

# Evaluating Risk Communication about Fish Consumption Advisories: Efficacy of a Brochure versus a Classroom Lesson in Spanish and English

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Presentation format can influence the way target audiences understand risk-related information. Brochures or fish fact sheets are the methods traditionally used by state agencies to inform the public about fish consumption advisories and the risks from consuming fish. This study examines the efficacy of presenting information about the risks from consuming contaminated fish and shellfish in two different formats: a brochure and classroom presentation. The two instruments were developed and tested in Spanish and English, reflecting the local ethnic composition in the Newark Bay Complex. The instruments were tested on women of child-bearing age at the Women, Infants, and Children Center in Elizabeth, New Jersey. Detailed diagrams were used in both presentations, including contaminated fish species, fish preparation methods, and food chain bioaccumulation and transmission to the fetus. There were few language-related differences in the efficacy of the classroom lesson, and the main ideas were understood by both groups. Where there were significant differences in understanding about the risks from consuming fish or crabs from the contaminated waters of Newark Bay, in all cases the women exposed to the classroom lesson had a better understanding than those who read the brochure. Ninety-six percent of the women who heard the lesson understood that it was unsafe to eat fish from the port, compared to 72% of those reading the brochure. Both formats succeeded in imparting information to most women about the area under advisories, the fish species under advisories, and transmission of toxins to the fetus. Information on fish preparation was recalled less clearly, partly because women were asked to relate methods to reduce the risk from consuming fish from 11 presented, and most recalled only two or three of the list. The advantages and disadvantages of conducting short classes to women of child-bearing age are discussed.

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**KEY WORDS:** Brochure; consumption advisories; fish consumption; language-related differences; lesson; Newark Bay; risk communication

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## 1. INTRODUCTION

For many Americans, fishing is an important activity for food, recreation, and as a way to be outdoors with family and friends. Fish provide many benefits, both nutritional and social.<sup>(1)</sup> Fishing is an enjoyable activity that has many social benefits, particularly for Native Americans.<sup>(1-4)</sup> For some people, fish may be the main affordable source of protein, while for others, it may be the healthiest source. Fish provide omega-3 fatty acids, which have the potential to reduce cholesterol levels and reduce the incidence of heart disease, stroke, and preterm delivery, along with other health benefits.<sup>(5-10)</sup>

In many freshwater and saltwater fish the contaminant levels are sufficiently high to provide potential adverse health effects, particularly for developing fetuses and young children. A positive relationship exists between mercury and PCB levels in fish, fish consumption by pregnant women, and deficits in neurobehavioral development in children.<sup>(11-18)</sup> State agencies have dealt with the potential for adverse health effects from eating fish by issuing consumption advisories for some waters, as the federal government does not normally do this (except for commercial fish). Moreover, most state agencies distributed fish consumption guidance mainly with fishing licenses (and often no marine fishing licenses are required).

Consumption advisories stimulated a flurry of studies to determine consumption patterns, the perceptions of risk by anglers, and the compliance of anglers. In general, compliance is not high for many regions,<sup>(19-28)</sup> suggesting that risk communication is either not reaching the target audience, the message is not believed, or people choose not to follow the advice.<sup>(29-33)</sup>

Most state agencies do not have the resources to determine whether the target audience is receiving the intended message, whether they understand the concepts of bioaccumulation and trophic-level transfer, and whether some aspects are misunderstood, nor have the economic costs of advisories been determined.<sup>(34)</sup> It is critical to understand how the target audience is understanding the consumption advisories or other information provided to it. While there are a great number of studies on the risk from consuming fish, on consumption patterns, and on risk perception, there are almost none that evaluate different parameters of risk communication or different risk communication instruments (but see References 35 and 36). This is unfortunate, given the

national interest in risk management and communication about fish consumption and consumption advisories.<sup>(31)</sup>

The overall purpose of the project was to design and conduct a community-based education and outreach program to understand perceptions so that a program could be designed to reduce consumption by Latinos of environmentally contaminated fish and crabs caught in the Newark Bay Complex, and to provide the communities with information they need to make informed nutritional choices. In previous work we showed that knowledge about consumption advisories and the risk from consuming contaminated fish was lowest for Latinos (Hispanics), but when presented with the potential risk they indicated a willingness to comply with advisories.<sup>(23,37)</sup> These studies suggested a need for an approach directly targeted at the Latino community that emphasizes the reasons for limiting consumption. This is particularly important because the Latino population is the fastest growing segment of the population in the United States.<sup>(38)</sup>

In this article, we examine the efficacy of two risk communication instruments (a brochure and a classroom lesson plan) to determine whether subjects were obtaining the desired messages, and whether they would consider changing their fish consumption (or preparation and cooking) behavior. Unlike most consumption studies, which survey fishermen (most of whom are men), our efforts were aimed toward women of child-bearing age and pregnant women. The materials were developed in consultation with health educators and based on feedback from the women themselves. We also compare the responses of women reading the brochure or attending the class in English and Spanish.

