

Toward Understanding Suicide Among Youths: Results From the White Mountain Apache Tribally Mandated Suicide Surveillance System, 2001–2006

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Suicide is the third leading cause of death among US youths aged 10 to 24 years,¹ and suicide attempts are a major source of adolescent morbidity in the United States. As behavioral scientists have increasingly recognized youths' suicide behavior as an important and preventable public health problem, Healthy People 2010 has set specific objectives to reduce suicide and suicide attempt rates among youths. Past evidence supports the premise that youth suicide can be prevented by addressing risk factors and promoting early identification, referral, and treatment of mental and substance use disorders. However, risk factors vary across races, ethnic groups, and regions, necessitating targeted formative research and community-specific prevention approaches.²

It is well-documented that American Indians and Alaska Natives have the highest rates of suicide of all US races.³ American Indian and Alaska Native (AIAN) suicides occur predominantly among youths (<25 years), in contrast to the US general population, in which deaths from suicide are concentrated among the elderly (≥65 years).⁴ Further, there is significant variability in suicide rates among youths across tribes and rural versus urban AIAN populations. Among the 1.3 million American Indians and Alaska Natives residing on or near rural reservation lands tracked by the Indian Health Service, the average rate of suicide per 100 000 is 20.2, with a range of 7.7 (Nashville area) to 45.9 (Alaska area).⁵ In comparison, for all 4.1 million American Indians and Alaska Natives identified by the US Census, the suicide rate is 11.7.⁶ Because urban AIAN residents compose approximately 60% of the US Census AIAN population,⁷ the lower overall census suicide rate indicates that rural reservation suicide rates are higher than urban AIAN suicide rates.

To date, little reservation-specific information on suicide behavior or related risk factors

Objectives. We examined suicide and suicide attempt rates, patterns, and risk factors among White Mountain Apache youths (aged <25 years) from 2001 to 2006 as the first phase of a community-based participatory research process to design and evaluate suicide prevention interventions.

Methods. Apache paraprofessionals gathered data as part of a tribally mandated suicide surveillance system. We compared findings to other North American populations.

Results. Between 2001 and 2006, 61% of Apache suicides occurred among youths younger than 25 years. Annual rates among those aged 15 to 24 years were highest: 128.5 per 100 000, 13 times the US all-races rate and 7 times the American Indian and Alaska Native rate. The annual suicide attempt incidence rate in this age group was 3.5%. The male-to-female ratio was 5:1 for suicide and approximately 1:1 for suicide attempts. Hanging was the most common suicide method, and third most common attempt method. The most frequently cited attempt precipitants were family or intimate partner conflict.

Conclusions. An innovative tribal surveillance system identified high suicide and attempt rates and unique patterns and risk factors of suicidal behavior among Apache youths. Findings are guiding targeted suicide prevention programs. (*Am J Public Health.* 2009;99:1840–1848. doi:10.2105/AJPH.2008.154880)

exists to explain differences in rates across AIAN communities and in comparison with other US populations. Developing the means to collect and analyze local tribal data is key to discerning unique risk factors that are driving local and national disparities in suicide among AIAN youths, and to the public health mission of reducing suicide among youths across the United States and the world.

There are approximately 15 500 White Mountain Apache (Apache) tribal members who reside on the 1.6 million acre Fort Apache Reservation in east-central Arizona. More than half (54%) of the tribal members are younger than 25 years, compared with approximately 35% of the US all-races population.⁸ In 2001, a cluster of suicides among youths on the Apache reservation led the Tribal Council to enact a resolution to mandate tribal members and community providers to report all suicidal behavior (ideation, attempts, and deaths) to a central data

registry. The resulting surveillance system is the first of its kind, gathering data from both community-based and clinical settings.

