

Metal Levels in Asian/Pacific Islander Community Exposures (ACE) Project

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ACE Project

Motivation for project:

- Data from the Biomonitoring Exposures Study (BEST)
- Interest from community partners, including APA Family Support Services

Collaboration with community partners to design the study, recruit participants, and disseminate findings.

100 participants in each phase:

- 18 years or older
- Lived in SF Bay Area for prior year
- Self-identified as at least partially Chinese (ACE 1) or Vietnamese (ACE 2)

Samples tested for arsenic, cadmium, lead, mercury, and perfluoroalkyl and polyfluoroalkyl substances (PFASs).

ACE Sample Collection

ACE 1

Community Partner:
APA Family Support Services
(San Francisco)



Sample collection: 2016

Interviews conducted in Cantonese, Mandarin,
or English

96 blood / 100 urine samples

Results sent to participants in August 2017

ACE 2

Community Partner:
Vietnamese Voluntary Foundation (VIVO)
(San Jose)



Sample collection: 2017

Interviews conducted in Vietnamese or
English

99 blood / 100 urine samples

Results sent to participants in May 2018

ACE Exposure Questionnaire

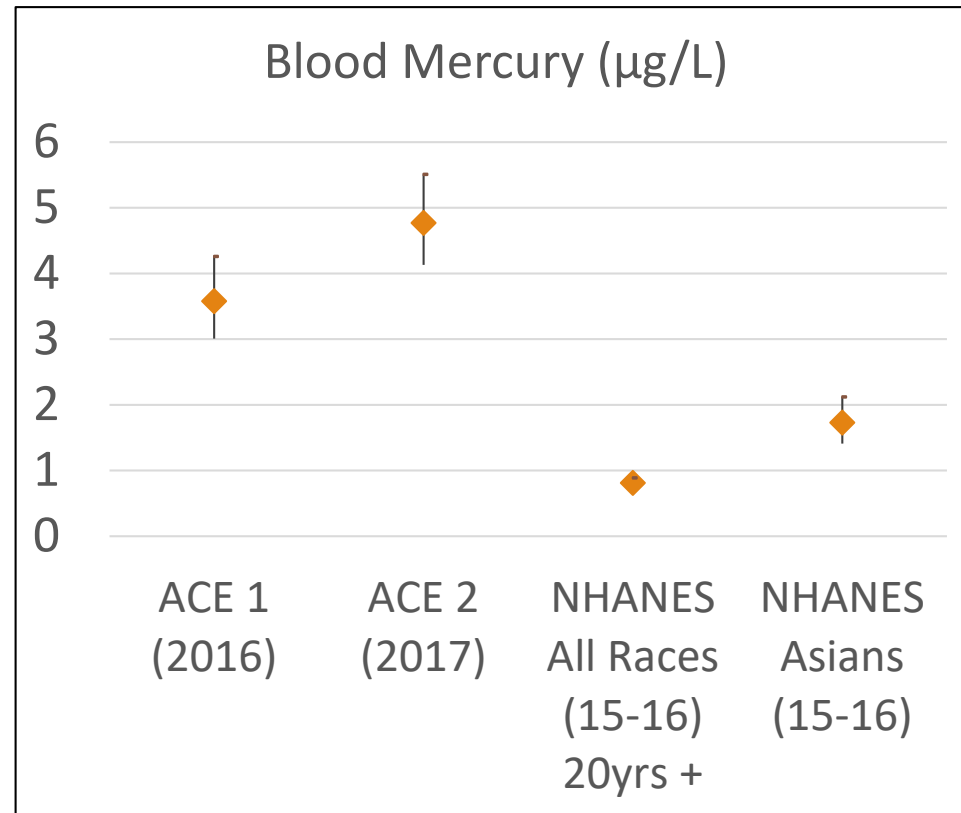
Extensive exposure questionnaire, which included:

- 18 questions about rice and rice products, such as rice noodles, rice vinegar, and rice syrup
- 26 questions about fish and seafood, such as source, type, and frequency and manner of consumption (e.g., eating of fish heads, organs, etc.)
- Other questions about diet: seaweed; candies; and other foods, spices, and supplements, including traditional Chinese medicine
- Use of personal care products, including imported creams for skin lightening or whitening
- Occupation and industry
- Other activities, such as welding and metalworking
- Smoking

