3-29-2017

Minority Health Disparities: The case of the American Indians

Lawrence M. Schell
University at Albany, State University of New York, lmschell@albany.edu

Minority Health Disparities: The Case of American Indians.

Lawrence Schell

Department of Anthropology

Department of Epidemiology & Biostatistics

Center for the Elimination of Minority Health Disparities

University at Albany, State University of New York

- Globally, aboriginal populations have been in great decline, demographically and culturally.
- American Indians continue to be the poorest and the least healthy population within the borders of the United States.

What are health disparities?

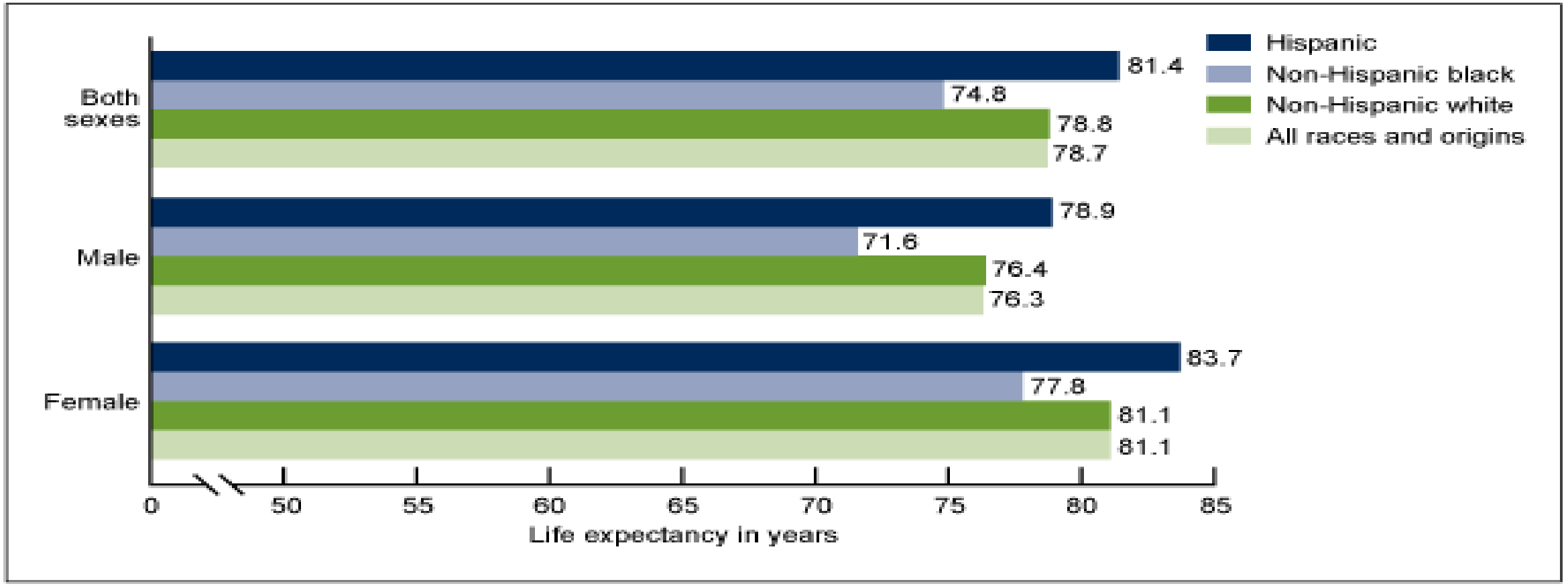
- **Health disparities** are preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal **health** that are experienced by socially disadvantaged populations. (https://www.cdc.gov/healthyyouth/disparities/)

- Health disparities result from multiple factors, including
  - Poverty
  - Environmental threats
  - Inadequate access to health care
  - Individual and behavioral factors
  - Educational inequalities

Examples of Health Disparities

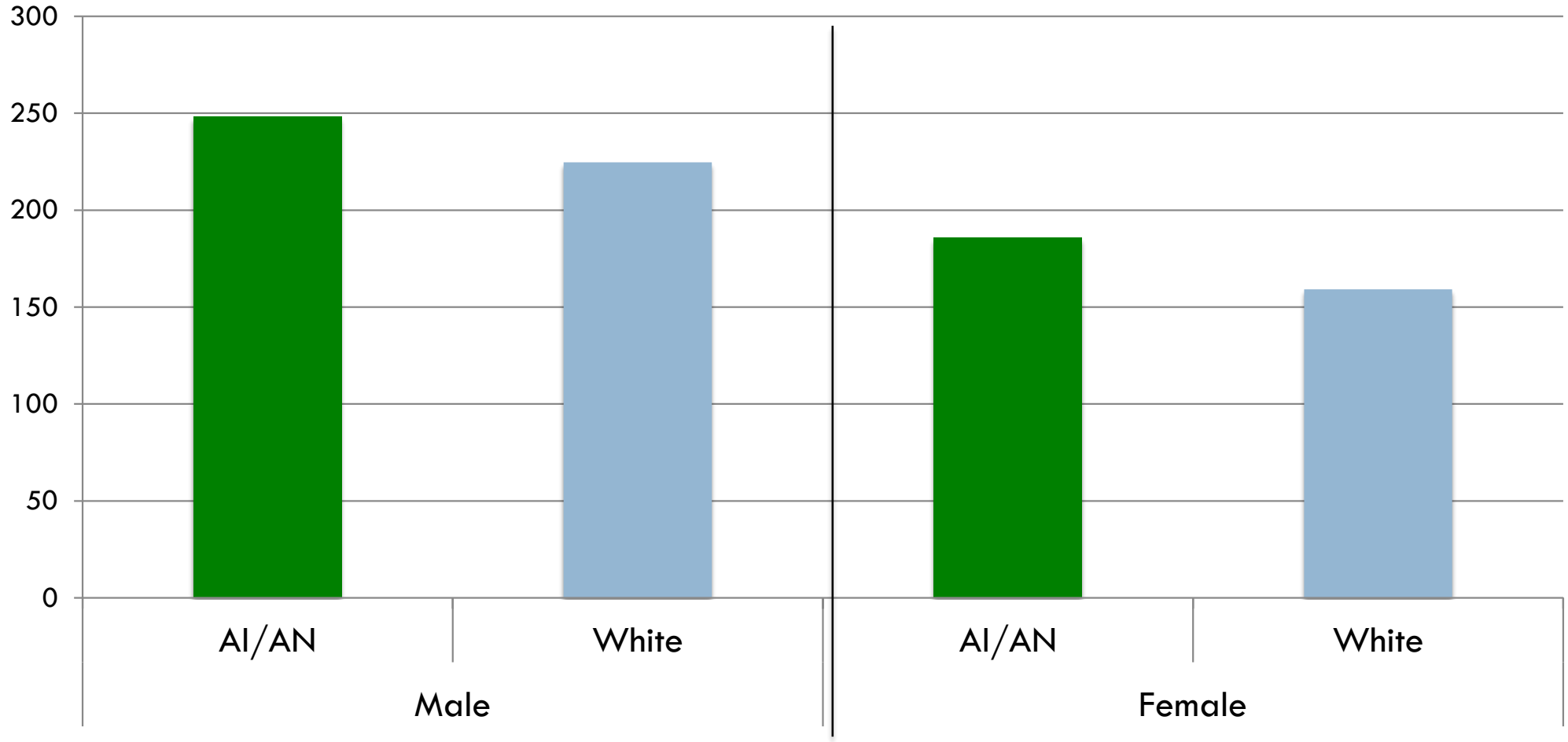
How long Can we expect to live?

Life expectancy at birth, by Hispanic origin, race for non-Hispanic population, and sex: United States, preliminary 2011



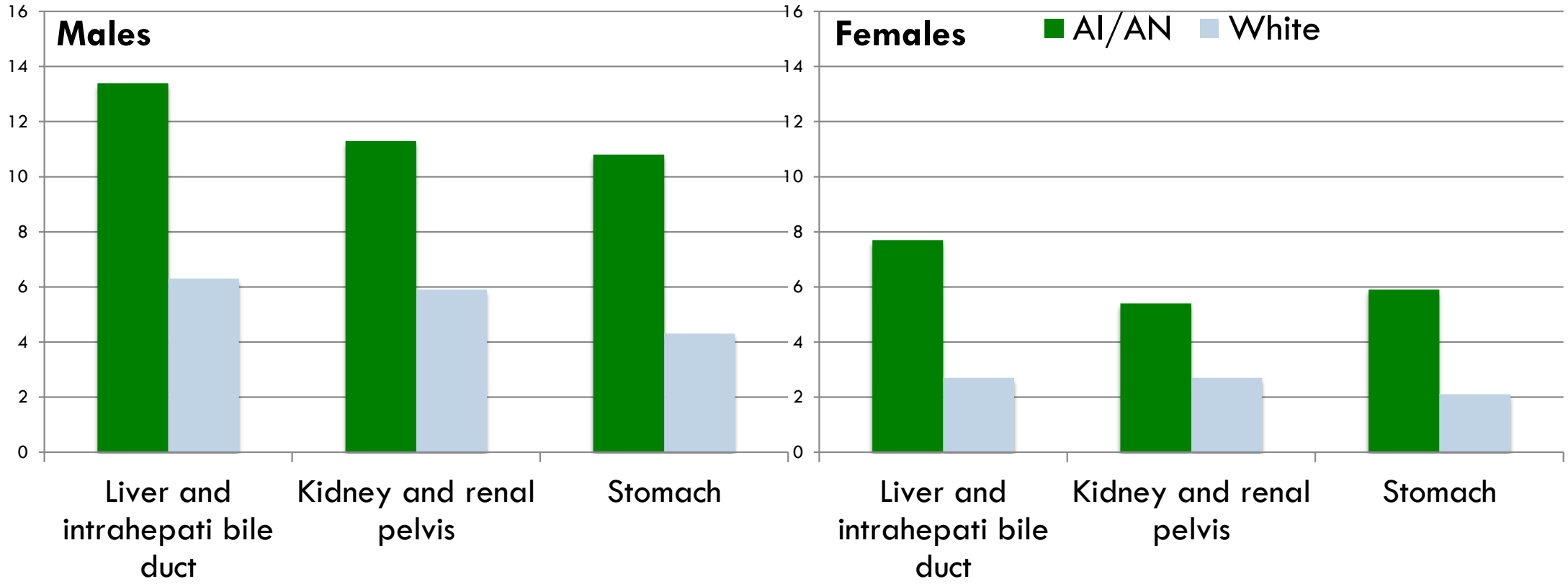
NCHS Data Brief No. 115
March 2013

Death rates from all malignancies: American Indians/Alaskan Natives and Whites, 1990-2009.



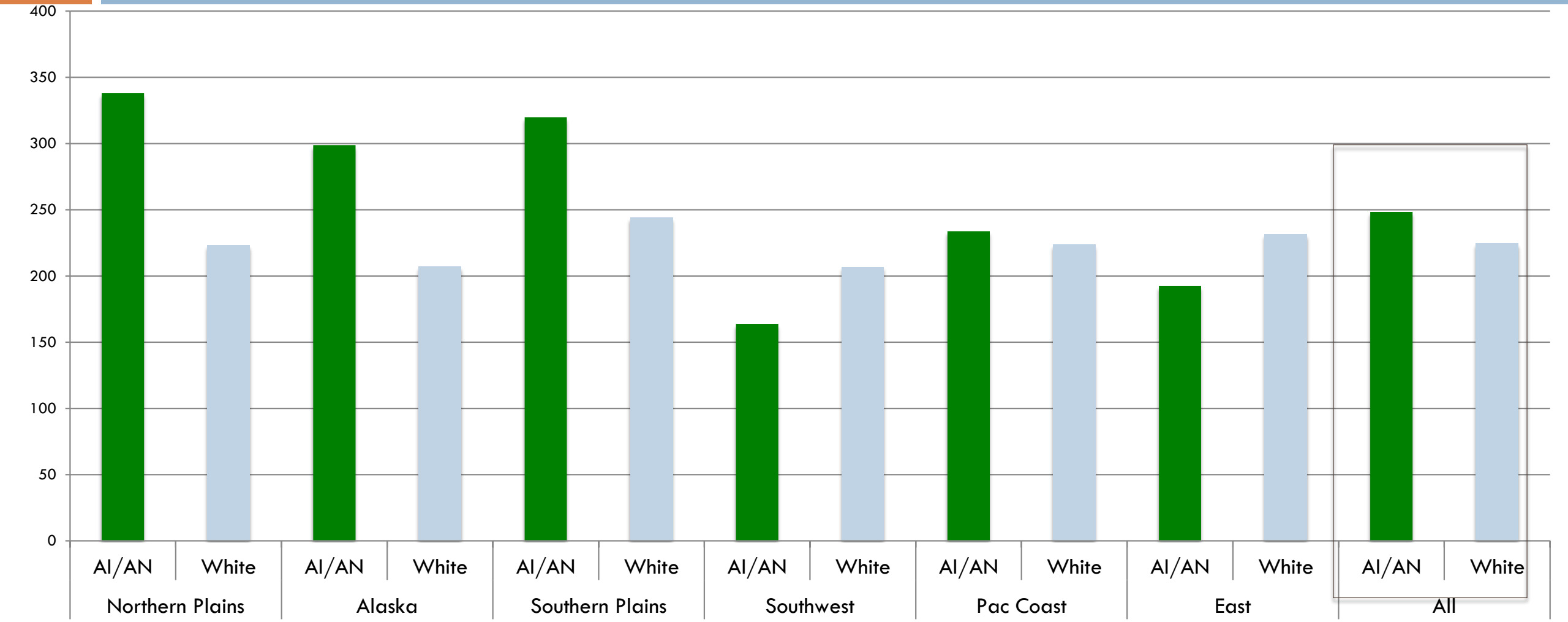
From White et al. Am J Public Health. 2014;104:S377–S387. doi:10.2105/AJPH.2013.301673)

Three of the most disparate and common cancers among American Indians/Alaska Natives 1990-2009..

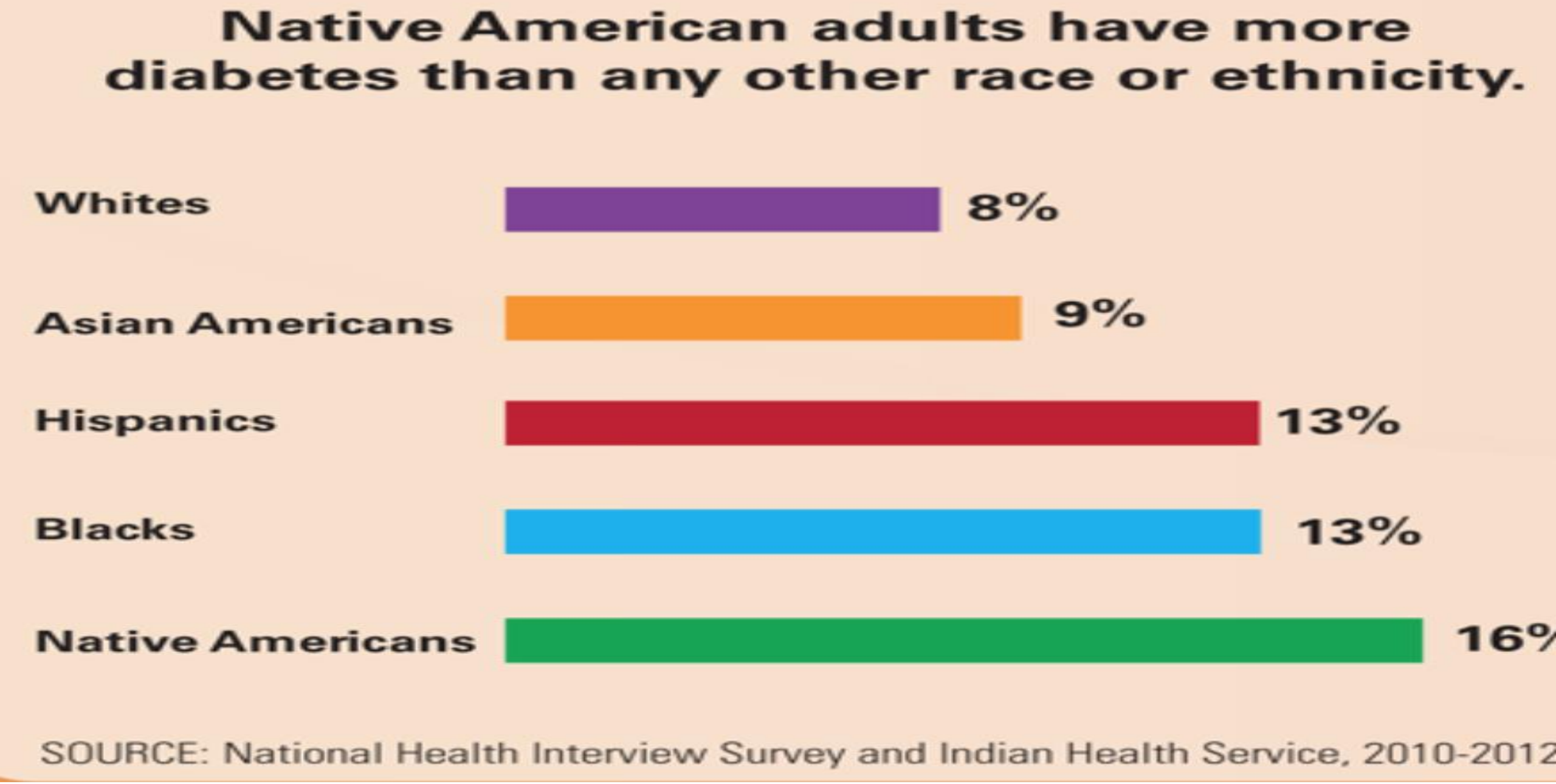


(From White et al. 2014 Am J Public Health;104:S377–S387. doi:10.2105/AJPH. 2013.301673)

American Indians/Alaskan Natives cancer death rates vary by region, Whites' rates do not. - Males, all malignant cancers, 1990-2009.