In 2004, as part of the Johns Hopkins Center for American Indian Health, we partnered with the Apaches to conduct a community-based participatory research (CBPR) project that included formalizing the mandated reporting process, transferring the registry system to an electronic format, analyzing quarterly trends, and engaging community leaders in interpreting surveillance data to inform prevention strategies. Because of the contentious history of research in tribal communities, CBPR methodologies are essential to ensuring a culturally sensitive interpretation of findings and culturally relevant interventions.⁹ A CBPR approach is particularly important in the complex area of mental health because explanatory models for cause and treatment of mental illness can vary widely across tribal and nontribal cultures.¹⁰

We describe the Apache suicide behavior surveillance system, report patterns of Apache youths' suicide and suicide attempts between 2001 and 2006, and compare those rates with those of other tribal and North American populations. We discuss the relevance of the paraprofessional-administered surveillance system and its findings to public health prevention of suicide behavior among youths.

METHODS

Apache case managers, who were paraprofessionals indigenous to the local community, were hired and trained to (1) educate community members regarding the suicide surveillance system and completion of the data registry forms, (2) validate and enter data from registry forms, (3) follow up on registry cases and facilitate referral, and (4) liaise with community leaders and providers to interpret data and develop ideas for prevention strategies.

The registry form collected data regarding name, age, gender, tribal affiliation, type of suicidal behavior, date and location of behavior, method, history of previous suicidal behavior, possible precipitant, and referral information. Registry forms were completed by police, fire, medical, school, and social service personnel; religious leaders; family members; and peers of suicidal individuals. Case managers collected and entered the data. A secure electronic database that used TrialDB (<http://ycmi.med.yale.edu/trialdb>) was used to store and manage data.

Analysis

For analysis purposes, we defined a suicide as a death resulting from intentional self-inflicted injury as determined by the local medical examiner or authorized law enforcement official, and validated with local medical and police records. We defined a suicide attempt as intentional self-injury with intent to die. We included attempt data from 2005 to 2006 in this analysis and validated the data by using medical, police, and human service records. Prior to 2005, attempt reporting was confounded by inconsistent terminology for suicide attempts and ideation on the registry form. Thus, we excluded pre-2005 attempt data from analysis. Additional validation included a consensus procedure in which

attempts were coded as "definite," "probable," or "possible." Coding was based on the attempt method and documentation of intent to die on the registry form or in clinical notes from medical charts or police reports.

We expressed incidence of suicide per 100 000 per year and calculated the rate with 6 years of data (2001 through 2006). Incidence of suicide attempts is expressed as percentage of youths per year who attempted suicide in 2 years of data (2005 and 2006). Numbers of suicides and suicide attempts (the numerators) came from the registry. No registry data were collected from non-AIAN reservation residents. Numbers for the total and age-specific tribal population sizes (the denominators) came from the most current (2001–2003) Indian Health Service (IHS) estimates for the Whiteriver Service Unit, which serves the Apache reservation. The Whiteriver Service Unit user population is limited to those who have used Whiteriver Service Unit services at least once in the past 3-year period. Population estimates for 2004 to 2006 were based on population growth rates and total and age-specific population sizes from 2001 to 2003.

Apache suicide and suicide attempt rates were compared with age-specific and crude suicide incidence rates for the general US all-races population, the US all-AIAN population, and the IHS Service Area population. We calculated suicide rates for US all-races and US all-AIAN populations by using the most recent data from the Centers for Disease Control and Prevention's Web-Based Injury Statistics Query and Reporting System (WISQARS).⁶ WISQARS defines the AIAN population within the United States according to self-reported census classifications. Age-specific and age-adjusted suicide incidence rates for the IHS Service Area population were provided by the Division of Program Statistics at the IHS (J. Pappalardo and E. Paisano, oral communication, May 2007).

Because of the younger age distribution of the Apache Tribe relative to the general US population, we calculated age-adjusted suicide rates by using the 2000 US Census population as the reference population. Exact Poisson confidence limits for incidence rates were presented when possible. We compared Apache methods of suicide to methods of suicide among US all-races, AIAN, and IHS populations

by using WISQARS and IHS data sources. All data were analyzed with Stata version 9.2 (Stata Corp, College Station, TX).

To better understand the magnitude of Apache youths' suicide attempt rates, we reviewed existing epidemiological literature pertaining to studies of suicide attempts among youths within the United States and Canada, which has similar disparities in suicide among First Nations youths.¹¹ We included studies published after 1990 that provided estimates of suicide attempts by youths on an annual basis.

