Fish Consumption and Fish Advisory Awareness among Minnesota Women Who Recently Gave Birth

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Minnesota Department of Health (MDH)
Fish Consumption Advisory Program

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Summary

The Minnesota Department of Health (MDH) conducted a mail survey of Minnesota women to assess their fish consumption during pregnancy, awareness of health guidelines for eating fish, and familiarity with MDH outreach materials. Surveys were mailed in June 2004 to 1,464 women who gave birth in May 2004. Twenty-three surveys were returned as undeliverable; MDH received 1,045 (71%) completed surveys. The response rate, adjusted for undeliverable surveys, was 73% percent.

Eighty-seven percent of respondents reported eating at least one meal of fish (including shellfish) in the past 12 months. Among fish consumers, 38% ate more than two fish meals per month, 13% ate more than four meals per month and 3% ate more than eight meals per month. The average number of fish meals consumed per month was 2.6. The most commonly consumed fish was canned tuna (78%). Forty-one percent of fish consumers reported eating sport-caught fish.

Thirty-nine percent of respondents had seen at least one of two MDH fish advisory brochures (Moms' Guide or Eat Fish Guide). Knowledge of mercury in fish (mercury levels are higher in older fish, carnivorous fish, and in the flesh of the fish) was significantly greater among women who had seen the brochures. Respondents were least knowledgeable about the part of fish containing the highest level of mercury, with only 10% correctly identifying higher levels of mercury in the flesh versus other parts of the fish.

The majority of respondents (62%) reported knowing at least "a little" about the guidelines for eating sport-caught fish. Knowledge about MDH guidelines for eating sport fish was significantly higher among sport fish consumers and those who had seen MDH advisory brochures. Respondents reported having modified their fish consumption after they had become aware of the issues associated with mercury in fish. The most common dietary change among these respondents was to reduce their fish consumption. However, women who had seen the "Moms' Guide" were significantly more likely to modify their diet by eating different types of fish than those who had not seen it.

Background

Fish is the primary dietary source of long-chain omega-3 fatty acids. Recent evidence has suggested that fish consumption and the associated intake of omega-3 acids from fish can help maintain healthy heart function; and that consumption of fish is associated with reduced risk of sudden cardiac death in healthy people. Furthermore, regular consumption of fish by pregnant women plays a role in the normal development of the eyes, brain and nervous system of the

fetus. However, fish also contain trace levels of contaminants, including the neurotoxicant methyl mercury. The toxic effect of methyl mercury is most damaging during rapid brain development, particularly for children exposed *in utero* (USEPA 1997). Methyl mercury is the contaminant of greatest concern in Minnesota fish.

The Minnesota Department of Health (MDH) Fish Advisory Program conducts educational outreach in a variety of formats designed to help the public make informed decisions about eating commercial and sport-caught fish. Because the developing fetus is sensitive to the effects from methyl mercury, women of child-bearing age are regarded as an important target population for program outreach. At the time the survey was conducted, program print materials, *Eat Fish Often? A Minnesota Guide to Eating Fish* (Eat Fish Guide) and *An Expectant Mother's Guide to Eating Minnesota Fish* (Moms' Guide) were available to Minnesota women, families and sport fishers, in print and online, from a variety of sources.

Despite efforts by fish advisory programs to reach sensitive populations, results from several surveys suggest that awareness of fish consumption advice is less common among women than men (Karouna-Renier et al. 2008; Imm et al. 2005; Knobeloch et al. 2005). To assess Minnesota women's fish consumption during pregnancy and their awareness of Minnesota's fish consumption advisory and outreach materials, MDH conducted a mail survey in 2004 among Minnesota women who had recently given birth.

Methods

The survey was closely modeled after a survey conducted by the Wisconsin Department of Health and Human Services in 2003 (Gliori et al. 2006). The self-administered Minnesota survey consisted of 12 questions that addressed four topics: 1) fish consumption, 2) knowledge of mercury levels in fish, 3) awareness of MDH fish advisory materials, and 4) modifications in fish consumption after learning about issues associated with mercury in fish. Prospective participants received two mailings of the survey, one reminder postcard and a two-dollar incentive in the first survey mailing. The MDH Institutional Review Board reviewed and approved the project.

