

Top Cancers in Indian Country: Regional Patterns and Prevention Opportunities

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Questions

- **What are the leading causes of cancer death in AI/AN?**
- **How do trends in cancer death rates over time compare between AI/AN populations and non-Hispanic whites?**
- **Concept of Mortality to Incidence Ratio (MIR) as a proxy for survival**
- **What are the opportunities for cancer prevention and control?**

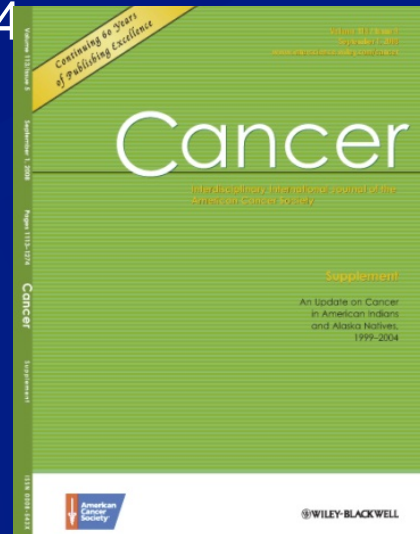
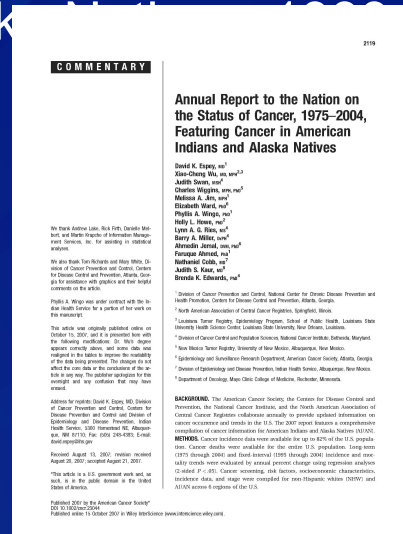
Summary of Previous of AI/AN Linkages

Study	Incidence (# cases) before match	Incidence (# cases) after match	Change
Washington (1992-93)	153.5	267.5	74%
Minnesota (1988-93)	245.2	390.25	59%
California (1988-92)	89.6	211.0	135.5%
Puget Sound (1974-89)	(137)	(233)	70%

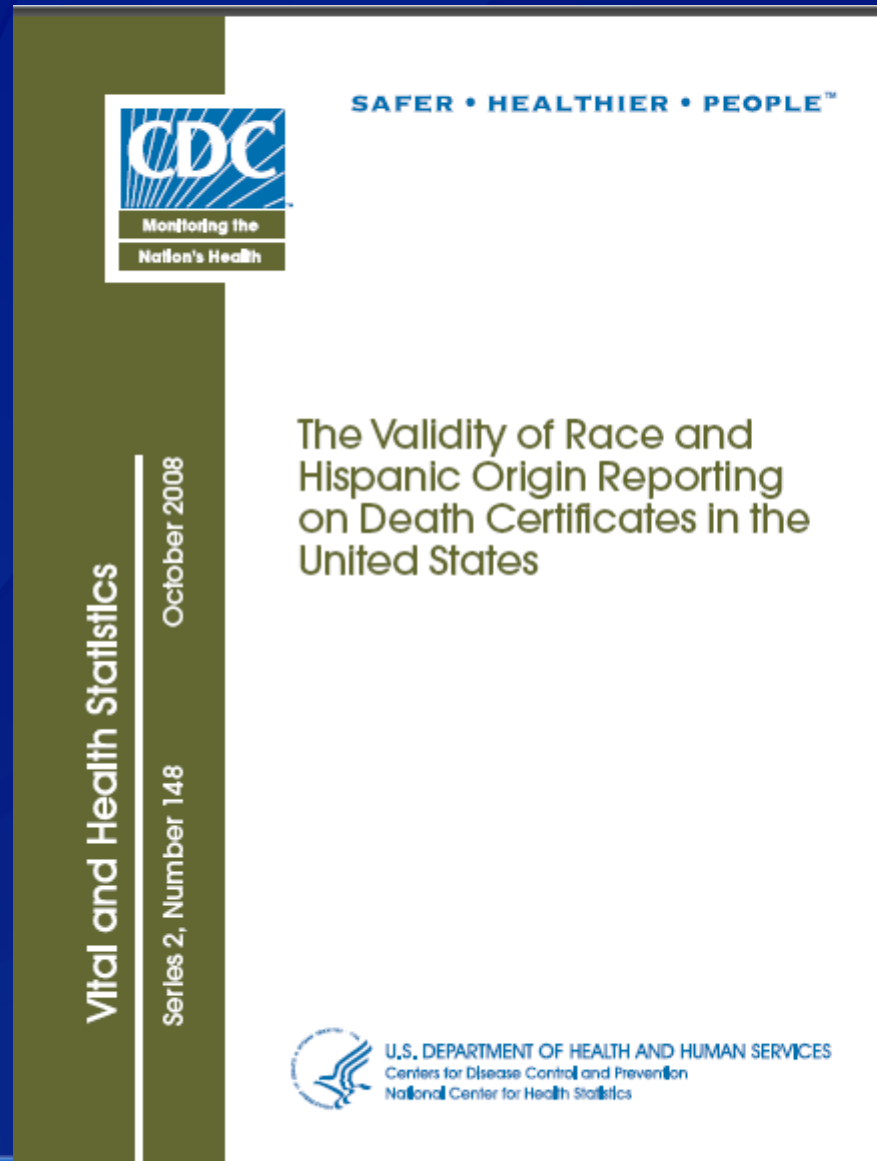
Previous IHS Linkage with Cancer Registry Data

■ Use of improved data to report cancer burden of AI/AN

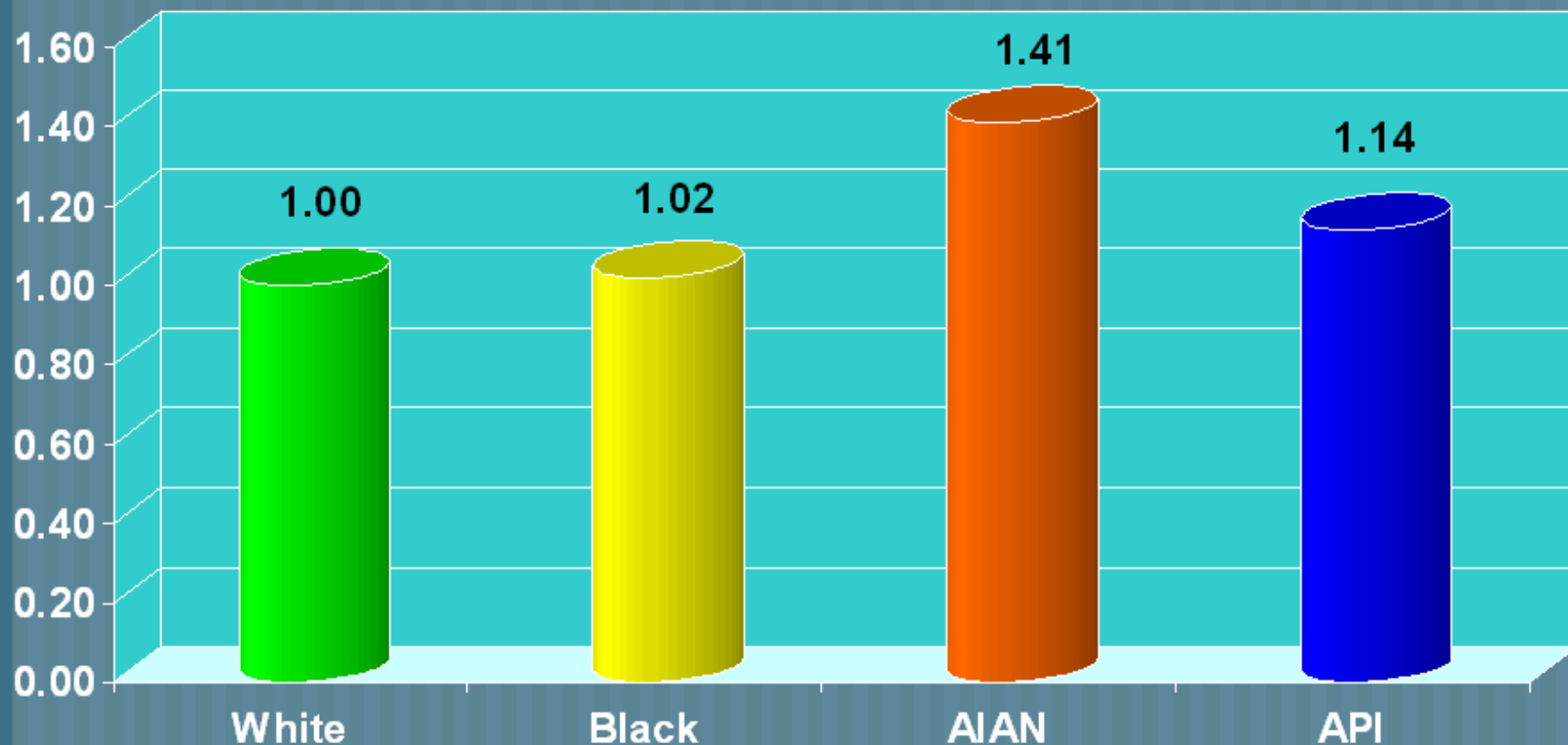
- Annual Report to the Nation on the Status of Cancer , 1975-2004, Featuring Cancer in American Indians and Alaska Natives
- Cancer Supplement: An Update on Cancer in American Indians and Alaska Natives, 1999-2004



National Longitudinal Mortality Survey



Ratios for Race Categories



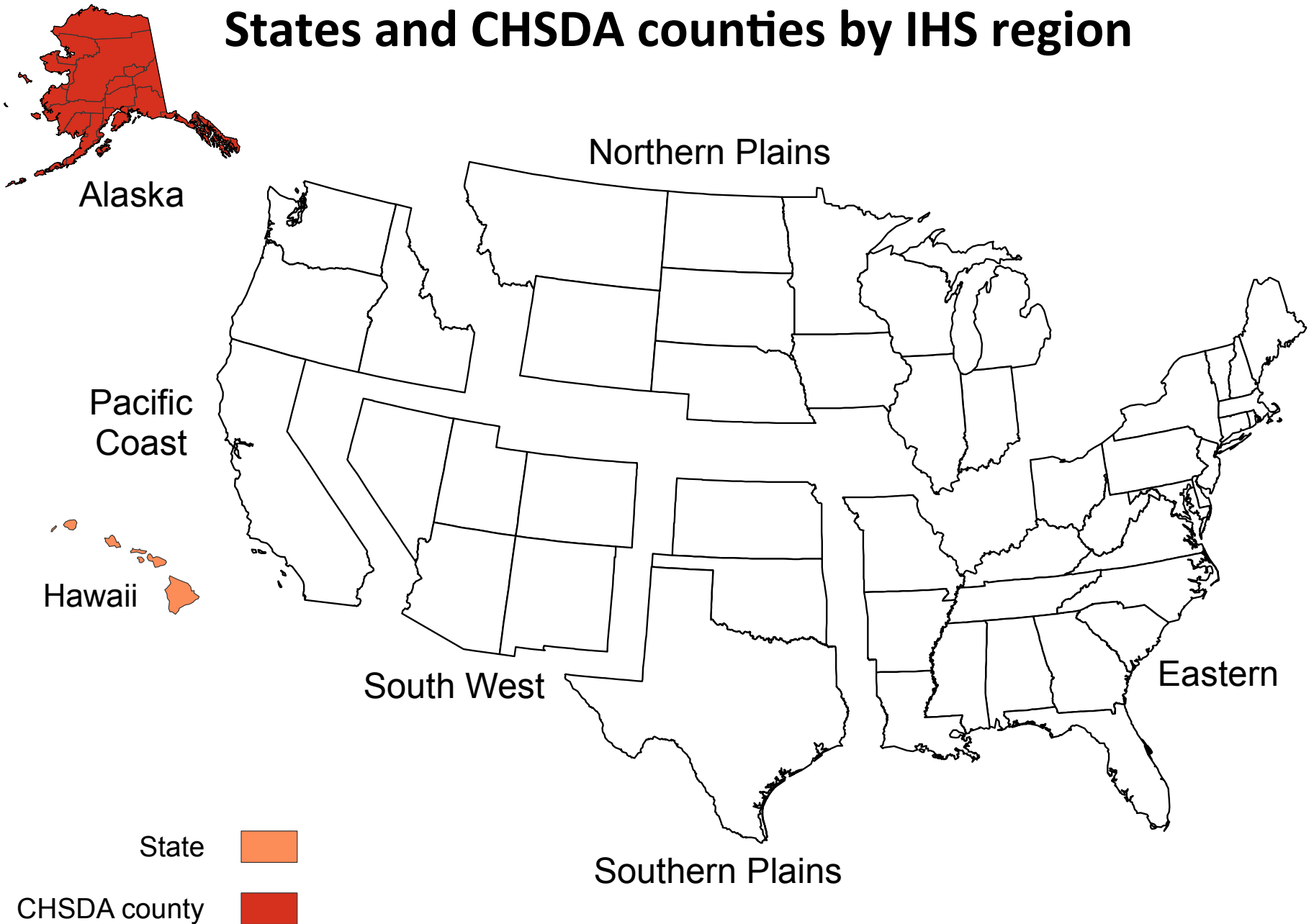
Mortality Records

- ❑ Records from the National Death Index (NDI) were linked with the Indian Health Service (IHS)**
 - NDI is the central index of death record information on file in state vital statistics offices
 - Established as a resource to aid investigators with mortality ascertainment activities
- ❑ AI/AN deaths misclassified as non-AI/AN, additional indicator of AI/AN ancestry added to mortality file**
- ❑ All analyses limited to non-Hispanic AI/AN (because of difficulties in obtaining accurate population estimates)**

