

# Hepatitis C Mortality Among American Indians and Alaska Natives in the Northwest, 2006–2012

**Sarah Hatcher, PhD**

**Epidemic Intelligence Service Officer**

**Northwest Portland Area Indian Health Board**

**HCV ECHO Clinic**

**June 28, 2017**

**\*Please do not distribute without written permission.**

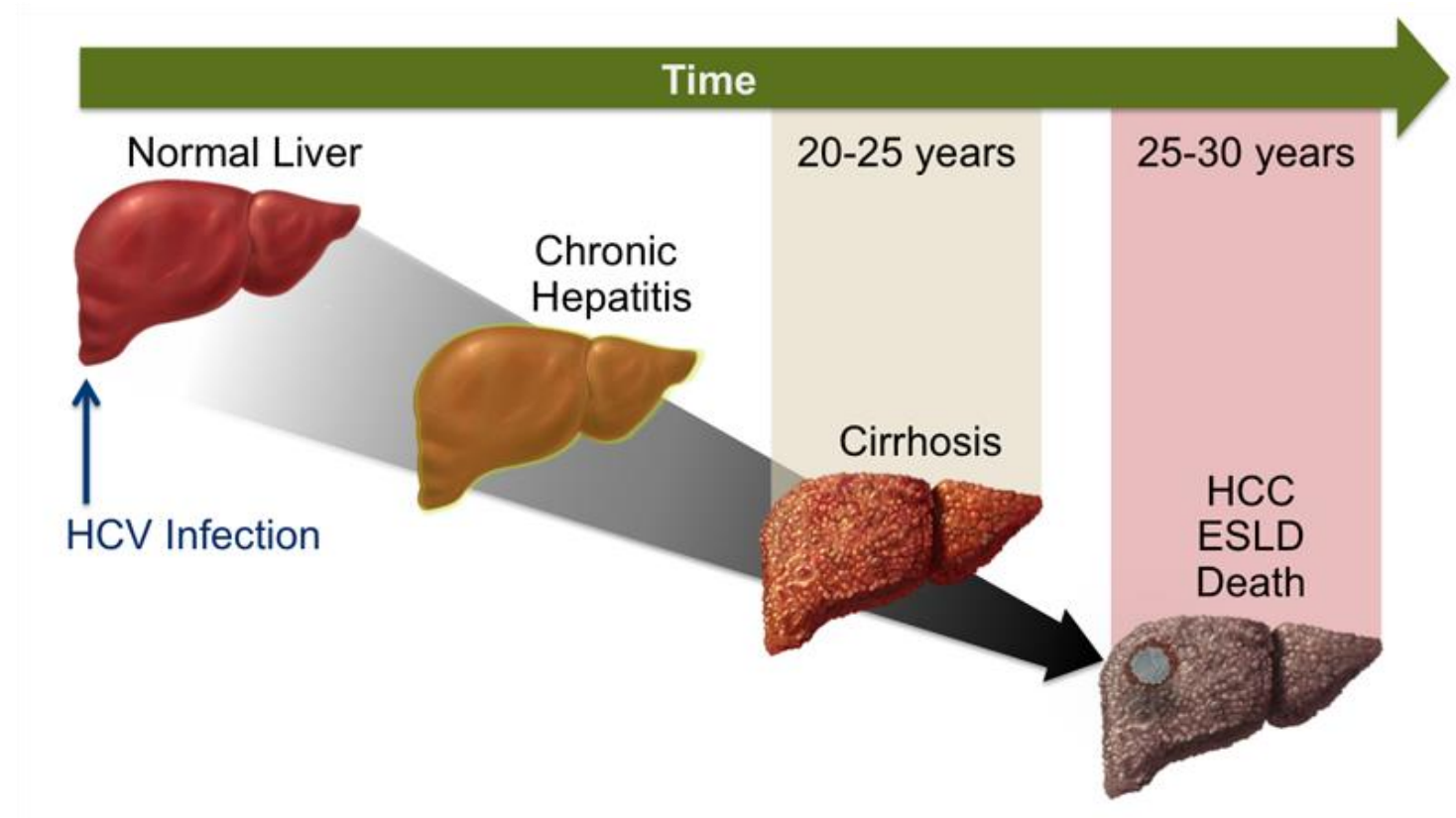


**NPAIHB**

*Indian Leadership for Indian Health*

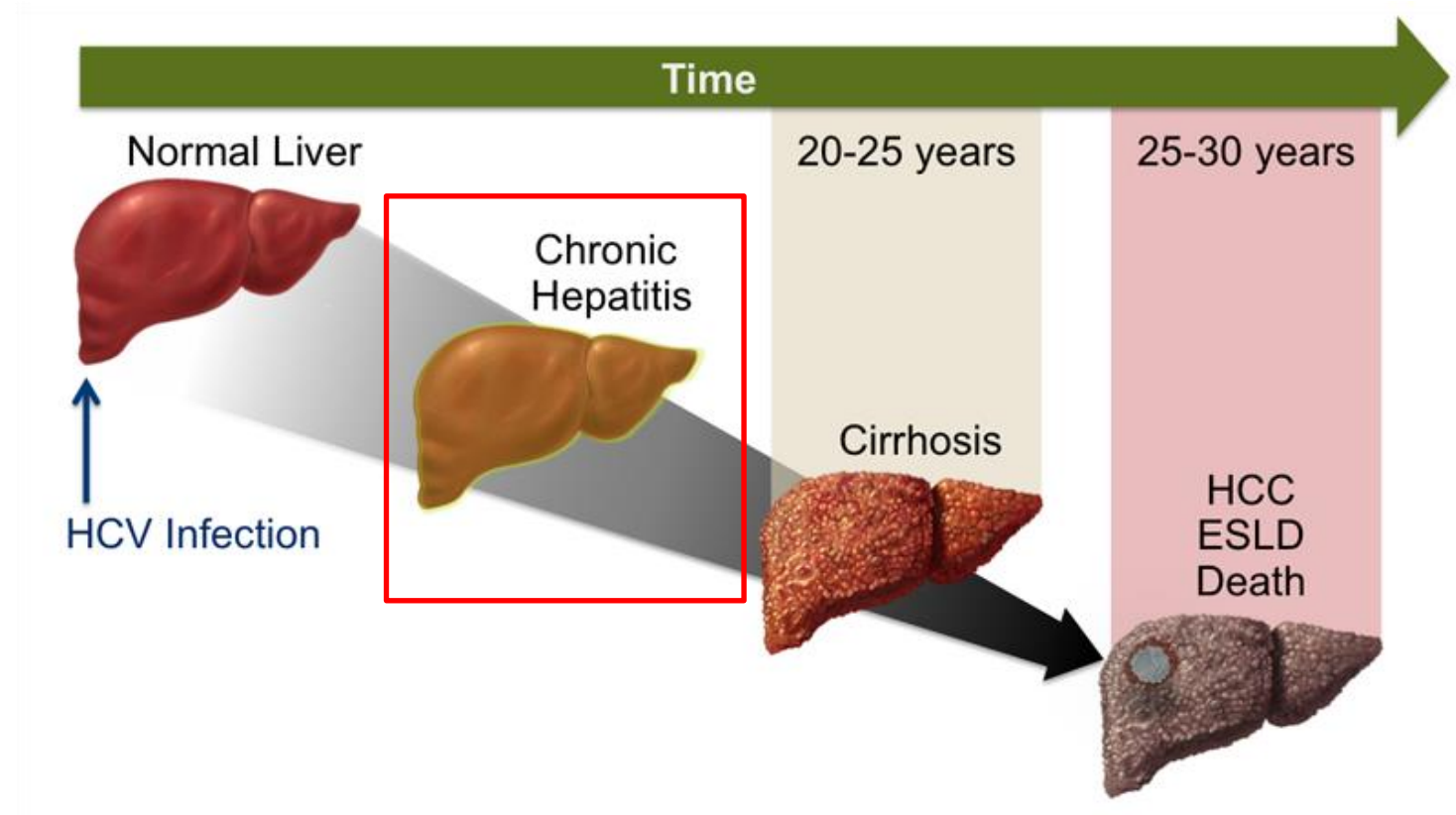
# Hepatitis C Virus (HCV) Infection

Acute or chronic