There were several key risk-related concepts that seemed important to transmit in both instruments: (1) your baby eats what you eat; (2) some fish and crabs from the Newark Bay Complex are so contaminated that they should not be eaten by women of child-bearing age (including pregnant woman); (3) specific fish and crabs should be avoided; (4) there are several methods of preparing and cooking fish that reduce the risk from contaminants; and (5) changes in consumption, fish preparation, and cooking methods can reduce risk to unborn children. Thus the risk communication message was more complex than a simple fish consumption advisory, and we wished to examine whether the two risk communication instruments could transmit these concepts.

We also wanted to convey some additional information: (1) some other fish obtained from the sea and sold commercially also contain contaminants (mercury) and should be avoided or intake limited; (2) fish are a healthy and nutritional source of protein; and (3) contaminants increase through the food chain, and are transmitted from the fish through the woman to her unborn child. We believed that the latter point was important because it would provide women with enough information to understand why larger fish normally contain higher levels of contaminants than smaller fish. We aimed to provide sufficient information so that women could make their own informed decision, and not just avoid fish that could result in a decline in overall health.

The Newark Bay Complex includes waters that flow between New York and New Jersey, and people from both states fish and crab in the region. It is one of the most polluted in the United States,<sup>(39-41)</sup> and both New York and New Jersey issue fish consumption advisories.<sup>(42,43)</sup> Recently it has been reported that levels of PCBs in fish from the lower Passaic River, and elsewhere in the New York Bight, exceed the National Oceanographic and Atmospheric Administration (NOAA) benchmark level.<sup>(44,45)</sup> Both states issue advisories for blue crabs (*Callinectes sapidus*), bluefish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*), and American eel (*Anguilla rostrata*), and New Jersey also has advisories for white perch (*Morone americana*) and white catfish (*Ameiurus [Ictalurus] catus*). Advisories in the Newark Bay Complex range from do not eat (crab, striped bass), to do not eat for high risk individuals (e.g., women of child-bearing age and children), and do not eat more than once a week for the general population (American eel, white catfish, white perch, bluefish over six pounds). New York State recently issued an advisory stating that no women or children should eat striped bass.<sup>(46)</sup>

Recently the EPA issued a national advisory for freshwater fish because of mercury contamination,<sup>(47)</sup> and the FDA did so for some marine fish.<sup>(48)</sup> The FDA's advisory, also based on mercury, suggested that pregnant women and women of child-bearing age who may become pregnant should avoid eating four marine species (or species groups): shark spp., swordfish (*Xiphias gladius*), king mackerel (*Scorpaenopsis cavalla*), and tilefish (*Lopholatilus chamaeleonticeps*).<sup>(48)</sup> This is a national problem, as 23% of the lakes in the United States, 100% of the Great Lakes, and 70% of coastal waters are under advisories.<sup>(49)</sup>

## 2. METHODS

### 2.1. Study Area and Subjects

The Newark Bay Complex of the New York-New Jersey Harbor area was in need of research and development of outreach targeted to specific sub-populations because of the stringency of fish consumption health advisories due to high levels of contamination, the increase in the Latino population in the region, the influx of new immigrants, and previous knowledge of an information gap among ethnic groups in the region regarding fish contamination.<sup>(24)</sup> Instead of concentrating on anglers themselves (a high proportion of whom are men), we derived our subjects from the Women, Infants, and Children Center (WIC) in Elizabeth, New Jersey (Fig. 1).