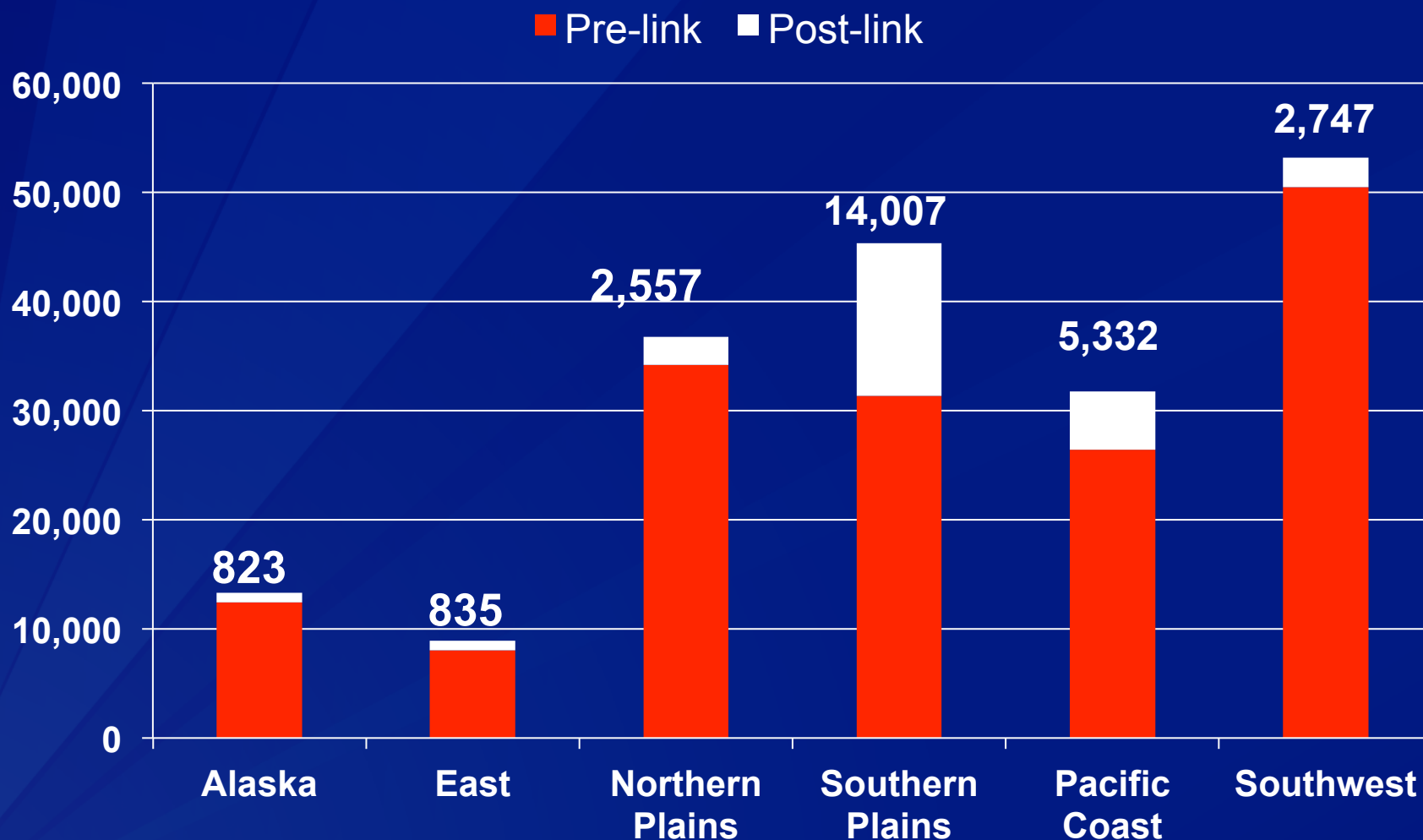
Geographic coverage

- ❑ **Analyses restricted to “Contract Health Service Delivery Area” (CHSDA) counties**
 - contain federally recognized tribal lands or
 - adjacent to tribal lands
- ❑ **More accurate race classification for AI/AN in CHSDA counties**
- ❑ **64% of the U.S. AI/AN population resides in the 637 CHSDA counties**

States and CHSDA counties by IHS region



Number of individuals identified by IHS linkage with NDI, CHSDA counties, 1990-2008



Statistical methods

- ❑ All rates directly age adjusted**
 - SEER*State software version 8.0.2
 - 2000 U.S. standard population
 - 11 age groups
- ❑ Standardized rate ratios (RR) used non-Hispanic white rates for comparison**
- ❑ Long-term cancer death trends described using joinpoint analysis including annual percent change (APC) statistic for each interval**

SUPPLEMENT TO

American Journal of
**PUBLIC
HEALTH**

A PUBLICATION OF
AMERICAN PUBLIC HEALTH ASSOCIATION

Geographic Variation in Colorectal Cancer Incidence and Mortality | Perspectives on Mortality Data From the Indian Health Service | Racial Misclassification of American Indians

and Alaska Natives | **AMERICAN INDIAN AND ALASKA NATIVE MORTALITY** |

Disparities in Cancer Mortality and Incidence Among AI/AN People | American Indian Health Policy | The Alcohol-Attributable Death Rate Disparity Between American Indians and Alaska Natives and Non-Hispanic Whites | What Are the Causes of Suicide Among Young Alaska Native Men?



Top 10 Leading Causes of Death for AI/AN men compared with White men: CHSDA, US, 1999-2009

Cause of Death	AI/AN Rank (White)	AI/AN Rate (White)	AI/AN:White RR
All causes	...	1381.8 (948.8)	1.46*
Heart disease	1 (1)	320.9 (262.5)	1.22*
Cancer	2 (2)	248.4 (224.7)	1.11*
Unintentional injury	3 (4)	141.3 (55.6)	2.54*
Diabetes	4 (6)	75.5 (23.6)	3.19*
Chronic liver disease	5 (11)	50.0 (12.9)	3.88*
Suicide	6 (7)	34.7 (23.2)	1.49*
CLRD	7 (3)	61.4 (56.4)	1.09*
Stroke	8 (5)	59.3 (49.6)	1.20*
Homicide	9 (21)	18.5 (3.8)	4.85*
Flu and Pneumonia	10 (8)	42.7 (22.4)	1.90*

* Statistically significant

Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, Plescia M. Leading Causes of Death and All-Cause Mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014;104:S303-S311.

Top 10 Leading Causes of Death for AI/AN women compared with White women: CHSDA, US, 1999-2009

Cause of Death	AI/AN Rank (White)	AI/AN Rate (White)	AI/AN:White RR
All causes	...	991.5 (678.6)	1.46*
Cancer	1 (2)	185.8 (159.1)	1.17*
Heart disease	2 (1)	204.8 (167.2)	1.22*
Unintentional injury	3 (6)	65.6 (27.0)	2.43*
Diabetes	4 (8)	69.2 (17.1)	4.04*
Stroke	5 (3)	58.9 (49.3)	1.20*
Chronic liver disease	6 (12)	34.6 (6.4)	5.36*
CLRD	7 (4)	45.4 (43.9)	1.03
Flu and pneumonia	8 (7)	31.7 (17.2)	1.84*
Kidney disease	9 (9)	25.0 (9.2)	2.72*
Septicemia	10 (10)	18.6 (7.8)	2.38*

* Statistically significant

Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, Plescia M. Leading Causes of Death and All-Cause Mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014;104:S303-S311.

Top 10 Leading Causes of Death for AI/AN men compared with White men: CHSDA, US, 1999-2009

#	Northern Plains	Alaska	Southern Plains	Southwest	Pacific Coast	East
.	All causes 1.89*	All causes 1.67*	All causes 1.42*	All causes 1.35*	All causes 1.33*	All causes 0.98
1	Heart disease (1) 1.58*	Cancer (1) 1.44*	Heart disease (1) 1.33*	UI (4) 2.83*	Heart disease (1) 1.23*	Heart disease (1) 0.90*
2	Cancer (2) 1.51*	UI (3) 2.52*	Cancer (2) 1.31*	Heart disease (1) 0.94*	Cancer (2) 1.05	Cancer (2) 0.83*
3	UI (4) 3.10*	Heart disease (2) 1.29*	UI (4) 1.73*	Cancer (2) 0.79*	UI (4) 2.03*	UI (4) 1.39*
4	Diabetes (6) 4.18*	Suicide (4) 2.34*	Diabetes (6) 3.01*	CLD (10) 4.74*	CLD (10) 3.33*	Diabetes (6) 2.67*
5	CLD (11) 6.64*	CLRD (5) 1.55*	CLD (3) 1.13*	Diabetes (8) 3.91*	CLRD (3) 1.29*	Stroke (5) 1.13
6	Suicide (7) 1.98*	Stroke (6) 1.57*	Suicide (5) 1.25*	Suicide (6) 1.08*	Diabetes (6) 2.43*	CLD (11) 2.38*
7	CLRD (3) 1.71*	Homicide (10) 3.44*	CLRD (11) 2.87*	Homicide (18) 4.51*	Stroke (5) 1.14*	CLRD (3) 0.69*
8	Stroke (5) 1.30*	Flu/Pneumo (11) 3.10*	Stroke (8) 1.25*	Flu/Pneumo (7) 2.41*	Suicide (8) 1.19*	Kidney disease (9) 1.27
9	Homicide (21) 9.79*	Diabetes (7) 1.07	Homicide (7) 1.42*	Stroke (5) 1.06	Homicide (21) 3.72*	Suicide (8) 0.69*
10	Flu/Pneumo (8) 2.19*	CLD (8) 1.28	Kidney disease (10) 1.93*	Kidney disease (11) 2.01*	Flu/Pneumo (9) 1.26*	Flu/Pneumo 1.09

* Statistically significant

Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, Plescia M. Leading Causes of Death and All-Cause Mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014;104:S303-S311.

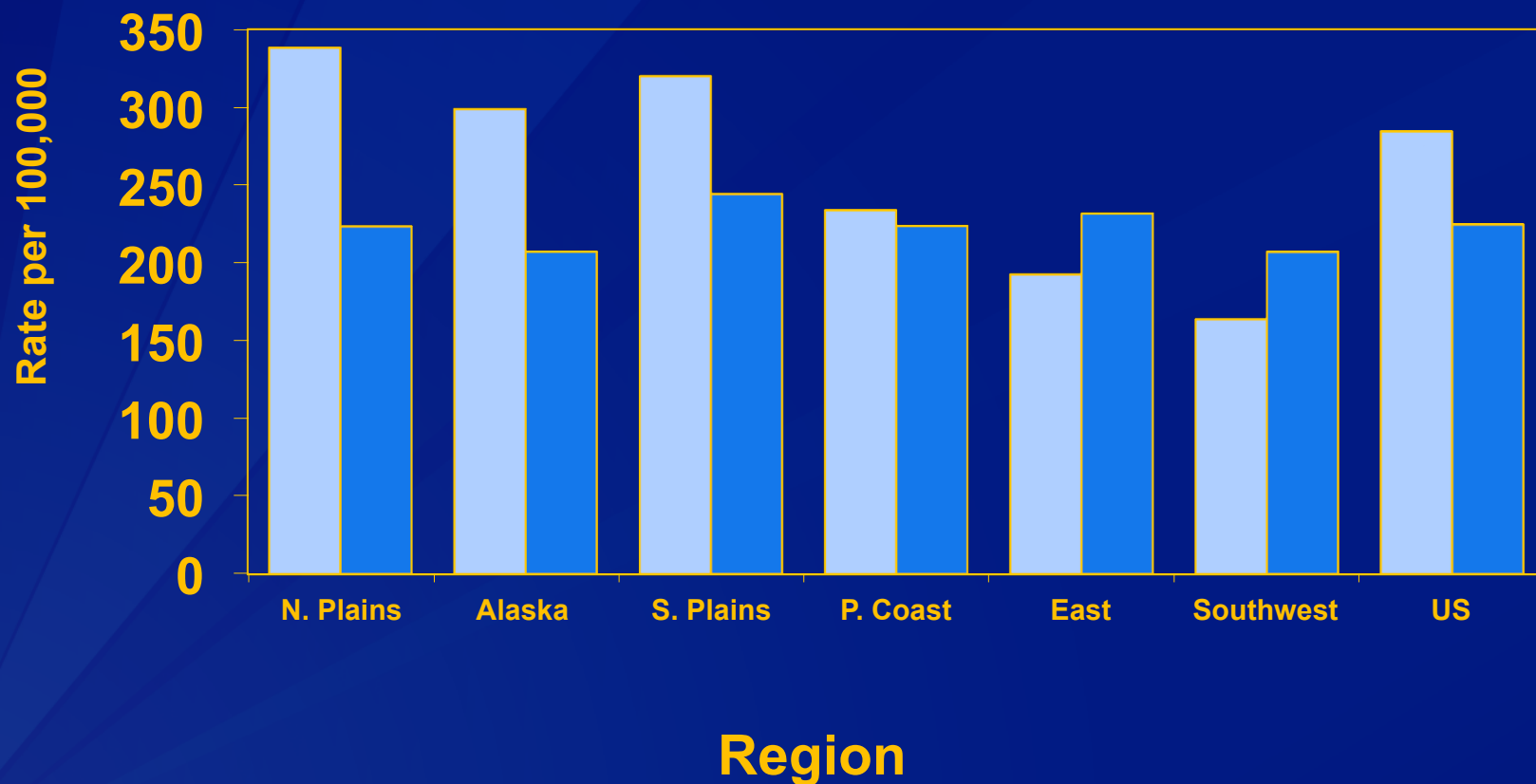
Top 10 Leading Causes of Death for AI/AN women compared with White women: CHSDA, US, 1999-2009

#	Northern Plains	Alaska	Southern Plains	Southwest	Pacific Coast	East
.	All causes 1.92*	All causes 1.66*	All causes 1.41*	All causes 1.24*	All causes 1.33*	All causes 1.10*
1	Cancer (2) 1.60*	Cancer (1) 1.50*	Heart disease (1) 1.27*	Cancer (2) 0.84*	Cancer (1) 1.23*	Heart disease (1) 1.06
2	Heart disease (1) 1.59*	Heart disease (2) 1.35*	Cancer (2) 1.36*	Heart disease (1) 0.88*	Heart disease (2) 1.05	Cancer (2) 0.88*
3	UI (6) 3.14*	UI (5) 2.62*	UI (6) 1.78*	UI (6) 2.11*	UI (4) 2.03*	Diabetes (8) 3.77*
4	Diabetes (7) 5.11*	Stroke (3) 1.47*	Diabetes (8) 3.40*	Diabetes (8) 5.19*	Stroke (10) 3.33*	UI (6) 1.58*
5	CLD (13) 10.20*	CLRD (4) 1.58*	Stroke (3) 1.22*	CLD (12) 5.75*	CLRD (3) 1.29*	Stroke (3) 1.08
6	CLRD (4) 1.92*	CLD (10) 4.36*	CLRD (4) 1.02	Flu/Pneumo (7) 2.38*	Diabetes (6) 2.43*	CLRD (4) 0.81*
7	Stroke (3) 1.31*	Suicide (8) 2.88*	Kidney disease (9) 2.35*	Stroke (4) 0.86*	Flu/Pneumo (5) 1.14*	CLD (13) 3.55*
8	Kidney disease (9) 3.37*	Flu/Pneumo (9) 2.66*	CLD (14) 3.51*	Kidney disease (9) 3.23*	CLD (8) 1.19*	Septicemia (10) 1.68*
9	Flu/Pneumo (8) 1.92*	Diabetes (7) 0.92	Flu/Pneumo (7) 1.27*	Septicemia (10) 2.57	Kidney disease (21) 3.72*	Kidney disease (9) 1.62*
10	Suicide (18) 2.62*		Septicemia (10) 2.03*	CLRD (3) 0.36*	Septicemia (9) 1.26*	Flu/Pneumo (7) 1.01