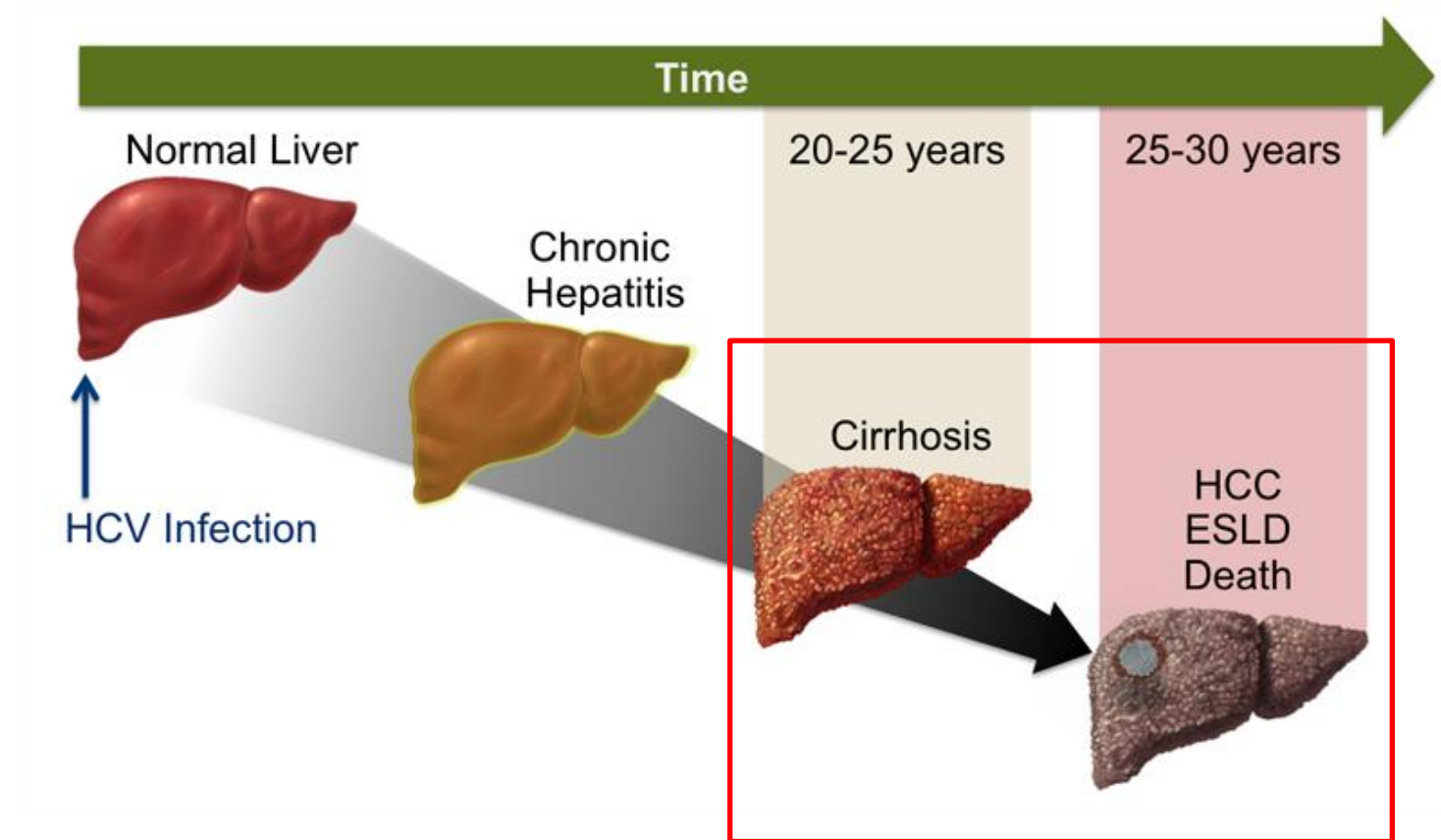


# Hepatitis C Virus (HCV) Infection

**75-85%**

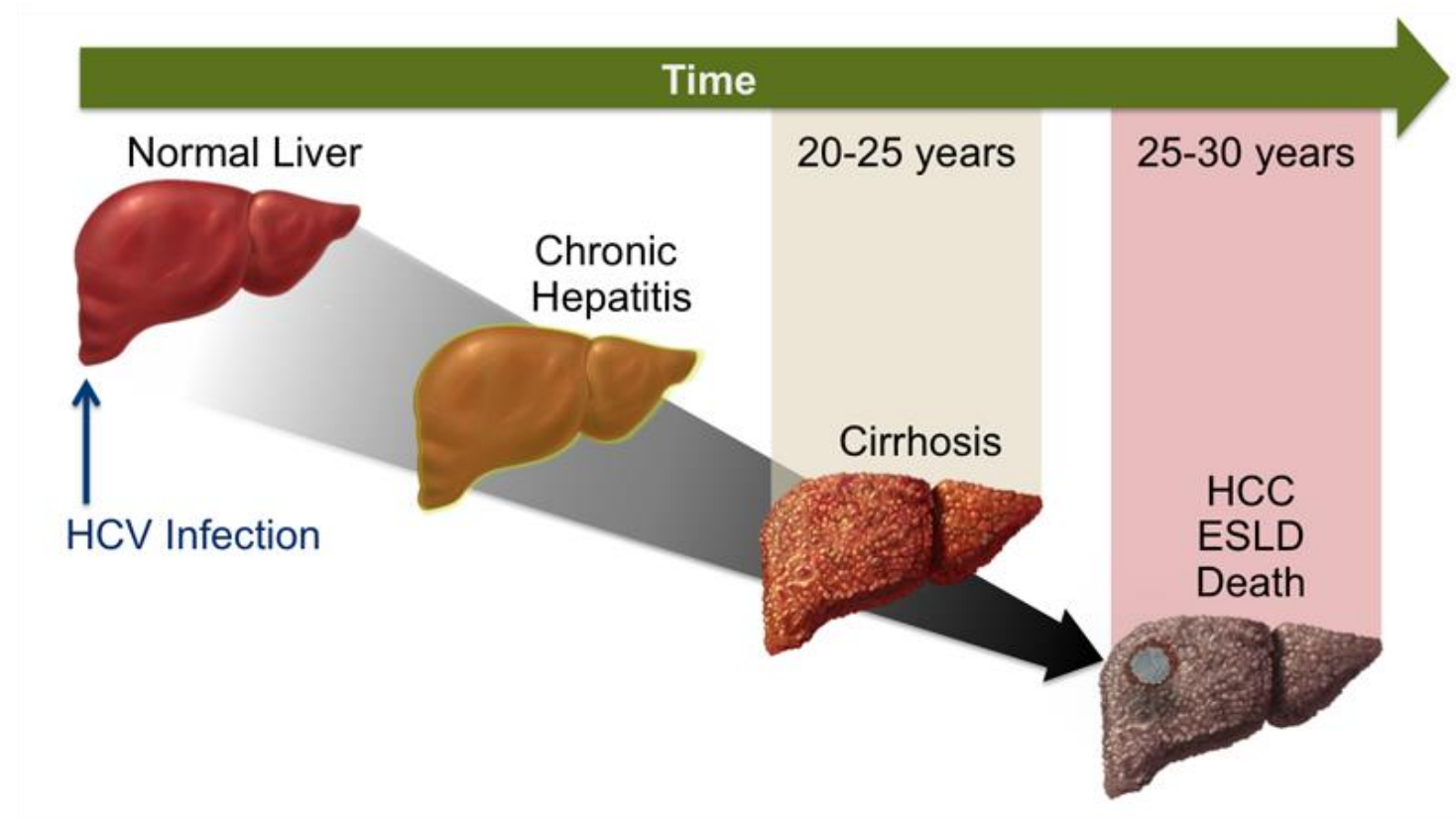


# Hepatitis C Virus (HCV) Infection

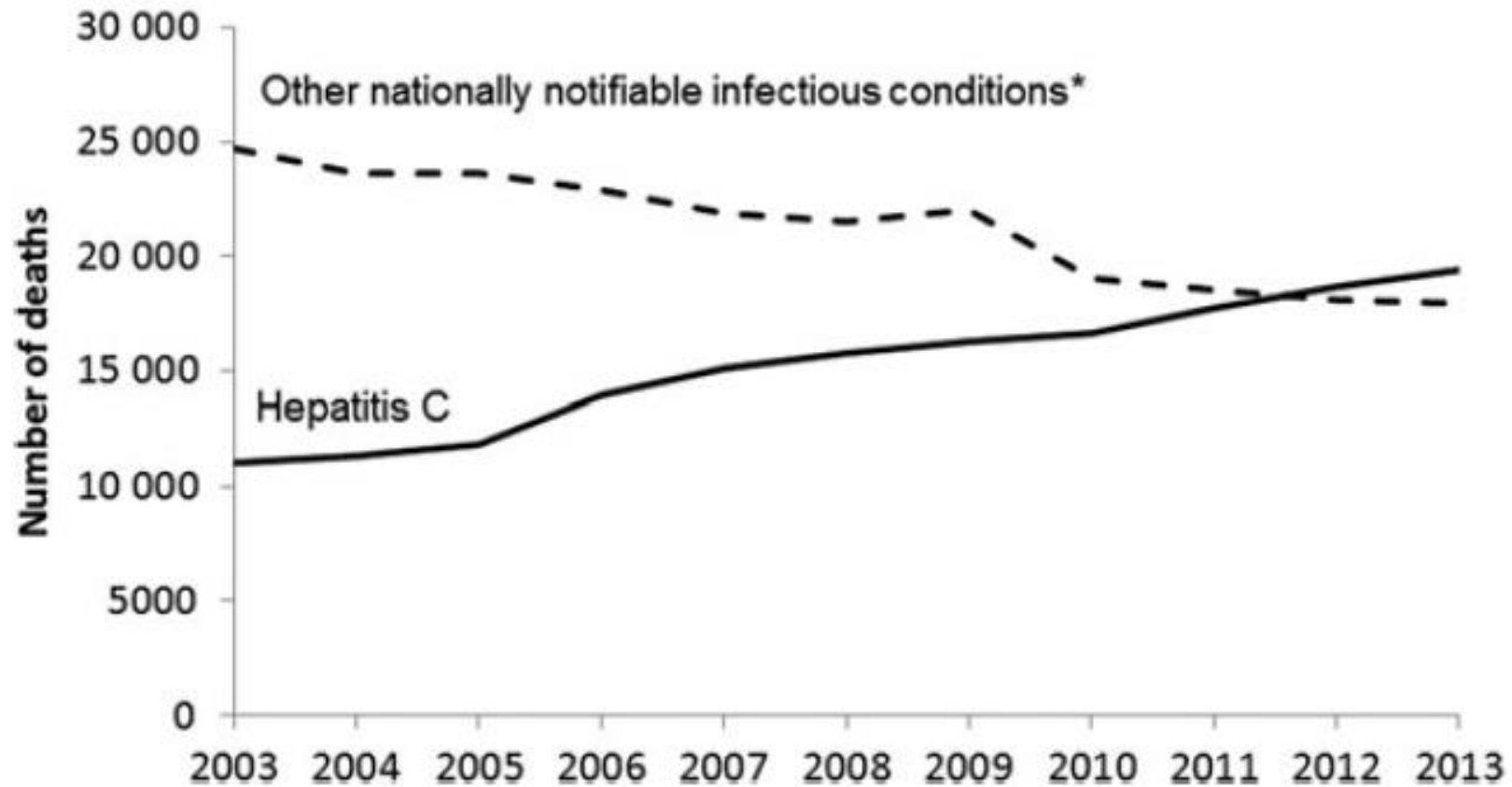


# Hepatitis C Virus (HCV) Infection

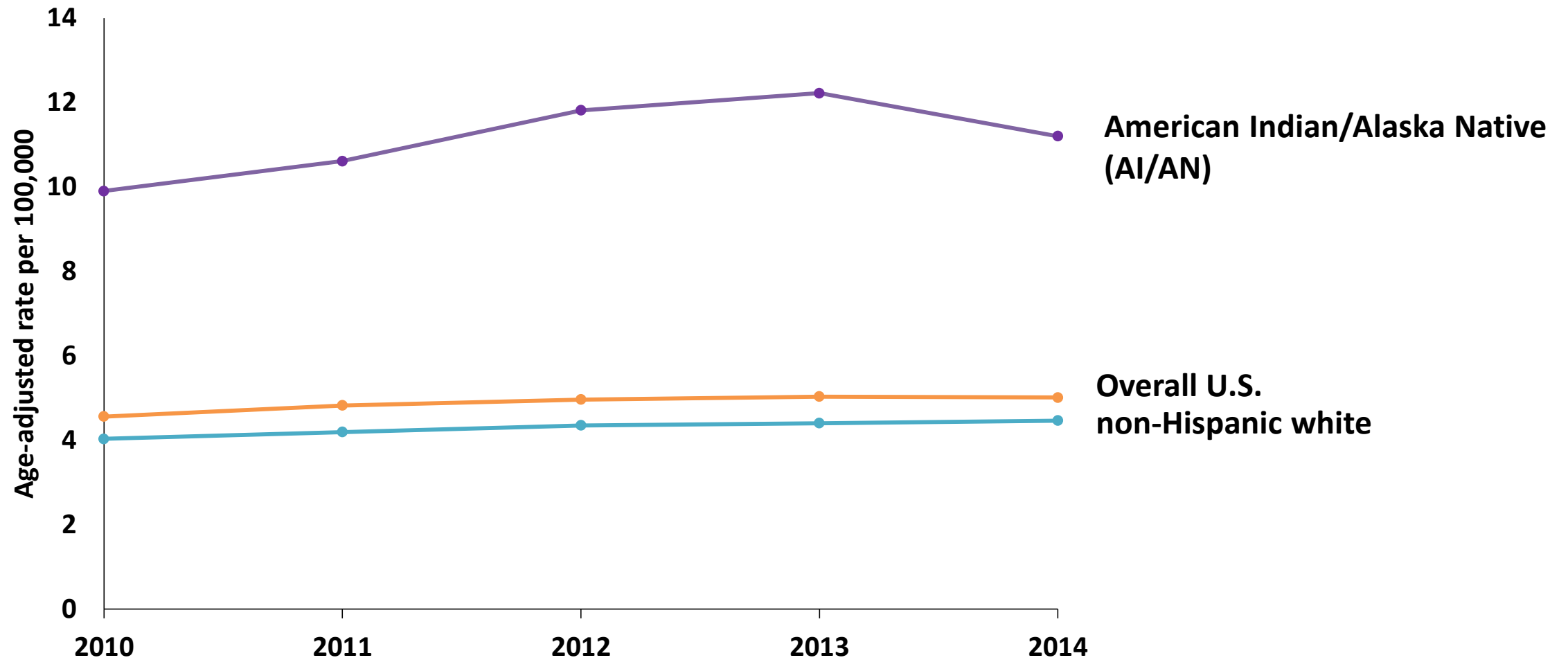
Increased risk of all-cause and non-liver disease related mortality



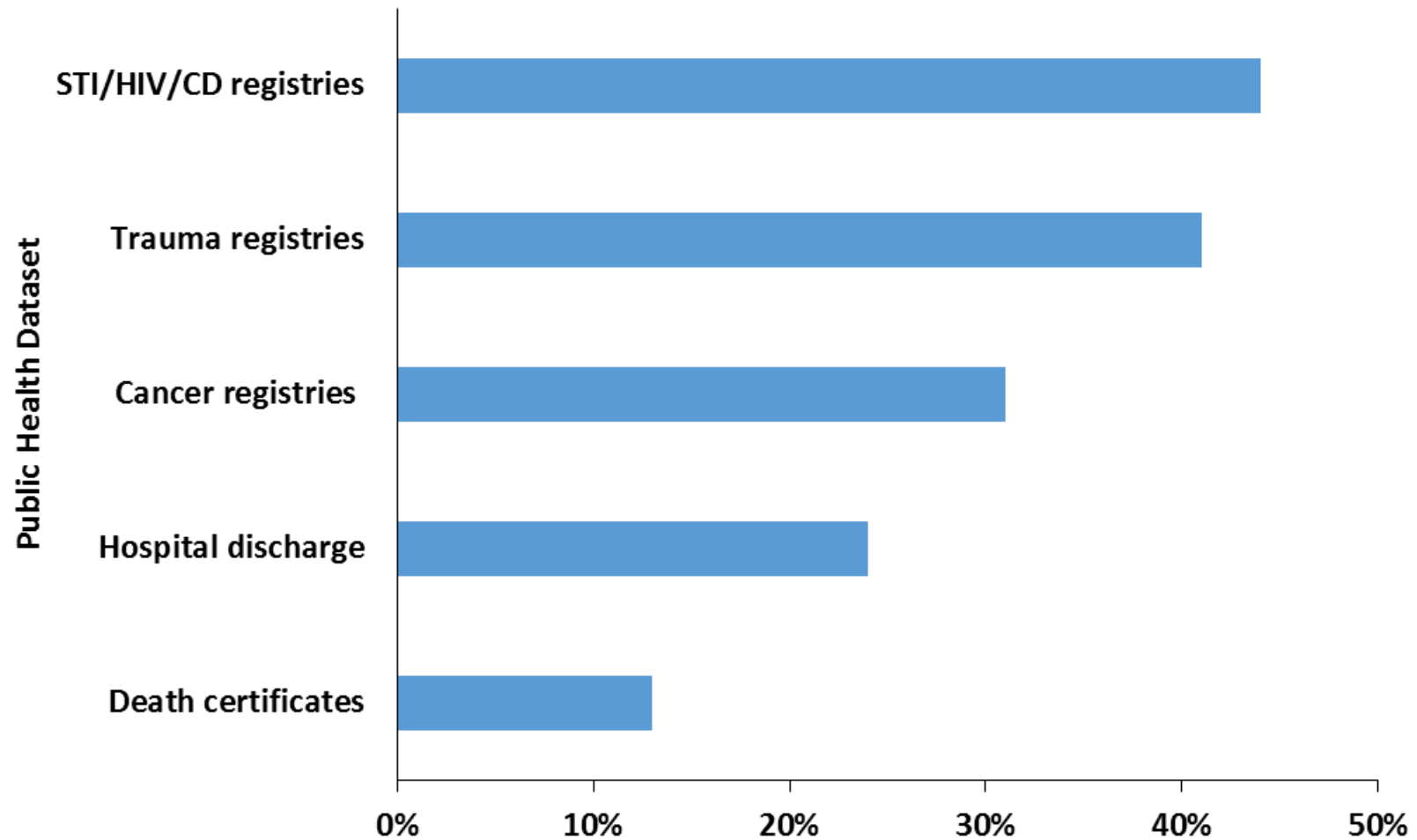
# Hepatitis C Mortality is Increasing in the United States



