Fish consumption and mercury exposure among pregnant women in a Sacramento, CA clinic

WREN Part II

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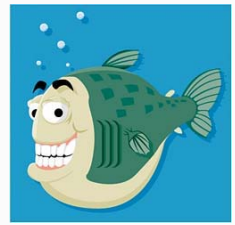
  - Delta Tributaries Mercury Council of the Sacramento River Watershed Program
  - State Water Resources Control Board
  - CALFED Bay-Delta Program

Introduction

- Fish consumption - primary source of mercury exposure in the general population (a potential health concern)
  - 6% women of childbearing age with blood mercury ≥5.8 µg/L[1]
  - 17% of Asian, Pacific Islander, Native American, multiracial women with blood mercury ≥5.8 µg/L[2]

- Fish consumption associated with many health benefits
  - Reduced risk of heart disease
  - Improved cognitive and developmental outcomes in infants

- Women of childbearing age should eat fish
- Need consumption advice for sport and commercial fish[3]

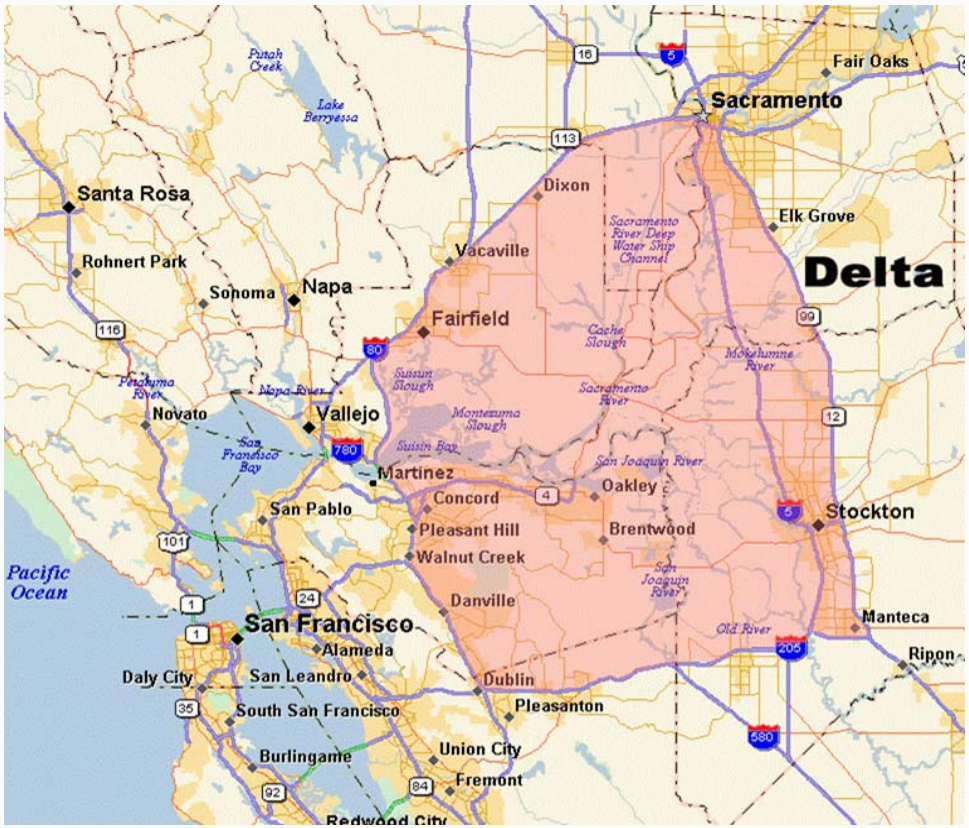


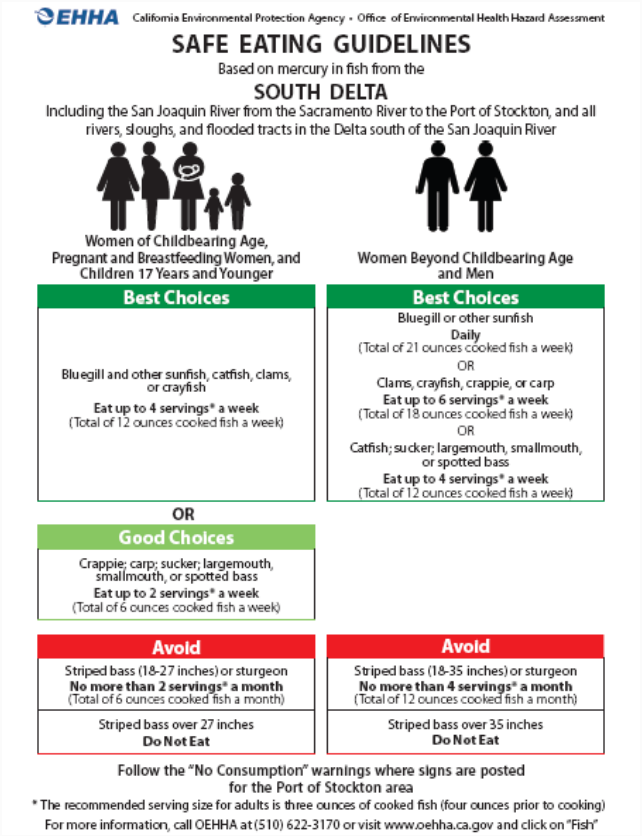
5.8 µg/L – reference dose

1. MMWR 2004
2. Hightower 2006
3. Institute of Medicine 2006

Sacramento - San Joaquin Delta

- Numerous nearby water bodies with sport fish consumption advisories due to mercury contamination
  - Delta, American River, Sacramento River, Cosumnes River, Feather River, Cache Creek, Putah Creek