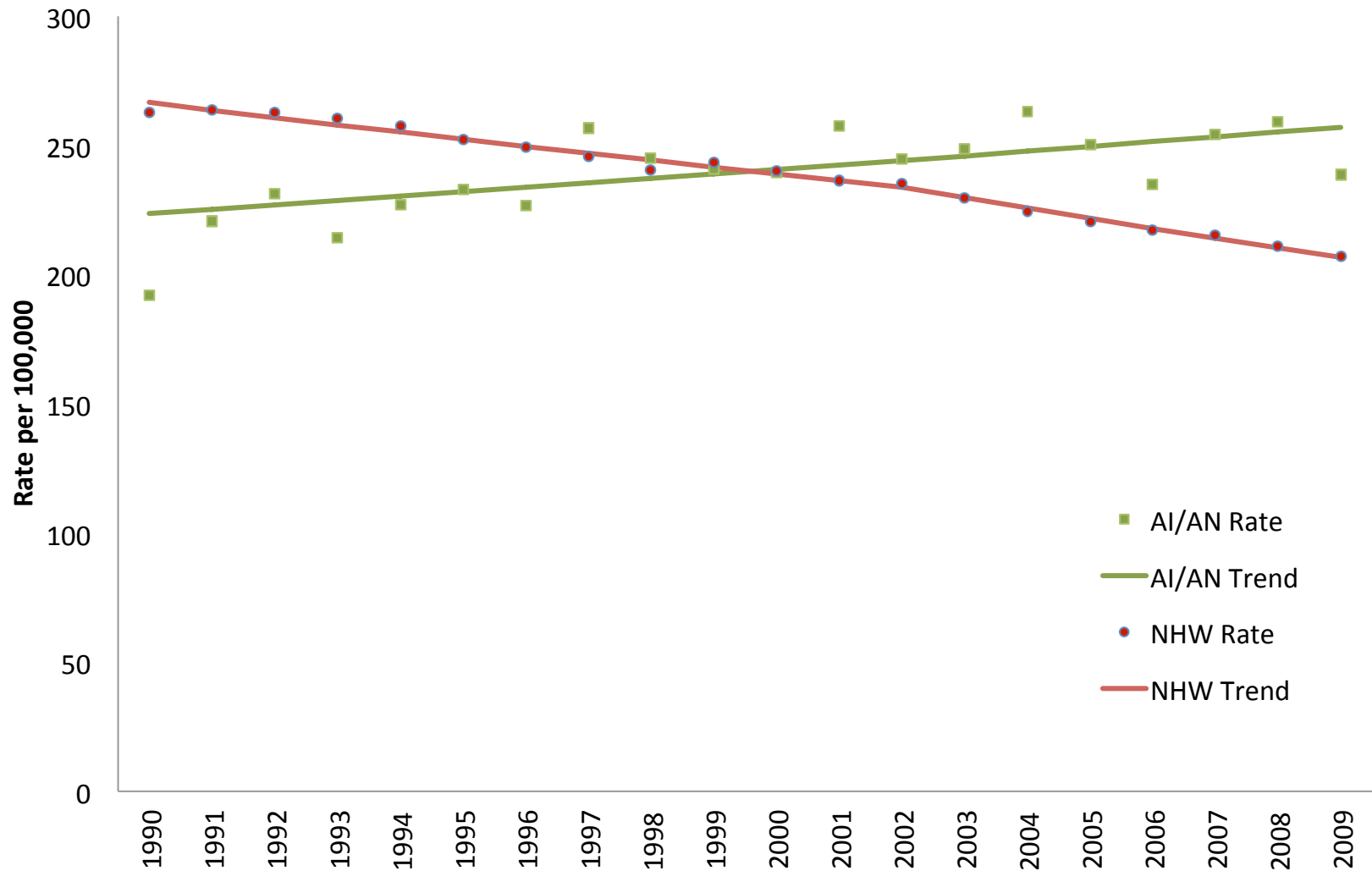
* S Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, Prescia M. Leading Causes of Death and All-Cause Mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014;104:S303-S311.

AI/AN and NHW death rates, all malignant cancers combined, by region, males, 1999-2009

■ AI/AN ■ NHW

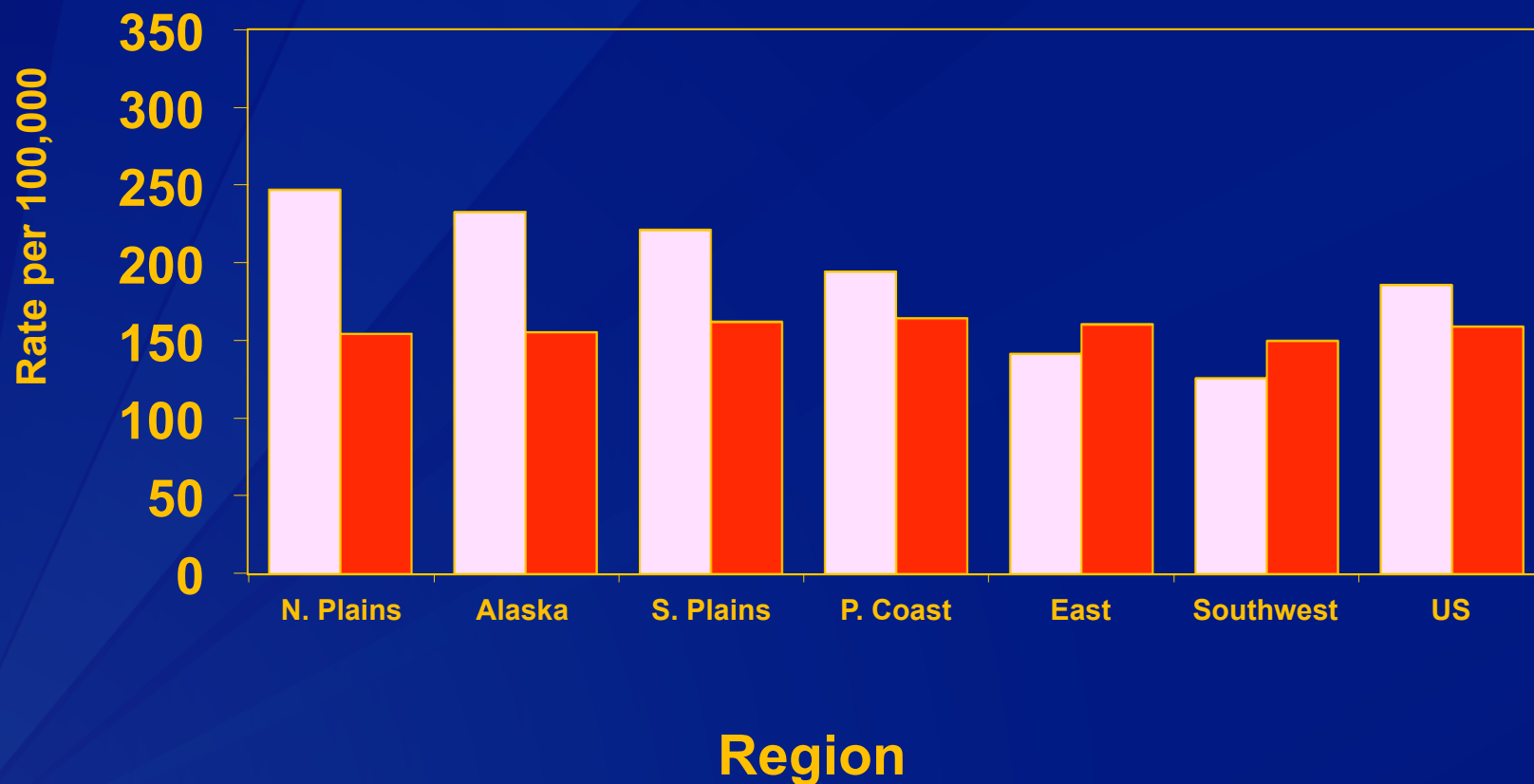


Age-adjusted All Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Males

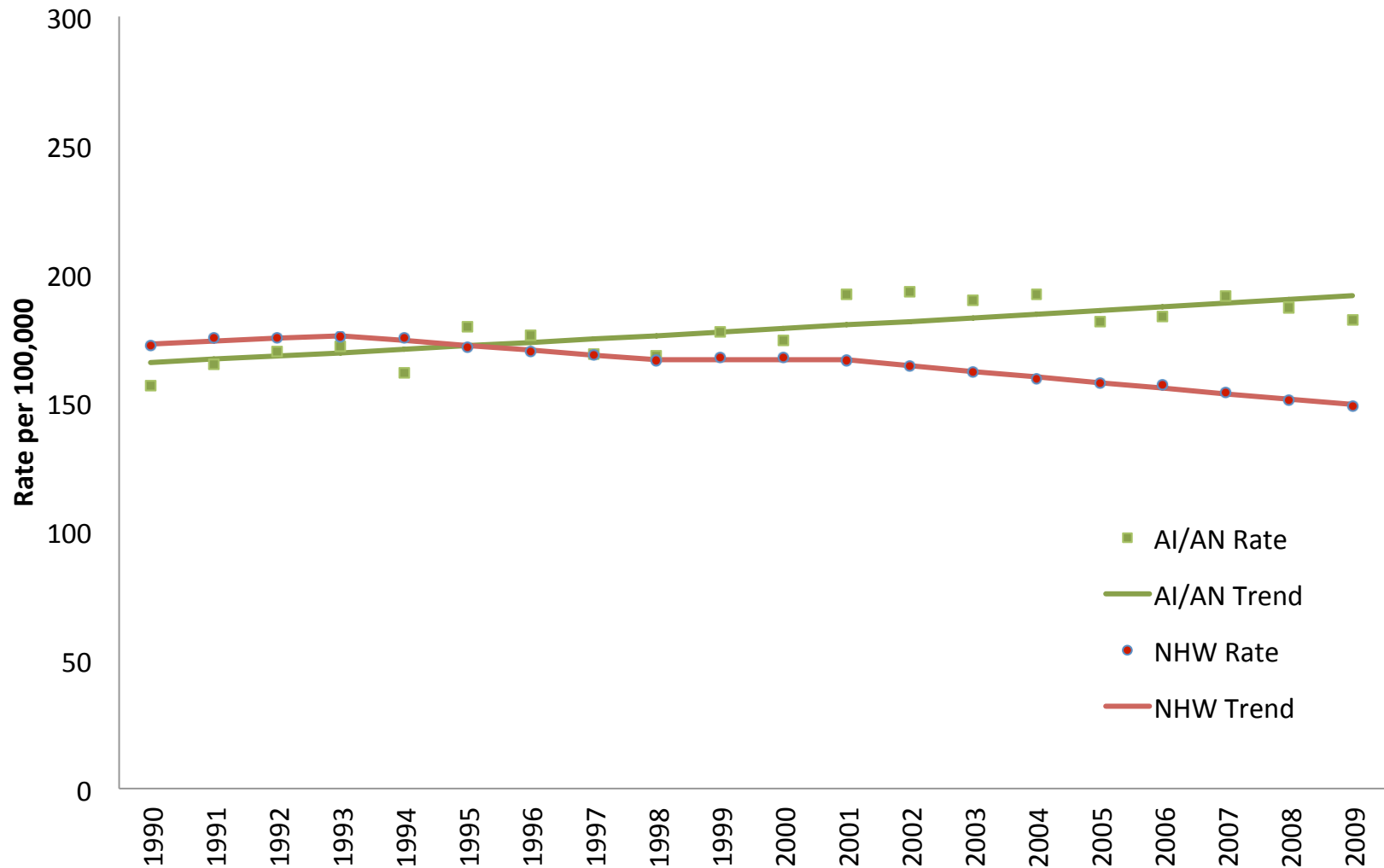


AI/AN and NHW death rates, all malignant cancers combined, by region, females, 1999-2009