# Disparity in Hepatitis C Mortality—United States, 2010–2014

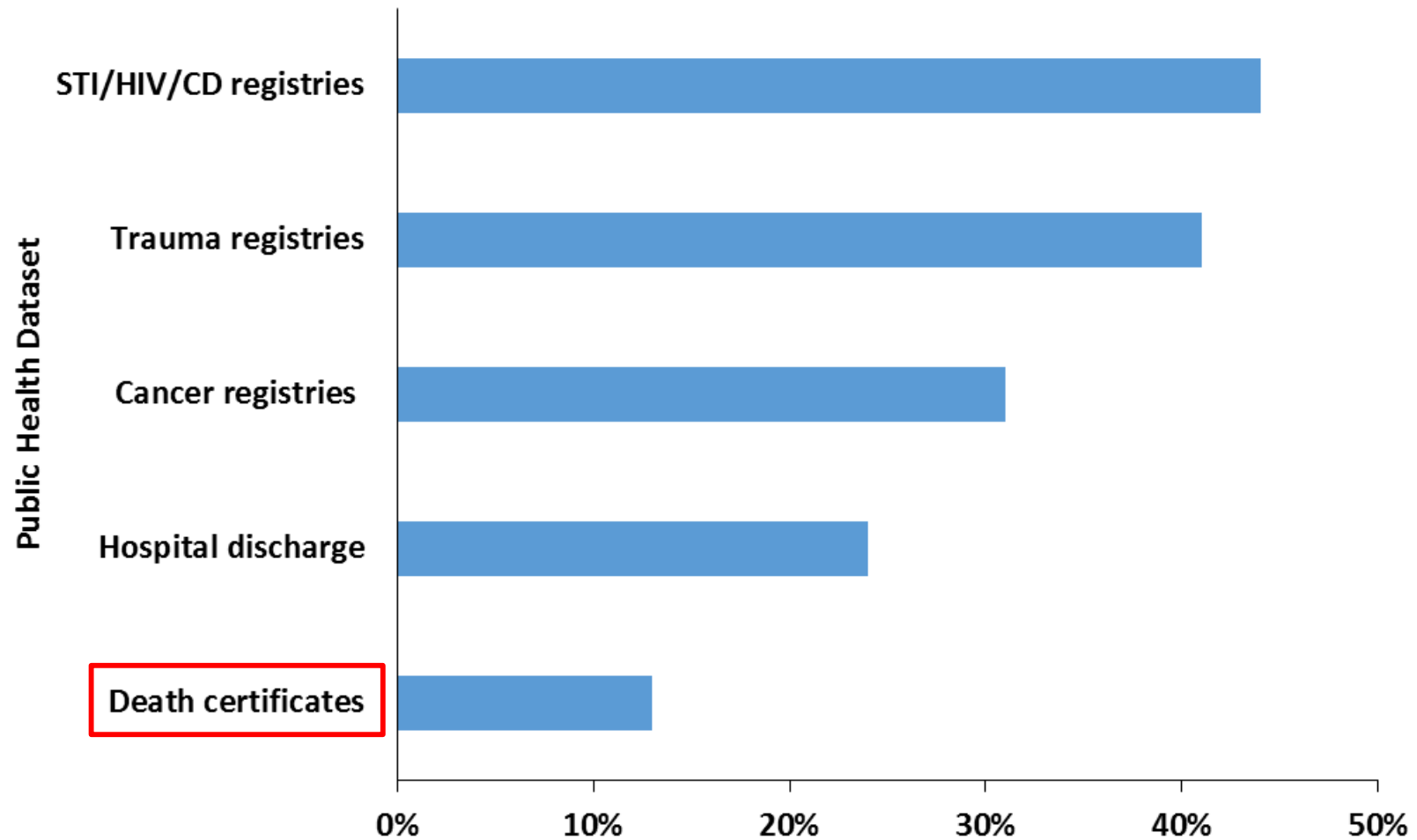


# Racial misclassification





# Racial misclassification



**Assess the health disparity in AI/AN hepatitis C-related mortality in the Northwest**

# Methods

# Methods

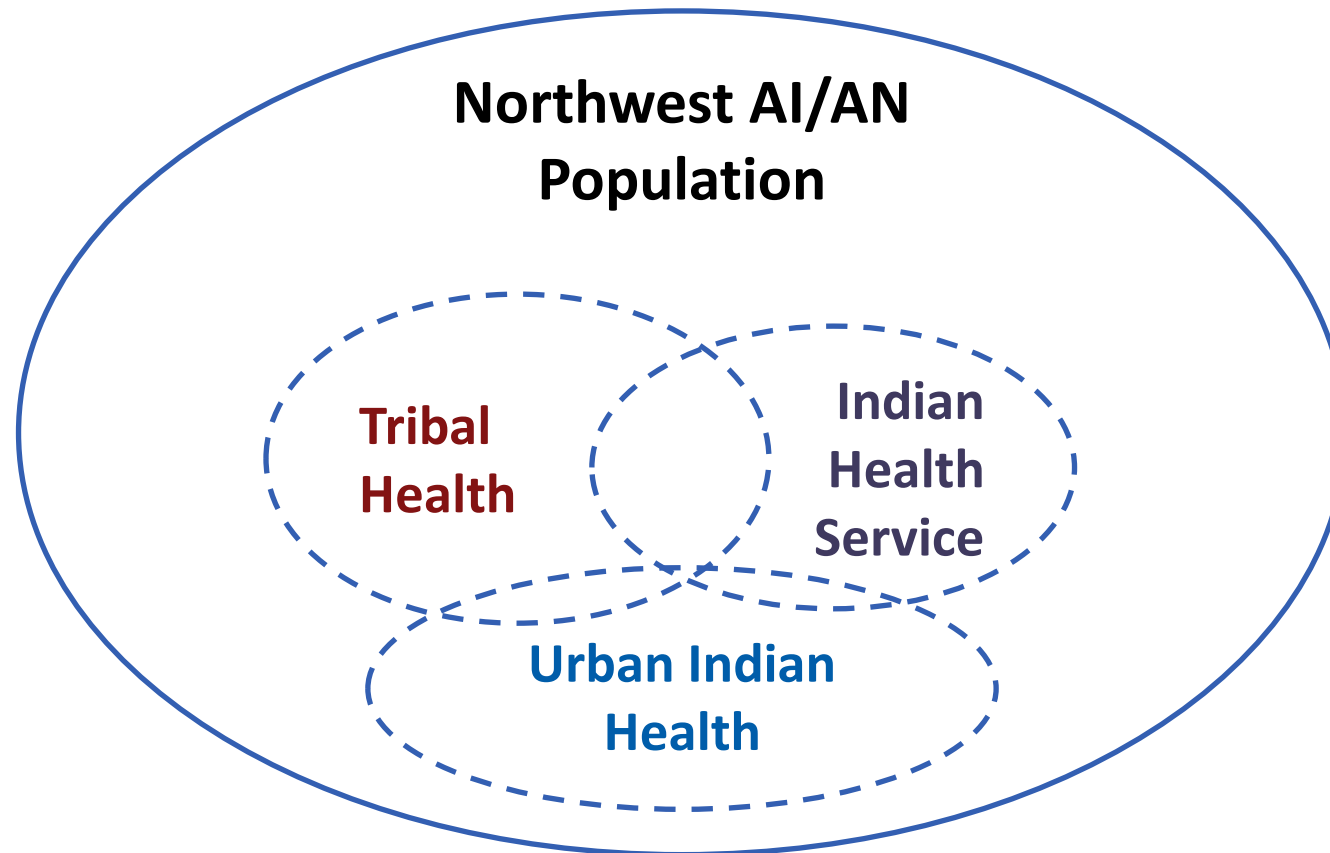
- **Idaho, Oregon, and Washington death certificates, 2006–2012**

# Methods

- Idaho, Oregon, and Washington death certificates, 2006–2012
- **Corrected for racial misclassification using the Northwest Tribal Registry**

# Northwest Tribal Registry

A list of AI/AN patients in the Northwest



# Methods

- Idaho, Oregon, and Washington death certificates, 2006–2012
- **Corrected for racial misclassification using the Northwest Tribal Registry**
  - **LinkPlus software**

# Definition of AI/AN Race

A death certificate record listed as AI/AN alone or in combination in death certificate

OR

A death certificate record matched with a patient in the Northwest Tribal Registry



Photo credit: Erik Kakuska



# AI/AN Race

---

**Death certificate  
race/ethnicity**

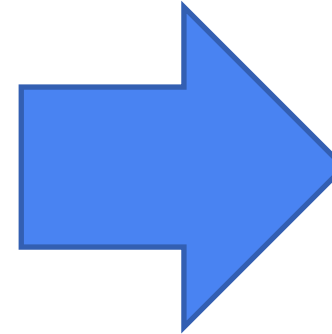
---

**AI/AN**

**Northwest Tribal  
Registry Match?**

---

**No**



---

**Final Dataset  
Race/Ethnicity**

---

**AI/AN**

---

# AI/AN Race

---

Death Certificate Race/Ethnicity	Northwest Tribal Registry Match?
----------------------------------	----------------------------------

---

AI/AN

No

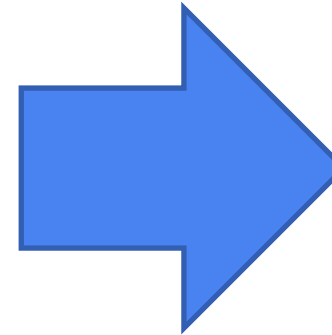
**Non-AI/AN**

**Yes**

**Missing**

**Yes**

---



---

Analytic Dataset Race/Ethnicity
---------------------------------

---

AI/AN

**AI/AN**

**AI/AN**

---

# Hepatitis C-Related Death

International Classification of Diseases, 10<sup>th</sup> Revision codes

---

<b>Underlying or contributing cause of death</b>	<b>ICD-10 code</b>
<b>Acute Hepatitis C</b>	<b>B17.1</b>
<b>Chronic viral Hepatitis C</b>	<b>B18.2</b>

---

# Mortality Rate and Rate Ratio

- Age-adjusted mortality rate for AI/AN and non-Hispanic whites (NHW) separately
- Rate ratio comparing AI/AN mortality rate with NHW mortality rate

# Mortality Rate and Rate Ratio

- Age-adjusted mortality rate for AI/AN and non-Hispanic whites (NHW) separately
- Rate ratio comparing AI/AN mortality rate with NHW mortality rate

$$\text{Rate Ratio (RR)} = \frac{\text{AI/AN age-adjusted mortality rate}}{\text{NHW age-adjusted mortality rate}}$$

# Mortality Rate and Rate Ratio

- Age-adjusted mortality rate for AI/AN and non-Hispanic whites (NHW) separately
- Rate ratio comparing AI/AN mortality rate with NHW mortality rate

$$\text{Rate Ratio (RR)} = \frac{\text{AI/AN age-adjusted mortality rate}}{\text{NHW age-adjusted mortality rate}}$$

RR > 1  Mortality rate greater among AI/AN

# Mortality Rate and Rate Ratio

- Age-adjusted mortality rate for AI/AN and non-Hispanic whites (NHW) separately
- Rate ratio comparing AI/AN mortality rate with NHW mortality rate

$$\text{Rate Ratio (RR)} = \frac{\text{AI/AN age-adjusted mortality rate}}{\text{NHW age-adjusted mortality rate}}$$

RR > 1            Mortality rate greater among AI/AN

RR < 1            Mortality rate greater among NHW

# Mortality Rate and Rate Ratio

- Age-adjusted mortality rate for AI/AN and non-Hispanic whites (NHW) separately
- Rate ratio comparing AI/AN mortality rate with NHW mortality rate

$$\text{Rate Ratio (RR)} = \frac{\text{AI/AN age-adjusted mortality rate}}{\text{NHW age-adjusted mortality rate}}$$

**RR > 1**            Mortality rate greater among AI/AN

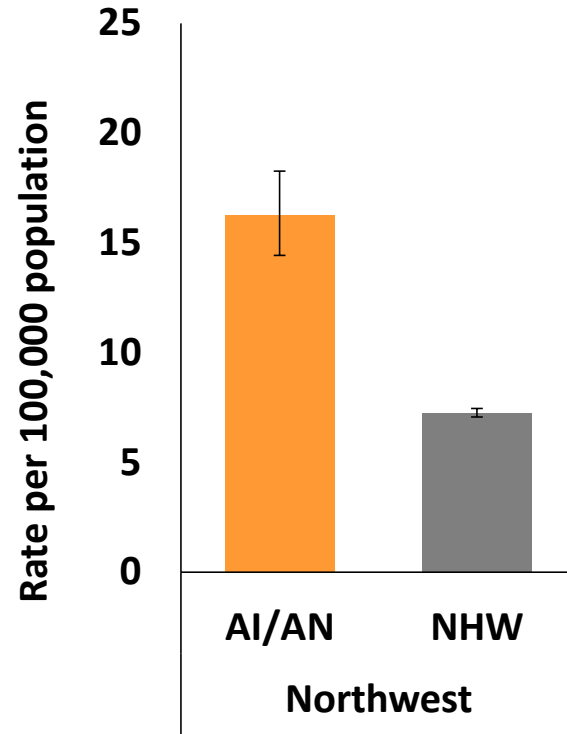
**RR < 1**            Mortality rate greater among NHW