The MDH Center for Health Statistics collected names and addresses from electronic birth records of Minnesota women who gave birth starting May 12, 2004 until 1,500 names were collected. Mothers of deceased children or children whose electronic birth record indicated abnormal conditions or congenital abnormalities were excluded from the list, as were private records. Duplicate records resulting from multiple births and records with out-of-state addresses were removed from the list. The total number of surveys mailed was 1,464. Women whose surveys were returned due to an improper address were removed from the list, bringing the number of surveys mailed to 1,441.

The initial survey was mailed during the second week of June 2004. The cover letter stressed that the information received would remain confidential. A follow-up letter and survey were mailed to those women who had not returned the survey after approximately one month. Survey results were not associated with names. A code was printed on the return envelope to identify the responder for exclusion from the follow-up mailing. Returned surveys were separated from the return envelope upon receipt.

Seventy-three percent of surveys (1,045/1,441) were completed and returned. Given ~70,000 births in Minnesota in 2004 and the survey sample size of 1,045 births, if the sampling is assumed random then the survey results have a ±3% error (confidence interval based on worst-case probability percentage of 50%) at a 95% confidence level.

Analysis of survey results data included descriptive statistics, chi-squared analyses, and *t*-tests. Due to the non-normal distribution of number of fish meals consumed, values were log-transformed prior to testing. The Mann-Whitney-Wilcoxon test was used to compare knowledge scores between groups. In all cases, the 0.05 level of significance was used. Analyses were conducted using SAS statistical software Version 9.1 (SAS Institute Inc., Cary, NC).

Results

Brochure and Fish Advisory Awareness

The MDH brochure directly targeted toward pregnant women, *An Expectant Mother's Guide to Eating Minnesota Fish* ("Moms' Guide") is commonly distributed by health care providers, local public health agencies, and WIC clinics. The more general brochure, *Eat Fish Often? A Minnesota Guide to Eating Fish* ("Eat Fish Guide") is typically made available to the general public through the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, and non-governmental organizations.

Thirty-seven percent of respondents had seen the Moms' Guide and 10% had seen the Eat Fish Guide. Respondents had seen both brochures most often from OB/GYN clinics (Table 1).

Table 1. Where did you see the brochures?

	Percent all respondents	Percent respondents among those who saw Moms' Guide	Percent respondents among those who saw Eat Fish Guide
Family doctor's clinic	10	24	38
OB/GYN doctor's clinic	26	68	49
Health Department	2	4	4
WIC clinic	7	18	26

The majority of those who reported seeing the brochures found them either somewhat or very helpful; results were similar for both brochures (Table 2).

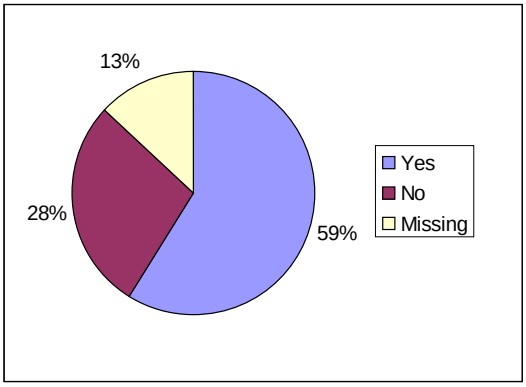
Table 2. How helpful were the brochures?[1]

	Percent respondents who saw Moms' Guide	Percent respondents who saw Eat Fish Guide
Very helpful	50	50
Somewhat helpful	41	42
Not very helpful	2	3
Not at all helpful	2	4
Did not see or missing	6	3

[1]May not equal 100% due to rounding and because 5 respondents recorded more than 1 answer.

Of the women who had seen at least one of the brochures, the majority (59%) reported prior knowledge about the issues associated with mercury in fish (Figure 1).

Figure 1. Did you know about the issues associated with mercury in fish before seeing the brochure(s)?[1]



[1]Excludes respondents who did not see at least one of the brochures. Although a "check box" option was provided for "Did not see the brochures," the missing responses in Figure 1 may represent additional women who did not see the brochures.

Sixty-two percent of all respondents said they knew at least "a little" about the guidelines for eating sport-caught fish. Respondents who had seen at least one of the brochures and those who had eaten sport-caught fish reported significantly greater knowledge about sport-caught fish guidelines (Table 3).

Table 3. How much do you know about guidelines for eating sport fish?

