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ANGLERS' PERCEPTIONS ABOUT PCB-CONTAMINANT RISKS FROM SPORT-CAUGHT FISH CONSUMPTION

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ABSTRACT: Presentation format can influence the extent to which target audiences understand and respond to risk-related information. This study surveyed a convenience sample of 153 sports anglers within the setting of three Illinois state parks located in Lake County and McHenry County. A two-part written questionnaire was used to collect data from across all three sites. Responses were analyzed for: 1) sociodemographic information (age, sex, race, income bracket, level of education), and 2) for subjects' fishing patterns (consumption of fish, whether households of concern were included in subjects' fish meals, type of fish eaten, and cooking methods). In addition, the subjects' responses to four message pairs were also examined. These message pairs varied by (a) reading level, (b) use of diagrams vs. text, (c) commanding versus persuasive tone, and (d) use of qualitative vs. quantitative information as printed in fish consumption health advisory bulletins. Health advisory information is disseminated in the Illinois Department of Natural Resources fishing regulation booklets. A risk communication planning model was used as an evaluation framework. Comparisons of specific formats were evaluated by chi square analysis of variance to determine if a variety of styles are required to meet the needs of anglers for any of the four pairs of format types examined. The fish consumption health advisory may not be reaching two sensitive subpopulations, women of childbearing age and children, referred to as "households of concern". The health advisory might be improved with additional information on risk-reducing cooking and cleaning methods and by diversifying the dissemination methods to reach the variety of audiences who potentially consume chemically contaminated sport-caught fish. The role of the investigator might involve case finding and management of populations for previously unsuspected health effects, ruling in or out alternative explanations for observed health effects, and consulting with public health professionals for exposure assessment through toxicological screening and biological monitoring.
KEY TERMS: fish consumption health advisory; PCB contaminant risks

INTRODUCTION

Chemical contaminants in fish can be an important source of human exposure to chemicals. Although many of these chemicals are resistant ton degradation in the natural environment, they dissolve readily in oils and thus accumulate in the fatty tissues of fish, birds, and mammals (Dar, Kanarek, & Anderson, 1992).

Polychlorinated biphenyls (PCBs) - synthetic hydrocarbon compounds once used as insulating materials in electrical transformers and capacitators - are among the most ubiquitous and persistent environmental contaminants (Kimbrough, 1995). Ingestion, including the consumption of fatty sports fish from contaminated waters is consequently a major route of human exposure (Humphrey, 1988; Mendola et al, 1995). Despite the fact that PCBs were banned in the 1970s, dangerous concentrations persist in the water of rivers and inland lakes, where they were dumped years ago as waste products from electrical transformer, capacitator, and plasticizer factories (Berger, 1985). From the sediment at the bottom of harbors, hazardous waste residues pollute the water and are eaten by

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microscopic organisms and fish. Once ingested, PCBs are stored in body fat and dissipate only slowly after ingestion ceases. Man is the final consumer in the food chain, and is exposed to the greatest concentrations of any environmental poison (Millichap, 1995). For more than ten years Illinois has issued a sport-fish consumption advisory annually. The advisory consistently provides anglers with information on how to minimize exposure to PCBs while still enjoying their catch. Not only is the advisory contained within the fishing regulations booklet given to each license holder, but media releases are issued at the start of each fishing season. Information is also distributed through guide services, bait and sport shops, and resorts. Posters describing how to clean fish to maximize removing the PCB-containing fat are posted at Lake Michigan fish cleaning stations near boat launch facilities.