Study Goals and Activities

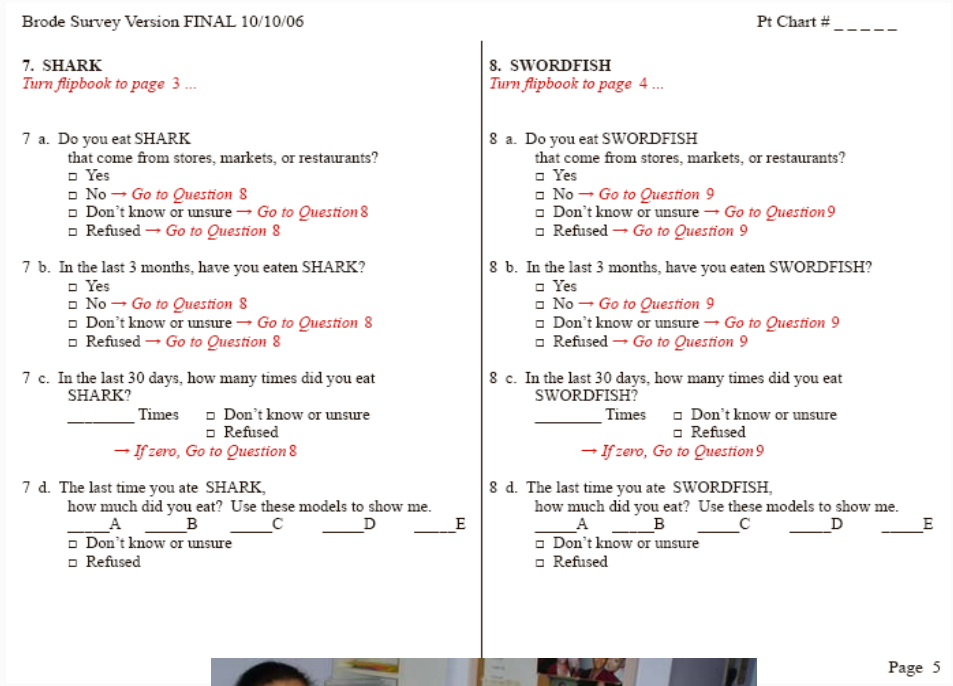
- Characterize mercury exposure in a high risk population
  - *Survey*
  - *Blood mercury concentration*
- Increase knowledge of clinic staff and patients about risks and benefits of fish consumption and ways to reduce fish-related exposure to mercury
  - *Educational activity*
  - *Evaluation*

Study Logistics

- Clinic
  - low income, diverse, at-risk population
- Inclusion criteria
  - Patients seeking pre-natal services from 10/16/06 to 2/6/07
  - Age ≥ 18 and ≤ 49 years
  - Pregnant and prior to 32 weeks' gestation
  - Fluency in English, Vietnamese, or Hmong
    - (some Chinese and Spanish brought own interpreters)
- Study phases
  - Consent/HIPAA
  - Consumption survey
  - Educational activity ($15 incentive)
  - Blood draw
  - Clinical followup ($25 incentive)

Fish Consumption Survey

- Administered by clinic staff in English, Hmong, and Vietnamese
  (or translated Spanish/Chinese)
  - Advisories awareness
  - Demographic information
  - Consumption
    - species
    - frequency
    - portion size
- Props
  - Flip book
  - Portion size models
  - Tuna cans



Brode Survey Version FINAL 10/10/06 Pt Chart # _____

7. SHARK
Turn flipbook to page 3 ...

7 a. Do you eat SHARK that come from stores, markets, or restaurants?
- ☐ Yes
- ☐ No → *Go to Question 8*
- ☐ Don't know or unsure → *Go to Question 8*
- ☐ Refused → *Go to Question 8*

7 b. In the last 3 months, have you eaten SHARK?
- ☐ Yes
- ☐ No → *Go to Question 8*
- ☐ Don't know or unsure → *Go to Question 8*
- ☐ Refused → *Go to Question 8*

7 c. In the last 30 days, how many times did you eat SHARK?
_____ Times ☐ Don't know or unsure ☐ Refused
→ *If zero, Go to Question 8*

7 d. The last time you ate SHARK, how much did you eat? Use these models to show me.
____A ____B ____C ____D ____E
- ☐ Don't know or unsure
- ☐ Refused

8. SWORDFISH
Turn flipbook to page 4 ...

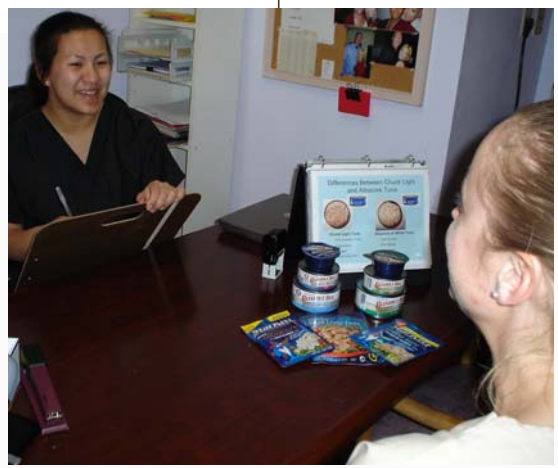
8 a. Do you eat SWORDFISH that come from stores, markets, or restaurants?
- ☐ Yes
- ☐ No → *Go to Question 9*
- ☐ Don't know or unsure → *Go to Question 9*
- ☐ Refused → *Go to Question 9*

8 b. In the last 3 months, have you eaten SWORDFISH?
- ☐ Yes
- ☐ No → *Go to Question 9*
- ☐ Don't know or unsure → *Go to Question 9*
- ☐ Refused → *Go to Question 9*

8 c. In the last 30 days, how many times did you eat SWORDFISH?
_____ Times ☐ Don't know or unsure ☐ Refused
→ *If zero, Go to Question 9*

8 d. The last time you ate SWORDFISH, how much did you eat? Use these models to show me.
____A ____B ____C ____D ____E
- ☐ Don't know or unsure
- ☐ Refused