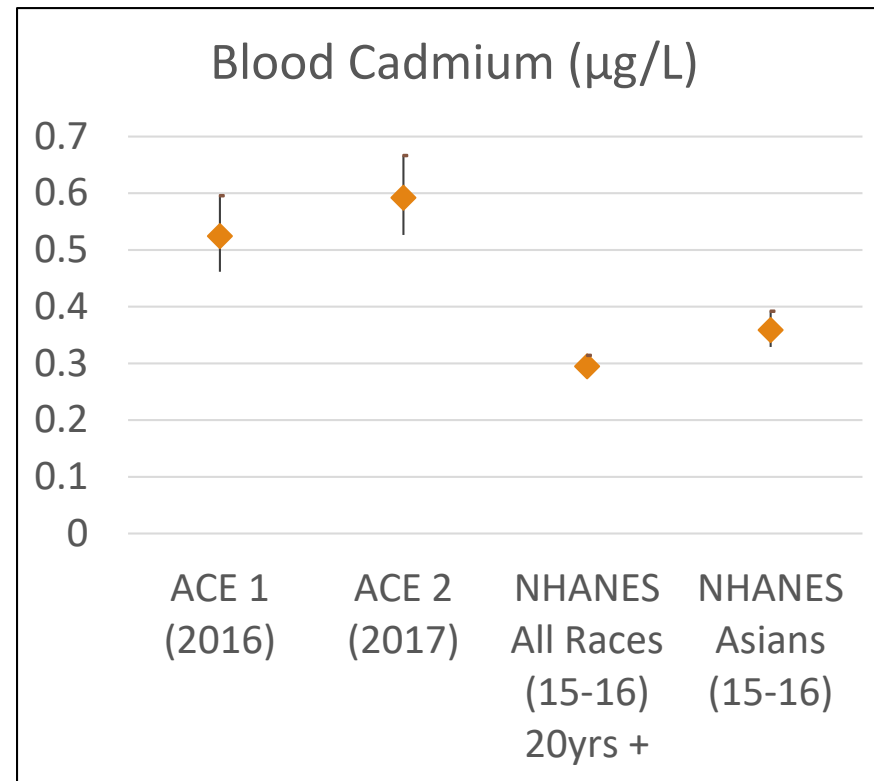
Who was in the ACE Project?

Characteristic		ACE 1 N=96	ACE 2 N=99	Comparison p- value
Income	<\$25K	27%	45%	0.02
	\$25-\$75K	41%	26%	
	>\$75K	13%	10%	
	Declined	20%	18%	
Education	% Greater than high school	58%	42%	0.03
Birth country	% Outside the US	81%	96%	<0.01
Portion of life in US	Mean %	51%	36%	<0.01
Home language	% Non-English	79%	97%	<0.01