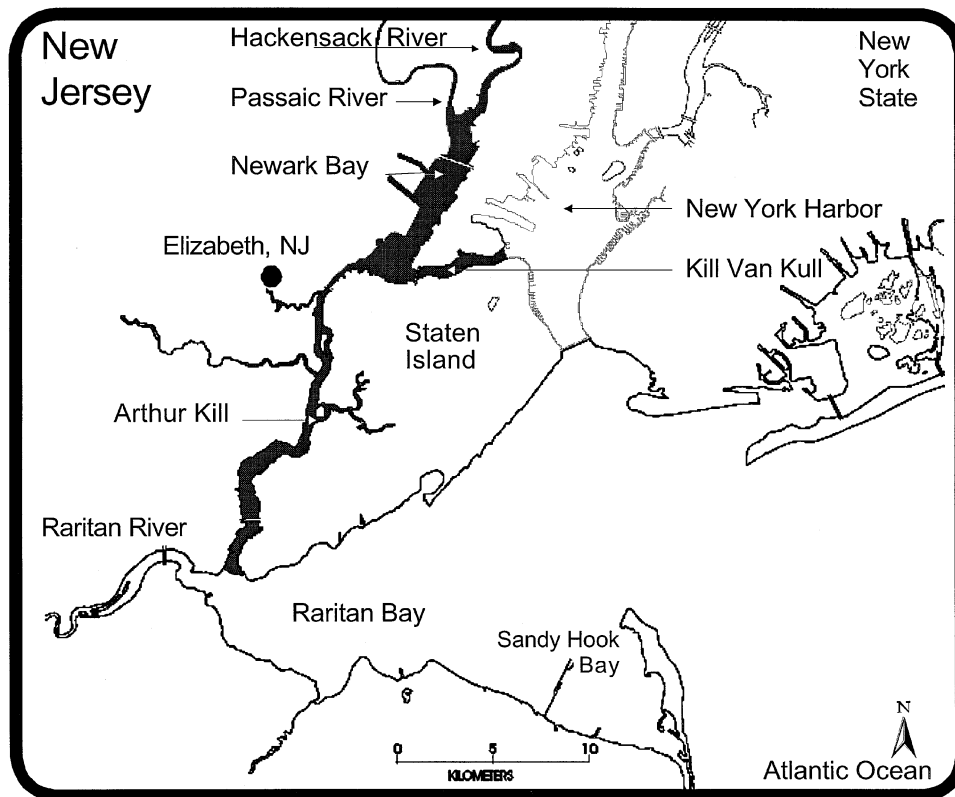
WIC provides federal grants from the U.S. Department of Agriculture to states for supplemental foods, health care referrals, and nutritional education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children found to be nutritionally at risk.<sup>(50)</sup> These centers are aimed at improving women's health and nutrition, particularly during pregnancy and the child-bearing years. Thus, it is a federal program that could be applicable to all states. The program serves about 7 million people each month.<sup>(50)</sup> There are federal income eligibility guidelines: a woman in a family of four must have an annual family income of less than \$33,485.

Interviewing was completed from January 14 through March 1, 2002, following an initial round of pretesting in the fall of 2001.

### 2.2. Development of Brochure and Classroom Lesson Plan

The overall protocol was to develop risk communication materials aimed at informing pregnant women and women of child-bearing age about the risks from consuming contaminated fish from the Newark Bay Complex. We made the choice of format for risk communication materials based on reviews of many fish fact sheets and fish consumption advisories, and consultation with community leaders and organizations, public health providers, and nutrition educators. While there are state fishing advisory brochures, they do not contain information that is specifically targeted to pregnant women, or on ways to reduce risk that are aimed at a Hispanic audience.

Focus groups and interviews held with health and nutrition managers and staff pointed to face-to-



**Fig. 1.** Map of the Newark Bay Complex showing the advisory area covered by the brochure and classroom lesson, and the location of the Women, Infants, and Children Center in Elizabeth, New Jersey.

face communication, such as an interactive lesson, as the most effective form of outreach. In addition to a lesson plan, we chose to develop a brochure due to the low cost of production and ease of wide distribution. Both instruments were entitled “Your baby eats the fish you eat!”<sup>(51)</sup> We aimed for a fifth-grade reading level, and used extensive graphics and other features of presentation found to be optimal for audiences with low levels of English language literacy.<sup>(35,52)</sup> The brochure was a single page folded to provide six different panels, and the classroom lesson consisted of a teacher’s guide and 44 slides in PowerPoint format (for a class of 15–25 minutes duration). The slides, which can be displayed in PowerPoint as overheads or on a flipchart, were designed to be self-explanatory.

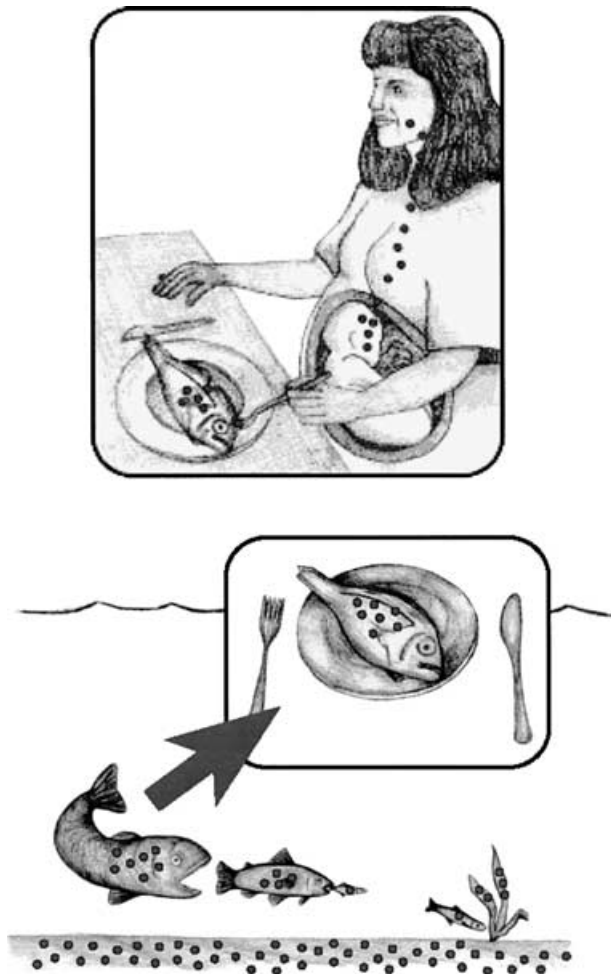
After each instrument was developed, it was pretested in interviews for the brochure ( $N = 43$ ), and in two focus groups with educators for the lesson plan ( $N = 8, 13$ ). Each was then modified based on responses and suggestions received before the final products were tested again to determine the efficacy of each in conveying the risk message (brochure:  $N = 46$ , survey:  $N = 51$ ). The tables present survey results

