



Are women anglers of childbearing age in the Great Lakes region following fish consumption guidelines?



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ABSTRACT

States in the Great Lakes region of the United States issue fish consumption guidelines for women of childbearing age (WCBA) to help them minimize the health risks to themselves and their potential offspring from eating fish contaminated with chemicals. We used diary methods to study 1395 WCBA who purchased fishing licenses in the Great Lakes coastal region to determine if they were aware of the guidelines and following them. We found that two-thirds of WCBA reported at least minimal awareness of the fish consumption guidelines, and those that reported awareness were more likely to hold beliefs consistent with the messages emphasized in the guidelines. WCBA reported eating less than one meal/week of fish with most of this fish purchased at a store or restaurant. On average, they consumed just 2.4 sport-caught fish meals over the 16-week study period. The average portion size for sport-caught fish meals eaten by WCBA was similar to that assumed by states when determining the guidelines. However, one-quarter of WCBA in the overall sample exceeded the guidelines, with rates as high as 41% exceeding the guidelines in Michigan and Minnesota. Additional outreach efforts may be needed to increase compliance with fish consumption guidelines, particularly among subpopulations that exceed the guidelines more frequently.

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Introduction

Eating fish contaminated with chemicals, like mercury and polychlorinated biphenyls (PCBs), poses health risks to women and their potential offspring (Jacobson and Woodson, 1993; Lonky et al., 1996). These risks may include carcinogenesis and developmental, reproductive, behavioral, metabolic, or neurological impairment (e.g., Counter and Buchanan, 2004; Davidson et al., 2004; Humphrey, 1988; Kreiss, 1985). Some of the chemicals of greatest concern in the Great Lakes region include methylmercury, PCBs, dioxin, and mirex. For example, a study in the late 1990s found that women who ate salmonines from Lake Ontario had higher concentrations of mirex in their breast milk than women who ate Lake Ontario panfish or did not eat Lake Ontario fish at all (Madden and Makarewicz, 1996).

As a result of these concerns about chemical contaminants, U.S. states have issued fish consumption guidelines for several decades. Most states target women of childbearing age (WCBA) and children, aged 15 or younger, with the most restrictive guidelines because of the concerns described above. Guidelines for WCBA in the Great Lakes region range from do-not-eat recommendations for species such as large carp or lake trout (Pennsylvania Department of Environmental

Protection, 2016) to less restrictive guidelines (one or two times per week) for species such as sunfish or yellow perch, which are low in contaminants and can provide health benefits if consumed (Minnesota Department of Health, 2016).

Past research has shown that most anglers are generally aware of the fish consumption guidelines in their state (Connelly et al., 1993; Imm et al., 2005; Katner et al., 2011; Kearney and Cole, 2003). For example, Connelly et al. (2012) found that over 90% of anglers living in the Great Lakes region were aware of sport-caught fish advisories. However, certain segments of the angler community (e.g., younger, non-white) were less likely to be aware (Katner et al., 2011).

Awareness of the advice for sport-caught and purchased fish among WCBA may be more variable, and in some cases lower, than awareness among anglers in general. Imm et al. (2005) found that while 65% of male Great Lakes anglers were aware of the advice for fish caught in the Great Lakes, only 30% of women were aware. Giori et al. (2006) conducted a study of Wisconsin women who recently gave birth and found that 65% of those who ate sport-caught fish had some awareness of the Wisconsin advisory. However, only 3% said they knew a lot about the advisory. Connelly et al. (2014) found that two-thirds of new mothers surveyed in Minnesota, Wisconsin, and Pennsylvania who fished or had a household member that fished reported receiving information about the types of fish and how much fish to eat. Specifically for mercury, Lando et al. (2012) found that 73% of pregnant and 74% of

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postpartum women were aware that mercury was a problem, while Knobeloch et al. (2005) said few (20%) WCBA were aware that states issue guidelines about mercury consumption.

Several studies show that most anglers believe they are following the guidelines of their state (Imm et al., 2005; Kearney and Cole, 2003). However, other studies show that they may be mistaken. A recent study of urban anglers living in three areas within the Great Lakes region found that between 7% and 40% of anglers were exceeding the guidelines for the area where they lived (Lauber et al., 2017—in this issue). In a 1992 survey of Lake Ontario anglers, 36% consumed fish in excess of the fish consumption limits recommended for Lake Ontario, and of that group, 90% said they believed their consumption was within the recommended limit (Connelly et al., 1996). These studies focused on anglers in general, not WCBA specifically. Very little is known about the adherence of WCBA to the sport-fish guidelines specific to them. Silver et al. (2007) suggest that this may be because local advisories vary a great deal, and consequently, determining if they are being followed is a major challenge to researchers.

To address this gap, we conducted a study of women anglers of childbearing age living near the Great Lakes to determine if they were aware of fish consumption guidelines, where they reported getting their information, and if they followed the guidelines. We also explored whether notable socio-demographic groups within WCBA were more or less likely to exceed the guidelines.