**RR = 1**            No difference



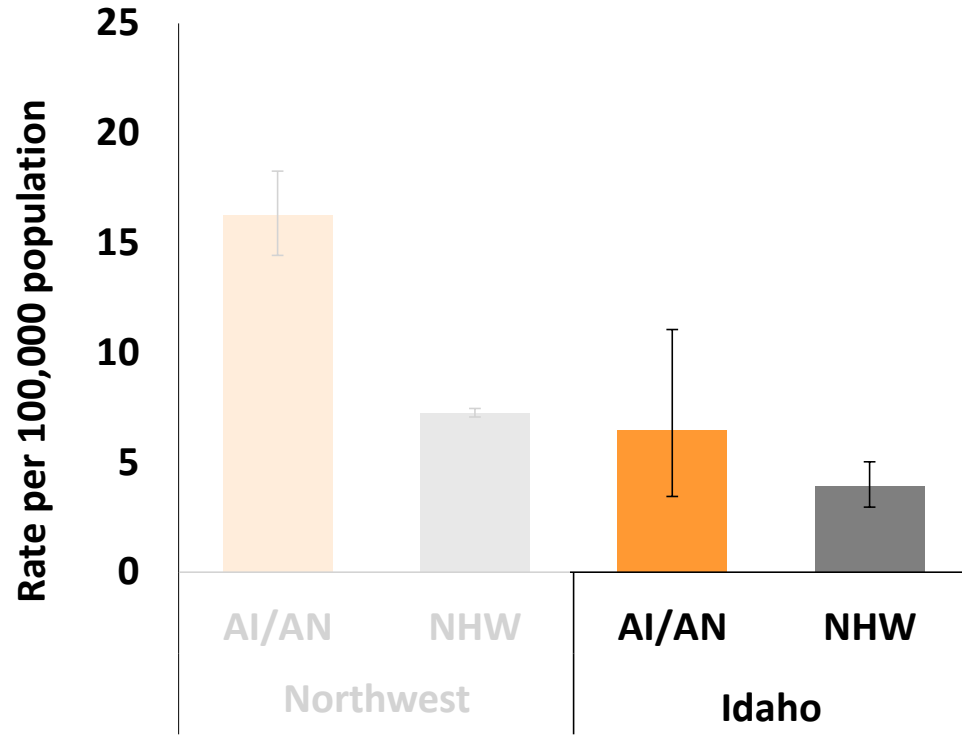
# Results

# Age-adjusted Hepatitis C-related Mortality – Northwest, 2006–2012



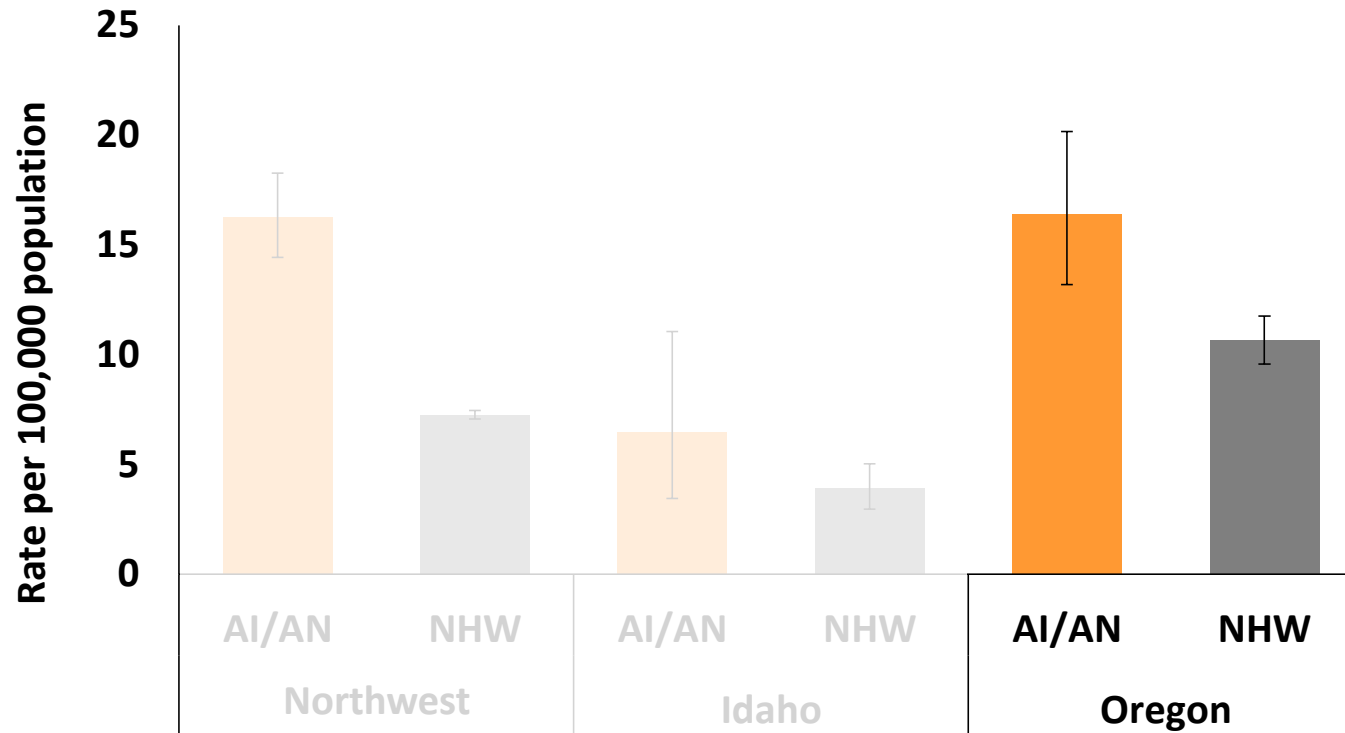
Rate Ratio (95% Confidence Interval) AI/AN : NHW	3.33 (2.96, 3.75)
--	-------------------

# Age-adjusted Hepatitis C-related Mortality – Northwest, 2006–2012



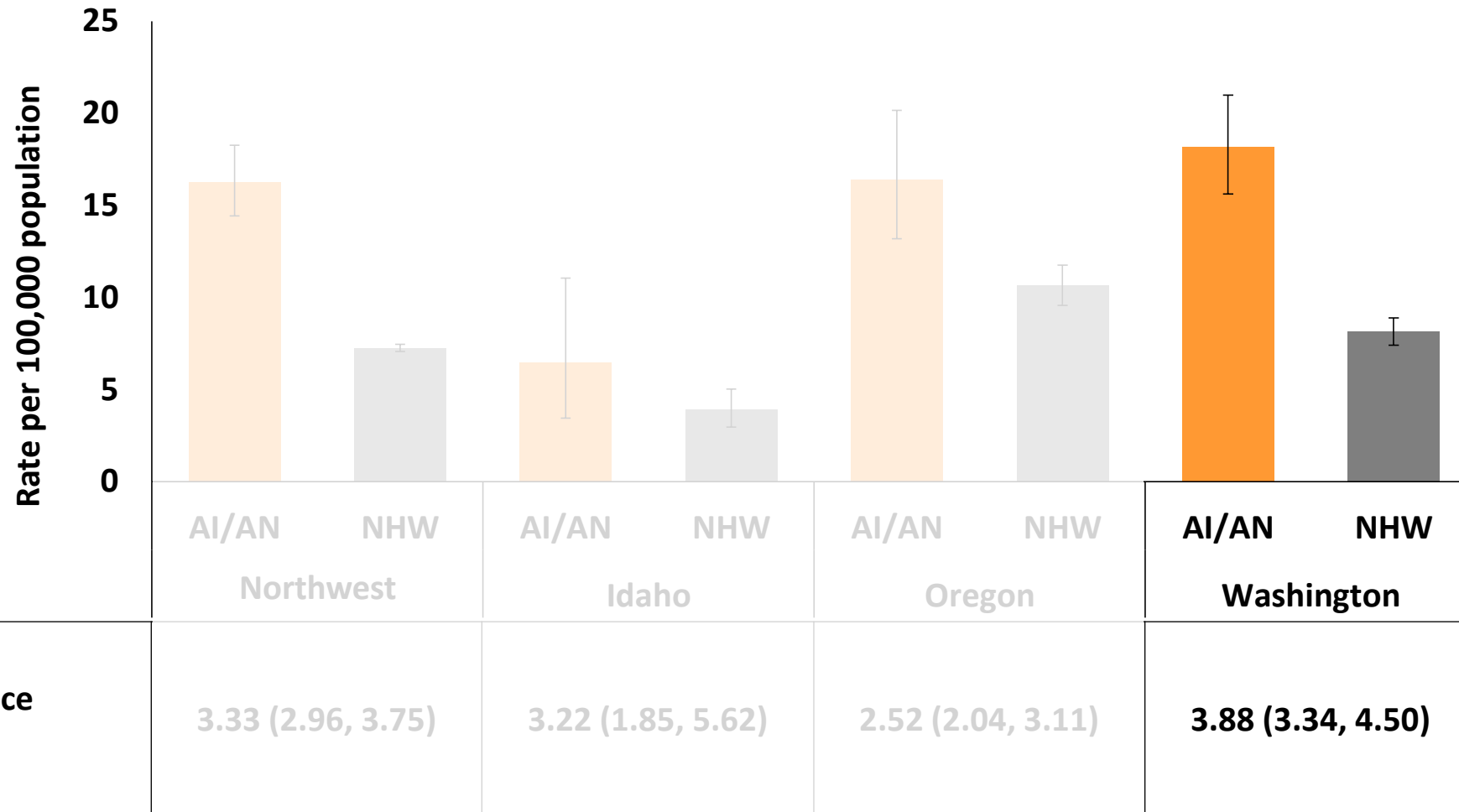
<b>Rate Ratio (95% Confidence Interval) AI/AN : NHW</b>	<b>3.33 (2.96, 3.75)</b>	<b>3.22 (1.85, 5.62)</b>
---	--------------------------	--------------------------

# Age-adjusted Hepatitis C-related Mortality – Northwest, 2006–2012

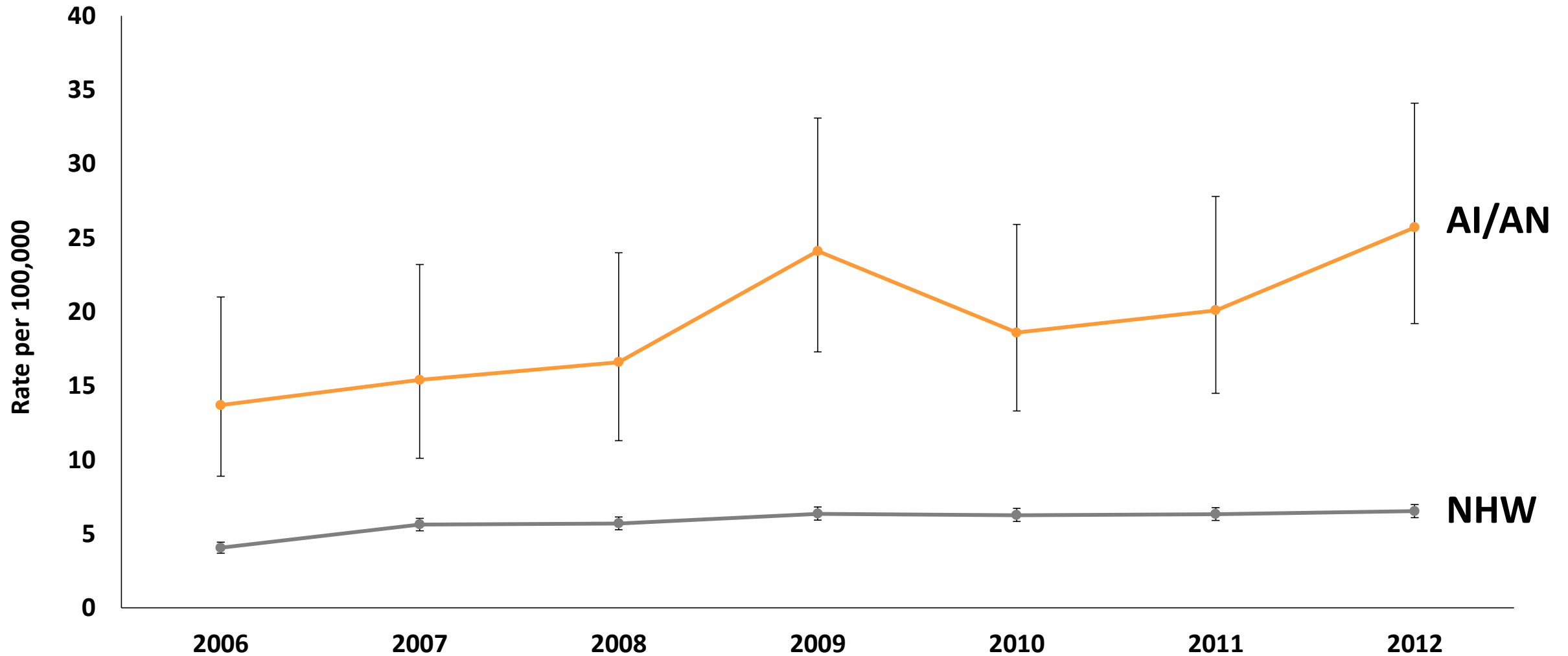


<b>Rate Ratio (95% Confidence Interval) AI/AN : NHW</b>	3.33 (2.96, 3.75)	3.22 (1.85, 5.62)	2.52 (2.04, 3.11)
---	-------------------	-------------------	-------------------