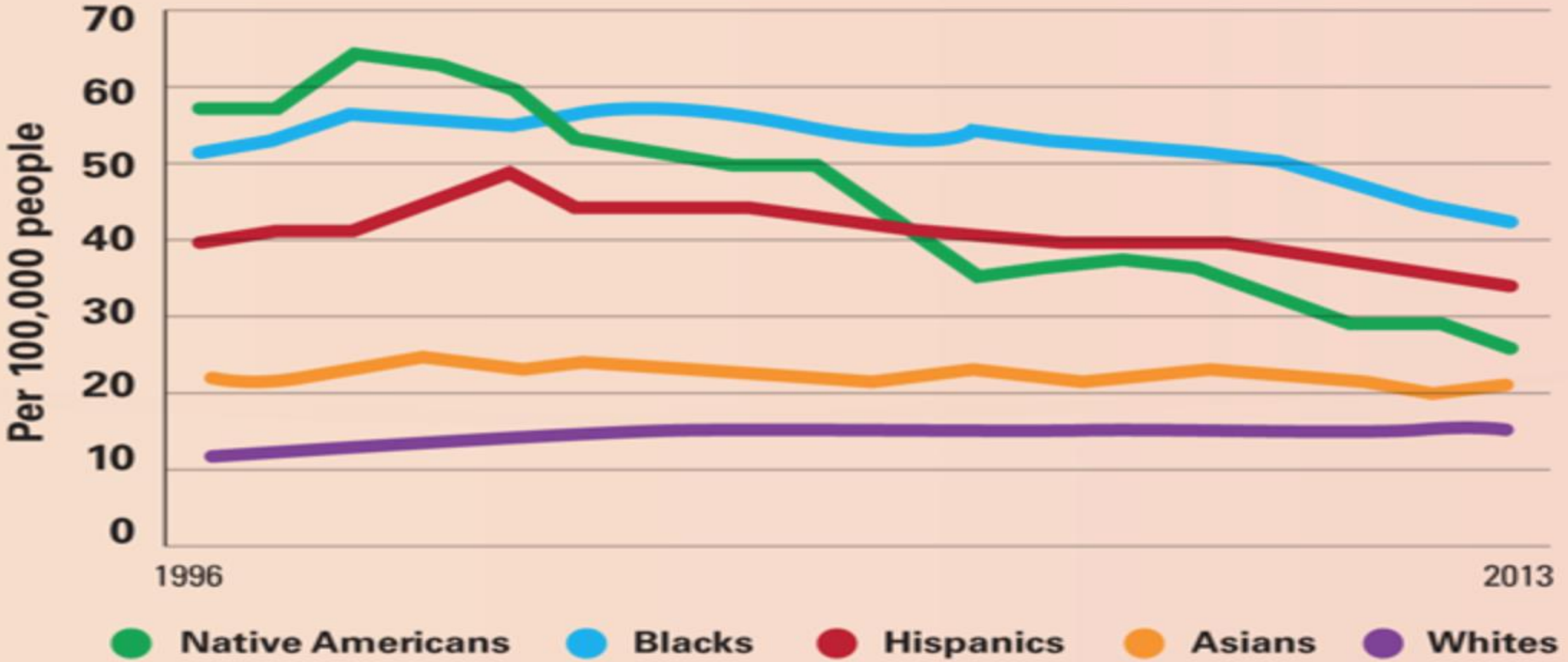


From White et al. Am J Public Health. 2014;104:S377–S387. doi:10.2105/AJPH.2013.301673)



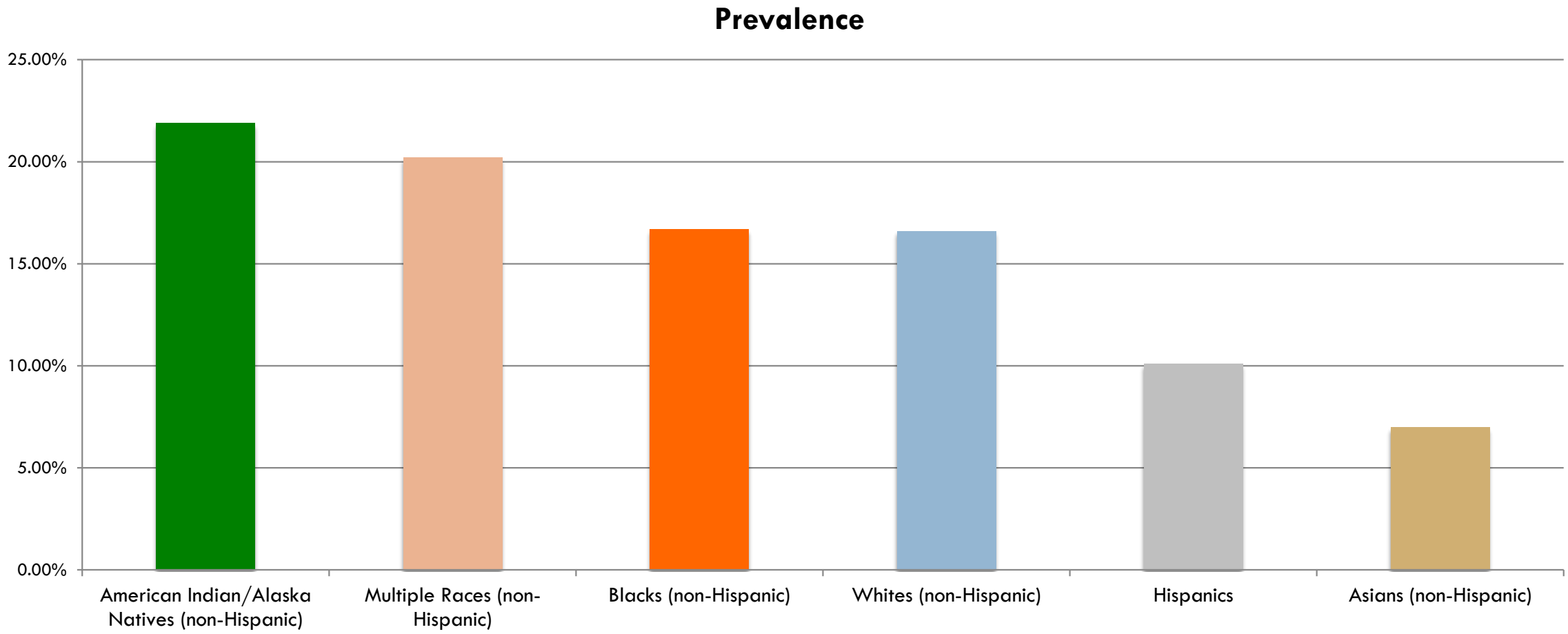
https://www.cdc.gov/vitalsigns/aian-diabetes/infographic.html#graphic18 and older.

Kidney failure from diabetes in Native Americans has dropped more than any other race or ethnicity.



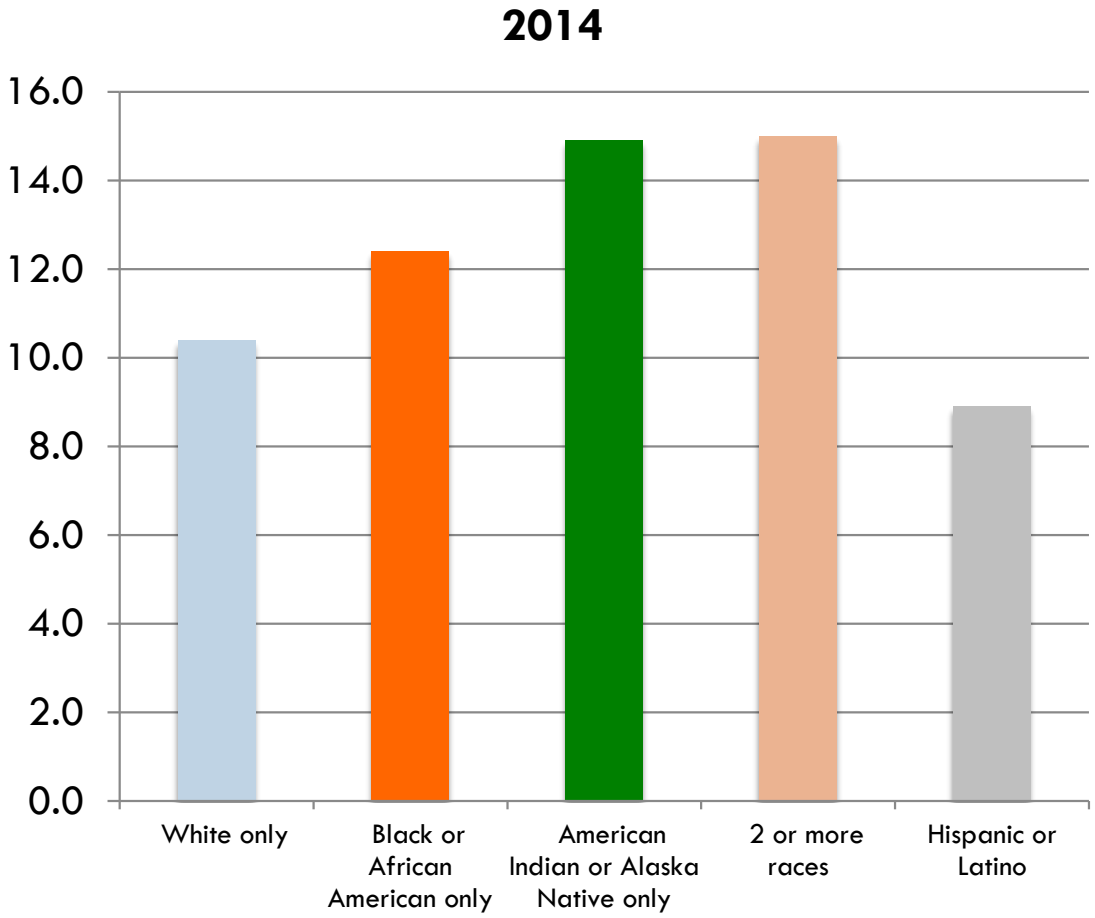
SOURCE: United States Renal Data System (USRDS), 1996-2013, adults 18 and older.

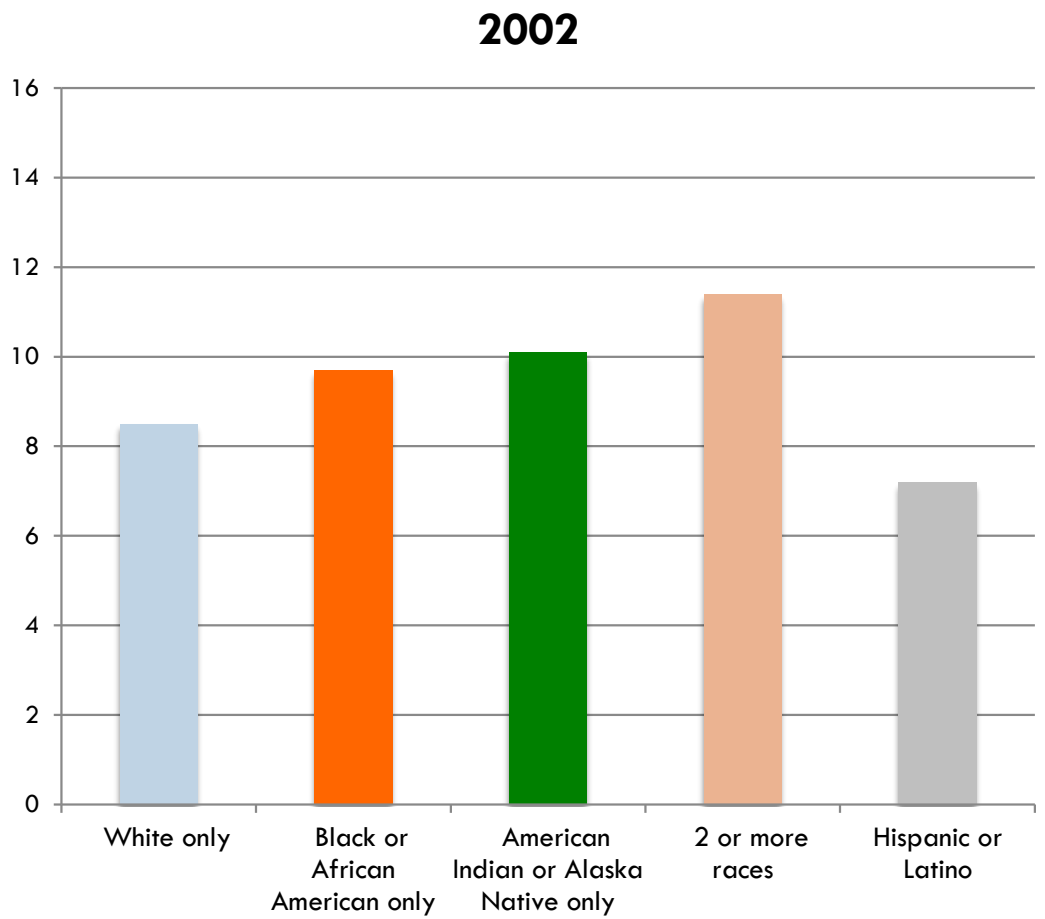
Current Cigarette Smoking Among U.S. Adults Aged 18 Years and Older: 2015



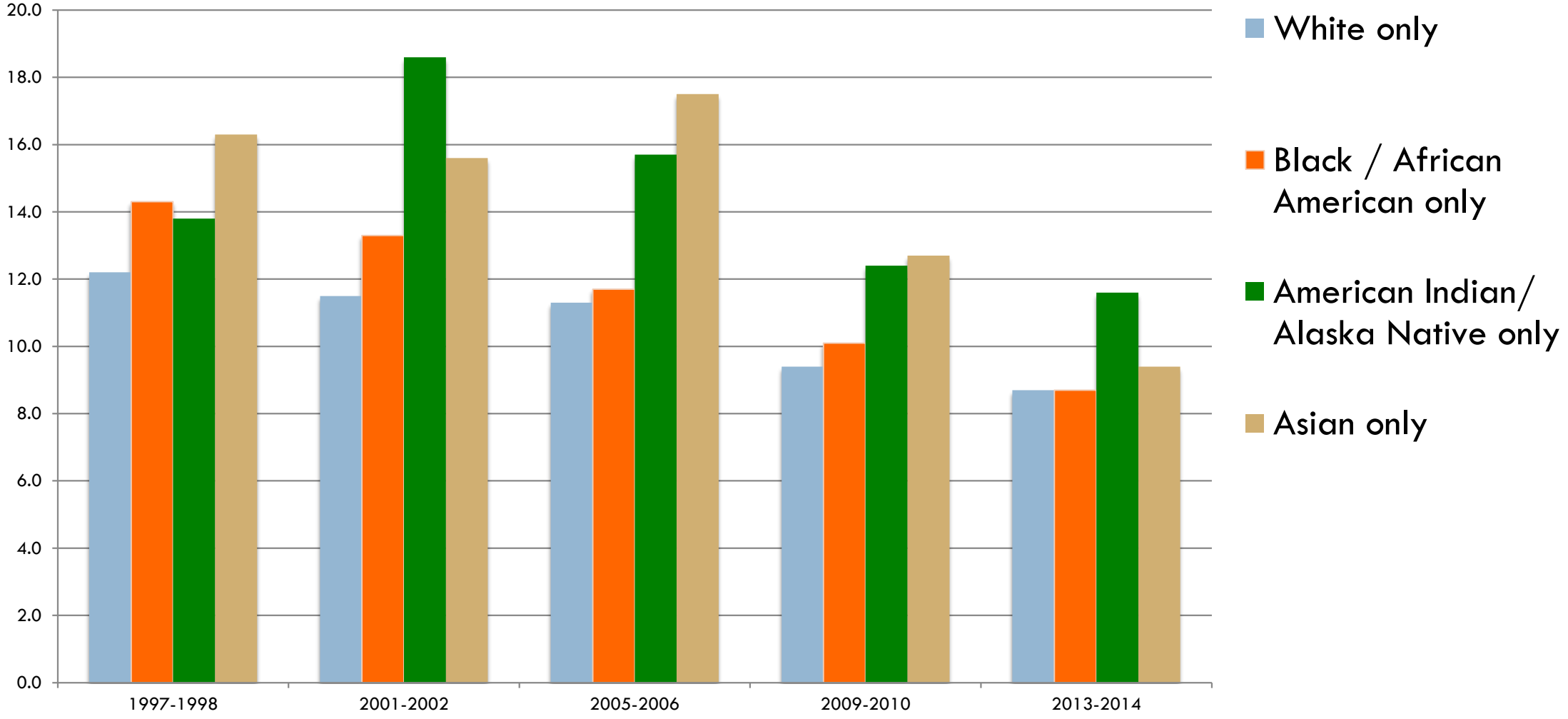
https://www.cdc.gov/tobacco/campaign/tips/resources/data/cigarette-smoking-in-united-states.html

Use of any illicit drug: Percent of Population.



