2014 Report About the Effects of Eating Fish on Baby Brain Development: Executive Summary

On June 10, 2014, the U.S. Food and Drug Administration (FDA) released a scientific report called "A QUANTITATIVE ASSESSMENT OF THE NET EFFECTS ON FETAL NEURODEVELOPMENT FROM EATING COMMERCIAL FISH (As Measured by IQ and also by Early Age Verbal Development in Children)." The purpose of the report is to estimate the health effects on children when their mothers eat commercial fish during pregnancy.

Early research addressed the effects of mercury exposure on brain development. The scientific approach used in this report reflects the new norm of looking at the "net effects" of eating fish – both the beneficial effects of the nutrients in fish and any harmful effects of mercury.

Included in the report is a description of the types and amounts of fish Americans eat, a review of the state of the science about eating seafood during pregnancy, and several modeling exercises to estimate the net effects of eating varying levels and types of seafood during pregnancy.

The report reflects two rounds of peer review, 460 public comments, and federal interagency scientific review.

Types and Amounts of Fish Americans Eat

American woman of childbearing age eat 3.7 ounces of seafood per week.

Fish Consumption in Ounces per Week		
Cumulative Percentile	**Women 16-45**	**Men 16-45**
10th	0.0	0.1
25th	0.8	1.0
50th	1.9	2.6
75th	4.4	5.9
90th	8.8	12.0
95th	12.7	18.3
99th	25.2	36.2
99.5th	32.3	46.3
99.9th	55.1	70.6
Mean	3.7	5.0

Pregnant women eat less than two ounces of seafood per week.

Most commercial fish have mercury levels toward the low end. The mean mercury level for commercial fish, weighted for consumption, is 0.072 parts per million (ppm). There are no measurable differences

over time in mercury concentrations in commercial fish, nor does the FDA database reveal a trend toward increasing concentrations. Because it occurs naturally in the environment as a result of geologic and biological processes, mercury is part of the food chain and humans have been ingesting it since fish became part of the human diet.

The four seafood species that FDA and EPA recommend be avoided by pregnant women and young children – shark (0.98 ppm), swordfish (1.0 ppm), king mackerel (0.73 ppm) and tilefish from the Gulf of Mexico (1.45 ppm) – collectively account for one half of one percent of U.S. consumption.

Key Learnings from the Review of Published Seafood Studies

Nutrients in seafood like omega-3 fatty acids contribute to the beneficial side of the net effects equation, while mercury contributes to the adverse side. Beneficial net effects were consistently associated with consumption during pregnancy that exceeded 12 ounces weekly. The benefits of eating seafood tended to peak within 1-3 meals per week and in some cases appeared to diminish slightly above three meals, although the net effects were still beneficial.

There is consistent evidence that young children can benefit from their own fish consumption, but the evidence is not consistent about whether young children are especially vulnerable to mercury and at what point. This is an area in need of additional research.

Key Learnings from the Modeling of the Net Effects of Eating Fish during Pregnancy on Children's IQ

On a population basis, average neurodevelopment in this country is estimated to currently benefit by nearly 0.7 of an IQ point from maternal consumption of commercial fish.

The Net Effects on IQ Through Nine Years of Age		
Cumulative Percentiles of U.S. Children	**Change in IQ Points**	**Change in IQ Points**
0.1	-0.05	-0.04
0.5	-0.02	-0.01
1st	-0.02	-0.01
5th	-0.01	0.00
10th	0.00	0.00
25th	0.00	0.00
50th	0.03	0.11
75th	0.69	0.82
90th	2.99	3.06
95th	3.28	3.36
99th	3.41	3.45
99.5th	3.42	3.46
99.9th	3.46	3.49
Average for all children	0.67	0.69

In addition to estimating effects from current consumption, researchers considered how various changes in consumption during pregnancy could affect fetal neurodevelopment. Of the seven hypothetical scenarios modeled in this assessment, the largest benefits on a population-wide basis occurred when all pregnant women ate 12 ounces of a variety of fish per week.

Scenario	**Change in Neurodevelopment with IQ as the Indicator of Neurodevelopment**
Baseline: The effect on fetal neurodevelopment from commercial fish consumption by women during pregnancy over what neurodevelopment would have been if the women had eaten no fish.	0.7 of an IQ point
1st Scenario: Pregnant women eat no more than 4 oz. of fish per week.	0.41 of an IQ point
2nd Scenario: Pregnant women eat no more than 12 oz. of fish per week.	near zero (no change)
3rd Scenario: Pregnant women eat no more than 12 oz. per week of fish with mean methylmercury concentrations of 0.23 ppm or less.	0.03 of an IQ point
4th Scenario: Pregnant women eat only fish species with mean methylmercury concentrations of 0.23 ppm or less, but with no limit on consumption.	0.02 of an IQ point
5th Scenario: Pregnant women eat exactly 4 oz. of fish per week.	0.14 of an IQ point
6th Scenario: Pregnant women eat exactly 8 oz. of fish per week.	2.29 IQ points
7th Scenario: Pregnant women eat exactly 12 oz. of fish per week.	2.63 IQ points
8th Scenario: Pregnant women eat exactly 18 oz. of fish per week.	2.58 IQ points

The modeling indicates that the population-level benefits are less than a third of what could be attained for IQ on a population basis through optimum fish consumption during pregnancy

On an individual level, researchers modeled what would happen if a pregnant woman were to eat only one species of commercial fish. For each species, the following three numbers are estimated:

1. How much would have to be eaten per week during pregnancy for a child to obtain the maximum neurodevelopmental improvement.
2. The size of that maximum improvement measured in IQ points by nine years of age.
3. H ow much of that species would have to be eaten per week in order for the net effect on a child to be adverse rather than beneficial.

The figures for the top ten most popular species are as follows:

This analysis assumes omega-3s are responsible for the benefits of seafood and the amount of mercury in each fish is 20 percent higher than reality (to determine how higher mercury levels than have been captured in the FDA database might affect outcomes).

SPECIES	**OZ. PER WEEK TO REACH MAXIMUM BENEFIT**	**SIZE OF MAXIMUM BENEFIT EXPRESSED AS A NUMBER OF IQ POINTS**	**OZ. PER WEEK TO BECOME ADVERSE**
SHRIMP	14	3.2	1784
CANNED LIGHT TUNA	17	2.9	164
CANNED ALBACORE TUNA	5	3	56
SALMON	4	3.3	853
TILAPIA	52	3.2	1509
POLLOCK	9	3.2	530
PANGASIUS & CATFISH	22	3.2	1154
CRAB	12	3.2	311
COD	28	2.8	223
CLAMS	24	3.2	853

Fish that contain higher than average concentrations of omega-3s generally require less consumption per week to reach their maximum beneficial effect and the size of that effect is somewhat higher than for fish that contain below average concentrations of omega-3s.