OBJECTIVE

The primary purpose of the study was to examine the information presented to the public concerning the nature of potential risks posed by toxic chemicals in sport fish, and to study Lake County and McHenry County anglers to assess their sport fishing and fish consumption habits and evaluate their comprehension of the Illinois fish consumption health advisory. This investigation sought to provide both a better understanding of the contaminant risk issue and knowledge to evaluate policies that might reduce risks to public health in the future

Target Population

This study focused on the target audience of McHenry and Lake County recreational anglers. Recreational anglers were surveyed at three Illinois state park fishing areas: (a) Moraine Hills/McHenry Dam State Park; (b) Chain-O'Lakes State Park; and (c) Illinois Beach State Park. The angler's awareness of risks from consumption of contaminated sport-caught fish was examined because dietary intake is the main source of nonoccupational PCB exposure (Dewailly, Ayotte, & Laliberte, 1996).

McHenry and Lake Counties have an increasing number of at-risk individuals in households of concern within the population. The number of youths under 20 years of age in 1997 has been estimated at 75,185 (31.7 percent of the total population) in McHenry County, and at 187,794 (31.4 percent of total population) in Lake County (Population Data, 1997). This is significant because young females are the most likely of all age groups to accumulate toxic contaminants over time and then eventually transfer the chemicals to developing fetuses and newborn nursing infants.

METHODOLOGY

Research Design

The research design for this study was a written, validated questionnaire, developed by Connelly & Knuth (1998) at Cornell University to survey audience response to format variations in sports fish health advisories. The main factors measured in the surveys included sociodemographics, fishing behavior, and response to risk messages regarding consumption of chemically contaminated sport-fish. Data were managed and analyzed using EPI-INFO to report descriptive statistics and chi-square significance test.

Survey Tool

A two-part survey was used to collect information about fishing and fish consumption habits. A two-part 5-page questionnaire designed to test responses to sports fish health advisories was used in the survey .

Part I of the questionnaire contained 11 questions concerning demographics (age, sex, race, income bracket, and education level); fishing history; targeted species; whether fish were caught and kept for eating by family members; fish preparation and cooking methods; and knowledge of the Illinois fish consumption advisory.

Part II of the questionnaire was given to the study subjects along with the sociodemographic survey. This four-page questionnaire assessed responses to pairs of four messages which varied by reading grade level, persuasive versus commanding tone, presence of diagrams, and risk ratio information.

Setting and Research Sample

The study setting was three state parks heavily visited by anglers in two counties in northeastern Illinois, McHenry and Lake. Data were collected on subjects who were surveyed at the three Illinois state park fishing areas in these counties during May, 1999. Criteria used to select the two counties included proximity to waters identified in the Illinois fish consumption advisory and representation of various fishing location opportunities in Illinois.

Permission to conduct the survey on state property was obtained from the Illinois Department of Natural Resources . All anglers who were present in the state parks during the survey were eligible for inclusion in the study. A convenience sample of registered anglers in McHenry and Lake County, Illlinois, was surveyed. The sample size was large enough to allow for comparison with the survey results reported in the original research by Connelly and Knuth (1998). There were 153 surveys evaluated

One hundred and seven (70%) subjects were from McHenry Dam and Chain-O'Lakes State Parks, in McHenry County, and forty-six (30%) from within Illinois Beach State Park, in Lake County, which is proportional to the number of licenses issued in each area.

Consent and Data Collection

Approval for the study was obtained from the institution's Institutional Review Board . All subjects who agreed to take part in the survey signed a consent to participate. Subjects were given a copy of the consent. This consent was witnessed by the investigator. All surveys were kept confidential and no one was identified in the study. Participation was voluntary. Refusal to participate had no effect on their fishing license at the state park.

The researcher was present at the park sites, either at the picnic area, the fishing piers, the boat docks, or the state parks' concession/bait shops, while distributing survey materials. Clipboard, pencil, cover letter, consent form, and survey questionnaire were handed to the subject. The researcher explained the study, obtained consent, gave a copy of the consent to the subject, and administered the five-page survey.The researcher was on-site for approximately two to three hours while distributing the survey materials during each day scheduled for data collection. The estimated time to complete each survey was ten to fifteen minutes. After completing the survey, the subject returned the completed survey in person to the researcher. The researcher was available at the site to answer questions.