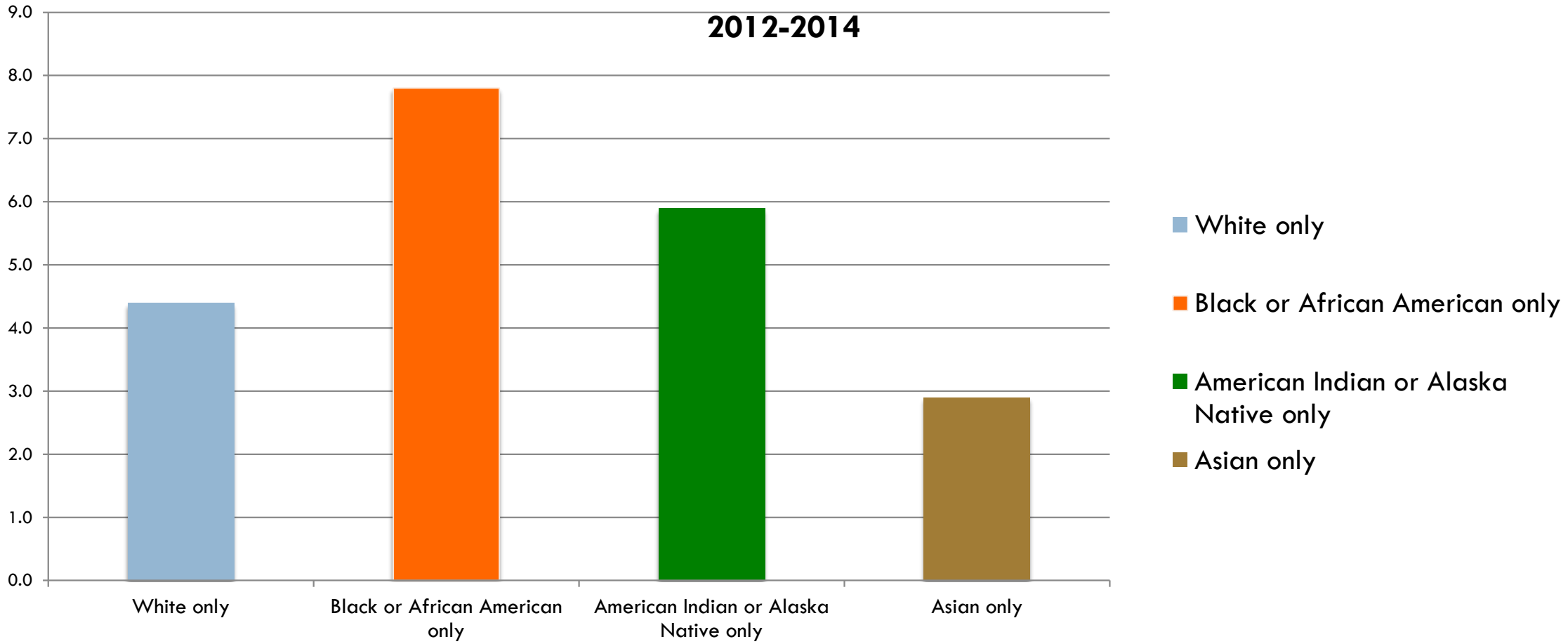


Percent of under 18 year olds without an office or clinic health visit in the past 12 months (NCHS).



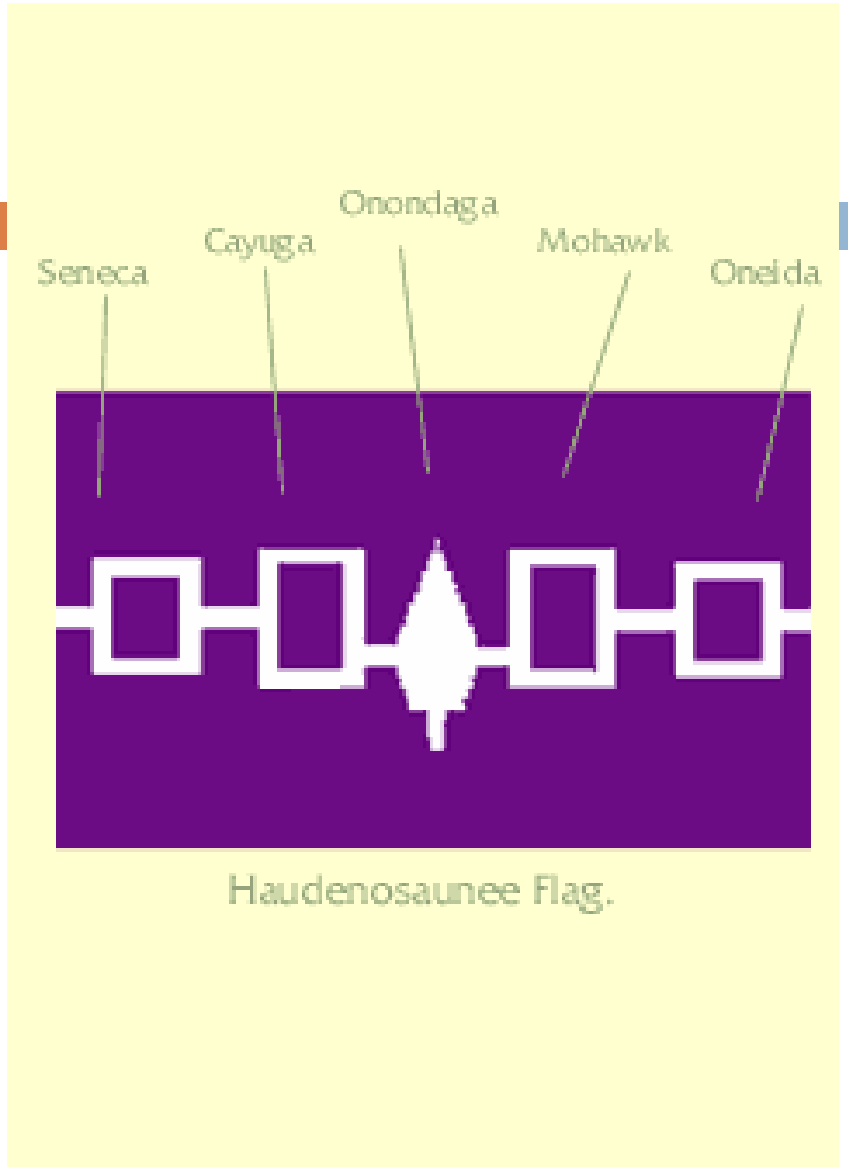
https://www.cdc.gov/nchs/hus/american.htm

Current Asthma: sub-18 year olds



https://www.cdc.gov/nchs/hus/american.htm. Table 35. Health conditions among children under age 18, by selected characteristics: United States, average annual, selected years 1997-1999 through 2012-2014

Akwesasne Mohawk Nation



Haudenosaunee Flag.

Identity- Sovereignty Issues

- Separate County - - Akwesasne Mohawk **Nation**
- Perpetual assault on Mohawk culture
- Resolute effort to preserve a better way of life


THIS IS MOHAWK LAND, NOT NYS LAND!!!
PM DAILY


Tésta'n


COMMUNITY BUILDING
ST. REGIS
MOHAWK TRIBE
ADMINISTRATION
Pet Photos with
Santa 12/3 2-5
RESERVED
TRIBAL
SUB-CHIEF
STACY
SKIDDERS
RESERVED
TRIBAL
SUB-CHIEF
MICHAEL
L. CONNERS
COURIER OBSERVER
Times


Our Goal... To Stop Underage Drinking!
Family
Community
Retailers
Law Enforcement
YOU
It Takes Us All
St. Regis Mohawk Health Services, Alcoholism Chemical Dependency Prevention Program


How Can You Reach Them...
Before Drugs Do?


ALL NATURAL
NATIVE
ALL NATURAL
NATIVE
Full Flavor 100's
Full Flavor
Lights 100's
Lights
Ultra Lights 100's
Ultra Lights
Menthol 100's
Menthol
Menthol Lights
20 Class A Cigarettes


TOBACCOS CIGARETTES PIPES CIGARS
SMOKEY'S
TOBACCO SHOP
EAST
37
95
Christmas Trees
SUNNY VIEW
GREENERY
4 MILES


Smokey's
Tobacco
Store
Cigarettes · Cigars · Pipe Tobacco
SMOKE Shop
CAMEL
SENECA
$27.00
$39.50
ALL NATURAL
NATIVE
Full Flavor
$55.00
$36.00
Marlboro
$33.50
Carton
LOWER PRICE!
$39.50
CAMEL
TURKISH ROYAL
SENECA
BIG FLAVOR. SMALL PRICE
HUGE SELECTION
USA Gold
$42.00
Made in USA
USA Gold
MENTHOL
$42.00
SONOMA
39.50
SIGNAL
Tomahawk
CIGARETTES
CIGARS


MOHAWK BINGO PALACE
CLASS II CASINO
ONE WAY
ONE WAY


ONE
WAY
ONE
WAY

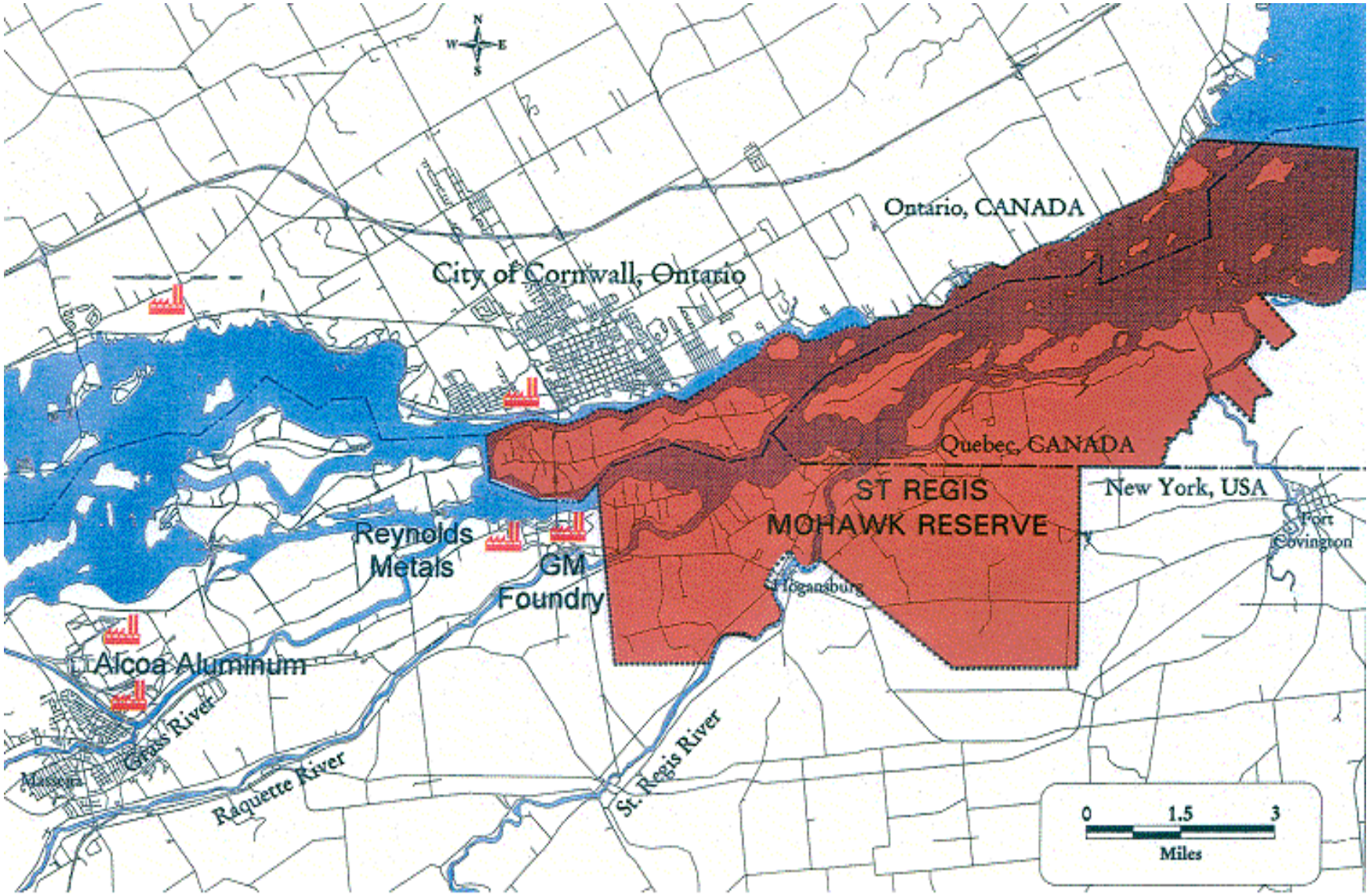

Tekanikonrahwakon
Wholistic Health
&
Wellness Program
Gambling Is Not
Our Tradition
Call:
(613) 575-2341
ext. 3100
DIESE
CANADIAN MONEY
AT
PAR


Mohawk Bingo Palace
& CASINO
Where The Winning
NEVER STOPS!
Left At Second Light
WWW.MOHAWKPALACE.COM


AKWESASNE MOHAWK
ASINO
Cheryl won
$10,000
Comfort
INN & SUITES
ENTRANCE


CASINO
STOP


Welcome to
GM
POWERTRAIN
MASSENA, NY.
LOCAL
465



Location of Manufacturing near the Akwesasne Mohawk Nation

Contamination of the Akwesasne Mohawk ecology

- **Industrial development** over the last 50 years has contaminated the St. Lawrence River, its tributary rivers and the local environment with numerous toxicants especially PCBs (polychlorinated biphenyls).
- **Fish advisories** were issued by tribal leaders and N.Y. State in 1985. Many residents no longer fish, hunt, or garden due to concerns of environmental contamination.

Toxicant Exposure at Akwesasne

Schell et al. EHP, 2003.

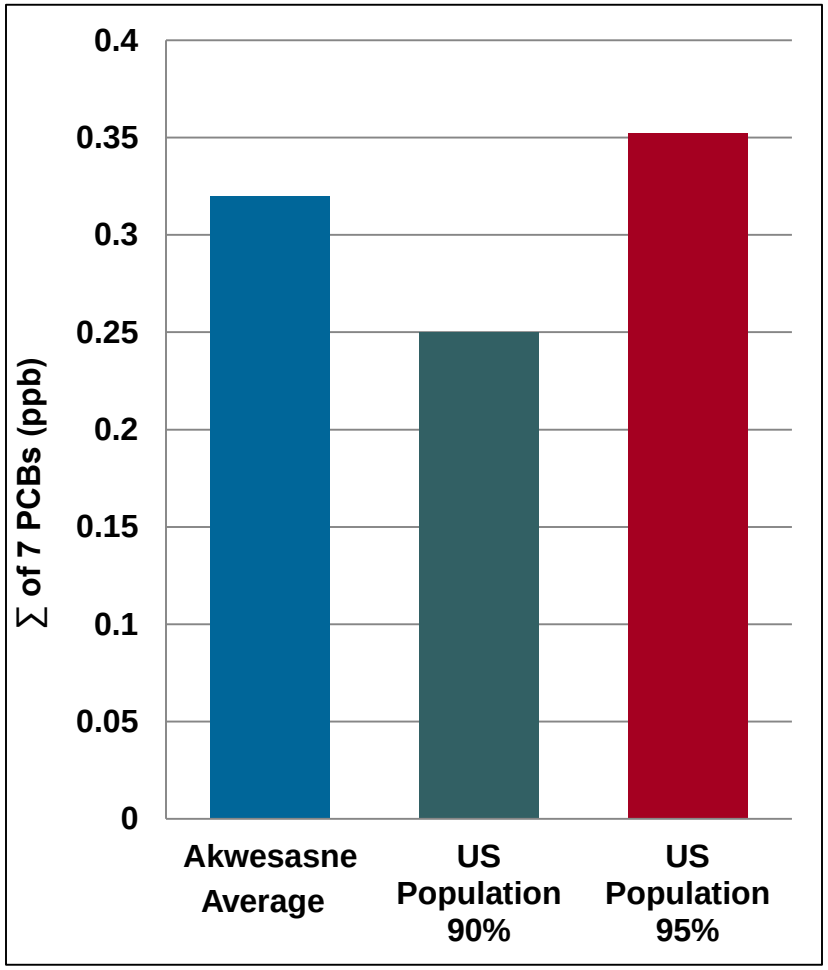
PERSISTENT ORGANIC POLLUTANTS (POPS)

- **PCBs (polychlorinated biphenyls)**
  - **produced for a variety of industrial purposes**
  - **fish, meat, poultry, dairy products**
- DDE (dichlorodiphenyldichloroethylene)
  - metabolite of the pesticide DDT
  - fish, meat, poultry, dairy products
- HCB (hexachlorobenzene)
  - pesticide and fungicide
  - fish, shellfish, and waterfowl
- Mirex
  - pesticide and flame retardant
  - fish

Mohawk Adolescent Well-Being Study (MAWBS) 1995-2000: Sample & Data Collection

- Akwesasne Mohawk Nation youth
  - 10 - 16.9 yrs.; born between 1979 and 1989,
  - n = 271 boys and girls.
- All data were collected by members of the Akwesasne Mohawk Nation; 1996-2000.
- Data collectors were blinded to toxicant levels of participants.
- Blood draws upon first rising, before eating.