	Percent				
	All respondents	**Saw Moms' Guide or Eat Fish Guide**	**Did not see either guide**	**Ate sport-caught fish**	**Did not eat sport-caught fish**
A lot	4	7 (p=0.0004)	2	5	3
Some	23	30 (p<0.0001)	19	34 (p<0.0001)	17
A little	35	35	34	39 (p=0.04)	32
Nothing	39	29 (p<0.0001)	45	24 (p<0.0001)	47

P-values given when a statistically significant difference was found between respondents who saw/did not see the guides or ate/did not eat sport-caught fish in past 12 months (Chi-squared tests).

Respondents' Fish Intake

The results in this section summarize the respondent's fish consumption during the 12 months preceding the survey. Table 4 presents an overview of fish (fish=finfish and shellfish) consumption based on the question, "Over the past 12 months, about how many meals of fish or shellfish did you eat per month?" Twelve percent of respondents reported zero fish meals per month. Fourteen respondents did not answer this question; in 10 of these cases, the respondent later reported eating certain types of fish in the past 12 months. This inconsistency may stem from the wording of the question, as occasional consumers may not eat fish *every month*. In four cases, a reason for nonresponse could not be ascertained.

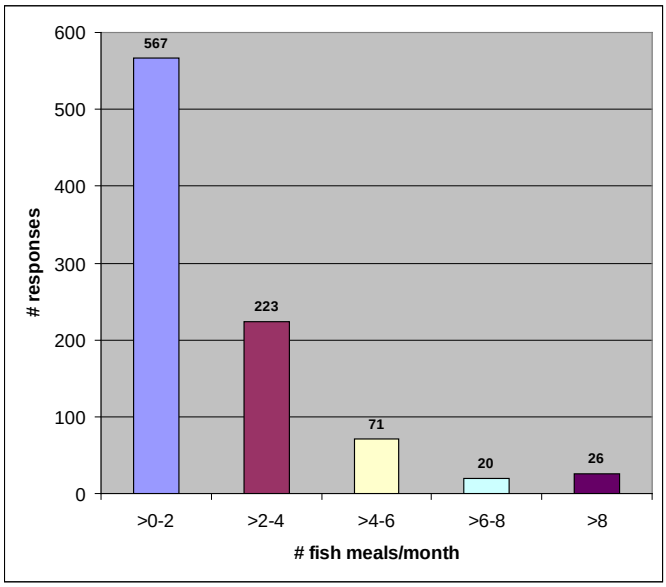
Table 4. General fish consumption

Response	**Frequency (percent)**	**Cumulative frequency**
Fish/shellfish consumption – No	124 (12)	124
Fish/shellfish consumption – Yes	907 (87)	1031
Missing	14 (1)	1045

As shown in Figure 2, of the 907 respondents who reported one or more fish meals per month, the majority (54%) ate 1-2 fish meals per month. The mean number of meals/month was 2.6 (range 0.8 – 43 meals), the median number of meals/month was 2.0, and the 95th percentile of consumption was 7.0 meals per month.

Three percent (N=26) of fish consumers reported eating >8 fish meals per month. Three women among this group reported eating fish in the "other" category. These were: (1) dried squid/fish from Cambodia, (2) fast food fish sandwich and (3) sushi-twice weekly; raw tuna, salmon, yellowtail, etc. Sixty-five percent of the high-consumers reported only commercial fish consumption. This group included the two highest consumers (48 and 40 meals per month) who each reported eating canned tuna, shellfish and frozen fish. Lacking information on type and frequency of tuna meals, and species-specific information for other fish meals, it is difficult to say which of the high-consumers may have exceeded the EPA/FDA advice of two meals per week of fish that are lower in mercury for women who are pregnant (EPA/FDA, 2004).