Community-Based Participatory Research Process

The methods and results of our study were derived from a CBPR process that balances traditional and scientific expertise. For example, tribal leaders identified what type of information they wanted their surveillance system to collect, and we helped develop and standardize data collection instruments. Similarly, we provided technical support in familiarizing tribal case managers with standard suicidal behavior nomenclature and conducted statistical data analyses, whereas the interpretation and presentation of data in this article were developed through an iterative process with Apache case managers, Tribal Council and Health Board members, and Johns Hopkins investigators. In the end, tribal leaders decided that only scientifically validated data would appear in this article. They conveyed sensitivities about sharing internal communication that personalized suicide events or speculated on thoughts, attitudes, or behaviors of the deceased. They determined that the goal of publication was to share their communities' innovation in instituting the surveillance system and partnering with a research institution to utilize surveillance findings in selecting and adapting evidence-based suicide prevention interventions for Apache youths.

This article was reviewed and approved by the White Mountain Apache Tribal Council and Health Board. The related study protocol was additionally approved by the White Mountain Apache Tribal Council and Health Board, the Whiteriver IHS Service Unit, Johns Hopkins institutional review board, and Phoenix Area IHS institutional review board.

RESULTS

Between January 2001 and December 2006, 41 Apache tribal members died by suicide on the reservation, producing an average annual suicide rate of 45.5 per 100 000. Twenty-five of the 41 suicides (61%) were among people younger than 25 years, with a mean age of 19.4 years (SD=3.6 years; median=19.8 years). Table 1 shows age-specific suicide rates with confidence intervals for the Apache population compared with rates among US all-races, all American Indians and Alaska Natives in the United States, and American Indians and Alaska Natives residing within IHS Service Areas. The highest incidence was among those aged 15 to 24 years, whose rate of suicide (128.5 per 100 000) was approximately 13 times that of the US all-races rate, 7 times the all-AIAN rate, and 4 times the IHS AIAN User Population rate. Among those aged 10 to 14 years, the Apache suicide incidence rate (17.1 per 100 000) was approximately 15 times that of the US all-races rate and 7 times the all-AIAN rate.

Figure 1 depicts the selected method of suicide among Apache youths, compared with youths in the US all-races, all-AIAN, and IHS populations. Hanging was the predominant method of suicide (20 of 25; 80%), followed by firearms (4 of 25; 16%). Among comparison populations, firearms account for approximately half of suicides among youths in the same time frame, followed by suffocation or hanging.

Among the 25 youths who died by suicide, 21 were males and 4 were females, a male-to-female ratio of approximately 5:1 (Figure 2b). Four (16%) had previous attempts documented in the registry between 2001 and 2006, and 1 had documented ideation (4%). Although blood alcohol data were not available, 7 of the youths (28%) were reportedly using substances at the time of death. Nearly one quarter of these suicides among youths (n=6; 24%) occurred in August, followed by February (n=4; 16%). The most common day for youths to die by suicide was Saturday (8 of 25; 32%). The majority of suicides were reported to the surveillance system via the tribal police department or social services department.

In 2005 and 2006, 236 and 203 attempts, respectively, were reported via the surveillance system. Approximately 70% of attempts in both years occurred among people younger than 25 years (160 attempts among 143 youths in 2005 and 141 attempts among 115 youths in 2006). Of these 301 total reported attempts, 271 (90%) were validated as “definite,” 24 (8%) as “probable,” and 6 (2%) as “possible.” Figure 2 presents annual age- and gender-specific rates of Apache suicide attempts for 2005 and 2006, excluding those reported attempts deemed only “possible.” Figure 2b provides the comparable rates for completed suicides.

For both males and females, rates of attempt were highest among those aged 15 to 19 years, followed closely by those aged 20 to 24 years. The ratio of youths’ suicide attempts to suicides was 36:1. The most common methods of suicide attempt for youths were laceration or cutting and overdose (31% each) followed by hanging (18%). Hanging as an attempt method was used more than twice as much by males (25%) than used by females (11%).