Page 5



Education and Evaluation

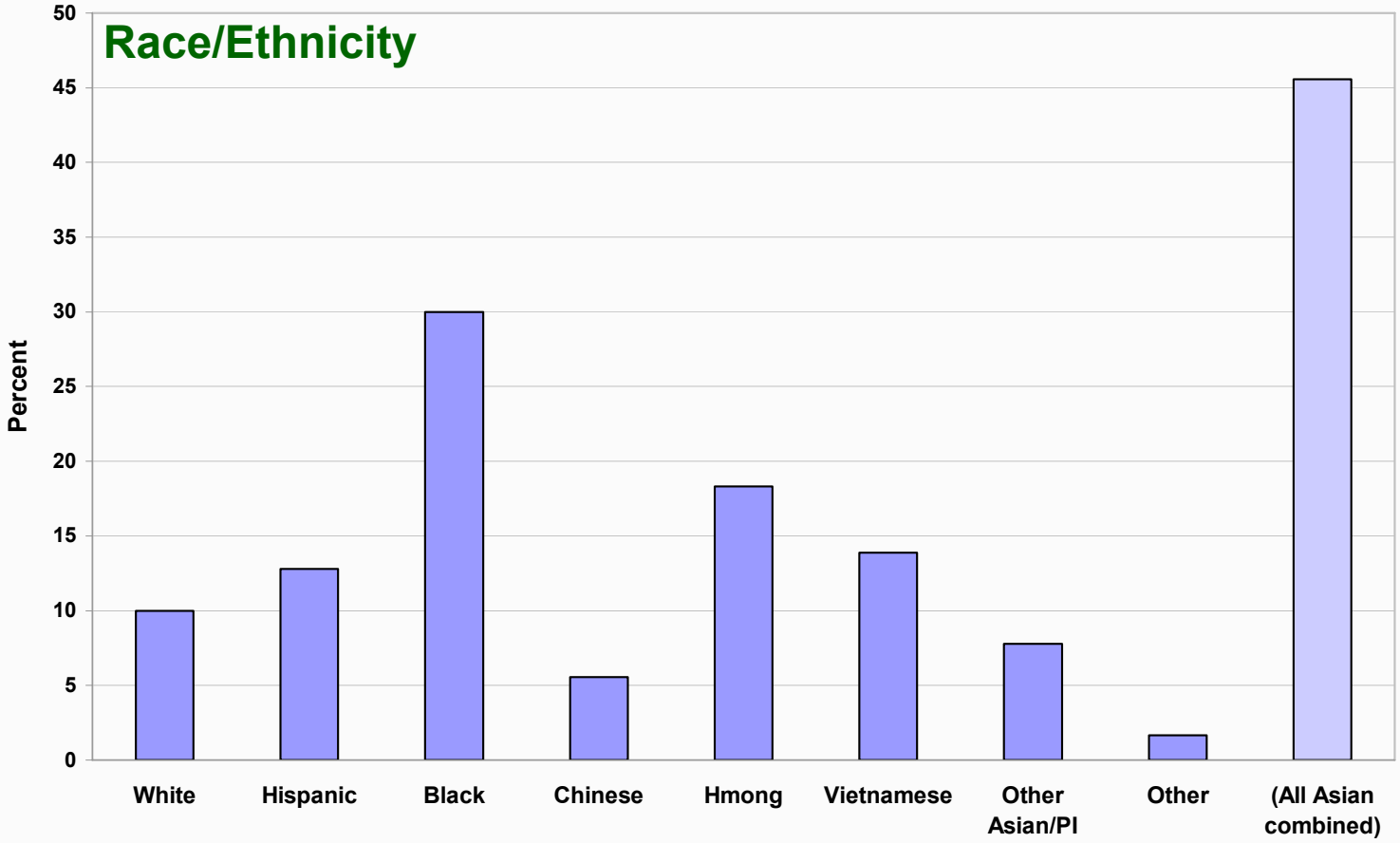
- Education
  - Personalized education session following survey
  - Low literacy brochure handout
  - Counseling upon receipt of blood test result

- Evaluation
  - Interview with clinic staff
  - Follow up on knowledge before receipt of blood test result
  - Patient satisfaction card
  - In-depth interviews with participants (N = 20)

Consumption indicators

- Individual **species** (grams per day)
- **Commercial** fish
- **Sport** fish
- **Overall**
- Commercial **shellfish** and **fin** fish separately
- Sport shellfish and fin fish separately
- Very high mercury fish (**shark, swordfish, king mackerel, tilefish**) and high mercury fish (**albacore tuna and tuna steak**)
- **Advisory** exceedance (commercial, sport)
- **American Heart Association** guidelines
- All of the above, in grams per day per kilogram of **body weight**
- **Portion sizes** (all above categories)
- *Total: approximately **350** consumption variables*

Results (demographics)



Age		Education		Income		Interview language	
95 (**53**%)	**18-24**	65 (**36**%)	**<HS**	116 (**78**%)	**<$20K**	143 (**79**%)	**English**
37 (**21**%)	**25-29**	58 (**32**%)	**HS**	33 (**22**%)	**>$20K**	23 (**13**%)	**Hmong**
48 (**27**%)	**30-49**	56 (**31**%)	**>HS**	>90% on Medicaid		14 (**8**%)	**Vietnamese**

Fish species by race/ethnicity

	White	Hispanic	Black	Chinese	Hmong	Vietnamese	Other Asian/PI	Other
1	ALBACORE	CHUNK_LIGHT	ALBACORE	FISH_STICKS	CATFISH	CHUNK_LIGHT	ALBACORE	ALBACORE
2	CHUNK_LIGHT	FISH_STICKS	CATFISH	SALMON_B	CHUNK_LIGHT	CRAYFISH	BLACK_BASS	CHUNK_LIGHT
3	FISH_STICKS	KING_MACKERE	CHUNK_LIGHT	SHARK	CRAYFISH	FISH_STICKS	CATFISH	FISH_STICKS
4	SALMON_B	SHRIMP	FISH_STICKS	SHRIMP	FISH_STICKS	KING_MACKEREL	CHUNK_LIGHT	SALMON_C
5	SHRIMP	STRIPED_BASS	KING_MACKEREL	STRIPED_BASS	SALMON_B	PANFISH	CRAYFISH	SHRIMP
6	TUNA_STEAK	TILEFISH	SALMON_B	catfish_bt	SHRIMP	SALMON_B	FISH_STICKS	TROUT
7	clams_bt	catfish_bt	SALMON_C	clams_bt	STRIPED_BASS	SHARK	PANFISH	crab_bt
8	crab_bt	crab_bt	SHRIMP	crab_bt	TROUT	SHRIMP	SHRIMP	crab_ct
9		oysters_bt	STRIPED_BASS	crayfish_bt	carp_bt	STRIPED_BASS	STRIPED_BASS	
10		tilapia_bt	TUNA_STEAK	flounder_sole_b	catfish_bt	TILEFISH	catfish_bt	
11		unknown_variety	buffalo_fish_bt	lobster_bt	crab_bt	TUNA_STEAK	flounder_sole_b	
12			catfish_bt	mussels_bt	lobster_bt	american_shad_b	lobster_bt	
13			clams_bt	oysters_bt	mackerel_bt	catfish_bt	milk_fish_bt	
14			cod_bt	scallops_bt	mussels_bt	clams_bt	striped_bass_bt	
15			cod_ct	striped_bass_bt	striped_bass_bt	crab_bt	tilapia_bt	
16			crab_bt	sturgeon_bt	tilapia_bt	crayfish_bt	unknown_variety	
17			crayfish_bt	tilapia_bt	trout_bt	flounder_sole_b		
18			lobster_bt		tuna_bt	lobster_bt		
19			mackerel_bt			mussels_bt		
20			oysters_bt			oysters_bt		
21			snapper_bt			squish_bt		
22			tilapia_bt			striped_bass_bt		
23			unknown_variety			sturgeon_bt		
24			whiting_bt			tilapia_bt		