Data Analysis

Data from across all three sites were analyzed for: 1) sociodemographic information (age, sex, race, income bracket, level of education), and 2) for subjects' fishing patterns (consumption of fish, whether households of concern were included in subjects' fish meals, type of fish eaten, and cooking methods). In addition, the subjects' responses to four message pairs were also examined.

The Epi-Info computer program was used for analysis. Qualitative variables were expressed as percentages, and quantitative variables as means +/- SD. A p value of 0.01 or less in a two-sided test was considered to indicate statistical significance, and 96 percent confidence intervals were calculated for results. Percentages were compared with use of the chi-square test.

RESULTS

Sociodemographic characteristics

There are approximately 16,000 licensed anglers within the two counties, Lake and McHenry, where the study was conducted. This study surveyed a convenience sample of 153 anglers, approximately one percent of the total target population within the two counties.

Sex. Of the 153 subjects, 129 (84%) were male and 24 (16%) were female.

Age. The ages of the subjects ranged from 16 to 68. The mean age was 32.7 years.

Race. Fifty-four (29%) of the subjects were white; 23 (15%) were African-American; 55 (36%) were Hispanic, and 31 (20%) were Asian/Pacific Islander.

Income. The majority of the subjects, 98 (64%), reported income as moderate (between $20,000 to $50,000); 35 (23%) of the subjects reported income as low (less than $20,000), and 20 (13%) of the subjects reported income as high (greater than $50,000).

Education. The majority of the subjects, 109 (71%), had at least a high school education; 41 (27%) of the subjects had a college education; and 3 (2%) had a post-graduate education.

Fish Preparation and Cooking Methods

Fishing habits. Of the 153 subjects, 128 (84%) fished on Lake Michigan, a major area covered by the fish consumption advisory. The majority of the subjects, 148 (97%) reported "catch and keep", while only 5 (3%) of the subjects reported "catch and release".

Fish consumption. A total of 135 (88%) subjects reported that perch was the fish species caught and eaten most often. However, the survey found that few anglers eat or catch only one fish species.

Although fishing for food was not a primary motivation, almost everyone in the target audiences ate a portion of their catch and gave some of their catch to relatives and friends. One hundred and forty-eight (97%) of the anglers gave away some their catch and kept some of their catch to eat. All of the subjects who consumed sport-caught fish reported that they shared some or all of their catch.

One hundred (68%) of these subjects involved households of concern, specifically sharing sport-caught fish with women of child-bearing age and children. These two groups represent sensitive subpopulations because of potential reproductive and developmental effects associated with some of the contaminants. The subjects in the highest economic group contained the greatest proportion of households of concern that consumed sport-caught fish.

Great importance has been accorded to research related to how primary health care providers might interact more effectively with communities that are culturally different than white, middle-class ones. This was likely due, in part, to studies which question whether poor communities and communities of color are disproportionately burdened by environmental hazards (Chess, Salomone, & Hance, 1995).

Risk-reduction cleaning techniques. Forty (95%) of the whites and 20 (87%) of the African-Americans removed the skin and/or trimmed the fat off the fillet before eating (see Table 1 on page 24). These techniques help remove the fatty tissues that store lipophilic contaminants (Velicer & Knuth, 1994). Forty-five (82%) Hispanic subjects and 16 (52%) Asian-Pacific Islander subjects indicated that they did not remove the skin or fatty tissues of the fish before eating.

Risk reduction cooking techniques. Broiling, baking, and poaching fish are cooking techniques that may reduce contaminant concentrations in the fish. Whites and Asian- Pacific Islanders tended to use these cooking methods, whereas African Americans and Hispanic subjects usually fried all their fish, a technique less likely to reduce risks from contaminants.

Advisory Style Preference

Of the 153 survey respondents, 110 (72%) were not familiar with the fish consumption advisory.