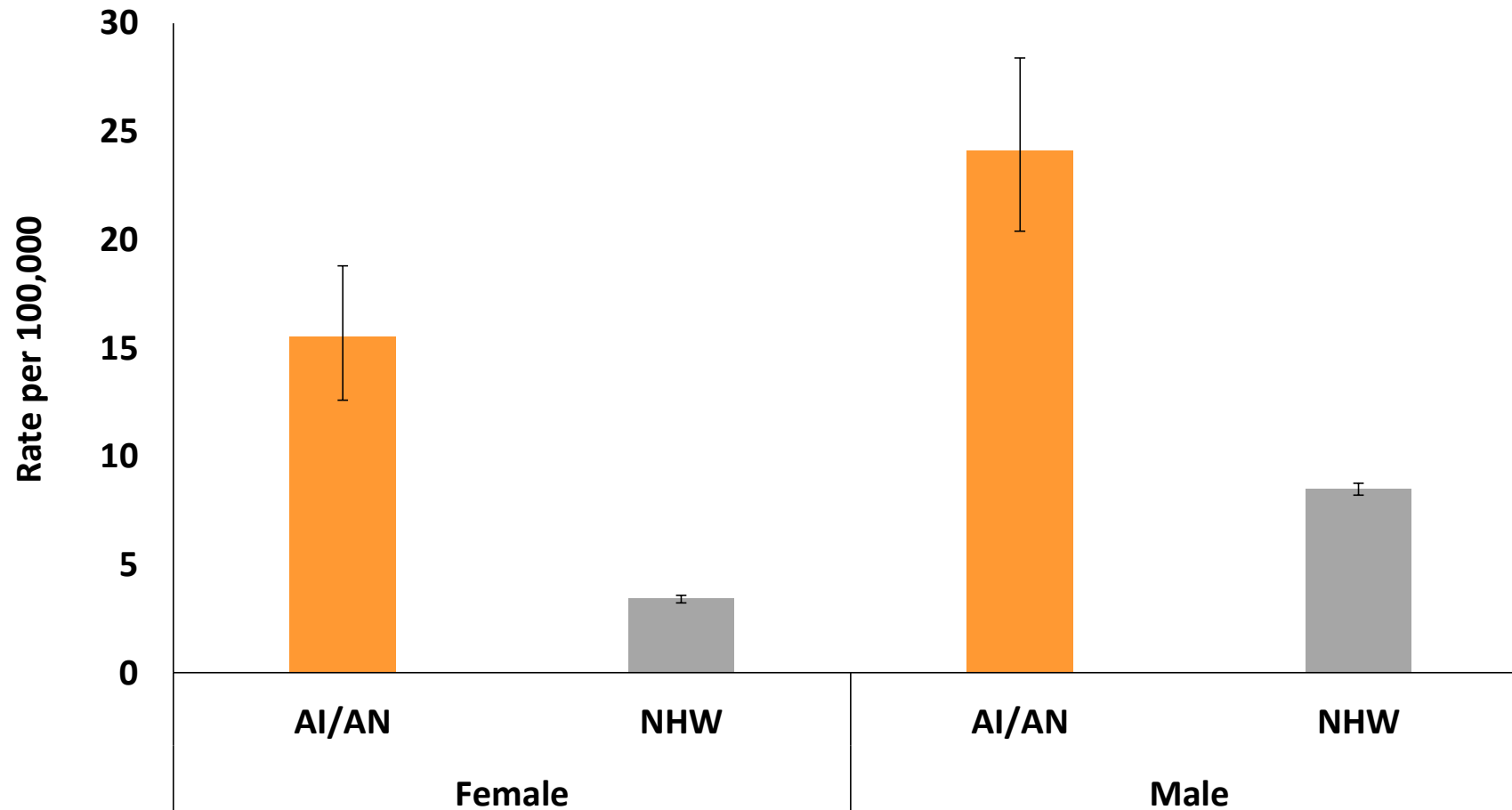
# Age-adjusted Hepatitis C-related Mortality – Northwest, 2006–2012



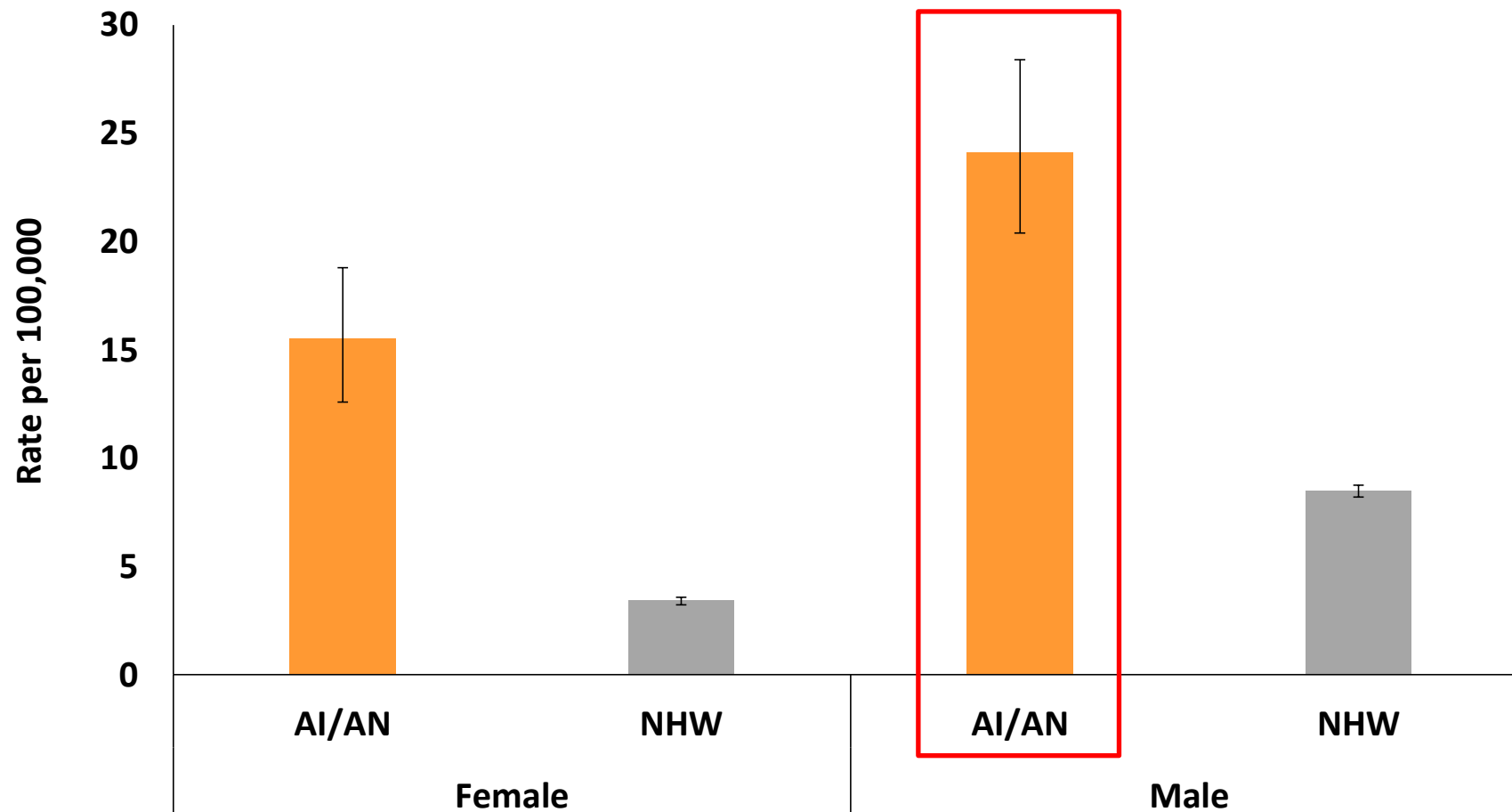
# Age-Adjusted HCV-Related Mortality, 2006–2012