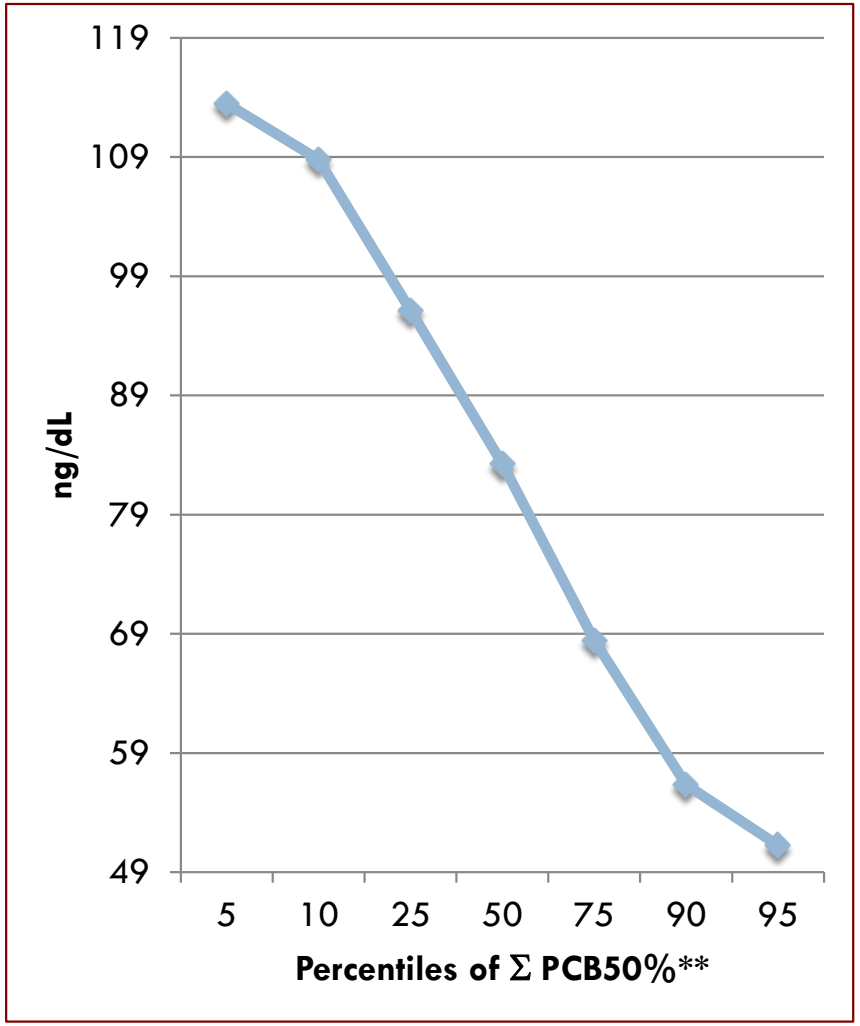
Comparison of PCB levels among Akwesasne adolescents with age-similar samples



- The average PCB level of Akwesasne adolescents is *equal* to the 93rd percentile in the US reference data from CDC.

∑ of 7 PCBs: CBs 118, 138, 153, 170, 180, and 187
Adapted from Schell and Gallo, 2010 Physiology & Behavior 99 :246–253

Magnitude of change in adolescent boys testosterone levels in relation to PCB percentiles (n=120)*



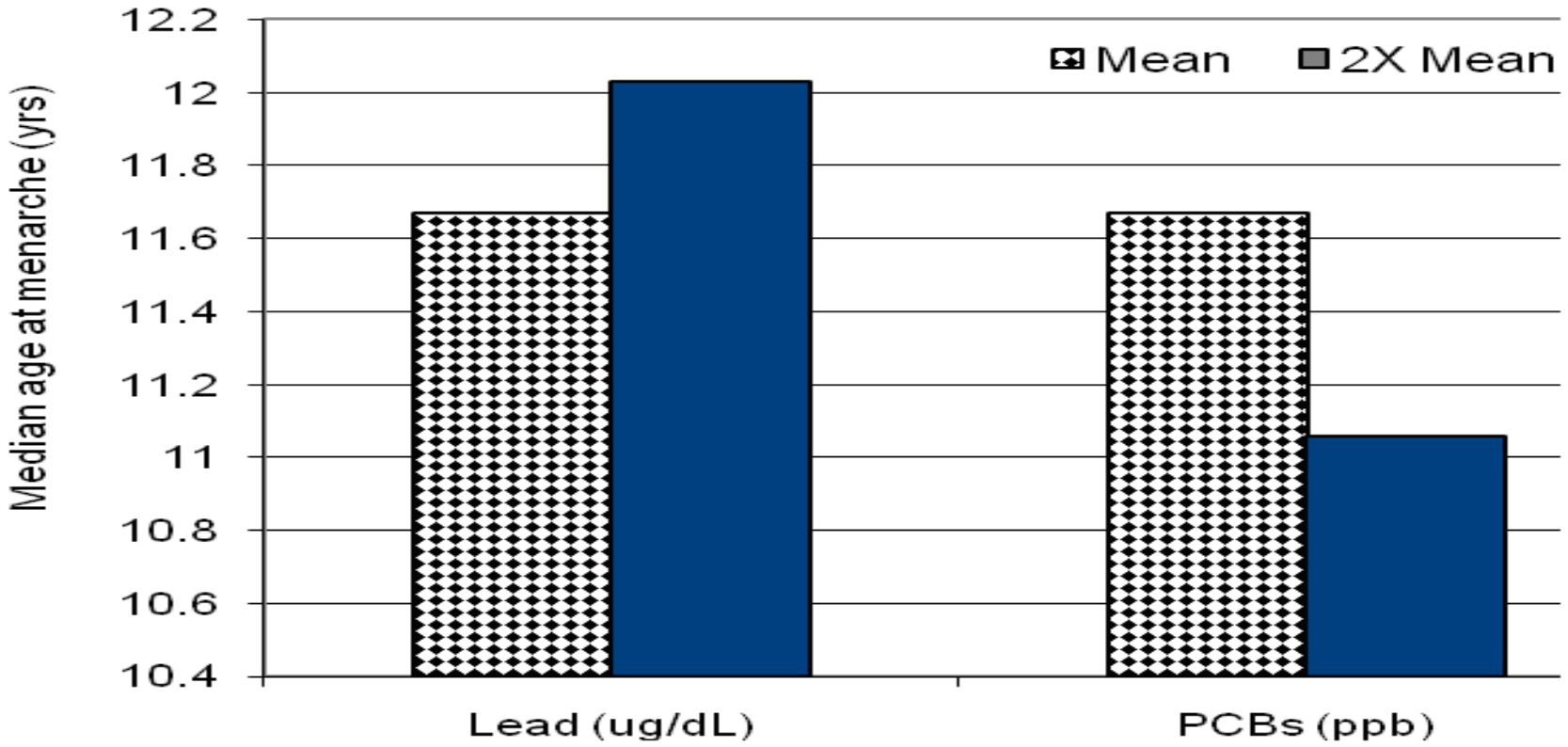
- For every *10%* increase in PCB levels, there is a ***5.6%*** decrease in testosterone levels.
- A *50%* increase in PCBs from the mean, increases the odds of having a lower testosterone level by ***24%.***

From: Schell, Gallo, Dean, et al. 2014. EHP, 122:304.

*Results of a multivariate regression analysis controlling for Tanner Stages, height-for-age z-score, weight-for-age z-score, cholesterol, triglycerides, alcohol and cigarette use, blood lead, DDE, and HCB levels.

**ΣPCB50%: Sum of PCB Congeners with ≥ 50% detection rate; Sum of IUPAC#s 52, 70, 74, 84, 87, 95, 99, 101[+90], 105, 110, 118, 138[+163+164], 149[+123], 153, 180, 187

Predicted median age at menarche* based on logistic regression model controlling for SES, and other toxicants (n=138, 10-16.99 yrs of age) .



At mean PCBs of 0.121 ppb = Median age=11.7 yrs

At 2x Mean PCBs = Median age=11.1 yrs

* Menarche assessed by status quo method

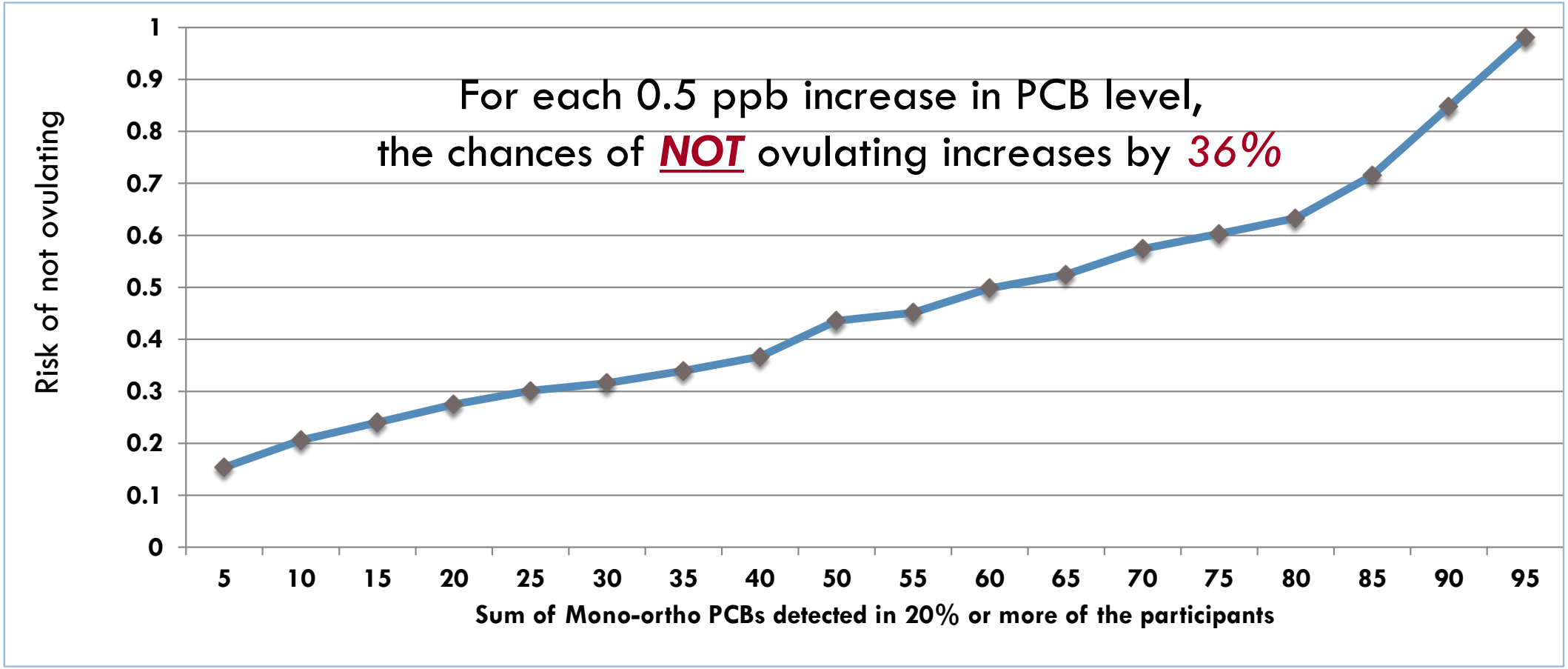
Other associations with PCBs at Akwesasne

- Thyroid hormones
  - Elevated TSH, lowered free T4 *(Schell et al. 2008)*
  - Elevated anti-thyroid antibody levels are associated with higher PCB levels *(Schell et al. 2009);)*

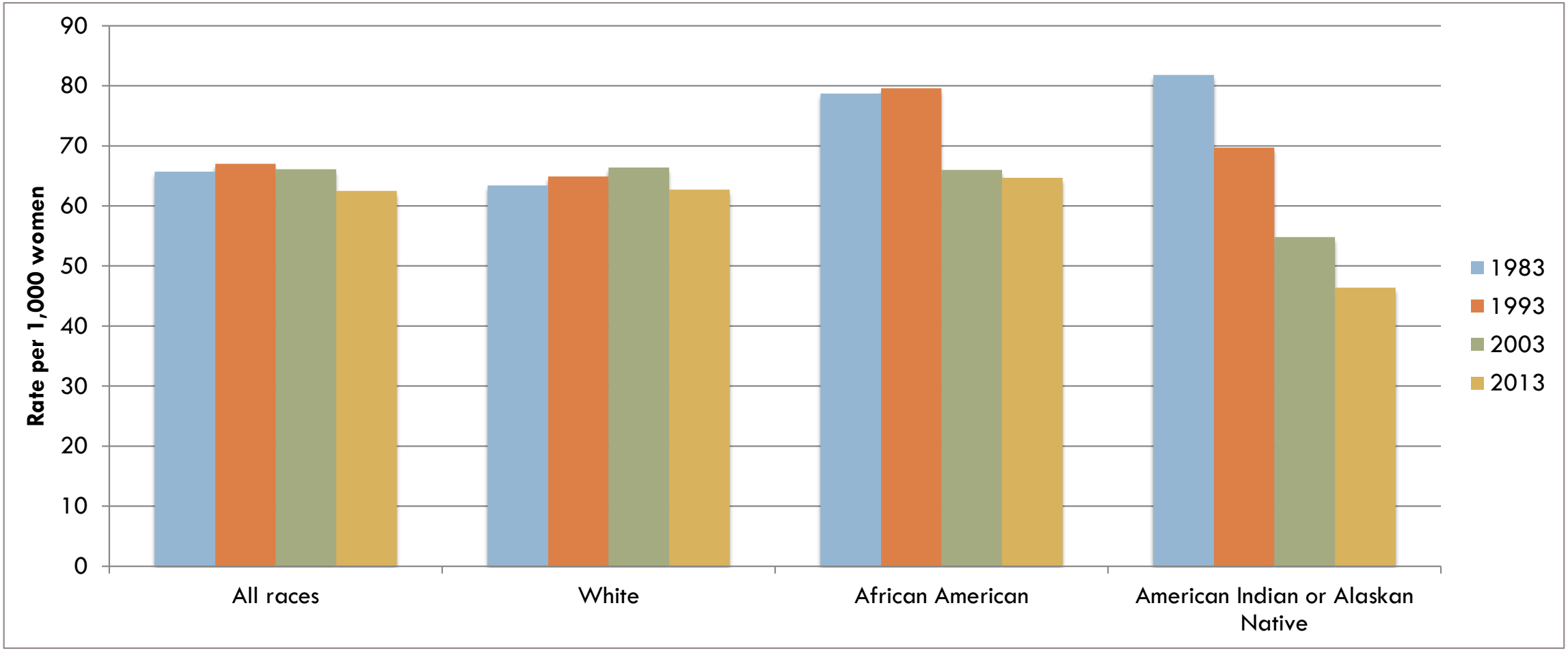
Menstrual Cycle Results: Adult Akwesasne (21-28 yrs. of age)

- Sample
  - 2009 – 2014
  - 155 completed the data collection protocol: day 3 blood draw, daily saliva sample, cycle diaries, interviews, anthropometry
- Among Akwesasne women who collected saliva:
  - ***110*** have ovulatory menstrual cycles (71%)
  - ***45*** have anovulatory cycles (29%)
    - ***15*** did not cycle and chose a day to start saliva collection

Risk of not ovulating and dioxin-like PCBs: Higher risk of no-ovulation status. (from Gallo et al. 2016, Environ. Res.17:151.



