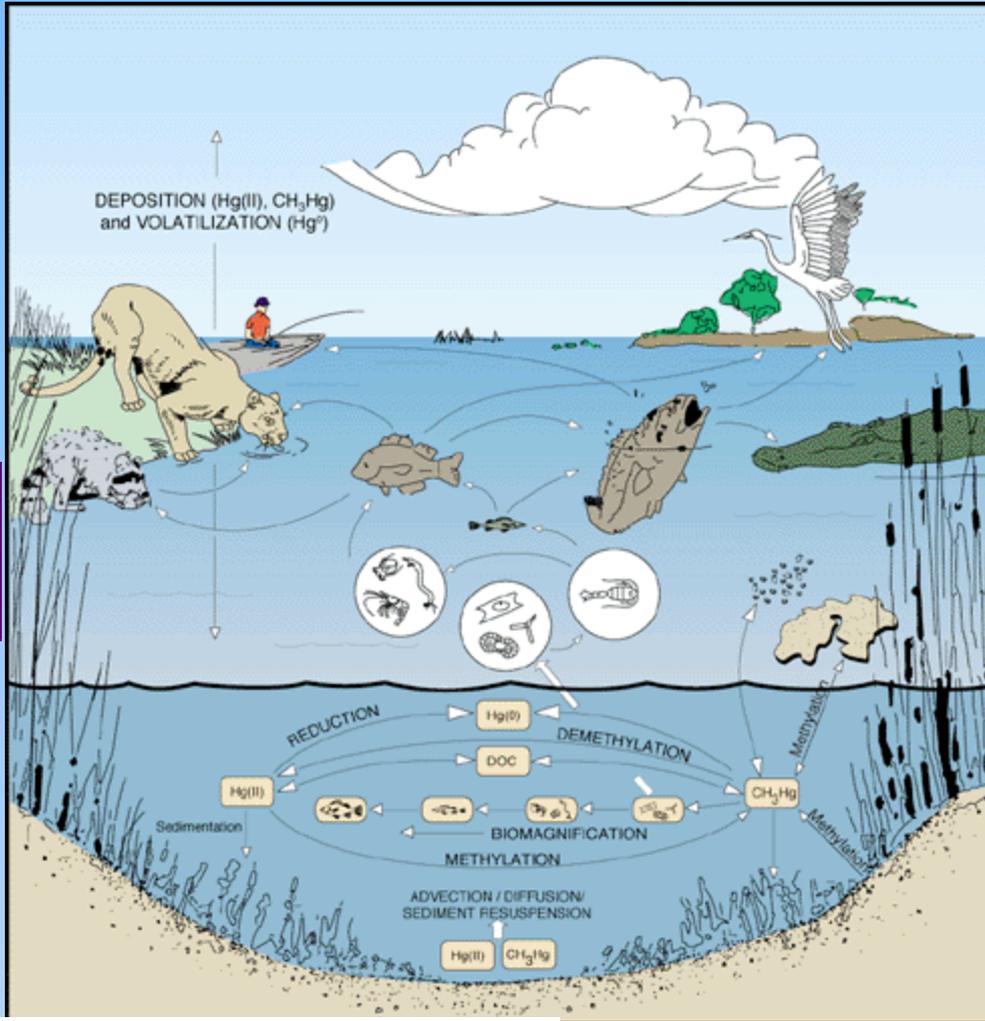
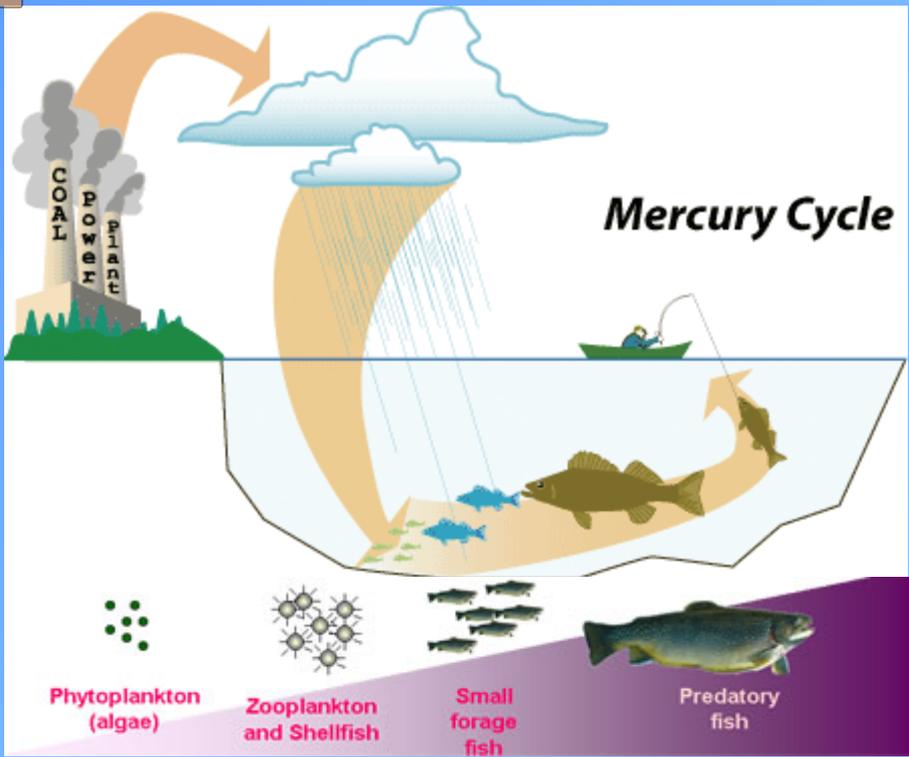
1.0 PPM (FDA)



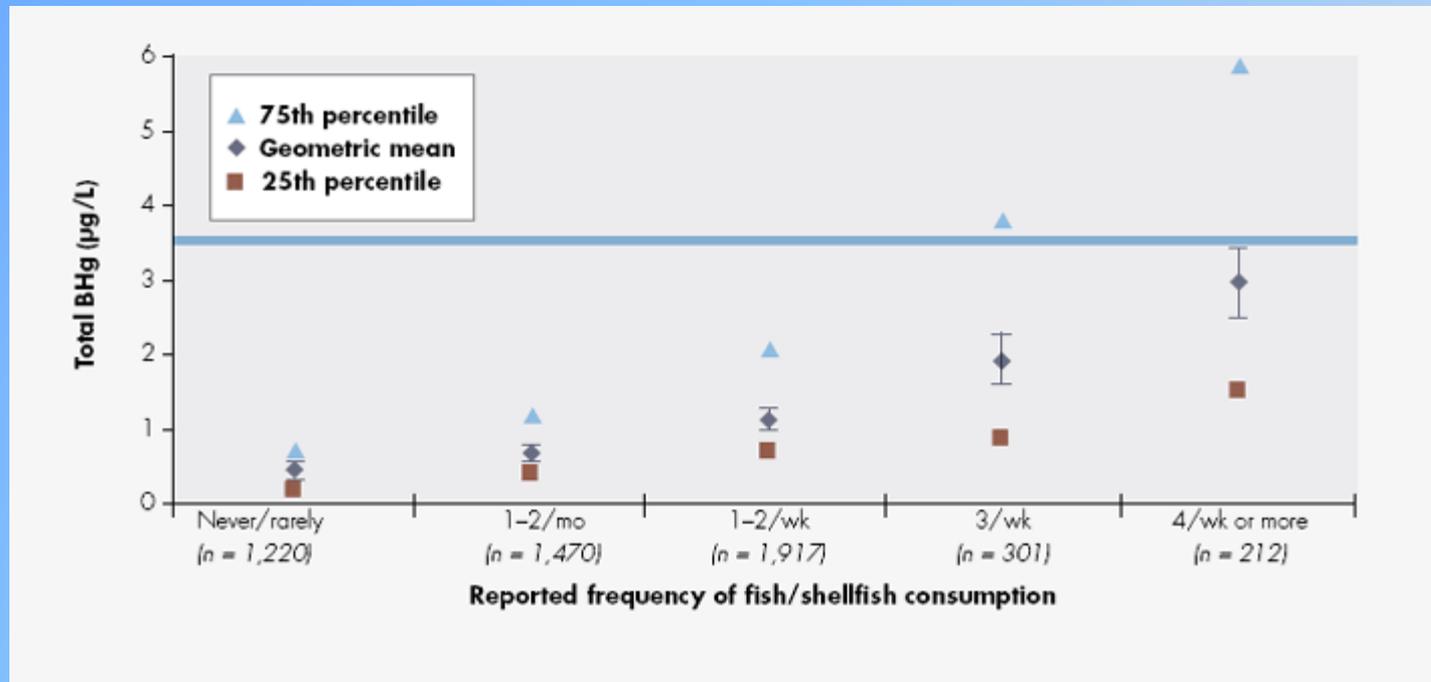
Mercury, Fish Oils and Risk of Acute Coronary Events and Cardiovascular Disease, Coronary Heart Disease, and All Cause Mortality in Men in Eastern Finland with Hair Mercury $> 2.03\mu\text{g/g}$

	<u>OR</u>	<u>95% CI</u>
Acute Coronary Event	1.6	1.2-2.1
CVD	1.7	1.2-2.4
CHD	1.6	0.99-2.5
Death Any Cause	1.4	1.2-1.7

(Arterioscler Thromb Vasc Biol 2005; 25:228-233)



Fish Intake and Blood Mercury Level in US Women 1999-2004, NHANES



(EHP 2009; 117 47-53)

Blue line marks lowest blood mercury level associated with toxicity to the fetus.

Store Bought Fish with the Highest Levels of Mercury (about 1 ppm)



Omega-3 fatty acids (grams per 3-oz. serving)

Mean mercury level in parts per million (ppm)

Tilefish (golden bass or golden snapper)

0.90

1.45

Shark

0.83

0.99

Swordfish

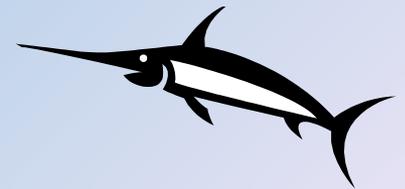
0.97

0.97

King mackerel

0.36

0.73



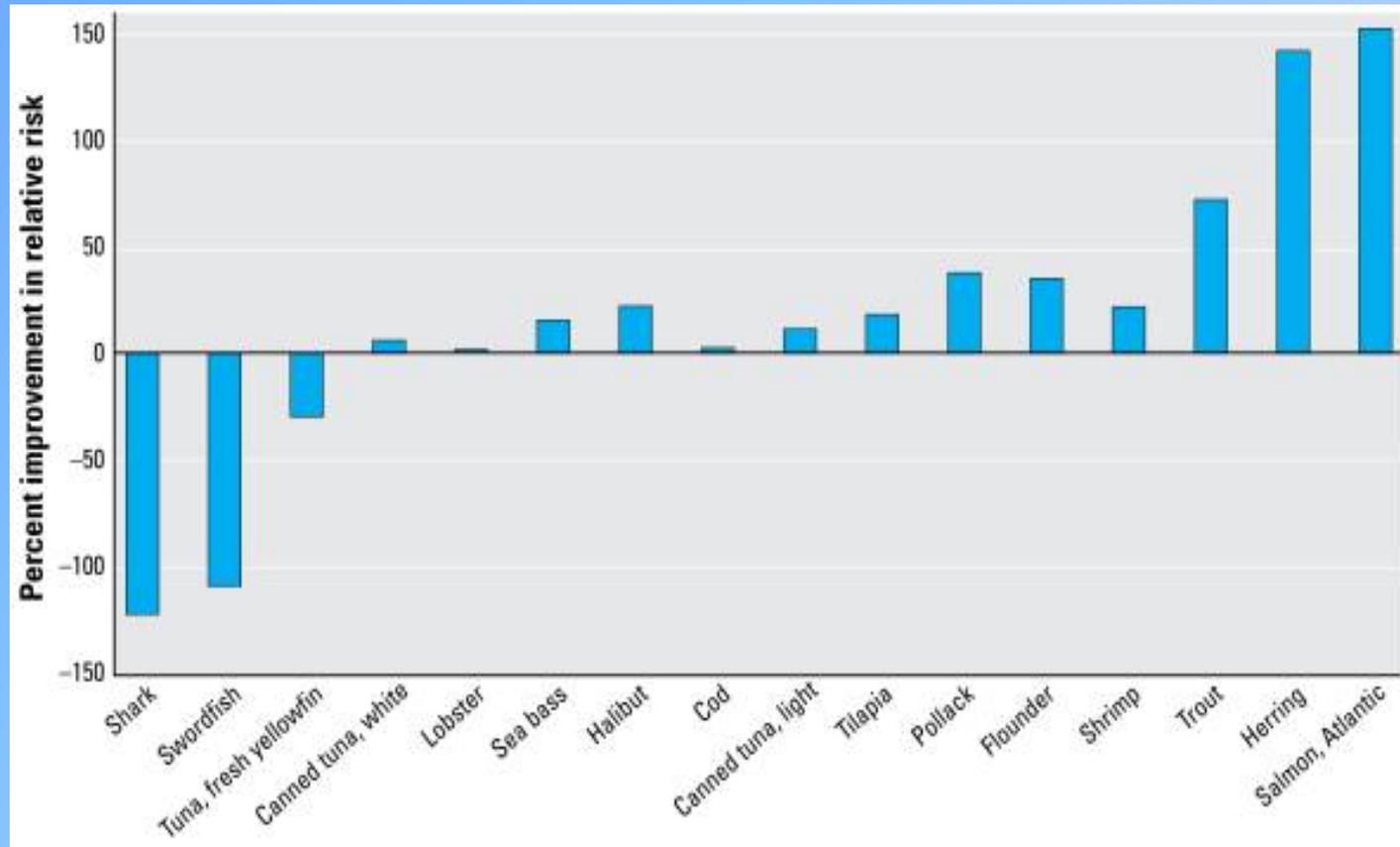
Omega-3 and Mercury Levels of Top 10 Fish and Shellfish in the United States Based on Consumption

	Omega-3 Fatty Acids (grams per 3-oz. serving)	Mean Mercury Level in Parts per Million (ppm)
Canned Tuna (light)	0.17–0.24	0.12
Shrimp	0.29	ND*
Pollack	0.45	0.06
Salmon (fresh, frozen)	1.1–1.9	0.01
Cod	0.15–0.24	0.11
Catfish	0.22–0.3	0.05
Clams	0.25	ND*
Flounder or Sole	0.48	0.05
Crabs	0.27–0.40	0.06
Scallops	0.18–0.34	0.05

* ND – mercury concentration below the Level of Detection (LOD=0.01ppm)



Estimated Net Effect of Mercury and Fish Oils on Cardiovascular Risk, Two 6-oz Fish Meals per Week.



EHP 2009; 117: 267-275

Chlorinated Hydrocarbons

	FDA Limits
DDT -TDE and DDE metabolites	5.0 PPM
PCB's	2.0 PPM
Dioxin	1.0 ppt



Adverse Health Effects of Chlorinated Hydrocarbons

Polychlorinated Biphenyls (PCB's)

- Rice Oil Poisoning – Japan 1968 and Taiwan 1979

- ✓ Adults - Chloracne

- ✓ Children – cognitive abnormalities and swollen gums, deformed nails, hyperpigmentation, acne, Decreased IQ when older

- Chronic Studies

- ✓ Michigan and North Carolina Cohorts

- Multiple neurocognitive defects in children

- Short term memory deficits, Decreased IQ

- Decreased muscle tone and activity in infants

- Cancer

Dioxin

- Anti-estrogen effects

- Cancer

- Diabetes

- Immune suppression



Populations at Increased Risk for Mercury/PCB Toxicity

- Children <15
- Pregnant women
- Women of child-bearing age

Populations at Increased Risk for Accumulation of Toxins from Fish

- Urban subsistence fishers
- Certain immigrant populations (e.g., Hmong)

Fish vs. Fish Oil

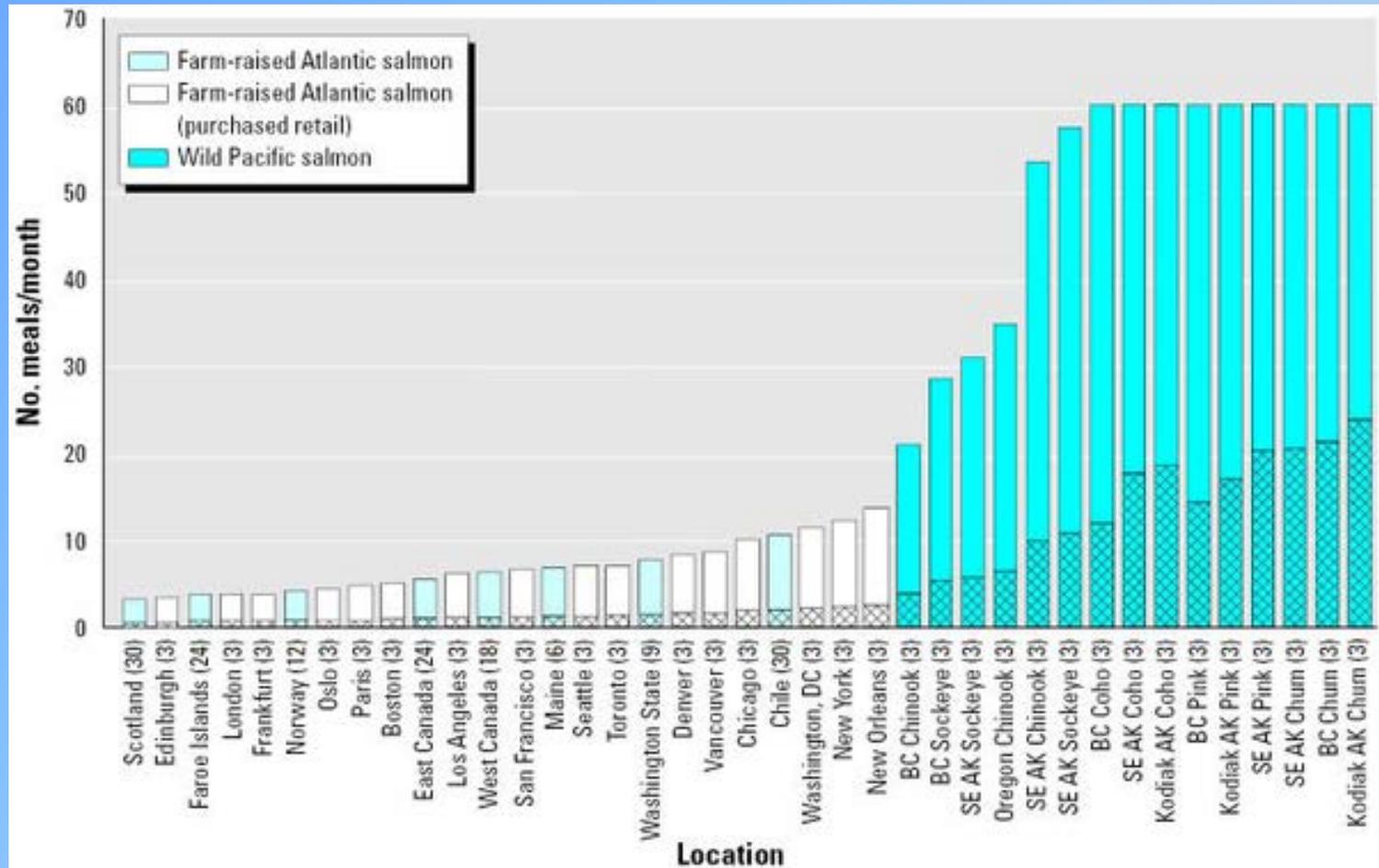
Fish	Fish Oil
340 gm, (Two 6-oz servings per week)	500-1000 mg EPA & DHA per day
Positive	
Benefits in Epi Studies	Benefits in Epi Studies
Other Nutrients <ul style="list-style-type: none">• Vitamin D• Selenium	Absent
Negative	
Contaminants <ul style="list-style-type: none">• Chlorinated hydrocarbons• Mercury	Less www.edf.org/page.cfm?tagID=16536



Life Span and Contaminants of Farmed vs. Wild Fish

Farmed Fish	Wild Fish
Life Span	
Atlantic: 1.5-2 years	Pacific: 1-7 years
Concentrations Omega 3/Contaminants	
Depends on feed source <ul style="list-style-type: none">• Omega 3• Chlorinated hydrocarbons• Mercury	

Risk-based Consumption Advice Farm VS. Wild Salmon Based on Dioxin/Dioxin Like Contamination



(EHP 2005; 113: 552-556)

Choosing Fish from Grocery Store/Restaurant

Eating Fish – Maximizing Benefits and Minimizing Risks.



Selected References and Resources for Health Professionals:

- Layie, CJ, Milani RV, Mehra MR, Ventura HO. Omega-3 Polyunsaturated Fatty Acids and Cardiovascular Diseases. J Am Coll Cardiol 2009; 54: 585-594
- Association of Reproductive Health Professionals <http://www.arhp.org/publications-and-resources/clinical-proceedings/RHE>
- Fish Facts for Health Professional: Methylmercury Exposure and Health Effects and Four web based modules www.fish-facts.org

Resources for Patients:

EPA Fish Advisories

http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/advisories_index.cfm

FDA Mercury in Fish and Shellfish – Consumer Guide

<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm110591.htm>

MDCH Guidelines for Eating Michigan Fish and Wild Game

http://www.michigan.gov/mdch/0,1607,7-132-54783_54784_54785---,00.html

Michigan 2010 Fish Advisory –Recreational Caught Fish

http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf

Statewide Mercury Advisory –Recreational Caught fish

http://www.michigan.gov/documents/mdch/Statewide_Mercury_Advisory_Fact_Sheet_2010-07_327066_7.pdf

Mercury Advisory – Store Caught Fish – Consumer Guide

http://www.michigan.gov/documents/family_fish_166020_7.pdf

Evaluation of Contaminants of Fish Oils

www.edf.org/page.cfm?tagID=16536

NRDC Mercury Calculator

<http://www.nrdc.org/health/effects/mercury/calculator/calc.asp>

General Principles of Preparing Fish Safely – Michigan Department of Community Health

1. Trimming and Cooking
 - Cut off all the fat.
 - Remove or poke holes in the fish's skin before cooking. This will help the fat and chemicals drain off the fish.
 - Bake, broil or grill the fish on a rack. Throw away the drippings.
 - Do not eat the guts, head, skin, bones or dark fatty areas.
 - Do not re-use the oil that was used to deep or pan fry fish.
2. Eat fish from different places such as the grocery store, restaurants, rivers and lakes.
3. Eat smaller, younger fish. Bigger and older fish have had more time to collect more chemicals in their bodies.
4. Don't eat fatty fish like carp and catfish from polluted waters. Most chemicals (except for mercury) collect in the fat. Buy catfish from your grocery store instead.
5. Mercury stays in the filet of the fish and cannot be cut or cooked away. Use the guides to choose fish that are low in mercury. Do not eat any of the internal organs of any fish (example: liver).

Funding – Great Lakes Restoration Initiative EPA GL-00E00461
Ken Rosenman M.D. – Principal Investigator
Chief, Division of Occupational and Environmental Medicine – Michigan State University
Rosenman@msu.edu

Mercury cannot be removed from fish by trimming and cooking.
Use the following information to choose fish and seafood from the grocery store or restaurant.

Mercury Advisory

for Store-bought or Restaurant Fish

Going to the store or out to eat?

Fish are grouped and assigned points based on the amount of mercury in 6 ounces of fish (one meal). Fish with more mercury get more points.

The lower the score, the better the fish is for you to eat. Eat no more than 8 points of fish meals per month...

EAT
no more than... **8** points per month

• This chart is based on FDA fish fillet mercury data.

• Advice to eat no more than 8 points is good for everyone, including pregnant women & children.

* If you catch these fish in Michigan, please see the *Michigan Fish Advisory* at www.michigan.gov/eatsafefish.

Per Meal
1
Point

Anchovies	Pollock
Catfish (farm-raised)	Salmon* (canned, frozen, fresh)
Crab	Sardines
Crawfish	Scallops
Flatfish (flounder, sole)	Shrimp
Herring*	Squid
Mullet	Tilapia
Oysters	Trout* (freshwater)
Perch* (ocean or freshwater)	Whitefish*

Per Meal
2
Points

Cod	Mahi mahi
Freshwater Drum* (aka Sheepshead)	Snapper
Jack smelt	Tuna (canned light)

Per Meal
4
Points

Bass* (sea, striped, rockfish)	Scorpion fish
Bluefish	Tuna (Albacore, canned white)
Halibut	Tuna (fresh, frozen)
Lobster	Weakfish (sea trout)
Sablefish	

Per Meal
8
Points

Grouper	Marlin
Mackerel	Orange Roughy



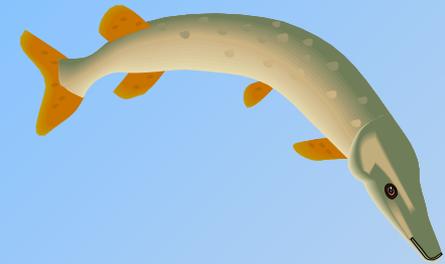
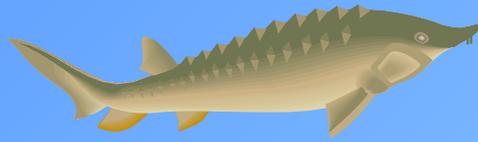
Do not eat these fish:

Shark, Swordfish, Tilefish, King Mackerel

Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources





Michigan Fish

Bass – Large, Rock, Small Mouth
Bluegill
Black Buffalo
Brown Bullhead
Carp
Catfish, Channel
Crappie, Black
Freshwater Drum
Lake Herring
Muskellunge

Perch – White, Yellow
Northern Pike
Salmon – Chinook, Coho
Gizzard Shad
Sturgeon
Suckers
Trout – Brown, Lake, Rainbow
Turbot
Walleye
Lake Whitefish

Benefits & Risks of Store/Restaurant vs. Recreational Fish

Store- or Restaurant-Bought Fish	Recreationally-Caught Fish
Benefits	
Wider Variety	Able to Select Smaller Fish
Able to Select Oily Fish	Able to Select Fishing Locale
FDA standard for PCBs/Mercury	
Risks	
Highest Mercury Fish	Possibly Highly Contaminated



2011-2012
MICHIGAN FISH ADVISORY
A Family Guide to Eating Michigan Fish



MDCH Division of Environmental Health • 1-800-648-6942
Visit us on the web at www.michigan.gov/eatsafefish

Get to know the **3Cs**

Choose, Clean, Cook

1 Choose

2 Clean

Going fishing?

