

# Suicide Mortality Among American Indians and Alaska Natives, 1999–2009

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Suicide was the 10th leading cause of death in the United States in 2010, accounting for 38 364 deaths (a rate of 12.4 per 100 000 population).<sup>1</sup> Suicide is a growing public health concern throughout the United States, particularly among vulnerable populations that bear a disproportionate burden of completed suicides. Nationally, suicide death rates among American Indian and Alaska Native (AI/AN) persons are significantly higher than among representative samples of Whites, African Americans, Hispanics, Asians, and Pacific Islanders.<sup>2</sup> Among certain age groups, the suicide rate among AI/AN people is more than 3 times the US rate for all races combined, and this disparity is increasing.<sup>3</sup>

Suicide rates among AI/AN populations can vary as a result of the heterogeneity of individual tribes, including history, geographic location, and access to clinical and community service programs, creating a complex interrelationship between potential predictors of suicide<sup>4</sup> and the capacity to address them.<sup>5</sup> Additionally, racial misclassification of AI/AN people is often a limitation in accurately assessing mortality data. An accurate estimate of suicide mortality among AI/AN persons is crucial to planning and implementing public health prevention and intervention programs. Our objective in this study was to more accurately assess national and regional suicide death rates among the AI/AN population using mortality data that have been linked to Indian Health Service (IHS) administrative records to improve race classification.

## METHODS

Detailed methods for generating the analytic mortality files are described in more detail elsewhere in this supplement.<sup>6</sup> A brief description follows.

### Population Estimates

This study includes population estimates and reported deaths from 1999 to 2009. Bridged

**Objectives.** We assessed national and regional suicide mortality for American Indian and Alaska Native (AI/AN) persons.

**Methods.** We used 1999 to 2009 death certificate data linked with Indian Health Service (IHS) patient registration data to examine death rates from suicide in AI/AN and White persons. Analysis focused primarily on residents of IHS Contract Health Service Delivery Area counties; Hispanics were excluded. We used age-adjusted death rates per 100 000 population and stratified our analyses by age and IHS region.

**Results.** Death rates from suicide were approximately 50% higher among AI/AN persons (21.2) than Whites (14.2). By region, rates for AI/AN people were highest in Alaska (rates = 65.4 and 19.3, for males and females, respectively) and in the Northern Plains (rates = 41.6 and 11.9 for males and females, respectively). Disparities between AI/AN and White rates were also highest in these regions.

**Conclusions.** A coordinated, multidisciplinary effort involving federal, state, local, and tribal health officials is needed to address this important public health issue. (*Am J Public Health.* 2014;104:S336–S342. doi:10.2105/AJPH.2014.301929)

single-race population estimates developed by the US Census Bureau and the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) and adjusted for the population shifts resulting from Hurricanes Katrina and Rita in 2005 are included as denominators in the calculation of death rates.<sup>7,8</sup> Bridged single-race data allow for comparability between the pre- and post-2000 racial/ethnic population estimates during this study period.

During preliminary analyses, it was discovered that the updated bridged intercensal population estimates significantly overestimated AI/AN persons of Hispanic origin.<sup>9</sup> Therefore, to avoid underestimating mortality in AI/AN populations, analyses are limited to non-Hispanic AI/AN individuals. Non-Hispanic White was chosen as the most homogeneous referent group. For conciseness, the term "non-Hispanic" is omitted henceforth when discussing both groups.

### Death Records

Death certificate data are compiled by each state and sent to the NCHS, where they are edited for consistency and stripped of personal identifiers. The NCHS makes this information

available to the research community as part of the National Vital Statistics System and includes underlying and multiple cause of death fields, state of residence, age, sex, race, and ethnicity.<sup>10</sup> NCHS applies a bridging algorithm nearly identical to that used by the Census Bureau to assign a single race to decedents with multiple races reported on the death certificate.<sup>11</sup>

We coded the underlying cause of death for this analysis according to the *International Classification of Diseases, 10th Revision (ICD-10)*<sup>12</sup>; for deaths resulting from suicide, we used ICD-10 codes X60–X84 and Y87.0.