# Age-Adjusted HCV Mortality Rate, Stratified by Sex

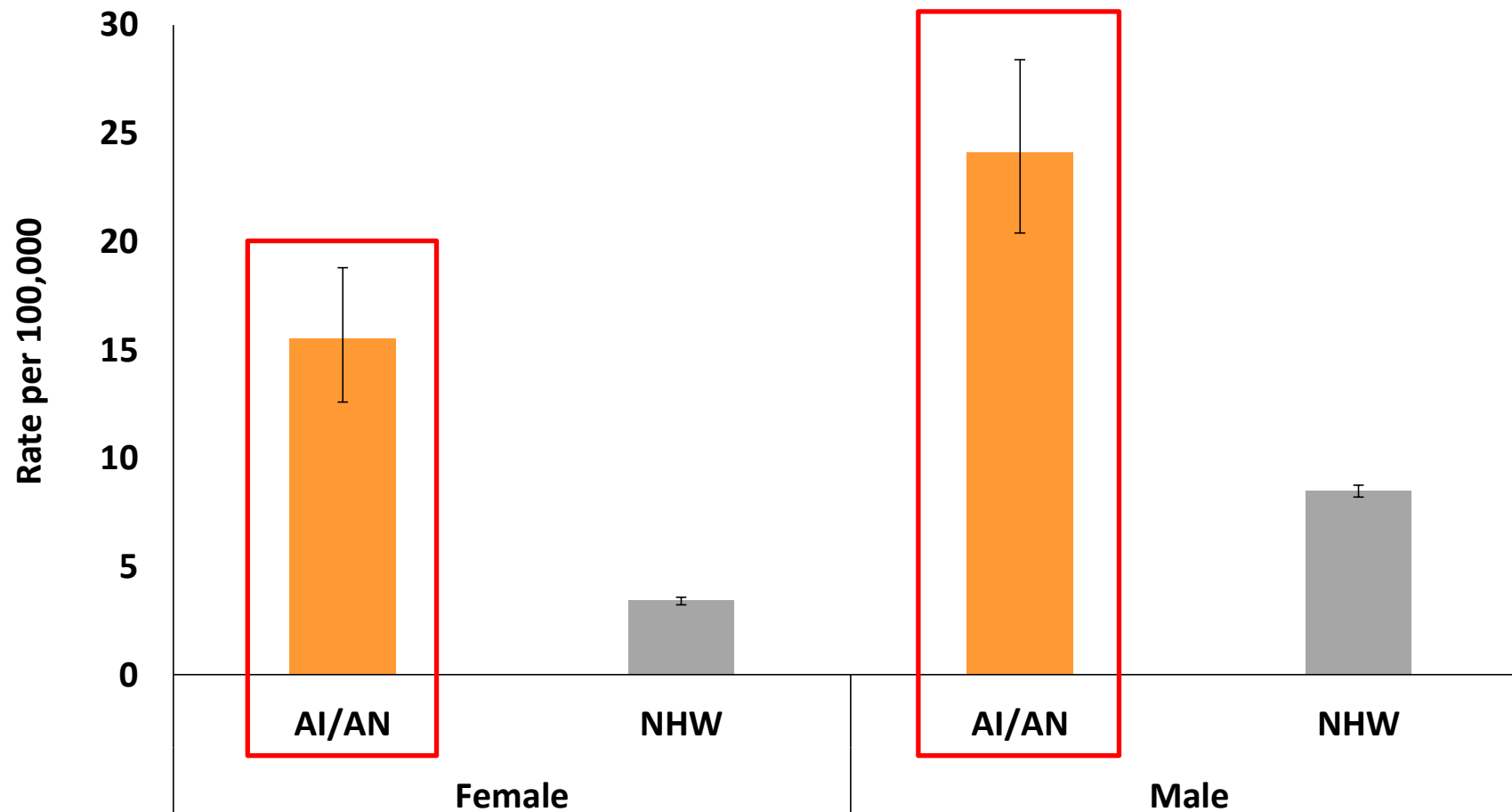


# Age-Adjusted HCV Mortality Rate, Stratified by Sex

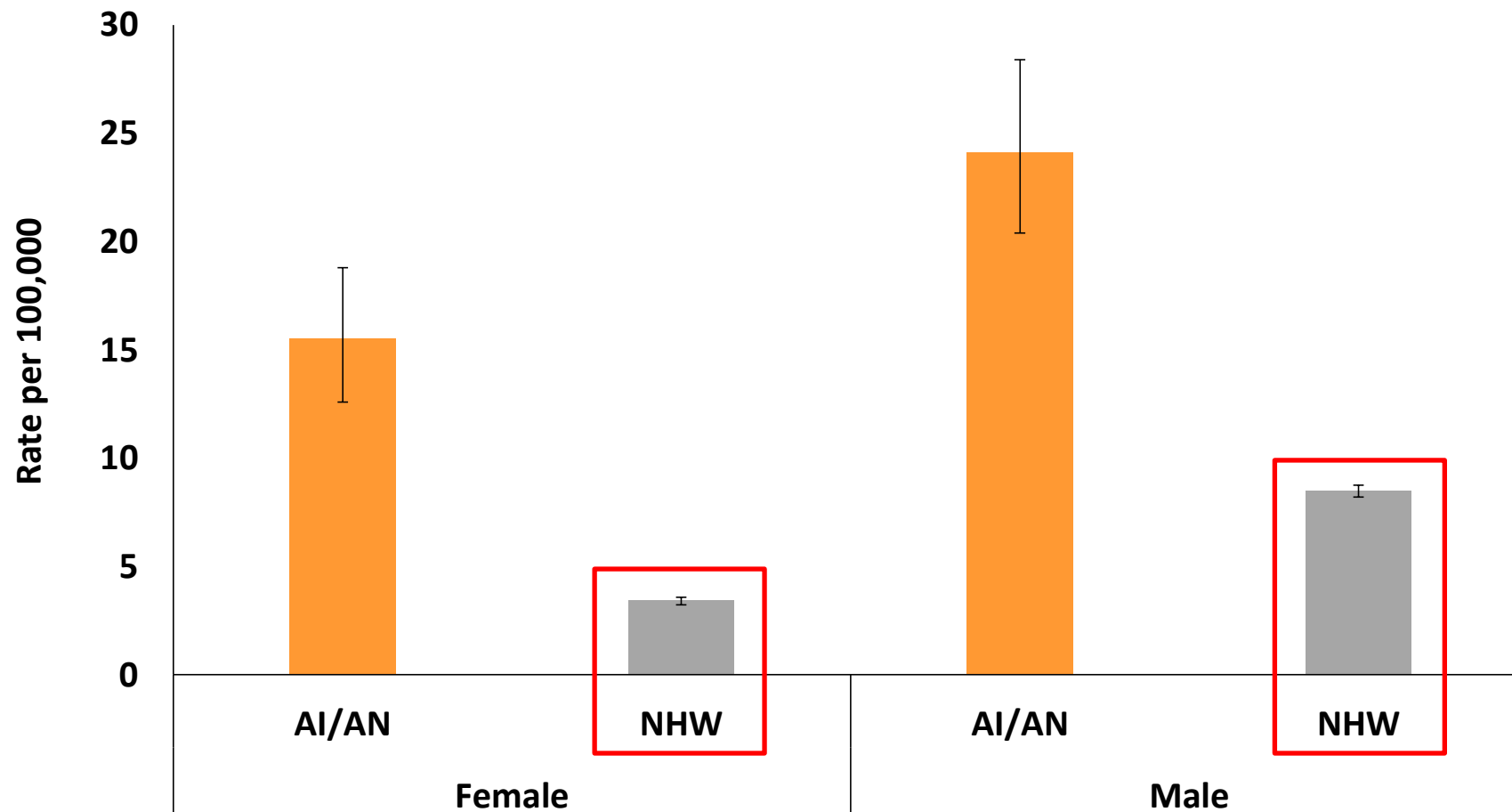




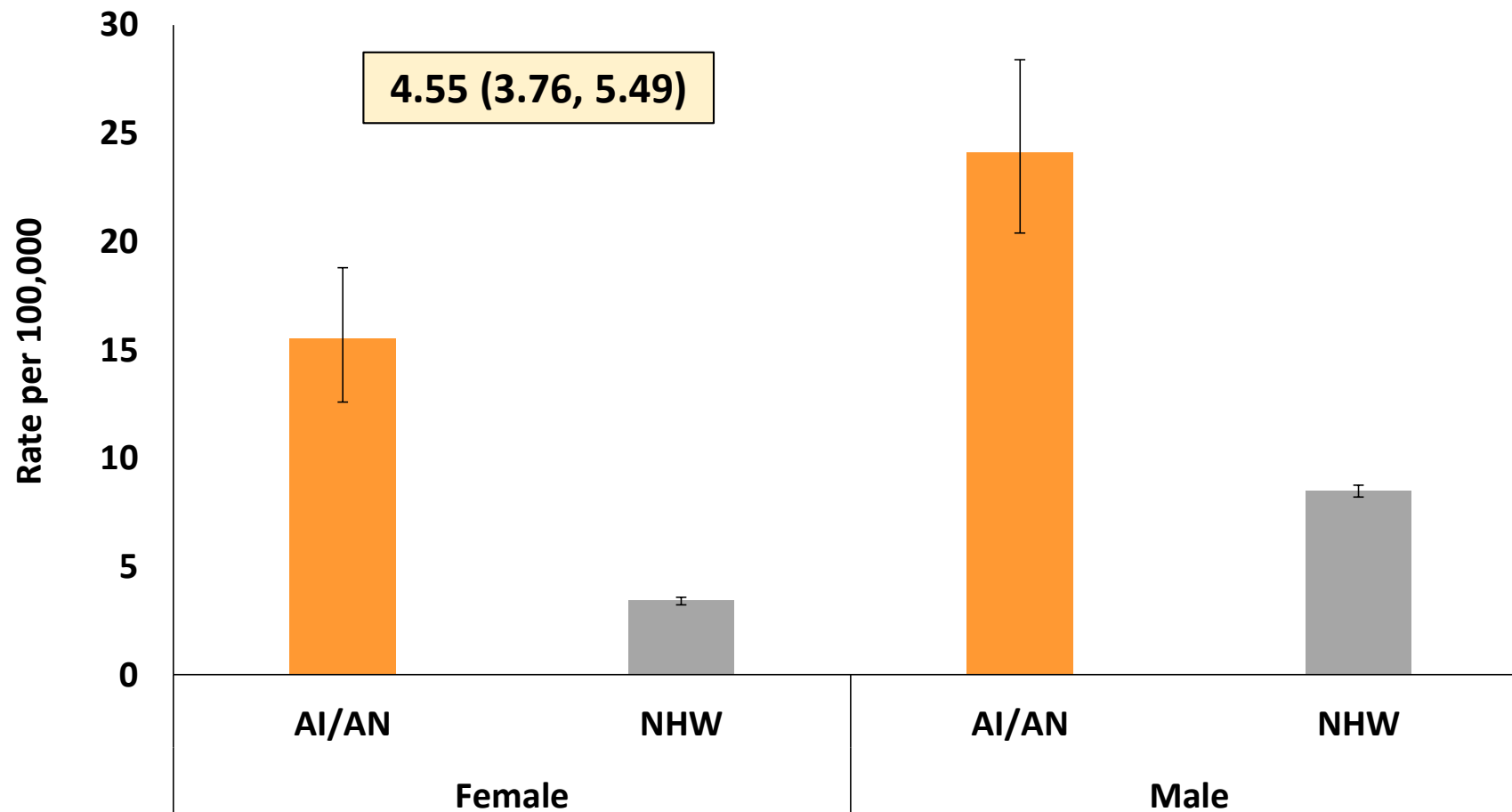
# Age-Adjusted HCV Mortality Rate, Stratified by Sex



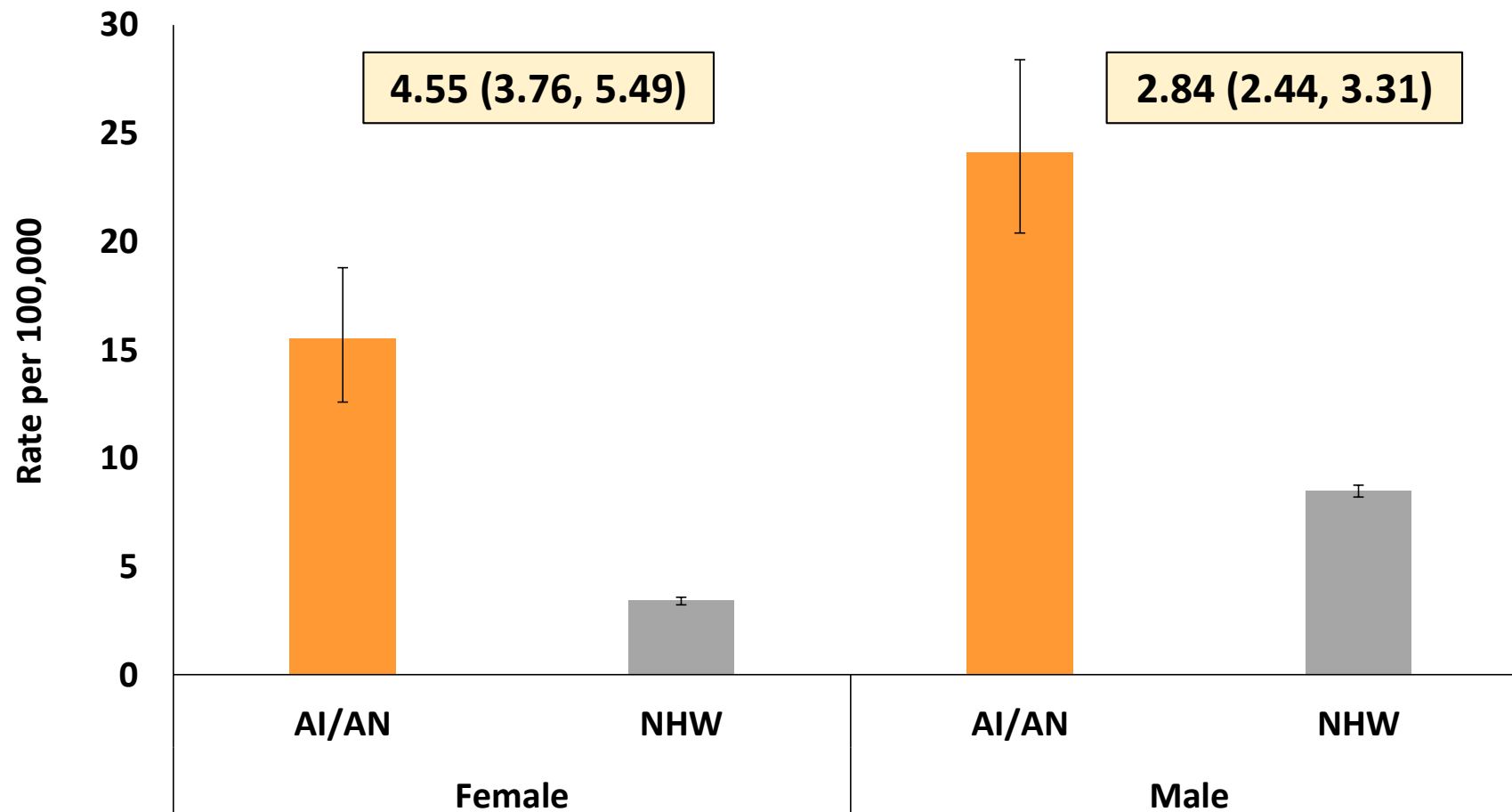
# Age-Adjusted HCV Mortality Rate, Stratified by Sex



# Age-Adjusted HCV Mortality Rate, Stratified by Sex



# Age-Adjusted HCV Mortality Rate, Stratified by Sex



# HCV Outcomes

Cause	AI/AN		NHW		AI/AN:NHW	
	Count (%)	Rate	Count (%)	Rate	Rate Ratio	95% CI
All HCV-related mortality	286 (100)	19.6 (17.3, 22.2)	5358 (100)	5.88 (5.73,6.05)	3.33	(2.96, 3.75)
Liver failure	69 (24.1)	4.53 (3.48, 5.87)	1086 (20.3)	1.18 (1.11, 1.26)	3.83	(3.00, 4.88)
Cirrhosis	96 (33.6)	6.52 (5.31, 8.11)	1622 (30.3)	1.76 (1.68, 1.85)	3.7	(3.01, 4.54)
Other liver disease	23 (8.04)	1.63 (1.00, 2.58)	333 (6.21)	0.37 (0.33, 0.41)	4.4	(2.88, 6.72)
Hepatitis B	10 (3.5)	0.72 (0.32, 1.46)	140 (2.62)	0.16 (0.13, 0.19)	4.55	(2.39, 8.63)
Primary Liver Cancer	35 (12.2)	2.40 (1.63, 3.47)	936 (17.5)	1.00 (0.93, 1.06)	2.41	(1.72, 3.38)
Other liver cancer	2 (0.7)	0.19 (0.02, 0.77)	79 (1.47)	0.09 (0.07, 0.11)	2.17	(0.53, 8.85)
Alcoholic Liver Disease	81 (28.3)	5.29 (4.15, 6.72)	1297 (24.2)	1.43 (1.35, 1.51)	3.7	(2.96, 4.64)

# HCV Outcomes

Cause	AI/AN		NHW		AI/AN:NHW	
	Count (%)	Rate	Count (%)	Rate	Rate Ratio	95% CI
All HCV-related mortality	286 (100)	19.6 (17.3, 22.2)	5358 (100)	5.88 (5.73,6.05)	3.33	(2.96, 3.75)
Liver failure	69 (24.1)	4.53 (3.48, 5.87)	1086 (20.3)	1.18 (1.11, 1.26)	3.83	(3.00, 4.88)
Cirrhosis	96 (33.6)	6.52 (5.31, 8.11)	1622 (30.3)	1.76 (1.68, 1.85)	3.7	(3.01, 4.54)
Other liver disease	23 (8.04)	1.63 (1.00, 2.58)	333 (6.21)	0.37 (0.33, 0.41)	4.4	(2.88, 6.72)
Hepatitis B	10 (3.5)	0.72 (0.32, 1.46)	140 (2.62)	0.16 (0.13, 0.19)	4.55	(2.39, 8.63)
Primary Liver Cancer	35 (12.2)	2.40 (1.63, 3.47)	936 (17.5)	1.00 (0.93, 1.06)	2.41	(1.72, 3.38)
Other liver cancer	2 (0.7)	0.19 (0.02, 0.77)	79 (1.47)	0.09 (0.07, 0.11)	2.17	(0.53, 8.85)
Alcoholic Liver Disease	81 (28.3)	5.29 (4.15, 6.72)	1297 (24.2)	1.43 (1.35, 1.51)	3.7	(2.96, 4.64)

# HCV Outcomes

Cause	AI/AN		NHW		AI/AN:NHW	
	Count (%)	Rate	Count (%)	Rate	Rate Ratio	95% CI
All HCV-related mortality	286 (100)	19.6 (17.3, 22.2)	5358 (100)	5.88 (5.73,6.05)	3.33	(2.96, 3.75)
Liver failure	69 (24.1)	4.53 (3.48, 5.87)	1086 (20.3)	1.18 (1.11, 1.26)	3.83	(3.00, 4.88)
Cirrhosis	96 (33.6)	6.52 (5.31, 8.11)	1622 (30.3)	1.76 (1.68, 1.85)	3.7	(3.01, 4.54)
Other liver disease	23 (8.04)	1.63 (1.00, 2.58)	333 (6.21)	0.37 (0.33, 0.41)	4.4	(2.88, 6.72)
Hepatitis B	10 (3.5)	0.72 (0.32, 1.46)	140 (2.62)	0.16 (0.13, 0.19)	4.55	(2.39, 8.63)
Primary Liver Cancer	35 (12.2)	2.40 (1.63, 3.47)	936 (17.5)	1.00 (0.93, 1.06)	2.41	(1.72, 3.38)
Other liver cancer	2 (0.7)	0.19 (0.02, 0.77)	79 (1.47)	0.09 (0.07, 0.11)	2.17	(0.53, 8.85)
Alcoholic Liver Disease	81 (28.3)	5.29 (4.15, 6.72)	1297 (24.2)	1.43 (1.35, 1.51)	3.7	(2.96, 4.64)