Use the picture below to choose fish to catch that are generally safer for you and your family to eat. Be sure to check the *Michigan Fish Advisory* to find details about the lakes and rivers where you're fishing.

These fish are lower in chemicals, and are better to eat.

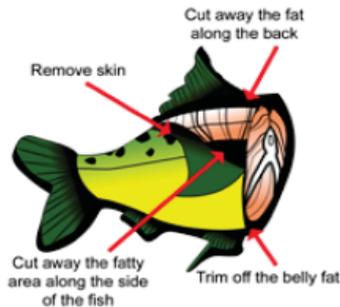
Better to eat

Check the Advisory

These fish are higher in chemicals.

Cleaning and cooking your fish the right way can remove up to half of the chemicals!

- ☑ Trim off the dark fatty tissue along the backbone, sides and belly. Most of the chemicals are stored in the fat, except for mercury. Mercury cannot be removed from fish. See page 5 for more information.
- ☑ Take out all organs, such as the liver and stomach. Do not eat the organs.



3 Cook

- ☑ Remove the skin or poke holes in it before cooking. This allows fat to drip off the fish.
- ☑ Cook the fish on a broiler pan or grill so that the fat can drip away through the grates.



Statewide Mercury Advisory

For fish caught in Michigan's inland lakes, reservoirs and impoundments not listed on pages 8-57 in this booklet.



For Men & Women*



For Women & Children**

Eat **one meal or less per WEEK** of **ONE** of the following:

- rock bass (over 9 inches long)
- yellow perch (over 9 inches long)
- crappie (over 9 inches long)
- largemouth bass (any size)
- smallmouth bass (any size)
- walleye (any size)
- northern pike (any size)
- muskellunge (any size)



*Advisory for males 15 years or older and females over 45 years old.

Eat **one meal or less per MONTH** of **ONE** of the following:

- rock bass (over 9 inches long)
- yellow perch (over 9 inches long)
- crappie (over 9 inches long)
- largemouth bass (any size)
- smallmouth bass (any size)
- walleye (any size)
- northern pike (any size)
- muskellunge (any size)



**Advisory for boys and girls under the age of 15 and females ages 15-45 years old.



For information about mercury in fish you buy from restaurants or grocery stores, please see the *Mercury Advisory for Store-bought or Restaurant Fish* (available at www.michigan.gov/eatsafefish).

When fishing from the Great Lakes or Michigan rivers, use pages 8-57 in this booklet to find safe fish for you and your family to eat.

Visit www.michigan.gov/eatsafefish or call 1-800-648-6942 to request a free copy of the *Michigan Fish Advisory*.

Example of 2010 Michigan Fish Advisory

Water body	Type of fish	Chemical(s)	General Population									Women & Children									
			Length (inches)									Length (inches)									
			6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30+	6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30+	
▲	No eating restrictions.	▼	One meal per week.																		
●	One meal per month.	■	Six meals per year.																		
		◆	Do not eat these fish.																		

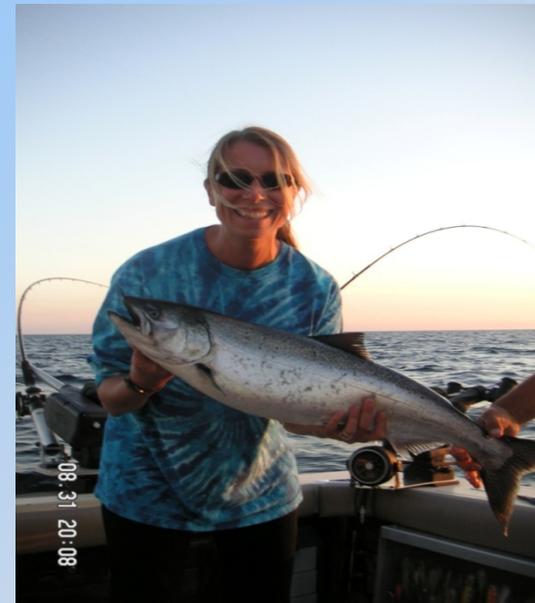
Lake Michigan Watershed

Water body	Type of fish	Chemical(s)	General Population									Women & Children								
			6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30+	6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30+
Grand River (Upstream of Webber Dam; Ionia, Clinton, Eaton, Ingham & Jackson Co.)	Carp	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	
	Channel Catfish	PCBs				▲	▲	▲	▲	▲	▲			▼	▼	●	●	●	●	
	Northern Pike	PCBs							▲	▲	▲					▼	▼	▼		
	Suckers	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	
	Walleye	PCBs					▲	▲	▲	▲	▲				▼	▼	▼	▼	▼	



Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources



Awareness of Health Advisories for Consumers of Great Lakes Sport Fish

- Great Lakes fish eaten by 8.4% (95 CI 7.6-9.2) of adults
- 60% (95 CI 53-68) Michigan residents aware of fish advisory

	OR	95% CI
Men	2.3	1.5 – 3.4
White	4.2	1.9 – 9.1
College Degree	3.1	1.3 – 7.6
Eating \geq 24 Great Lakes fish meals per year	2.4	1.4 – 4.3

(*EHP* 1997; 105:1360-1365)



Populations at Increased Risk for Mercury/PCB Toxicity

- Children <15
- Pregnant women
- Women of child-bearing age

Populations at Increased Risk for Accumulation of Toxins from Fish

- Urban subsistence fishers
- Certain immigrant populations (e.g., Hmong)



Clinical Activity

1. Brief Dietary History

www.aafp.org/afp/990315ap/1521.html

Starting the Conversation -AJPM 2011; 40(1):67-71

2. Encouraging Fish Consumption

3. Advice for Cooking and Fish Selection

MDCH Consumer Guide – Eat Safe Fish

http://www.michigan.gov/documents/family_fish_166020_7.pdf

4. Advice on fish selection if patient or member of patient's family catch and eat fish

http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf



General Principles of Preparing Fish Safely

1. Trimming and Cooking

- Cut off all the fat.
- Remove or poke holes in the fish's skin before cooking. This will help the fat and chemicals drain off the fish.
- **Bake, broil or grill** the fish on a rack. Throw away the drippings.
- Do not eat the guts, head, skin, bones or dark fatty areas.
- Do not re-use the oil that was used to deep or pan fry fish.

2. Eat fish from different places such as the grocery store, restaurants, rivers and lakes.

3. **Eat smaller, younger fish.** Bigger and older fish have had more time to collect more chemicals in their bodies.

4. Don't eat fatty fish like carp and catfish from polluted waters. Most chemicals (except for mercury) collect in the fat. Buy catfish from your grocery store instead.

5. Mercury stays in the filet of the fish and cannot be cut or cooked away. Use the guides to choose fish that are low in mercury.



Do not eat any of the internal organs of any fish from any water body (example: liver).

(MDCH)

Mercury Reference Values

Specimen	Half-Life	Normal	Allowable Workplace Level	Acute Toxicity
Urine	40 days	4µg/L	50µg/L	>300µg/L
Blood	1-2 days	A 4.6 µg/L C 1.9 µg/L	25µg/L	>50µg/L



Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources





Resources for Patients

EPA Fish Advisories

http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/advisories_index.cfm

FDA Mercury in Fish and Shellfish – Consumer Guide

<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucml10591.htm>

MDCH Guidelines for Eating Michigan Fish and Wild Game

http://www.michigan.gov/mdch/0,1607,7-132-54783_54784_54785---,00.html

Michigan 2010 Fish Advisory –Recreational Caught Fish

http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf

Statewide Mercury Advisory –Recreational Caught fish

http://www.michigan.gov/documents/mdch/Statewide_Mercury_Advisory_Fact_Sheet_2010-07_327066_7.pdf

Mercury Advisory – Store Caught Fish – Consumer Guide

http://www.michigan.gov/documents/family_fish_166020_7.pdf

Resources for Health Professionals

De Caterina R. n-3 Fatty Acids in cardiovascular Disease. New Eng J Med 2011; 364: 2439-2450

Layie, CJ, Milani RV, Mehra MR, Ventura HO. Omega-3 Polyunsaturated Fatty Acids and Cardiovascular Diseases. J Am Coll Cardiol 2009; 54: 585-594

Association of Reproductive Health Professionals

<http://www.arhp.org/publications-and-resources/clinical-proceedings/RHE>

Fish Facts for Health Professional: Methylmercury Exposure and Health Effects and Four web based modules

www.fish-facts.org



Summary

- To maximize the benefits of fish ingestion avoid certain types of fish.
- Children and women of child bearing age, in particular, should avoid/limit ingestion of certain types of fish.
- Availability of consumer guides on fish selection and preparation.



MSU/EPA Fish Group

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Funding - Great Lake Restoration Initiative EPA GL-00E00461



Michigan (MSU) Post-Test

Name: _____

April 15, 2013

1. What does the American Heart Association recommend regarding ingestion of fish?
 a. A three-ounce serving of oily fish at least once per week
 b. A three ounce serving of oily fish daily twice per week
 c. A six ounce serving of oily fish at least twice per week
 d. A six ounce serving of oily fish daily once per week
 e. A six ounce serving of oily fish at least three times per week

2. Which of the following fatty acids is an essential fatty acid that cannot be made by humans?
 a. Eicosapentaenoic acid
 b. Oleic acid
 c. Stearic acid
 d. α -linolenic acid
 e. Arachidonic acid

3. Which of the following fish is considered an oily fish?
 a. Trout
 b. Pollock
 c. Catfish
 d. Canned tuna
 e. Cod

4. What is the recommended daily dose of fish oil as primary cardiovascular prevention?
 a. 100 milligrams
 b. 200 milligrams
 c. 300 milligrams
 d. 500 milligrams
 e. 4000 milligrams

5. Which cardiovascular benefit of fish oil has a linear relationship with increasing dose of fish oil?
 a. Anti-arrhythmic
 b. Primary cardiovascular mortality prevention
 c. Anti-thrombosis
 d. Triglyceride lowering
 e. Blood pressure lowering

6. The primary adverse health effects of mercury involve?
- a. Digestive tract
 - b. Bone marrow
 - c. Skin
 - d. Pulmonary system
 - e. Central nervous system
7. The amount of mercury ingested from fish can be reduced by which of the following approaches?
- a. Broiling the fish
 - b. Eating certain species of fish
 - c. Removing fatty parts of the fish
 - d. Eating only store-bought fish
 - e. Eating only fresh fish
8. The amount of chlorinated hydrocarbons ingested from fish can be reduced by which of the following approaches?
- a. Eating only store bought fish
 - b. Eating only fresh fish
 - c. Frying the fish
 - d. Removing fatty parts of the fish
 - e. Eating only recreational caught fish
9. Group considered at highest risk for mercury toxicity are?
- a. Elderly
 - b. Children
 - c. Minorities
 - d. Patients with heart disease
 - e. Patients with cancer
10. Because of mercury concentration the following species of fish/shellfish should not be eaten:
- a. Salmon
 - b. Shrimp
 - c. Scallops
 - d. Tilapia
 - e. Swordfish

MSU Post-test Results

Michigan (MSU) Post-Test Results

N = 8

The number of HCP responses is given at the end of each possible answer. The correct answer is in **bold**.

1. What does the American Heart Association recommend regarding ingestion of fish?
 - a. A three-ounce serving of oily fish at least once per week = 0
 - b. A three ounce serving of oily fish daily twice per week = 2
 - c. **A six ounce serving of oily fish at least twice per week = 6**
 - d. A six ounce serving of oily fish daily once per week = 0
 - e. A six ounce serving of oily fish at least three times per week = 0
2. Which of the following fatty acids is an essential fatty acid that cannot be made by humans?
 - a. Eicosapentaenoic acid = 5
 - b. Oleic acid = 0
 - c. Stearic acid = 0
 - d. **α -linolenic acid = 1**
 - e. Arachidonic acid = 0Not answered = 2
3. Which of the following fish is considered an oily fish?
 - a. **Trout = 6**
 - b. Pollock = 0
 - c. Catfish = 0
 - d. Canned tuna = 2
 - e. Cod = 0
4. What is the recommended daily dose of fish oil as primary cardiovascular prevention?
 - a. 100 milligrams = 1
 - b. 200 milligrams = 1
 - c. 300 milligrams = 1
 - d. **500 milligrams = 5**
 - e. 4000 milligrams = 0
5. Which cardiovascular benefit of fish oil has a linear relationship with increasing dose of fish oil?
 - a. Anti-arrhythmic = 1
 - b. Primary cardiovascular mortality prevention = 3

- c. Anti-thrombosis = 0
 - d. **Triglyceride lowering = 4**
 - e. Blood pressure lowering = 0
6. The primary adverse health effects of mercury involve?
- a. Digestive tract = 0
 - b. Bone marrow = 0
 - c. Skin = 0
 - d. Pulmonary system = 0
 - e. **Central nervous system = 8**
7. The amount of mercury ingested from fish can be reduced by which of the following approaches?
- a. Broiling the fish = 0
 - b. **Eating certain species of fish = 8**
 - c. Removing fatty parts of the fish = 0
 - d. Eating only store-bought fish = 0
 - e. Eating only fresh fish = 0
8. The amount of chlorinated hydrocarbons ingested from fish can be reduced by which of the following approaches?
- a. Eating only store bought fish = 1
 - b. Eating only fresh fish = 0
 - c. Frying the fish = 0
 - d. **Removing fatty parts of the fish = 7**
 - e. Eating only recreational caught fish = 0
9. Group considered at highest risk for mercury toxicity are?
- a. Elderly = 0
 - b. **Children = 8**
 - c. Minorities = 0
 - d. Patients with heart disease = 0
 - e. Patients with cancer = 0
10. Because of mercury concentration the following species of fish/shellfish should not be eaten:
- a. Salmon = 0
 - b. Shrimp = 0
 - c. Scallops = 0
 - d. Tilapia = 0
 - e. **Swordfish = 8**

MSU Individual Course Evaluation

Michigan (MSU) – Eating Fish, Maximizing Benefits - Evaluation

Name: _____

April 15, 2013

1. Was the content clear and useful?

Yes No

Comment - explain your reasons

2. Was the material credible with adequate science literature cited?

Yes No

Comment - explain your reasons

3. Was the content presented at an appropriate level to your expertise?

Yes No

Comment - explain your reasons

4. Was there additional information you wish had been included?

Yes No

Comment - explain your reasons

5. Please enter any additional comments on the course in the space below

Did this course prepare you to:

6. Describe the benefits of polyunsaturated fatty acids

Agree

Disagree

No answer

Comment - explain your reasons

7. Discuss the risks of eating fish.

Agree

Disagree

No answer

Comment - explain your reasons

8. Describe the risks and benefits of store-bought and recreationally caught fish.

Agree

Disagree

No answer

Comment - explain your reasons

9. Advise patients on safe consumption of fish.

Agree

Disagree

No answer

Comment - explain your reasons

10. Access national and local fish advisories.

Agree

Disagree

No answer

Comment - explain your reasons

MSU Individual Course Evaluation Results

Michigan (MSU) – Eating Fish, Maximizing Benefits - Evaluation Results

N=7

1. **Was the content clear and useful?**

Yes No No answer

- No answer. *Fair.*
- (3) No answer. *Some clear and useful, some not.*
- No answer. *The simpler material was helpful and will be useful in the future. Some of the more in-depth was helpful for reference.*
- No. *Too many confusing slides.*

2. **Was the material credible with adequate science literature cited?**

Yes No No answer

- Yes. *Too much citing. Esp. CV benefit studies. Summarize.*

3. **Was the content presented at an appropriate level to your expertise?**

Yes No No answer

- No answer. *Mostly. Some of the scientific data was over my head.*
- No answer. *For the most part. Some of the research was a little hard to focus on.*

4. **Was there additional information you wish had been included?**

Yes No No answer

- Yes. *I think it should be simplified.*
- Yes. *More of our local fish... but of course, this was from Michigan.*
- Yes. *More summary of messages to give patients.*
- Yes. *Local information which I realize will eventually be presented.*
- Yes. *Clear patient information.*
- No answer. *Simplify message. Be clear.*

5. **Additional comments:**

- *The information needs to be presented in the simplest form to relay this info to our patients*
- *More detail than we needed. Wanted more simple summaries.*
- *Tables in general: Fish vs fish oil, awareness of advisory, mercury content – not helpful. Like: list benefits, fatty acids, CV benefits.*
- *Quick bullet points info sticks with me better than a lot of words or data.*

Did this course prepare you to:

6. Describe the benefits of polyunsaturated fatty acids
7. Discuss the risks of eating fish.
8. Describe the risks and benefits of store-bought and recreationally caught fish.
9. Advise patients on safe consumption of fish.
10. Access national and local fish advisories.

Learner	Q6	Q7	Q8	Q9	Q10
N1	Disagree	Agree	Agree	Disagree	Agree
N2	Disagree	Agree	Agree	Agree	Agree
N3	No Answer	Agree	Agree	Agree	Disagree
N5	Agree	Agree	Agree	Agree	Agree
N6	Agree	Agree	Agree	Agree	Agree
D1	Disagree	Agree	Agree	Agree	Agree
D2	Disagree	Agree	Agree	Agree	Agree

- N1, Q8. *Too complicated.*
- N3, Q6. *Somewhat*
- N3, Q10. *Not really*
- N6, Q7. *More info on risks than benefits.*
- N6, Q9. *A little complex – would like it streamlined.*
- N6m Q10. *Maybe.*

Stony Brook Curriculum

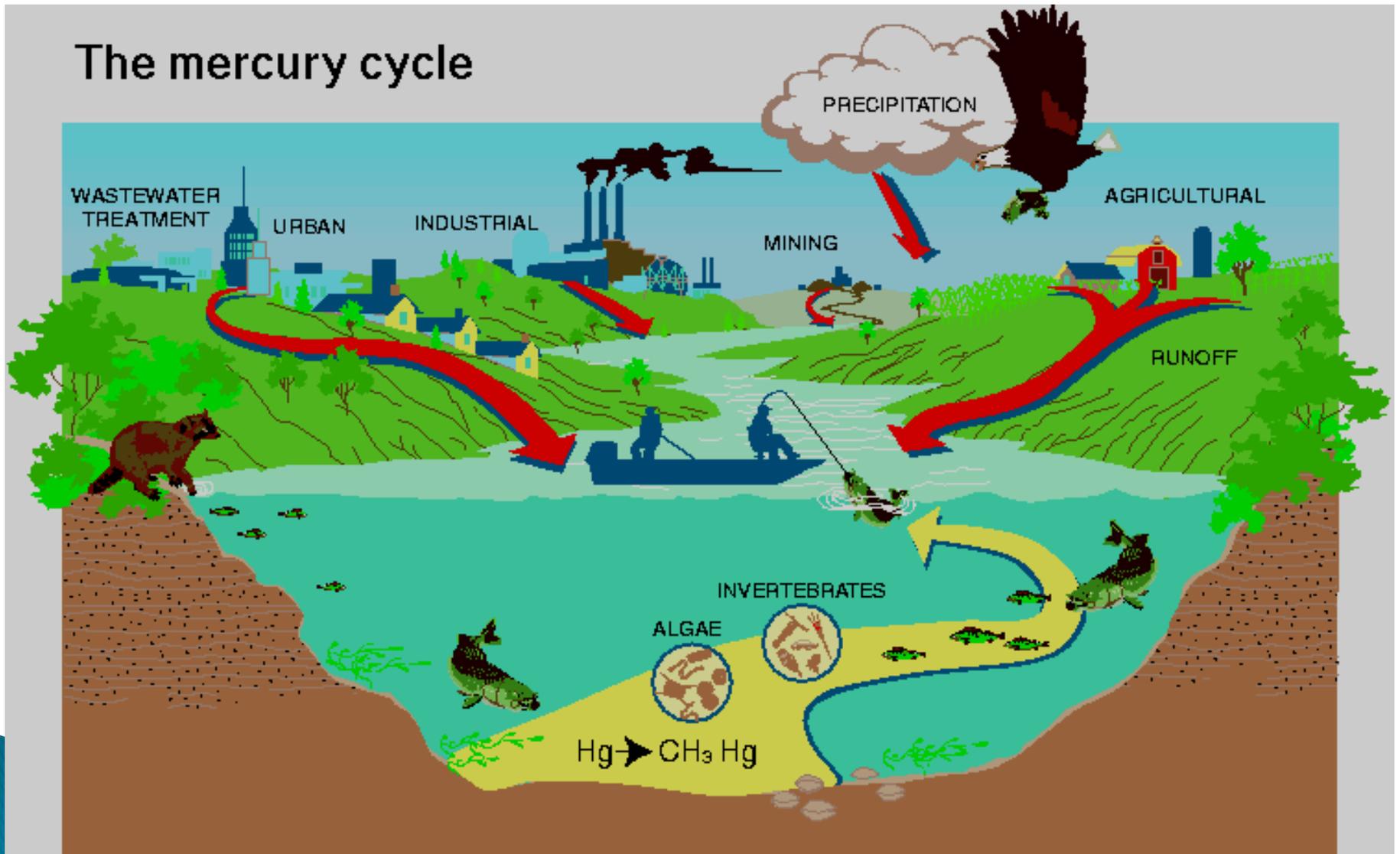


Recognizing and Preventing Overexposure to Methylmercury from Fish & Seafood Consumption: Information for Physicians

*Adapted from manuscript of the same title published
in the Journal of Toxicology, Volume 2011, Article ID
983072, doi: 10.1155/2011/983072*

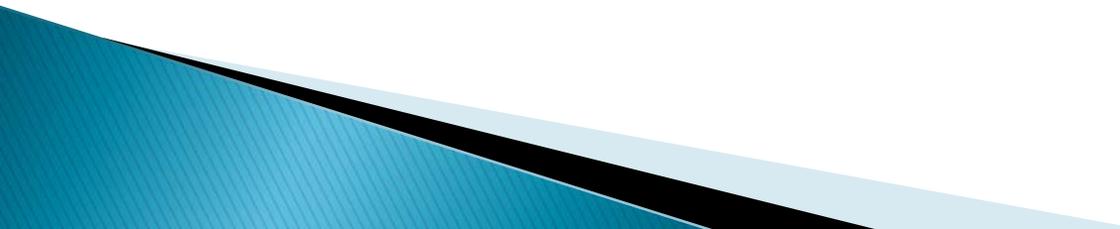
How does MeHg get into fish?

The mercury cycle



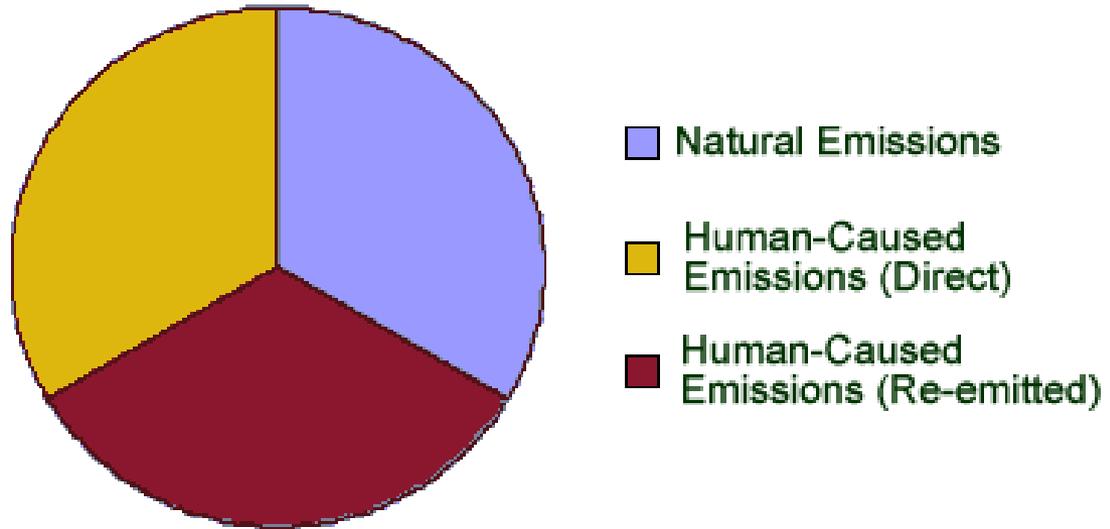
(Illustration by Connie J. Dean, U.S. Geological Survey)

Formed in the Environment

- ▶ Methylmercury is formed in the environment (in water bodies and wetlands) by micro-organisms that convert inorganic mercury to the organic (methylated) form.
 - ▶ Inorganic mercury enters the environment from a variety of natural and anthropogenic sources.
- 

Sources of Mercury Pollution

- ▶ Roughly 1 / 3 of emissions are naturally occurring (e.g., volcanoes, weathering)
- ▶ Roughly 2 / 3 are from anthropogenic sources
 - The U.S. is estimated as the #3 producer of anthropogenic mercury emissions at about 3% of global emissions; Asia produces about 53%



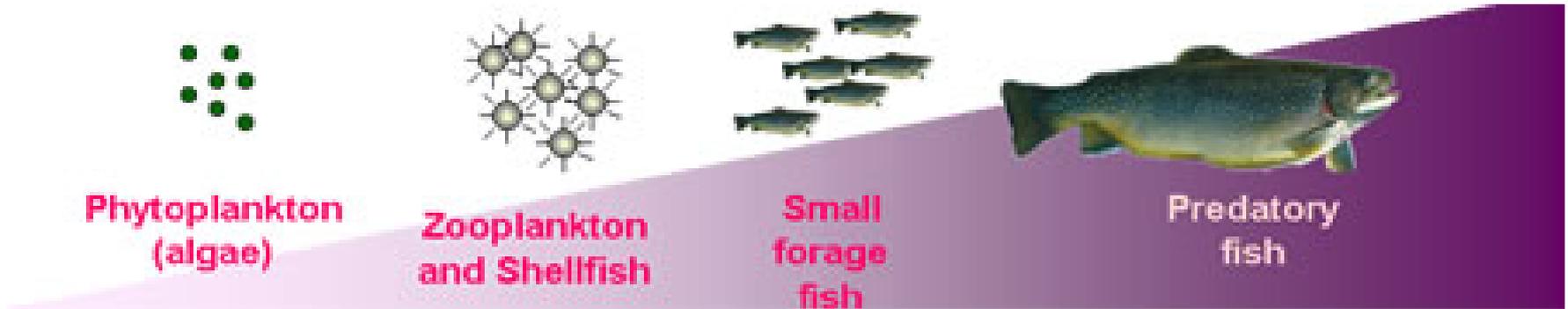
(Seigneur, 2004 and Mason and Shue, 2002)

(<http://www.epa.gov/mercury/about.htm>)

Mercury Sources in the Environment

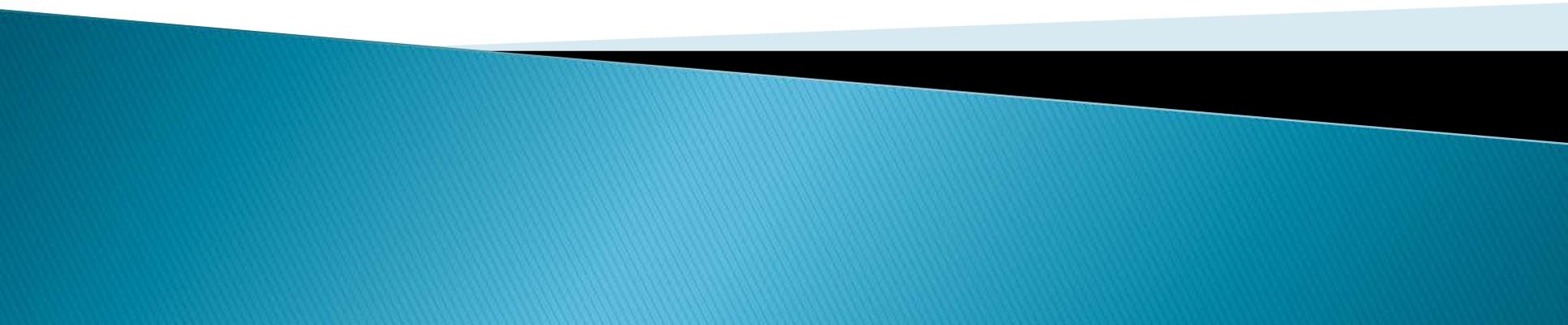
- ▶ Largest source is fossil fuel (mostly coal) combustion for energy production
 - Concentrations in the global environment have increased about 3 fold from anthropogenic activities
- ▶ Gold mining is now estimated to be a significant source
- ▶ Cement kilns, chlor-alkaloi plants, medical waste & fluorescent light bulbs are also sources

How does mercury get into fish?