### Data Linkage and Analysis File

We linked death certificate data in the National Death Index to the IHS patient registration database to identify deaths in AI/AN persons misclassified as non-Native.<sup>6</sup> The IHS patient registration database contains medical information about AI/AN individuals who are members of federally recognized tribes and who use IHS services. After this linkage, a flag indicating a positive link to IHS was added to the National Vital Statistics System mortality file as another indicator of AI/AN ancestry.

This file was combined with the population estimates to create an analytic file in SEER\*Stat,

version 8.1.2 (AI/AN–US Mortality Database; National Cancer Institute, Bethesda, MD) that includes all deaths for all races reported to NCHS from 1990 to 2009. We included analyses for 1999 to 2009 to reflect a more recent time frame. We based race for deaths among AI/AN persons in this article on the death certificate or the information derived from data linkages between the IHS patient registration database and the National Death Index.

### Geographic Coverage

Most of the analyses in this supplement were restricted to IHS Contract Health Service Delivery Area or Tribal Service Delivery Area (CHSDA) counties that, in general, contain federally recognized tribal reservations or off-reservation trusts or are adjacent to them.<sup>6</sup> The IHS uses CHSDA residence to determine eligibility for services not directly available within the IHS. Linkage studies have indicated less misclassification of race for AI/AN persons in these counties.<sup>6</sup> The CHSDA counties also have a higher proportion of AI/AN persons in relation to total population than do non-CHSDA counties, with 64% of the US AI/AN population residing in the 637 counties designated as CHSDA (these counties represent 20% of the 3141 counties in the United States). Although less geographically representative, analyses restricted to CHSDA counties are presented for death rates in this article for the purpose of offering improved accuracy in interpreting mortality statistics for AI/AN persons relative to the general population.

We completed analyses for all regions combined and by individual IHS region: Northern Plains, Alaska, Southern Plains, Southwest, Pacific Coast, and East. Additional details about CHSDA counties and IHS regions, including population coverage, are provided elsewhere<sup>13</sup> (Tables 1 and 2). Identical or similar regional analyses have been used for other health-related publications focusing on AI/AN persons.<sup>14–16</sup>

### Statistical Methods

All rates, expressed per 100 000 population, were directly age adjusted, using SEER\*Stat software, version 8.1.2, to the 2000 US standard population (Census P25-1130).<sup>17</sup> Readers should avoid comparison of these data with published death rates adjusted using a different standard population.

Using the age-adjusted death rates, we calculated standardized rate ratios (RRs) for AI/AN and White populations. We calculated confidence intervals (CIs) for age-adjusted rates and RRs on the basis of methods described by Tiwari et al. using SEER\*Stat version 8.0.2.<sup>18</sup> We set statistical significance at a *P* level of .05.

## RESULTS

Table 1 summarizes age-adjusted suicide death rates for AI/AN and White persons by IHS region and sex for CHSDA counties and all US counties combined for 1999 to 2009. For all regions combined and for most regions, death rates for suicide in AI/AN persons were greater in CHSDA counties than in all US counties combined (Alaska—in which all counties are CHSDA counties—was an exception). Subsequent results focus on CHSDA counties only. Overall and in each IHS region, AI/AN males had higher suicide death rates than AI/AN females. For both sexes combined, death rates for AI/AN persons were higher than for Whites in all regions combined and in each region except the East and the Southwest. Suicide death rates for AI/AN persons were highest in Alaska (42.5) and the Northern Plains (26.2); rates among AI/AN persons were lowest in the East. Rates among Whites ranged from 11.6 in the East to 19.7 in the Southwest. Sex-specific RRs were highest for females in the Alaska region (RR = 2.88; 95% CI = 2.25, 3.68) followed by males in the Alaska region (RR = 2.34; 95% CI = 2.05, 2.68) and females in the Northern Plains (RR = 2.62; 95% CI = 2.23, 3.07).