TABLE 1—Average Age-Specific and All-Age Suicide Incidence Rates per 100 000 per Year for US All-Races, All-AIAN, IHS Service Area AIAN, and WMAT Populations: 2000–2006

	US All-Races ^a 2003, Rate (95% CI)	All-AIAN ^a 2003, Rate (95% CI)	IHS Service Area AIAN ^b 2000–2002, Rate (95% CI)	WMAT 2001–2006, Rate (95% CI)	WMAT to US All-Races, Rate Ratio	WMAT to All-AIAN, Rate Ratio	WMAT to IHS Service Area AIAN, Rate Ratio
Age group, y							
5–9	0.03 (0.01, 0.06)	0 (0)	NA	0 (0)	0	0	NA
10–14	1.2 (1.0, 1.3)	2.3 (0.9, 4.8)	NA	17.1 (2.1, 61.6)	14.8**	7.4*	NA
15–19	7.3 (6.9, 7.6)	17.0 (12.6, 22.5)	29.6 ^c (NA)	107.8 (53.8, 192.8)	14.8**	6.3**	4.3 ^c
20–24	12.0 (11.6, 12.5)	19.2 (14.4, 25.2)	29.6 ^c (NA)	151.9 (78.5, 265.2)	12.6**	7.9**	4.3 ^c
25–34	12.7 (12.4, 13.1)	18.7 (14.9, 23.1)	NA	95.0 (47.4, 169.9)	7.5**	5.1**	NA
35–44	14.9 (14.5, 15.2)	16.6 (13.1, 20.8)	NA	23.3 (4.8, 68.2)	1.6	1.4	NA
45–64	15.0 (14.7, 15.3)	6.3 (4.7, 8.8)	NA	15.5 (1.9, 56.2)	1.0	2.5	NA
≥65	14.6 (14.2, 15.0)	5.9 (2.9, 10.5)	NA	0 (0)	0	0	NA
Total (all ages)							
Crude	10.8 (10.7, 10.9)	10.4 (9.3, 11.6)	NA	45.5 (32.7, 61.7)	4.1**	4.4**	NA
Age-adjusted	10.7 (10.6, 10.8)	10.1 (9.0, 11.3)	17.3 (NA)	40.0 (27.8, 52.1)	3.7**	3.9**	2.3