# Limitations

Death certificates might underestimate HCV mortality



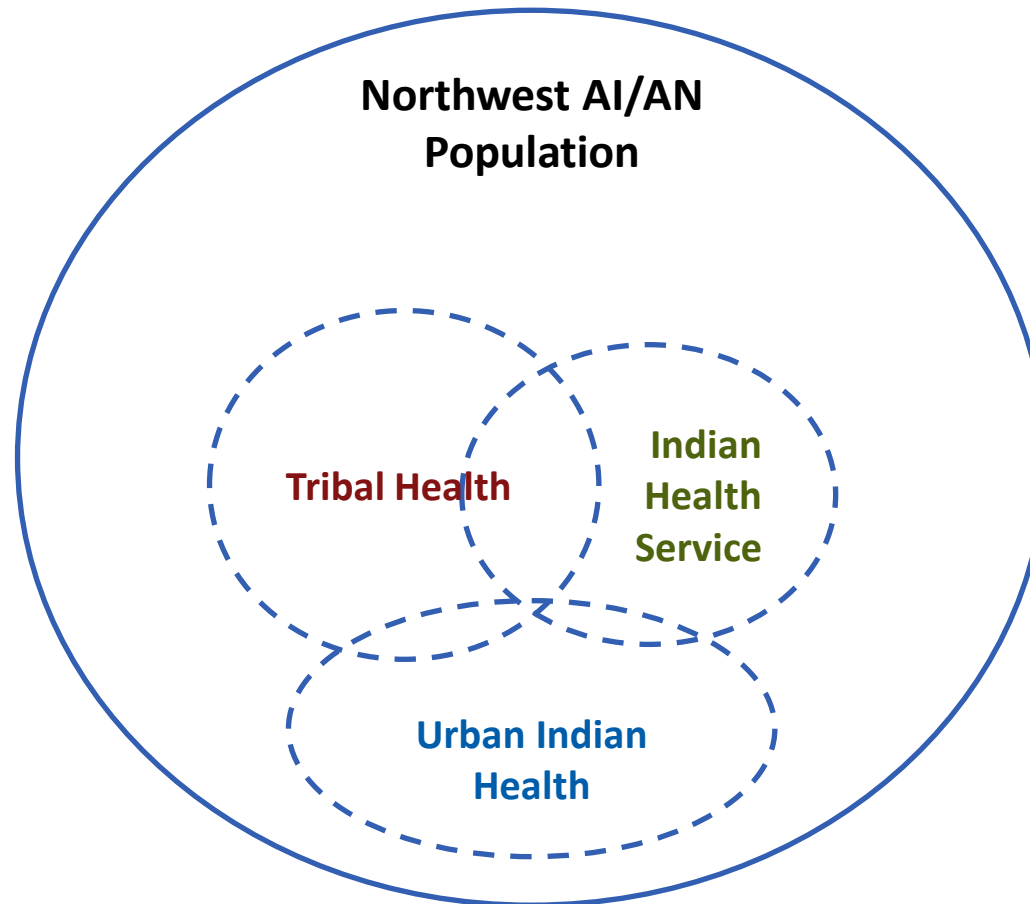
# Limitations

Death certificates may underestimate HCV mortality

20%

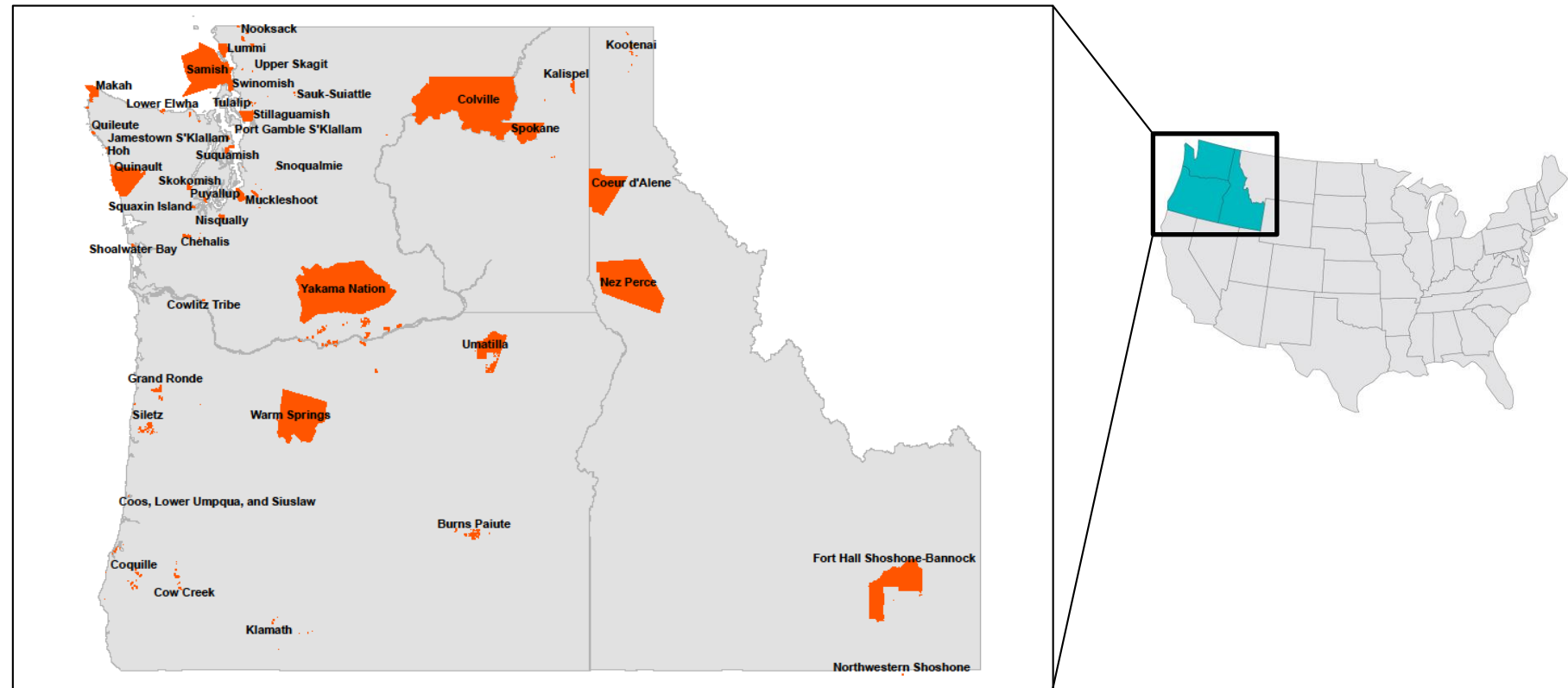
# Limitations

## Representativeness of Northwest Tribal Registry



# Strengths

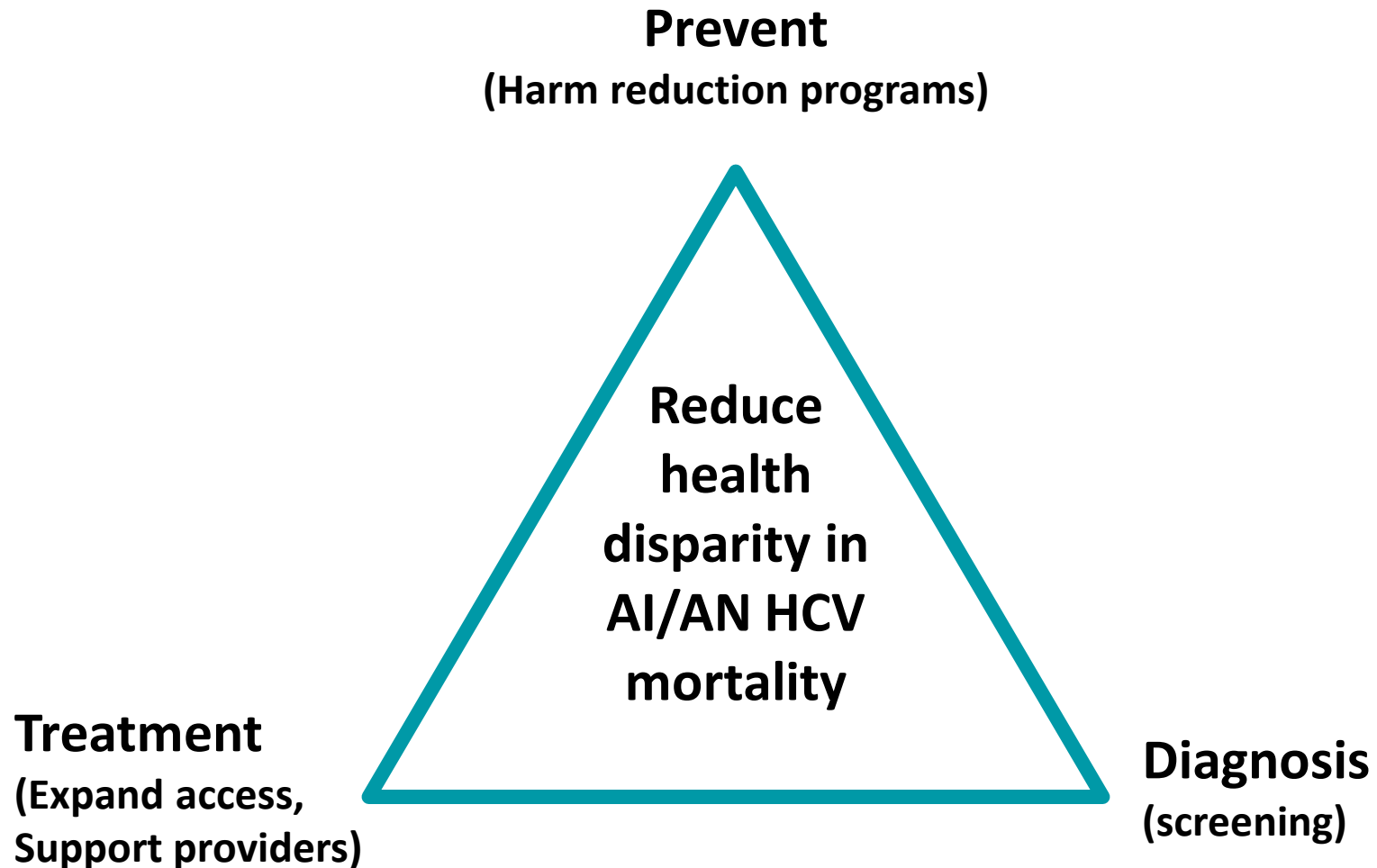
- Regional analysis
- Data source



# Conclusion

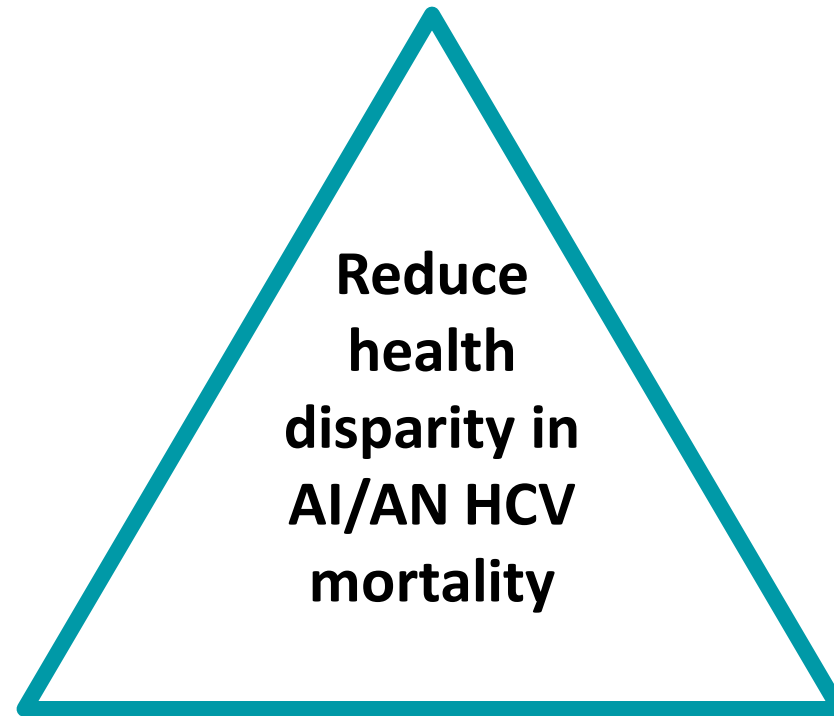
- **HCV-related mortality is greater among American Indian/Alaska Natives compared with non-Hispanic whites**
- **Health disparity persists over time**

# Recommendations



# Recommendations

**Prevent**  
(Harm reduction programs)



# Recommendations

**Prevent**  
(Harm reduction programs)



**Diagnosis**  
(screening)

# Recommendations

**Prevent**  
(Harm reduction programs)

**Reduce  
health  
disparity in  
AI/AN HCV  
mortality**

**Diagnosis**  
(screening)

**Treatment**  
(Expand access,  
Support providers)





## Acknowledgments

Patients and families of the Tribes of Idaho, Oregon, and Washington.