Overall, in CHSDA counties age group-specific RRs comparing suicide among AI/AN persons to suicide among Whites were significantly higher for those younger than 25 years (RR = 3.18; 95% CI = 3.00, 3.38) and for those aged 25 to 44 years (RR = 1.88; 95% CI = 1.78, 1.97; Table 2). The RRs were significantly less than 1 for those aged 45 to 64 years (RR = 0.85; 95% CI = 0.78, 0.92), 65 to 84 years (RR = 0.61; 95% CI = 0.50, 0.73), and 85 years and older (RR = 0.41; 95% CI = 0.19, 0.79).

The RRs comparing age group-specific suicide rates between AI/AN and White people were highest and were statistically significant for the group younger than 25 years in every

region except the East. By region, we found the highest RRs for those aged younger than 25 years in the Alaska region (RR = 5.65; 95% CI = 4.56, 7.03) and the Northern Plains region (RR = 4.02; 95% CI = 3.54, 4.54; Table 2). Similar to data for all regions combined, in most individual regions, older AI/AN people had significantly lower suicide death rates than Whites in the same age group.

## DISCUSSION

Our study showed the variability of AI/AN suicide rates across IHS regions. We found significantly high rates of suicide among AI/AN persons aged younger than 25 years and significantly lower rates among AI/AN persons aged older than 45 years. These data improve our understanding of suicide mortality in AI/AN populations and can inform suicide prevention efforts. First, the data improve on earlier observations of elevated suicide mortality in this population<sup>19</sup> compared with Whites, using more accurate data obtained by linkages with IHS registration data and by focusing attention on CHSDA counties in which evidence has suggested fewer race misclassifications. Second, they highlight substantial suicide mortality disparities between AI/AN and White people in regional analyses that are muted when rates are aggregated across regions. Third, suicide mortality disparity is not evenly distributed across age groups. Younger AI/AN people are at much greater risk for suicide than their White counterparts across most regions, and in the Northern Plains and Alaska, the youngest age groups experience 4- and more than 5-fold increases, respectively, in suicide mortality compared with Whites.

The Centers for Disease Control and Prevention<sup>19</sup> recently reported a 28.4% increase in annual, age-adjusted suicide rates among people aged 35 to 64 years in the United States from 1999 to 2010 (from 13.7 in 1999 to 17.6 in 2010). Among racial and ethnic populations, the greatest increase was observed among AI/AN persons (65.2%, from 11.2 to 18.5). Among AI/AN persons, the suicide rate increased for both men (59.5%, from 17.0 to 27.2) and women (81.4%, from 5.7 to 10.3).

The IHS, the principal health care provider for AI/AN people, in its latest *Trends in Indian Health: 2002-2003 Edition*, reported the

**TABLE 1—Death Rates for Intentional Self-Harm (Suicide), by IHS Region and Sex, for American Indians/Alaska Natives Compared With Whites: United States, 1999–2009**