Fertility rates by race of mother (15-44 yrs. of age), US, 1983-2013

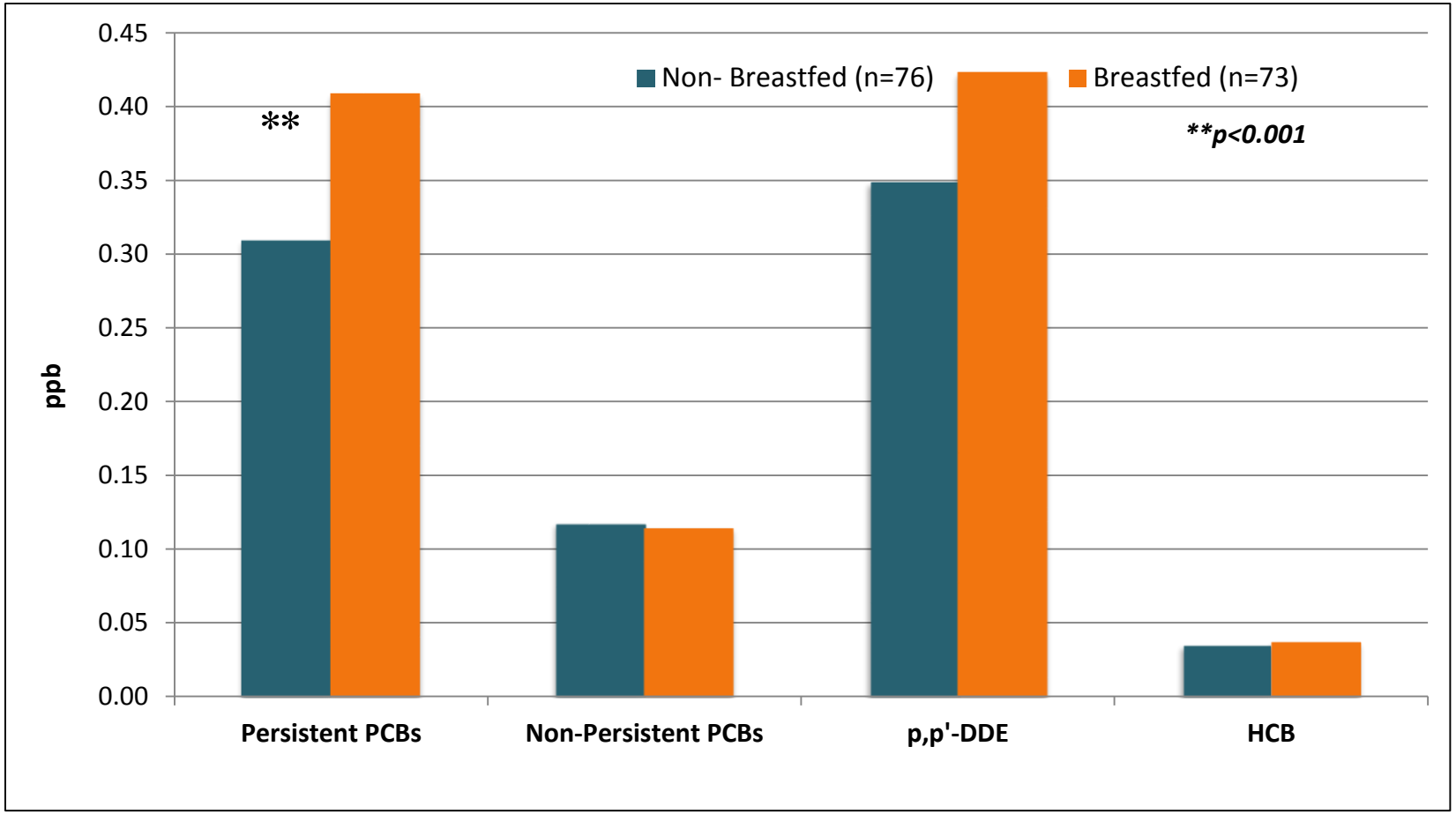


Source: National Vital Statistics Reports Vol 64, No. 1, January 2015

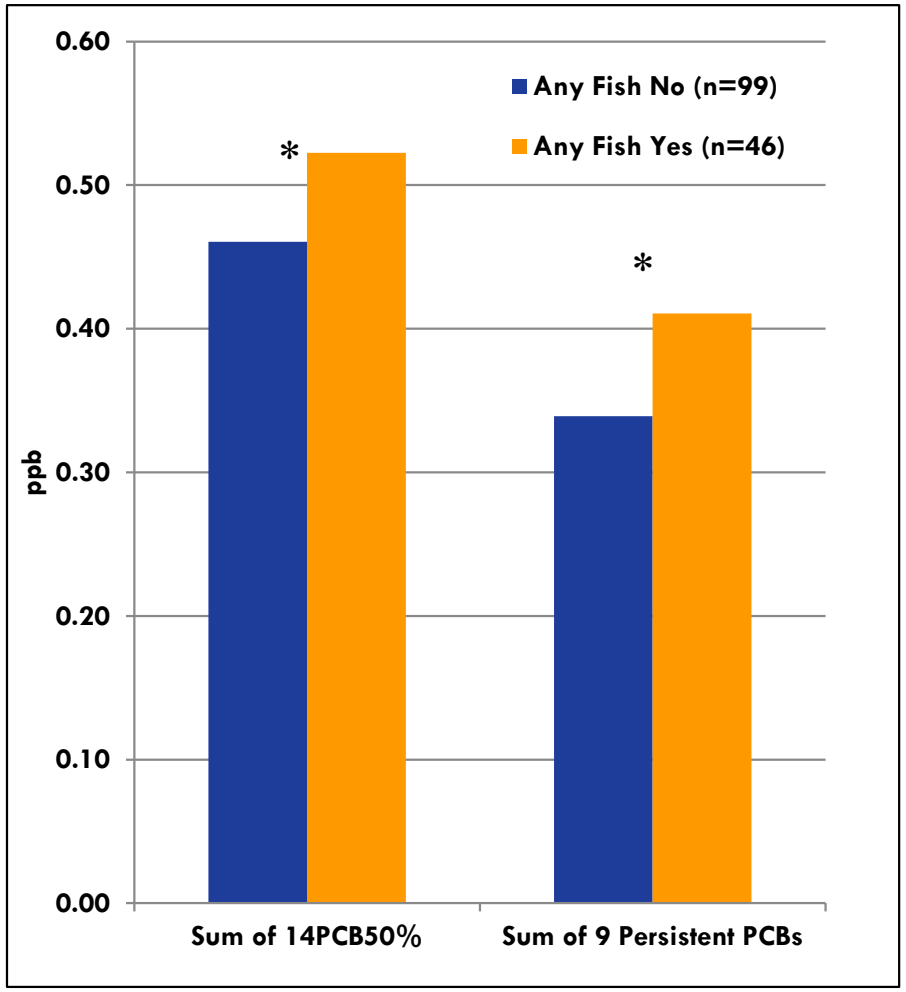
Avoiding exposure and continuing to practice activities that are very Mohawk

- *Young adult participants (19-21 years of age) were asked to rate how often they were likely to participate in the following activities:*
  - Medicine plant picking
  - Picking medicine in wetlands
  - Trapping in wetlands, trapping in drylands
  - Farming and gardening, berry picking
  - Fishing
  - Swimming, wading, or boating in the river
  - Use of traditional medicine
  - Eating locally caught fish
  - Eating locally caught wildlife
  - Breastfeeding

The persistent PCBs are still higher in young adults who had been breast fed 20 years later.



Eating locally caught fish in the past year and mean PCB levels

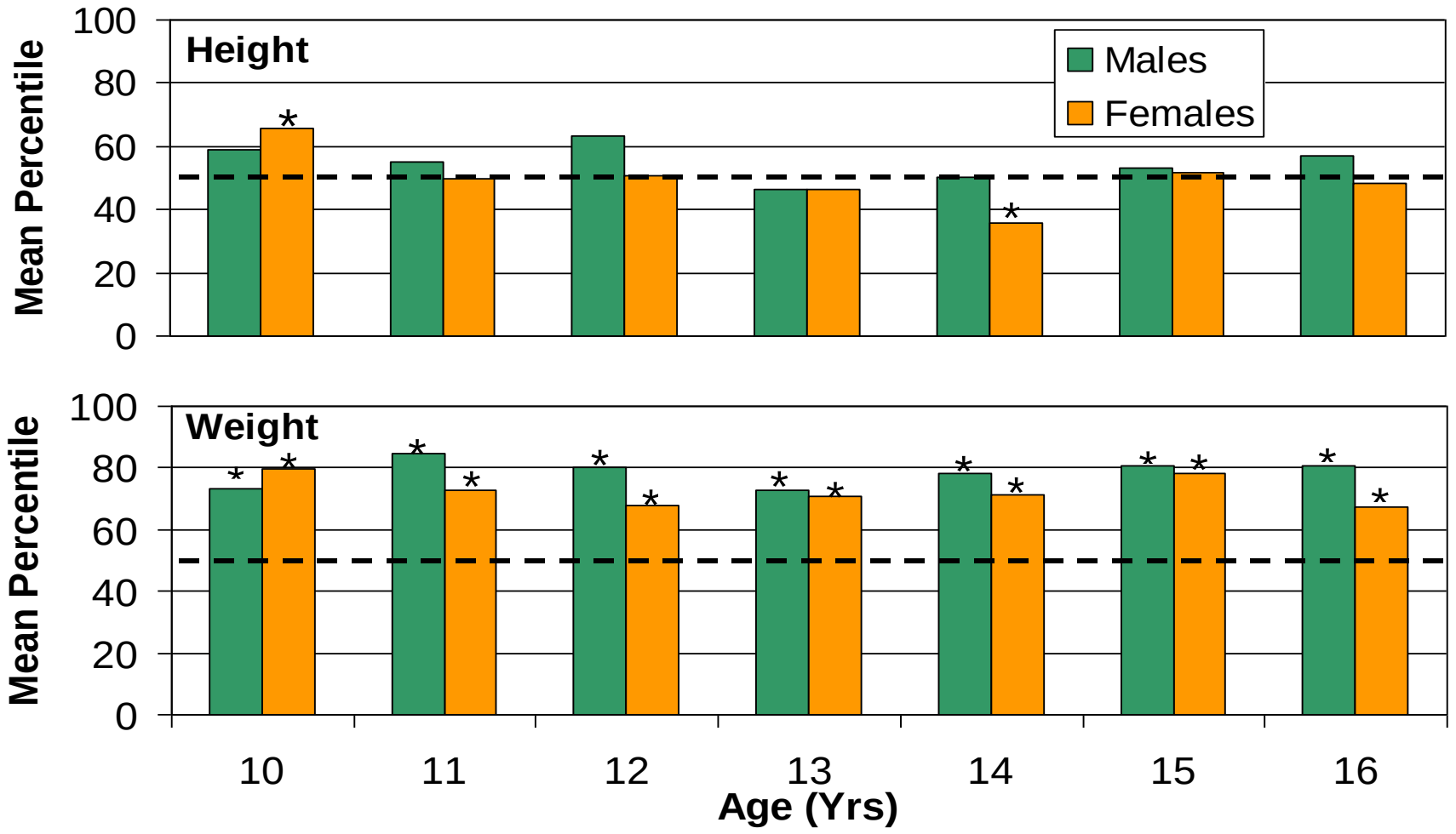


- Locally caught fish consumed by the Akwesasne Mohawk include:
  - Bass
  - Bullhead
  - Catfish
  - Northern Pike
  - Perch
  - Salmon
  - Sturgeon
  - Trout
- ***Higher PCB levels*** are found in those individuals who ***consume*** locally caught fish.

What is the Relationship of behaviors to current toxicant levels?

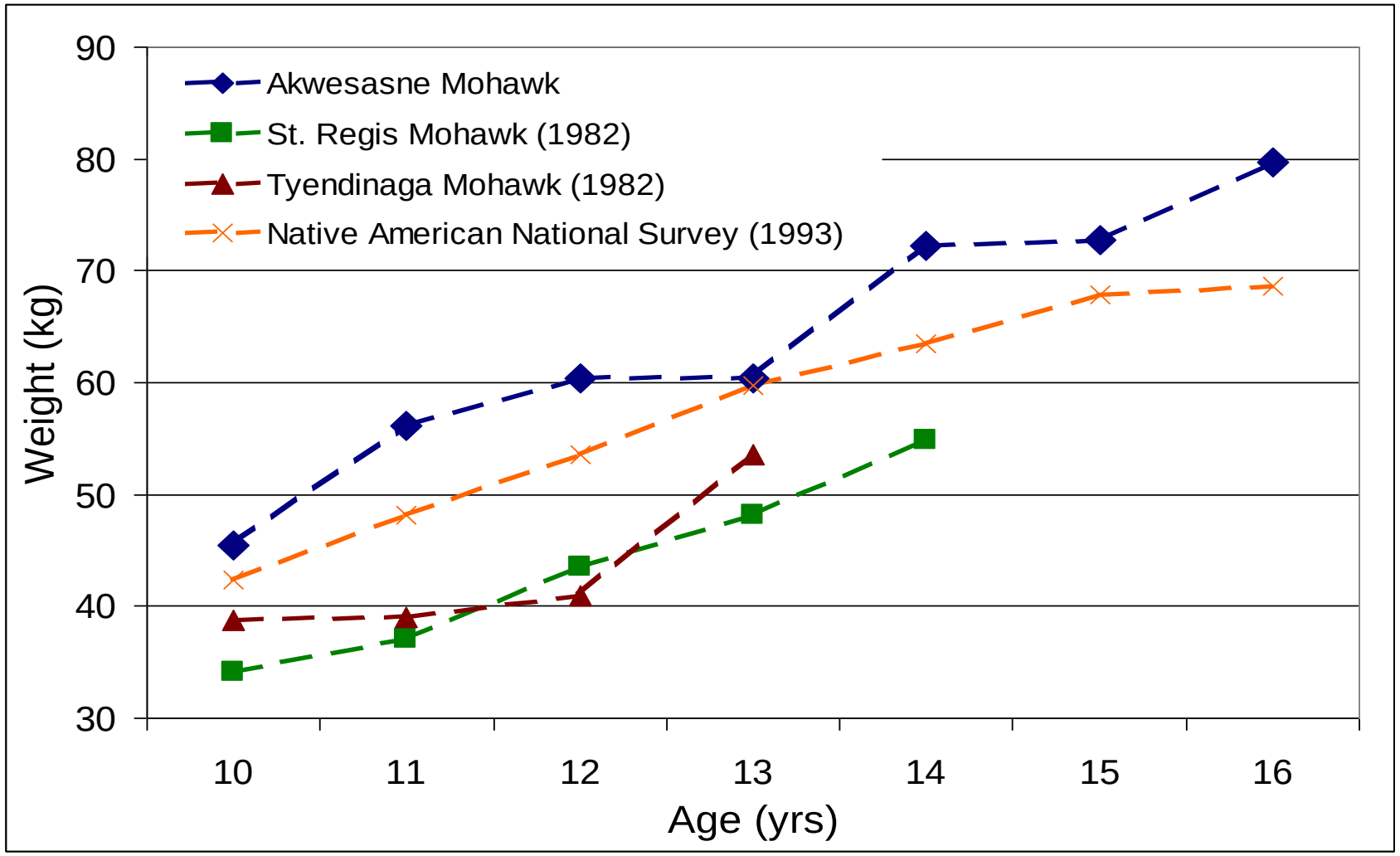
Activities		Associations with toxicant levels
Eating locally caught fish		Persistent PCBs and DDE
Eating locally caught wildlife		Persistent PCBs and DDE
Breastfeeding		Persistent PCBs and DDE
Trapping in drylands		DDE
Medicine plant picking		--------
Picking medicine in wetlands		--------
Trapping in wetlands		--------
Farming and gardening, berry picking		--------
Fishing		--------
Swimming, wading, or boating in the river		--------
Use of traditional medicine		--------

Mean weight & height for age percentiles (CDC reference values) of Akwesasne boys and girls (n=271)



Mean weight of Akwesasne boys

(from Gallo et al. *Am J Hum Biol*, 17(3):269-279)



“Between a rock and a hard place…”

Is this a choice between identity and survival?

- Avoiding local food will reduce exposure to pollutants with detrimental health effects, standard public health message.
- Avoiding local food will increase the loss of Mohawk Culture
  - Loss of relationship between generations
  - Greater sense of victimization
  - Increased risk behaviors
- Avoiding local foods will increase overweight
  - Poorer health, shorter lifespans
  - Population decline, further decline

Steering a path: The Akwesasne Way

- Sovereignty issue means self determination
- Pollution clean up involves several governments
- Solutions will be crafted
  - By the community
  - In consultation with the community
- Information about pollution's effects essential to deciding on solutions

Studies of the Akwesasne Mohawk Community: Collaborators at Akwesasne

Akwesasne Collaborators

1. Alice Tarbell, First Environment Research Projects at Akwesasne

1. 2. Agnes 'Sweets' Jacobs, First Environment Research Projects at Akwesasne

1. Dawn David, First Environment Research Projects at Akwesasne

1. Priscilla Worswick, First Environment Research Projects at Akwesasne

1. Trudy Lauzon, First Environment Research Projects at Akwesasne

2. Maxine Cole, First Environment Research Projects at Akwesasne

3. Tewentahawih'tha' Cole, St. Regis Mohawk Health Services

3. Louise Ingle, St. Regis Mohawk Health Services

3. Amanda Garrow, St. Regis Mohawk Health Services

3. Helen Lazore, St. Regis Mohawk Health Services

3. Debra Martin, St. Regis Mohawk Health Services

3. Beverly Cook, St. Regis Mohawk Health Services

Studies of the Akwesasne Mohawk Community: Collaborators at Albany

1. 2, 3. Mia V. Gallo, Ph.D., CEMHD

1. 3. David O. Carpenter, MD., EHI, SPH

1. 2. 3. Julia Ravenscroft, Ph.D., University at Buffalo

1. 2. Anthony DeCaprio, Ph.D. Florida Atlantic University

1. Robert Ray, Ph.D. NYSDOH

3. Elizabeth Holdsworth, MA, UAlbany

3. Kyrie Nelder, MA, UAlbany

3. Kristopher Burnitz, MA, UAlbany

Thank you!

People of Akwesasne and distinguished audience.