### IHS

CAPT Tom Weiser, MD, MPH\*

### NPAIHB/NWTEC

Tom Becker, MD, PhD

Victoria Warren-Mears, PhD

Sujata Joshi, MSPH\*

Jessica Leston, MPH

David Stephens, BSN, RN

\*co-authors

### CDC

Larry Cohen, MD, MPH

Byron Robinson, PhD

Scott Holmberg, MD, MPH

Kathleen Ly, MPH

### Photo credits:

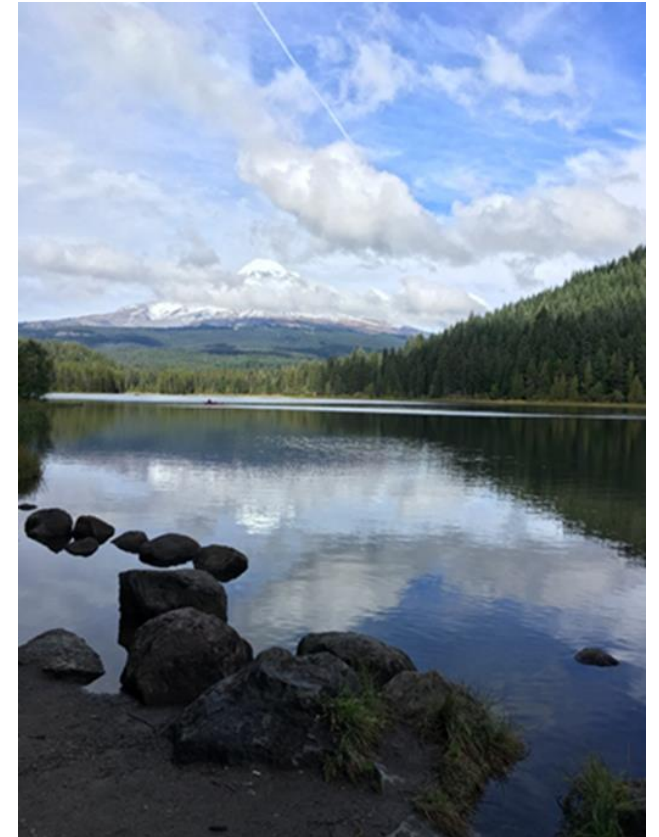
Erik Kakuska (NPAIHB)

NPAIHB

### Contact:

Sarah Hatcher

[lxj9@cdc.gov](mailto:lxj9@cdc.gov) | [shatcher@npaihb.org](mailto:shatcher@npaihb.org)



*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.*

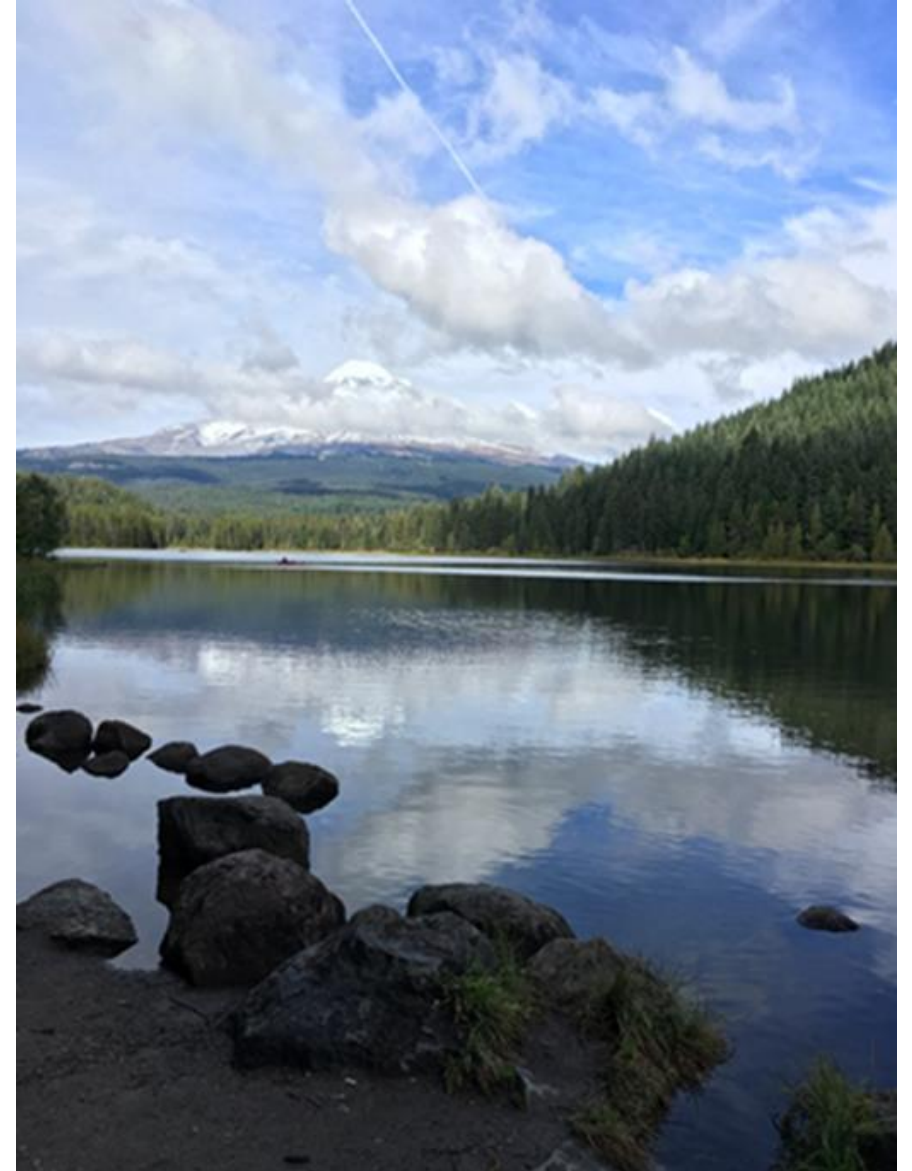


**NPAIHB**

*Indian Leadership for Indian Health*

# Image sources

- University of Washington, Hepatitis C Online
- Department of Health and Human Services:  
<https://www.hhs.gov/about/budget/fy2017/budget-in-brief/ihs/index.html>



**Extra slides**

# Age-Specific Rates

	AI/AN			NHW			AI/AN:NHW
	n	Rate (95% CI)	Rate Ratios (95% CI)	n	Rate (95% CI)	Rate Ratios (95% CI)	Rate Ratios (95% CI)
<b>Northwest</b>							
≤44	29	2.25 (1.51, 3.23)	Ref	216	0.50 (0.43, 0.57)	Ref	4.50 (3.05, 6.63)
45-54	107	48.6 (39.9, 58.8)	21.6 (14.3, 32.6)	1604	14.9 (14.1, 15.6)	29.8 (25.9, 34.4)	3.26 (2.68, 3.97)
55-64	108	72.1 (59.2, 87.1)	32.0 (21.3, 48.3)	2675	28.3 (27.2, 29.4)	56.6 (49.3, 65.0)	2.55 (2.10, 3.09)
≥65	42	41.7 (30.0, 56.4)	18.5 (11.6, 29.8)	863	8.63 (8.06, 9.22)	17.3 (14.9, 20.0)	2.25 (1.65, 3.07)

# Age-Adjusted Mortality Rate Calculation

## Numerator

- **HCV-related deaths**
  - **AI/AN and non-Hispanic whites (NHW)**

# Mortality Rate Calculation

## Numerator

- HCV-related mortality rates and 95% confidence intervals
  - AI/AN and non-Hispanic whites (NHW)

## Denominator

- **National Center for Health Statistics bridged race estimates**

# Mortality Rate Calculation

## Numerator

- HCV-related mortality rates and 95% confidence intervals
  - AI/AN and non-Hispanic whites (NHW)

## Denominator

- National Center for Health Statistics bridged race estimates

## Standardized to the U.S. 2000 standard population

- 2006—2012 aggregate and annual

# Age-Specific Rates

	AI/AN			NHW		
	n	Rate (95% CI)	Rate Ratios (95% CI)	n	Rate (95% CI)	Rate Ratios (95% CI)
<b>Northwest</b>						
≤44	29	2.25 (1.51, 3.23)	Ref	216	0.50 (0.43, 0.57)	Ref
45-54	107	48.6 (39.9, 58.8)	21.6 (14.3, 32.6)	1604	14.9 (14.1, 15.6)	29.8 (25.9, 34.4)
55-64	108	72.1 (59.2, 87.1)	32.0 (21.3, 48.3)	2675	28.3 (27.2, 29.4)	56.6 (49.3, 65.0)
≥65	42	41.7 (30.0, 56.4)	18.5 (11.6, 29.8)	863	8.63 (8.06, 9.22)	17.3 (14.9, 20.0)
<b>Oregon</b>						
≤44	13	3.25 (1.73, 5.56)	Ref	19	0.95 (0.57, 1.49)	Ref
45-54	34	49.0 (33.9, 68.5)	15.1 (8.0, 28.6)	93	19.6 (15.8, 24.0)	20.6 (12.6, 33.8)
55-64	33	68.7 (47.3, 96.5)	21.1 (11.1, 40.2)	202	40.5 (35.1, 46.5)	42.6 (26.6, 68.2)
≥65	10	31.8 (15.2, 58.4)	9.78 (4.29, 22.3)	60	10.8 (8.25, 13.9)	11.4 (6.8, 19.0)
<b>Washington</b>						
≤44	15	2.03 (1.13, 3.35)	Ref	10	0.30 (0.14, 0.55)	Ref
45-54	67	53.1 (41.2, 67.5)	26.2 (14.9, 45.8)	104	12.6 (10.3, 15.3)	42.0 (22.0, 80.4)
55-64	71	83.1 (64.9, 104.9)	40.9 (23.5, 71.5)	247	31.7 (27.9, 36.0)	105.7 (56.2, 198.8)
≥65	30	52.1 (35.1, 74.5)	25.7 (13.8, 47.7)	107	13.0 (10.7, 15.7)	43.3 (22.7, 82.9)



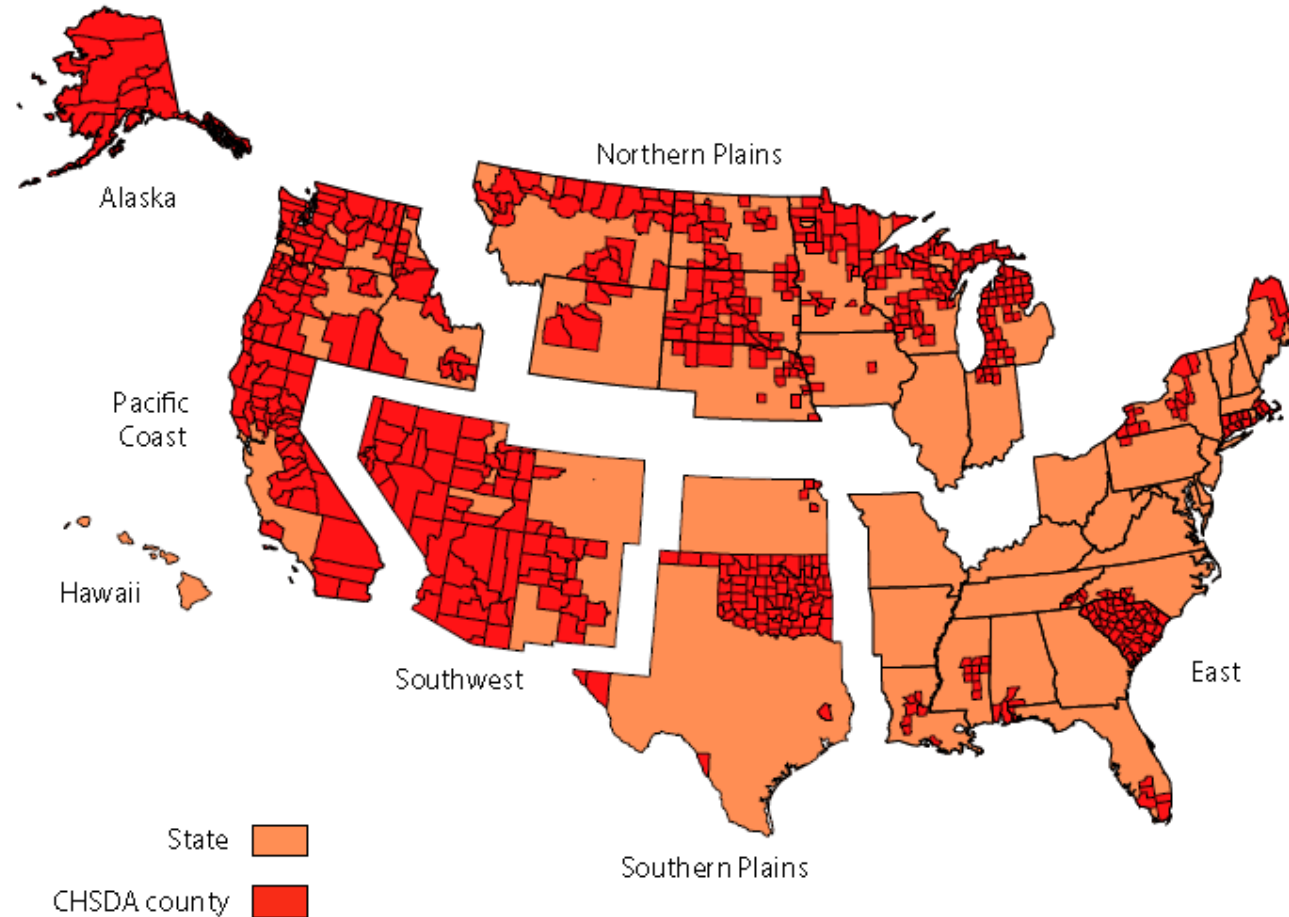
# Sex-stratified age-adjusted HCV-related mortality

	AI/AN			NHW		
	n	Rate	95% CI	n	Rate	95% CI
3-State Overall	286	19.6	(17.3, 22.2)	5358	5.88	(5.73, 6.05)
Female	116	15.5	(12.6, 18.8)	1559	3.41	(3.24, 3.59)
Male	170	24.1	(20.4, 28.4)	3799	8.21	(8.21, 8.76)

# Sex-stratified age-adjusted HCV-related mortality

	AI/AN			NHW		
	n	Rate	95% CI	n	Rate	95% CI
3-State Overall	286	19.6	(17.3, 22.2)	5358	5.88	(5.73, 6.05)
Female	116	15.5	(12.6, 18.8)	1559	3.41	(3.24, 3.59)
Male	170	24.1	(20.4, 28.4)	3799	8.21	(8.21, 8.76)

# Regional analysis



Note. CHSDA - Contract Health Service Delivery Area.

Espey et al.

# Hepatitis C-Related Death

International Classification of Diseases, 10<sup>th</sup> Revision codes

---

<b><u>Underlying or contributing</u> cause of death</b>	<b>ICD-10 code</b>
Acute Hepatitis C	B17.1
Chronic viral Hepatitis C	B18.2

---

# Hepatitis C-Related Death

International Classification of Diseases, 10<sup>th</sup> Revision codes

---

<b>Underlying or <u>contributing</u> cause of death</b>	<b>ICD-10 code</b>
Acute Hepatitis C	B17.1
Chronic viral Hepatitis C	B18.2

---

# Population denominators

Data source	Denominator (2003-2007)	Oregon Cancer Incidence Rate (2003-2007)	95% Confidence Interval
NCHS: AI/AN bridged-race estimate	316,531	402.7	372.4 - 435.3
American Community Survey: AI/AN alone or in combination	477,511	235.3	218.0 - 253.9



For more information, contact CDC  
1-800-CDC-INFO (232-4636)  
TTY: 1-888-232-6348 [www.cdc.gov](http://www.cdc.gov)

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.