for the second round of testing on the revised version of the brochure and lesson plan.

After the initial brochure and lesson plan were developed in English, they were translated into Spanish by M. Perez-Lugo, as were all subsequent versions (Fig. 2). Subjects could choose the language they wished to read; the English version was evaluated in English, and the Spanish version was evaluated in Spanish. This process resulted in a final brochure and classroom lesson plan that could be used statewide.

### 2.3. Testing of Instruments

Each day we determined on a random basis which instrument we were going to test (brochure or classroom), and then all women present were approached and asked to participate. Only two women refused, although a few left before the interviews were completed (due to being called to the doctor office). Whenever possible, women were given a choice of language. In some cases, out of preference or if the timing was more convenient, immigrants from Spanish-speaking countries elected to review English



**Fig. 2.** Diagrams of food chain concepts used in the brochure and in the lesson plan.

materials. Because many of the women had small children with them, we provided a selection of small presents, including coloring books, activity books, stickers, and crayons, as a thank you (which also aided in keeping the children occupied during interviews).

As would be expected, different approaches were used to introduce the women to the brochure and lesson plan. However, regardless of whether they read the brochure or listened to the lesson plan, the questions we asked of them were the same. Questions were administered in one-to-one interviews. Women were approached as they sat in the waiting rooms, and asked if they would volunteer to look at the brochure (or attend the classroom lesson) and answer a few questions. The classroom lesson was taught during regular, weekly sessions required by the WIC program. Women who volunteered to stay on to be interviewed

were thanked with a gift certificate to a local department store.

Many of the questions could be answered by yes, no, or I do not know, or other categorical answers. Other questions were open-ended, and we scored responses as relevant (according to preset categories), or as correct, liberally interpreted. For example, on the question about the area covered, we counted correct responses ranging from “the Newark Bay” to “the port” (of Elizabeth). In the tables we give a short form of the question actually asked of the women.

## 2.4. Statistical Evaluation

In the text and tables we give the percent of people giving a “yes” response, responses equivalent to our preset categories, or the correct response. Statistics, however, were computed on the raw data. We used SPSS (Statistical Package for the Social Sciences) Pearson chi-square tests, which give a chi-square value and level of significance. If expected value for a cell was less than 5, the analysis was not considered significant.

One open-ended question (What are some of the ways you can make sure the fish you eat are safe?) did not have mutually exclusive answers, making a chi-square test inappropriate. Thus for this question we used a binomial test to test the hypothesis that people who got the lesson took home more of the messages than people who only read the brochure.

## 3. RESULTS

### 3.1. Demographics

The mean age of women interviewed was 28 years for the brochure and 29 years for the classroom lesson, and most people had one to three children. We did not ask educational and income information because this would have reduced participation in the survey; additionally, WIC has an income ceiling, ensuring that the program is reaching only low-income women and children (by definition of the U.S. Department of Agriculture).<sup>(50)</sup>

Only 7% (brochure) to 19% (English classroom) of the women were pregnant at the time (Table I). Only 36% of women who read the brochure and 28% of those who attended the class were born in the United States; most of the rest were born in Puerto Rico or in other Latin American countries. Over 90% of both samples consumed fish, although a much smaller group admitted to eating fish or crabs from the Newark Bay Complex.