Table D. Deaths and percentage of total deaths for the 10 leading causes of death, by race: United States, 2014

[Data for races other than white and black should be interpreted with caution because of misreporting of race on death certificates; see Technical Notes. An asterisk (*) preceding a cause-of-death code indicates that the code is not included in the *International Classification of Diseases, Tenth Revision* (ICD–10); see Technical Notes]

Cause of death (based on ICD–10)	White			Black			American Indian or Alaska Native			Asian or Pacific Islander		
	Rank[1]	Deaths	Percent of total deaths	Rank[1]	Deaths	Percent of total deaths	Rank[1]	Deaths	Percent of total deaths	Rank[1]	Deaths	Percent of total deaths
All causes	...	2,237,880	100.0	...	308,960	100.0	...	18,008	100.0	...	61,570	100.0
Diseases of heart (I00–I09,I11,I13,I20–I51)	1	524,695	23.4	1	73,095	23.7	1	3,288	18.3	2	13,270	21.6
Malignant neoplasms (C00–C97)	2	502,932	22.5	2	69,090	22.4	2	3,153	17.5	1	16,524	26.8
Chronic lower respiratory diseases (J40–J47)	3	134,541	6.0	6	9,934	3.2	6	788	4.4	7	1,838	3.0
Accidents (unintentional injuries) (V01–X59,Y85–Y86)	4	117,242	5.2	4	14,168	4.6	3	1,997	11.1	4	2,646	4.3
Cerebrovascular diseases (I60–I69)	5	111,035	5.0	3	17,088	5.5	7	649	3.6	3	4,331	7.0
Alzheimer's disease (G30)	6	84,990	3.8	9	6,567	2.1	11	304	1.7	8	1,680	2.7
Diabetes mellitus (E10–E14)	7	59,741	2.7	5	13,435	4.3	5	945	5.2	5	2,367	3.8
Influenza and pneumonia (J09–J18)	8	47,293	2.1	11	5,611	1.8	9	412	2.3	6	1,911	3.1
Intentional self-harm (suicide) (*U03,X60–X84,Y87.0)	9	38,675	1.7	16	2,421	0.8	8	489	2.7	10	1,188	1.9
Nephritis, nephrotic syndrome and nephrosis (N00–N07,N17–N19,N25–N27)	10	37,976	1.7	7	8,586	2.8	10	338	1.9	9	1,246	2.0
Chronic liver disease and cirrhosis (K70,K73–K74)	11	33,508	1.5	15	3,103	1.0	4	951	5.3	14	608	1.0
Septicemia (A40–A41)	12	31,512	1.4	10	6,386	2.1	12	289	1.6	12	753	1.2
Assault (homicide) (*U01–*U02,X85–Y09,Y87.1)	19	7,362	0.3	8	7,876	2.5	13	263	1.5	19	308	0.5

... Category not applicable.

[1]Based on number of deaths. Ranks above 10 are provided for informational purposes when a cause is among the top 10 for at least one of the groups being compared.


Speedway
Diesel
CAT
SCALE
Speedway
Convenienc
REGULAR 302
PLUS 312
PREMIUM 322
DIESEL 315
Drive - Thru
Tobacco
& ATM
SUBWAY
SUBWAY
DIESEL
ATM
Adirondack
ENERGY
SERVICE AT ITS PEAK
83-FUEL

Predictors of testosterone levels in adolescent males: Results of multivariate regression analysis with other PCB groupings (n=120)*.

Covariate	Std. β	Std. β (95%CIs)**	*p*	% decrease in testosterone levels for 10% increase in PCB level
∑8PerPCBs[a,b]	-0.15	(-0.28, -0.01)	***0.03***	***5.7***
∑6NonPerPCBs[a,c]	-0.09	(-0.20, 0.02)	0.13	3.1
∑7 Estrogenic PCBs[a,d]	-0.12	(-0.24, -0.00)	***0.05***	***4.7***
Anti-estrogenic PCB[a,e]	-0.04	(-0.15, 0.07)	0.50	1.5
∑4MOPCBs[a,g]	-0.15	(-0.27, 0.03)	***0.02***	***6.2***

Each model controlled for: Tanner Stages I & II vs. III, Tanner Stages IV & V vs. III, weight - for-age z-score, height - for-age z-score, breastfed as an infant (y/n), child's alcohol use (y/n), child's cigarette use (y/n), triglycerides (mg/dL, cholesterol (mg/dL), Pb (µ/dL), *p,p'*-DDE (ppb), and HCB (ppb).

*Testosterone, cholesterol, triglycerides, lead, *p,p'*-DDE, HCB and PCB variables are all logged transformed to normalize distribution.

[a]Values below the MDL were calculated following the EPA recommended method for estimating non-detected values as described in the methods section of our text.

[b]Sum of IUPAC#s: 74, 99, 105, 118, 138[+163+164], 153, 180, 187 [c]Sum of IUPAC#s: 52, 84, 95, 101[+90], 110, and 149[+123] [d]Σ of 7 Estrogenic PCBs: IUPAC#s 52,70,95,99, 101[+90], 110, 153 (Cooke et al. 2001) [f]Anti-Estrogenic PCB IUPAC# 105 (Cooke et al. 2001) [g]Σ of 4 mono-ortho PCBs: IUPAC#s 70, 74, 105, 118 (Goncharov et al. 2009)

From: Schell, Gallo, Dean, et al. EHP, 122:304.

Table 2. Effect of Blood Lead Concentrations of 3 μg per Deciliter as Compared with 1 μg per Deciliter on Measures of Pubertal Development.*

	Non-Hispanic Whites	African Americans	Mexican Americans
8-to-18-year-old girls			
Breast development — odds ratio (95% CI)			
Adjusted for age only	0.82 (0.53–1.27)	0.60 (0.42–0.84)†	0.77 (0.61–0.97)†
Fully adjusted‡	0.82 (0.47–1.42)	0.64 (0.42–0.97)†	0.76 (0.63–0.91)†
Pubic-hair development — odds ratio (95% CI)			
Adjusted for age only	0.64 (0.36–1.13)	0.58 (0.41–0.81)†	0.60 (0.45–0.80)†
Fully adjusted§	0.75 (0.37–1.51)	0.62 (0.41–0.96)†	0.70 (0.54–0.91)†
8-to-16-year-old girls			
Age at menarche — hazard ratio (95% CI)§			
Adjusted for lead only	0.81 (0.61–1.08)	0.79 (0.64–0.99)†	0.91 (0.76–1.10)
Fully adjusted¶	0.74 (0.55–1.002)	0.78 (0.63–0.98)†	0.90 (0.73–1.11)

* Odds ratios reflect the likelihood of reaching a successive stage of pubertal development for girls with a log-transformed lead concentration of 3 μg per deciliter as compared with 1 μg per deciliter. Hazard ratios were calculated with the use of Cox proportional-hazards models. CI denotes confidence interval.

† $P<0.05$.

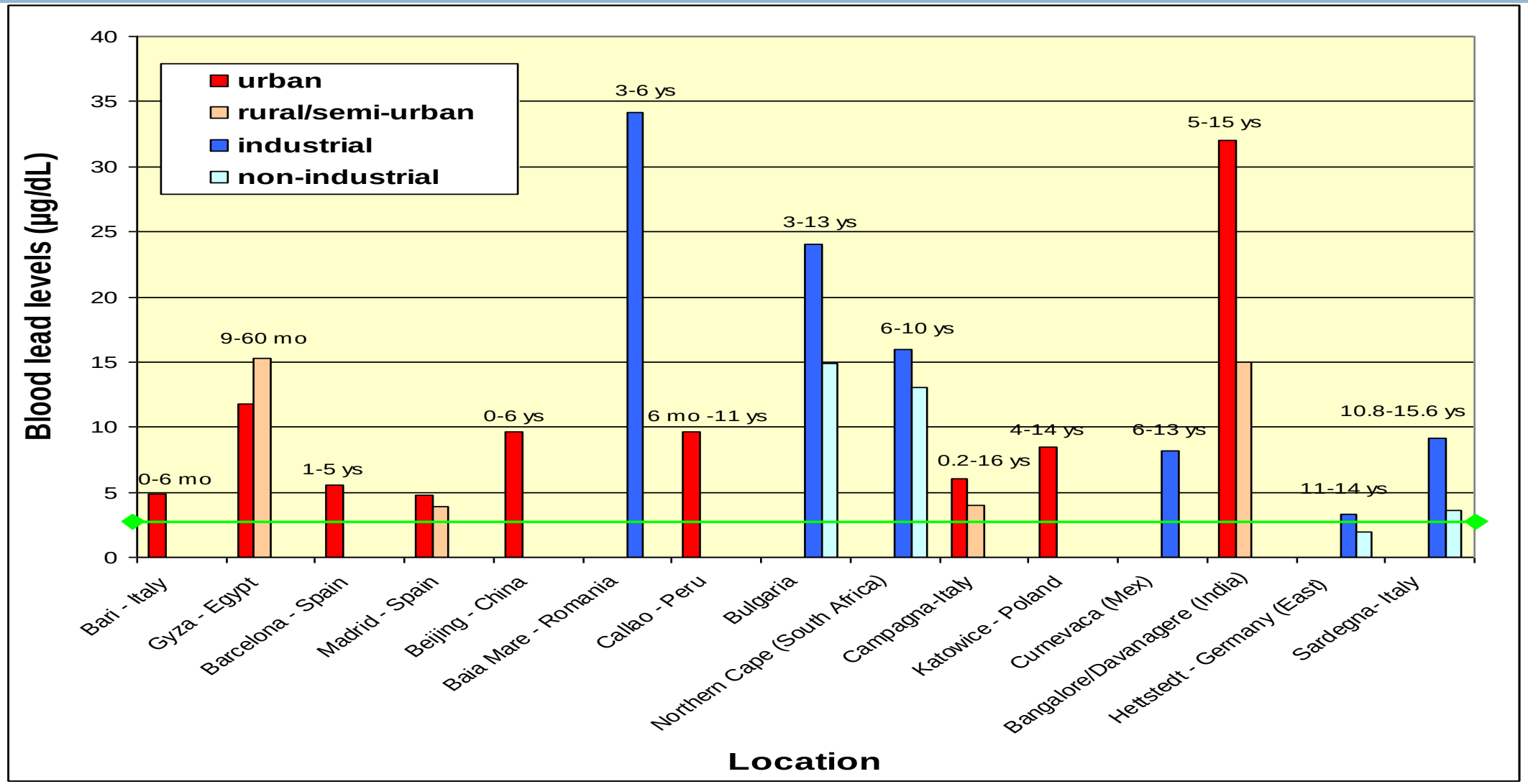
‡ Analyses were adjusted for age, age squared, height, body-mass index, family income (<$20,000 per year vs. $20,000 or more), ever having smoked 100 cigarettes (vs. never having done so), and dietary intake of iron, vitamin C, and calcium.

§ Analyses were adjusted for age, age squared, height, family income (<$20,000 per year vs. $20,000 or more), ever having smoked 100 cigarettes (vs. never having done so), presence or absence of anemia (defined on the basis of age-specific hemoglobin cutoff values[24]), and dietary intake of iron and vitamin C.

¶ Analyses were adjusted for height, body-mass index, family income (<$20,000 per year vs. $20,000 or more), presence or absence of anemia (defined on the basis of age-specific hemoglobin cutoff values[24]), and dietary intake of calcium.

Lead exposure is a common problem worldwide, especially in urban, industrialized areas.

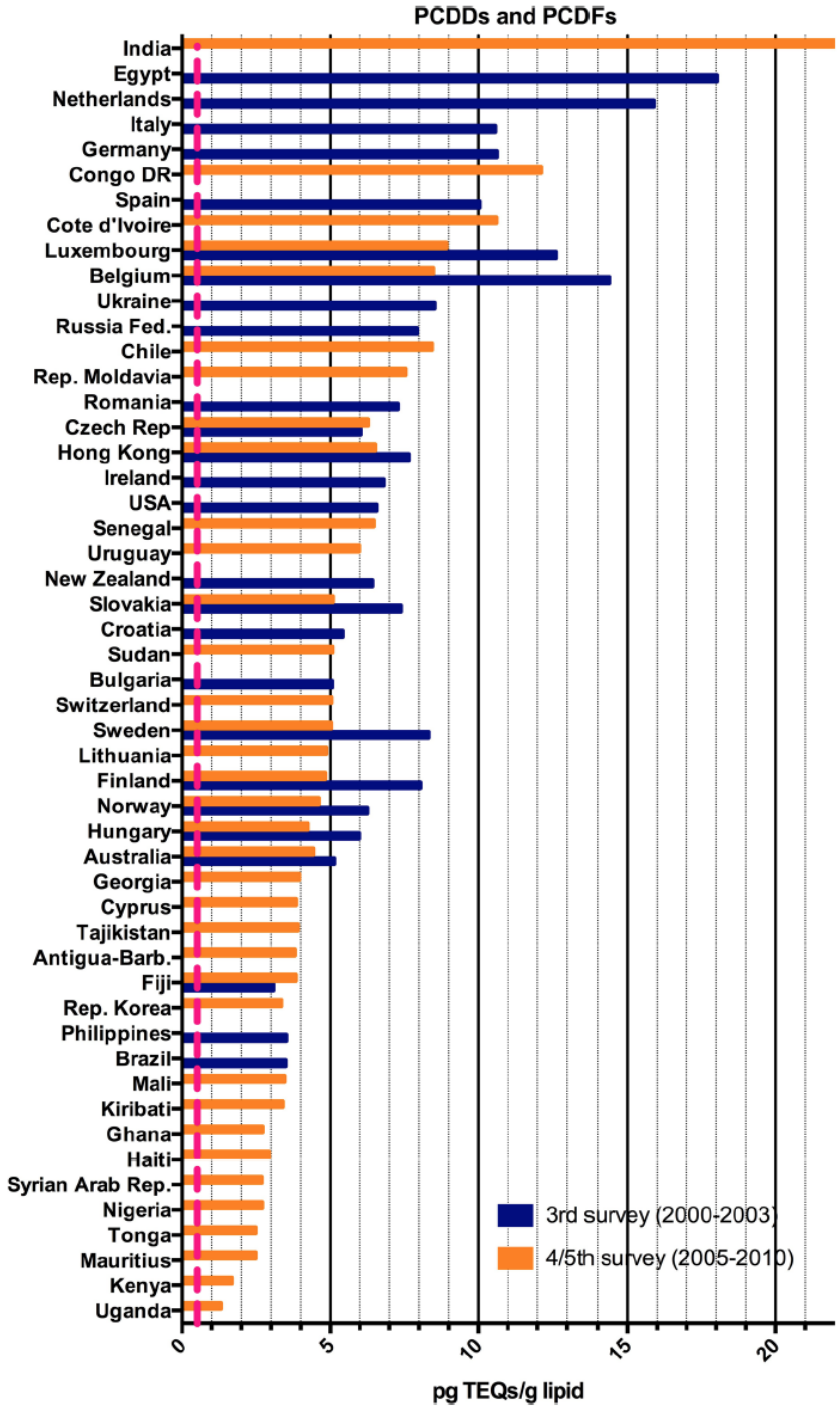
Children's blood lead levels outside the United States

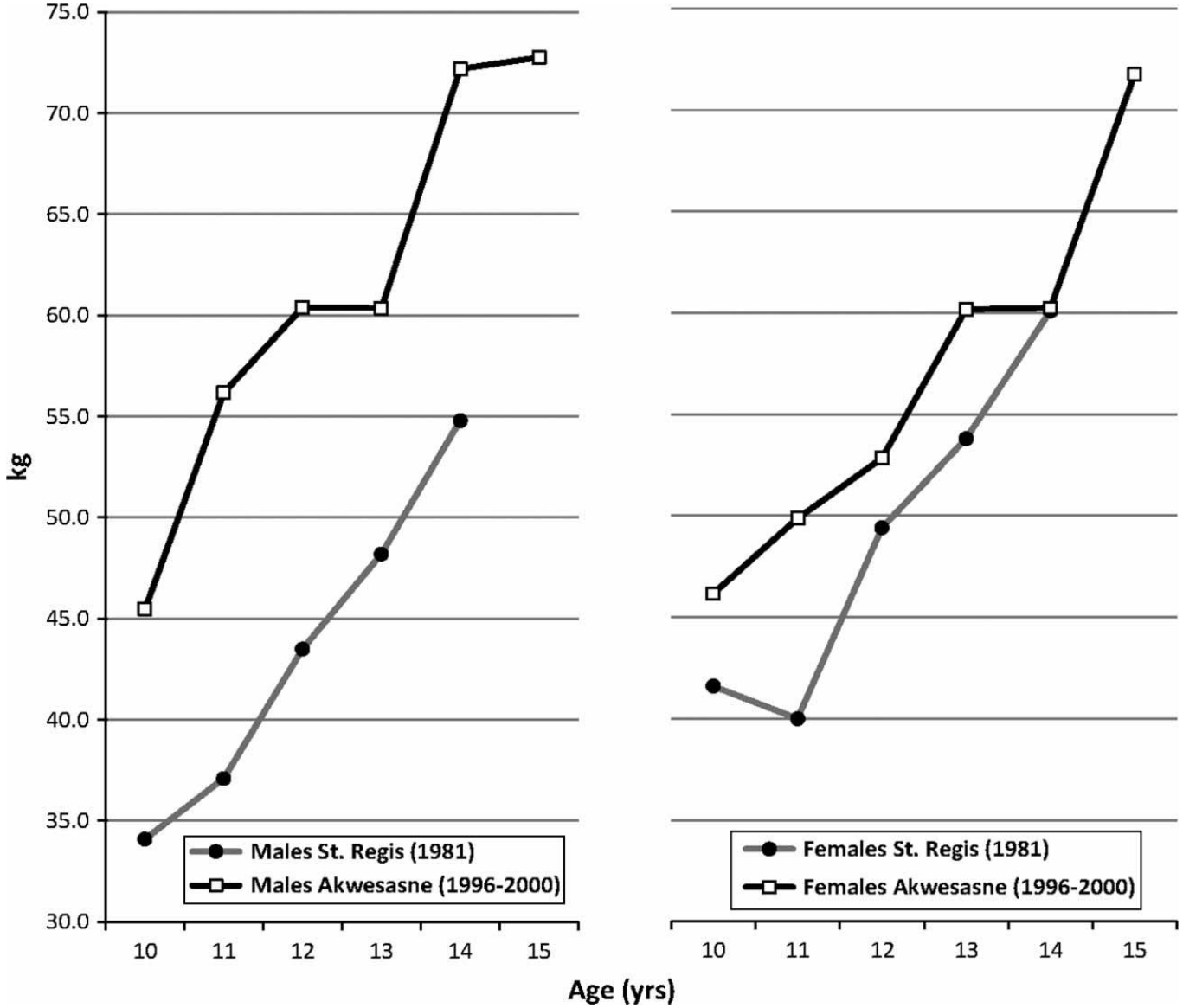


Whose problem is this?