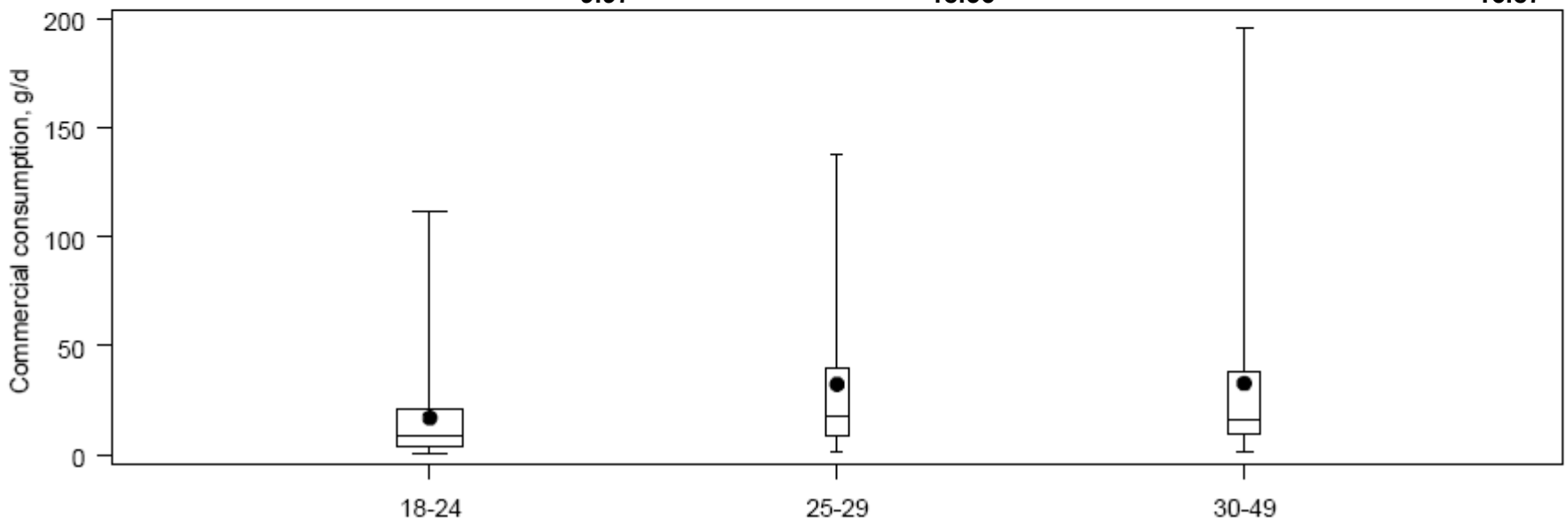
Commercial fish cons., by age

All consumers

Nobs	159	Mean	24.57	Min	0.95	Max	195.62

All consumers, by sub-group

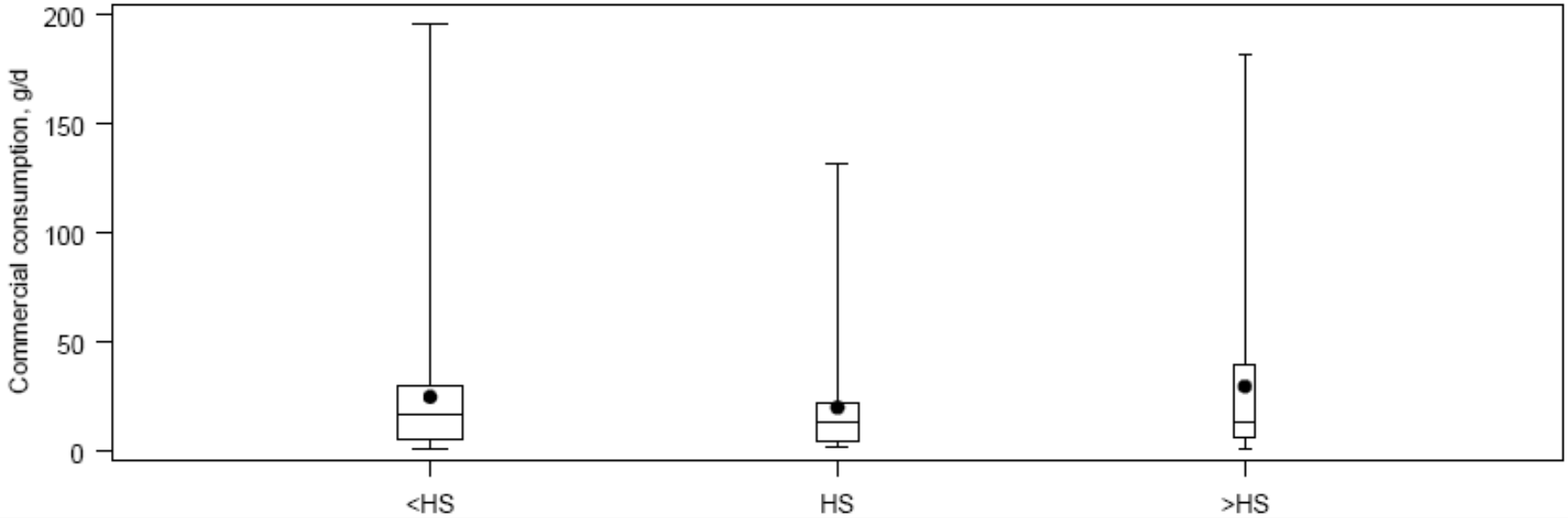
N	83	32	44
Mean	17.10	32.48	32.90
Median	8.51	17.49	16.55
Min	0.95	1.42	1.42
25%	4.25	8.98	9.69
75%	21.27	39.70	37.93
Max	111.99	137.98	195.62
Geometric mean	**9.97**	**18.36**	**16.87**



Commercial fish cons., by education

All consumers							
Nobs	158	Mean	24.71	Min	0.95	Max	195.62

All consumers, by sub-group			
N	61	52	45
Mean	24.96	20.08	29.73
Median	17.01	13.00	13.07
Min	0.95	2.13	1.42
25%	5.67	4.49	6.15
75%	29.77	22.45	39.70
Max	195.62	131.36	181.45
Geometric mean	**13.60**	**11.59**	**14.82**