■ AI/AN ■ NHW

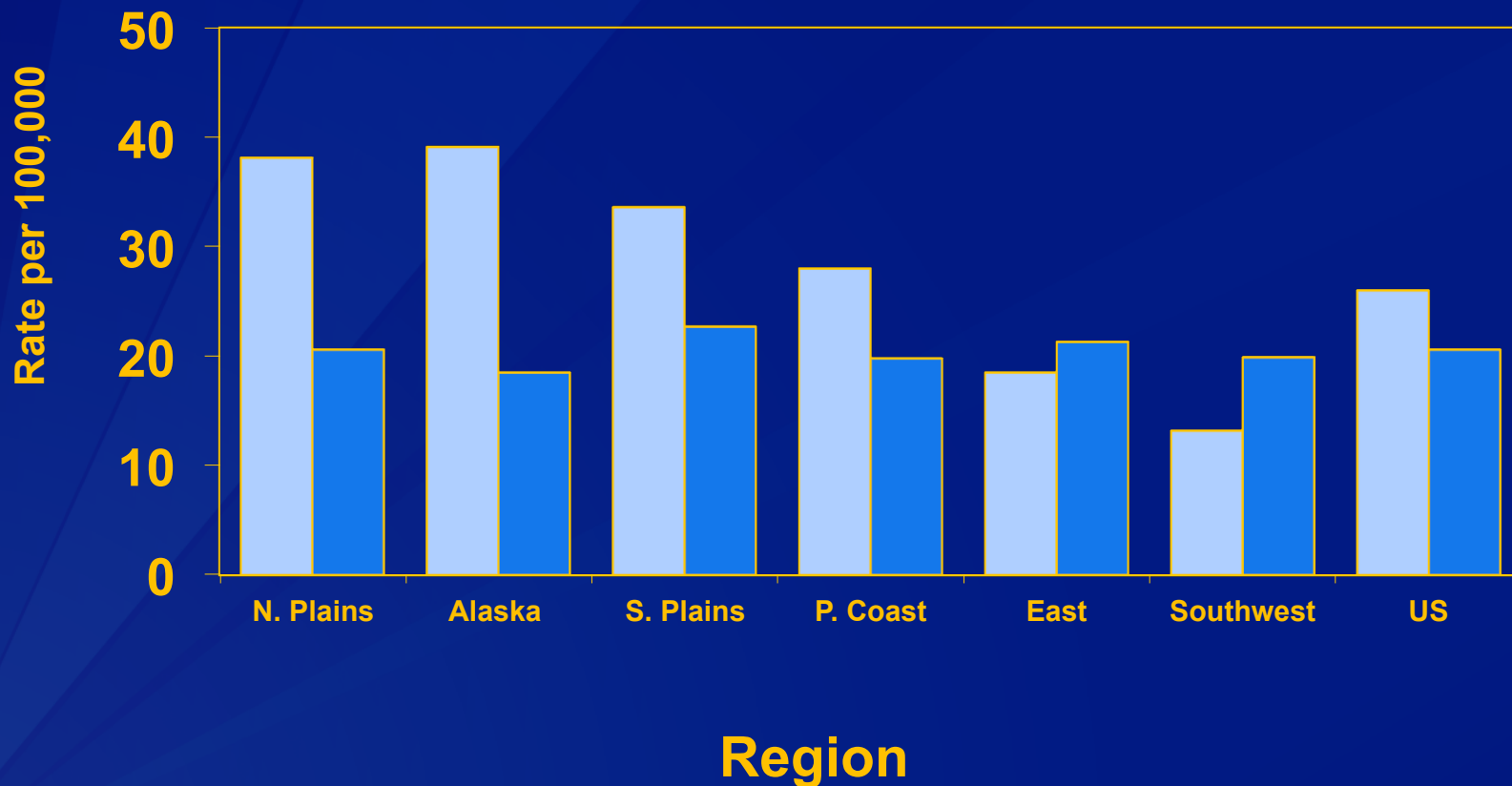


Age-adjusted All Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Females

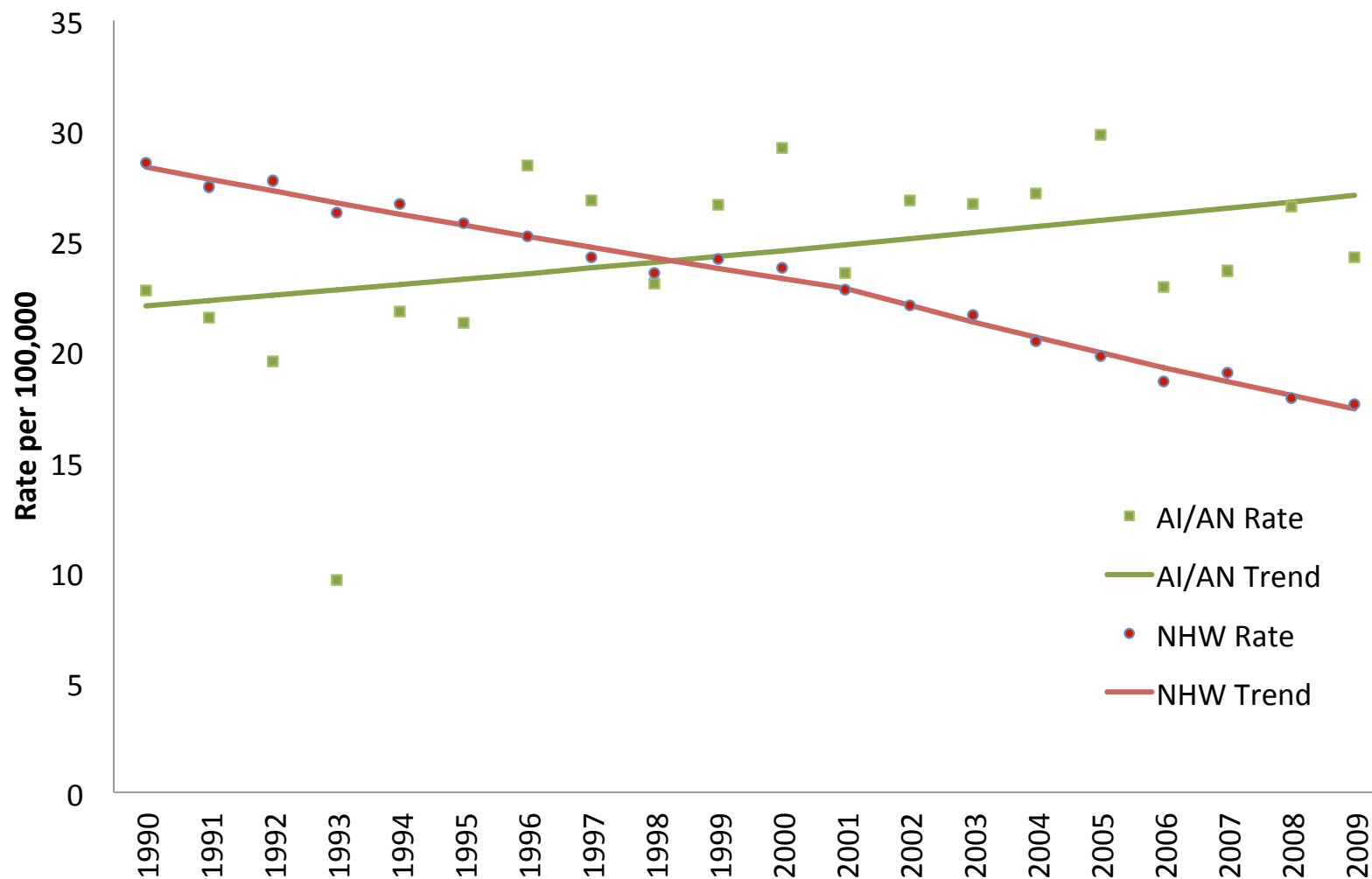


AI/AN and NHW death rates, colorectal cancer, by region, males, 1999-2009

■ AI/AN ■ NHW

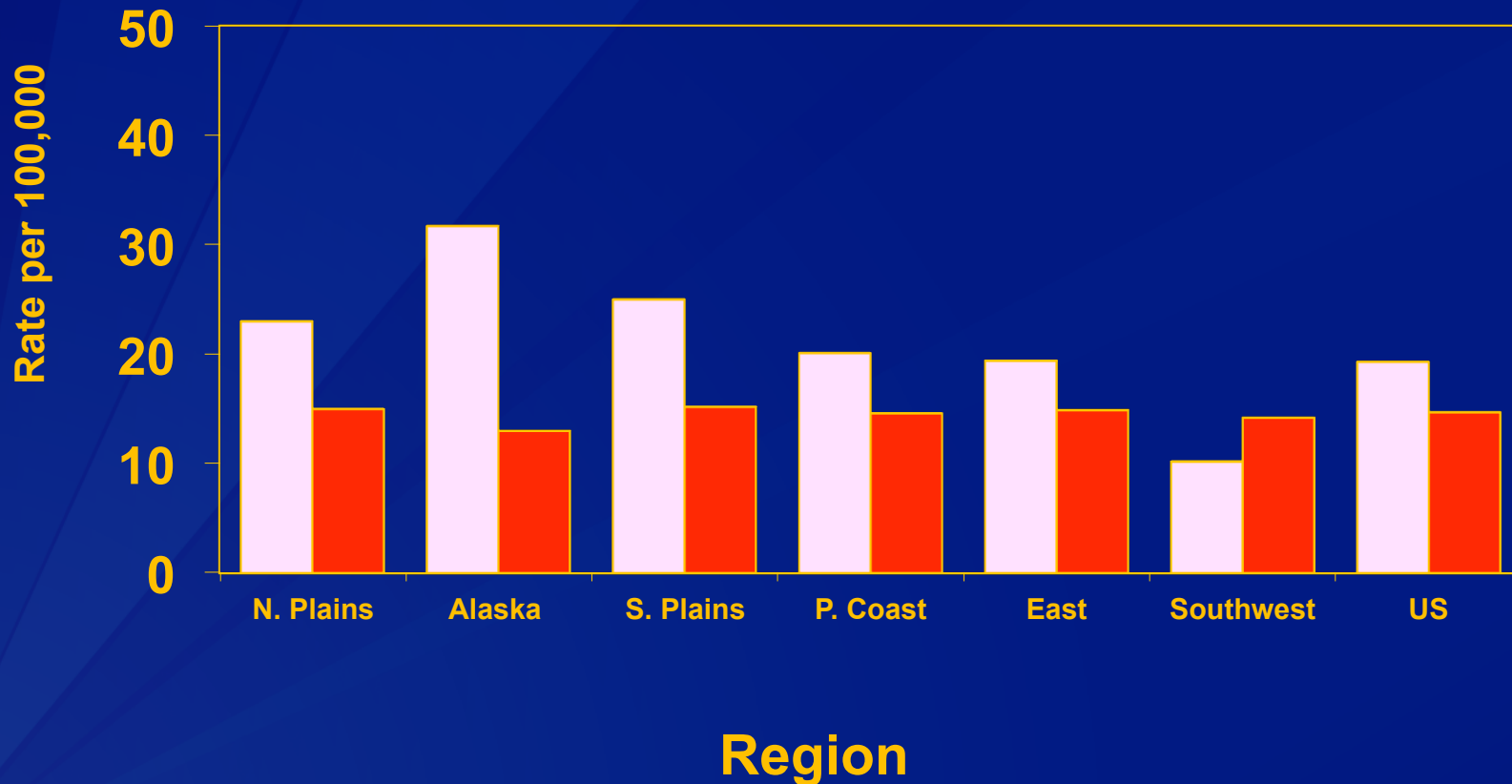


Age-adjusted Colorectal Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Males