IHS Region	CHSDA Counties				All US Counties			
	AI/AN Count	AI/AN Rate	White Rate	AI/AN:White RR (95% CI)	AI/AN Count	AI/AN Rate	White Rate	AI/AN:White RR (95% CI)
<b>Northern Plains</b>								
Both sexes	755	26.2	12.6	2.09* (1.93, 2.25)	999	21.8	11.7	1.87* (1.75, 2.00)
Male	577	41.6	21.0	1.98* (1.80, 2.17)	765	34.6	19.6	1.77* (1.63, 1.91)
Female	178	11.9	4.6	2.62* (2.23, 3.07)	234	10.0	4.4	2.30* (2.00, 2.63)
<b>Alaska</b>								
Both sexes	528	42.5	17.4	2.45* (2.18, 2.74)	528	42.5	17.4	2.45* (2.18, 2.74)
Male	407	65.4	27.9	2.34* (2.05, 2.68)	407	65.4	27.9	2.34* (2.05, 2.68)
Female	121	19.3	6.7	2.88* (2.25, 3.68)	121	19.3	6.7	2.88* (2.25, 3.68)
<b>Southern Plains</b>								
Both sexes	626	18.7	15.4	1.21* (1.11, 1.32)	721	15.9	14.9	1.07 (0.99, 1.15)
Male	507	31.5	25.3	1.25* (1.13, 1.38)	576	26.4	24.3	1.09 (1.00, 1.19)
Female	119	6.9	6.3	1.08 (0.88, 1.31)	145	6.2	6.2	0.99 (0.84, 1.18)
<b>Southwest</b>								
Both sexes	1066	19.9	19.7	1.01 (0.94, 1.07)	1152	19.5	19.0	1.02 (0.96, 1.09)
Male	870	33.9	31.5	1.08* (1.00, 1.16)	935	32.8	30.5	1.08* (1.01, 1.16)
Female	196	6.8	8.6	0.79* (0.68, 0.92)	217	6.9	8.2	0.84* (0.73, 0.97)
<b>Pacific Coast</b>								
Both sexes	532	18.2	14.9	1.22* (1.11, 1.33)	674	15.7	14.0	1.12* (1.03, 1.21)
Male	400	29.0	24.3	1.19* (1.07, 1.33)	503	24.7	22.6	1.09 (0.99, 1.20)
Female	132	8.4	6.3	1.33* (1.11, 1.59)	171	7.4	6.1	1.21* (1.03, 1.41)
<b>East</b>								
Both sexes	93	8.4	11.6	0.73* (0.59, 0.90)	467	7.5	12.4	0.60* (0.55, 0.66)
Male	70	13.0	18.9	0.69* (0.53, 0.88)	353	11.7	20.4	0.57* (0.51, 0.64)
Female	23	4.1	4.8	0.85 (0.54, 1.29)	114	3.5	5.0	0.71* (0.58, 0.85)
<b>Total</b>								
Both sexes	3600	21.2	14.2	1.49* (1.44, 1.55)	4541	16.9	13.1	1.29* (1.25, 1.33)
Male	2831	34.7	23.2	1.49* (1.43, 1.55)	3539	27.1	21.5	1.26* (1.22, 1.31)
Female	769	8.7	5.9	1.48* (1.37, 1.59)	1002	7.2	5.3	1.35* (1.27, 1.44)

Note. AI/AN = American Indian/Alaska Native; CHSDA = Contract Health Service Delivery Areas; CI = confidence interval; IHS = Indian Health Service; RR = rate ratio. Leading causes of death created using the Centers for Disease Control and Prevention's National Center for Health Statistics List of 113 selected causes of death based on the *International Classification of Diseases, 10th Revision*.<sup>12</sup> Analyses are limited to people of non-Hispanic origin. AI/AN rate is reported from death certificates or through linkage with the IHS patient registration database. Rates are per 100 000 people and were age adjusted to the 2000 US standard population (11 age groups; Census P25-1130).<sup>19</sup> RRs were calculated in SEER\*Stat before rounding of rates and may not equal rate ratios calculated from rates presented in table. IHS regions are defined as follows: AK<sup>a</sup>; Northern Plains (IL, IN, IA, MI, MN, MT, NE, ND, SD, WI, WY<sup>a</sup>); Southern Plains (OK, KS, TX<sup>a</sup>); Southwest (AZ, CO, NV, NM, UT<sup>a</sup>); Pacific Coast (CA, ID, OR, WA, HI); East (AL, AR, CT, DE, FL, GA, KY, LA, ME, MD, MA, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, DC). Percentage regional coverage of AI/AN persons in CHSDA counties to AI/AN persons in all counties: Northern Plains = 64.8%; Alaska = 100%; Southern Plains = 76.3%; Southwest = 91.3%; Pacific Coast = 71.3%; East = 18.2%; and total US = 64.2%.

Source. AI/AN-US Mortality Database (1999–2009).