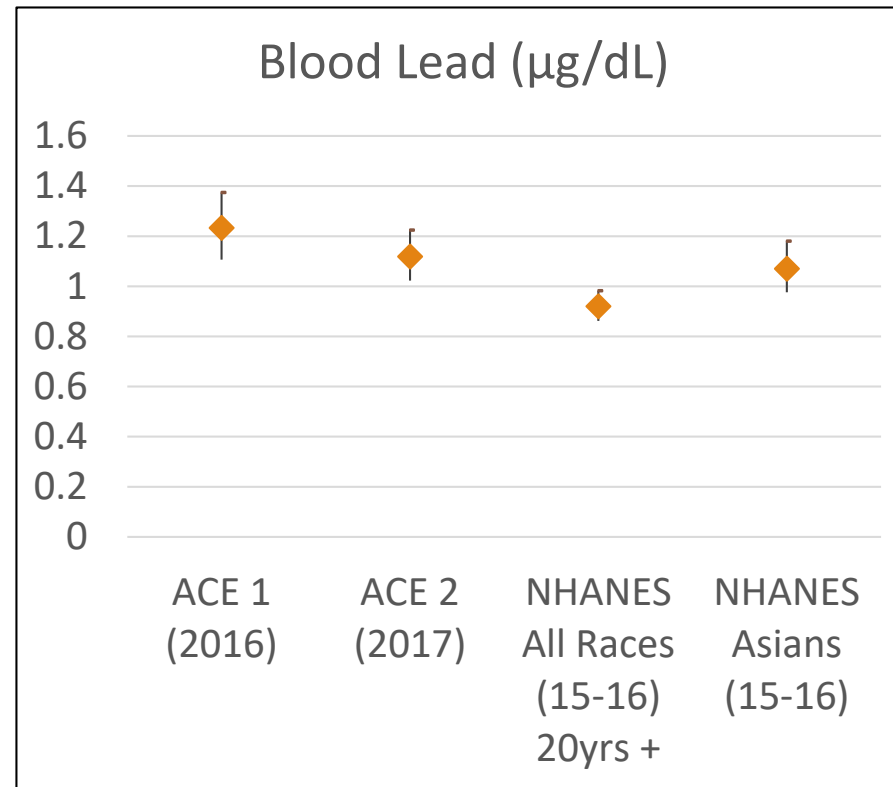
Geometric Mean Levels of Blood Mercury



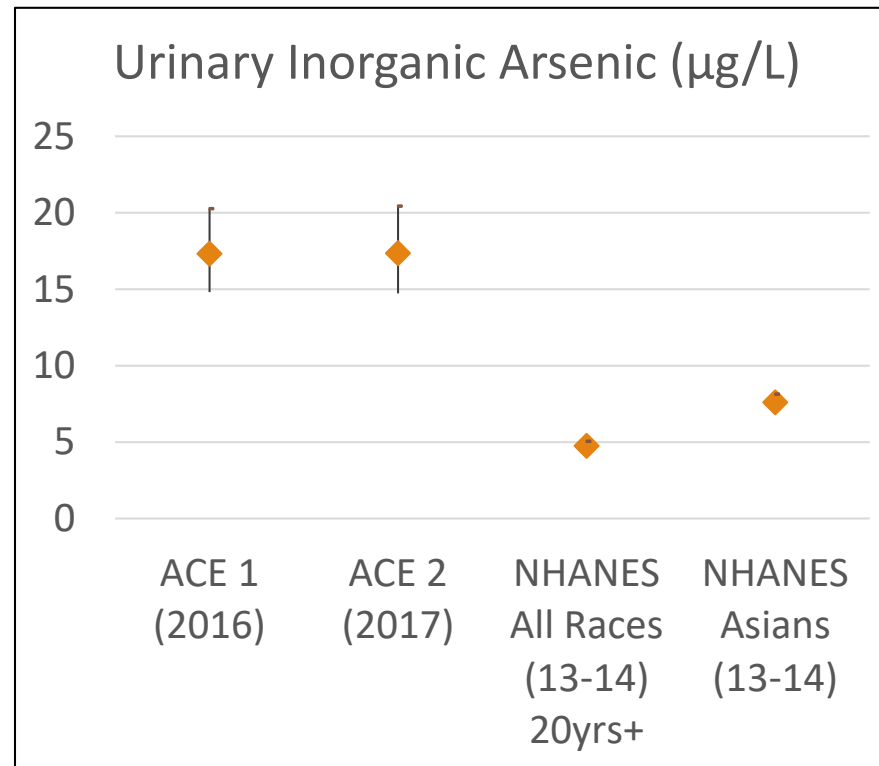
Geometric Mean Levels of Blood Cadmium