Reading level comparisons. The reading level comparison described the potential effects of chemical contaminants on humans using two reading levels, fifth-grade and eleventh grade. Both passages focused on the effects of PCBs, particularly in women and children. The majority, 104 (68%) of the subjects, felt the example with the eleventh-grade reading level was clearer and easier to understand.

Education. Those with a high school education were more likely than others to find the fifth-grade reading level materials clearer and easier to understand (chi square = 7.3, $p < 0.01$). Forty-four (40%) of this less-educated group selected the grade 5 materials, while 21 (51%) college-educated subjects and one (48%) post-graduate educated subject chose the fifth-grade reading level material.

. Age. Differences existed by age (chi square = 20.9, $p < 0.01$) and gender (chi square = 4.3, $p < 0.05$) as well. For example, 76 (70%) of subjects in the youngest age group felt the Grade 11 materials were clearer and easier to understand compared to 4 (56%) in the oldest age group.

Gender. Eighty-six (67%) male subjects felt the Grade 11 materials were clearer and easier to understand compared with 17 (72%) of female subjects.

Text and diagram versus text only comparison. The second set of comparisons described how to clean a fish to reduce exposure to contaminants. One version used a diagram with a text, the other version used text only. Overall, a slight majority, 89 (58%) subjects, felt the example with the combined diagram and text was the clearer and easier to understand.

Education. Education (chi square = 9.3, $p < 0.01$) was associated with the choice of presentation format. Twenty four (59%) of the anglers with a college education were more likely to find the text/diagram combination clearer and easier to understand than those 53 (49%) subjects with less education.

Age. Age (chi square = 34.5, $p < 0.01$) was also associated with the choice of presentation format. Similar to Connelly and Knuth's findings (1998), the youngest, 71 (65%) anglers, found the text/diagram combination clearer and easier to understand while the oldest, 4 (56%) anglers, were more likely to choose text only.

Gender and households of concern. Sixty-two (62%) female subjects of child-bearing age and anglers living in households with women of child-bearing age and children under 15 (who are believed to be at greater risk from contaminants), referred to as households of concern (HOC), were more likely to choose the text/diagram combination versus 30 (56%) subjects who were not in households of concern (chi square = 9.8, $p < 0.01$).

Race. Twenty-four of the white subjects (55%) were more likely to find the text/diagram example more understandable, whereas 27 (49%) Hispanic subjects, 11 (48%) African-American subjects, and 16 (53%) Asian/Pacific Islanders were more likely to find both examples equally understandable.

Subjects in Connelly and Knuth's study (1998) were almost evenly split between either example (text/diagram 33%; text only 26%) or both examples (39%) helping them to understand how to clean fish to reduce risks. They reported that education (chi square = 27.4, $p < 0.01$), income (chi square = 20.6, $p < 0.05$), race, (chi square = 26.6, $p < 0.01$), age (chi square = 22.0, $p < 0.05$),and awareness of the health advisory (chi square = 19.7, $p < 0.01$) were each associated with differences in understandability. As education increased, the percentage choosing the text only format decreased (32% among those without a high school degree; about 20% among college graduates).

Commanding versus persuasive tone. The third comparison involved two presentation tones: authoritative tone versus a persuasive, more conversational tone. The theme of both passages was the same (limit fish consumption). The majority, 121 (79%) of subjects, felt the persuasive tone best provided them with the information they needed to make their own decision about eating sport-caught fish compared with 32 (21%) of the subjects who chose the commanding tone. Education (chi square = 18.4, $p < 0.01$), income (chi square = 12.7, $p < 0.01$), race (chi square = 7.4, $p < 0.05$), and age (chi square = 17.7, p 0.01) were each associated with differences in choice of the persuasive presentation style.

Qualitative versus quantitative comparison. The fourth and final comparison involved qualitative versus quantitative information on a comparison chart . The descriptions of risky activities and the physical placement of fish consumption on the risk charts were the same for both charts.

The quantitative chart described the level of risk in chances out of 1000. The message included quantitative estimates of the magnitude of risk associated with consuming a particular amount of contaminated fish, as well as recommended consumption limits. The other chart described the risk as higher, moderate, or low.