Arch Toxicol (2017) 91:83–96

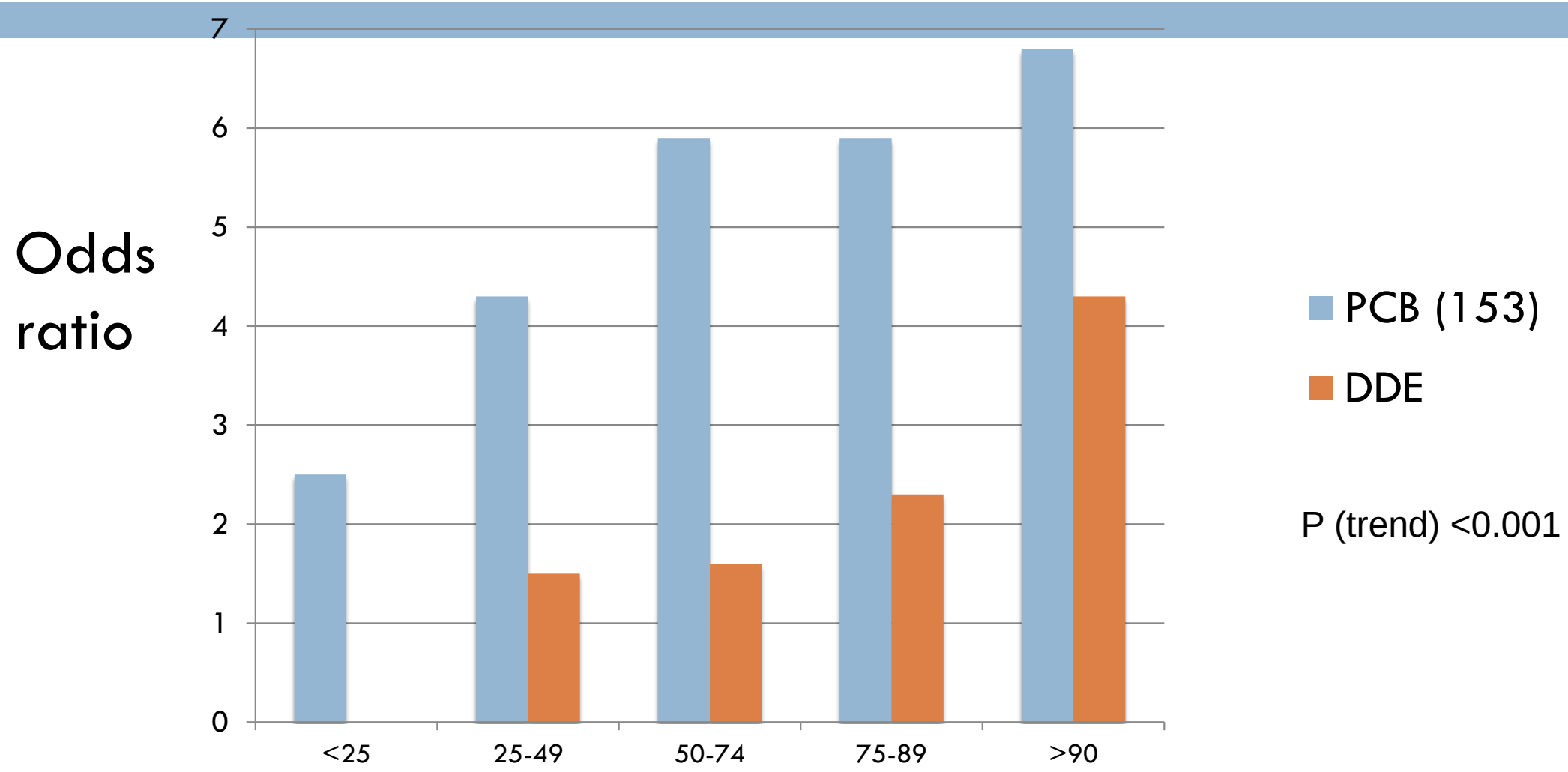
Fig. 3 Results of the WHO/ UNEP surveys for PCDDs and PCDFs in TEQs (pg/g lipid) in pooled human milk samples from different countries. The *dotted red line* represents the calculated safe level of these compounds for the breastfed infant (color figure online)





- Mean weights of Akwesasne adolescent youth, from 1981 to 2000.
- (From Schell et al., AHB: 2012)

Risk of diabetes by percentile group of two toxicants: polychlorinated biphenyls and DDT*, NHANES 1999-2002.



*DDT=dichlorodiphenyltrichloroethane

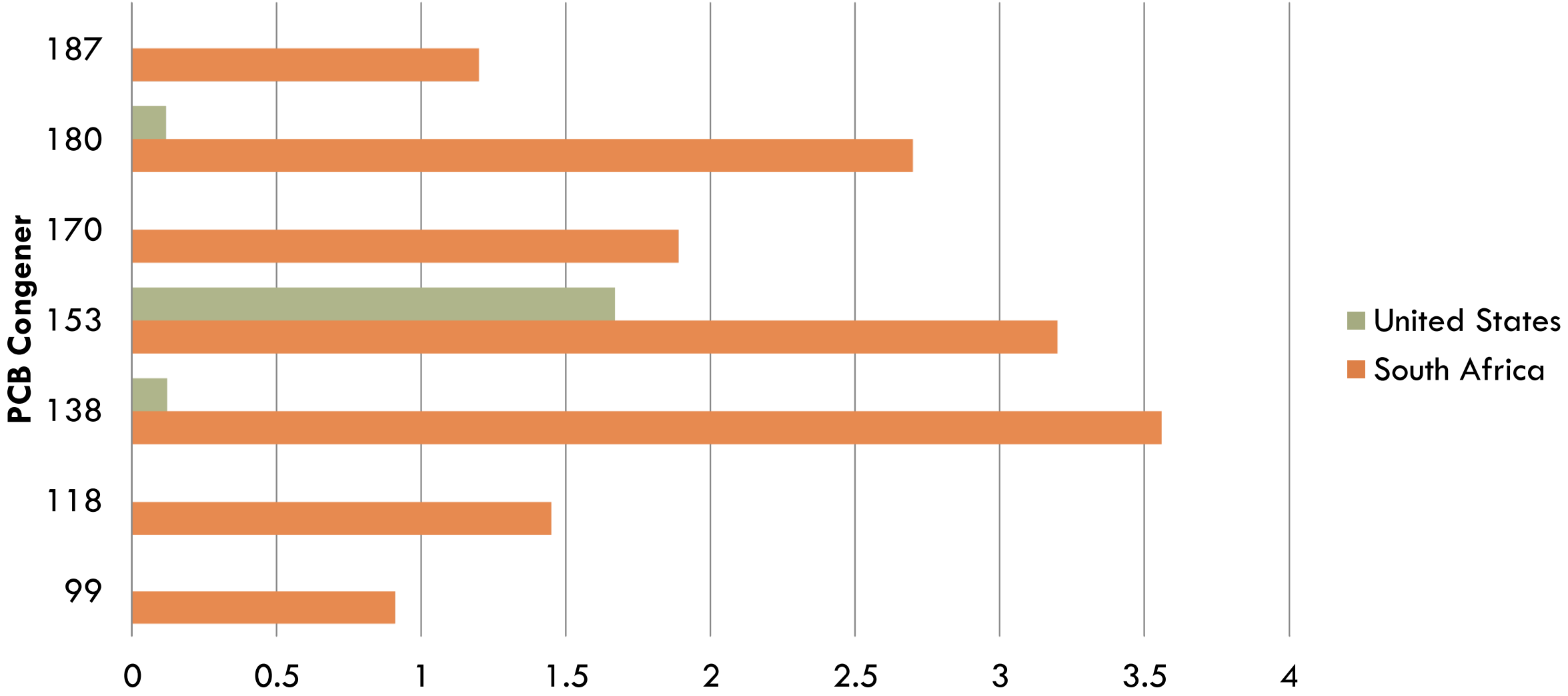
From Lee et al. Diabetes Care 29:1638–1644, 2006

Traditional subsistence

- Farming (Three Sisters: corn, beans, squash)
- Fishing
- Trapping/hunting

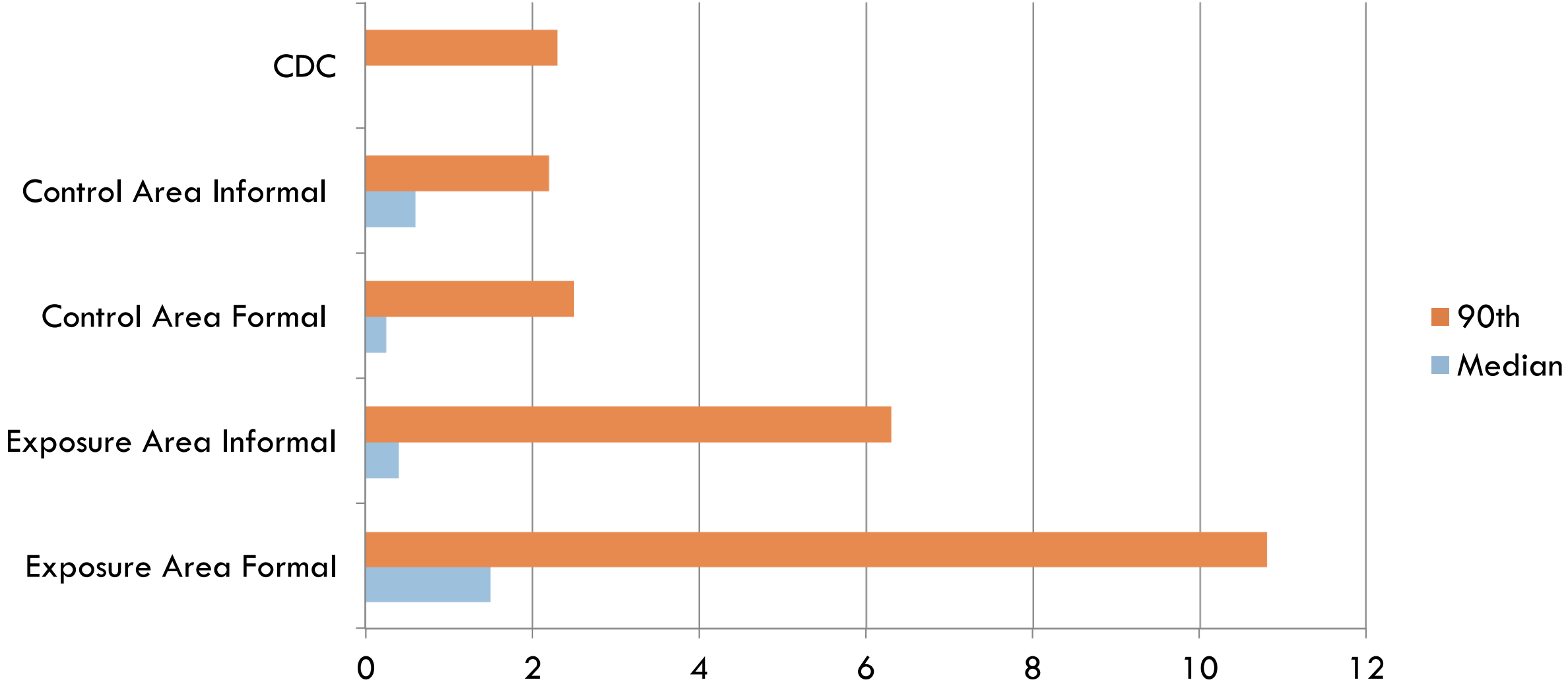
Geometric Means of PCB levels in South Africa and the United States CDC (lipid adjusted)

(Rollin 2009 et al. Science of the Total Environment)



Median and 90% Levels of Urinary Mercury in Cape Town, South Africa and the United States CDC (creatinine adjusted)

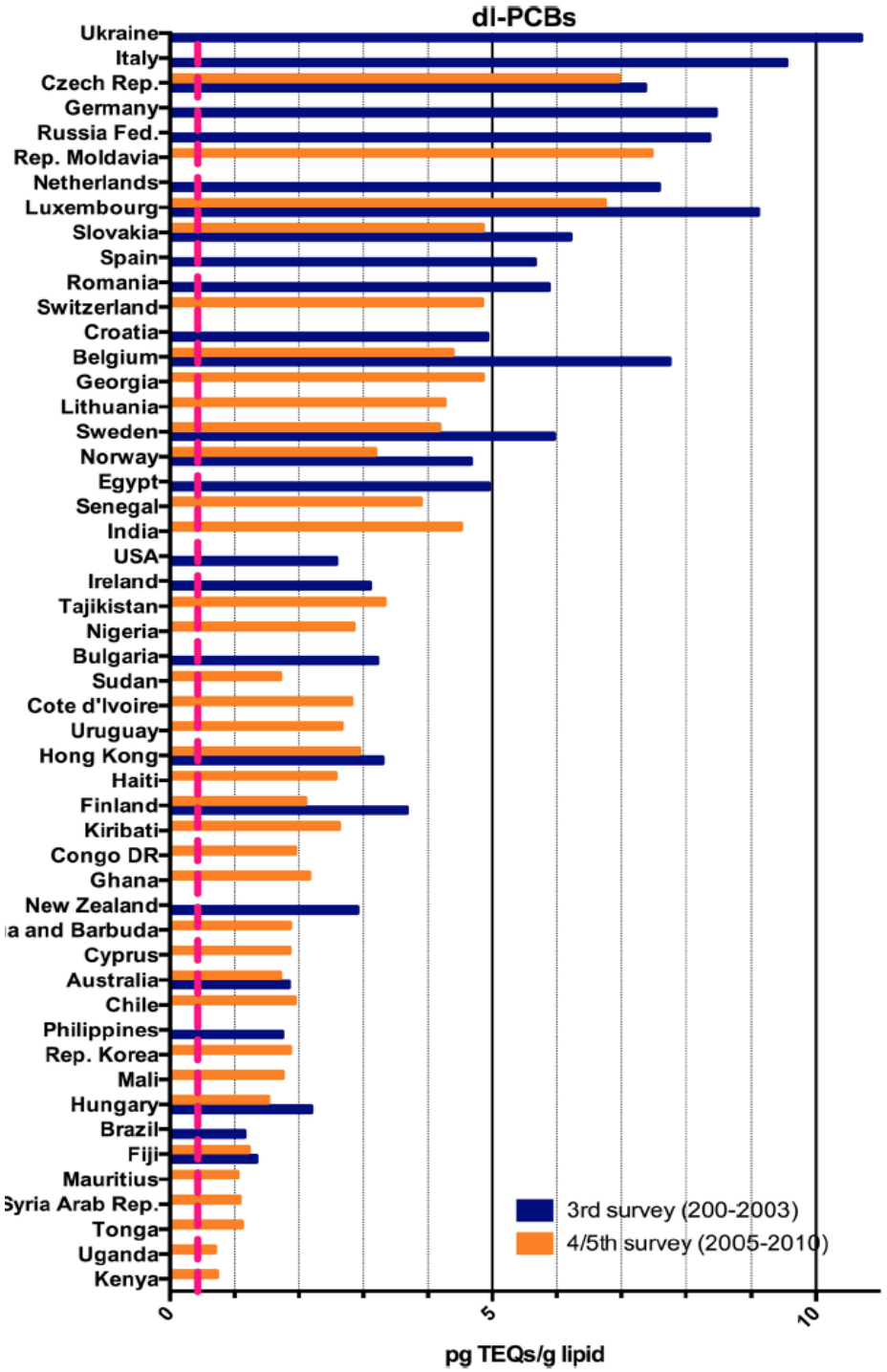
(Dalvie and Ehrlich 2006 *Environment International*)



Results of the WHO/UNEP surveys for DL-PCBs in TEQs (pg/g lipid) in pooled human milk samples

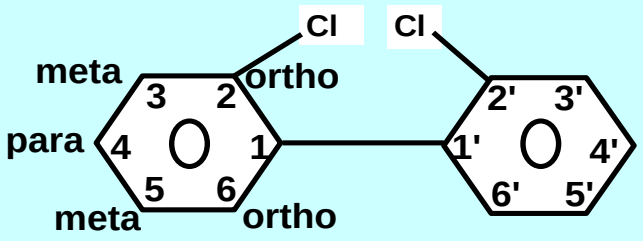
(Arch Toxicol (2017) 91:83–96).

The dotted red line represents the calculated safe level of these compounds for the breast fed infant.