**Table I.** Demographics of Women Sampled in Interviews on the Efficacy of Using the Brochure or a Classroom Lesson on the Risks from Fish Consumption. English and Spanish Refer to Their Choice of Language for the Brochure or Class

	Brochure (English and Spanish)	Classroom	
		English	Spanish
Sample size	45	26	25
Mean age ( $\pm$ SD) in years	28 $\pm$ 7.0	26 $\pm$ 11.2	32 $\pm$ 8.5
Mean number of children ( $\pm$ SD)	2.0 $\pm$ 1.3	1.3 $\pm$ 0.7	2.4 $\pm$ 1.3
Percent pregnant	7	19	12
Percent that consume fish	91	100	88
Place of birth			
U.S.	16	14	1
Mexico	2	0	4
West Indies	9	5	6
Central America	7	1	6
South America	11	3	8
Europe	0	1	0
Africa	0	2	0

### 3.2. The Classroom Lesson Plan

The classroom lesson proved to be an effective method of imparting a number of complicated concepts. In general, there were few differences as a function of whether they listened to the lesson in English or Spanish (Table II); this was also the case with the brochure (unpublished data). A number of women noted that they were pleased that the class was taught in Spanish, and that this was a first for them. One hundred percent of respondents correctly recalled that the species under advisory were unsafe, and correctly identified the area of concern as “the port” or other areas within the Newark Bay Complex. All but one woman in each class stated that she believed the warning about the fish under advisory, that eating fish caught in the Port of Elizabeth was not a good idea (or words to that effect), and that a pregnant woman could harm her baby by doing so (Table II).

One of the objectives of the risk communication instruments was to impart information on ways to reduce the risk from contaminants in fish. We expected a lower correct response rate on the question about “ways to make sure that the fish you eat are safe” because there were 11 correct methods discussed in the class, and any given person might be expected to recall only some of them. Nonetheless, some methods were more readily recalled than others, including removing fat, cooking on a rack, and eating fish that are

purchased, rather than caught by family or friends (Table II). There were some small differences between the responses to the English versus the Spanish version, including removing fat and buying fish rather than eating fish they catch (Table II). Some responses suggested that information about contaminated fish from our classroom lesson had not been transmitted, and people retained concepts based on previous understanding about fish, including “look at the eyes and gills,” “soak in lemon juice,” and “smell it.”

One of the more complex concepts discussed was the movement of contaminants from small fish to large fish, from fish in the water to fish on the plate, and from the fish to the mother to the fetus (Fig. 3). Most women had a generally correct understanding of the movement of chemicals up the food chain, although it was rarely expressed in this manner. For example, the answers we accepted in response to the question “Can you describe what you think this picture [Fig. 3] is trying to show?” included “big fish eat small fish,” “the chain of food,” “the food chain,” and “the big fish has more contamination than the small fish, and that ends up on your plate.” Others understood the concept completely, and said “The bigger fish eats the smaller fish. The bigger fish is more contaminated, and you eat the bigger fish” or “The bigger fish eats the smaller fish and that is the one that is contaminated on the plate.”

Two other questions were particularly of interest: “Imagine you were talking to a pregnant friend about the information in this pamphlet, what would you tell her?” and “What is the main advice this pamphlet gives here?” (Table III). Although most women would give their friends correct advice, some did not relay the correct message (see the last 3 in Table III).

Another significant finding is that a full 70% of respondents stated that they intended to change how they chose or prepare fish they ate as a result of what they learned from the lesson. If we exclude those who said they do not eat fish, that figure rises to 74%. Moreover, 90% of the women who say that a family member fishes (10% of the total) indicated an intent to make these changes in behavior. This latter category represents the most vulnerable group and the lesson’s key target audience.

### 3.3. Comparison of Brochure and Classroom Lesson Plan

An important objective of our research was to determine whether a classroom lesson with a teacher was more effective than having women read only a brochure (Table IV). Where there were significant

**Table II.** Differences in the Efficacy of a Classroom Lesson in Spanish and English Concerning Risk and Fish Consumption

Question	English	Spanish	$X^2(p)$
Sample size	26	25	
Does anyone in your family catch fish or crabs? (yes)	26	12	1.8 (NS)
Was the class clear and easy to understand?	100	100	
What do you think about eating fish from the port? (given is the percent who gave the following response)			
It is not a good idea.	96	96	2.0 (NS)
Do you think that a pregnant woman can harm her baby by eating fish from the port? (yes response)	96	100	0.9 (NS)
What did the instructor say about the six types of fish?			
Unsafe	100	100	0.5 (NS)
Contaminated	42	64	
Do not eat	77	84	
What are some of the ways you can make sure the fish you <sup>a</sup> eat are safe? (percent who mentioned this method)			
Eat safe fish	0	4	
Avoid fish from Newark Bay, species under advisory	12	16	
Remove fat	62	32	
Cook on a rack	54	72	
Throw away juices	8	24	
Do not fry or coat the fish	31	32	
Buy fish (rather than eat fish you catch)	35	8	
Don't buy or eat swordfish, etc.	8	8	
Eat other fish only up to 12 oz. a week	0	4	
Ask where fish came from	23	16	
Eat smaller fish	23	8	
Vary types of fish	4	4	(NS) <sup>ac</sup>
Do you believe fish from Newark Bay came from an unsafe location? (yes)	96	96	1.1 (NS)
What is the area the class refers to? (percent who gave the following response)			
Newark Bay	100	100	0.0 (NS)
What is the picture with the red dots in fish showing? (percent giving correct response)	92	80	
contaminant movement, food chain, fish are contaminated			
What is the picture with the red dots in the pregnant woman showing? (percent giving correct response) contaminants moving into woman and baby	96	96	0.0 (NS)
Do you plan to change the fish you eat or how you cook them? (yes)	64	76	0.9 (NS)

<sup>a</sup>You or your family.