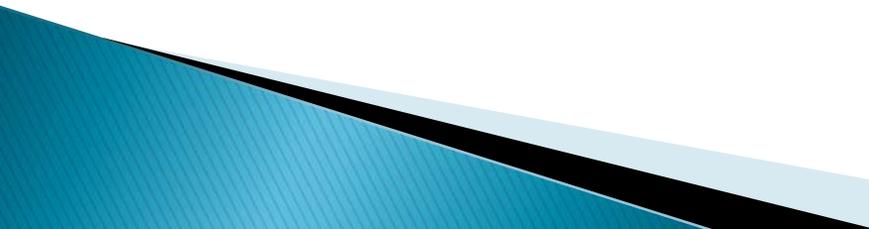


- ▶ Inorganic mercury enters aquatic systems from air and water discharges and natural sources
- ▶ Some is methylated by microorganisms
- ▶ MeHg accumulates and is biomagnified in the food chain
- ▶ By far the biggest bioconcentration step is from water to phytoplankton ($\sim 10^5 \times$)
- ▶ Longest lived, predatory fish contain the highest levels

**What Happens in the Body
When MeHg is consumed?
&
Identifying Patients with
Health Effects**



Methylmercury in the Body

- ▶ >95% of MeHg is absorbed in the gastrointestinal tract and distributed via the blood to all organs.
 - ▶ MeHg crosses the blood–brain barrier and about 10% of body burden is in the brain.
 - ▶ MeHg and demethylated (inorganic) mercury are gradually removed from the body, mainly via liver bile and feces.
 - ▶ MeHg is also excreted in urine, sweat and breast milk, and stored in hair and nails.
- 

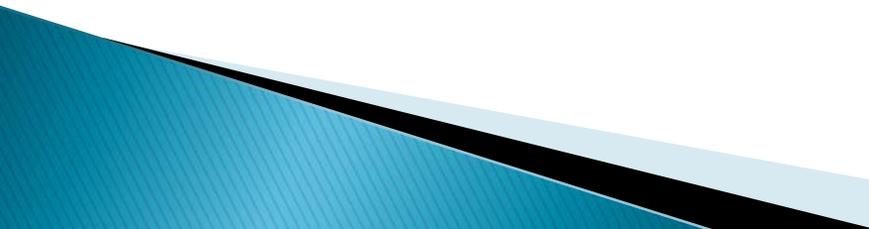
MeHg in the Body, continued

- ▶ The half-life of MeHg in blood is about 50–70 days in adults (longer in neonates). I.e., once exposure ceases, the blood level decreases by about half, each 50–70 days.
 - ▶ MeHg crosses the placenta and the blood–brain barrier. Levels in umbilical cord blood are about 1.7x higher than maternal blood levels.
- 

Clinical MeHg Poisoning

- ▶ Some people eat a great deal of fish, as often as 5 to 20 meals per week.
 - ▶ Some fish lovers also prefer to eat predatory species like swordfish and tuna that contain high mercury levels.
 - ▶ Such individuals can get extraordinarily high doses of methylmercury from their diets, and some may develop clinical MeHg toxicity.
 - ▶ Cases of methylmercury poisoning are rare and most physicians have never encountered one; symptoms may easily go unrecognized unless dietary habits are considered.
- 

Identifying Patients with MeHg Poisoning

- ▶ Clinical manifestations vary with intensity and duration of exposure
 - ▶ Symptoms can vary significantly among individuals
 - ▶ Symptoms may be delayed from time of exposure
 - ▶ Symptoms may emerge when body's ability to compensate for the damage is depleted
 - ▶ Genetic variation or food/nutrient interactions may affect mercury metabolism
- 

(Nonspecific) symptoms associated with chronic lower level MeHg exposure:

- ▶ sleep disturbance
- ▶ headache
- ▶ fatigue
- ▶ difficulty concentrating
- ▶ depression
- ▶ memory loss
- ▶ diminished fine motor coordination
- ▶ muscle and joint pain
- ▶ gastrointestinal upset
- ▶ hair thinning
- ▶ heart rate disturbance
- ▶ hypertension
- ▶ tremor
- ▶ numbness or tingling around the mouth

Symptoms associated with higher MeHg exposures:

- ▶ numbness or tingling in hands and feet
- ▶ clumsy gait, difficulty walking (ataxia)
- ▶ slurred speech
- ▶ tunnel vision
- ▶ diminished visual acuity

Symptoms from lower-level exposure list may (or may not) also be present

Variability of symptoms

- ▶ Multiple research studies and personal observations by the authors indicate that individuals vary widely in sensitivity to MeHg toxicity.
 - ▶ Milder symptoms have been seen at relatively low blood mercury levels (e.g. 15–25 $\mu\text{g}/\text{L}$).
 - ▶ People vary in susceptibility to mercury, and not everyone with high exposure experiences adverse effects.
- 

Minamata Disease

- ▶ MeHg exposure occurred as a result of wastewater from acetaldehyde production released into Minamata Bay, Japan from 1932–1968
- ▶ Health effects were devastating:
 - Congenital Minamata Disease (extreme example): blindness, mental retardation, cerebral palsy
 - Delayed development and impaired neurobehavioral performance
- ▶ Adults Symptoms (Hair level > 20 ppm)
 - Tingling and paresthesias (lips, fingers)
 - Difficulty speaking
 - Tunnel Vision
 - Blindness, Coma, Convulsions, Death
 - Subclinical: no apparent effects

Cases of MeHg Poisoning

A middle-aged company executive who ate about 14 fish meals per week, often choosing tuna and swordfish, experienced numbness around his mouth. About a year later he had trouble running, playing tennis and eventually walking. He underwent numerous tests but was not correctly diagnosed for more than a year. At that point his blood mercury level was 76 $\mu\text{g}/\text{L}$.

<http://www.stonybrook.edu/commcms/gelfond/physicians/cases.html>

Cases of MeHg Poisoning

A 40-year-old lawyer who ate fish three or four times a week, primarily sea bass, could not sleep and lost his ability to concentrate.

His hair contained 13 ppm and his blood Hg level was 58 $\mu\text{g}/\text{L}$.



Cases of MeHg Poisoning

A middle-aged sales manager ate fish eight or nine times a week, usually choosing tuna, swordfish, halibut or sea bass. She experienced chronic fatigue, muscle aches, memory and concentration loss, and thinning of hair. When diagnosed, her blood mercury level was $76 \mu\text{g}/\text{L}$.



Cases of MeHg Poisoning

A 66-year-old guitarist experienced a loss of fine motor coordination that affected her ability to play her instrument. She also had muscle weakness, thinning hair, and hand tremors. She had been eating swordfish and tuna steaks four to five times a week. Her blood mercury was $38 \mu\text{g}/\text{L}$.



Cases of MeHg Poisoning

A 64-year-old anthropologist who ate fish nine times a week, often choosing tuna, swordfish, sea bass, and halibut, suffered from chronic fatigue, headaches, memory loss and hair loss. Her blood mercury level at diagnosis was 21 $\mu\text{g}/\text{L}$.

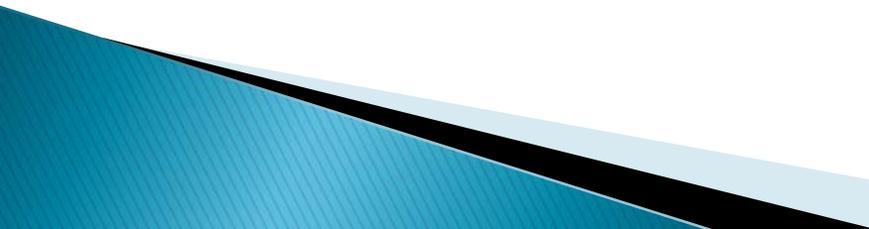


Cases of MeHg Poisoning

A 10-year-old boy who had always been an “A” student began having problems concentrating and completing assignments in school. He lost his ability to catch a ball and developed hand tremors. He had eaten a can of tuna every day for a year. His blood mercury level was above 60 $\mu\text{g}/\text{L}$.



Laboratory Tests

- ▶ Blood mercury test should be done for patients with suspected elevated MeHg exposure from eating fish and shellfish. Blood mercury levels reflect recent exposures as well as chronic accumulation.
 - ▶ Hair may also be analyzed. Hair mercury levels reflect longer-term exposure and help to distinguish organic from inorganic or elemental mercury exposure.
- 

Interpreting Test Results

- ▶ Urine tests primarily reflect inorganic and elemental mercury exposures.
- ▶ In general, a low urine mercury test ($<10 \mu\text{g/L}$) in combination with elevated blood ($>5 \mu\text{g/L}$) or hair ($>1 \mu\text{g/L}$) mercury points to MeHg exposure from seafood consumption.
- ▶ Most clinical analyses of blood or hair are for total mercury; this is the appropriate measure for suspected exposure from seafood consumption and in the absence of unusual exposures to elemental or inorganic mercury.

Interpreting Test Results

- ▶ Geometric mean blood levels in the USA based on NHANES data are:
 - $< 1 \mu\text{g/L}$ for ≤ 29 years of age
 - About $1 \mu\text{g/L}$ for ≥ 30 years of age
- ▶ Blood mercury levels tend to increase with age and peak in the 5th or 6th decade, depending on race and ethnicity.
- ▶ Between 5–9 percent of women of childbearing age may have blood mercury levels above $5 \mu\text{g/L}$ (varies across the U.S. from region to region)
- ▶ NYC Dept. Public Health study found 24% of women of childbearing age and 50% of Asians to be above $5 \mu\text{g/L}$.

Interpreting Blood or Hair Mercury Levels

- The EPA has defined excessive blood mercury in women of childbearing age as about 5 $\mu\text{g}/\text{L}$ (which corresponds to about 1 $\mu\text{g}/\text{g}$ in hair)
- There is no comparable definition of acceptable blood or hair mercury in the rest of the population.
- The Centers for Disease Control and Prevention define “excessive” mercury exposure as $> 10 \mu\text{g}/\text{L}$ in blood
- Many laboratories only report values $> 10 \mu\text{g}/\text{L}$, so blood mercury levels $>$ EPA RfD (5.8 $\mu\text{g}/\text{L}$) might be missed.
- Need to request labs to report specific results, even if below $<5 \mu\text{g}/\text{L}$.

Interpreting Blood Mercury Levels

- ▶ To protect against prenatal brain damage:
Research since the RfD was developed in 1999 suggests that there is no threshold for adverse effects of MeHg. Pregnant women should continue to eat fish but keep their mercury exposure as low as possible by choosing only low-Hg fish.
- ▶ For all others:
The authors of this course believe a blood mercury level of $\geq 5 \mu\text{g}/\text{L}$ calls for counseling of patients regarding their fish consumption, emphasizing the need to choose low mercury species.

Who is at risk of high blood MeHg?

- ▶ Blood mercury levels are strongly correlated with fish consumption
- ▶ Levels are higher in ethnic groups that eat more fish (Native American, Asian, Pacific Islanders)
- ▶ Levels are higher among those with higher incomes
- ▶ Levels are higher among those who live on the coasts



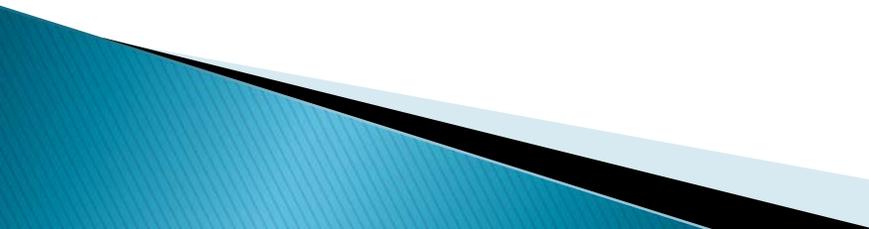
Interpreting Hair Mercury Levels

- ▶ Most people have hair mercury levels well below 1 $\mu\text{g/g}$ (1 ppm), the level in hair associated with the RfD.
 - For the USA the average is about 0.5 ppm
 - Different subgroups have higher levels of about 1 ppm
- ▶ Neuropsychological functional deficits have been reported in adults with average hair levels of 4.2 ppm.
- ▶ Prenatal neurodevelopmental effects have been associated with maternal hair levels of 1.2 ppm or higher.
- ▶ Postnatal cognitive effects have been associated with child hair levels greater than 0.96 ppm.

Recommended Action for Patients with High Blood or Hair Mercury

- 1) Stop eating fish temporarily or shift to very low-mercury fish.
- 2) Once blood mercury has declined to a lower level ($<5 \mu\text{g/L}$) and symptoms (if any) have resolved, low-mercury fish and shellfish can be reintroduced to the diet.

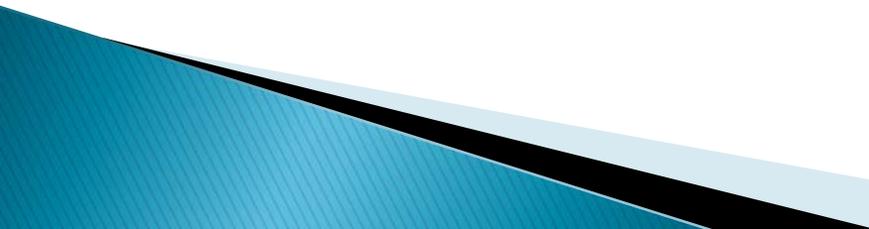
Is Chelation Recommended?

- ▶ Chelation can be a valuable intervention for inorganic mercury poisoning, but it poses its own risks.
 - ▶ Except in rare cases, it is not generally warranted for patients with elevated MeHg from fish consumption.
 - ▶ Some practitioners mistakenly use DMSA or DMPS provocation challenge when they test a patient's urine for mercury. This gives highly misleading results that overestimate mercury exposure.
- 

Benefits and Risks of Fish Consumption & Current Government Advice



Prenatal Benefits of Seafood Consumption

- ▶ Fish consumption during pregnancy has nutritional benefits that improve cognitive performance in children of women who ate low-mercury fish during pregnancy.
 - ▶ Mothers-to-be should be encouraged to eat low-mercury fish.
- 

Adverse Effects of MeHg Exposure

- ▶ The developing nervous system is particularly vulnerable to MeHg. Effects depend on both the dose and timing of exposure.
- ▶ Prenatal exposure can result in:
 - cognitive deficits
 - motor skill effects
 - attention deficits
 - language skill deficiencies
 - decreased learning capacity and memory

Adult Fish Consumption: Lifelong Benefits vs. Risks

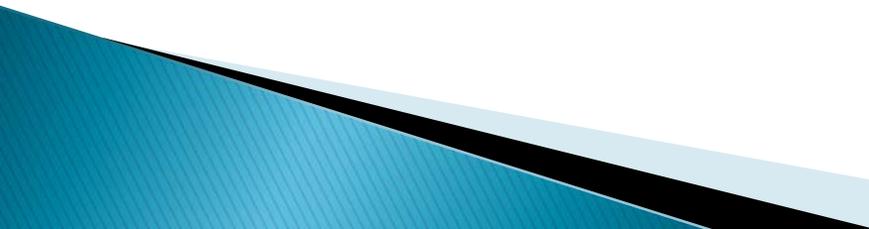
Benefits

- ▶ Improved blood lipid profiles
- ▶ Decreased risk of heart disease
- ▶ Lowered blood pressure
- ▶ Improvements in rheumatoid arthritis
- ▶ Prevention of macular degeneration
- ▶ Improvements in neurological and psychological disorders such as depression and Parkinson's

Risks (MeHg and other contaminants)

- ▶ Neurological effects of elevated MeHg exposure
- ▶ Increased heart rate and blood pressure
- ▶ Greater risk of myocardial infarction
- ▶ May alter immune and/or endocrine system function
- ▶ Possible elevated cancer risk

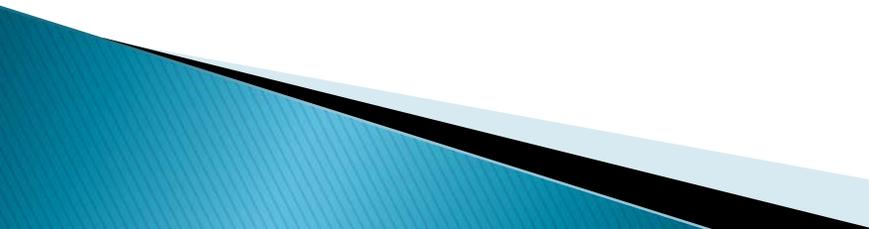
Populations at Risk

- ▶ Methylmercury poses different risks to different people.
 - ▶ The fetus—prenatal brain development—is now thought to be the most sensitive population, so risk management targets pregnant women.
 - ▶ Young children's developing brains are also at risk, so breastfeeding women and parents of children up to 12 years also need guidance.
 - ▶ People who eat a great deal of fish—more than two meals per week—generally have higher exposure to MeHg and are at the greatest risk of harm.
- 

Implications For Physicians

- ▶ Physicians encounter methylmercury risk issues in two contexts:
 - ▶ They may need to advise pregnant women and parents of young children on ways to manage their MeHg exposure by choosing lower-mercury seafood.
 - ▶ They should routinely ask patients about their fish consumption and should consider MeHg as a possible cause of otherwise unexplained neurological symptoms in high-end fish consumers.
- 

How much is too much MeHg?

- ▶ In 1999 the US EPA established a reference dose (RfD) for methylmercury.
 - ▶ The RfD is designed to protect against the effects of methylmercury on prenatal brain development.
 - ▶ It represents a level of dietary exposure that should be safe for sensitive individuals.
 - ▶ The EPA based the RfD on a 1997 study in the Faroe Islands.
- 

The US Reference Dose

- ▶ Data from the Faroes showed a significant adverse effect on prenatal brain development at a fetal blood mercury level of 58 $\mu\text{g}/\text{L}$.
- ▶ EPA applied a 10-fold “uncertainty factor” and estimated 5.8 $\mu\text{g}/\text{L}$ to be a safe blood level.
- ▶ Using a pharmacodynamic model, EPA set the RfD at a dietary intake of 0.1 μg mercury per kg body weight per day.
 - Corresponds to a blood level of 5.8 $\mu\text{g}/\text{L}$ or a hair level of about 1 $\mu\text{g}/\text{g}$ (or 1 ppm).

Limitations of the RfD

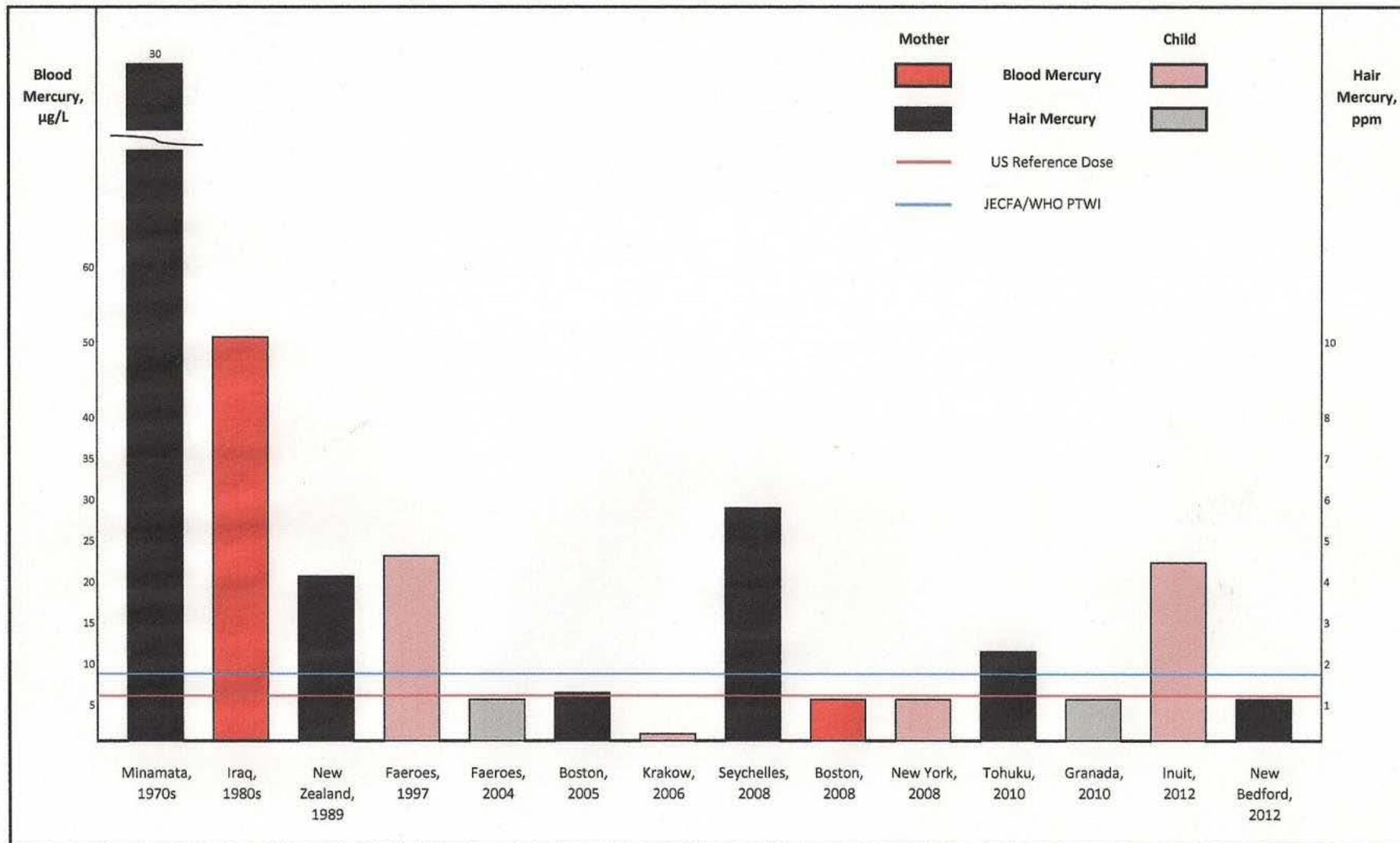
Research since 1999 has shown:

- ▶ Umbilical cord blood mercury levels are higher than maternal blood levels by a factor of about 1.7X; thus the target level in maternal blood would be $< 3.5 \mu\text{g/L}$.
- ▶ Several epidemiological studies since 2005 have now reported adverse effects of mercury on the developing brain at blood levels around or below the US RfD.

Harm at Lower Doses

- ▶ The next slide compares levels of mercury in blood or hair associated with damage to the developing brain, historically (starting with the Minamata disaster) and in 10 recent studies.
- ▶ The Faroes study (pink bar, 4th from left) was the basis for the US RfD; that study showed adverse effects at a fetal blood level of 58 $\mu\text{g}/\text{L}$.
- ▶ The red horizontal line represents the US RfD, a blood level of 5.8 $\mu\text{g}/\text{L}$, or a hair level of 1 ppm.
- ▶ Eight recent studies have found adverse effects at doses from just above to well below the RfD.