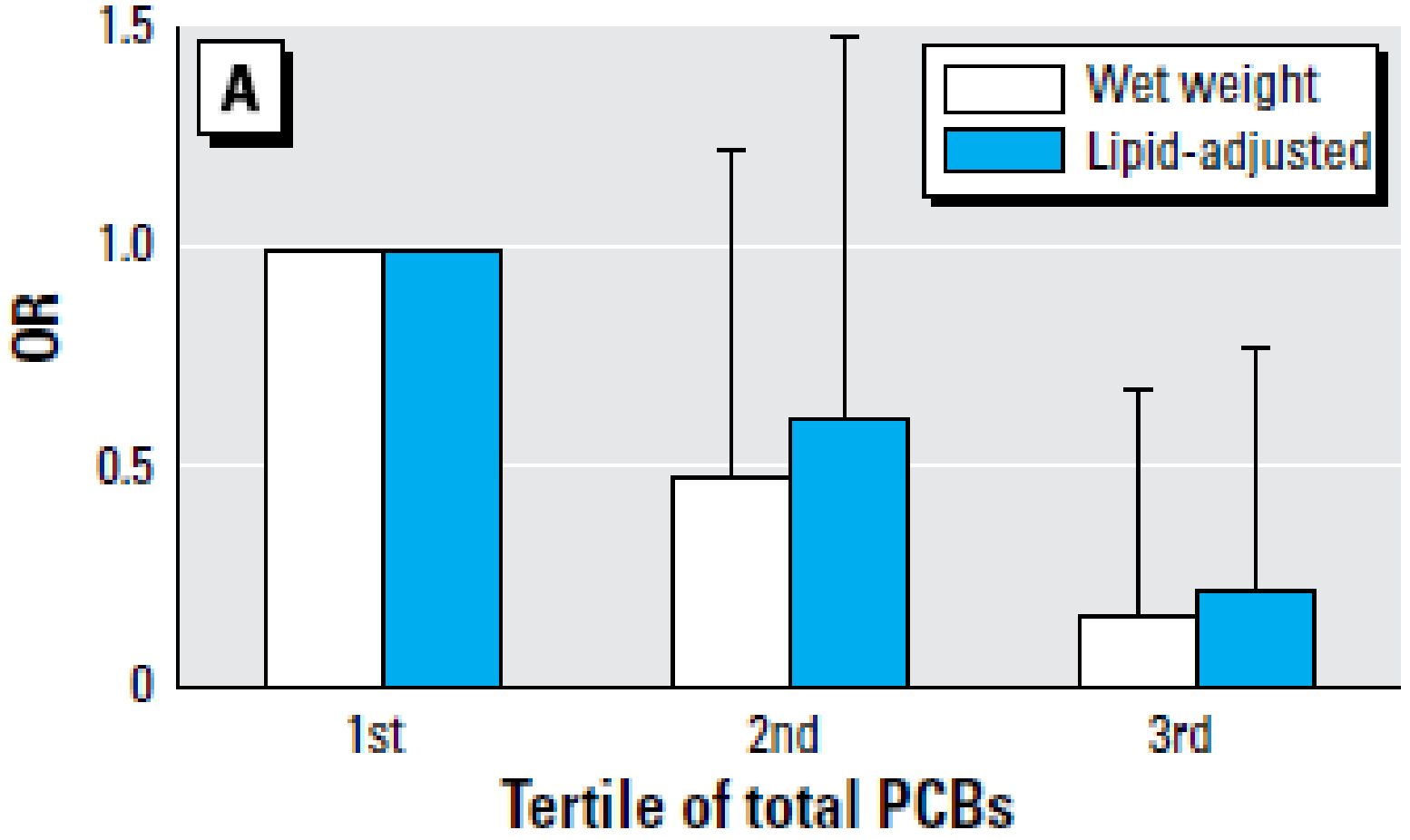
Polychlorinated biphenyls

- 209 possible PCB congeners
- Usually far fewer are present
- Vary by structure:
  - Persistence (length of half-life),
  - Toxicity (Ah receptor and Phenobarbital pathways), estrogenicity, anti-estrogenicity.
- Statistically analyzed as groups of congeners.
  - Persistent group and non- or less- persistent group
  - Most common congeners
  - Estrogenic congeners
  - Other structure based groups



di-ortho-PCB
2,2' - dichlorobipenyl

PCBs Concentrations and Level of Testosterone in 257 Mohawk Men (from Goncharov et al. 2009, EHP 117:1454)



Menarche* and toxicants: n=138, 10-16.99 yrs. of age

(from Denham et al. 2005. Pediatrics 115:e127)

Approximately ***67%*** of 12 year old girls are predicted to have reached menarche when all other model variables are held constant at their respective means.

- BUT at the 75th percentile of PCBs [0.17 ppb]:

Approximately ***82%*** of 12 year old girls are predicted to have reached menarche.

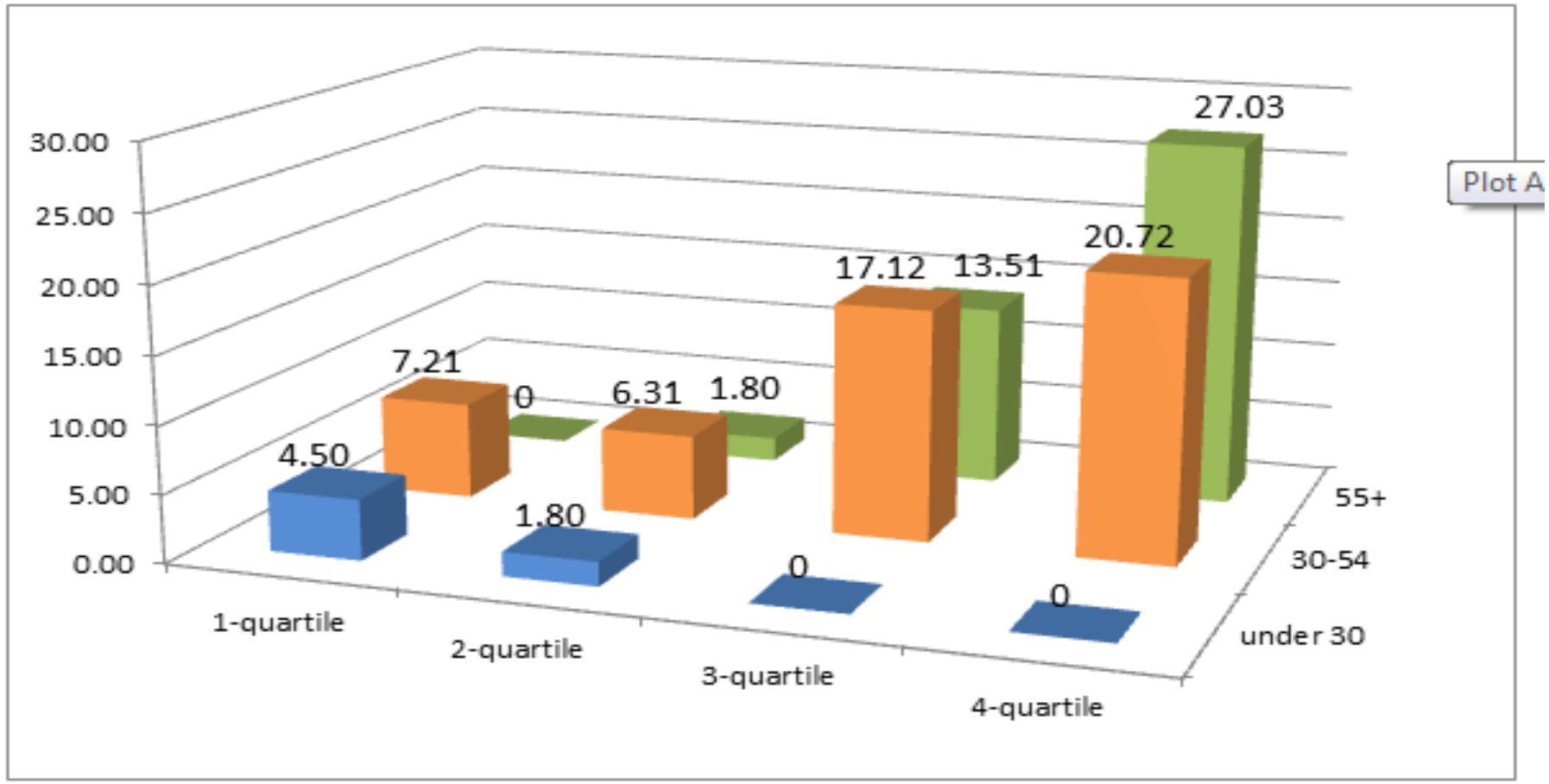
- BUT at the 75th percentile of lead [1.66 µg/dL]:

Only ***9%*** of 12 year old girls are predicted to have reached menarche, compared to ***67%*** at the mean lead level.

* Menarche assessed by status quo method

Prevalence of Diabetes by age and PCB level: Adults.

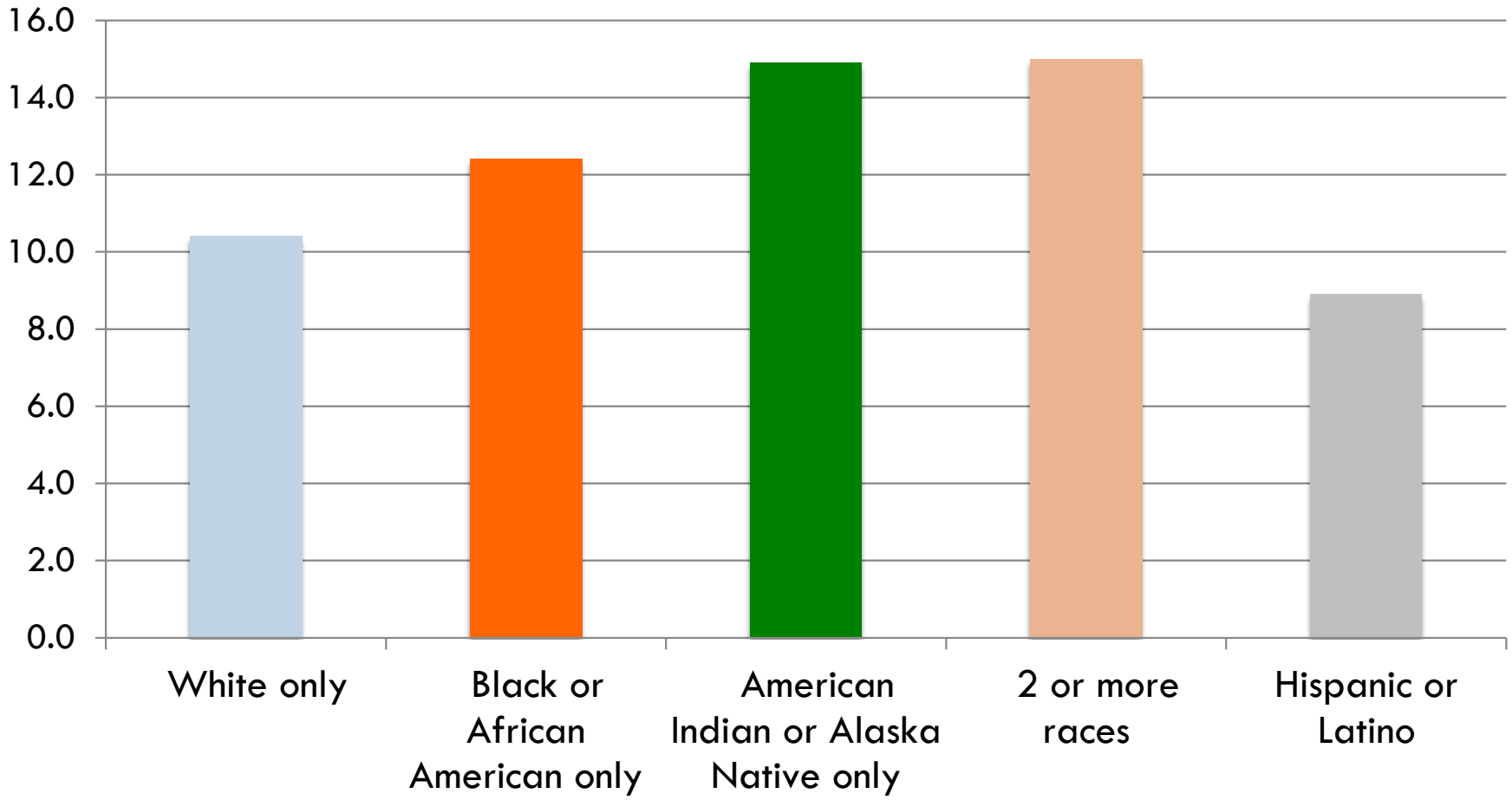
(from Codru et al. 2007, EHP: 115, 1442.



Race/Ethnicity	Prevalence
American Indian/Alaska Natives (non-Hispanic)	21.90%
Multiple Races (non-Hispanic)	20.20%
Blacks (non-Hispanic)	16.70%
Whites (non-Hispanic)	16.60%
Hispanics	10.10%
Asians (non-Hispanic)	7.00%

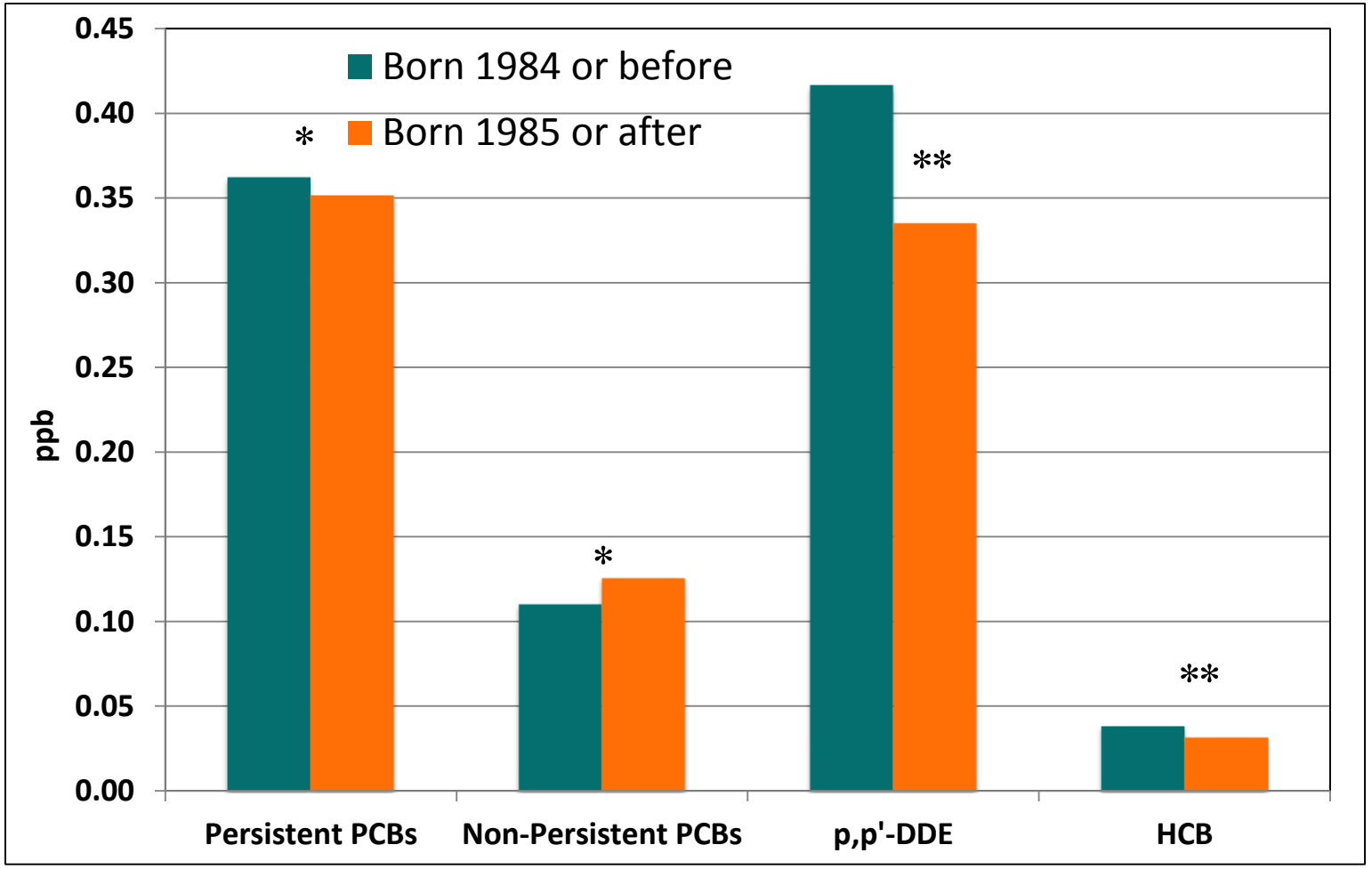
Race/Ethnicity	Prevalence
American Indian/Alaska Natives (non-Hispar	21.90%
Multiple Races (non-Hispanic)	20.20%
Blacks (non-Hispanic)	16.70%
Whites (non-Hispanic)	16.60%
Hispanics	10.10%
Asians (non-Hispanic)	7.00%

Use of any illicit drug: Percent of Population in 2014.



https://www.cdc.gov/nchs/hus/american.htm. **Table 50. Use of selected substances in the past month among persons aged 12 and over, by age, sex, race, and Hispanic origin: United States, selected years 2002-2014**

Avoiding local fish: Comparison of toxicant levels in adolescents by date of fish advisory issuance showing the effect of maternal and childhood diets.



*p<0.05; **p<0.001

Gallo et al. 2011, Chemosphere