<sup>b</sup>These are the six fish with health advisories.

<sup>c</sup>Binomial test.

*Notes:* Given are percentages. For most questions the correct answer is yes and that is the percent given, unless otherwise noted. NS = not significant.

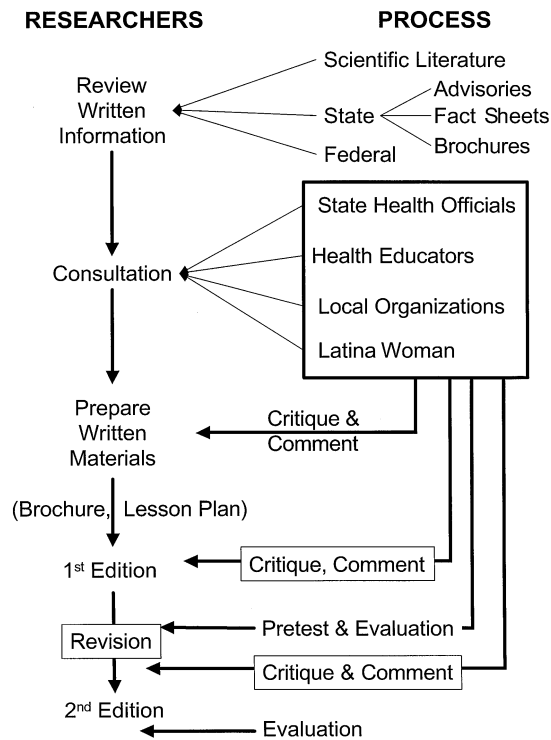
differences in understanding about the risks from consuming fish or crabs, most woman exposed to the classroom lesson had a better understanding than those who read the brochure. That is, for 18 of 20 questions, those hearing the lesson did better than those reading only the brochure ( $X^2 = 165.5$ ,  $p < 0.001$ ). Ninety-six percent of the woman who heard the lesson understood that it was unsafe to eat fish from the port, compared to 72% of those reading the brochure. Every woman who listened to the lesson understood that the six species of fish and crabs were unsafe, whereas 91% of those who read the brochure did. Nonetheless, both formats succeeded in imparting information to most women about the area under advisories, the fish

species under advisories, and bioaccumulation up the food chain.

## 4. DISCUSSION

### 4.1. Brochure and Lesson Development

Two important aspects of this study that we feel contributed to its success were: (1) close consultation with community-based organizations and with health care and nutrition education officials and staffers, and (2) an interactive process of outreach material development involving an interactive process of consultation, testing, and revision (Fig. 2). The former



**Fig. 3.** The process of developing the brochure and lesson plan involved an interactive process of several stakeholders.

is essential because these constituents provided valuable advice about the development of the two instruments. Moreover, it encouraged buy-in from health care management and staff, making them more likely to distribute brochures and teach the lessons (which were designed to be given by health educators with no prior knowledge of the subject). Indeed, the New Jersey State WIC program has approved the lesson plan and brochure for use at all WIC sites in the Newark Bay area. As an extension of this research project, we are providing training and materials for the use and distribution of the lesson plan at these sites. While numerous brochures prepared by outside groups are distributed at WIC sites, it is perhaps unlikely that the state agency would have adopted the lesson plan as part of its own curriculum if the management and staff (at both the local Elizabeth and state levels) had not participated in the review and development of the materials. Including stakeholders in decision making has become a popular concept, both for management and for research.<sup>(53-55)</sup>

Interactive testing of outreach materials (risk communication instruments) with the intended au-

**Table III.** Representative Quotes from Woman when Asked: "What Advice Would You Give a Pregnant Friend?"

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<p>Don't eat fish from the port.          Fish is a good source of protein but she should be careful what fish she eats. She should ask where fish came from and she should remove the head, guts, skin and fat.          Don't eat bluefish, shark, blue crabs. I'd say don't eat any fish from Bay.          She has to know where fish is coming from. But she should eat a lot of fish because it is good for the baby.          I'd tell her that she should eat fish because it is good for her and the baby but she should buy it in the supermarket and ask where it came from.          Don't eat fish unless bought in supermarket.          Before buying fish ask where it comes from because the fish from port is dangerous. Too much bacteria.          To be careful with the fish she buys and eats.          Be careful what fish you eat. Ask where it comes from.          I'd give her the pamphlet you gave us.          Don't eat any fish caught from all areas of New Jersey.<sup>a</sup>          To eat fish.<sup>b</sup>          I wouldn't eat the fish if you are pregnant because it is dirty.<sup>a</sup></p>
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<sup>a</sup>This was obviously not our message.