Figure 1. Methylmercury Levels in Blood and Hair Associated with Adverse Neurodevelopmental Effects, 1960-2012



E. Groth, PhD., "An Overview of the Evidence for the Effects of Methylmercury on Brain Development, and a Rationale for a Lower Definition of Tolerable Exposure", report for Zero Mercury Working Group. December 2012.

http://www.zeromercury.org/phocadownload/Developments_at_UNEP_level/INC5/groth_report_zmwg%20rev.pdf

Our advice on using the RfD

- ▶ For pregnant or breastfeeding women and children, the current RfD appears to offer no margin of safety. Advice should aim to keep women and children's exposure well below the RfD.
 - ▶ There is no definition of "safe exposure" for non-pregnant adults who eat a great deal of fish and have elevated mercury exposure. For those populations, the current RfD is probably a sensible exposure limit.
- 

Federal fish consumption advice

- ▶ The US FDA and US EPA issued joint fish consumption advice in 2004.
 - ▶ The advice is aimed at women of childbearing age, pregnant and nursing women, and parents of young children.
 - ▶ The agencies encourage those populations to eat fish for its nutritional benefits, but also to be aware of the risks of MeHg exposure.
- 

2004 EPA/FDA Advisory

- ▶ Do not eat Shark, Swordfish, King Mackerel, or Tilefish, which contain very high levels of mercury.
- ▶ Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
 - Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
 - Albacore ("white") tuna has more mercury than canned light tuna. So, eat up to 6 ounces (one average meal) of albacore tuna per week.
- ▶ Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don't consume any other fish during that week."

Limitations of the Advisory

- ▶ Since 2004, research has shown substantial nutritional benefits to the developing brain from fish consumption during pregnancy.
 - ▶ Research in the same timeframe, just cited here, has shown adverse effects of mercury on brain development at levels far below what was recognized in 2004.
 - ▶ EPA/FDA are now updating the advisory to incorporate current perspectives on benefits and risks of fish consumption.
- 

Prevention & Risk Communication- What to advise patients



The key message:

The health benefits of eating seafood exceed the risks from MeHg as long as the fish consumed are mostly low in mercury.



What to Advise Patients?

- ▶ Fish is a good source of protein and is low in saturated fats.
- ▶ Advise fish eaters to choose low-contaminant, high omega-3 fatty acid varieties, and to limit consumption of higher mercury fish.
- ▶ Pregnant women, women who are breastfeeding, women who plan to be pregnant within a year, and children less than 12 years old should eat only lowest-mercury fish (<0.05 ppm Hg).



Other contaminants in fish

- ▶ Fish also contain persistent organic pollutants (POPs) such as PCBs.
 - ▶ POPs have their own negative health effects that may offset some of the benefits of fish consumption.
 - ▶ Fat from pork, beef and chicken contain POPs at lower levels than in fish, but are consumed in greater quantities than fish.
- 

Can you avoid contaminants?

- ▶ Mercury accumulates in fish muscle and levels are not reduced by cooking or preparation.
- ▶ Persistent organic pollutants (POPs) like PCBs accumulate in fat and exposures can be decreased by removing skin and fatty tissue (darker color) and letting fat drip off during cooking.



How many fish meals per week?

MeHg dose depends on:

- how often one eats fish
- a person's body weight
- the portion size, and
- the mercury content of the fish choice.

Also important:

- individual health considerations such as pregnancy status.



How many fish meals per week?



- ▶ USDA dietary guidelines recommend 2 meals per week (a total of 8 ounces of seafood per week; less for children) of a variety of fish.
- ▶ We note:
 - Mercury concentrations vary widely in fish
 - USDA recommended adult portion sizes (2–3 oz) are much smaller than average American serving sizes
 - Portion sizes for children are about 1 oz. per 20 pounds of body weight

Fish with Highest Mercury

Bluefin Tuna 0.80 ppm



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THE UNITED NATIONS

Swordfish 0.90 ppm



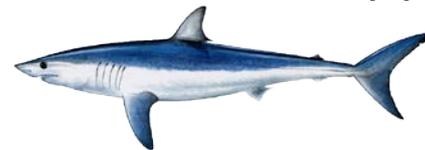
FLORIDA FISH AND WILDLIFE CONSERVATION
COMMISSION / DIANE ROME PEEBLES

King Mackerel 1.10 ppm

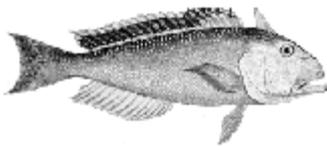


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COMMISSION / DIANE ROME PEEBLES

Mako Shark 1.26 ppm



Gulf of Mexico Tilefish 1.44 ppm



FROM THE NORA FISHERIES NORTHEAST
FISHERIES SCIENCE CENTER

Marlin 1.52 ppm



FLORIDA FISH AND WILDLIFE CONSERVATION
COMMISSION / DIANE ROME PEEBLES

Adapted from Karimi et al, EHP (2012) and E. Groth III, Env. Research 110 (2010)

Fish with High Mercury

Grouper 0.42 ppm



DUANE RAEER

Spanish Mackerel
0.44 ppm



FLORIDA FISH AND WILDLIFE CONSERVATION
COMMISSION / DIANE ROME PEEBLES

Orange Roughy 0.51 ppm



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Bigeye Tuna 0.58 ppm



FOOD AND AGRICULTURE ORGANIZATION OF
THE UNITED NATIONS

Fish with Moderately High Mercury

Albacore Tuna 0.33 ppm



US FOOD AND DRUG ADMINISTRATION'S
REGULATORY FISH ENCYCLOPEDIA

Yellowfin tuna 0.27 ppm



US FOOD AND DRUG ADMINISTRATION'S
REGULATORY FISH ENCYCLOPEDIA

Wild Striped Bass 0.30 ppm



US FISH AND WILDLIFE SERVICE NATIONAL
IMAGE LIBRARY

Halibut 0.25 ppm



THE ALASKA FISHERIES SCIENCE CENTER

Bluefish 0.35 ppm



FOOD AND AGRICULTURE ORGANIZATION OF
THE UNITED NATIONS

Eel, American 0.19 ppm



US FISH AND WILDLIFE SERVICE NATIONAL
IMAGE LIBRARY

American Lobster
0.20 ppm



Canned tuna fish is the largest source of Americans' MeHg exposure

- ▶ Canned tuna accounts for 33% of total exposure. Chunk light tuna (0.12 ppm) has less mercury than albacore/“white” tuna (0.33 ppm)
- ▶ Tuna used in sushi
 - “Ahi” can be Yellowfin (0.27 ppm) or Bigeye (0.58 ppm)
 - “Maguro” is Bluefin (0.80 ppm).



Groth, E. III, “Ranking the contributions of commercial fish and shellfish varieties to mercury exposure in the United States: Implications for risk communication”, *Environmental Research*, 110 (2010) 226–236.

Karimi et al., *A Quantitative Synthesis of Mercury in Commercial Seafood and Implications for Exposure in the U.S.*, 2012, EHP.

Fish & Shellfish with Lowest Mercury



Catfish (farmed)	0.01 ppm
☺ Oysters	0.02 ppm
Tilapia (US; farmed)	0.02 ppm
Smelt	0.03 ppm
Mussels	0.03 ppm
Clams	0.03 ppm
Crawfish	0.03 ppm
☺ Trout (farmed)	0.03 ppm
Scallops	0.04 ppm
☺ Herring	0.04 ppm
Whiting	0.04 ppm
☺ Salmon	0.05 ppm
Shrimp	0.05 ppm
Squid	0.04 ppm
Mullet	0.05 ppm
Pollock (Pacific)	0.05 ppm

☺ Indicates a good source of omega-3 fatty acids

Low-Moderate Mercury Seafood



😊 Sardines	0.08 ppm
Shad	0.08 ppm
😊 Anchovies	0.10 ppm
Crab	0.10 ppm
Croaker	0.09 ppm
Sole	0.09 ppm

😊 Indicates a good source of omega-3 fatty acids

▶ Adapted from Karimi et al, *EHP* (2012) and E. Groth III, *Env. Research* 110 (2010)

Good News

- ▶ Low-mercury fish and shellfish (<0.08 ppm Hg) account for about 70 percent of the US seafood market.
 - ▶ Lowest-Hg (<0.05 ppm) varieties include many top-selling choices.
 - ▶ Consumers can easily find familiar, tasty and affordable low-mercury choices in local supermarkets.
- 

What about Contaminants in Fish Oil Supplements?

- ▶ Some brands of supplements specify they are molecularly distilled or purified to remove contaminants.
- ▶ Mercury is chemically bound to proteins and not fats and thus should not be present in fish oils.
- ▶ POPs and halogenated natural products do accumulate in fish fats.
- ▶ Lack of government standards on acceptable levels complicates the issue.
- ▶ Prescription medicines are purified.



What about Contaminants in Fish Oil Supplements?

- ▶ Based on current knowledge, the most prudent approach would be to consume a variety of low mercury fish rather than supplements.
- ▶ If supplements are desired, those derived from small, cold water fatty fish such as anchovies, sardines and mackerel are reported to have lower levels of organic contaminants.



Online Seafood Advice



- ▶ Gelfond Fund for Mercury Research & Outreach website provides links to web resources for fish advice.

www.stonybrook.edu/mercury

Other Online Resources

- ▶ Environmental Defense Fund website (www.edf.org) offers conservative fish advice as it considers both Hg and POPs.
 - ▶ [CT](#) and [WA](#) state public health departments also consider both contaminants and both commercial and sport fish in their fish advice.
- 

On-line tools for choosing fish

- ▶ Gotmercury.org and the Natural Resource Defense Council (www.nrdc.org) both offer calculators that estimate safe intakes of various fish based on their average MeHg content and the EPA RfD.
- ▶ Due to variability in MeHg content and the scientifically dated nature of the RfD, on-line calculators should be used only as a general guide and not as an absolute indicator of safe fish servings.

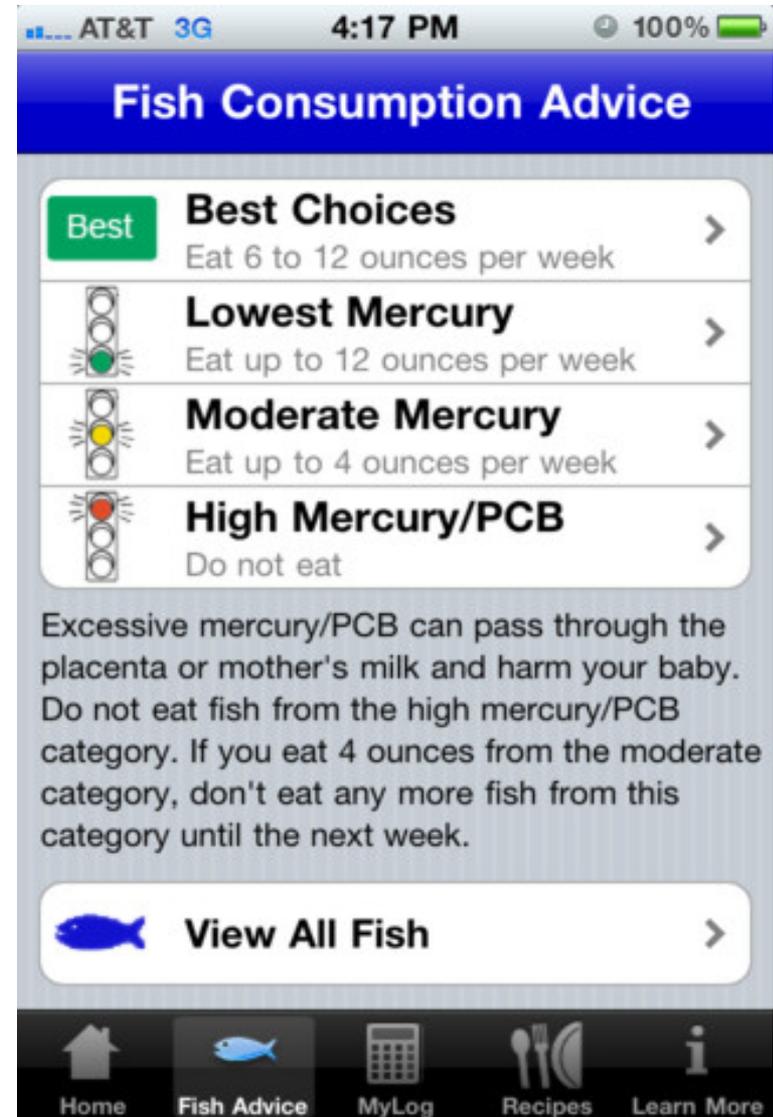
All calculators are not equal



Howmuchfish.com denies and understates mercury risks and suggests fish serving sizes 10 times larger than the EPA RfD suggests is safe.

Iphone Applications

- ▶ **Fish4Health** lists seafood choices by mercury content levels and allows user to select fish and quantity they consume. It calculates and reports daily mercury and omega-3 fatty acids you consume.



Advice for Children

- ▶ Children should be fed smaller portions (1 ounce per 20 pounds of body weight)
- ▶ [Sea Web Kid Safe Seafood](#) considers MeHg and POPs in advice geared specifically for children
- ▶ [Environmental Defense Fund's Seafood Selector](#) includes recommendations on how many meals of specific fish to eat each month to stay below the EPA RfD
 - EDF site considers both MeHg and POPs in advice—so it is more conservative than other advice.
 - EDF also has a sushi guide \
- ▶ [Until the RfD is reassessed these resources should be used only as general guidelines.](#)



Stony Brook University's Gelfond Fund for Mercury Research & Outreach website provides information and links to different web resources about the relationship of mercury and seafood consumption.

www.stonybrook.edu/mercury

Stony Brook Post-Test

Name: _____

April 15, 2013

1. Which of the following statements is NOT true? (Check all that apply)
 a. All forms of mercury - elemental, inorganic, and organic - are toxic.
 b. Methylmercury is formed in the environment by micro-organisms that convert inorganic mercury to the organic (methylated) form.
 c. The largest source of mercury in the environment is fossil fuel combustion.
 d. The highest concentrations of mercury in fish are found close to industrial sources.
 e. Humans are exposed to methylmercury through fish consumption.
2. Symptoms of high level methylmercury exposure include which of the following? (Check all that apply)
 a. Clumsy gait, difficulty walking (ataxia)
 b. Frequent or painful urination
 c. Diminished visual acuity
 d. Numbness or tingling in hands and feet
 e. Slurred speech
3. Blood mercury levels reflect only recent exposures to methylmercury.
 True False
4. Hair mercury levels reflect longer-term exposure.
 True False
5. High urine mercury levels are the best indicator of exposure to mercury from fish consumption.
 True False
6. According to NHANES data, mean blood mercury levels in the U.S. population are roughly:
 a. 2-3 $\mu\text{g/L}$
 b. 3-<5 $\mu\text{g/L}$
 c. 1 $\mu\text{g/L}$
 d. < 8 $\mu\text{g/L}$
7. The EPA has defined excessive blood mercury in women of childbearing age as about:
 a. 5-10 $\mu\text{g/L}$
 b. 10 $\mu\text{g/L}$
 c. 5 $\mu\text{g/L}$
 d. < 10 $\mu\text{g/L}$

8. Prenatal exposure to mercury can result in? (Check all that apply)
- a. Cognitive deficits
 - b. Language skill deficiencies
 - c. Motor skill effects
 - d. Attention deficits
 - e. Decreased learning capacity and memory
9. Which populations are considered at high risk from exposure to methylmercury in fish? (Check all that apply)
- a. The fetus
 - b. People who do not remove fat from fish before cooking
 - c. People who are high consumers of fish, particularly fish high in mercury
 - d. Babies and young children
 - e. Pregnant women
10. Except in rare cases, chelation is not generally warranted for patients with elevated methylmercury from fish consumption.
- True False
11. Health benefits of eating fish always exceed risks from exposure to methylmercury.
- True False
12. Two meals a week of fish low in mercury is a good goal for those who wish to balance benefits and risks of eating fish.
- True False

Stony Brook Post-test Results

Stony Brook Post-Test Results

N = 7

The number of HCP responses is given at the end of each possible answer. The correct answers are in **bold**.

1. Which of the following statements is NOT true? (*Check all that apply*)
 - a. All forms of mercury - elemental, inorganic, and organic - are toxic. = 2
 - b. Methylmercury is formed in the environment by micro-organisms that convert inorganic mercury to the organic (methylated) form. = 0
 - c. The largest source of mercury in the environment is fossil fuel combustion. = 0
 - d. **The highest concentrations of mercury in fish are found close to industrial sources.** = 7
 - e. Humans are exposed to methylmercury through fish consumption. = 0
2. Symptoms of high level methylmercury exposure include which of the following? (*Check all that apply*)
 - a. **Clumsy gait, difficulty walking (ataxia) = 7**
 - b. Frequent or painful urination = 0
 - c. **Diminished visual acuity = 5**
 - d. **Numbness or tingling in hands and feet = 7**
 - e. **Slurred speech = 5**
3. Blood mercury levels reflect only recent exposures to methylmercury.
True = 5 **False = 2**
4. Hair mercury levels reflect longer-term exposure.
True = 7 False = 0
5. High urine mercury levels are the best indicator of exposure to mercury from fish consumption.
True = 0 **False = 6** Not answered = 1
6. According to NHANES data, mean blood mercury levels in the U.S. population are roughly:
 - a. 2-3 $\mu\text{g/L}$ = 2
 - b. 3-<5 $\mu\text{g/L}$ = 1
 - c. **1 $\mu\text{g/L}$ = 3**
 - d. < 8 $\mu\text{g/L}$ = 0Not answered = 1

7. The EPA has defined excessive blood mercury in women of childbearing age as about:
- a. 5-10 $\mu\text{g}/\text{L}$ = 0
 - b. 10 $\mu\text{g}/\text{L}$ = 2
 - c. **5 $\mu\text{g}/\text{L}$ = 5**
 - d. < 10 $\mu\text{g}/\text{L}$ = 0
8. Prenatal exposure to mercury can result in? (Check all that apply)
- a. **Cognitive deficits = 6**
 - b. **Language skill deficiencies = 4**
 - c. **Motor skill effects = 4**
 - d. **Attention deficits = 3**
 - e. **Decreased learning capacity and memory = 7**
9. Which populations are considered at high risk from exposure to methylmercury in fish? (Check all that apply)
- a. **The fetus = 7**
 - b. People who do not remove fat from fish before cooking = 0
 - c. **People who are high consumers of fish, particularly fish high in mercury = 7**
 - d. **Babies and young children = 7**
 - e. Pregnant women = 7
10. Except in rare cases, chelation is not generally warranted for patients with elevated methylmercury from fish consumption.
- True = 7** False = 0
11. Health benefits of eating fish always exceed risks from exposure to methylmercury.
- True = 1 **False = 6**
12. Two meals a week of fish low in mercury is a good goal for those who wish to balance benefits and risks of eating fish.
- True = 7** False = 0

Stony Brook
Individual Course Evaluation

Stony Brook – Recognizing & Preventing Overexposure - Evaluation

Name: _____

April 15, 2013

1. Was the content clear and useful?

Yes No

Comment - explain your reasons

2. Was the material credible with adequate science literature cited?

Yes No

Comment - explain your reasons

3. Was the content presented at an appropriate level to your expertise?

Yes No

Comment - explain your reasons

4. Was there additional information you wish had been included?

Yes No

Comment - explain your reasons

5. Please enter any additional comments on the course in the space below

Did this course prepare you to:

6. Briefly discuss the biomagnification of mercury in the food chain.

Agree

Disagree

No answer

Comment - explain your reasons

7. Describe the action of methylmercury in the human body.

Agree

Disagree

No answer

Comment - explain your reasons

8. Identify patients who are at-risk of health effects from contaminants of fish due to high consumption.

Agree

Disagree

No answer

Comment - explain your reasons

9. Advise and interpret laboratory tests for mercury.

Agree

Disagree

No answer

Comment - explain your reasons

10. Discuss benefits and risks of fish consumption with patients.

Agree

Disagree

No answer

Comment - explain your reasons

Stony Brook
Individual Course Evaluation Results

Stony Brook – Recognizing & Preventing Overexposure - Evaluation Results

N=7

1. **Was the content clear and useful?**

[7] Yes [] No [] No answer

- Yes. This was the most organized
- Yes. Bullet points effective.

2. **Was the material credible with adequate science literature cited?**

[6] Yes [] No [1] No answer

- No answer. *Would need to review.*

3. **Was the content presented at an appropriate level to your expertise?**

[7] Yes [] No [] No answer

4. **Was there additional information you wish had been included?**

[1] Yes [3] No [3] No answer

- No. *Local fish information.*
- No answer. *Spice up slides, Local info.*
- No answer. *It was great for what it was.*

5. **Additional comments:**

- *Like this presentation best. Liked a variety of media.*
- *Some areas could be simplified - such as multiple slides showing why recommendations vary - to simplify presentation*
- *Clearest presentation of info.*

Did this course prepare you to:

6. Briefly discuss the biomagnification of mercury in the food chain.
7. Describe the action of methylmercury in the human body.
8. Identify patients who are at-risk of health effects from contaminants of fish due to high consumption.
9. Advise and interpret laboratory tests for mercury.
10. Discuss benefits and risks of fish consumption with patients.

Learner	Q6	Q7	Q8	Q9	Q10
N1	Agree	Agree	Agree	Agree	Agree
N3	Agree	Agree	Agree	Agree	Agree
N4	Agree	Agree	Agree	Disagree	Agree
N5	Agree	Agree	Agree	Disagree	Agree
N6	Agree	Agree	Agree	Agree	Agree
D1	Agree	Agree	Agree	Agree	Agree
D2	Agree	Agree	Agree	Agree	Agree

- N4, Q9. *Would not be doing this as part of my job. Would have to study this much more before practicing.*
- N5, Q6. *Would need to review and have references, e.g. handouts*
- N5, Q9. *Need further review and protocols.*
- N5, Q10. *Again, would need info to refer to*
- N6, Q 9. *Would need a cheat sheet. Hard to retain the info.*
- N6, Q10. *Good to have a handout.*

Overall Evaluation Form

FISH Project Risks and Benefits Training - Overall Evaluation

Name: _____

April 15, 2013

Description of the Three Training Products

- *(Illinois - UIC) Healthy Fish Choices*, University of Illinois at Chicago. The course includes six modules; each with video presentation, case scenario and discussion, objectives and references, pre- and post-tests, and course evaluation.
- *(Michigan - MSU) Eating Fish: Maximizing Benefits and Minimizing Risk*, Just In Time Medicine, Michigan State University. The course includes a PowerPoint presentation, a brief post-test, and a course evaluation.
- *(Stony Brook) Recognizing and Preventing Overexposure to Methylmercury from Fish & Seafood Consumption: Information for Physicians*, Stony Brook University. The course includes a PowerPoint presentation, video, a brief post-test, and a course evaluation.

Evaluation and Input from Learners

1. On a scale of one to five, was the content of the course clear and useful?

	<u>Not Clear & Useful</u>		<u>Moderately</u>	<u>Very Clear & Useful</u>	
Illinois	___1	___2	___3	___4	___5
Michigan	___1	___2	___3	___4	___5
SBrook	___1	___2	___3	___4	___5

Comment _____

2. Were the contents and materials for the following courses sufficient to prepare you to understand and discuss benefits and risks of fish consumption for your patients?

	<u>Not Really Sufficient</u>		<u>In Most Areas</u>		<u>Yes, In All Areas of Concern</u>	
Illinois	___1	___2	___3	___4	___5	
Michigan	___1	___2	___3	___4	___5	
SBrook	___1	___2	___3	___4	___5	

Comment _____

3. Presuming the course content is good, how would you rate the following media and/or methods of learning in terms of utility and convenience for learners working in a clinical setting?

	<u>Least Useful/Conv.</u>		<u>Adequate</u>		<u>Most Useful/Conv.</u>	
PowerPoint only – read by solo learner	___1	___2	___3	___4	___5	
PowerPoint only – presented to group	___1	___2	___3	___4	___5	
PPoint and video mix – solo learner	___1	___2	___3	___4	___5	
PPoint and video mix – presented to group	___1	___2	___3	___4	___5	
Online course with mixed media – solo learner	___1	___2	___3	___4	___5	
Case studies read by learner or discussed by group	___1	___2	___3	___4	___5	
Interactive case scenarios (as with Illinois course)	___1	___2	___3	___4	___5	

Comment _____

4. How important do you think it is to include the following topics in a course designed to prepare clinic staff to discuss benefits and risks of fish consumption with their patients?

Make a check mark in this column if you think one of the topics below was particularly well covered by Illinois, Michigan or Stony Brook

	<u>Least Important</u>		<u>Somewhat</u>		<u>Most Important</u>	<u>IL</u>	<u>MI</u>	<u>SB</u>
How Hg gets into fish	___1	___2	___3	___4	___5	___	___	___
Where Hg comes from	___1	___2	___3	___4	___5	___	___	___
How Hg acts in body	___1	___2	___3	___4	___5	___	___	___
Scientific basis for "safe levels" used to give advice	___1	___2	___3	___4	___5	___	___	___
Scientific basis for risks of fish consumption	___1	___2	___3	___4	___5	___	___	___
Bottom line for patients: What are proven risks?	___1	___2	___3	___4	___5	___	___	___
Scientific basis for benefits of fish consumption	___1	___2	___3	___4	___5	___	___	___
Bottom line for patients: What are proven benefits?	___1	___2	___3	___4	___5	___	___	___
Guidance for patient communication	___1	___2	___3	___4	___5	___	___	___
Lab tests for mercury: When to test?	___1	___2	___3	___4	___5	___	___	___
Lab tests for mercury: Which tests to order?	___1	___2	___3	___4	___5	___	___	___
Lab tests for mercury: How to interpret?	___1	___2	___3	___4	___5	___	___	___
How to identify who might be at risk for high Hg exposure	___1	___2	___3	___4	___5	___	___	___
How to access information on fish advisories	___1	___2	___3	___4	___5	___	___	___
Information on purchased fish	___1	___2	___3	___4	___5	___	___	___
Information on locally caught fish	___1	___2	___3	___4	___5	___	___	___

Other: _____

Other: _____

Other: _____

5. What is your personal attitude regarding the following statements – at this time?

	<u>Strongly Disagree</u>		<u>Neutral</u>		<u>Strongly Agree</u>
Pregnant women should eat fish	___1	___2	___3	___4	___5
Benefits outweigh risks if people eat fish low in mercury	___1	___2	___3	___4	___5
Fish is an important part of a healthy diet	___1	___2	___3	___4	___5
Eating fish is beneficial for fetal development	___1	___2	___3	___4	___5
Fish oil supplements are good for the fetus	___1	___2	___3	___4	___5
Eating fish is good for people with cardiovascular disease	___1	___2	___3	___4	___5
Fish oil supplements are good for people with cardiovascular disease	___1	___2	___3	___4	___5
Patients should rarely need to be tested for mercury	___1	___2	___3	___4	___5
Chelation is not generally necessary in cases of elevated MeHg from fish consumption	___1	___2	___3	___4	___5

6. For this topic (fish consumption risks and benefits), what is the ideal amount of time for a training presented to a group or taken alone for staff in a clinical setting?