<sup>a</sup>Identifies states with ≥1 county designated as CHSDA.

\*P < .05.

overall suicide rate for the years 2002 to 2004 was 73% greater among AI/AN persons compared with the US—all races suicide rate for 2003.<sup>3</sup> Suicide was the second leading cause of death for AI/AN youths aged 15 to 24 years, and the rate (34.3) was 3.5 times higher than the US rate for all races combined (9.8).<sup>3</sup> These data are similar to overall CHSDA rates reported for 1999 to 2009 and suggest that suicide rates

among AI/AN persons may be higher than previously reported.<sup>19</sup>

Regional differences in age-adjusted suicide death rates were published in the latest *IHS Regional Differences in Indian Health 2002–2003 Edition*. Between 1999 and 2001, age-adjusted suicide death rates in 3 IHS regions were greater than 20.0 per 100 000 people, a rate higher than the rate in the United

States for all races combined (10.6 for 2000). The Alaska area suicide death rate for AI/AN persons was 3.6 times greater than the US rate for all races combined.<sup>20</sup> Our findings suggest region-specific suicide rates may be higher than previously reported,<sup>20</sup> and RRs comparing suicide rates of AI/AN to White persons within regions provide additional information (i.e., sex and age of decedent) important to public health

**TABLE 2—Death Rates for Intentional Self-Harm (Suicide), by IHS Region and Age, for American Indians/Alaska Natives Compared With Whites: United States, 1999–2009,**