<sup>b</sup>Lacks information on the advisory.

dience, as well as continuous interaction with people and agencies ultimately responsible for their distribution is also essential because it allows refinement of the instruments for specific local conditions. This approach is about more than "reaching the target audience"; it is about continuously involving them and those who communicate health information directly to them in the development of materials that will provide them with the information they need to make informed decisions about their families health.

While the actual length of the classroom lesson was longer than the brochure, and the time devoted to each differed, the same material was presented in both. The difference was that in the classroom lesson, each idea was presented in more depth and highlighted.

#### 4.2. Universality of Results

Interest in examining the brochure and in listening to the classroom lesson was relatively high, perhaps because it provided information directly of interest to women concerning the health of their children. Over 90% of the women approached agreed to participate, a clear indication of interest, or at least openness. Although there are few other studies with which to compare these findings, Burger and Waishwell<sup>(36)</sup>

**Table IV.** Efficacy of Using a Brochure versus a Class Lesson Concerning the Risk from Consumption of Fish

	Brochure	Lesson	$X^2(p)$
Sample size	45	51	
Does anyone in your family catch fish or crabs? (yes)	15	20	0.3 (NS)
What do you think about eating fish from the port? (given is the percent who gave the following response)			
It is not a good idea.	72	96	11.6 (0.003)
Do you think a pregnant woman can harm her baby by eating fish from the port? (yes response)	89	98	3.9 (NS)
What did instructor say about the six species of fish? (percent who said the following)			
Unsafe	91	100	4.6 (0.03)
What are some of the ways you can make sure the fish you eat are safe? (percent who said each of the following)			
Eat safe fish you catch	4	2	
Avoid fish from Newark Bay, species under advisory	9	14	
Remove fat	46	47	
Cook on rack	39	62	
Throw away juices	13	15	
Don't fry or coat the fish	13	31	
Buy fish (rather than eat fish you catch)	20	21	
Don't buy or eat swordfish, etc.	0	8	
Eat other fish only up to 12 oz. a week	2	16	
Ask where fish came from	17	22	
Eat smaller fish	2	15	
Vary types of fish	0	4	(0.0001) <sup>a</sup>
Do you believe fish from Newark Bay came from an unsafe location? (yes)	87	98	4.7 (NS)
What is the area the class refers to? (percent giving the following response)	86	100	0.8 (NS)
Newark Bay			
What is the picture with the red dots in fish showing? (percent giving the correct response) (contaminant movement, food chain, fish are contaminated)	72	86	2.9 (NS)
What is the picture with red dots in pregnant women showing? (percent giving the correct response) (contaminant moving into fish, woman, and baby)	100	96	0.8 (NS)
Do you plan to change the fish you eat and how you cook them? (yes)	62	70	0.6 (NS)

<sup>a</sup>Binomial test.

Note: Percentages are given for the answer in parenthesis. NS = not significant.

found a similarly high interest rate in people (both men and women) fishing along the Savannah River in South Carolina. One aspect that seemed important was the direct approach by enthusiastic researchers.

While we tested the efficacy of two different methods of risk communication about fish consumption and found a high level of knowledge was obtained from both instruments, the results may not be as positive when brochures are not presented in person and when the classroom lesson is given by a less enthusiastic and informed teacher. In both cases, the instruments were administered in the subject's preferred language of choice by enthusiastic people. Further, the brochure and class were presented in a women's clinic where interest in infant and child health was high. The relatively high success of communicating the message under these circumstances suggests that women's health clinics and similar locations should be specifically targeted.

While the data presented in this article are specific for the New York-New Jersey harbor area, they may provide useful insights on risk communication for Latinas, for women who consume fish, and for agencies developing informational brochures and other outreach materials for pregnant women, women with young children, and women in their child-bearing years. Information on the study will be available through traditional scientific journals, but also via the Web.

#### 4.3. Efficacy of a Brochure versus a Classroom Lesson

Where there were significant differences in understanding about the risks from consuming fish or crabs from the contaminated waters of Newark Bay, the woman exposed to the classroom lesson had a better understanding than those who read the brochure.

This result may be a function of several factors, including additional time devoted to the problem (it took less time to read the brochure than to listen to the 15–25 minute presentation), the use of multiple modalities all reinforcing the same message (oral commentary, written text, and visual images), the engagement of interest by a “live” presenter, and finally, the interactive format in which participants were asked questions, volunteered information, and had the opportunity to question the instructor. Furthermore, the advantages of the lesson over the brochure may be higher under real-life circumstances, under which a woman who is handed a brochure may not take the time to read it at all.