- ___ a. one hour
- ___ b. one to two hours
- ___ c. two to four hours
- ___ d. four to six hours

Comment: _____

7. Do you have any other comments or suggestions about the final training course we will develop as part of this project?

Overall Evaluation Results

Overall Evaluation of Existing Fish Risks & Benefits Training Courses

N = 7

Description of the Three Training Products

- *(Illinois - UIC) Healthy Fish Choices*, University of Illinois at Chicago. The course includes six modules; each with video presentation, case scenario and discussion, objectives and references, pre- and post-tests, and course evaluation.
- *(Michigan - MSU) Eating Fish: Maximizing Benefits and Minimizing Risk*, Michigan State University. The course includes a PowerPoint presentation, a brief post-test, and a course evaluation.
- *(Stony Brook) Recognizing and Preventing Overexposure to Methylmercury from Fish & Seafood Consumption: Information for Physicians*, Stony Brook University. The course includes a PowerPoint presentation, video, a brief post-test, and a course evaluation.

Evaluation and Input from Learners

1. On a scale of one to five, was the content of the course clear and useful?

Course	1	2	3	4	5	Average Score
	<i>Not clear and useful</i> N	N	<i>Moderately clear and useful</i> N	N	<i>Very clear and useful</i> N	
Illinois		2	4	1		2.9
Michigan		1	3	1		3.0
Stony Brook				5	2	4.3

2. Were the contents and materials for the following courses sufficient to prepare you to understand and discuss benefits and risks of fish consumption for your patients?

Course	1	2	3	4	5	Average Score
	<i>Not clear and useful</i> N	N	<i>Moderately clear and useful</i> N	N	<i>Very clear and useful</i> N	
Illinois		2	5			2.7
Michigan		2	3	1		2.8
Stony Brook				7		4.0

Comment: *Stony Brook best in terms of organization of info/providing context and in terms of limiting to clinically relevant material.*

3. Presuming the course content is good, how would you rate the following media and/or methods of learning in terms of utility and convenience for learners working in a clinical setting?

Media/Methods of Learning	1	2	3	4	5	Average Score
	<i>Not clear and useful</i> N	N	<i>Moderately clear, useful</i> N	N	<i>Very clear and useful</i> N	
PowerPoint only, read by solo learner	3	4				1.6
PowerPoint only, presented to group	1	2	3	1		2.6
PPoint & video mix, solo learner		3	3	1		2.7
PPoint & video mix, for group			1	3	3	4.3
Online w/ mixed media, solo learner		3	1	2	1	3.1
Case studies read by learner or discussed by group		1	2	4		3.4
Interactive case scenarios (as with Illinois course)	3		2	2		2.4

Comment: Group learning improves thoughtful questioning, reinforces understand of materials. Would not call Illinois scenarios “interactive.”

4. How important do you think it is to include the following topics in a course designed to prepare clinic staff to discuss benefits and risks of fish consumption with their patients?

Topic (* top 3)	1	2	3	4	5	Average Score
	<i>Least Important</i> N	N	<i>Somewhat important</i> N	N	<i>Most important</i> N	
How mercury gets into fish			2		1	3.9
Where mercury comes from			1	6		3.9
How mercury acts in the body			1	4	2	4.1
Scientific basis for “safe levels” used to give advice		2	4	1		2.9
Scientific basis for risks of fish consumption		2	4	1		2.9
*Bottom line for patients: What are proven risks?				1	6	4.9
Scientific basis for benefits of fish consump.		1	4	2		3.1
*Bottom line for patients: What are proven benefits?				1	6	4.9
Guidance for patient communication			1	2	4	4.4
Lab tests for mercury: When to test?		1	2	4		3.4
Lab tests for mercury: Which tests to order?		1	3	2	1	3.4
Lab tests for mercury: How to interpret?		1	2	3	1	3.6
How to identify who might be at risk for high Hg exposure				4	3	4.4
How to access information on fish advisories				7		4.0
Information on purchased fish			1	5	1	4.0
*Information on locally caught fish				3	4	4.6

5. Make a check mark in the box if you think one of the topics below was particularly well covered by Illinois, Michigan or Stony Brook. (Number of responses each topic received is indicated.)

Topic	Illinois Course	Michigan Course	Stony Brook Course
How mercury gets into fish	1		4
Where mercury comes from		1	3
How mercury acts in the body			5
Scientific basis for "safe levels" used to give advice			1
Scientific basis for risks of fish consumption			1
*Bottom line for patients: What are proven risks?			2
Scientific basis for benefits of fish consumption			1
*Bottom line for patients: What are proven benefits?			2
*Guidance for patient communication			1
Lab tests for mercury: When to test?			
Lab tests for mercury: Which tests to order?			
Lab tests for mercury: How to interpret?			
How to identify who might be at risk for high Hg exposure			2
How to access information on fish advisories			
Information on purchased fish			1
Information on locally caught fish			

6. What is your personal attitude regarding the following statements – at this time?

Statement (* top 3)	1	2	3	4	5	Average Score
	<i>Strongly Disagree</i> N	N	<i>Neutral</i> N	N	<i>Strongly Agree</i> N	
*Pregnant women should eat fish					7	5.0
Benefits outweigh risks if people eat fish low in mercury				1	6	4.9
*Fish is an important part of a healthy diet					7	5.0
Eating fish is beneficial for fetal development				2	5	4.7
Fish oil supplements are good for the fetus		1	3	3		3.3
*Eating fish is good for people with cardiovascular disease**					7	5.0
Fish oil supplements are good for people with cardiovascular disease**		1	3	2	1	3.4
Patients should rarely need to be tested for mercury		1	1	3	2	3.9
Chelation is not generally necessary in cases of elevated meHg from fish consumption			1	3	3	4.3

**These 2 questions were not included in the MN Course evaluation because fish consumption benefits to cardiovascular health were not a learning objective for that course.

7. For this topic (fish consumption risks and benefits), what is the ideal amount of time for a training presented to a group or taken alone for staff in a clinical setting?

Training Time	# Responses
One hour	3
One to two hours	2
Two to four hours	1
Four to six hours	
Other: 1 hour alone online or 1 to 2 hours with a group (a better plan)	1

8. Do you have any other comments or suggestions about the final training course we will develop as part of this project?

- Reduce presentation of scientific evidence details (unnecessarily complicates learning of basics)
- Make it locally relevant. Keep it simple.
- Mix it up with visuals and stories. Keep it simple and localize information.
- Keep it simple. Clearly delineate risks vs. benefits.

**Curriculum for MN Course:
FISH Project Risks and Benefits Training**

Putting Fish on Your Plate & Preventing Mercury Exposures in Babies

Training for Health Care Providers

FISH Project Partners
Grand Portage Health Clinic
Sawtooth Mountain Clinic
Cook County North Shore Hospital
Grand Portage Trust Lands
Minnesota Department of Health



Eating fish is good
Eating fish is bad

Lots of conflicting information on
risks and benefits of eating fish

All “sides” agree...

Benefits outweigh risks for
eating fish low in mercury
& other contaminants



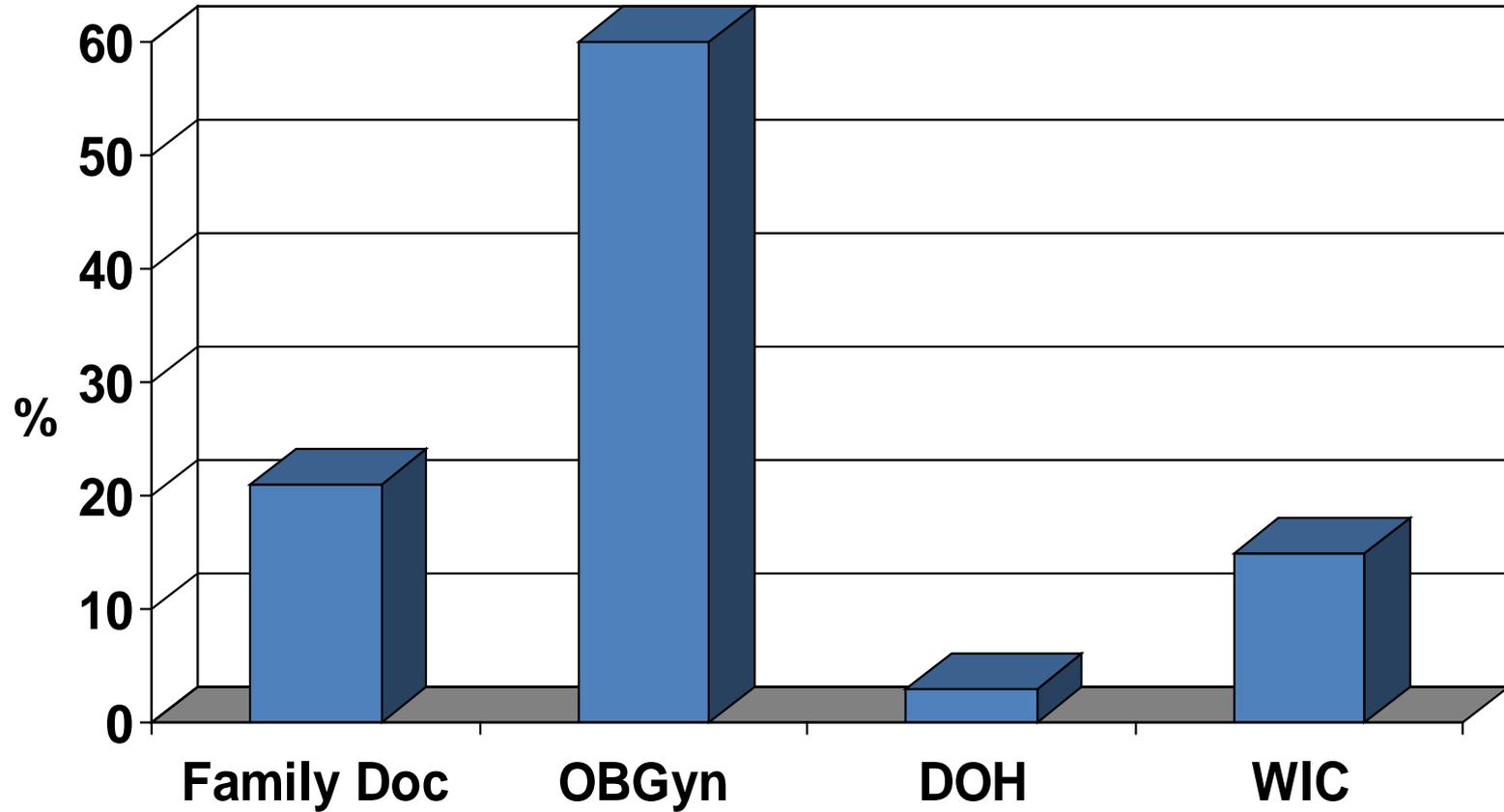
Challenge is knowing:

- Which fish are low in contaminants?
 - Fish are not all the same
 - Salmon = very low in mercury
 - Shark = very high in mercury
- Who needs to be most careful about exposure?
 - Risks and benefits are different for
 - developing fetus
 - adult with CVD

Health Care Provider Role

- Dietary guidance for patients
 - Difficult in the presence of conflicting recommendations about the risks and benefits of eating fish.
 - Need to be careful about the message
 - Unintended consequences
 - Promote substitution rather than avoidance
 - Substitution requires knowledge and effort
- HCP are good source of information for WCBA
 - To promote health fetus/baby, WCBA need to more careful about fish selection
 - Fetus is most sensitive to exposures

Source for Mom's Guide



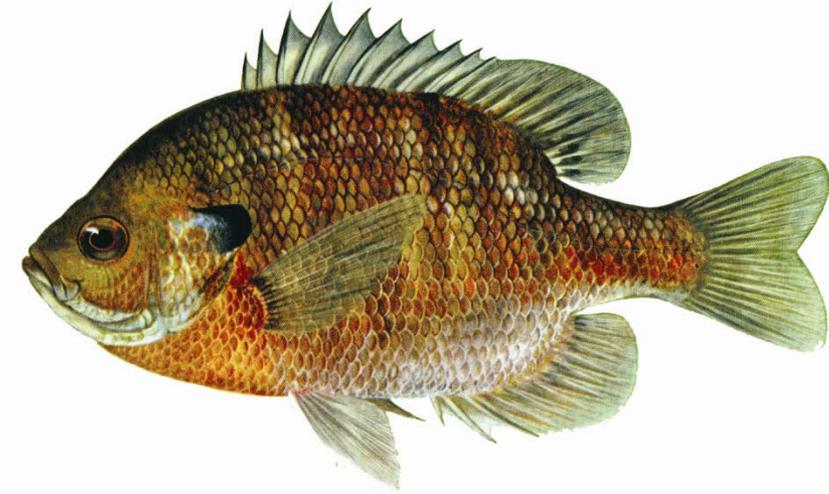
Training

- Summarize benefits and risks
- Fish consumption guidelines
- Screening and counseling



From: Minnesota DNR, 1989

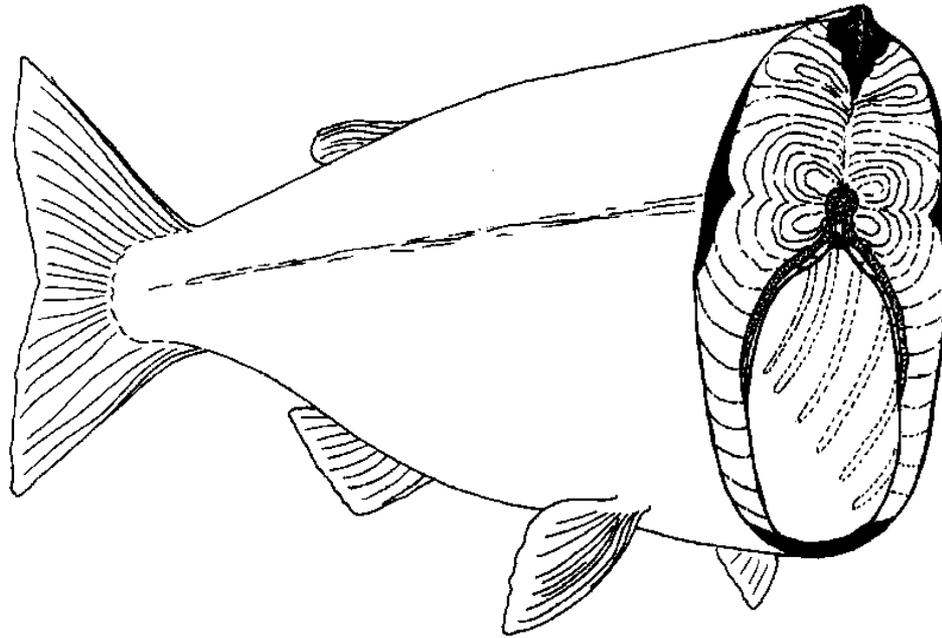
Which fish has more mercury?



Which lake has higher levels of mercury in the fish?



Is mercury in the fatty parts of fish or in the fillet?



A pregnant women should not eat fish (T/F)



Why eat fish?

- Nutritional Benefits
 - Low fat (saturated) protein
 - Vitamins and minerals
 - Omega-3 fatty acids
- Cultural, recreational, social and economic benefits
- Focus for this training: developmental benefits & why pregnant women should eat fish

Benefits - Observational Studies

- Higher maternal consumption of fish results in children showing better neurological function than those whose mothers ate low amounts or no fish

What is it about fish?

- DHA?
- Other nutrients in fish? e.g. Se, I, Fe
- Substitution for higher fat protein?
- Surrogate for a healthy lifestyle?

- Whatever the reason - All support eating fish

Omega-3 Supplements

- Meta-analysis of randomized trials of formula supplementation have not found persistent benefit on physical, visual, neurodevelopmental outcomes of term or pre-term infants
- Limited evidence from randomized trials of fish oil supplements in pregnancy supports cognitive benefit for offspring

DHA

- ALA, EPA and DHA are omega-3 fatty acids
- Structural component of the brain and eyes
- Most brain DHA is derived by uptake from plasma
- Dietary DHA is well absorbed and is readily incorporated into plasma and blood cell lipids in humans
- Primary dietary sources of EPA and DHA are fish and seafood
- Major dietary sources of ALA are soybean and canola oils, flax seed oils and some nuts
- Conversion of ALA to EPA to DHA is < 1%

DHA

- DHA is required for brain development
- Depletion of DHA from brain and retina interferes with normal neurogenesis and neurological function, and visual signaling pathways
- Pre- and post-natal periods likely critical period for incorporation into neural tissues

DHA Recommended Intake

- No dietary recommended intake (DRIs)
 - Guidelines in literature of 100-300 mg/day are based on observed and estimated intakes, and intervention studies
- No conversion available for dietary intake to blood levels
- Fish oil: may be a good choice if no or low fish consumption

Preliminary DHA Data

200 mg/day = 1400 mg/week

Species	DHA mg/8 oz serving
Salmon	1836 - 4941
Halibut	681
Lake Superior fish*	
Chinook Salmon	1362
Chub	1816
Herring	1362
Smelt	454
Whitefish	454
Lean Lake Trout	2270
Siscowet Lake Trout	4086
Inland fish	
Herring	424
Lake Trout	518
Northern	226
Rainbow Trout	637
Walleye	265
Perch	197

Unfortunately

Fish have Environmental Contaminants

- PCBs are an issue in the Great Lakes, major rivers and contaminated sites.
 - Levels are going down in fish
 - PCBs accumulate in fatty fish and in beef and dairy products.
 - Babies exposed to PCBs during pregnancy may have lower birth weight, reduced head size, and delayed physical development.
- Farm raised fish – feed can have contaminants
- Mercury is found in all fish

Dartmouth Toxic Metals
Superfund Research Program

Mercury: From Source to Seafood

A ten minute web-based film explaining how mercury gets into the seafood we eat, why it is important to eat low-mercury fish for good health, and the need to keep mercury out of the environment.

Post-video – comments

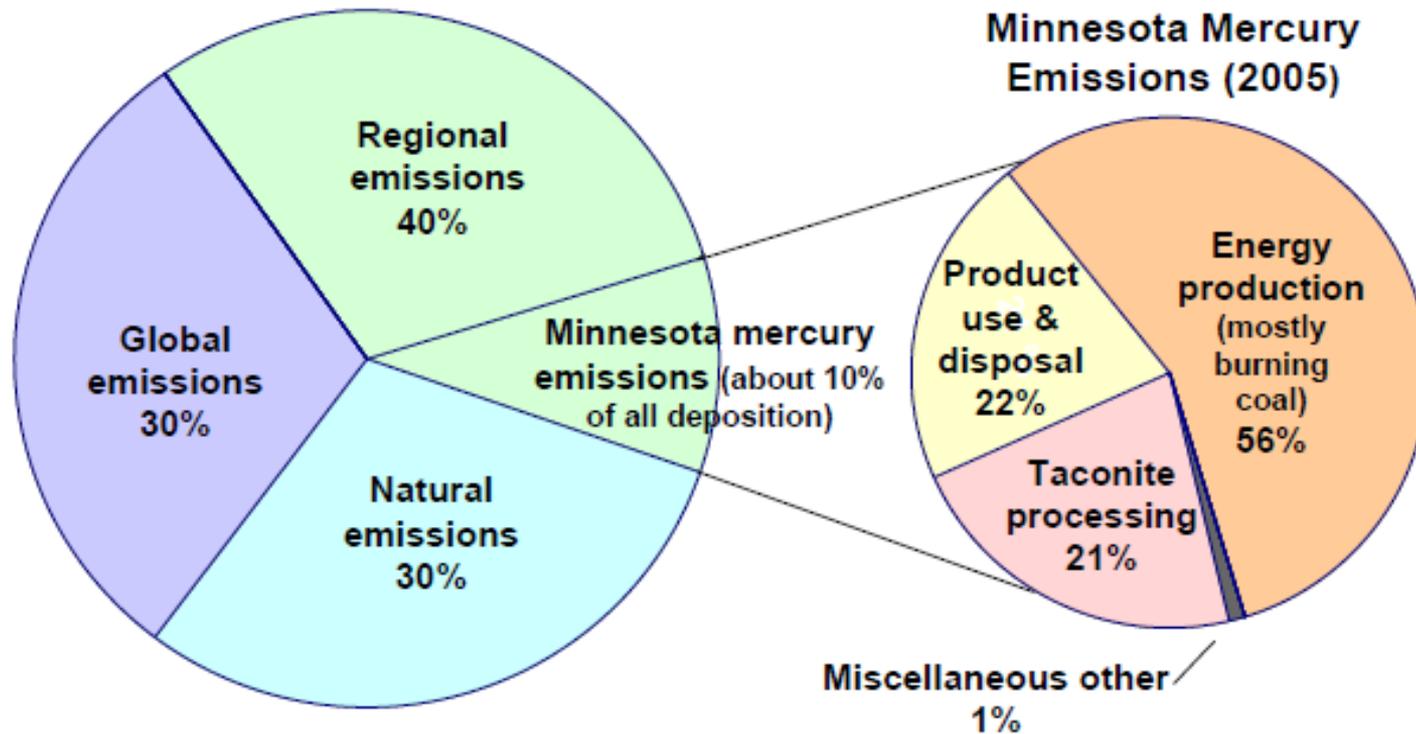
- NE MN fish tend to have higher levels of mercury
- Temporal trend in fish unclear

Which MN fish have the most mercury?

- walleye, northern, bass



Sources of Atmospheric Mercury Deposition to Minnesota



Mercury Species

Form of mercury influences how it moves in environment and within the body

- Elemental (Hg^0) or metallic - vapor
- Inorganic (Hg^+ , Hg^{++}) – occupational (products)
- Organic
 - Methylmercury (MeHg)(CH_3Hg^+) – fish
 - Ethylmercury – thimerosal preservative in vaccines
 - Dimethylmercury – chemistry lab
 - Phenylmercurics – fungicides in latex paint

Methylmercury in the Body

- >95% of MeHg is absorbed in the gastrointestinal tract and distributed via the blood to **all organs** in about 30-40 hours after ingestion.
- meHg in blood is assumed to reflect amount in body
- meHg crosses the blood-brain barrier
- meHg crosses the placenta. Levels in umbilical cord blood are on average 1.7x higher than maternal blood levels.

MeHg in the Body, continued

- meHg and demethylated (inorganic) mercury are gradually removed from the body, mainly via liver bile and feces.
 - Some meHg is stored in hair and nails.
- The half-life of meHg in blood is about 50-70 days in adults.

Methylmercury Toxicity

- Neurotoxic
- Developing nervous system is especially sensitive
- Fetal toxicity can occur in the absence of clinical signs or symptoms in the mother

Exposure to mercury

- EPA Reference Dose
 - Safe dose over a lifetime, within an order of magnitude
 - Neurodevelopmental effects
 - **0.1 $\mu\text{g}/\text{kg}/\text{day}$**
 - Uncertainty factor of 10
 - Equivalent blood concentration = 5.8 $\mu\text{g}/\text{l}$
- Safe dose for general population $\sim 3\text{X}$ higher ($\sim 20 \mu\text{g}/\text{l}$)

“Safe” exposure level

- Based on observational studies of prenatal mercury exposure and child development in fish eating populations
 - Cohorts were initiated to determine what level of methylmercury exposure is “safe”
 - Neuropsychological tests indicate deficits involved with a child’s ability to learn and process information
 - Not clinically observable
- Supported by many human and animal studies
- Small uncertainty factor compared to most risk assessments for environmental contaminants
- Still some debate about exact “safe” dose

Risks & Benefits

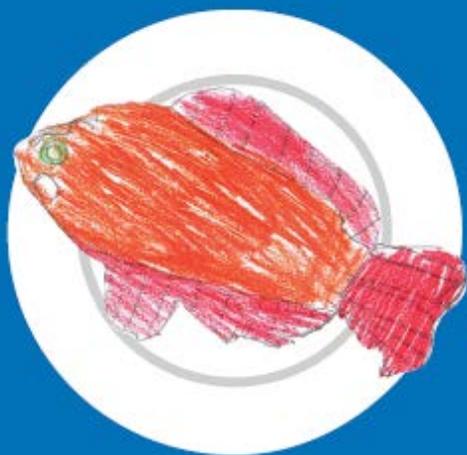
- Historically studies either looked at risk or benefit, not both
- A few recent observational studies have looked at both risk and benefit
- All conclude eating fish low in contaminants is beneficial for development

Fish Consumption Advice

- Concern that negative messages will scare people from eating fish and result in loss of benefits
- Mercury and beneficial nutrients are both present in fish
 - Data on omega-3 levels in fish, particularly freshwater fish, is lacking
- Benefits addressed qualitatively.....for now
 - Working towards a framework to quantitatively include both
- Overall Goal: Minimize people's exposure to contaminants in fish while promoting the many benefits of eating fish.