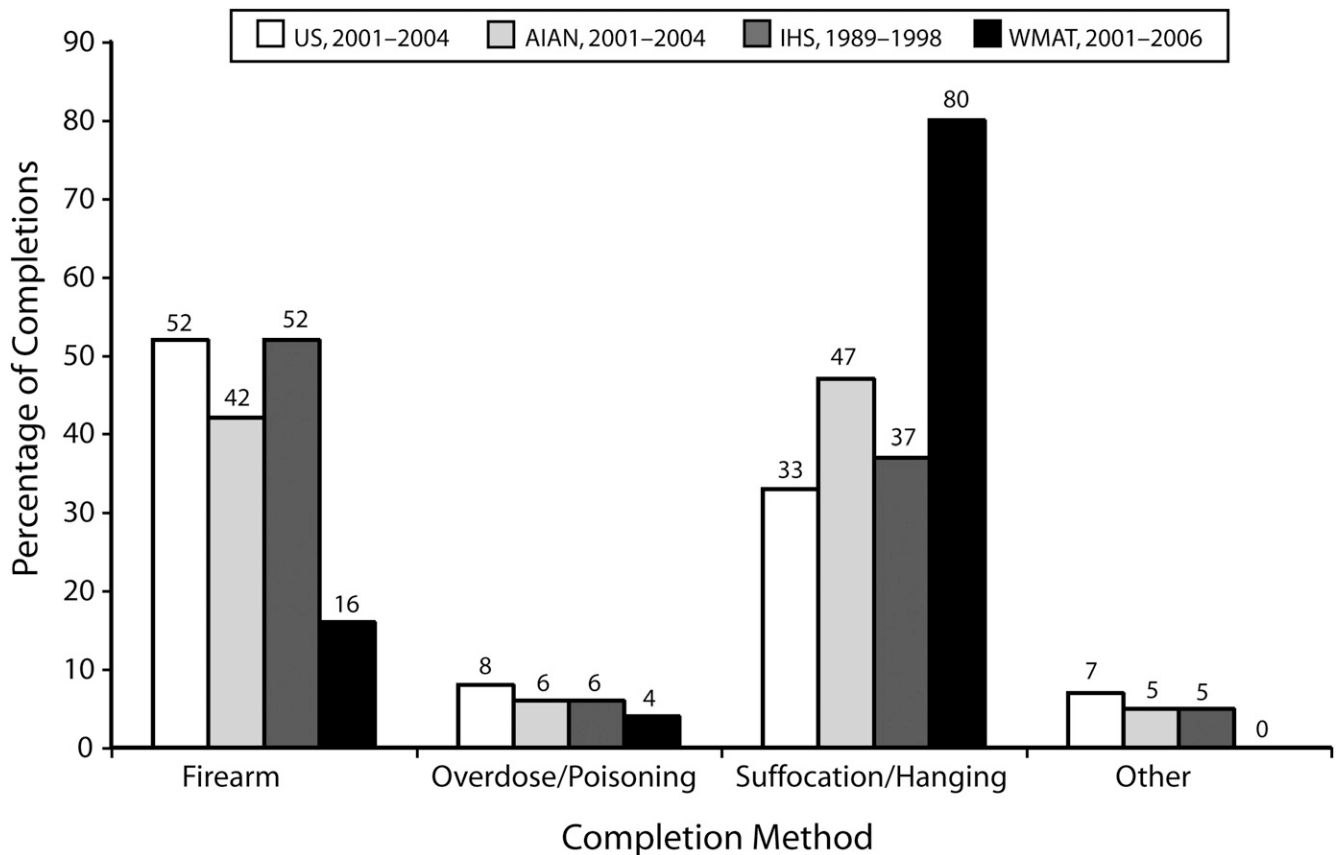
Note. AIAN = American Indian and Alaska Native; IHS = Indian Health Service; WMAT = White Mountain Apache Tribe; CI = confidence interval; NA = not available. All age-adjusted estimates have been adjusted to the 2000 US population as standard.

^aUS all-races and all-AIAN data were drawn from the Centers for Disease Control and Prevention Web-Based Injury Statistics Query and Reporting System⁶ and are based on self-reported census classification of AIAN status.

^bThe IHS data include all American Indians and Alaska Natives residing within IHS service areas, and rates are adjusted to compensate for misreporting of AIAN race on state death certificates.

^cFor the combined age group of 15–24 years. Data were not available for the individual groups.

*P < .05; **P < .005, for a test of inequality of incidence rate ratios.



Note. AIAN = American Indian and Alaska Native; IHS = Indian Health Service. US and AIAN data were drawn from the Centers for Disease Control and Prevention (CDC) Web-Based Injury Statistics Query and Reporting System.⁶ IHS data were drawn from the CDC¹² and includes only individuals aged 10 to 19 years residing in IHS Service Areas.

FIGURE 1—Method of suicide among youths, by percentage of all suicides, for US all-races (aged 15 to 24 years), all-AIAN (aged 15 to 24 years), IHS Service Area (aged 10 to 19 years), and White Mountain Apache Tribe (aged 10 to 24 years) populations, 1989–2006.

Approximately 35% (2005) and 38% (2006) of Apache youths who made an attempt had previous attempts documented in the registry, and 43% (2005) and 44% (2006) were reported to have been using substances at the time of the attempt. Clear patterns of attempts were not seen in seasonality or days of the week. The most commonly reported reasons for suicide attempts by youths were (1) conflict with family members, (2) conflict with boyfriend or girlfriend, or (3) the suicide or loss of a loved one. Most suicide attempts were reported to the surveillance system via the local emergency department (approximately 35%) or tribal behavioral health services (approximately 32%).