The disadvantage of classroom presentation include finding a suitable venue for the classes, and recruiting audiences and informed and enthusiastic instructors. Further, it is far more expensive to conduct classroom lessons than to print brochures. Brochures can be disseminated to far more places, and can be picked up by any interested parties.

Optimally, both formats should be available to the public. The lesson plan provides an in-depth discussion of the problem, where questions can be asked. The brochure provides a written explanation that can be taken home, referred to, and given to friends and family. Moreover, brochures could be distributed with fishing licenses, as well as at maternity clinics, health clinics, and child care facilities. Connelly and Knuth<sup>(35)</sup> similarly found that multiple formats may be required to meet the needs of anglers and fish consumers.

#### 4.4. Risk Management

In many European communities, consumers accept co-responsibility for solving environmental problems by changing their consumption patterns.<sup>(56)</sup> In the past, environmental problems were handled primarily by regulating the main sources of pollution, but recently consumers are being asked to take responsibility to avoid unsafe products.<sup>(57)</sup> This charge often leads to confusion, partly because of lack of knowledge, and to noncompliance. In dealing with contamination in fish from lakes, rivers, and estuarine waters, state agencies, as well as the U.S. Environmental Protection Agency and the Federal Drug Administration, have relied on the issuance of fish consumption advisories. Government agencies and others may prefer to follow a strategy of relying on advisories since that provides a means of reducing adverse health consequences while avoiding potentially large clean-up

costs.<sup>(34)</sup> However, when governments take this approach, it may be ineffective in protecting the health of the public.

There are several risk management problems inherent in using fish consumption advisories in this manner:<sup>(28)</sup> (1) knowledge about advisories is often limited, (2) correct knowledge about the complexities of which fish to eat, how much to eat, and the population at risk is limited, (3) even with such knowledge, compliance is often low, and (4) the highest-risk group among the target audience (pregnant women and those of child-bearing age) often do not receive word of them (in most states they are distributed with fishing licenses). The problem is further complicated for estuarine waters because most states do not have a marine fishing license that can serve as a conduit for dissemination of brochures.

Low compliance may be the result of ignoring the underlying reasons for fishing. One assumption of advisories is that people go fishing to catch fish to eat, and if they only understood that some fish are contaminated and can cause adverse health effects (to unborn and young children), they would cease this behavior. This is a naive assumption. Toth and Brown<sup>(1)</sup> clearly showed that there are a myriad of social and economic reasons that people fish, and that within many ethnic communities fishing plays a key social role. In a recent study of people fishing in the Newark Bay Complex, Burger<sup>(58)</sup> asked why they angled, using both open-ended questions and a rating scale. Relaxation, being outdoors, and outdoor sports ranked the highest, followed by getting away from demands and communing with nature. Addressing these needs seems critical for changing consumption patterns.

Rather than aim risk communication exclusively at the angling public, another way of approaching the problem is to target the population at risk directly (namely, women of child-bearing age, those pregnant and breast feeding in particular, and children). Presenting them with relevant information on both the benefits and the adverse effects of consuming fish allows them to make an informed decision about not only eating fish, but what fish to eat, obtained from what source. Fish consumption is by no means a simple problem, since a consumer must evaluate the health and economic benefits of eating fish (and self-caught fish), the disadvantages of eating contaminated fish, and the relative merits of specific species, obtained from specific locations, prepared and cooked in different manners. This is a complicated decision process.

The results of this study suggest lessons that can be examined further for this and other areas: (1) collaboration with health care and nutrition education agencies and staff can increase understanding and buy-in by those who disseminate information; (2) iteration in the development and testing of materials is critical to producing materials relevant for, and comprehensible by, the target audience; (3) provision of information in the appropriate language is essential; (4) presentation of materials directly to the target audience and to those responsible for and interested in fetal and infant health gets information to those who need it most and whose behavioral changes will make the greatest impact; (5) presentation of outreach materials by enthusiastic people is likely to increase effectiveness; and (6) balancing the approach is essential to achieving outcomes that maximize good health (fish are health-enhancing food for these reasons, but can be unsafe for particular people for other reasons).

Finally, the brochure and lesson plans developed as part of this study, and freely available on the Internet (<http://aesop.rutgers.edu/cec/fish/html>), can be modified and tested in other communities with other ethnic groups. While the species of fish to avoid may vary, other aspects, such as preparation and cooking methods, will not. The process used to initially develop the materials can be usefully applied to modify these materials for local conditions. That is, consulting with health officials and educators, and testing the materials with the target audience, will ensure modifications that apply locally.

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