Put Fish on Your Plate

A Family Guide to Eating Fish



Benefits outweigh risks if you
eat fish low in mercury
& other contaminants

Women in Grand Portage think
eating fish is more than healthy... *it's essential*

Put Fish on Your Plate

A Family Guide to Eating Fish



Benefits outweigh risks if you
eat fish low in mercury
& other contaminants

Women on the North Shore think
eating fish is more than healthy ... *it's essential*

Benefits — eating fish 1-2 times per week has benefits for people of all ages.

Fish are a source of lean protein, vitamins, minerals and omega-3 fatty acids. EPA and DHA are omega-3 fatty acids found in fish. Our bodies can't make EPA and DHA — eating fish is the primary way to get these fatty acids.

- DHA is a building block of the brain and eyes.
- Pregnant women and breastfeeding moms can eat fish to give DHA to their babies.
- Children of women who ate lower mercury fish every week have been found to do better developmentally.

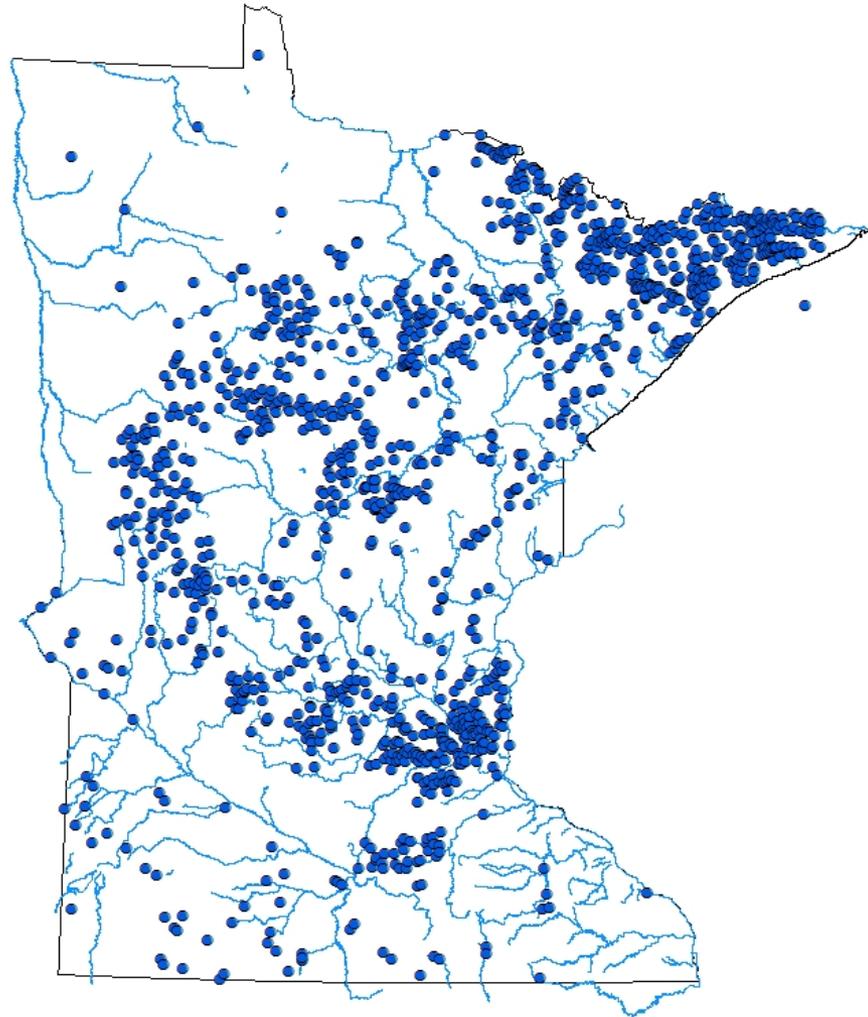
Eating fish has also been shown to lower the risk of heart disease in adults.



Benefits are maximized with fish higher in EPA and DHA but lower in mercury. Fish from Lake Superior are generally higher in EPA and DHA than fish from inland lakes and rivers. Fatty fish like salmon have the highest levels.

2 servings/week	0.1 µg/g	<p>Purchased fish: Salmon, Shrimp, Tilapia</p> <p>Lake Superior fish: Herring (Cisco), Coho Salmon, Rainbow trout/Steelhead</p> <p>Inland fish: Rainbow trout</p>
1 serving/week	0.2 µg/g	<p>Purchased fish: Canned Light Tuna</p> <p>Lake Superior fish: Lake Whitefish, Menominee, Lake Trout <22", Chinook <32"</p> <p>Inland fish: Herring (Cisco), Lake Whitefish, Splake, Perch</p>
1 serving/month	0.4 µg/g	<p>Purchased fish: Canned White (albacore) Tuna, Tuna (steak/fillet/sushi), Halibut</p> <p>Lake Superior: Lake Trout 22" to 37", Chinook Salmon 32"+, Walleye</p> <p>Inland fish: Walleye, Northern Pike</p>
Avoid	1 µg/g	<p>Purchased fish: Shark, Swordfish</p> <p>Lake Superior: Siscowet Lake Trout > 36"</p>

Minnesota Fish Contaminant Database: 1967-2012



Species and Advice



- Focus on species that can be eaten 1 – 2 times per week
- List species that are most popular based on national data and available in MN markets
- Acknowledge that people eat fish with moderate mercury

Eating Guidelines for Women who are or may become pregnant and Children under 15

Serving Guideline

LOW

Mercury Concentration

$\mu\text{g/g}$ = micrograms of mercury per gram of fish

HIGH

2 per week

0.1 $\mu\text{g/g}$

Species (Kind of Fish)

Purchased Fish: Salmon (Atlantic and canned), Shrimp, Sardines, Scallops, Tilapia, Crab, Cod, fast food fish sticks and sandwiches

Lake Superior Fish: Herring (Cisco), Coho Salmon, Rainbow Trout/Steelhead, Smelt

Inland Fish: Rainbow Trout



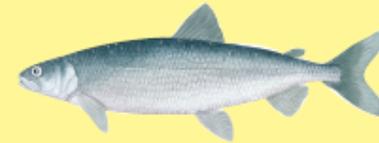
1 per week

0.2 $\mu\text{g/g}$

Purchased Fish: Canned Light Tuna

Lake Superior Fish: Lake Whitefish, Menominee, Brown Trout, Lake Trout <22", Chinook <32"

Inland Fish: Herring (Cisco), Lake Whitefish, Splake, Sunfish, Crappie, Yellow Perch



1 per month

0.4 $\mu\text{g/g}$

Purchased Fish: Canned White (albacore) Tuna, Tuna (steak/fillet/sushi), Halibut

Lake Superior Fish: Lake Trout 22" to 37", Chinook Salmon 32"+, Walleye

Inland Fish: Walleye, Northern Pike, Trout (Lake, Brown, Brook)



Avoid

1 $\mu\text{g/g}$

Purchased Fish: Shark, Swordfish

Lake Superior Fish: Siscowet Lake Trout > 36"



Bonus: During one month you can eat up to one serving of fish in the "1 per month" group AND eat fish from either the "1 per week" or "2 per week" groups.

Things to Consider When Choosing Your Fish

Who You Are

Women who are or may become pregnant, and children under 15 need to be more careful about which fish they eat because mercury has a greater effect on babies and young children.

Women not planning to be pregnant and men face fewer health risks from mercury. For that reason, they are able to eat more kinds of fish (species) more often.

Species

Mercury is in all fish but the amount depends on the species (and size). Some species of fish have higher levels of mercury than others because of what they eat and how long they live.

Size

Generally, smaller fish have less mercury than larger, older fish of the same species. Unlike people, fish don't get rid of mercury. Older, larger fish have had more time for mercury to build up in their bodies.

Source

Inland lakes and rivers, and purchased fish contain mercury, the main contaminant of concern for eating fish. Fish from lakes in northeastern MN generally have higher amounts of mercury than southern and central MN.

Lake Superior fish contain mercury and may also contain PCBs and other contaminants.

Fish Consumption Guidelines

- Provided by many government agencies and other organizations
 - Different purposes/charters

2 servings/week

0.1 $\mu\text{g/g}$

Purchased fish: Salmon, Shrimp, Tilapia

0.2 $\mu\text{g/g}$

Purchased fish: Canned Light Tuna

1 serving/week

0.4 $\mu\text{g/g}$

Purchased fish: **Canned White (albacore) Tuna,**
Tuna (steak/fillet/sushi), Halibut

Avoid

1 $\mu\text{g/g}$

Purchased fish: Shark, Swordfish



FDA/EPA advice

- Do not eat Shark, Swordfish, King Mackerel, or Tilefish because they contain high levels of mercury.
- Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
 - Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
 - Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don't consume any other fish during that week

FDA/EPA advice and MDH advice

- Assume average consumer, mixed species in diet
- MDH approach provides info on differences between species
 - Many people have favorite fish
 - Different advice for tuna
 - Uses FDA mercury data

Mercury Levels in Commercial Fish and Shellfish (1990-2010)

See also Mercury Concentrations in Fish: FDA Monitoring Program

Table 1. Fish and Shellfish With Highest Levels of Mercury

SPECIES	MERCURY CONCENTRATION (PPM)					NO. OF SAMPLES	SOURCE OF DATA
	MEAN	MEDIAN	STDEV	MIN	MAX		
MACKEREL KING	0.730	N/A	N/A	0.230	1.670	213	GULF OF MEXICO REPORT 2000
SHARK	0.979	0.811	0.626	ND	4.540	356	FDA 1990-2007
SWORDFISH	0.995	0.870	0.539	ND	3.220	636	FDA 1990-2010
TILEFISH (Gulf of Mexico)	1.450	N/A	N/A	0.650	3.730	60	NMFS REPORT 1978

Table 2. Fish and Shellfish With Lower Levels of Mercury

SPECIES	MERCURY CONCENTRATION (PPM)					NO. OF SAMPLES	SOURCE OF DATA
	MEAN	MEDIAN	STDEV	MIN	MAX		
ANCHOVIES	0.017	0.014	0.015	ND	0.049	14	FDA 2007-2010
BUTTERFISH	0.058	N/A	N/A	ND	0.36	89	NMFS REPORT 1978
CATFISH	0.025	0.005	0.057	ND	0.314	57	FDA 1991-2010
CLAM *	0.009	0.002	0.011	ND	0.028	15	FDA 1991-2010
COD	0.111	0.066	0.152	ND	0.989	115	FDA 1991-2010
CRAB ¹	0.065	0.050	0.096	ND	0.610	93	FDA 1991-2009
CRAWFISH	0.033	0.035	0.012	ND	0.051	46	FDA 1991-2007

Dietary Guidelines for Americans

- In addition to the health benefits for the general public, the nutritional value of seafood is of particular importance during fetal growth and development, as well as in early infancy and child-hood.
- Moderate evidence indicates that intake of omega-3 fatty acids, in particular DHA, from *at least* 8 ounces of seafood per week for women who are pregnant or breastfeeding is associated with improved infant health outcomes, such as visual and cognitive development.
- Therefore, it is recommended that women who are pregnant or breast-feeding consume at least 8 and up to 12 ounces of a variety of seafood per week, from choices that are lower in methylmercury.
- Obstetricians and pediatricians should provide guidance to women who are pregnant or breastfeeding to help them make healthy food choices that include seafood.

AHA Recommendation



- We recommend eating fish (particularly fatty fish) at least two times (two servings) a week. Each serving is 3.5 oz. cooked, or about $\frac{3}{4}$ cup of flaked fish

How Much Fish Makes a Serving?



- The amount of fish in a serving is based on the body weight of the person eating the fish.
 - We assume a 150 pound person eats a serving of one-half pound (eight ounce) of uncooked fish to stay within the MDH Safe-Eating Guidelines. Eight ounces of uncooked fish is equal to about six ounces of cooked fish.
- To adjust meal size for a heavier or lighter weight person, add or subtract one ounce of fish for every 20 pounds of body weight.

Do people eat enough fish to be
concerned?

Study: 1 in 10 babies in Lake Superior region are born with high levels of mercury

One of every 10 babies born in the Lake Superior region of Minnesota has unsafe levels of toxic mercury in his or her bloodstream, according to a Minnesota Department of Health study released Thursday.

By: [John Myers](#), Duluth News Tribune



StarTribune

High levels of mercury found in North Shore babies

Article by: [JOSEPHINE MARCOTTY](#) , Star Tribune

Updated: February 2, 2012 - 11:04 PM

Blood samples showed surprisingly elevated concentrations.



Study: High Mercury Levels In North Shore Babies

February 3, 2012 6:05 PM

MINNEAPOLIS (WCCO)



[Earth Journal: Ron Meador on Environment](#)

After decades of warnings and pollution controls, newborns arrive with a burden of mercury

By Ron Meador | Published Mon, Feb 6 2012

Case Study – Minnesota

- Two MN women
 - ~ 2 meals/day of predatory fish for years
 - Fatigue, lethargy (one reported memory loss)
 - Blood mercury levels 20 $\mu\text{g/l}$ and 25 $\mu\text{g/l}$
- One women treated with DMSA (by private physician)
- Other women received no chelation
- Both advised to limit fish consumption
- Mercury levels normalized and symptoms resolved within several months in both women

Is Chelation Recommended?

- Chelation can be a valuable intervention for inorganic mercury poisoning, but it poses its own risks.
- Except in rare cases, it is not generally warranted for patients with elevated MeHg from fish consumption.
- Some practitioners mistakenly use DMSA or DMPS provocation challenge when they test a patient's urine for mercury. This gives highly misleading results that overestimate mercury exposure.

Imported Seabass as a Source of Mercury Exposure: A Wisconsin Case Study

Lynda M. Knobeloch,¹ Meg Ziarnik,¹ Henry A. Anderson,¹ and Vernon N. Dodson²

¹Wisconsin Bureau of Public Health, Department of Health and Social Services, Madison, WI 53703 USA; ²University of Wisconsin Hospital and Clinics, Madison, WI 53703 USA

that he was experiencing sleep disturbances and had difficulty concentrating, and asked whether these symptoms might be due to mercury exposure. The caller was especially concerned about his 2.5-year-old son's exposure to mercury.

The family's diet included 3-4 fish meals per week

- Imported seabass (2 meals/week),
- Lake Superior whitefish (1-2 meals/month),
- Lake Superior trout (1-2 meals/month),
- Farm-raised trout (1-2 meals/month)
- Farm-raised salmon(1-2 meals/month)

Table 2. Mercury content of fish

Type of fish	Mercury content ($\mu\text{g/g}$)
Lake Superior whitefish	< 0.02
Lake Superior trout	< 0.02
Farm-raised salmon	0.05
Farm-raised trout	0.05
Seabass	
Filet 1	0.5
Filet 2	0.7

Table 1. Medical test results and personal data

	Man	Woman	Son
Age	40	42	2.5
Body weight kg (lbs)	57 (126)	52 (115)	13 (30)
Fish meals/week	3-4	3-4	3-4
Fish/meal (g)	227	150	75
Hair mercury ($\mu\text{g/g}$)	12	10	NA
Blood mercury ($\mu\text{g/L}$)			
Day 0	58	37	37
Day 15	45	24	NA
Day 70	24	14	NA
Day 200	5	3	NA
Hair Hg/blood Hg ratio	207	270	NA

NA, not available.

Mercury Levels in High-End Consumers of Fish

Jane M. Hightower¹ and Dan Moore²

- Serial blood mercury levels in 67 subjects
 - Dropped rapidly within 3 weeks after being told not to eat fish or greatly reduce consumption fish with high levels of mercury
 - All dropped to < 5 ug/l within 41 weeks except 2 who continued to eat large predatory fish

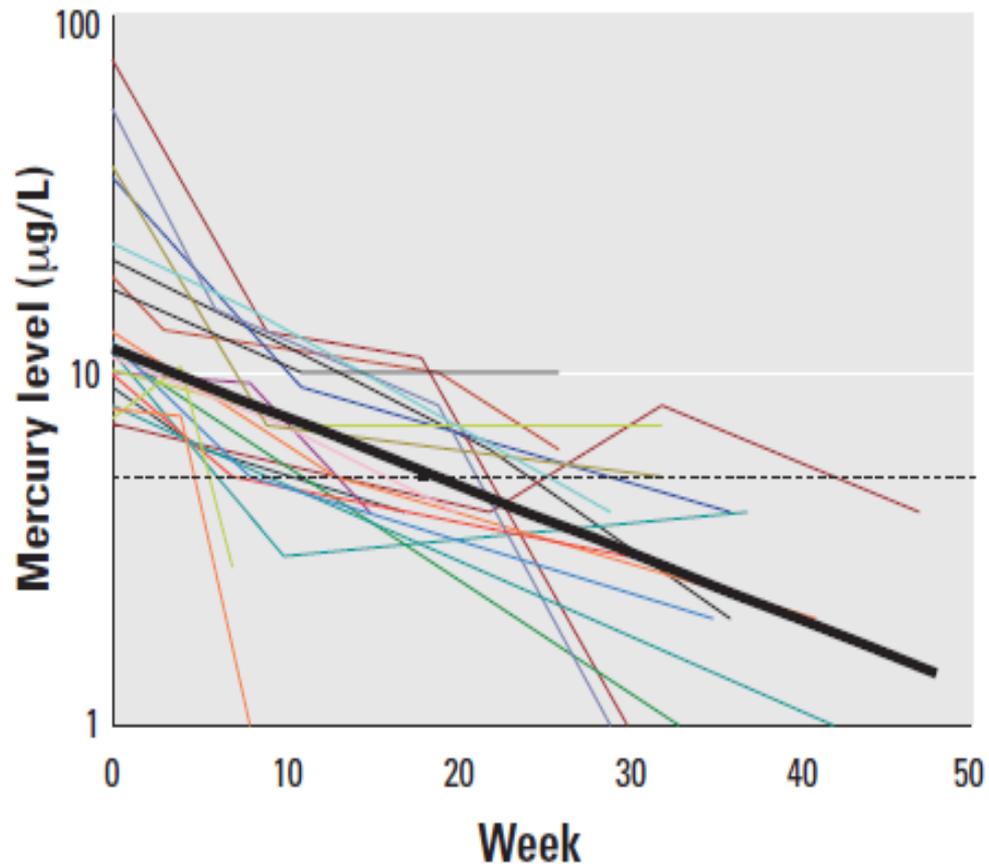


Figure 1. Blood mercury levels in 21 subjects with three or more measurements over time. Levels for individual patients are designated by straight lines. The thick line shows an exponentially declining fit to data from all 67 subjects. The horizontal dashed line is at 5 µg/L.

Clinical MeHg Poisoning

- Some people eat a lot of fish, as often as 5 to 20 meals per week.
- Some people prefer to eat predatory species like swordfish that contain high mercury levels.
- Such individuals can get high doses of methylmercury from their diets, and some may develop clinical meHg toxicity.
- Cases of methylmercury poisoning are rare and most physicians have never encountered one; symptoms may easily go unrecognized unless dietary habits are considered.

The Gelfond Fund for Mercury Research and Outreach

[HOME](#)[ABOUT US](#)[CURRENT PROJECTS](#)[MERCURY AND FISH](#)[FOR PHYSICIANS](#)[RESOURCES](#)[CONTACT US](#)

Case Reports of Methylmercury Poisoning

1. Grand Round presentation: "Medical Masquerade: One Man's Experience with Methylmercury Poisoning"

This unique one-hour video presentation about the clinical presentation of methylmercury poisoning includes three parts: the perspective of someone who experienced it himself; clinical information from an expert in methylmercury poisoning; and perspectives from a scientist who studies mercury in the marine environment. The video was made at a grand round presentation for the Department of Medicine at Stony Brook University Medical Center in November 2010.

Presenters included: Richard Gelfond, CEO and Director, IMAX Corporation and Chair, Stony Brook Foundation; Michael Gochfeld, MD, PhD, Professor, University of Medicine and Dentistry of New Jersey; and Nicholas Fisher, PhD, Distinguished Professor, SBU School of Marine and Atmospheric Sciences and Director of the Consortium for Inter-Disciplinary Environmental Research.

 Environmental Health News

Search

14 February [Less acid rain could mean more mercury in fish.](#)

Regulations on mercury emissions in Europe have led to a steady decline in mercury entering the environment since the 1990s. So government scientists in Norway were surprised to discover in 2009 that mercury levels in lake fish had strongly increased since 1991. [Chemical & Engineering News.](#)

14 February [The Yamuna is poisoned and so are your vegetables.](#) Fresh, green spinach leaves that Delhiites put on their plates contain more than just nutrients. A recent study indicates the presence of heavy metals in the vegetables that are grown with water from the Yamuna. [Hindu, India.](#)

Identifying Patients with meHg Poisoning

- Clinical manifestations vary with intensity and duration of exposure
- Symptoms can vary significantly among individuals
- Symptoms may be delayed from time of exposure
- Symptoms may emerge when body's ability to compensate for the damage is depleted
- Genetic variation or food/nutrient interactions may affect mercury metabolism

(Nonspecific) symptoms associated with chronic lower level MeHg exposure:

- sleep disturbance
- headache
- fatigue
- difficulty concentrating
- depression
- memory loss
- diminished fine motor coordination
- muscle and joint pain
- gastrointestinal upset
- hair thinning
- heart rate disturbance
- hypertension
- tremor
- numbness or tingling around the mouth

Symptoms associated with higher meHg exposures:

- numbness or tingling in hands and feet
- clumsy gait, difficulty walking (ataxia)
- slurred speech
- tunnel vision
- diminished visual acuity

Variability of symptoms

- Multiple research studies and personal observations by the authors indicate that individuals vary widely in sensitivity to MeHg toxicity.
- Milder symptoms have been seen at relatively low blood mercury levels.
- People vary in susceptibility to mercury, and not everyone with high exposure experiences adverse effects.

Testing for Mercury

- High exposure is rare, routine Hg testing is not indicated
- Better to ask about diet than test, promote change in diet if indicated
- Consider testing if symptoms or extreme diet
- Majority of mercury exposure will decline in about 3 months with correct fish consumption
- We are testing in this project to evaluate our mercury screening questions

Patient Communication

- Screen (questions in EMR)
- In the last 2 to 3 months...
 - How many times a week did you eat any kind of fish?
 - How many times a month did you eat any of these fish? walleye, northern, bass or lake trout from Lake Superior
 - Did you eat shark or swordfish?
- Further probing into diet if indicated
- Provide eating guidelines – try to be specific to individual

More Information

- FISH Project Nurses
- Dr. Sampson
- MDH
 - Pat McCann
 - Deborah Durkin

www.health.state.mn.us/fish

MN Course Evaluation

**FISH Project Risks and Benefits Training -
Minnesota Course Evaluation**

March 2014

Name: _____

1. Were the contents of this training sufficient to prepare you to understand and discuss benefits and risks of fish consumption your women of childbearing age patients?

Not Really Sufficient

In Most Areas

Yes, In All Areas of Concern

___1

___2

___3

___4

___5

Comments _____

2. For this topic (fish consumption risks and benefits), do you think this training was about the right amount of time?

___ a. Yes

___ b. No, should be shorter

___ c. No, should be longer

Comments _____

3. How important do you think it is to include the following topics in a course designed to prepare clinic staff to discuss benefits and risks of fish consumption with their women of childbearing age patients?

	<u>Least Important</u>		<u>Somewhat</u>		<u>Most Important</u>
How Hg gets into fish	___1	___2	___3	___4	___5
Where Hg comes from	___1	___2	___3	___4	___5
How Hg acts in body	___1	___2	___3	___4	___5
Scientific basis for “safe levels” used to give advice	___1	___2	___3	___4	___5
Scientific basis for risks of fish consumption	___1	___2	___3	___4	___5
Bottom line for patients: What are proven risks?	___1	___2	___3	___4	___5
Scientific basis for benefits of fish consumption	___1	___2	___3	___4	___5
Bottom line for patients: What are proven benefits?	___1	___2	___3	___4	___5
Guidance for patient communication	___1	___2	___3	___4	___5
Lab tests for mercury: When to test?	___1	___2	___3	___4	___5
Lab tests for mercury: Which tests to order?	___1	___2	___3	___4	___5
Lab tests for mercury: How to interpret?	___1	___2	___3	___4	___5
How to identify who might be at risk for high Hg exposure	___1	___2	___3	___4	___5
How to access information on fish advisories	___1	___2	___3	___4	___5
Information on purchased fish	___1	___2	___3	___4	___5
Information on locally caught fish	___1	___2	___3	___4	___5

Other:

4. What is your personal attitude regarding the following statements?

	<u>Strongly Disagree</u>		<u>Neutral</u>	<u>Strongly Agree</u>	
Pregnant women should eat fish	___1	___2	___3	___4	___5
Benefits outweigh risks if people eat fish low in mercury	___1	___2	___3	___4	___5
Fish is an important part of a healthy diet	___1	___2	___3	___4	___5
Eating fish is beneficial for fetal development	___1	___2	___3	___4	___5
Fish oil supplements are good for the fetus	___1	___2	___3	___4	___5
Patients should rarely need to be tested for mercury	___1	___2	___3	___4	___5
Chelation is not generally necessary in cases of elevated meHg from fish consumption	___1	___2	___3	___4	___5

Comments:

5. Do you have any other comments or suggestions about the final training course we will develop as part of this project?

MN Course Evaluation Results for The FISH Project

FISH Project Risks and Benefits Training – Minnesota Course Evaluation

N = 18

Evaluation and Input from Learners

1. Were the contents of this training sufficient to prepare you to understand and discuss benefits and risks of fish consumption for your women of childbearing age patients?

Course						Average Score
	1	2	3	4	5	
	<i>Not really sufficient</i> N	N	<i>In most areas</i> N	N	<i>Yes, in all areas of concern</i> N	
MN Course				7	11	4.6

Comments:

- Does type of cooking matter? Will serving size be easily defined for consumers?
- The brochure will be helpful.
- With the added links for more information

2. For this topic (fish consumption risks and benefits), do you think this training was about the right amount of time?

- Out of 18 respondents, **17 answered “yes”** the training was about the right time length, and one person did not answer this question.

Comments:

- Shorter is always better. Keep editing & simplifying.
- I was getting a little antsy because I'd heard this before & video seemed redundant, but if I was new to this - probably ok.
- Information was concise.