In 2005 and 2006, the average annual incidence rate of suicide attempts among

Apaches aged 15 to 24 years was 3.5%. Table 2 compares the suicide attempt rates among Apache youths to rates among other US and Canadian populations. The 2 methodologically closest studies, in which surveillance or vital events registries were used to calculate incidence of attempts by youths, are from Langlois and Morrison¹³ and Andrus et al.¹⁴ The 2005 and 2006 annual incidence rate of suicide attempts by Apache youths was approximately 17 times higher than rates reported in these similar studies (3.5% vs approximately 0.2%).^{13,14}

Other studies calculating annual suicide attempt prevalence rates have been based on youths' responses to self-report questionnaires about attempts in the previous 12 months. Suicide attempt rates from these studies range from 1.4% to 16%.^{24–28} Self-report data versus

registry, clinical, or vital events data are known to generate higher rates.^{24,25} Self-report studies in which specific wording was used to determine medically serious attempts resulted in lower rates, ranging from 0.4% to 2.3%.^{15,21,22} Studies among AIAN populations consistently reported higher attempt rates than among other groups, regardless of methodology.^{17,20,23}

Apache male youths' suicide attempt rates (3.7%) were similar to those of Apache female youths (3.2%). Past studies among other North American populations (Table 2) have found females are 1.6 to 2.5 times more likely than are males to both report and be hospitalized for suicide attempts, with the exception of 1 study among a Northern Plains AIAN population in which the male-to-female ratio for suicide attempts was reported to be similar.¹⁶