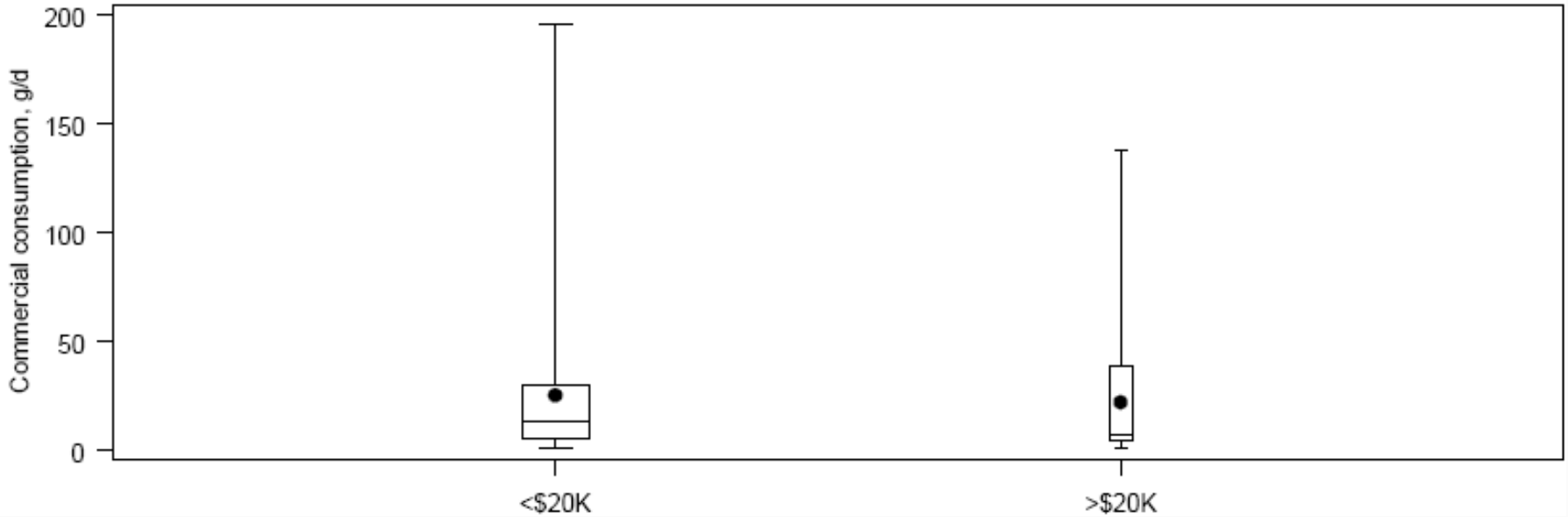
Commercial fish cons., by income

All consumers

Nobs	131	Mean	24.71	Min	1.42	Max	195.62

All consumers, by sub-group

N	104	27
Mean	25.37	22.15
Median	12.92	7.09
Min	1.42	1.42
25%	5.36	4.25
75%	29.77	38.75
Max	195.62	137.98
Geometric mean	**13.13**	**10.85**



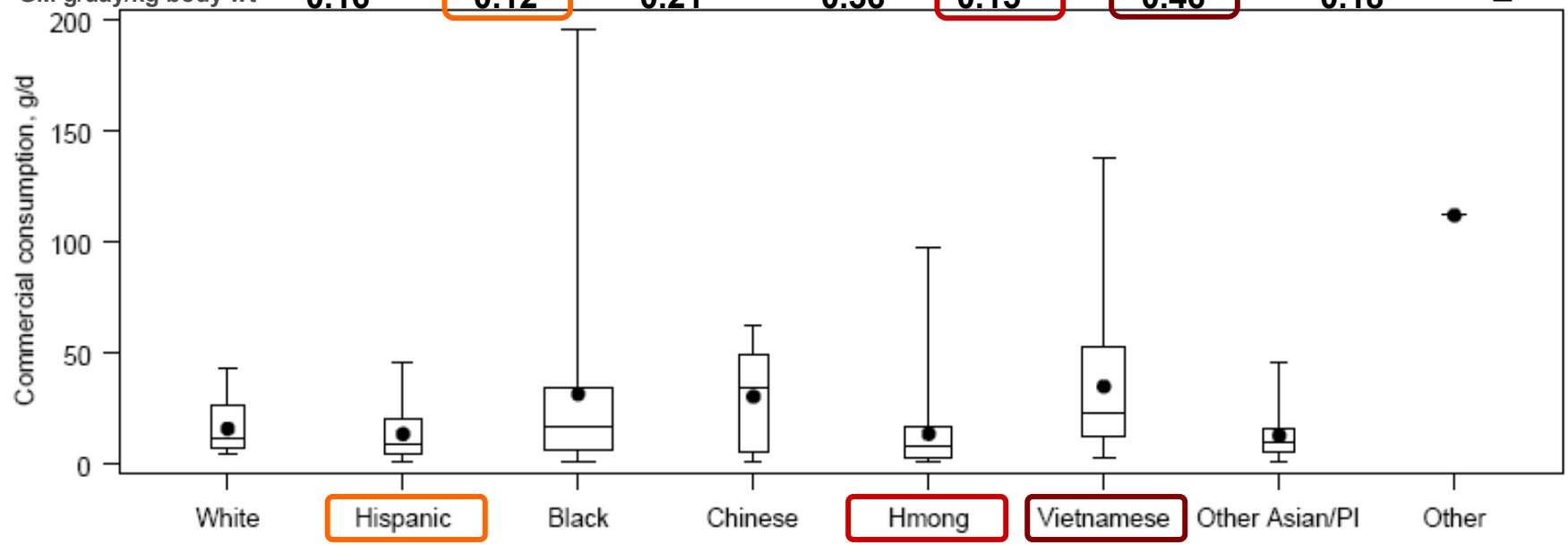
Commercial fish cons., by race/ethnicity

All consumers

Nobs	159	Mean	24.57	Min	0.95	Max	195.62

All consumers, by sub-group

N	14	18	51	10	29	25	11	1
Mean	15.97	13.57	31.58	30.41	13.60	34.98	12.97	111.99
Median	11.11	9.22	17.01	34.74	8.51	22.70	9.92	111.99
Min	4.25	1.42	0.95	1.42	1.42	2.84	1.42	111.99
25%	7.09	4.25	6.15	5.67	2.84	12.76	5.04	111.99
75%	26.46	19.86	34.02	49.61	17.01	52.46	15.59	111.99
Max	43.00	45.84	195.62	62.37	97.81	137.49	45.85	111.99
Geometric mean	**12.10**	**8.89**	**15.25**	**18.37**	**7.76**	**22.56**	**8.85**	–
GM g/day/kg body wt	**0.16**	**0.12**	**0.21**	**0.36**	**0.15**	**0.46**	**0.18**	–