3. How important do you think it is to include the following topics in a course designed to prepare clinic staff to discuss benefits and risks of fish consumption with their women of childbearing age patients?

Topic (* top 3)	1	2	3	4	5	Average Score
	<i>Least Important</i>		<i>Somewhat Important</i>		<i>Most Important</i>	
	N	N	N	N	N	
How mercury gets into fish			8	6	4	3.8
Where mercury comes from			8	6	4	3.8
How mercury acts in the body			3	8	7	4.2
Scientific basis for “safe levels” used to give advice		2	4	4	8	4
Scientific basis for risks of fish consumption		1	4	7	6	4
*Bottom line for patients: What are proven risks?				3	15	4.8
Scientific basis for benefits of fish consumption		1	4	5	8	4.1
*Bottom line for patients: What are proven benefits?				2	16	4.9
Guidance for patient communication			5	4	9	4.2
Lab tests for mercury: When to test?			6	8	4	3.9
Lab tests for mercury: Which tests to order?		1	7	8	2	3.6
Lab tests for mercury: How to interpret?		1	7	9	1	3.6
How to identify who might be at risk for high Hg exposure			1	9	8	4.4
How to access information on fish advisories			5	6	7	4.1
Information on purchased fish			1	4	13	4.7
*Information on locally caught fish				3	15	4.8

Other:

- Not necessary for general public to know [handwritten comment next to which tests to order]
- Not sure why all the information on other recommendations muddled up the message - too much

4. What is your personal attitude regarding the following statements?

Statement (* top 3)	1	2	3	4	5	Average Score
	<i>Strongly Disagree</i> N	N	<i>Neutral</i> N	N	<i>Strongly Agree</i> N	
Pregnant women should eat fish	1			1	16	4.7
*Benefits outweigh risks if people eat fish low in mercury				1	17	4.9
*Fish is an important part of a healthy diet				1	17	4.9
*Eating fish is beneficial for fetal development				3	15	4.8
Fish oil supplements are good for the fetus			7	7	4	3.8
Patients should rarely need to be tested for mercury			5	7	6	4.1
Chelation is not generally necessary in cases of elevated meHg from fish consumption			2	8	8	4.3

Comments:

- Thanks!
- Not enough info or understanding [handwritten comment next to chelation]

5. Do you have any other comments or suggestions about the final training course we will develop as part of this project?

- The length of time was good. Info not overwhelming.
- Review the handout. Provide links for more information as people/consumers vary in their interest for details. Provide a link for comparison with other sources' recommendations. * Many of my patients regularly use the internet for medical information & are likely to explore on their own.
- What about other seafood? Shrimp, scallops, oysters, squid, etc.
- Make slides less words.
- Would be nice to have more specific comments on how babies "do better developmentally" in women who consumed fish. The comment is sort of generic, & I don't really know what it means.
- I liked the Dartmouth video - liked the questions to engage participants.
- Focus needs even more to go from the science of it all into the nuts & bolts of what I do in the office - how to ask, how to advise, when to test - & tools to use as I talk to patients. Don't need to convince us why as much as guide us how.
- Nice flow of information
- I look forward to having the brochures for patient use!

**MN Course Curriculum - modified based
on WI fish consumption advice for the
South Shore Women Choose Wisely
Project (WI GLRI)**

Risks and Benefits of Fish Consumption Preventing Mercury Exposure in Babies



Training for Health Care Providers

FISH Project

Fish are Important for Superior Health

- Reduce mercury exposure in women of childbearing age
- Test use of in-clinic mercury screening
 - Integrate into EMR
 - Determine if screening questions predict mercury exposure
 - Model for other clinics
- Improve health education materials
- Training for health care providers

FISH Project Partners

- Grand Portage Health Clinic
- Sawtooth Mountain Clinic
- Cook County North Shore Hospital
- Grand Portage Trust Lands
- Minnesota Department of Health

FISH Project Training

Developed based on evaluation of 3 courses

- **Healthy Fish Choices** CME Course created at the University of Illinois, provides information on how to promote healthy fish consumption in women and children. It includes in-depth information on contaminants and nutrients and how to maximize benefits.
<http://cores33webs.mede.uic.edu/healthyfishchoices/index.html>
- **EATING FISH *Maximizing Benefits & Minimizing Risks***
Powerpoint and Just-in-Time Medicine, Michigan State University
<http://www.oem.msu.edu/FishMedicalEducation.aspx>
- **"Recognizing and Preventing Overexposure to Methylmercury: Information for Physicians"** Powerpoint provides manuscript content, slightly updated from 2011 publication (9/2013 Stony Brook University)
<http://www.stonybrook.edu/commcms/gelfond/physicians/info.html>

Eating fish is good
Eating fish is bad

Lots of conflicting information on
risks and benefits of eating fish

All “sides” agree...

Benefits outweigh risks for
eating fish low in mercury
& other contaminants



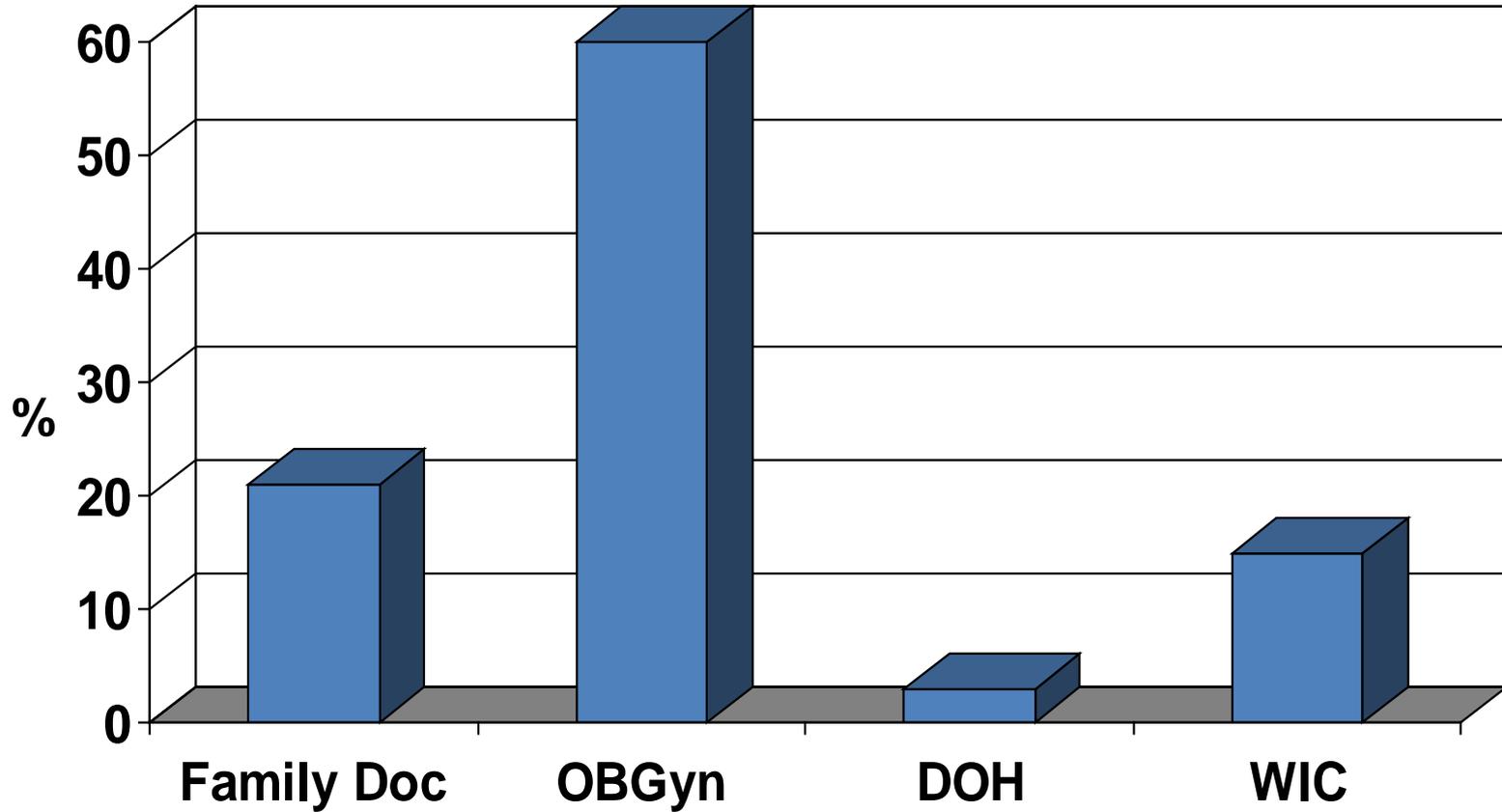
Challenge is knowing:

- Which fish are low in contaminants?
 - Fish are not all the same
 - Salmon = very low in mercury
 - Shark = very high in mercury
- Who needs to be most careful about exposure?
 - Risks and benefits are different for
 - developing fetus
 - adult with CVD

Health Care Provider Role

- Dietary guidance for patients
 - Difficult in the presence of conflicting recommendations about the risks and benefits of eating fish.
 - Need to be careful about the message
 - Unintended consequences
 - Promote substitution rather than avoidance
 - Substitution requires knowledge and effort
- HCP are good source of information for WCBA
 - To promote health fetus/baby, WCBA need to more careful about fish selection
 - Fetus is most sensitive to exposures

Source for Mom's Guide



Training

- Summarize benefits and risks
- Fish consumption guidelines
- Screening and counseling



From: Minnesota DNR, 1989

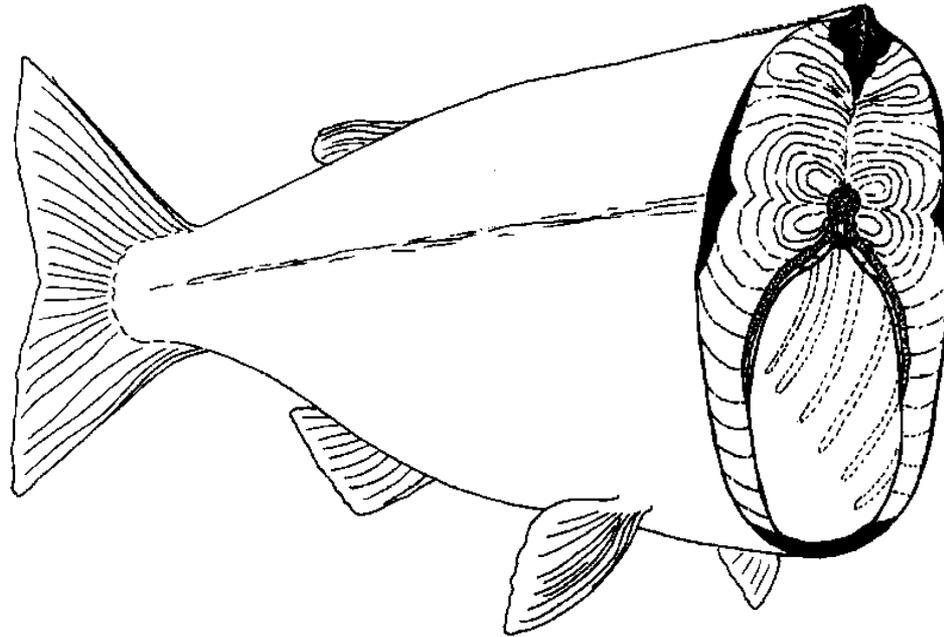
Which fish has more mercury?



Which lake has higher levels of mercury in the fish?



Is mercury in the fatty parts of fish or in the fillet?



A pregnant women should not eat fish (T/F)



Why eat fish?

- Nutritional Benefits
 - Low fat (saturated) protein
 - Vitamins and minerals
 - Omega-3 fatty acids
- Cultural, recreational, social and economic benefits
- Focus for this training: developmental benefits & why pregnant women should eat fish

Benefits - Observational Studies

- Higher maternal consumption of fish results in children showing better neurological function than those whose mothers ate low amounts or no fish

What is it about fish?

- Omega-3 fatty acids? DHA?
- Other nutrients in fish? e.g. Se, I, Fe, Vit D
- Substitution for higher fat protein?
- Surrogate for a healthy lifestyle?

- Whatever the reason - data support eating fish

Omega-3 fatty acids

- Omega-3 fatty acids: ALA, EPA and DHA
- EPA and DHA are structural components of the brain and eyes
- DHA is required for brain development
- Human brain gets DHA from diet
 - Dietary DHA is well absorbed and is readily incorporated into plasma and blood cell lipids in humans
 - Most DHA in brain is derived by uptake from plasma
- Primary dietary sources of EPA and DHA are fish and seafood
- Conversion of ALA to EPA to DHA is $< 1\%$

DHA

- Depletion of DHA from brain and retina interferes with normal neurogenesis and neurological function, and visual signaling pathways
- Pre- and post-natal periods likely critical period for incorporation into neural tissues

DHA Recommended Intake

- No dietary recommended intake (DRIs)
 - Guidelines in literature of 100-300 mg/day based on observed and estimated intakes, and intervention studies
- No conversion available for dietary intake to blood levels
- Fish oil: may be a good choice if no or low fish consumption

Omega-3 Supplements

- Meta-analysis of randomized trials of formula supplementation have not found persistent benefit on physical, visual, neurodevelopmental outcomes of term or pre-term infants
- Limited evidence from randomized trials of fish oil supplements in pregnancy supports cognitive benefit for offspring

DHA Data in Fish (Preliminary)

200 mg/day = 1400 mg/week

Species	DHA mg/8 oz serving
Salmon	1836 - 4941
Halibut	681
Lake Superior fish*	
Chinook Salmon	1362
Chub	1816
Herring	1362
Smelt	454
Whitefish	454
Lean Lake Trout	2270
Siscowet Lake Trout	4086
Inland fish	
Herring	424
Lake Trout	518
Northern	226
Rainbow Trout	637
Walleye	265
Perch	197

*Source: Addis, 1990

Unfortunately

Fish have Environmental Contaminants

- PCBs are an issue in the Great Lakes, major rivers and contaminated sites.
 - Levels are going down in fish
 - PCBs accumulate in fatty fish and in beef and dairy products.
 - Babies exposed to PCBs during pregnancy may have lower birth weight, reduced head size, and delayed physical development.
- Farm raised fish – feed can have contaminants
- Mercury is found in all fish

Dartmouth Toxic Metals
Superfund Research Program

Mercury: From Source to Seafood

A ten minute web-based film explaining how mercury gets into the seafood we eat, why it is important to eat low-mercury fish for good health, and the need to keep mercury out of the environment.

Post-video – comments

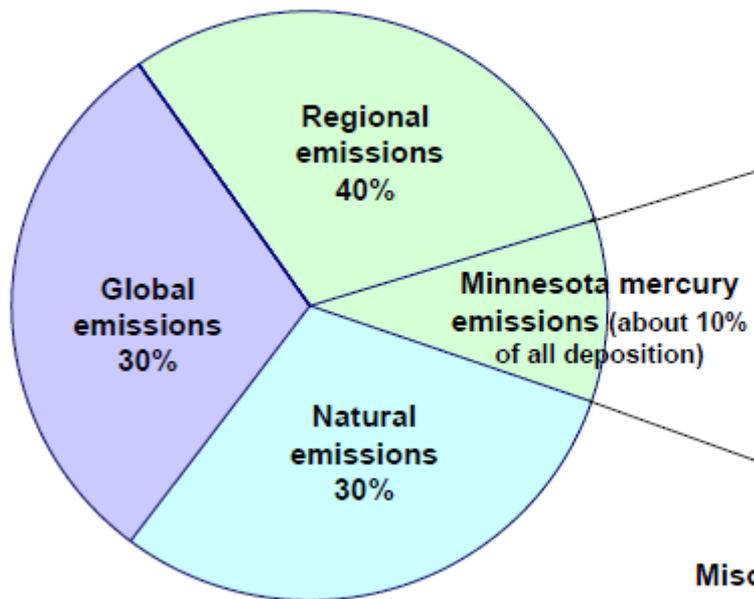
- WI fish from northern lakes tend to have higher levels of mercury
- Temporal trend in fish unclear

Which WI fish have the most mercury?

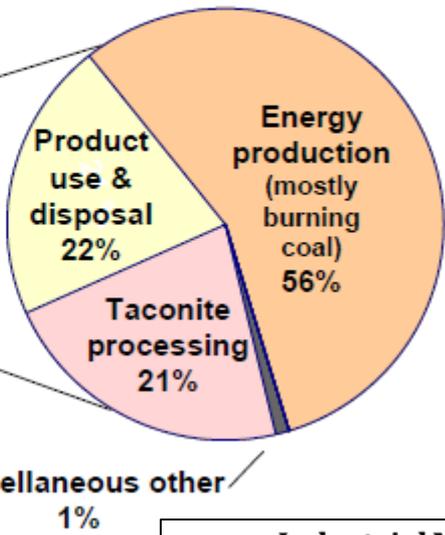
- Walleye, Northern pike,
Largemouth bass



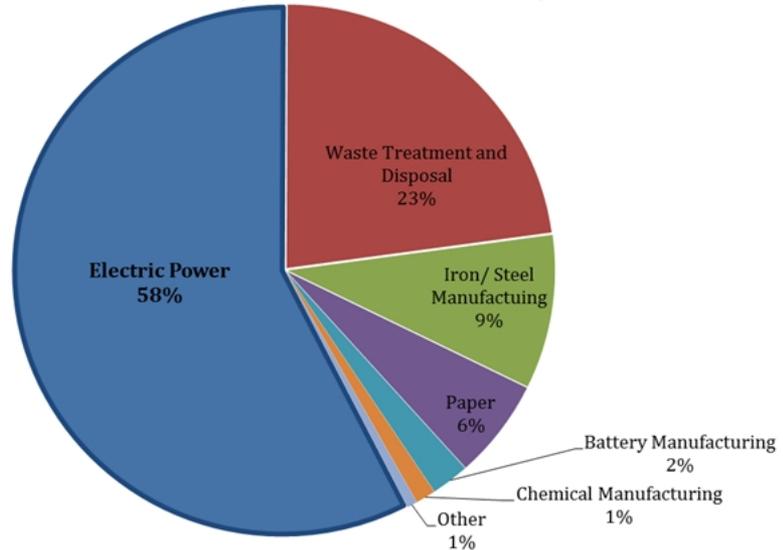
Sources of Atmospheric Mercury Deposition to Minnesota



Minnesota Mercury Emissions (2005)



Industrial Mercury Emissions in Wisconsin (2011 Total: 4,246 lb)



Mercury Species

Form of mercury influences how it moves in environment and within the body

- Elemental (Hg^0) or metallic - vapor
- Inorganic (Hg^+ , Hg^{++}) – occupational (products)
- Organic
 - Methylmercury (MeHg)(CH_3Hg^+) – fish
 - Ethylmercury – thimerosal preservative in vaccines
 - Dimethylmercury – chemistry lab
 - Phenylmercurics – fungicides in latex paint

Methylmercury in the Body

- >95% of meHg is absorbed in the gastrointestinal tract and distributed via the blood to **all organs** in about 30-40 hours after ingestion.
- meHg in blood is assumed to reflect amount in body
- meHg crosses the blood-brain barrier
- meHg crosses the placenta. Levels in umbilical cord blood are on average 1.7x higher than maternal blood levels.

MeHg in the Body, continued

- meHg and demethylated (inorganic) mercury are gradually removed from the body, mainly via liver bile and feces.
 - Some meHg is stored in hair and nails.
- The half-life of meHg in blood is about 50-70 days in adults.

Methylmercury Toxicity

- Neurotoxic
- Developing nervous system is especially sensitive
- Fetal toxicity can occur in the absence of clinical signs or symptoms in the mother

Exposure to mercury

- EPA Reference Dose
 - Safe dose over a lifetime, within an order of magnitude
 - Neurodevelopmental effects
 - **0.1 $\mu\text{g}/\text{kg}/\text{day}$**
 - Uncertainty factor of 10
 - Equivalent blood concentration = 5.8 $\mu\text{g}/\text{l}$
- Safe dose for general population $\sim 3\text{X}$ higher ($\sim 20 \mu\text{g}/\text{l}$)

“Safe” exposure level

- Based on observational studies of prenatal mercury exposure and child development in fish eating populations
 - Cohorts were initiated to determine what level of methylmercury exposure is “safe”
 - Neuropsychological tests indicate deficits involved with a child’s ability to learn and process information
 - Not clinically observable
- Supported by many human and animal studies
- Small uncertainty factor compared to most risk assessments for environmental contaminants
- Still some debate about exact “safe” dose

Risks & Benefits

- Historically studies either looked at risk or benefit, not both
- A few recent observational studies have looked at both risk and benefit
- All conclude eating fish low in contaminants is beneficial for development

Fish Consumption Advice

- Concern that negative messages will scare people from eating fish and result in loss of benefits
- Mercury and beneficial nutrients are both present in fish
 - Data on omega-3 levels in fish, particularly freshwater fish, is lacking
- Benefits addressed qualitatively.....for now
 - Working towards a framework to quantitatively include both
- Overall Goal: Minimize people's exposure to contaminants in fish while promoting the many benefits of eating fish.



What women of childbearing age should know about eating fish.

Fish are fun to catch and good to eat. Fish are healthy food – high in protein and low in fat.

But too much of a good thing can be bad for you. All fish contain some mercury, a contaminant. Eating too much mercury-contaminated fish can be harmful to your health and to your child's health. Chemicals found in fish are not known to cause immediate sickness, but chemicals can build up in the body over time.

Small amounts of mercury can damage a brain that is just starting to form and grow. That's why young children, babies in the womb and breast-fed babies are at most risk. Too much mercury may affect a child's behavior and lead to learning problems later in life.

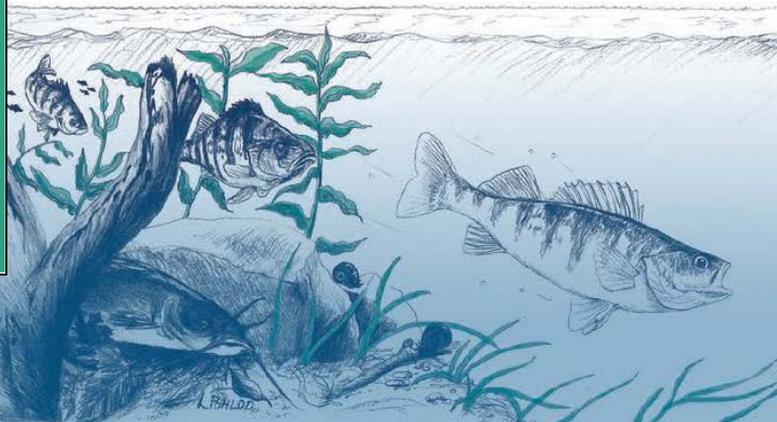
How can I reduce my health risks and my child's health risks from mercury and other chemicals in fish?

- ➔ Eat smaller, younger fish.
- ➔ Choose lean fish. These include panfish, such as bluegill, crappie, sunfish, and yellow perch.
- ➔ Choose fish that don't eat other fish. The large predator fish such as bass, walleye, northern pike, and muskie tend to have more chemicals.

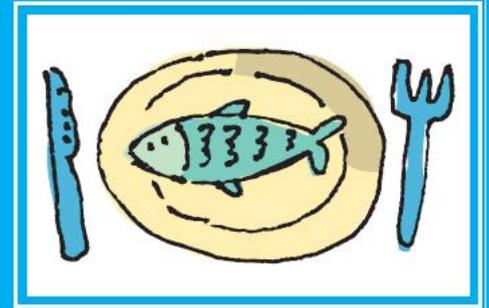
For more information about eating Wisconsin fish or to obtain a copy of the sport fish advisory, call the State Division of Public Health at 608-261-6875, call your local health department, or check out the Division's website at www.dhfs.state.wi.us or the Department of Natural Resources website at www.dnr.state.wi.us.

PPH 45029A (09/02)

Choose wisely - 2013 A health guide for eating fish in Wisconsin



A Family Guide to Eating Fish



Safe eating guidelines for fish from Wisconsin lakes, ponds, and rivers and for fish bought in restaurants and stores.

Wisconsin Department of Health Services and Wisconsin Department of Natural Resources



PUB-FH-824-2013



PRINTED ON RECYCLED PAPER

Benefits — eating fish 1-2 times per week has benefits for people of all ages.

Fish are a source of lean protein, vitamins, minerals and omega-3 fatty acids. EPA and DHA are omega-3 fatty acids found in fish. Our bodies can't make EPA and DHA — eating fish is the primary way to get these fatty acids.

- DHA is a building block of the brain and eyes.
- Pregnant women and breastfeeding moms can eat fish to give DHA to their babies.
- Children of women who ate lower mercury fish every week have been found to do better developmentally.