Figure2. Number of fish meals per month among consumers[1]



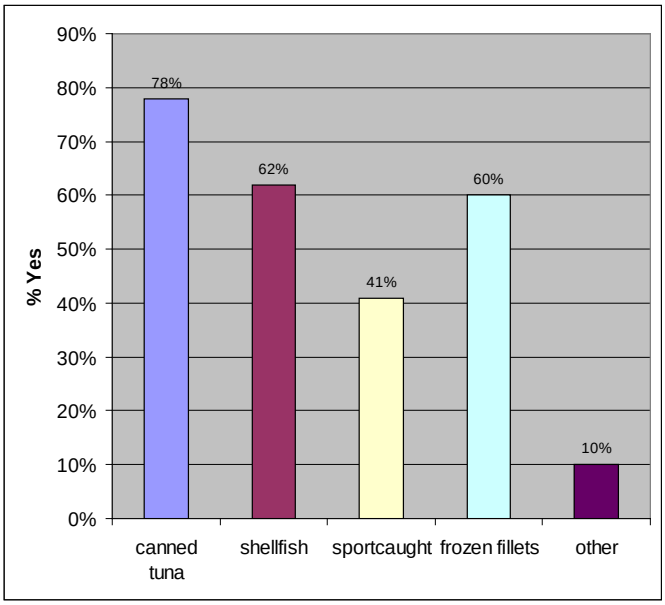
[1]A "consumer" is defined as a respondent who reported number of fish meals per month >0 (n=907). Fish is defined as finfish or shellfish. An additional 124 respondents reported zero fish meals in the past 12 months and 14 respondents did not report number of fish meals.

The difference in number of fish meals/month was examined between consumers who had seen at least one of the fish advisory brochures (n=359) and those who had not (n=548). No statistically significant difference in fish meals/month was found between the two groups (based on *t*-test of means of logs; p=0.49).

As shown in Figure 3, canned tuna was the most commonly consumed fish. Women typically reported eating from more than one category of fish with 34% eating fish from three of the four explicit fish categories in the past 12 months. Many consumers (58%) ate only commercial fish. A potential for response bias exists due to the structure of the question regarding type of fish

consumed. Respondents were provided "check boxes" to select four specific fish categories (shown in Figure 3) with the option to write-in additional responses (i.e., 'other').

Figure 3. Types of fish consumed in the past 12 months[1]



[1] Includes all respondents unless they reported eating zero fish meals in the past 12 months (n=921). Duplicate responses were allowed. Shellfish was defined as non-imitation shellfish. Sport-caught was defined as "fish you caught or that were given to you". Frozen fish was described as "such as fish sticks, fish fillets, and fish sandwiches".

Ninety-two women (10%) reported eating at least one species of "other" fish. Table 5 lists the fish which were reported one than once. Salmon was the most frequently consumed "other" fish.

Table 5. Write-in responses for "other" type of fish consumed in the past 12 months

Type	Frequency
Salmon	34
Walleye	8
Unspecified fish bought at a grocery store	8
Cod	7
Unspecified fish eaten at restaurant	7
Sea bass	4
Imitation crab	4

Halibut	4
Tilapia	3
Herring	3
Unspecified sushi	3
Catfish	3
Sunfish	2
Tuna	2

Knowledge of mercury levels in fish

The following results characterize the survey respondent's knowledge about mercury levels in fish. Three questions were used to ascertain women's awareness that: 1) mercury levels are higher in older fish; 2) mercury levels are higher in fish that eat other fish; and 3) mercury is found in higher levels in the meat versus other parts of the fish.

Combining results from all three questions, an aggregated score from 0-3 was calculated for each respondent. As shown in Table 6, overall knowledge of the three content areas was generally poor. Among all respondents,

- 3% answered all three questions correctly.
- 47% answered one or two questions correctly.
- 50% answered no question correctly.

Table 6. Overall knowledge about mercury levels in fish by total score

	Frequency (percent)		
Score	**All respondents**	**Saw Moms' Guide**	**Did not see Moms' Guide**
0	523 (50%)	146 (38%)	377 (57%)
1	301 (29%)	127 (33%)	174 (27%)
2	190 (18%)	100 (26%)	90 (14%)
3	31 (3%)	15 (4%)	16 (2%)

There was a statistically significant difference (p<0.0001) in the underlying distributions of scores between women who had seen the Moms' Guide and those who had not, indicating that the guide was effective in increasing the women's awareness of mercury in fish. However, 64% of women who saw the Moms' Guide reported that they knew about the issues associated with mercury in fish prior to seeing the brochure.