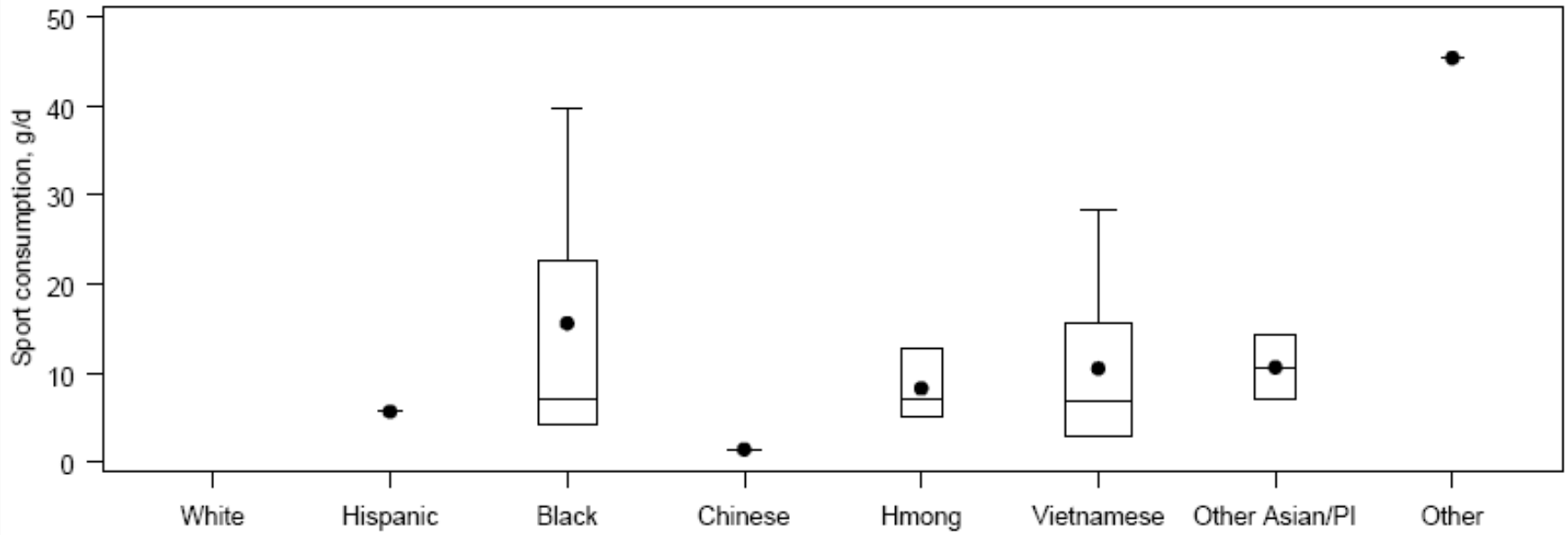
Sport fish cons., by race/ethnicity

All consumers

Nobs	21	Mean	11.98	Min	1.42	Max	45.37

All consumers, by sub-group

N	0	1	5	2	3	6	3	1
Mean	.	5.67	15.59	1.42	8.27	10.52	10.64	45.37
Median	.	5.67	7.09	1.42	7.10	6.74	10.64	45.37
Min	.	5.67	4.25	1.42	4.96	2.84	7.09	45.37
25%	.	5.67	4.25	1.42	4.96	2.84	7.09	45.37
75%	.	5.67	22.68	1.42	12.76	15.60	14.18	45.37
Max	.	5.67	39.70	1.42	12.76	28.35	14.18	45.37
Geometric mean	—	—	**10.29**	**1.42**	**7.66**	**6.90**	**10.23**	—



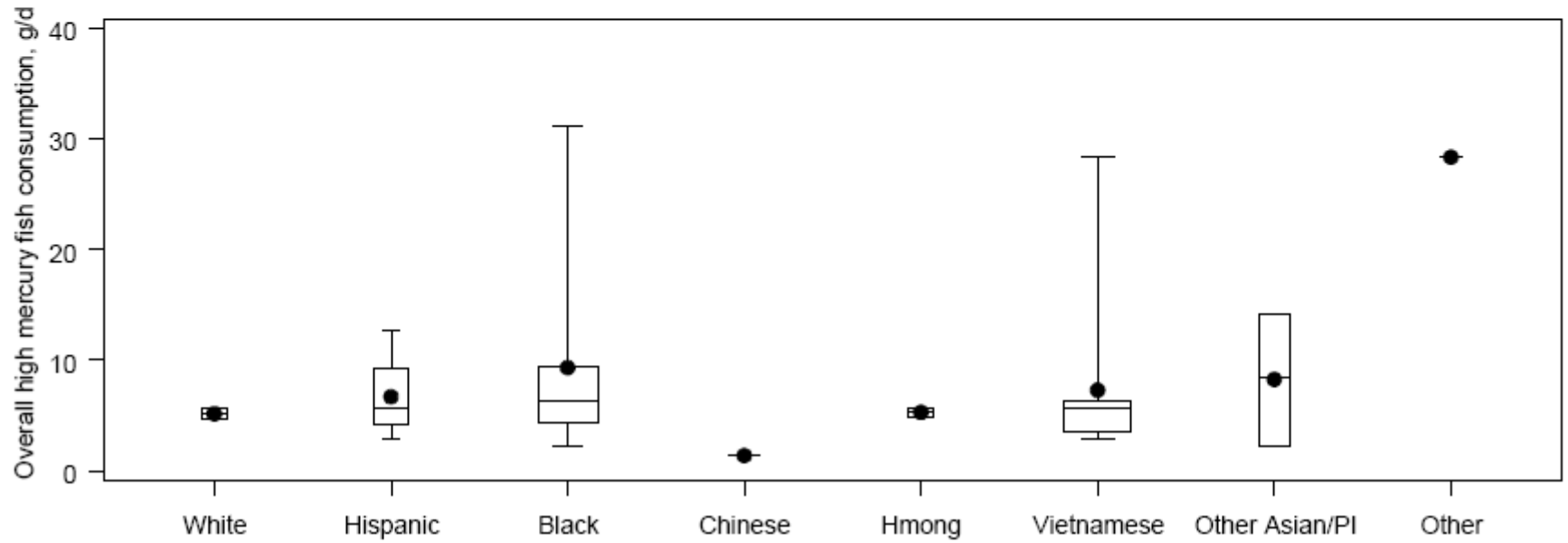
High mercury fish cons., by race/ethn.