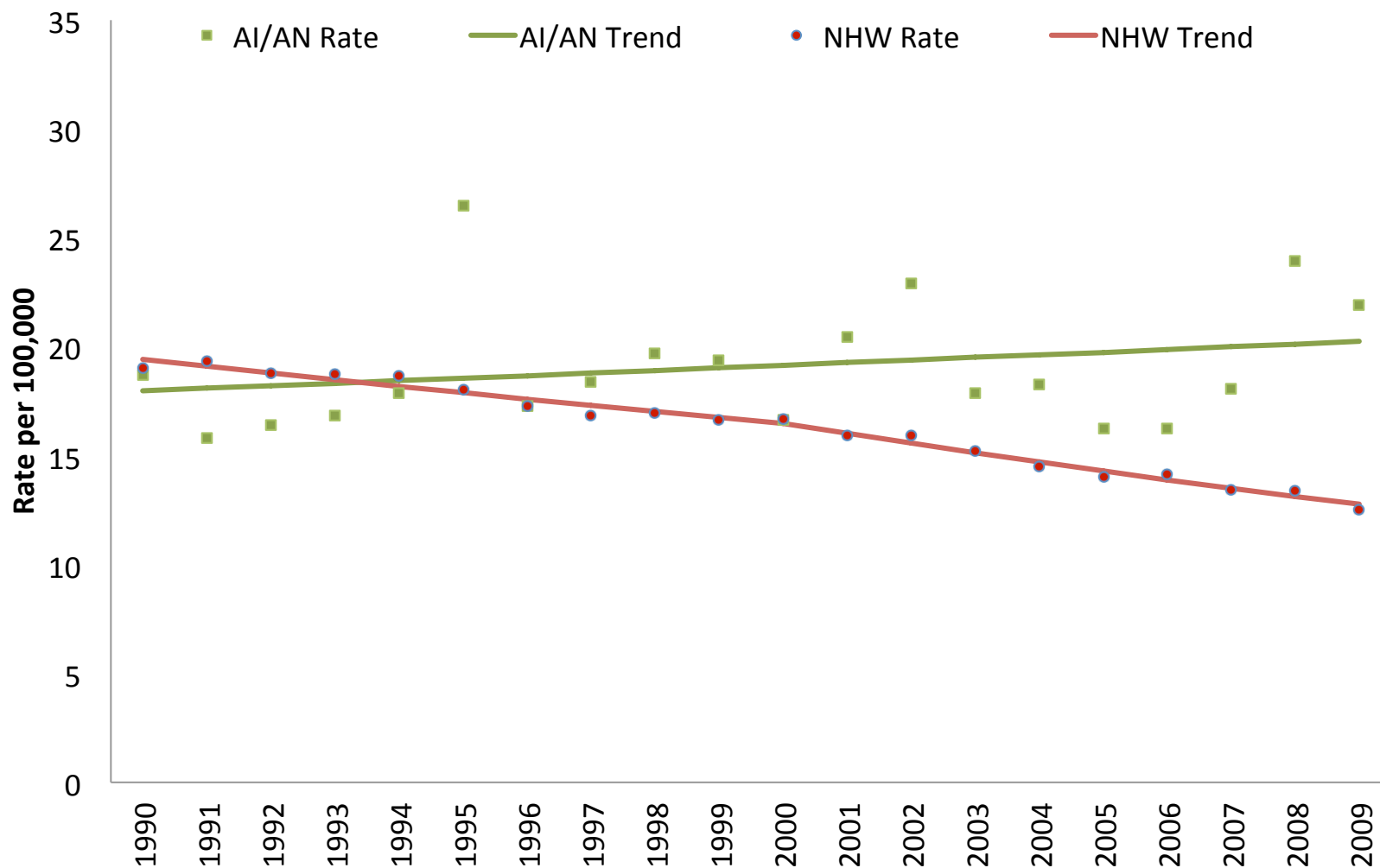


AI/AN and NHW death rates, colorectal cancer, by region, females, 1999-2009

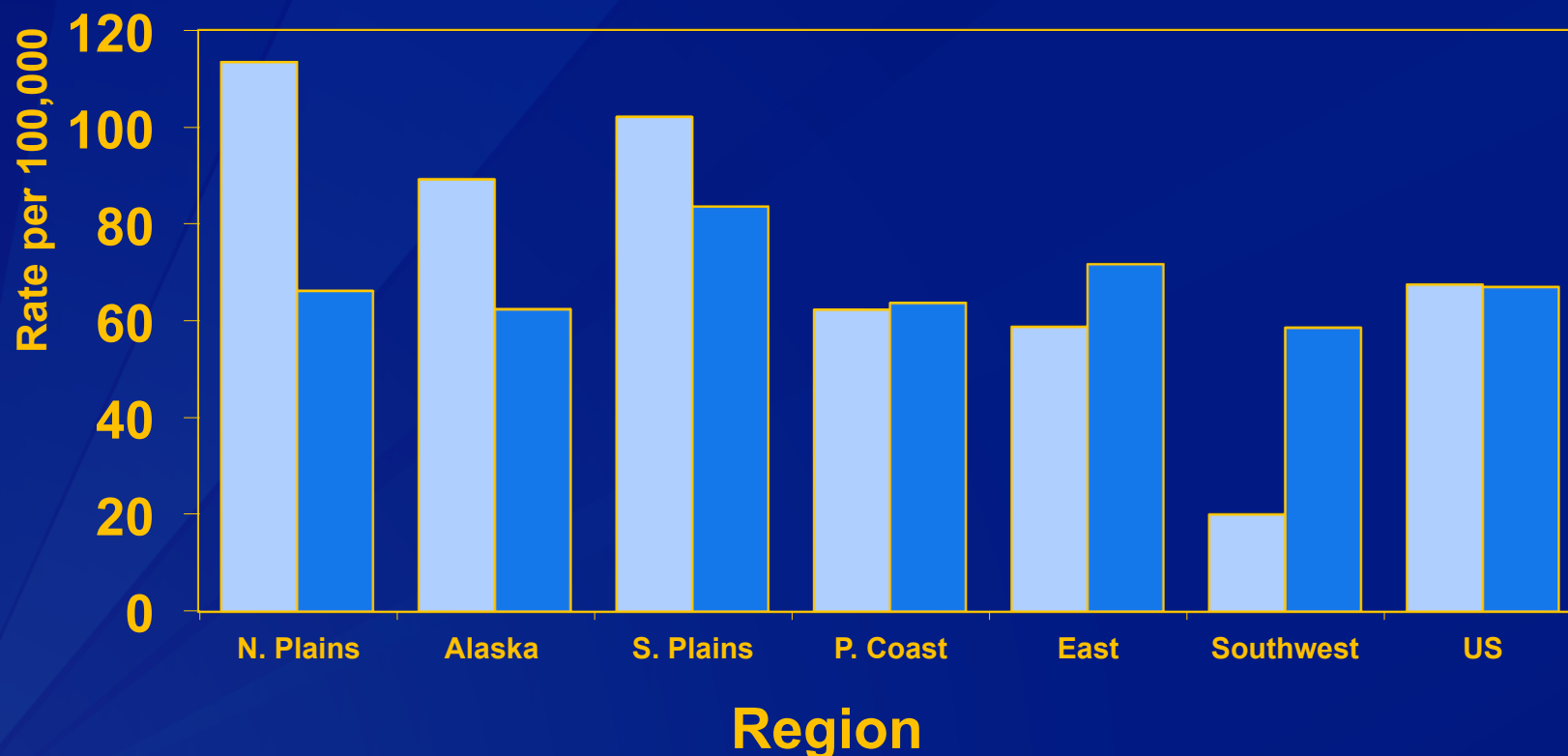
■ AI/AN ■ NHW



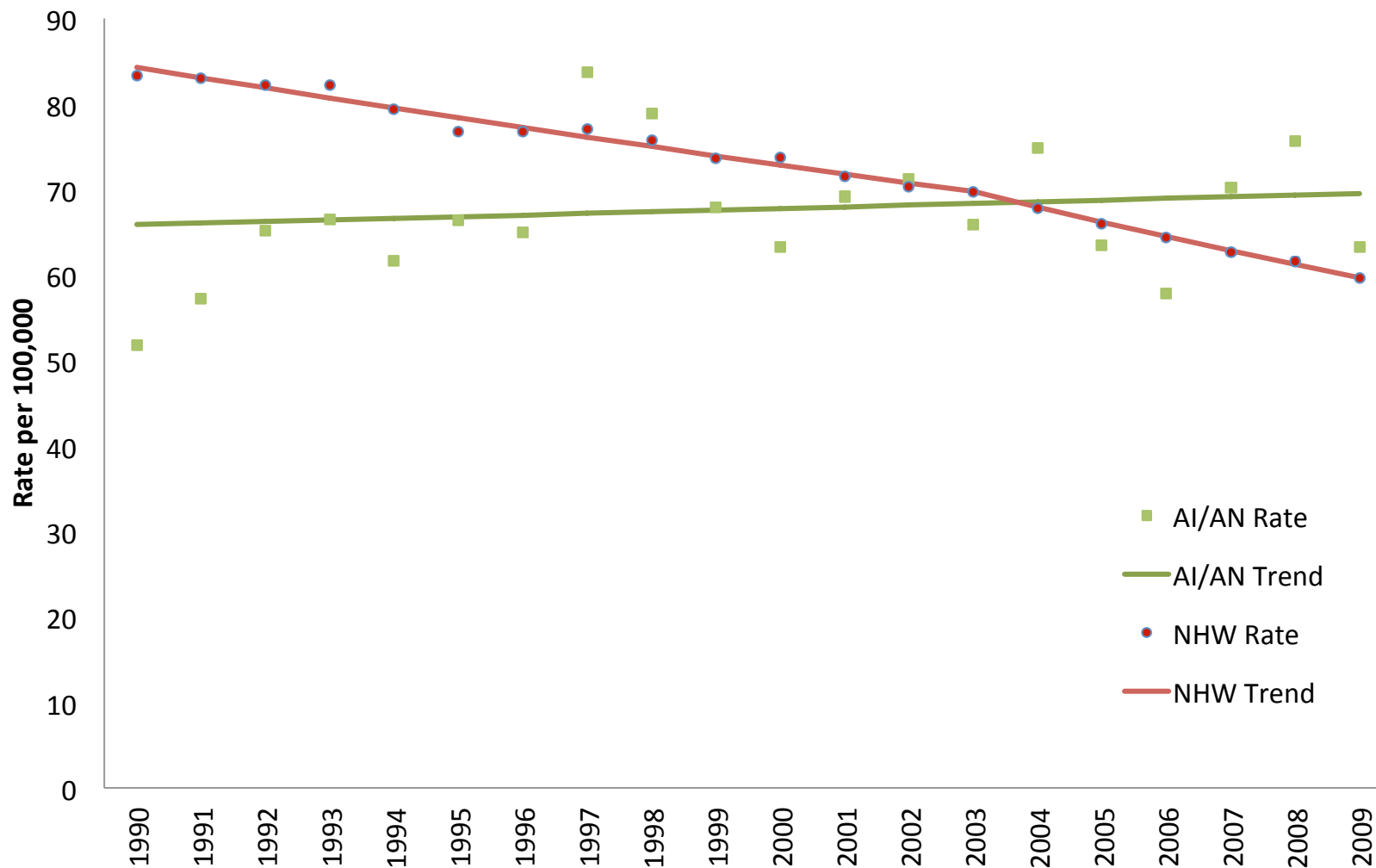
Age-adjusted Colorectal Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Females



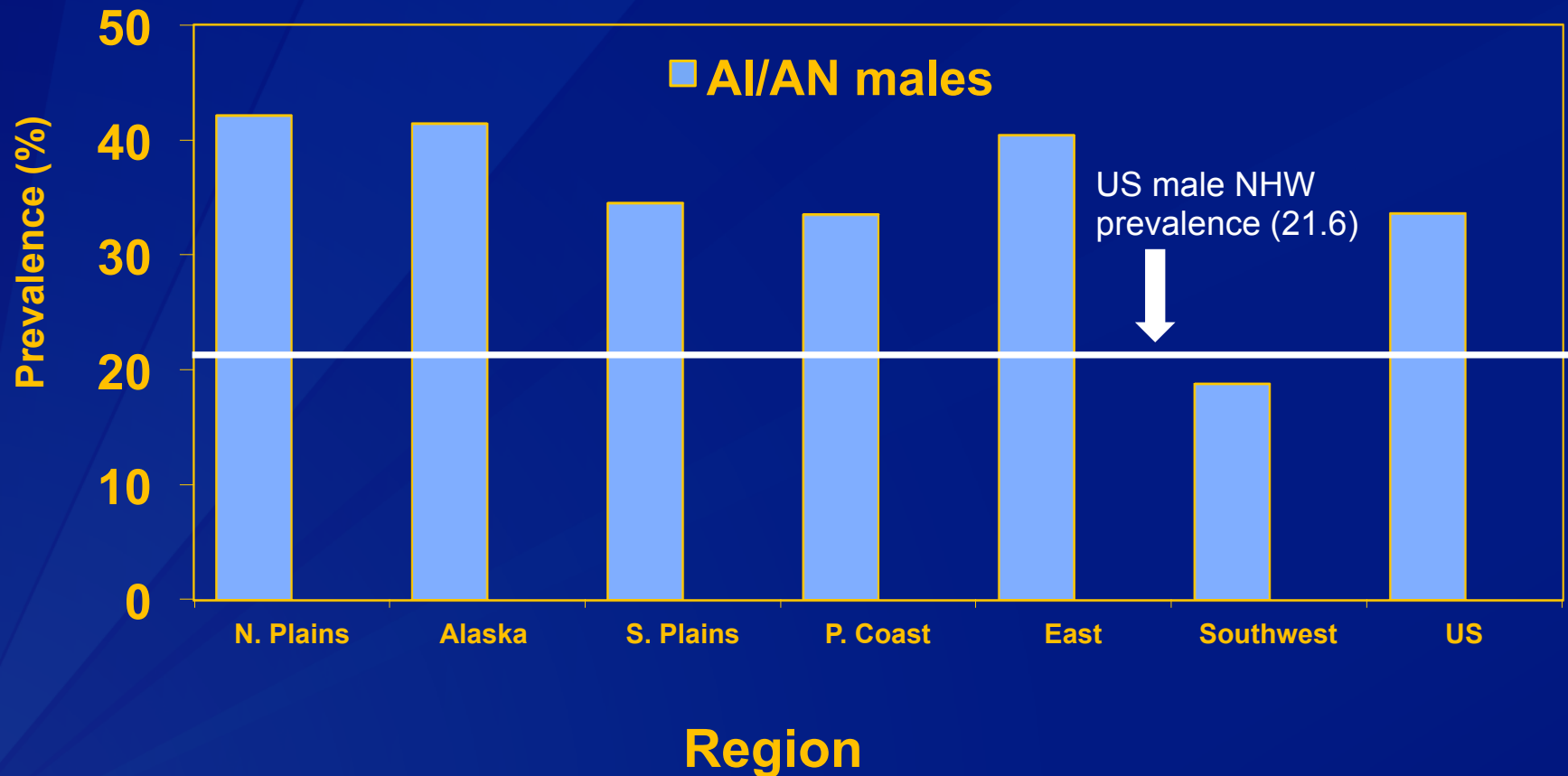
AI/AN and NHW death rates, lung and bronchus cancer by region, males, 1999-2009



Age-adjusted Lung Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Males

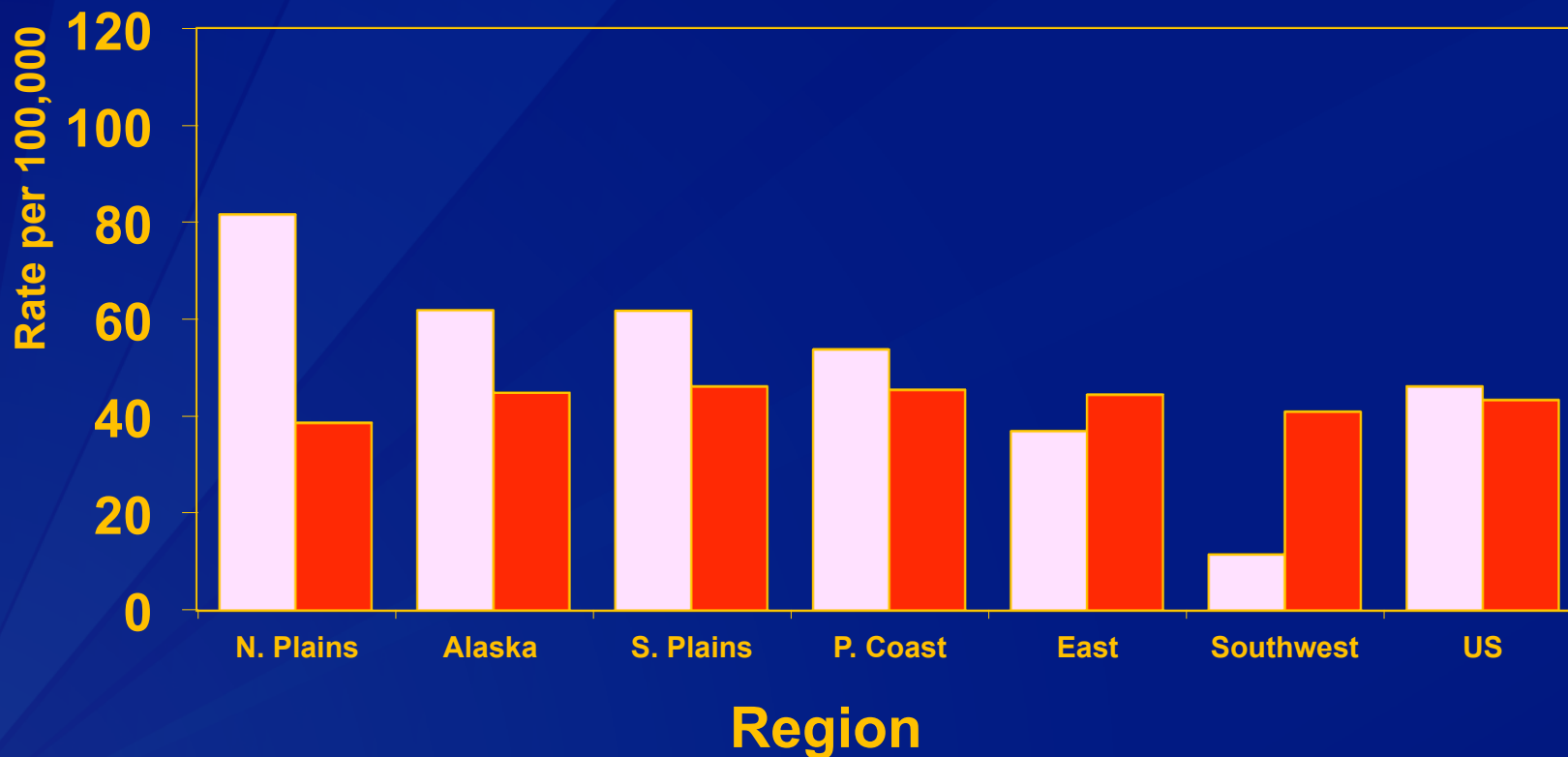


AI/AN and NHW estimated prevalence of **current smokers**,
Behavioral Risk Factor Surveillance System,
Contract Health Service Delivery Areas, males,
2000-2010