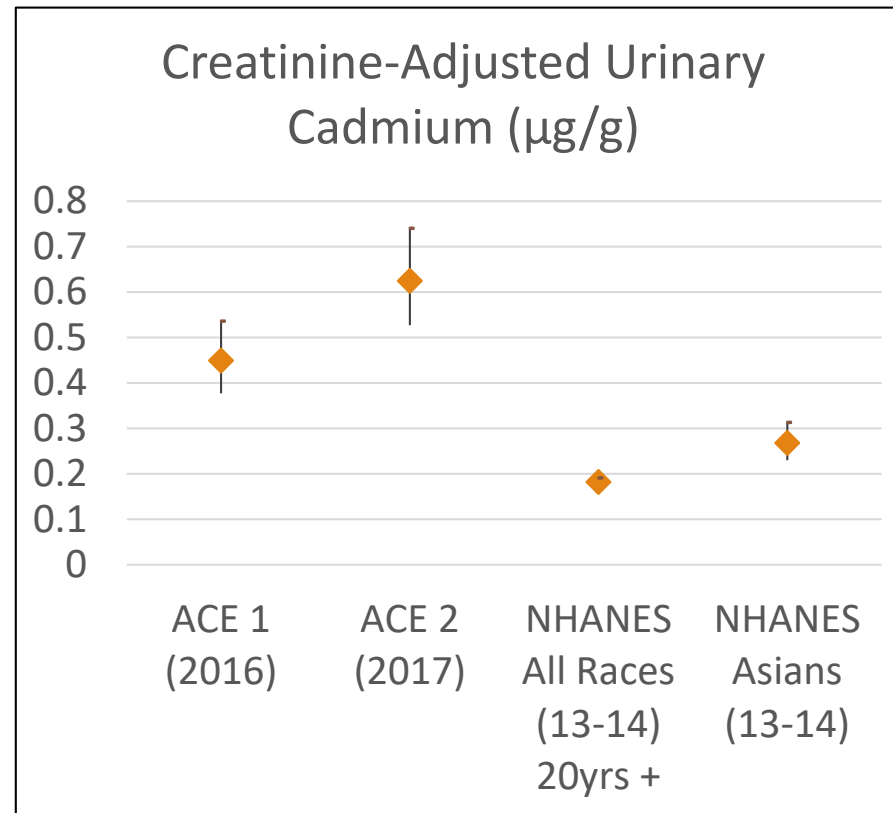
Geometric Mean Levels of Blood Lead



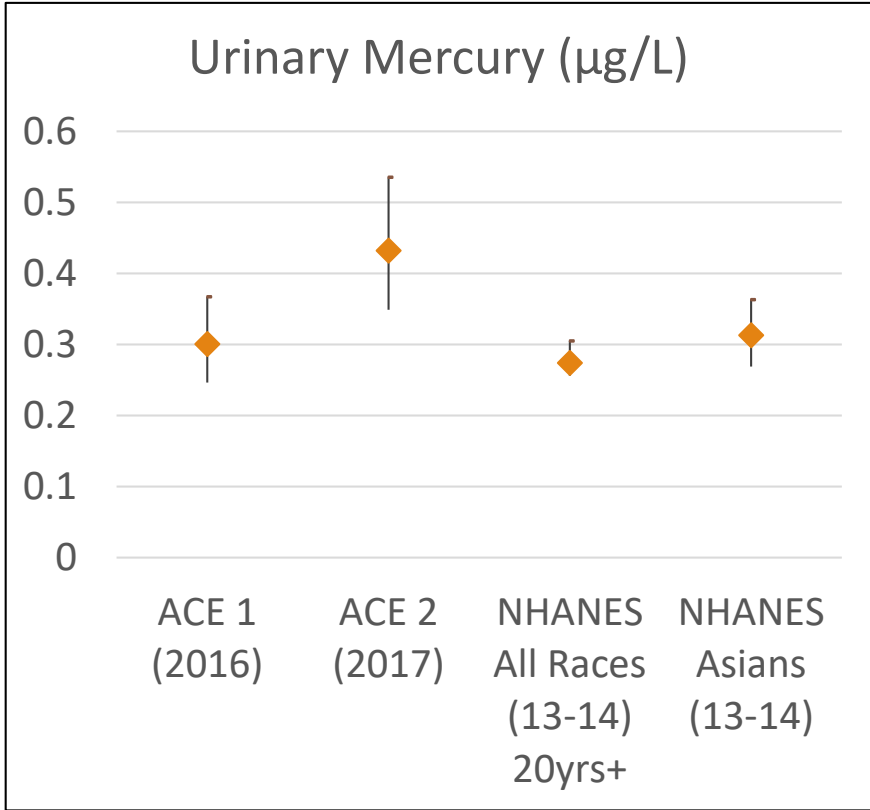
Geometric Mean Levels of Urinary Inorganic Arsenic