All consumers

Nobs	37	Mean	7.76	Min	1.42	Max	31.19

All consumers, by sub-group

N	2	4	10	3	2	12	3	1
Mean	5.20	6.74	9.36	1.42	5.32	7.33	8.30	28.35
Median	5.20	5.67	6.38	1.42	5.32	5.67	8.51	28.35
Min	4.73	2.84	2.20	1.42	4.96	2.84	2.20	28.35
25%	4.73	4.26	4.40	1.42	4.96	3.55	2.20	28.35
75%	5.67	9.22	9.45	1.42	5.68	6.39	14.18	28.35
Max	5.67	12.76	31.19	1.42	5.68	28.35	14.18	28.35
Geometric mean	**5.18**	**5.84**	**7.14**	**1.42**	**5.31**	**5.67**	**6.43**	—



Blood mercury concentrations

Blood mercury level	N	%
Non-detect	134	81.2
4-5 µg/dL	13	**7.9**
6+ µg/dL	18	**10.9**

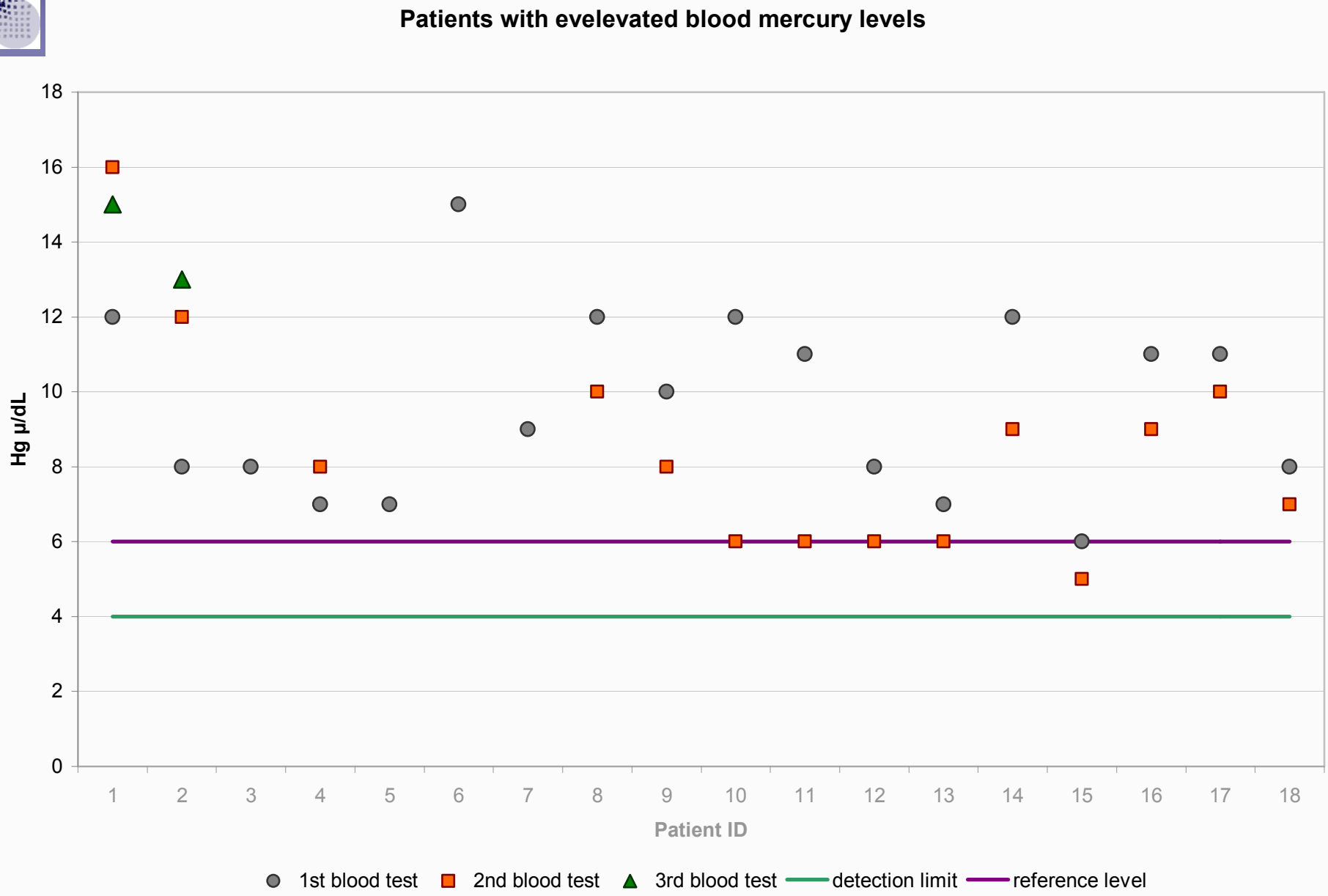
	Excluding non-detects	6+ µg/dL
N	**31**	**18**
Median	7	9.5
Mean	7.68	9.67
Min	4	6
25%	5	8
75%	11	12
90%	12	12
95%	12	15
Max	15	15

Blood mercury concentrations

Blood mercury Level		Race/Ethnicity							
		White	Hispanic	Black	Chinese	Hmong	Vietna-mese	Other Asian/ PI	Other
Non-Detect	(N)	15	23	51	2	27	4	9	3
	(%)	11.2	17.2	38.1	1.5	20.2	3.0	6.7	2.2
4-5 µg/dL	(N)	0	0	0	1	0	9	3	0
	(%)				**7.7**		**69.2**	**23.1**	
6+ µg/dL	(N)	0	0	0	7	0	11	0	0
	(%)				**38.9**		**61.1**		
Total		15	23	51	10	27	24	12	3

- 46% of Vietnamese and 70% of Chinese with 6+ µg/dL

Elevated blood mercury re-test



Advisory Awareness

Advisory awareness

Advisory awareness	No		Yes	
	(N)	(%)	(N)	(%)
Seen warnings about eating commercial fish	141	82.0	31	18.0
Seen warnings about eating sport fish	152	88.4	20	11.6
Seen any warnings	133	76.4	41	23.6