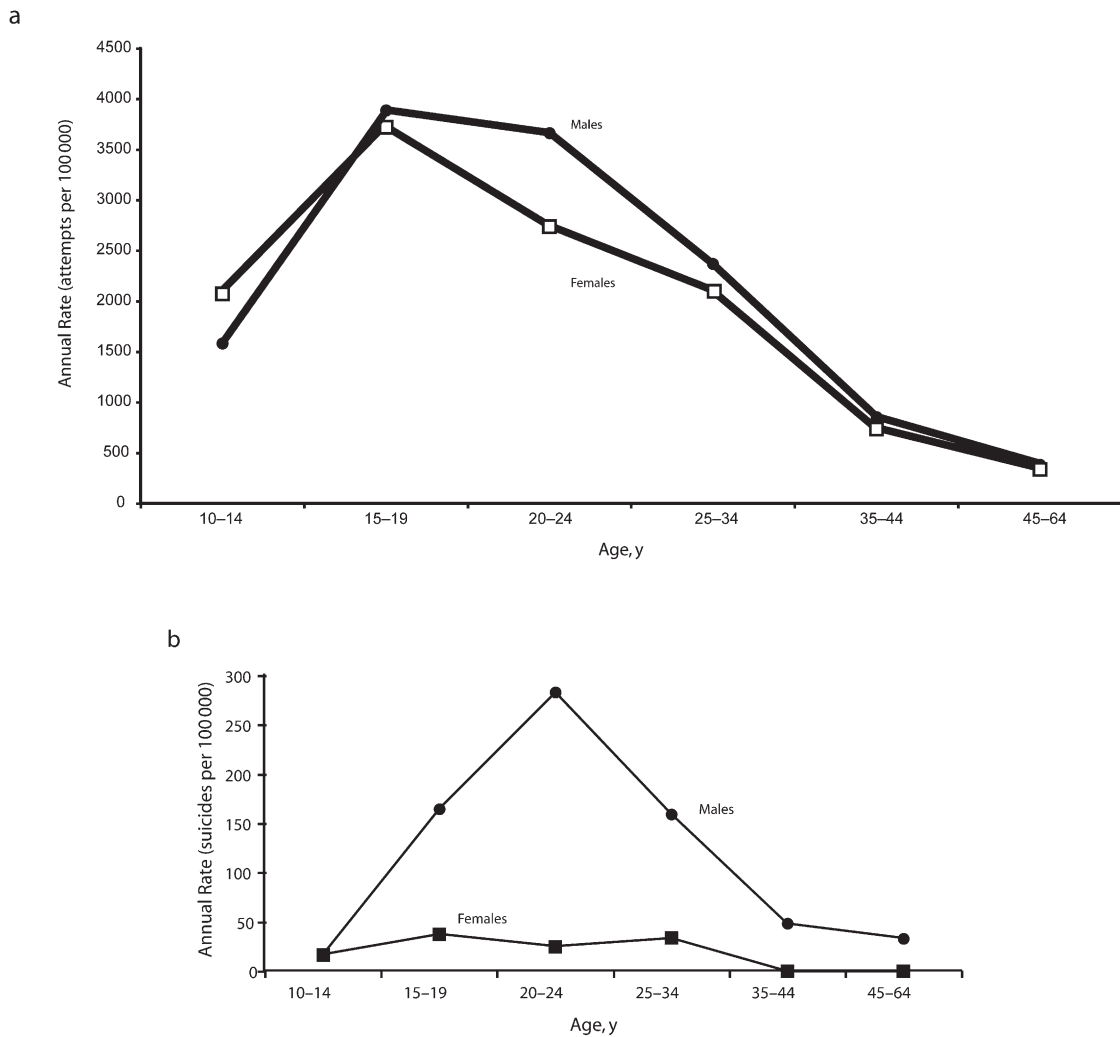


FIGURE 2—Average annual (a) age- and gender-specific suicide attempt rates among the White Mountain Apache Tribe (WMAT) population in 2005 and 2006 and (b) age- and gender-specific suicide rates among the WMAT population, 2001–2006.

DISCUSSION

White Mountain Apache suicide surveillance data from 2001 to 2006 indicated that rates of suicide for youths aged 15 to 24 years were 128.5 per 100 000, or 13 times the US all-races rate. These findings were strikingly similar to a previous period of surveillance studied by the Apache and Johns Hopkins between 1990 and 1993,²⁹ when rates among those aged 15 to 24 years were 133.5 per 100 000, indicating that nearly 2 consecutive generations of Apache youths have been at high risk for death by suicide. It is important to note that tribally

directed surveillance did not occur between 1994 and 2000. The fact that high rates of suicide among Apaches during both surveillance periods are concentrated among youths aged 15 to 24 years is consistent with tribal data for all-AIAN and IHS populations, but contrasts with general US White and all-races patterns, in which rates remain highest among those 65 years and older and are increasing among those aged 40 to 64 years.³⁰

Although rates of suicide over the past decade appear to be increasing among African Americans aged 15 to 24 years, the magnitude of deaths in this group remains lower than

for Whites³¹ and approximately 3 times lower than for American Indians and Alaska Natives.⁶ Suicide rates for Apache youths currently appear 25 times higher than the Healthy People 2010 targeted objective of 5.0 per 100 000 for the all-ages national suicide rate² and are an inestimable source of years of productive life lost and collective grief for the Apache Tribe.

The annual attempt rate for youths (3.5%) calculated via the registry is also higher than recently published surveillance or vital events data from North American populations. Objective 18-2 of Healthy People 2010 is to reduce the rate of adolescent suicide attempts

TABLE 2—Comparison of Annual Incidence and Prevalence of Youths' Suicide Attempt Rates Across Similar Studies