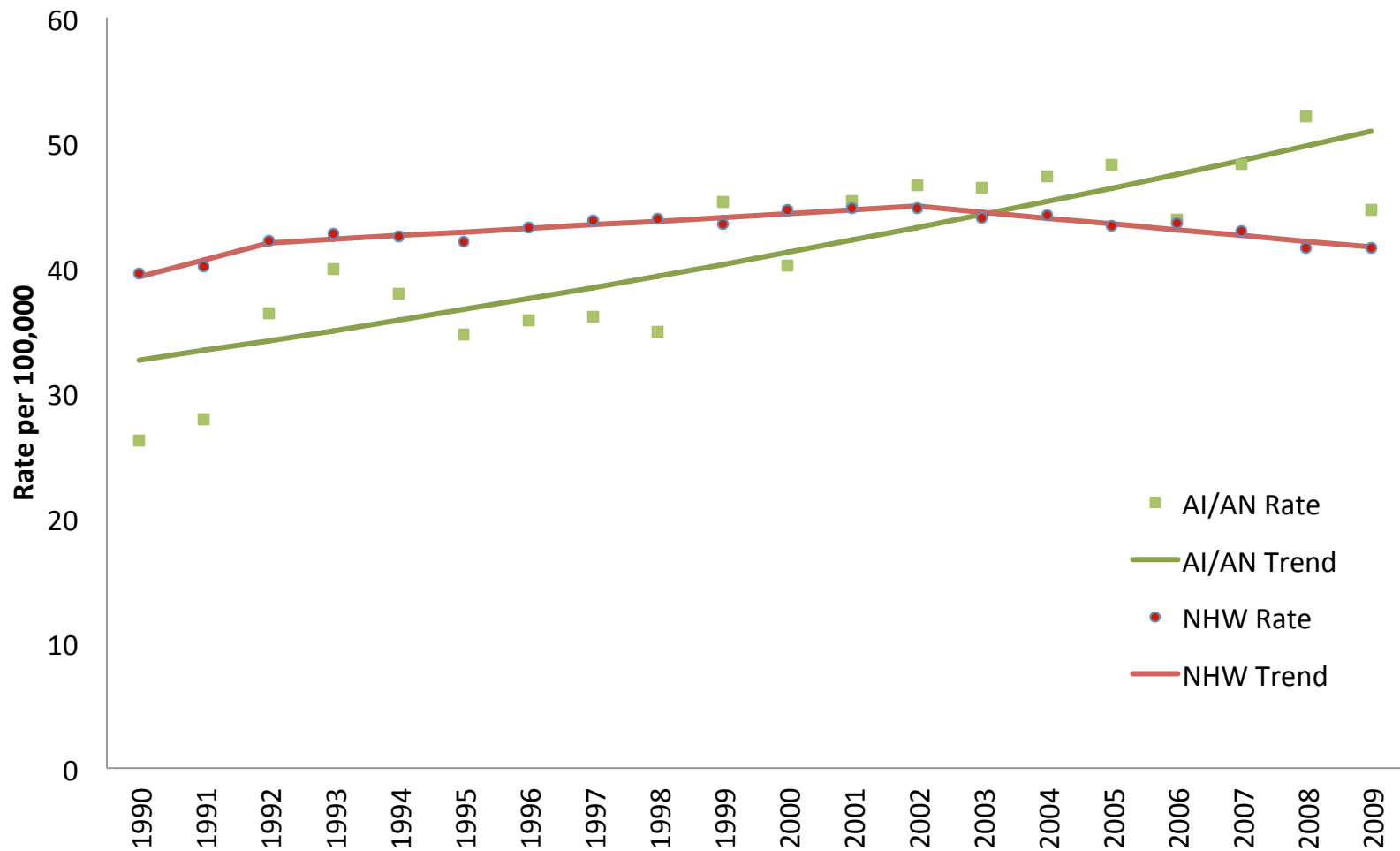


AI/AN and NHW death rates, lung and bronchus cancer by region, females, 1999-2009

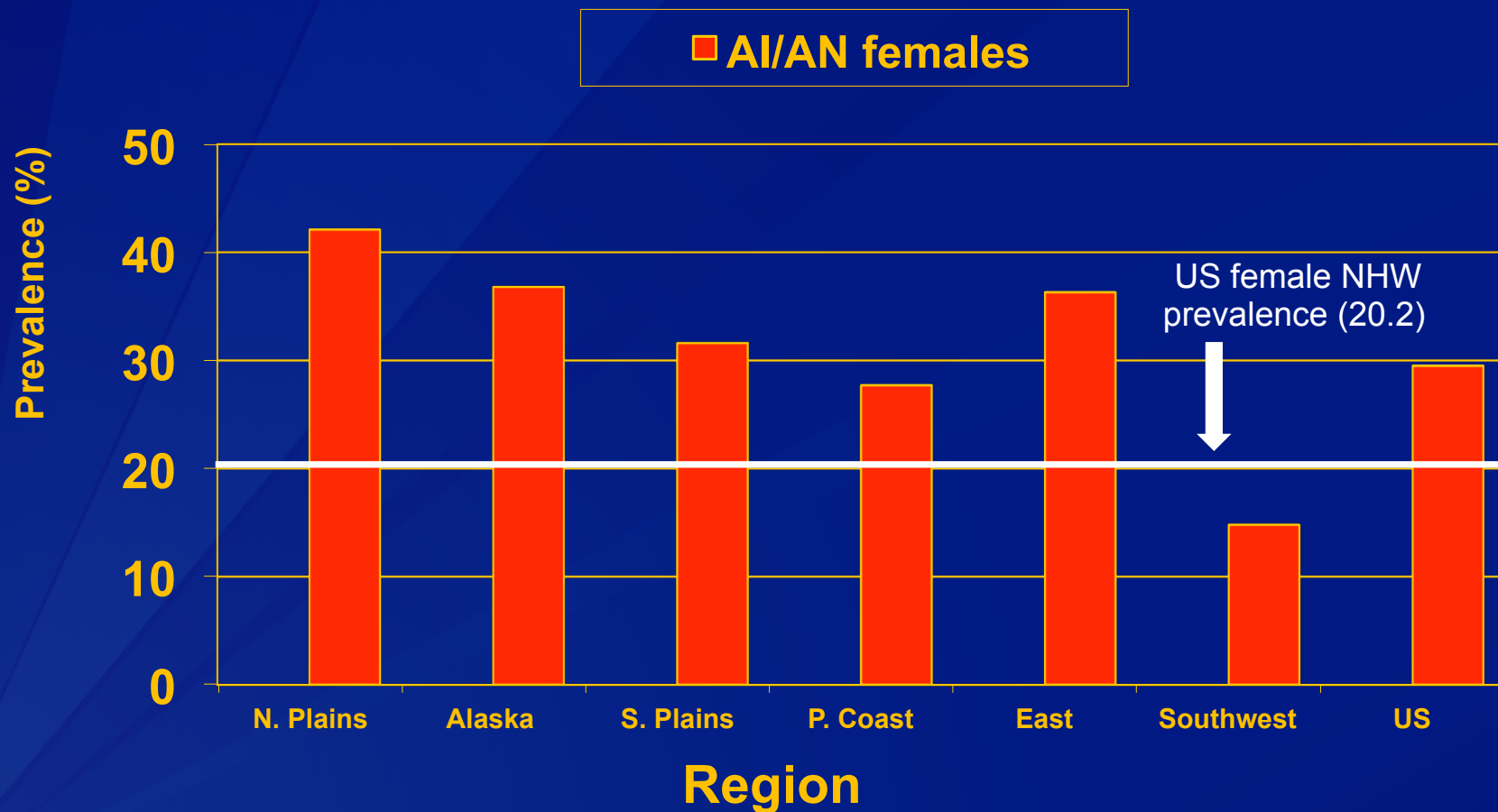
AI/AN NHW



Annual age-adjusted lung cancer mortality rates and Joinpoint trend lines in CHSDA counties, 1990-2009, Females

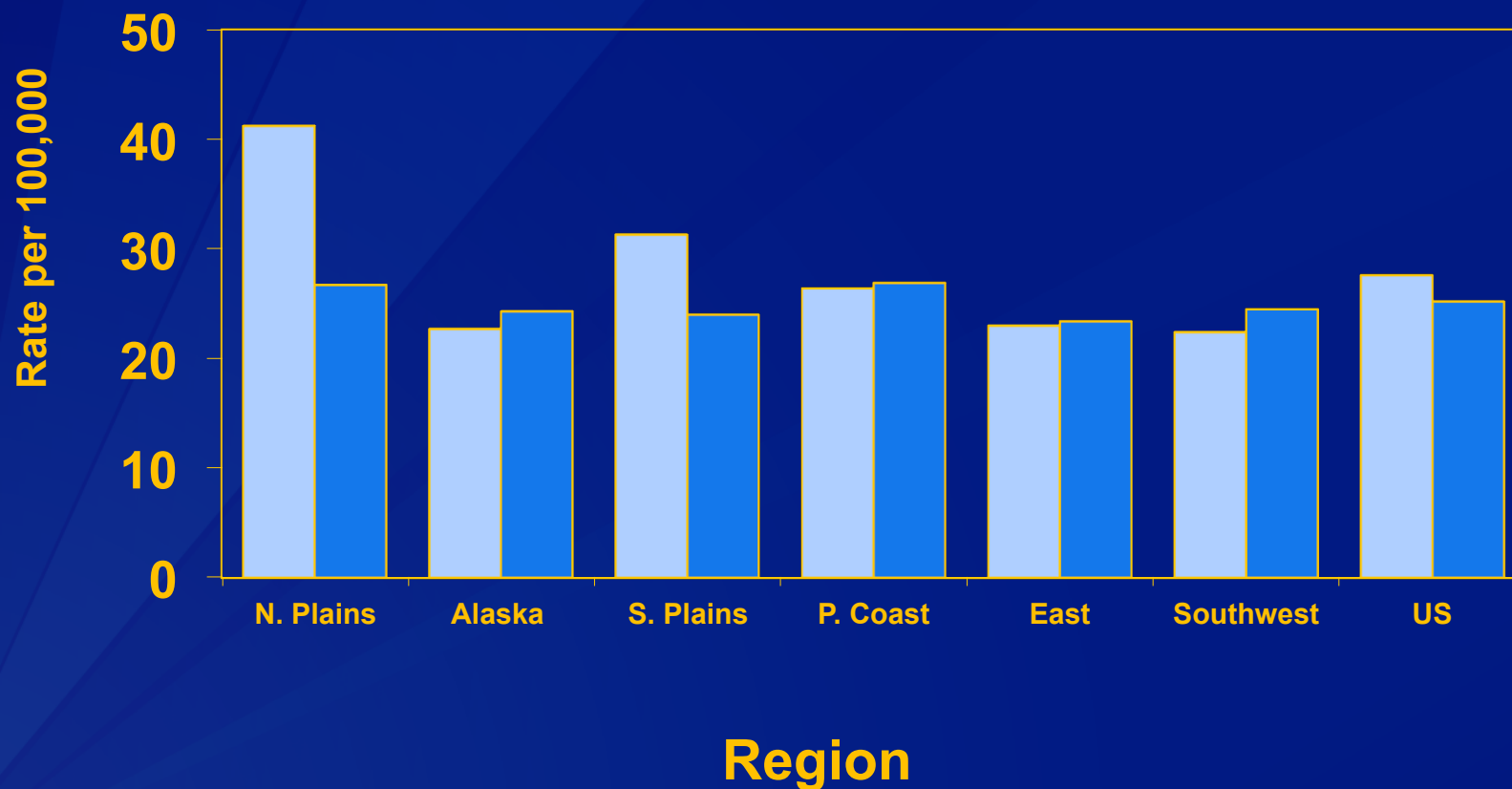


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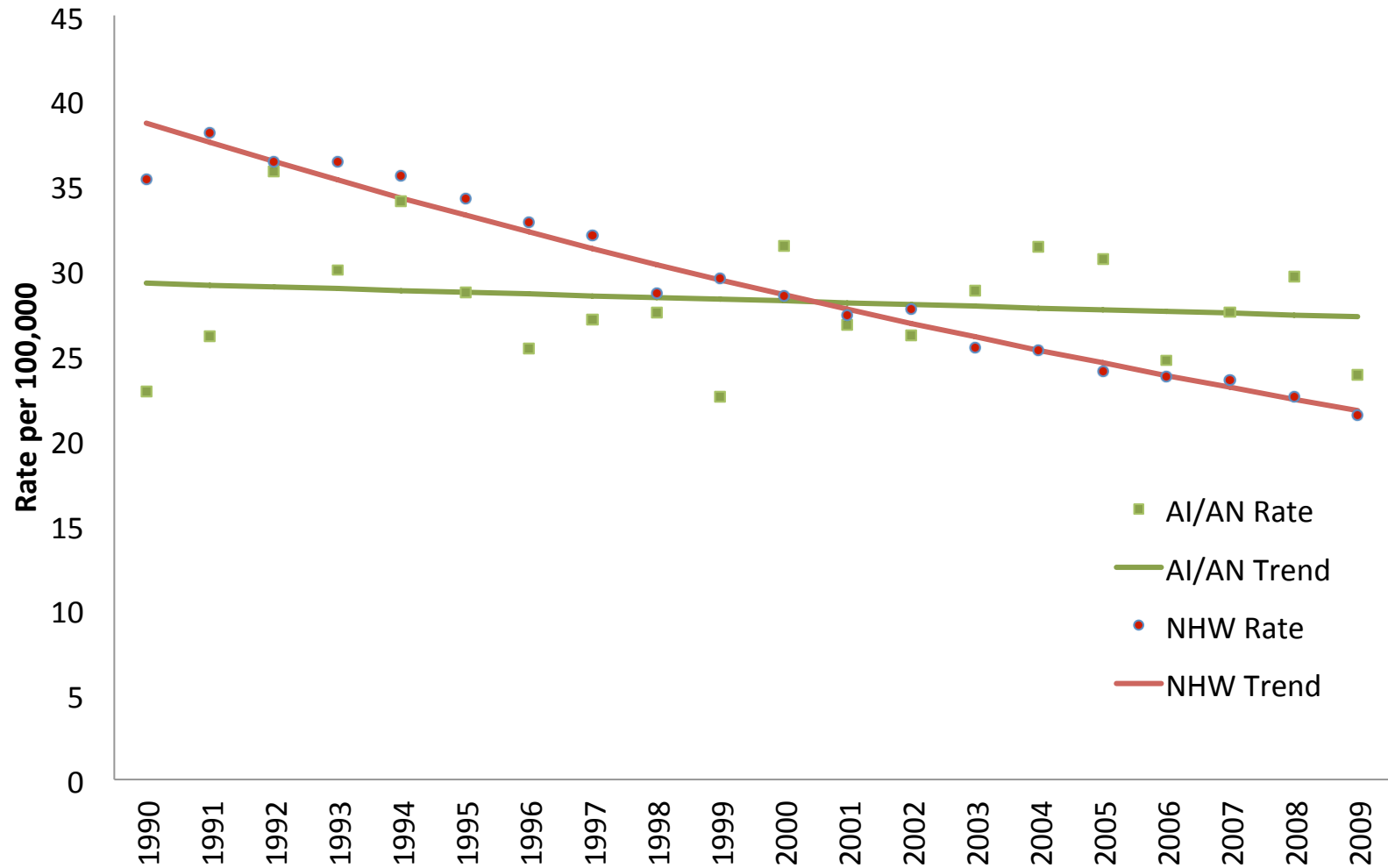