IHS Region	CHSDA Counties					All US Counties				
	AI/AN Count	AI/AN Rate	White Count	White Rate	AI/AN:White RR (95% CI)	AI/AN Count	AI/AN Rate	White Count	White Rate	AI/AN:White RR (95% CI)
<b>Northern Plains</b>										
< 25 y	301	21.3	1624	5.3	4.02* (3.54, 4.54)	366	16.9	6783	4.8	3.55* (3.18, 3.94)
25–44 y	327	42.2	3890	17.4	2.43* (2.16, 2.72)	436	34.1	18 001	16.1	2.12* (1.92, 2.33)
45–64 y	107	20.3	3737	16.7	1.22 (0.99, 1.47)	166	18.7	17 071	15.9	1.17* (1.00, 1.37)
65–84 y	18	11.6	1500	13.8	0.84 (0.49, 1.35)	28	11.6	6648	13.0	0.89 (0.59, 1.30)
≥ 85 y	<sup>a</sup>	17.7	281	15.9	1.11 (0.13, 4.05)	<sup>a</sup>	16.6	1249	14.7	1.13 (0.23, 3.31)
<b>Alaska</b>										
< 25 y	242	42.7	136	7.6	5.65* (4.56, 7.03)	242	42.7	136	7.6	5.65* (4.56, 7.03)
25–44 y	214	67.0	319	21.3	3.14* (2.63, 3.75)	214	67.0	319	21.3	3.14* (2.63, 3.75)
45–64 y	68	30.1	316	22.3	1.35* (1.03, 1.77)	68	30.1	316	22.3	1.35* (1.03, 1.77)
65–84 y	<sup>a</sup>	6.4	74	23.4	0.27* (0.07, 0.74)	<sup>a</sup>	6.4	74	23.4	0.27* (0.07, 0.74)
≥ 85 y	<sup>a</sup>	<sup>a</sup>	15	51.1	<sup>a</sup> (NA)	<sup>a</sup>	<sup>a</sup>	15	51.1	<sup>a</sup> (NA)
<b>Southern Plains</b>										
< 25 y	154	9.2	597	5.3	1.74* (1.45, 2.08)	173	8.1	3397	5.7	1.42* (1.21, 1.65)
25–44 y	300	31.5	1838	22.1	1.43* (1.26, 1.61)	348	26.9	9737	20.1	1.34* (1.20, 1.49)
45–64 y	132	18.5	1763	21.2	0.87 (0.73, 1.04)	157	15.5	9720	20.6	0.75* (0.64, 0.88)
65–84 y	38	16.1	793	18.1	0.89 (0.62, 1.23)	41	13.4	4046	18.0	0.74 (0.53, 1.02)
≥ 85 y	<sup>a</sup>	8.7	111	17.7	0.49 (0.06, 1.81)	<sup>a</sup>	6.9	648	19.6	0.35 (0.04, 1.27)
<b>Southwest</b>										
< 25 y	411	16.3	1499	6.6	2.47* (2.21, 2.76)	438	15.9	2778	6.7	2.39* (2.15, 2.64)
25–44 y	493	33.5	4637	24.8	1.35* (1.23, 1.48)	530	32.4	8205	24.2	1.34* (1.22, 1.46)
45–64 y	140	14.8	5476	29.1	0.51* (0.43, 0.60)	161	15.2	8925	27.6	0.55* (0.47, 0.64)
65–84 y	21	6.9	2664	26.4	0.26* (0.16, 0.41)	22	6.7	3836	24.9	0.27* (0.17, 0.41)
≥ 85 y	<sup>a</sup>	3.2	485	38.9	0.08* (0.00, 0.46)	<sup>a</sup>	3.0	714	35.4	0.09* (0.00, 0.48)
<b>Pacific Coast</b>										
< 25 y	143	10.8	2440	4.9	2.22* (1.86, 2.63)	163	8.9	3986	4.5	1.96* (1.66, 2.29)
25–44 y	244	28.9	7391	18.2	1.58* (1.39, 1.80)	319	25.5	12 991	16.8	1.52* (1.35, 1.69)
45–64 y	115	16.8	9148	22.0	0.76* (0.63, 0.92)	154	14.8	16 442	21.1	0.70* (0.60, 0.82)
65–84 y	26	14.8	4249	21.8	0.68 (0.44, 1.01)	34	12.7	7527	20.6	0.62* (0.42, 0.87)
≥ 85 y	<sup>a</sup>	25.7	972	31.2	0.82 (0.22, 2.11)	<sup>a</sup>	16.0	1709	28.4	0.57 (0.15, 1.45)
<b>East</b>										
< 25 y	17	3.6	1904	4.0	0.90 (0.52, 1.44)	97	3.9	16 953	4.5	0.86 (0.70, 1.05)
25–44 y	46	14.5	6371	15.6	0.93 (0.68, 1.24)	220	12.1	53 607	16.7	0.73* (0.63, 0.83)
45–64 y	27	10.6	6980	17.2	0.62* (0.41, 0.90)	126	8.2	55 285	17.5	0.47* (0.39, 0.56)
65–84 y	<sup>a</sup>	4.2	2760	13.1	0.32* (0.06, 0.97)	21	4.9	24 276	14.9	0.33* (0.20, 0.51)
≥ 85 y	<sup>a</sup>	<sup>a</sup>	515	15.0	<sup>a</sup> (NA)	<sup>a</sup>	7.9	4180	17.1	0.46 (0.10, 1.36)

Continued

prevention efforts aimed at reducing health disparities among AI/AN people.

**Risk and Protective Factors**

A recent World Health Organization survey reported risk factors for suicidal behaviors in both developed and developing countries and suggested that providers consider using them

as a tool for suicide prevention.<sup>21</sup> These risk factors included younger age, lower education and income, unmarried status, unemployment, parent psychopathology, childhood adversities, and presence of diverse mental disorders.<sup>22</sup> In many AI/AN communities, significant disparities exist with respect to the socioeconomic and educational variables identified in the

World Health Organization survey.<sup>3,19,20</sup> Risk factors identified in studies on adolescent suicide include mood disorders, lifetime history of abuse, availability of a gun, and past suicide attempt.<sup>23</sup> Young AI/AN males who are unemployed or undereducated and those with a history of trauma are at higher risk for suicide and may choose more lethal and irreversible