Geometric Mean Levels of Creatinine-Adjusted Urinary Cadmium



Geometric Mean Levels of Urinary Mercury



Levels of Concern (LOCs)

For arsenic, cadmium, lead, and mercury:

- LOCs were identified, from the Centers for Disease Control and Prevention (CDC) or California Department of Public Health (CDPH)
- Results above an LOC trigger a specific protocol, which can include:
 - Additional analyses, such as speciation of arsenic
 - Notification about potential health concern, if appropriate
 - Follow-up telephone survey to help identify potential sources of exposure
- *Blood lead levels above 9.5 $\mu\text{g}/\text{dL}$ are referred to CDPH Occupational Lead Poisoning Program (OLPP) for follow-up*

LOCs - Screening Analysis of Exceedances

Metal	LOC
Arsenic, total urinary	$\geq 50 \mu\text{g/L}$
Arsenic, inorganic urinary	$\geq 20 \mu\text{g/L}$
Cadmium, urinary	$>3 \mu\text{g/g creatinine}$
Cadmium, blood	$\geq 5 \mu\text{g/L}$
Lead, blood, women 18-49 yrs	$\geq 4.5 \mu\text{g/dL}$
Lead, blood, women over 49 yrs and all men	$\geq 9.5 \mu\text{g/dL}$
Mercury, blood, women 18-49 yrs	$\geq 5.8 \mu\text{g/L}$
Mercury, blood, women over 49 yrs and all men	$\geq 10 \mu\text{g/L}$
Mercury, urinary	$\geq 20 \mu\text{g/L}$

1. Exceedances above any LOC were determined for ACE 1 and ACE 2
2. Participants categorized as having at least one exceedance or no exceedance

Percentages of Arsenic Results Above LOCs

	ACE 1	ACE 2	LOC
Urinary Arsenic	n=100	n=100	
Total	18%	36%	$\geq 50 \mu\text{g/L}$
Inorganic	26%	26%	$\geq 20 \mu\text{g/L}$

Arsenic Results above LOCs: ACE compared to BEST

	ACE 1	ACE 2	Pilot BEST	Exp BEST	LOC
Urinary Arsenic	n=100	n=100	n=108	n=218	
Total	18%	36%	13%	8%	≥ 50 µg/L
Inorganic	26%	26%	7%	13%	≥ 20 µg/L

Percentages of Mercury Results Above LOCs

	ACE 1	ACE 2	LOC
Blood Mercury	n=96	n=99	
All exceedances	14%	25%	<i>Depends on category</i>
Women 18-49 yrs	8%	16%	≥ 5.8 µg/L
Women over 49 yrs and all men	5%	9%	≥ 10 µg/L
Urinary Mercury	n=100	n=100	
Exceedances	0%	1%	≥ 20 µg/L

Mercury Results above LOCs: ACE compared to BEST

	ACE 1	ACE 2	Pilot BEST	Exp BEST	LOC
Blood Mercury	n=96	n=99	n=110	n=315	
All exceedances	14%	25%	0%	2%	<i>Depends on category</i>
Women 18-49 yrs	8%	16%	0%	1%	≥ 5.8 µg/L
Women over 49 yrs and all men	5%	9%	0%	0.3%	≥ 10 µg/L
Urinary Mercury	n=100	n=100	n=108	n=218	
Exceedances	0%	1%	0%	0%	≥ 20 µg/L

Percentages of Exceedances of Any LOC: ACE compared to BEST

Metal	ACE 1	ACE 2	Pilot BEST	Exp. BEST
0 elevated metals	63	46	83	83
1 elevated metal	32	42	17	15
2 elevated metals	5	10	0	1
3 elevated metals	0	1	0	0

Comparison of Variables between Those with Exceedances and without Exceedances

Demographics:

- Sex
- Age
- Household income
- Education
- Smoking status

Immigration Characteristics:

- Household language
- Interview language
- Birth country
- Portion of life in the U.S.
- Years in the U.S.