AI/AN and NHW death rates, prostate cancer, by region, males, 1999-2009

■ AI/AN ■ NHW

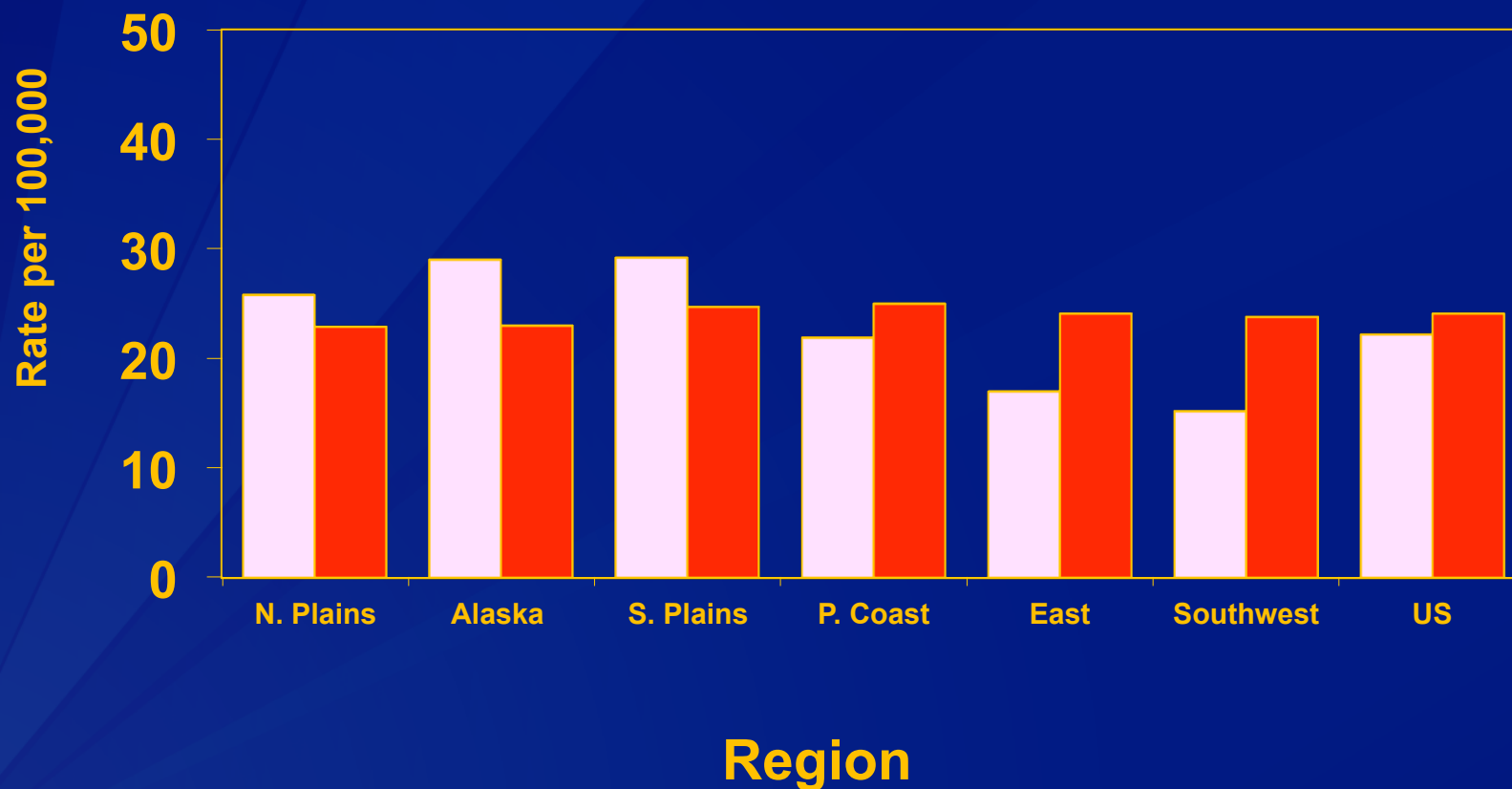


Age-adjusted Prostate Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Males

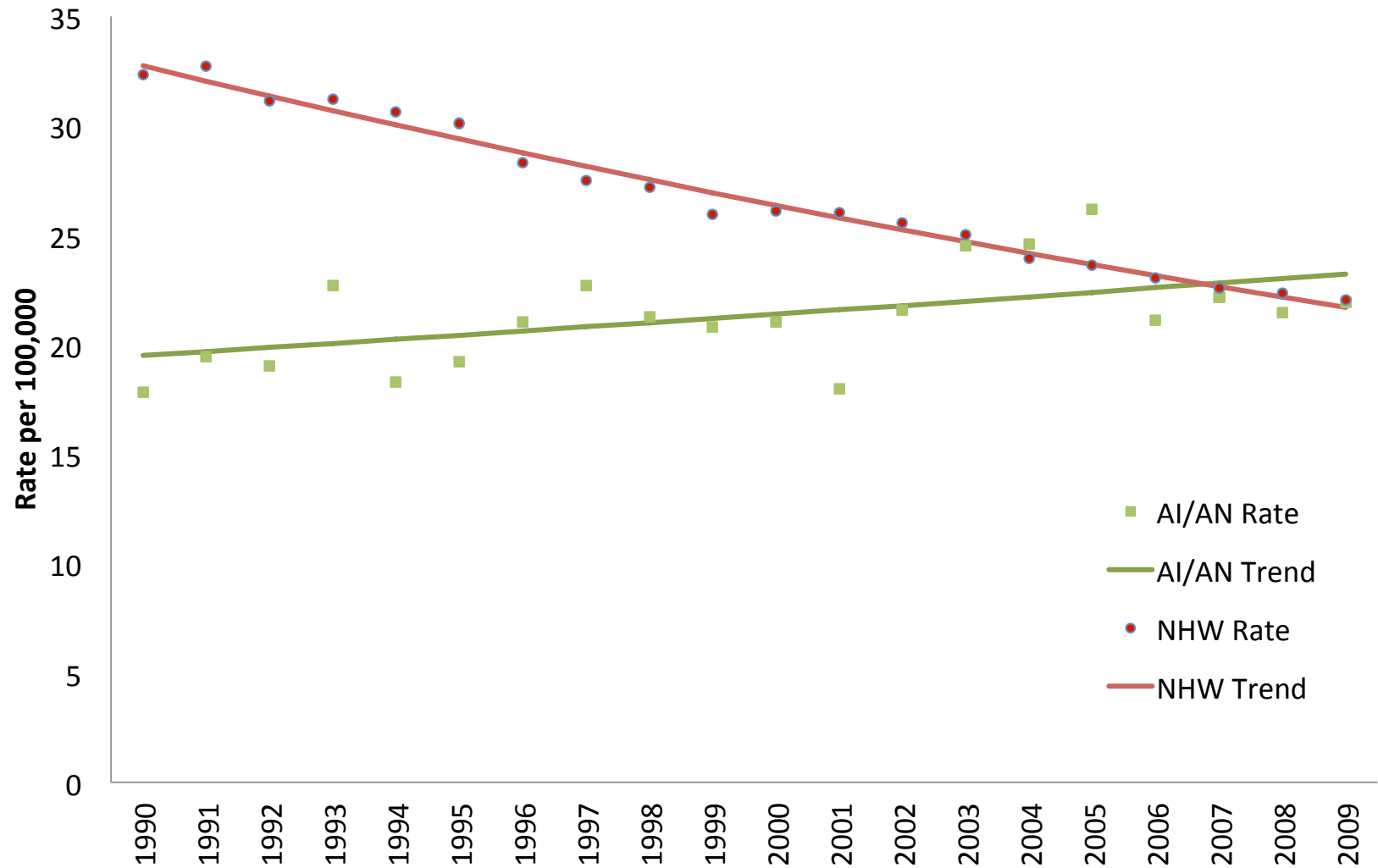


AI/AN and NHW death rates, breast cancer, by region, females, 1999-2009

■ AI/AN ■ NHW

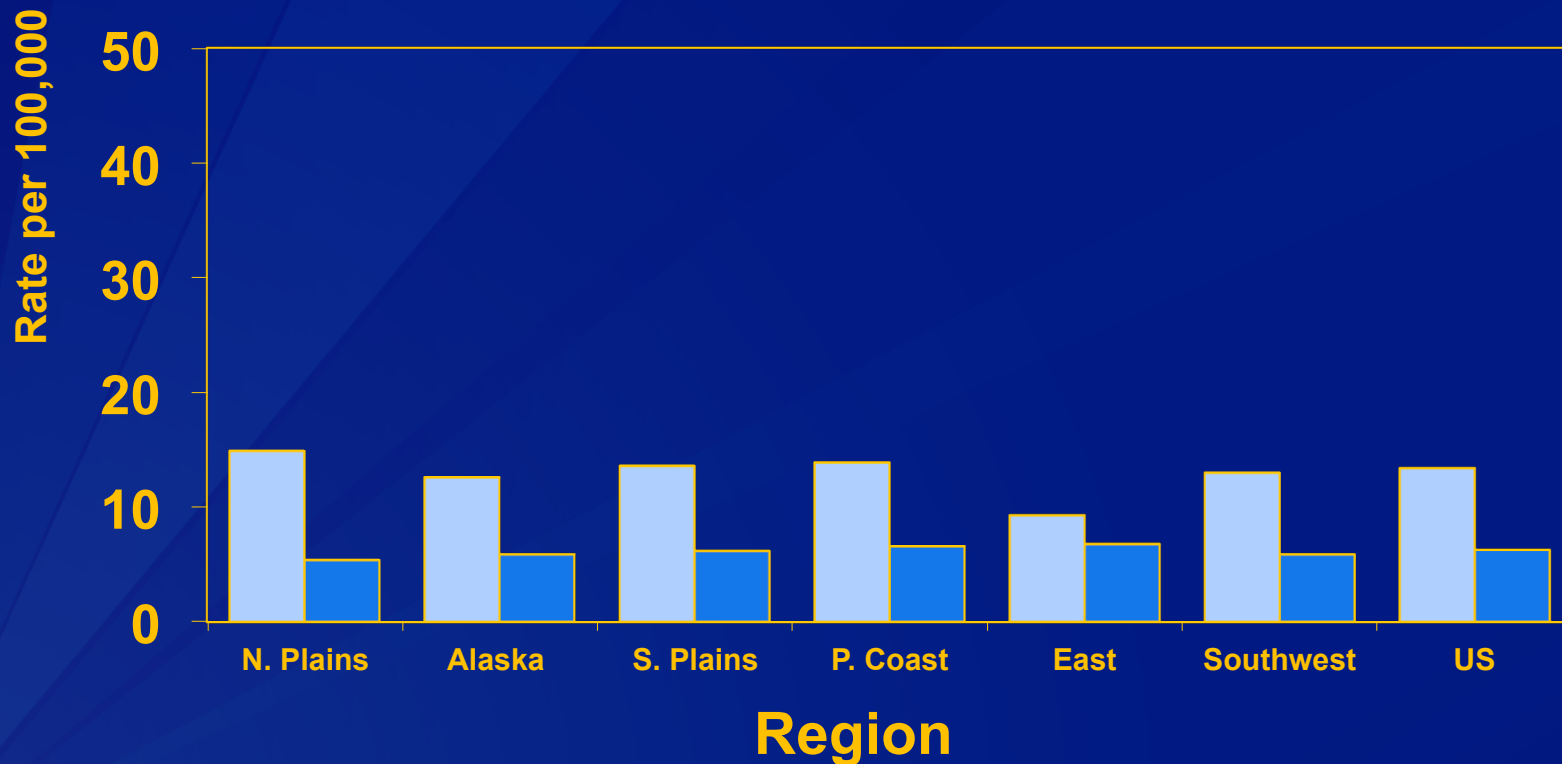


Age-adjusted Breast Cancer Death Rates and Joinpoint Trend Lines in CHSDA Counties, 1990-2009, Females