Advisory awareness by race/ethnicity

Seen any warnings		No	Yes	Total
White	(N)	11	7	18
	(%)	61.1	38.9	
Hispanic	(N)	16	7	23
	(%)	69.6	30.4	
Black	(N)	39	14	53
	(%)	73.6	26.4	
Chinese	(N)	7	3	10
	(%)	70.0	30.0	
Hmong	(N)	26	3	29
	(%)	89.7	10.3	
Vietnamese	(N)	21	3	24
	(%)	87.5	12.5	
Other Asian/PI	(N)	11	3	14
	(%)	78.6	21.4	
Other	(N)	2	1	3
	(%)	66.7	33.3	
Total		133	41	174

Advisory levels

Race/ Ethnicity		Exceed consumption advisories	Below American Heart Association guidelines	Total
White	(N)	0	10	14
	(%)		71.4	
Hispanic	(N)	3	15	18
	(%)	16.7	83.3	
Black	(N)	11	32	51
	(%)	21.6	62.8	
Chinese	(N)	3	4	10
	(%)	30.0	40.0	
Hmong	(N)	1	24	29
	(%)	3.5	82.8	
Vietnamese	(N)	12	11	25
	(%)	48.0	44.0	
Other Asian/PI	(N)	1	9	11
	(%)	9.1	81.8	
Other	(N)	1	0	1
	(%)	100		
Total		32	105	

- 2 Hispanic and 3 Vietnamese participants exceed advisories, but below AHA

Evaluation result example

- Did you change anything about the fish or shellfish you eat, since the time you took the survey? (N = 110)
  - No: 53%
  - Yes: 27%
  - Maybe: 12%
  - Don't know: 8%

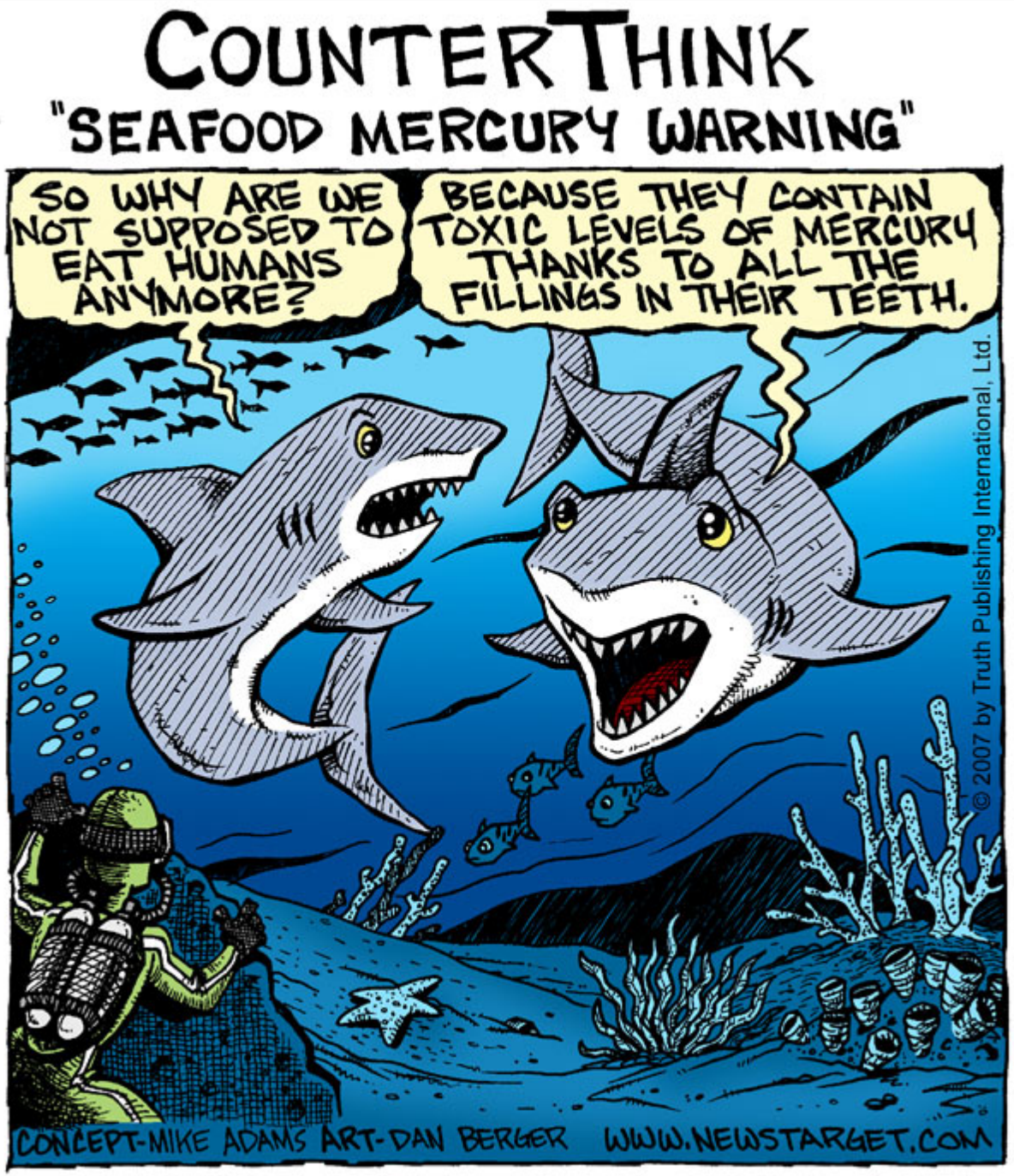
- Fish consumption advisory awareness
  - Baseline survey: 23%
  - Follow up: 63%

Summary

- Very high participation in the survey and blood draw
  - Hmong more likely to refuse blood
- High consumption of commercial fish in this population
- Lower than expected consumption of sport fish
- Variable consumption of fish among ethnic groups
  - Expected high consumption among Vietnamese
  - Unexpected low consumption among Hmong
    - not all SE Asian populations have the same practices
- Low advisory awareness
- 25% of Asian/PI respondents with elevated blood mercury
- No other group exceeded 6µg/dL
- Educational campaign in a clinic setting may be successful

Next Steps

- Further consumption analysis
  - common species
  - individual species
  - high mercury species
- Relationship between blood mercury and consumption
  - high mercury species
  - advisories
- Further evaluation
- Explore incorporating screening/educational activities into a Comprehensive Perinatal Services Program


COUNTERTHINK
"SEAFOOD MERCURY WARNING"
SO WHY ARE WE NOT SUPPOSED TO EAT HUMANS ANYMORE?
BECAUSE THEY CONTAIN TOXIC LEVELS OF MERCURY THANKS TO ALL THE FILLINGS IN THEIR TEETH.
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