TABLE 2—Continued

Total										
< 25 y	1268	15.9	8200	5.0	3.18* (3.00, 3.38)	1479	12.4	34 033	4.8	2.59* (2.46, 2.73)
25-44 y	1624	34.7	24 446	18.5	1.88* (1.78, 1.97)	2067	27.2	102 860	17.3	1.57* (1.50, 1.64)
45-64 y	589	17.6	27 420	20.6	0.85* (0.78, 0.92)	832	14.4	107 759	18.5	0.78* (0.73, 0.83)
65-84 y	110	11.0	12 040	18.2	0.61* (0.50, 0.73)	150	9.3	46 407	16.1	0.58* (0.49, 0.68)
≥ 85 y	<sup>a</sup>	9.6	2379	23.3	0.41* (0.19, 0.79)	13	8.7	8515	19.2	0.46* (0.24, 0.78)

Note. AI/AN = American Indian/Alaska Native; CHSDA = Contract Health Service Delivery Areas; CI = confidence interval; IHS = Indian Health Service; NA = not applicable; RR = rate ratio. Leading causes of death created using the Centers for Disease Control and Prevention's National Center for Health Statistics List of 113 selected causes of death based on the *International Classification of Diseases, Tenth Revision*. Analyses are limited to people of non-Hispanic origin. AI/AN race is reported from death certificates or through linkage with the IHS patient registration database. Rates are per 100 000 people and are age adjusted to the 2000 US standard population (11 age groups; Census P25-1130).<sup>29</sup> RRs were calculated in SEER\*Stat before rounding of rates and may not equal RRs calculated from rates presented in table. IHS regions are defined as follows: AK<sup>b</sup>; Northern Plains (IL, IN, IA, MI, MN, MT, NE, ND, SD, WI, WY<sup>b</sup>); Southern Plains (OK, KS, TX<sup>b</sup>); Southwest (AZ, CO, NV, NM, UT<sup>b</sup>); Pacific Coast (CA, ID, OR, WA, HI); East (AL, AR, CT, DE, FL, GA, KY, LA, ME, MD, MA, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, DC). Percentage regional coverage of AI/AN in CHSDA counties to AI/AN in all counties: Northern Plains = 64.8%; Alaska = 100%; Southern Plains = 76.3%; Southwest = 91.3%; Pacific Coast = 71.3%; East = 18.2%; and total US = 64.2%.

Source. AI/AN-US Mortality Database (1999-2009).

<sup>a</sup>Counts <10 are suppressed; if no cases reported, then rates and RRs could not be calculated. Cases are included in overall totals, but counts for specific age group have been suppressed as a result of there being only a few cases.

<sup>b</sup>Identifies states with ≥1 county designated as CHSDA.

\**P* < .05.

means to attempt suicide.<sup>24-27</sup> Adverse childhood experiences increase lifetime risk for suicide<sup>28</sup> as well as risk for substance abuse.<sup>29</sup> Substance use has been associated with greater risk<sup>30</sup> and more lethal means of suicide attempts.<sup>31</sup>

When compared with other racial and ethnic groups, AI/AN people have more severe mental health disorders related to suicide, such as anxiety, depression, substance abuse, and victimization.<sup>32</sup> Despite this increased severity of mental health disorders, many suicidal AI/AN persons do not receive mental health services.<sup>32</sup> When services are accessed, care can be culturally inappropriate and thus ineffective.<sup>32,33</sup> Overall, the availability and adequacy of mental health programs for AI/AN people varies widely, and geographically isolated reservations are challenged with severe provider shortages.<sup>33</sup> In some geographic regions (i.e., the Northeast) and among older age groups, access to health care may increase the likelihood of receiving mental health services and thus lower the risk for suicide. Moreover, those in the older age groups may have developed more positive coping mechanisms and have established social networks, both of which can be protective against suicide. The Northeast region also has more employment and educational opportunities, which may also be protective against suicide. This may describe the findings in our study, but more focused and structured research efforts are needed to investigate this further.