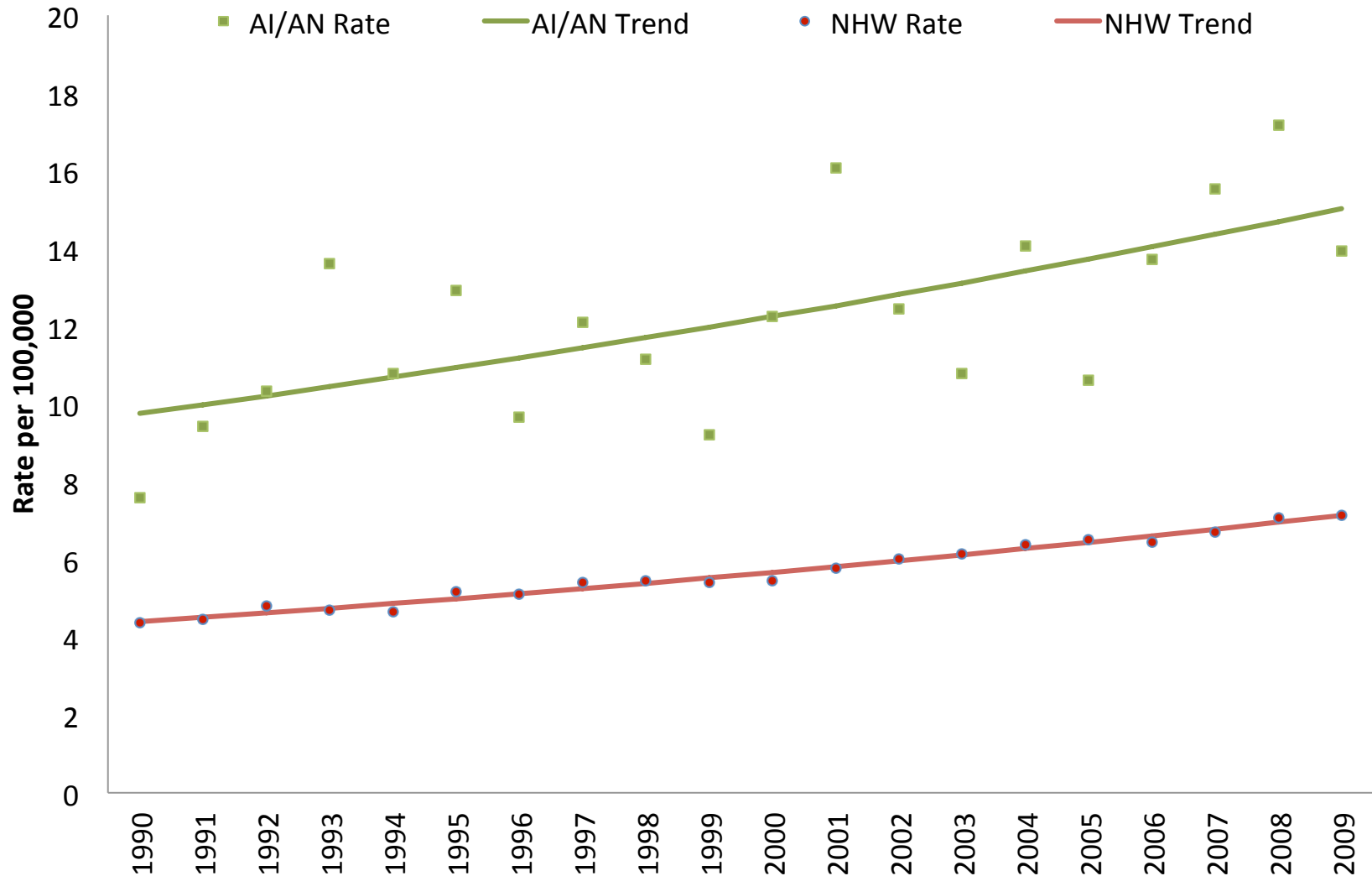


**AI/AN and NHW death rates,
liver and intrahepatic bile duct cancer,
by region, males,
1999-2009**

■ AI/AN ■ NHW

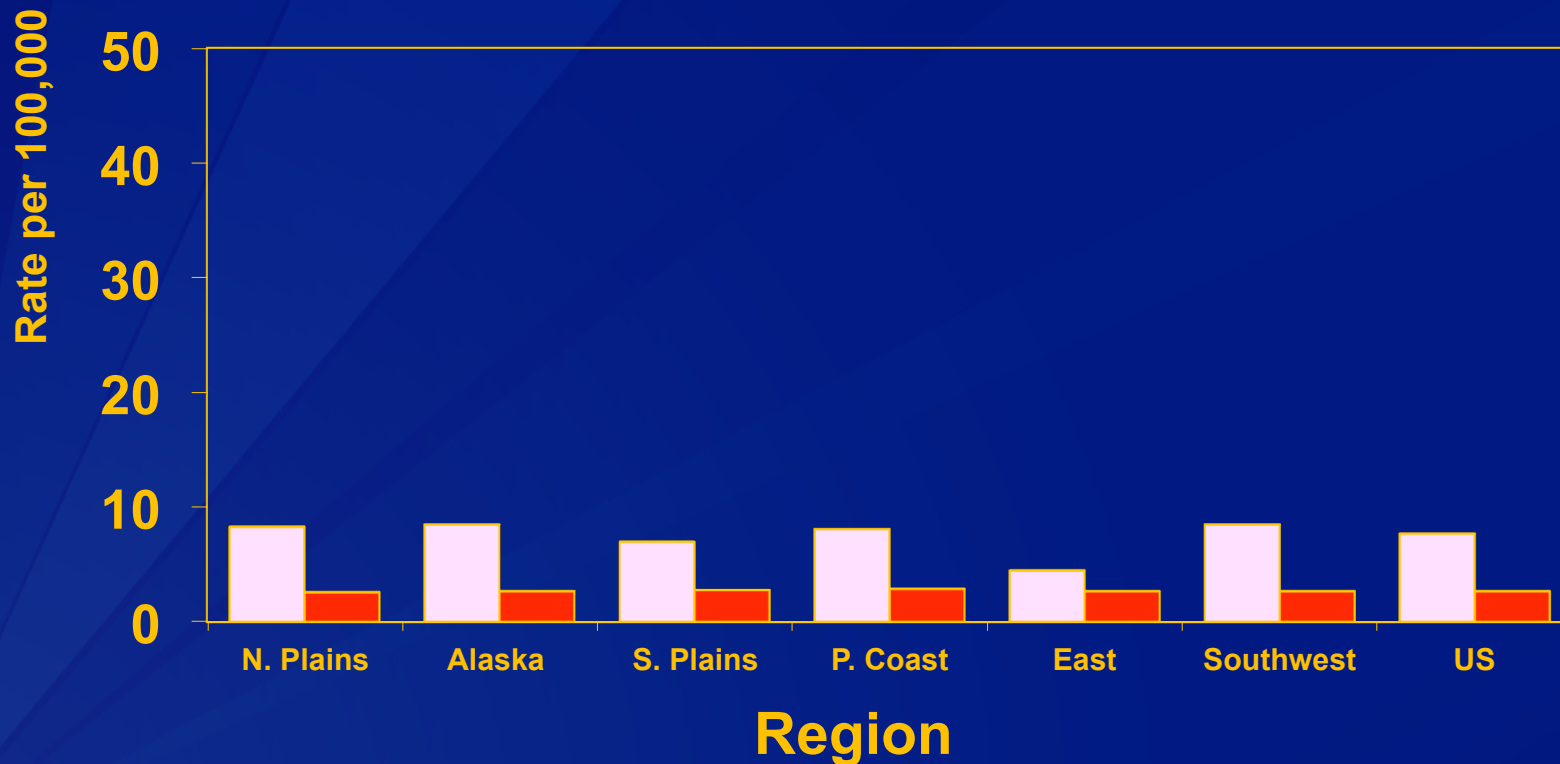


Annual age-adjusted liver and intrahepatic bile duct cancer mortality rates and Joinpoint trend lines in CHSDA counties, 1990-2009, Males



**AI/AN and NHW death rates,
liver and intrahepatic bile duct cancer,
by region, females,
1999-2009**

■ AI/AN ■ NHW



Annual age-adjusted liver and intrahepatic bile duct cancer mortality rates and Joinpoint trend lines in CHSDA counties, 1990-2009, Females



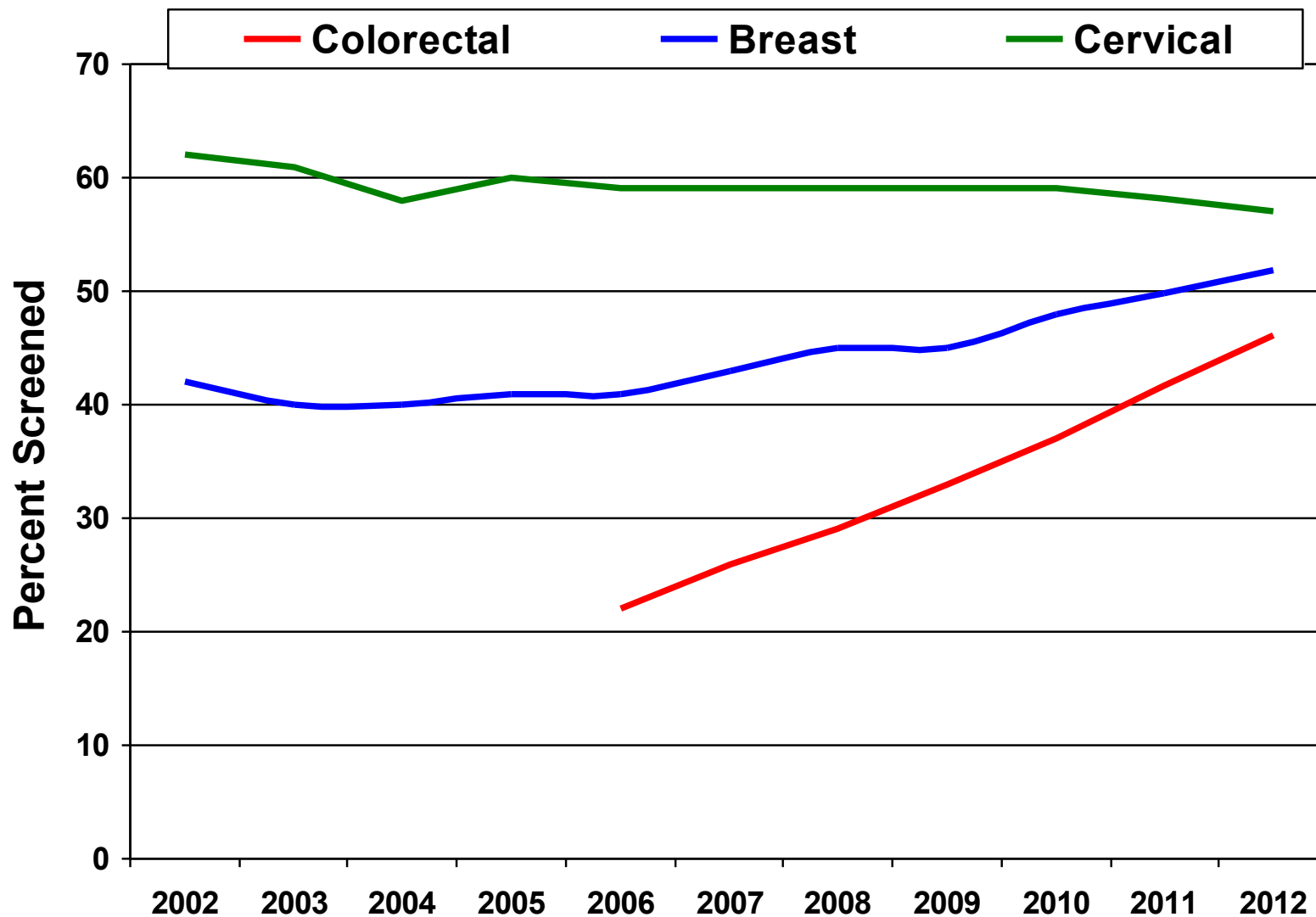
Mortality to Incidence Ratio

- ❑ MIR: an indicator of survival to compare cancer fatality between groups
- ❑ Calculated as the age-adjusted death rate divided by the age-adjusted incidence rate
- ❑ Is not a record level comparison as in relative survival
- ❑ Easy to calculate from existing data (cancer registry and death certificate data)
- ❑ Not a widely used measure and few publications

Factors influencing MIR

- ❑ Screening
- ❑ Quality and timeliness of treatment
- ❑ Tumor characteristics

Cancer screening among IHS user population



MIR for All Cancer Sites Combined and Specific Cancer Sites, for AI/AN compared with NHW, CHSDA counties, 1999-2009

Cancer Sites	AI/AN		NHW		AI/AN: NHW RATIO
	MIR	95% CI	MIR	95%CI	
All Cancers	0.49	0.48-0.50	0.39	0.39-0.391	1.26 ⁺
Bladder	0.24	0.20-0.27	0.20	0.20-0.20	1.19 ⁺
Breast (female)	0.22	0.21-0.24	0.18	0.18-0.19	1.22 ⁺
Cervical (female)	0.38	0.33-0.44	0.28	0.27-0.29	1.36 ⁺
Colorectal	0.42	0.40-0.44	0.36	0.36-0.36	1.16 ⁺
Hodgkin disease	0.21	0.14-0.30	0.15	0.14-0.15	1.40
Kidney & Renal Pelvis	0.35	0.32-0.38	0.30	0.29-0.30	1.18 ⁺
Leukemia	0.60	0.55-0.67	0.58	0.57-0.58	1.05
Liver/HBD	0.91	0.83-0.99	0.91	0.90-0.93	0.99
Lung & Bronchus	0.83	0.80-0.86	0.77	0.77-0.78	1.07 ⁺
Ovary (female)	0.68	0.61-0.77	0.66	0.65-0.67	1.03
Pancreas	0.96	0.88-1.05	0.95	0.94-0.96	1.02
Prostate (male)	0.23	0.21-0.25	0.17	0.17-0.17	1.39 ⁺
Stomach	0.71	0.64-0.78	0.56	0.55-0.57	1.27 ⁺
Uterus (female)	0.18	0.16-0.21	0.16	0.16-0.16	1.14

MIR for All Cancer Sites Combined by Region, for AI/AN compared with NHW, CHSDA counties, 1999-2009

	AI/AN		NHW		AI/AN: NHW RATIO
Region	MIR	CI	MIR	CI	
Northern Plains	0.53	0.51-0.55	0.40	0.39-0.40	1.33*
Alaska	0.49	0.46-0.52	0.37	0.36-0.38	1.32*
Southern Plains	0.46	0.44-0.47	0.42	0.42-0.42	1.09*
Southwest	0.51	0.49-0.53	0.40	0.40-0.40	1.27*
Pacific Coast	0.49	0.47-0.51	0.39	0.39-0.39	1.26*
East	0.51	0.47-0.55	0.38	0.38-0.38	1.34*
Total	0.49	0.48-0.50	0.39	0.39-0.39	1.26*

Mortality to Incidence Ratio (MIR)

- ❑ **MIR is a potentially useful proxy for estimating cancer survival**
- ❑ **MIR was consistently less favorable for AI/AN compared to NHW for nearly all cancers examined**
- ❑ **These disparities are likely related to lower socioeconomic status and lack of health care access**
- ❑ **Geographic, financial and bureaucratic barriers are faced by AI/AN populations, resulting in lower access to screening and to specialty medical care for prevention, early detection and timely treatment of cancer.**

* Citations, references, and credits



Summary

- **Overall cancer death rates increased significantly for AI/AN men and women from 1990 to 2009**
- **Overall cancer death rates declined significantly for white men from 2002 to 2009 and white women from 2001 to 2009**
- **Compared to whites, deaths for all cancers combined among AI/AN were significantly lower from 1990 to 1998 but significantly higher from 1999 to 2009**

Priorities for Prevention

- **Lung cancer – smoking cessation and tobacco control (also important for improved cancer survival)**
- **Colorectal cancer – increase screening (not only colonoscopy)**
- **Breast cancer – screening mammography, quality of care**
- **Prostate cancer – improved health care access**
- **Cervical cancer – screening and expand use of HPV vaccine**
- **Liver cancer – hepatitis B vaccination, hepatitis C testing and treatment**
- **Overall – prevent and control chronic conditions such as diabetes, excess weight, metabolic syndrome; increase physical activity; decrease alcohol; general health promotion**

Limitations

- **Method of linking records does not address racial misclassification among AI/ANs who did not receive care from the IHS**
- **Non-Hispanic AI/AN residents of CHSDA counties may not represent AI/AN residents of non-CHSDA counties**

Conclusions

- Over the past two decades, substantial progress was achieved in reducing cancer mortality among whites, but less progress has been achieved for AI/AN populations
- These results demonstrate growing disparities in cancer mortality among AI/AN populations compared to whites

Implications

- **Existing cancer control efforts are important but not enough, and many areas remain underserved**
- **Need to identify and address the social, physical and economic determinants of cancer risk at the community level**
- **Comprehensive and culturally appropriate approaches are needed that address the multilevel determinants of health behavior**
- **Need for improved access and utilization of quality health services for cancer screening, diagnosis and treatment**

Acknowledgement

- **Co-authors: Mary White, Judith Swan, Charles L. Wiggins, Christie Ehemman, Judith S. Kaur**
- **Technical assistance: Melissa Jim, Don Haverkamp, Jane Henley, Ashwini Soman, Jasmine Jacobs**

Thank you!

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: www.cdc.gov | Contact CDC at: 1-800-CDC-INFO or www.cdc.gov/info

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.