A fairly evenly divided proportion, 87 (57%) of the subjects, felt that the quantitative chart helped them to best understand the health risks associated with eating sport-caught fish. Sixteen (65%) of the female subjects reported a significant preference for the quantitative risk chart

Subjects in Connelly & Knuth's study (1998) were less evenly divided between the charts when asked which provided them with clearer information to enable them to make their own decison about eating fish. 68 percent chose the quantitative chart. Some preference by older subjects was shown for the qualitative chart (chi square = 26.3, $p < 0.01$), but the majority favored the quantitative chart as providing them with the needed information. Households of concern (chi square = 9.8, $p < 0.05$) and subjects aware of the health advisories (chi square = 9.7, $p < 0.05$) were more likely to choose the quantitative chart compared to other households and those unaware of the advisories.

DISCUSSION

Fish consumption health advisories are tools designed to inform and protect consumers of chemically contaminated sport fish. An effective advisory is one that can protect human health adequately when consumers of contaminated sport-fish receive, understand, and comply with the message.

A limitation of this study is that it sought to contact people with knowledge of the health advisory. However, despite the availability of information, 110 out of 153 (72%) of the sample audience, composed of licensed anglers, had no knowledge of the health advisories.

Findings from this study may not be generalizable to subjects in other settings. The migrant farm worker, for example, is often an unlicensed angler. The Regulations Guide would not be an important source of information for this population because of language barriers and lack of access to the guide containing the fish advisories.

The findings in this study reflect the anglers present in the state park setting. This sample might be younger than subjects sampled in other settings. The survey was conducted during evenings and weekends, and the subjects

present in the state parks were typically with large family and social groups. The findings of this study reflect the anglers within a rural setting, and might not reflect the findings found in an urban sample of anglers. Anglers who fish in other settings, such as the oceans or far northern lakes, would not be exposed to the same contaminants as those reported in the Illinois fish advisories

APPLICATION

Data from this study shows that no single communication strategy is likely to have similar effects on all target audiences. The diverse community of sports-fish consumers must be identified to help them understand the fish health advisories. Fishing is an important and popular activity in far northern Illinois, where nearly every gas station sells live bait for fishing. Should people stop eating fish? No! Fish are nutritious. The fat of the fish is where most of the contaminants are stored. Size does matter. Smaller fish have less fat and have retained fewer contaminants. Follow the cooking and cleaning advice in the advisory to reduce contaminants in fish.

The fish advisory is intended to protect children from potential problems. Women who eat highly contaminated fish for many years may have children who are slower to develop and learn. Adults are less likely to have health problems at the same low levels of exposure that affect children. According to past studies, fish consumption limits have a protective effect in at-risk populations. Because of the prolonged persistence of the chemical contaminants in the food chain, particularly fish in Lake Michigan, and the lack of well-understood health advisory information, there exists a need for further research in this area.. Designing audience-oriented communication programs will likely demand a diversity of approaches including communication methods other than the written word discussed here, such as videotapes in native language, interpersonal contacts, and signs or maps with symbols.

SUMMARY

In this sample, communication about contaminant risks from sport-caught fish may not be effectively reaching potential target audiences. Although fish consumption health advisories appeared to be successful in reaching recreational anglers (Velicer & Knuth, 1994), the advisories may not be reaching two sensitive subpopulations, women of childbearing age and children. The nonangling women and children under 15 years old might be unaware of the advisory, but might have an opportunity to eat sport-caught fish provided to them by family members or neighbors. The health advisory could be improved by varying the dissemination methods to reach the variety of audiences who potentially consume sport-caught fish . Information from this study has helped determine how target audiences desire information to be presented about reducing their contaminant fish consumption risk.

Interactions between communities and public health researchers offer unique opportunities to serve the needs of people. Practice of good science together with the participation of an informed and involved public can result in beneficial outcomes.

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