As shown in Table 7, the largest percentage of respondents reported knowing that higher levels of mercury are found in older fish. Women were least aware about the part of fish containing the highest level of mercury. Respondents who had seen *either* the Moms' Guide or the Eat Fish Guide performed better on the first question than those who had not, and the difference was statistically significant (p<0.0001). Women who had seen *either* of the two print materials also performed significantly better on question #2 than those who had not (p<0.0001). For question #3, significant differences in the correct response were seen between those who had/had not seen the Moms' Guide and those who had/had not seen the Eat Fish Guide (p=0.03 for Moms' Guide and p=0.0014 for Eat Fish Guide).

Table 7. Knowledge about mercury levels in fish by question

	Percent all respondents	Percent of respondents who saw Moms' Guide	Percent of respondents who saw Eat Fish Guide	Percent of respondents who saw either guide
1) More mercury in:				
Older fish	40	51*	41	50*
Younger fish	1	1	2	2
Doesn't matter	23	21	26	21
Don't know	38	29	33	29
2) More mercury in fish that:				
Eat plants	5	4	6	4
Eat other fish	25	32*	26	31*
Doesn't matter	15	14	20	15
Don't know	57	51	53	52
3) More mercury in:				
Fat	12	18	15	17

Organs	5	4	6	5
Meat	10	13*	19*	12
Doesn't matter	10	11	13	11
Don't know	64	58	52	58

Correct answers are in italics. Of all respondents, 388 respondents reported seeing the Moms' Guide, 107 respondents reported seeing the Eat Fish guide, and 402 saw either guide. *= statistically significant difference between those who had/had not seen the guide(s) (Chi-squared tests).

Change in fish consumption behavior upon awareness of mercury

The majority of respondents reported eating less fish or the same amount of fish after becoming aware of the issues associated with mercury (Table 8). Women who saw the Moms' Guide were significantly more likely to eat different types of fish (p<0.0001) after becoming aware of issues related to mercury. Sixty-one respondents (6%) reported more than one dietary change. In 77% of these cases, respondents reported eating both less fish and different types of fish. The majority of women who reported eating less fish after learning about mercury in fish consumed 1-2 fish meals per month (62%) or 3-4 fish meals per month (25%). However, the number of fish meals they consumed per month *prior* to reducing their consumption is unknown. Seventeen percent of respondents did not learn about the issues associated with mercury in fish until reading the survey.

Table 8. Change in fish intake after learning about mercury[1]

	Percent all respondents	Percent respondents who saw Moms' Guide	Percent respondents who did not see Moms' Guide
Ate less fish	33	36	32
Ate more fish	<1	<1	<1
Ate different types of fish	15	21*	11
Ate same amount of fish	35	36	34
Never ate fish	16	15	17

[1] Excludes respondents who didn't know about the issue until receiving the survey (n=177). May not equal 100% due to rounding and because duplicate responses were allowed. Nonresponse=5%. *= Statistically significant difference between respondents who saw/did not see the Moms' Guide (Chi-squared tests).

Discussion

In general, the distribution of advisory outreach materials, most commonly by OB/GYNs, appears successful at raising awareness among pregnant women. Women who reported having seen the brochures had significantly greater knowledge about mercury in fish. There is also some indication that women who had access to the brochures also had higher previous knowledge of mercury in fish. Isolating the effectiveness of the outreach materials is challenging. Women with prior knowledge of mercury in fish may have been more likely to remember seeing the brochures, or may have been more motivated to read them. It is unknown how many of the women who saw the outreach materials also received a verbal message about fish consumption from healthcare providers. Further, pregnant women are likely to be concurrently accessing other sources of information on this topic during pregnancy (e.g., websites or books on pregnancy).

The biggest knowledge gap among all respondents revealed by this survey was failure to understand that mercury levels are higher in the flesh of the fish (filets) than in other parts of the fish. This information may be misunderstood because the brochures contain fish advisories based on both mercury and polychlorinated biphenyls (PCBs). PCBs levels are higher in fish fat, and can be reduced by cleaning and cooking. The non-chemically specific risk messaging in the brochures may have contributed to confusion on this issue. For example, the Moms' Guide states that contaminants are higher in fatty fish, which could lead to the assumption that higher levels of mercury are found in the fat. Also, the Moms' Guide states, "mercury cannot be removed through cooking or cleaning" but does not explain that this is because mercury gets into the flesh. This risk communication problem has also been identified in other surveys. It may help to separate the advice by contaminant when it is different (Anderson et al. 2004).