Standard approaches to addressing suicide among AI/AN communities should take into account cultural issues as well as both risk and protective factors.<sup>34</sup> Research has suggested that cultural factors, such as sense of belonging to one's culture, strong tribal spiritual orientation, and cultural continuity, can be protective against suicide among AI/AN populations.<sup>35</sup> Increasing access to culturally competent and responsive services, development and implementation of school- and community-level interventions, educating and increasing awareness of suicide, and connecting young people to their culture are all successful approaches reported in the literature.<sup>36</sup> In addition, resources have been developed that provide the basis for AI/AN community-based suicide prevention, addressing risks and protective factors and providing prevention models that can be adapted to the individual community's circumstances.<sup>37</sup>

A critical step in addressing AI/AN health disparities generally, and suicide mortality specifically, is better characterization of the health status of AI/AN populations that includes adjustment for racial misclassification on the death records contained in large health-related databases. Additionally, in recognition of the heterogeneity of the AI/AN population, region-specific suicide rates are essential to planning, implementing, and evaluating potential public health interventions.

### Racial Misclassification

Public health studies involving AI/AN people often cite racial misclassification as a limitation to a study's results, resulting in an underestimation of the cases of disease or disease-specific mortality in question. Stehr-Green et al.<sup>38</sup> identified 414 (14.7%) of 2819 AI/AN decedents as misclassified on Washington State death certificates after linking the Northwest Tribal Registry and the Washington State death files. Similarly, during the 14-year period from 1990 to 2003, 17% of AI decedents in North Carolina were misclassified on the death certificate. Racial misclassification can occur when recorded racial information is based on observations by health care personnel rather than reports given by the patient or patient's family. Misidentifying AI/AN persons with Hispanic surnames as Latino and limited AI/AN data entry fields on medical records or intake forms all contribute to misclassification. This linkage study helps to improve, but not entirely eliminate, the misclassification of AI/AN people who died from an intentional self-harm injury and allows for improved estimates of suicide mortality among AI/AN populations.

### Limitations

Several limitations should be considered when interpreting the results presented in this article. First, although linkage with the IHS patient registration database improves the

classification of race for AI/AN decedents, the issue is not completely resolved because AI/AN people who are not members of the federally recognized tribes are not eligible for IHS services and are not represented in the IHS database. Additionally, some decedents have been eligible for—but never used—IHS services and were therefore not included in the IHS registration database. Second, the findings from CHSDA counties highlighted in our findings do not represent all AI/AN populations in the United States or in individual IHS regions.<sup>6</sup> In particular, the East region includes only 15.4% of the total AI/AN population for that region. As such, rates of suicide for AI/AN persons living in the East may be underestimates. Furthermore, the analyses based on CHSDA designation exclude many AI/AN decedents in urban areas that are not part of a CHSDA county. AI/AN residents of urban areas differ from all AI/ANs in poverty, health care access, and other factors that may influence mortality trends.<sup>37</sup> Third, these analyses revealed less variation for Whites than for AI/AN persons by IHS region using data from CHSDA counties only. Perhaps alternative groupings of states or counties would reveal a different level of variation for Whites. Fourth, federally recognized tribes vary substantially in the proportion of Native ancestry required for tribal membership and therefore for eligibility for IHS services. Whether and how this discrepancy in tribal membership requirements may influence some of our findings is unclear, although our findings are consistent with those of prior reports. Finally, although the exclusion of Hispanic AI/AN individuals from the analyses reduces the overall count of deaths among AI/AN persons by less than 5%, it may disproportionately affect some states.

We detailed rates of suicide among AI/AN people that vary by region, sex, and age of decedents. A culturally appropriate, coordinated, and multidisciplinary effort involving federal, state, local, and tribal health officials is needed to address this important public health issue.

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M. A. Herne led the study and analysis. M. L. Bartholomeu and R. L. Weahkee contributed substantive writing and editorial comments and participated in finalizing the article.

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The CDC and IHS determined this project to constitute public health practice and not research; therefore, no formal institutional review board approvals were required.

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