Methods

We used a web-based diary method, described in detail in Connelly et al. (2016), to gather fish consumption data from WCBA who had fishing licenses and lived in U.S. counties bordering the Great Lakes. We drew a random sample of 15,000 fishing licenses sold over the previous year to women aged 18 to 48 who would reach a maximum age of 50, considered the end of the childbearing years at the end of our two-year study. We report only data from the first year of the study in this paper, as the second year of data collection involved an experimental manipulation. We drew the sample by state in proportion to the number of licenses sold in each state to WCBA. We set recruitment quotas for each state based on the number of participants we estimated we needed at the end of the two-year study for sufficient power in our statistical analysis. The recruitment quotas were in the same proportions as the sample selection. We recruited participants by mail and telephone.

We collected fish consumption information from participants for 16 weeks from May 18 through September 6, 2014. For each meal reported, participants recorded whether the fish was purchased (at a store or restaurant) or sport-caught (i.e., fish caught by you or someone else), the species eaten, the portion size, and (for sport-caught fish) where the fish was caught. We provided a list of fish species, including the most commonly consumed purchased fish and those with consumption guideline recommendations, along with a text box to record purchased fish species not on the list. For sport-caught species, we listed only those with consumption guideline recommendations and provided an “other” option. Participants indicated portion size in reference to a picture of an 8 oz. uncooked (6 oz. cooked) portion of salmon (Fig. 1) and we asked participants if the meal they ate was larger, smaller, or the same size as the picture.

We obtained data on participant age from fishing license records. We gathered data on awareness of fish consumption guidelines, sources of information, beliefs about fish consumption, pregnancy and breastfeeding status during the study period, and other socio-demographic characteristics, such as education, income and race, using online surveys conducted at the end of diary data collection.

We analyzed data from the diary using SPSS (IBM SPSS Statistics 24). We used chi-square tests to identify statistically significant differences between subgroups at the $P < 0.05$ level. Any differences described in the narrative text are statistically significant at this level.

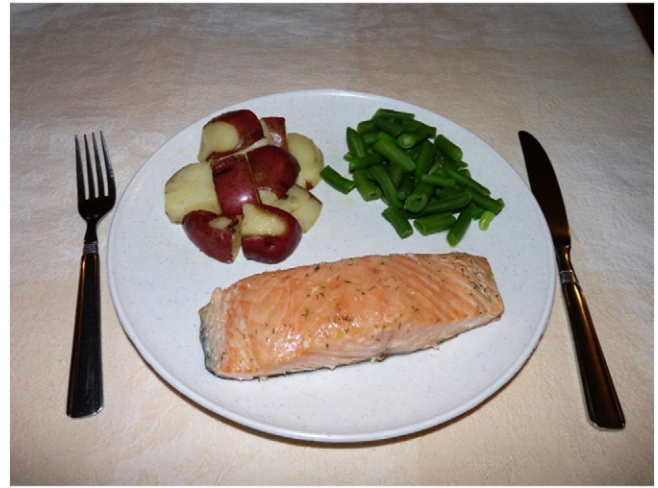


Fig. 1. Picture shows an 8 oz. uncooked (6 oz. cooked) portion of salmon.

We compared the meals eaten by each participant to the guidelines of the state where they lived. We characterized participants as adhering to the guidelines if they kept their total consumption for the 4-month study period within the recommendations for that time period. For example, if the recommendation was to consume no more than one serving of coho salmon per month from Lake Michigan, and a person consumed five servings of coho salmon during the 4-month study period, we concluded that she had exceeded the guidelines. We measured fish consumption against the guidelines for the Great Lakes (including bays, tributaries, and connecting waters as defined by each state), the statewide guidelines for all other sport-caught fish, and the state guidelines (or federal guidelines if no state guidelines existed) for purchased fish. If an individual exceeded any of these guidelines, we concluded that she “exceeded the guidelines.” This term, referring to an individual who exceeded one or more the state or federal guidelines, is used throughout the remainder of the paper. In those instances when we are referring to only the Great Lakes guidelines, we state that explicitly.

We present some results as ranges because some advice is based on the length of the fish caught; if consumers did not know the length of the fish they ate, we estimated their adherence to the guidelines assuming both the most and least restrictive consumption recommendations for that species. Similarly, a few consumers did not know the species of fish they were eating, or more commonly, reported eating multiple species at one meal. In these cases, we estimated their adherence to the guidelines assuming both the most and least restrictive consumption recommendations for the water where the fish was caught.

We report state-specific data unweighted; we weighted all other reported data (aggregated across states) in proportion to the number of fishing licenses sold to WCBA in the counties bordering the Great Lakes in each state. Weighting factors ranged from 0.85 to 1.17.

Results and discussion

Diary recruitment and participation rates

We recruited 2014 WCBA licensed anglers to participate in the study. Our recruitment quotas, which were in proportion to the number of licenses sold in each state, were met in six of the eight states. The number recruited was 6% less than the recruitment quota in Michigan and 17% less in Ohio; but, after weighting the data (as described in the Methods section), the overall results are representative of the number of WCBA anglers from each state. We conducted our study in English, finding during the recruitment process only 22 women who could not participate because they did not speak English.

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