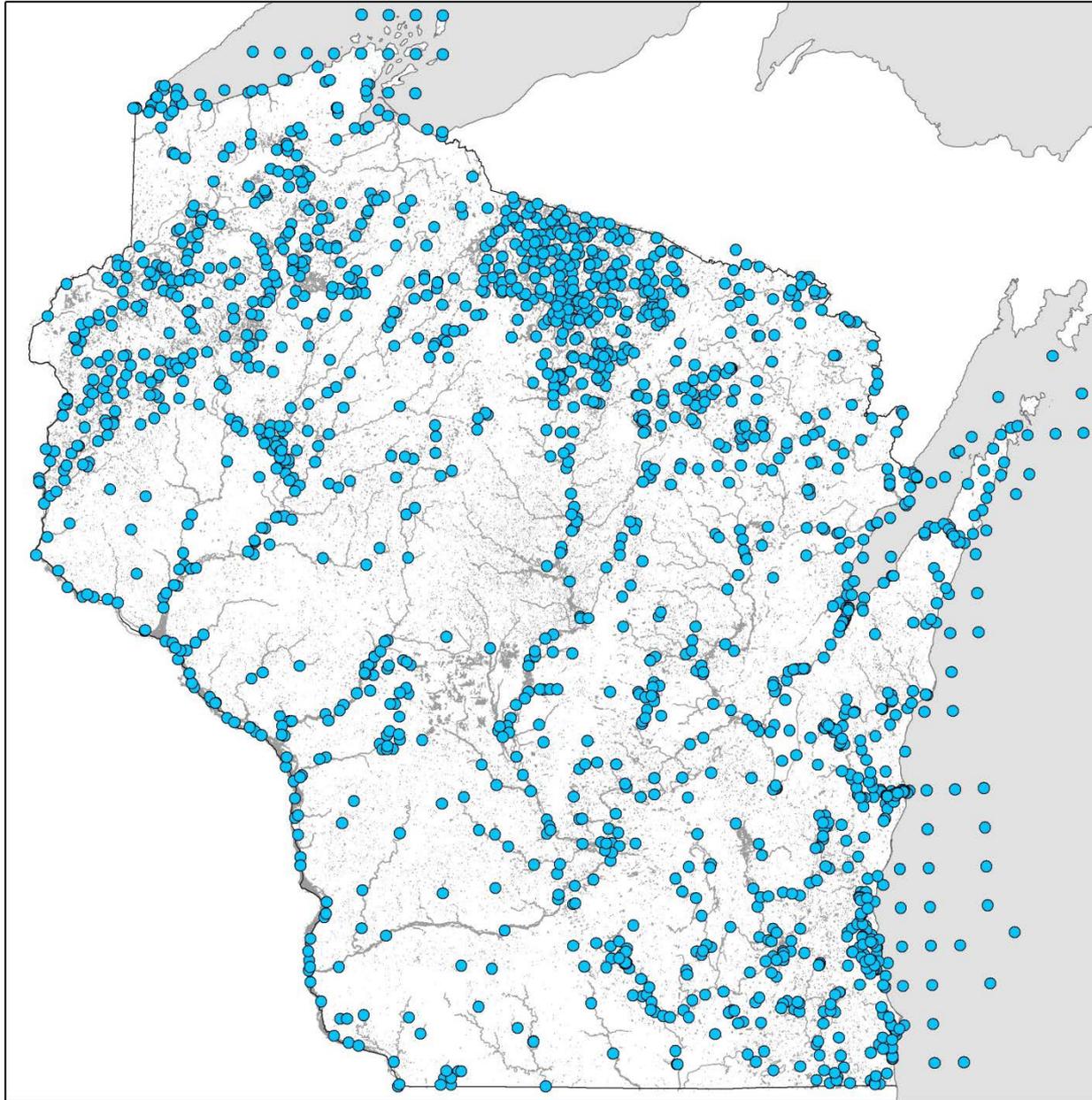
Eating fish has also been shown to lower the risk of heart disease in adults.



Benefits are maximized with fish higher in EPA and DHA but lower in mercury. Fish from Lake Superior are generally higher in EPA and DHA than fish from inland lakes and rivers. Fatty fish like salmon have the highest levels.

2 servings/week	0.1 µg/g	<p>Purchased fish: Shrimp, Pollock, Catfish (farm raised), Salmon (Atlantic or Pacific)</p> <p>Lake Superior fish: Rainbow smelt</p>
1 serving/week	0.2 µg/g	<p>Purchased fish: Canned Light Tuna</p> <p>Lake Superior fish: Brown trout, Burbot, Chinook salmon < 32", Chubs, Herring (Cisco), Coho salmon, Lean lake trout < 22", Lake whitefish, Rainbow trout/Steelhead, Yellow perch</p> <p>Inland fish: Panfish (bluegill, sunfish, crappie), Yellow perch, bullhead, inland trout</p>
1 serving/month	0.4 µg/g	<p>Purchased fish: Canned White (albacore) Tuna, Tuna (steak/fillet/sushi), Halibut</p> <p>Lake Superior: Lean lake trout 22" to 37", Chinook Salmon 32"+, Lake sturgeon 50"+, Siscowet lake trout < 29", Walleye</p> <p>Inland fish: Walleye, Northern pike, Largemouth bass, catfish, all other sport fish except muskie</p>
Avoid	1 µg/g	<p>Purchased fish: Shark, Swordfish, King Mackerel, Tilefish</p> <p>Lake Superior: Lean lake trout > 37", Siscowet Lake Trout > 36"</p> <p>Inland fish: Muskie</p>

Wisconsin's Fish Contaminant Monitoring Locations: 1970 - 2014



Mercury Levels in Commercial Fish and Shellfish (1990-2010)

See also Mercury Concentrations in Fish: FDA Monitoring Program

Table 1. Fish and Shellfish With Highest Levels of Mercury

SPECIES	MERCURY CONCENTRATION (PPM)					NO. OF SAMPLES	SOURCE OF DATA
	MEAN	MEDIAN	STDEV	MIN	MAX		
MACKEREL KING	0.730	N/A	N/A	0.230	1.670	213	GULF OF MEXICO REPORT 2000
SHARK	0.979	0.811	0.626	ND	4.540	356	FDA 1990-2007
SWORDFISH	0.995	0.870	0.539	ND	3.220	636	FDA 1990-2010
TILEFISH (Gulf of Mexico)	1.450	N/A	N/A	0.650	3.730	60	NMFS REPORT 1978

Table 2. Fish and Shellfish With Lower Levels of Mercury

SPECIES	MERCURY CONCENTRATION (PPM)					NO. OF SAMPLES	SOURCE OF DATA
	MEAN	MEDIAN	STDEV	MIN	MAX		
ANCHOVIES	0.017	0.014	0.015	ND	0.049	14	FDA 2007-2010
BUTTERFISH	0.058	N/A	N/A	ND	0.36	89	NMFS REPORT 1978
CATFISH	0.025	0.005	0.057	ND	0.314	57	FDA 1991-2010
CLAM *	0.009	0.002	0.011	ND	0.028	15	FDA 1991-2010
COD	0.111	0.066	0.152	ND	0.989	115	FDA 1991-2010
CRAB ¹	0.065	0.050	0.096	ND	0.610	93	FDA 1991-2009
CRAWFISH	0.033	0.025	0.012	ND	0.051	46	FDA 1991-2007

Species and Advice



- Include species that can be eaten 1 – 2 times per week
- List species that are most popular based on national data and available in WI markets
- Acknowledge that people eat fish with moderate mercury

SAFE EATING GUIDELINES for women who are pregnant, planning to be pregnant, or are breastfeeding and for children under age 15.

For most of Wisconsin's inland (non-Great Lakes) waters.*

WEEKLY	2 meals per WEEK   Atlantic or Pacific Salmon (not Great Lakes), farm-raised catfish, shrimp, pollock, and other purchased fish low in mercury.
	OR
	1 meal per WEEK  Canned "light" tuna. Wisconsin panfish including bluegill, sunfish, crappies, and yellow perch. Also, bullheads, and inland trout*.
MONTHLY	1 meal per MONTH  Canned "white" tuna (6 oz.), tuna steaks, and halibut. Wisconsin gamefish including walleye, pike, bass, catfish, and any other Wisconsin species*.
DO NOT	DO NOT EAT  ANY SWORDFISH, SHARK, KING MACKEREL, TILEFISH, OR WISCONSIN MUSKIE

SAFE EATING GUIDELINES for men and women beyond their childbearing years.

Unrestricted* – Wisconsin panfish, bullheads, and inland trout. Also, farm-raised catfish, shrimp, pollock, canned "light" tuna, Pacific or Atlantic salmon (not Great Lakes), and other purchased fish low in mercury.

1 meal per week* – Wisconsin gamefish and any other Wisconsin species. Also, canned "white" tuna, tuna steaks, and halibut.

1 meal per month – Shark, swordfish, king mackerel, tilefish, and Wisconsin muskie.

*On certain waters, where data indicate higher mercury levels, more restrictive advice is needed. Please visit our website at dnr.wi.gov/topic/fishing/consumption or call your local health department.



For more information about purchasing fish, visit the FDA website at fda.gov.

FISH YOU CATCH IN WISCONSIN	MERCURY LEVEL	FISH YOU PURCHASE
PANFISH  BLUEGILL  YELLOW PERCH  BLACK CRAPPIE  WHITE CRAPPIE	LOW	COMMERCIAL FISH  SHRIMP  SALMON  POLLOCK
GAMEFISH  LARGEMOUTH BASS  SMALLMOUTH BASS  NORTHERN PIKE  WALLEYE		MEDIUM
GAMEFISH 	HIGH	
<p> Some gamefish listed above can contain HIGH levels of mercury depending ON THE LAKE.</p>		



Reel in the Facts About Mercury in Fish

Fish are fun to catch and good to eat. Fish are healthy food - high in protein and low in fat.

But too much of a good thing can be bad for you. All fish contain some mercury. Eating too much mercury-contaminated fish can be harmful to your health and your child's health.

Keep Eating Fish

The benefits of eating fish outweigh the health risks as long as you follow these guidelines.

This brochure will help you to:

- * decide which fish to eat,
- * determine how often to eat fish, and
- * identify fish with high levels of mercury.

Mercury

Small amounts of mercury can damage a brain that is just starting to form and grow. That's why young children, babies in the womb and breast-fed babies are at most risk. Too much mercury may affect a child's behavior and lead to learning problems later in life.

Mercury can also harm older children and adults. Older children and adults can experience symptoms of numbness and tingling, memory loss, and vision changes following exposure to mercury. Recent studies conducted in Europe have linked mercury to heart disease and blood pressure changes. Mercury can come from natural and man-made sources. Mercury in the air settles into lakes and rivers. It can then build up in fish. All fish have some mercury, including:

- * fish caught in Wisconsin lakes and rivers,
- * fish caught in waters in other states, and
- * fish you buy in the store or eat in a restaurant



However, you can't see, smell or taste mercury in fish. That's why it's important to know which fish are safer than others to eat.

Which Fish are More Likely to Contain Higher Amounts of Mercury?

- * larger fish
- * older fish
- * fish that feed on other fish (walleye, northern, bass)

Can't We Trim Away or Clean or Cook the Fish to Get Rid of the Mercury?

No, the mercury gets into the flesh. However, by removing fat when you clean and cook fish, you can help to reduce the amount of other contaminants like PCBs.

How Big is a Meal Size?

One meal is assumed to be one-half pound of fish before cooking for a 150-pound person. Meal sizes for people weighing less may be adjusted accordingly (e.g. 1/4 pound uncooked for 75-pound person).

Should I Just Stop Eating Fish?

No...just be sure to follow the guidelines presented in this brochure.

More Information.

These are general guidelines based on mercury levels measured in fish throughout Wisconsin and levels of mercury found in commercial fish. More specific advice is available for fish from Wisconsin lakes and rivers that have been tested.

For information on mercury and other contaminants in Wisconsin gamefish, consult the full fish consumption advisory booklet. This booklet is available at your local Department of Natural Resources (DNR) office, your local health department, or on the web at dnr.wi.gov/topic/fishing/consumption You can find more information by visiting these websites: epa.gov/fish; dhfs.wi.gov/eh/fish; and fda.gov.

Wisconsin Department of Health Services
Division of Public Health
1 West Wilson Street
Madison, WI 53702-0007
608-266-1120
PPH 44031B (REV. 07/08)



How Much Fish Makes a Serving?



- The amount of fish in a serving is based on the body weight of the person eating the fish.
 - We assume a 150 pound person eats a serving of one-half pound (eight ounce) of uncooked fish to stay within our guidelines. Eight ounces of uncooked fish is equal to about six ounces of cooked fish.
 - To adjust meal size for a heavier or lighter weight person, add or subtract one ounce of fish for every 20 pounds of body weight.

Fish Consumption Guidelines

- Provided by many government agencies and other organizations

2 servings/week

0.1 µg/g

Purchased fish: Salmon, Shrimp, Tilapia

0.2 µg/g

Purchased fish: Canned Light Tuna

1 serving/week

0.4 µg/g

Purchased fish: **Canned White (albacore) Tuna,**
Tuna (steak/fillet/sushi), Halibut

Avoid

1 µg/g

Purchased fish: Shark, Swordfish



FDA/EPA advice

- Do not eat Shark, Swordfish, King Mackerel, or Tilefish because they contain high levels of mercury.
- Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
 - Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
 - Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don't consume any other fish during that week

Organization	Advice by species?	Serving Size
<i>Purchased fish</i>		
EPA/FDA	4 species DNE, canned white tuna 6 oz/wk, all other species 12 oz/week	6 oz cooked
American Heart Association	Same as EPA/FDA Recommend eating fish (particularly fatty fish) at least two times (two servings) a week	3.5 oz. cooked
Dietary Guidelines for Americans	Same as EPA/FDA Recommend at least 8 and up to 12 ounces of a variety of seafood per week, from choices that are lower in methylmercury	
States and Tribes	Yes. Using FDA data for mercury in fish	8 oz uncooked/150 lb person
<i>Locally-caught fish</i>		
EPA/FDA	Defers to local advice. If none, 6 oz per week any kind of fish.	6 oz cooked
States and Tribes	Yes. Using state/tribal data for mercury in fish	8 oz uncooked/150 lb person

Do people eat enough fish to be
concerned?

Study: 1 in 10 babies in Lake Superior region are born with high levels of mercury

One of every 10 babies born in the Lake Superior region of Minnesota has unsafe levels of toxic mercury in his or her bloodstream, according to a Minnesota Department of Health study released Thursday.

By: **John Myers**

Duluth News Tribune

Case Study – Minnesota

- Two MN women
 - ~ 2 meals/day of predatory fish for years
 - Fatigue, lethargy (one reported memory loss)
 - Blood mercury levels 20 $\mu\text{g/l}$ and 25 $\mu\text{g/l}$
- One women treated with DMSA (by private physician)
- Other women received no chelation
- Both advised to limit fish consumption
- Mercury levels normalized and symptoms resolved within several months in both women

Is Chelation Recommended?

- Chelation can be a valuable intervention for inorganic mercury poisoning, but it poses its own risks.
- Except in rare cases, it is not generally warranted for patients with elevated MeHg from fish consumption.
- Some practitioners mistakenly use DMSA or DMPS provocation challenge when they test a patient's urine for mercury. This gives highly misleading results that overestimate mercury exposure.

Imported Seabass as a Source of Mercury Exposure: A Wisconsin Case Study

Lynda M. Knobeloch,¹ Meg Ziarnik,¹ Henry A. Anderson,¹ and Vernon N. Dodson²

¹Wisconsin Bureau of Public Health, Department of Health and Social Services, Madison, WI 53703 USA; ²University of Wisconsin Hospital and Clinics, Madison, WI 53703 USA

that he was experiencing sleep disturbances and had difficulty concentrating, and asked whether these symptoms might be due to mercury exposure. The caller was especially concerned about his 2.5-year-old son's exposure to mercury.

The family's diet included 3-4 fish meals per week

- Imported seabass (2 meals/week),
- Lake Superior whitefish (1-2 meals/month),
- Lake Superior trout (1-2 meals/month),
- Farm-raised trout (1-2 meals/month)
- Farm-raised salmon(1-2 meals/month)

Table 2. Mercury content of fish

Type of fish	Mercury content ($\mu\text{g/g}$)
Lake Superior whitefish	< 0.02
Lake Superior trout	< 0.02
Farm-raised salmon	0.05
Farm-raised trout	0.05
Seabass	
Filet 1	0.5
Filet 2	0.7

Table 1. Medical test results and personal data

	Man	Woman	Son
Age	40	42	2.5
Body weight kg (lbs)	57 (126)	52 (115)	13 (30)
Fish meals/week	3-4	3-4	3-4
Fish/meal (g)	227	150	75
Hair mercury ($\mu\text{g/g}$)	12	10	NA
Blood mercury ($\mu\text{g/L}$)			
Day 0	58	37	37
Day 15	45	24	NA
Day 70	24	14	NA
Day 200	5	3	NA
Hair Hg/blood Hg ratio	207	270	NA

NA, not available.

Mercury Levels in High-End Consumers of Fish

Jane M. Hightower¹ and Dan Moore²

- Serial blood mercury levels in 67 subjects
 - Dropped rapidly within 3 weeks after being told not to eat fish or greatly reduce consumption fish with high levels of mercury
 - All dropped to < 5 ug/l within 41 weeks except 2 who continued to eat large predatory fish

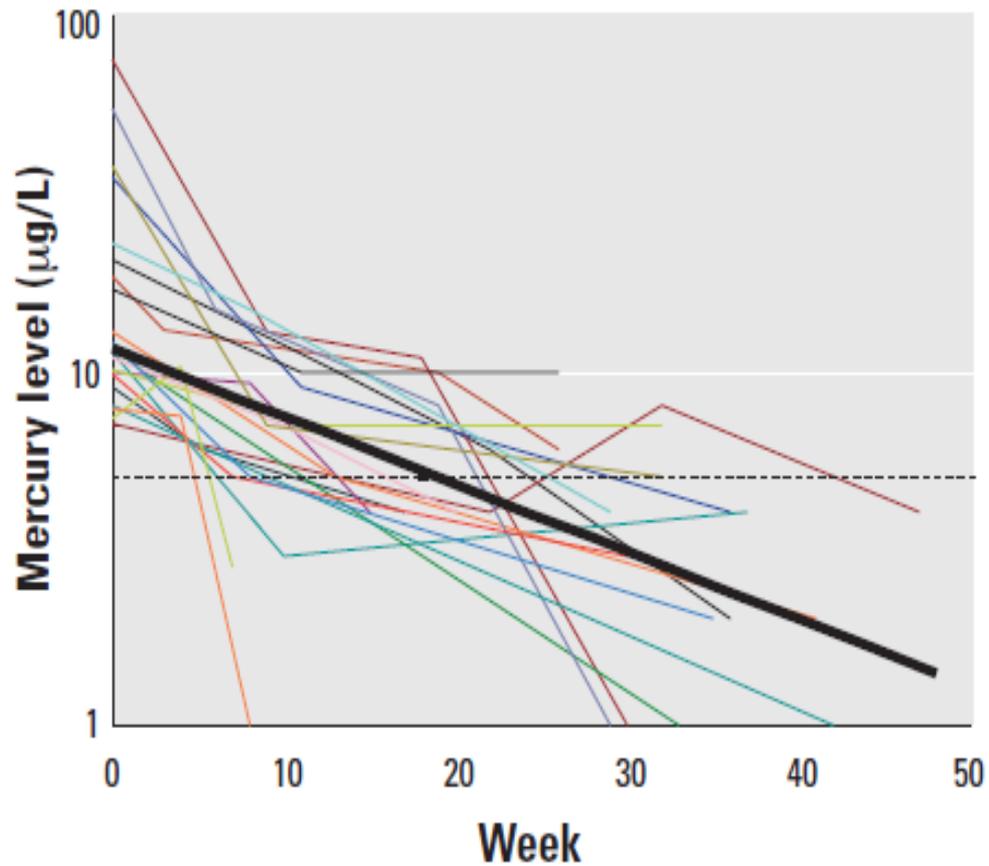


Figure 1. Blood mercury levels in 21 subjects with three or more measurements over time. Levels for individual patients are designated by straight lines. The thick line shows an exponentially declining fit to data from all 67 subjects. The horizontal dashed line is at 5 µg/L.

Clinical meHg Poisoning

- Some people eat a lot of fish, as often as 5 to 20 meals per week.
- Some people prefer to eat predatory species like swordfish that contain high mercury levels.
- These individuals can get high doses of methylmercury from their diets, and some may develop clinical meHg toxicity.
- Cases of methylmercury poisoning are rare and most physicians have never encountered one; symptoms may easily go unrecognized unless dietary habits are considered.

The Gelfond Fund for Mercury Research and Outreach

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Case Reports of Methylmercury Poisoning

1. Grand Round presentation: "Medical Masquerade: One Man's Experience with Methylmercury Poisoning"

This unique one-hour video presentation about the clinical presentation of methylmercury poisoning includes three parts: the perspective of someone who experienced it himself; clinical information from an expert in methylmercury poisoning; and perspectives from a scientist who studies mercury in the marine environment. The video was made at a grand round presentation for the Department of Medicine at Stony Brook University Medical Center in November 2010.

Presenters included: Richard Gelfond, CEO and Director, IMAX Corporation and Chair, Stony Brook Foundation; Michael Gochfeld, MD, PhD, Professor, University of Medicine and Dentistry of New Jersey; and Nicholas Fisher, PhD, Distinguished Professor, SBU School of Marine and Atmospheric Sciences and Director of the Consortium for Inter-Disciplinary Environmental Research.

 Environmental Health News

Search

14 February [Less acid rain could mean more mercury in fish.](#)

Regulations on mercury emissions in Europe have led to a steady decline in mercury entering the environment since the 1990s. So government scientists in Norway were surprised to discover in 2009 that mercury levels in lake fish had strongly increased since 1991. [Chemical & Engineering News.](#)

14 February [The Yamuna is poisoned and so are your vegetables.](#) Fresh, green spinach leaves that Delhiites put on their plates contain more than just nutrients. A recent study indicates the presence of heavy metals in the vegetables that are grown with water from the Yamuna. [Hindu, India.](#)

Identifying Patients with meHg Poisoning

- Clinical manifestations vary with intensity and duration of exposure
- Symptoms can vary significantly among individuals
- Symptoms may be delayed from time of exposure
- Symptoms may emerge when body's ability to compensate for the damage is depleted
- Genetic variation or food/nutrient interactions may affect mercury metabolism

(Nonspecific) symptoms associated with chronic lower level MeHg exposure:

- sleep disturbance
- headache
- fatigue
- difficulty concentrating
- depression
- memory loss
- diminished fine motor coordination
- muscle and joint pain
- gastrointestinal upset
- hair thinning
- heart rate disturbance
- hypertension
- tremor
- numbness or tingling around the mouth

Symptoms associated with higher meHg exposures:

- numbness or tingling in hands and feet
- clumsy gait, difficulty walking (ataxia)
- slurred speech
- tunnel vision
- diminished visual acuity

Variability of symptoms

- Multiple research studies and personal observations by the authors indicate that individuals vary widely in sensitivity to MeHg toxicity.
- Milder symptoms have been seen at relatively low blood mercury levels.
- People vary in susceptibility to mercury, and not everyone with high exposure experiences adverse effects.

Testing for Mercury

- High exposure is rare, routine Hg testing is not indicated
- Better to ask about diet than test, promote change in diet if indicated
- Consider testing if symptoms or extreme diet
- Majority of mercury exposure will decline in about 3 months with correct fish consumption
- We are testing in this project to evaluate our mercury screening questions

Patient Communication

- Screen (questions in EMR)
- In the last 2 to 3 months...
 - How many times a week did you eat any kind of fish?
 - How many times a month did you eat any of these fish? walleye, northern, bass or lake trout from Lake Superior
 - Did you eat shark or swordfish?
- Further probing into diet if indicated
- Provide eating guidelines – try to be specific to individual

More Information

- WI DHS → www.dhs.wisconsin.gov/eh/fish/
 - Dr. Henry Anderson
 - Brooke Thompson
- WI DNR → dnr.wi.gov/topic/Fishing/Consumption/
 - Candy Schrank
 - Meghan Williams
- MDH → www.health.state.mn.us/fish
 - Pat McCann

**MN Course Evaluation Results for
South Shore Women Choose Wisely
(WI GLRI Project)**

FISH Project Risks and Benefits Training – Minnesota Course Evaluation

Wisconsin GRLI Project: Essentia Health

May 2014

N = 5

Evaluation and Input from Learners

1. Were the contents of this training sufficient to prepare you to understand and discuss benefits and risks of fish consumption for your women of childbearing age patients?

Course						Average Score
	1	2	3	4	5	
	<i>Not really sufficient</i> N	N	<i>In most areas</i> N	N	<i>Yes, in all areas of concern</i> N	
MN Course				1	4	4.8

Comments:

- Increase Native American population - need more on data

2. For this topic (fish consumption risks and benefits), do you think this training was about the right amount of time?

- **All 5 respondents answered “yes”** the training was about the right time length.

3. How important do you think it is to include the following topics in a course designed to prepare clinic staff to discuss benefits and risks of fish consumption with their women of childbearing age patients? **(Only 4 out of 5 people answered this question.)**

Topic (* top rated)	1	2	3	4	5	Average Score
	<i>Least Important</i> N	N	<i>Somewhat Important</i> N	N	<i>Most Important</i> N	
*How mercury gets into fish				1	3	4.8
*Where mercury comes from				1	3	4.8
*How mercury acts in the body				1	3	4.8
Scientific basis for “safe levels” used to give advice				2	2	4.5
*Scientific basis for risks of fish consumption				1	3	4.8
Bottom line for patients: What are proven risks?				2	2	4.5
Scientific basis for benefits of fish consumption				2	2	4.5
*Bottom line for patients: What are proven benefits?				1	3	4.8
*Guidance for patient communication				1	3	4.8
Lab tests for mercury: When to test?		1		1	2	4
Lab tests for mercury: Which tests to order?		1		1	2	4
Lab tests for mercury: How to interpret?		1		1	2	4
How to identify who might be at risk for high Hg exposure				2	2	4.5
How to access information on fish advisories		1		1	2	4
Information on purchased fish				2	2	4.5
Information on locally caught fish				2	2	4.5

Other:

- It is all important stuff!
- No time to complete this part. [person did not answer at part of question 3)

4. What is your personal attitude regarding the following statements?

Statement (* top rated)	1	2	3	4	5	Average Score
	<i>Strongly Disagree</i> N	N	<i>Neutral</i> N	N	<i>Strongly Agree</i> N	
*Pregnant women should eat fish					5	5
*Benefits outweigh risks if people eat fish low in mercury				1	4	4.8
*Fish is an important part of a healthy diet				1	4	4.8
*Eating fish is beneficial for fetal development				1	4	4.8
Fish oil supplements are good for the fetus (only 4 out of 5 responded to this question)			1	2	1	4
Patients should rarely need to be tested for mercury		2		1	2	3.6
Chelation is not generally necessary in cases of elevated meHg from fish consumption				2	3	4.6

Comments:

- Depending on source [handwritten next to "fish oil supplements are good for the fetus"]
- Excellent presentation worth the time.

5. Do you have any other comments or suggestions about the final training course we will develop as part of this project?

- Great presentation! Very interested in participating.
- Very informational. Good. Well done.