The most desirable outcome of advisory awareness is for pregnant women is that they will continue to obtain the health benefits of eating fish but will consume types of fish low in mercury at the recommended frequency. Regardless of whether survey respondents had seen the Moms' Guide, one-third of women modified their consumption after learning about issues related to mercury in fish by eating less fish. However, women who had seen the Moms' Guide were more likely to have switched to different types of fish than those who had not seen the guide.

Compared to Wisconsin's analogous survey of 1,000 women who gave birth in 2003, the number of fish meals consumed per month and the types of fish consumed were very similar. The only notable distinction was in the percent of women who ate sport caught fish in the past 12 months (WI=29%, MN=41%). A higher intake of sport fish in Minnesota compared to other Great Lake states has been previously shown (Imm et al. 2005). A related difference was found in the percent of respondents who knew ("a lot" or "some") about the guidelines for eating

sport fish (WI=18%, MN=27%). Women in both surveys performed similarly on all three questions in the knowledge assessment portion of the survey.

One notable finding is that only one respondent in this survey reported eating one of the four commercial fish species listed in the brochure's "Do not eat" list for pregnant women (i.e., shark, swordfish, tile fish, and king mackerel). That respondent reported that she had stopped eating swordfish when she learned about its high mercury content. Future outreach efforts in Minnesota should perhaps focus more intensely on more commonly consumed fish containing "low" and "moderate" levels of methyl mercury. For example, this survey supports the popularity of canned tuna among women (78% of fish consumers) and highlights the need for education among women of childbearing age on guidelines for safe tuna consumption (type, frequency).

Caution must be taken when using this survey to draw inference for all Minnesota women of childbearing age. The sample population was comprised of women who had recently given birth. Their pregnancies may have resulted in dietary modifications and greater access to information on contaminants in fish. Further, results may not accurately reflect all women who gave birth in 2004 due to nonresponse bias (i.e., the return of surveys was voluntary). Since no information on socio-demographic characteristics was collected, it could not be determined if respondents differed in meaningful ways from non-respondents. Survey responders may disproportionately eat more fish; although one survey-based study that included follow-up phone calls to nonrespondents found that they ate nearly as much fish as respondents (West et al. 1989). The survey was written in English, which may have limited the participation of groups with low literacy rates and those who cannot read English. No in-depth evaluation of the missing data in returned surveys was conducted. Although missing data were generally minimal, they could represent another source of bias in the results.

There are some advantages to the survey in terms of its design. It was specifically targeted to pregnant women and mailing it shortly after childbirth likely increased the recall accuracy of fish consumption during pregnancy. It is one of only a few surveys to focus on knowledge of mercury in fish and the impact of fish health advisories on changes in fish consumption. The high response rate was likely influenced by the short length of the survey, and perhaps to high interest among new mothers in the health of their babies.

There are also limitations to the survey. Time constraints related to funding availability and IRB approval precluded the development a more comprehensive study design and question development. Since no socio-demographic information was collected, nonresponse bias could not be evaluated and the results could not be stratified by age, education, income, race/ethnicity, geographical region, etc. The questions were limited in complexity and scope, with most answers reported as "yes/no" or multiple choice. Although a short survey may result in better response, it limits the depth and breadth of information collected. Only the number of

fish meals was ascertained, not the weight of fish consumed, limiting the ability to compare intake rates with other studies. Information on the type of fish consumed was limited by the use of a question for which respondents were provided "check boxes" limiting selection to four specific fish categories (shown in Figure 3) with the option to write-in additional responses (i.e., 'other'). Recalling consumption over an entire year via a mail survey is generally problematic, although pregnant women as a group may be more aware of their fish consumption than the general population. A prospective diary approach is considered the "gold standard," resulting in the fewest recall errors.

In sum, these results suggest that fish advisory outreach targeted to pregnant women is effective and should be intensified. Suggested modifications to current efforts include a greater focus on popular commercial fish containing low and moderate amounts of mercury, and improvements in chemical-specific messaging. Considering that most pregnant women in this survey ate only a modest quantity of fish and one-third modified their diet by eating less fish, emphasis should be placed on helping women to understand the benefits of eating fish and to manage proper choice of fish. Adding a socio-demographic component to future research studies would help identify sub-groups of women who are not being consistently reached and/or who are at potentially greater exposure risk.

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