Diet:

- Number of times (past 30 days) ate fish from stores, restaurants, street sellers
- Number of times (past 30 days) ate fish from stores, restaurants, street sellers **AND** fish caught locally by friends or family
- Consumption of shellfish past 30 days
- Consumption of rice more than once a day

Comparisons of LOC Exceedances to No Exceedances

Variable	ACE 1			ACE 2		
	Exceedances (%) n=36	No exceedances (%) n=60	p-value	Exceedances (%) n=45	No exceedances (%) n=54	p-value
Interview language non-English	72*	48	0.02	64	52	0.74
Education: % greater than high school	61	57	0.67	33*	46	0.03

*p<0.05

Comparisons of LOC Exceedances to No Exceedances

Demographic and Dietary Variable	ACE 1			ACE 2		
	Exceedances (mean)	No exceedances (mean)	p-value	Exceedances (mean)	No exceedances (mean)	p-value
Portion of life in U.S.	0.5	0.5	0.86	0.3**	0.4	0.05
Years in U.S.	20.9	20.0	0.77	13.9*	19.3	0.02
Number of times ate fish from stores, restaurants, or street sellers (past 30 days)	10.6*	7.4	0.08	7.1	5.7	0.27
Number of times ate fish (past 30 days)	9.8*	7.1	0.08	6.9	5.1	0.12

*0.05<p<0.10

**p<0.05

Analyses By Individual Chemical

Conducted same analyses based on:

- Urinary inorganic arsenic exceedances alone

OR

- Blood mercury exceedances alone
 - Women 18-49 years
 - Women over 49 and all men

Are there significant differences between the participants with exceedances of a single LOC and participants without exceedances?

Comparisons of Blood Mercury LOC Exceedances to No Exceedances

Variable	ACE 1			ACE 2		
	Blood mercury exceedances (%) n=13	Blood mercury No exceedances (%) n=83	p-value	Blood mercury exceedances (%) n=25	Blood mercury No exceedances (%) n=74	p-value
Female	69	49	0.18	76**	47	0.01
Household income < \$25,000	46	24	0.38	28*	51	0.05
Household income \$25,001-\$75,000	31	42	0.38	40*	22	0.05
Interview language non-English	92**	52	0.01	72	59	0.26

*0.05<p<0.10

**p<0.05

Comparisons of Blood Mercury LOC Exceedances to No Exceedances

Variable	ACE 1			ACE 2		
	Blood mercury exceedances n=13 (mean)	Blood mercury No exceedances n=83 (mean)	p-value	Blood mercury exceedances n=25 (mean)	Blood mercury No exceedances n=74 (mean)	p-value
Age	44.0	43.6	0.95	41.2**	49.5	0.04
Years in U.S.	13.5**	21.4	0.01	13.0*	17.6	0.09
Number of times ate fish from stores, restaurants, or street sellers (past 30 days)	11.3*	7.6	0.06	8.8*	5.6	0.05

*0.05<p<0.10

**p<0.05

Comparisons of Urinary Inorganic Arsenic LOC Exceedances to No Exceedances

Variable	ACE 1			ACE 2		
	Inorganic arsenic exceedances n=24 (mean)	Inorganic arsenic No exceedances n=72 (mean)	p-value	Inorganic arsenic exceedances n=28 (mean)	Inorganic arsenic No exceedances n=71 (mean)	p-value
Portion of life in U.S.	0.5	0.5	0.64	0.3**	0.4	0.01
Years in U.S.	24.5	18.9	0.12	13.1*	17.7	0.08

*0.05<p<0.10

**p<0.05

Future Analyses

Examine the relationship between an exceedance of a specific LOC with additional characteristics, such as:

- Use of traditional remedies
- Specific types/sources of rice and rice products
- Specific types/parts/sources of fish

Model the relationship between metal levels and demographics, diet, and other characteristics

Thank you!

- ACE Project Participants
 - APA Family Support Services
 - VIVO Vietnamese Voluntary Foundation
 - Biomonitoring California Staff
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