	Incidence or Prevalence of Having Made a Suicide Attempt in Past 12 Mo	Definition of Youths	Sample Type	Methods	Sample Size	Gender Ratios	Year(s) of Data Collection
White Mountain Apache Surveillance Registry, 2008	Annual incidence rate of 3495 per 100 000 (approximately 3.5%)	15–24 y	Mandatory tribal surveillance system among White Mountain Apache Tribe	Surveillance	~15 500	Males and females equally likely to have made attempt reported to registry	2001–2006
Langlois and Morrison, 2002 ¹³	Annual incidence rate of 152 per 100 000 hospitalizations for attempted suicide (approximately 0.2%)	15–19 y	1999 Canadian Hospital Morbidity Database	Nationally maintained inpatient database	NA	Females 2.5 times more likely to have been hospitalized for attempt than were males	1998–1999
Andrus et al., 1991 ¹⁴	Annual incidence rate of 214 per 100 000 (approximately 0.2%)	10–17 y	Mandatory statewide hospital surveillance system in Oregon	Surveillance	70 hospitals	Majority (83%) of those who attempted were female	1988
Eaton et al., 2006 ¹⁵	8.4% reported having attempted suicide; 2.3% reported having made attempt that required medical treatment	9th–12th graders	2005 nationally representative Youth Risk Behavior Survey among public and private high school students	Anonymous self-administered questionnaire	13 917	Females 1.8 times more likely to report attempt than were males	2004–2005
Lemaster et al., 2004 ¹⁶	1.4% reported having attempted suicide	15–24 y	Population-based survey among Northern Plains American Indians	Face-to-face interviews	1 638	Similar rates reported between males and females	1997–1999
Shaughnessy et al., 2004 ¹⁷	16.0% reported having attempted suicide	9th–12th graders	2001 Youth Risk Behavior Survey among Bureau of Indian Affairs–funded schools in 22 states	Anonymous self-administered questionnaire	5 624	Females 1.6 times more likely to report attempt than were males	2001
Benally et al., 2003 ¹⁸	20.0% reported having attempted suicide	9th–12th graders	2003 Navajo Youth Risk Behavior Survey among high schools on or near Navajo Nation with at least 50% Navajo student enrollment	Anonymous self-administered questionnaire	8 374	Females 1.7 times more likely to report attempt than were males	2003
Borowsky et al., 2001 ¹⁹	3.6% reported having attempted suicide	7th–12th graders	1995–1996 National Longitudinal Survey of Adolescent Health	In-school survey, in-home interviews	13 110	Females 2.5 times more likely to report attempt than were males	1994–1996
Borowsky et al., 1999 ²⁰	9.1% reported having attempted suicide	7th–12th graders	1990 National American Indian Adolescent Health Survey among schools of reservation communities	Anonymous self-administered questionnaire	11 666	Females 1.8 times more likely to report attempt than were males	1990

Continued

TABLE 2—Continued

Garrison et al., 1993 ²¹	5.9% reported having made attempt that did not require medical care; 1.6% reported having made attempt that required medical treatment	9th–12th graders	1990 South Carolina Youth Risk Behavior Survey among public high school students	Anonymous self-administered questionnaire	3 764	Females 2 times more likely to report attempt than were males	1990
Meehan et al., 1992 ²²	1.9% reported having attempted suicide; 0.4% reported having sought medical care as a result of suicide attempt	18–24 y	Freshman students at major public university in Nevada	Anonymous self-administered questionnaire	694	NA	Unclear (approximately 1990)
Grossman et al., 1991 ²³	9.5% reported having attempted suicide	6th–12th graders	1988 Indian Health Service Adolescent Health Survey among students on Navajo reservation	Anonymous self-administered questionnaire	7 254	Females 1.8 times more likely to report attempt than were males	1988

Note. NA = not available.

to an annual average of 1%.² Apache youths aged 15 to 19 years were at highest risk for suicide attempts, and suicide peaked among those aged 20 to 24 years (Figure 2), suggesting that universal and targeted suicidal behavior prevention interventions may be most effective when started within younger age groups (i.e., 10 to 14 years).

Many characteristics of Apache suicidal behavior contrast with findings among other US and AIAN populations. Although the male-to-female ratio for suicide (5:1) is similar to that of US all-races,²⁴ the gender ratio for suicide attempts in the Apache population (approximately 1:1) contrasts with other tribal, US, and international data, in which females are approximately 2 to 3 times more likely than are males to report attempting suicide.^{16,25,32,33} The predominant method of suicide among Apache youths was hanging (80%), with a small group (16%) using firearms. For US all-races youths, the primary method during the study period was firearms (52%), followed by hanging (33%) and overdose (8%). Over the past decade, however, hanging has been increasing among US all-races youths, particularly within the youngest age groups. In the general US population, suffocation suicide rates among those aged 10 to 14 years increased

approximately 5% annually from 1992 to 2001¹ and doubled between 2003 and 2004 for females in this age group.³⁴ Suffocation also recently surpassed firearms for suicide deaths among all American Indians and Alaska Natives aged 10 to 19 years (54% vs 40%).³⁵ Hanging is the primary means of suicide among some international populations, including Canadian men,¹³ New Zealand youths,³⁶ and Japanese men and women.³⁷

Means restriction, especially for firearms, is routinely advocated for reducing suicide. In the Apache community, rates of firearm ownership are high and firearms are often unsecured within homes. Despite the availability of firearms, hanging was the most common method of suicide and a frequent method of suicide attempts, especially among male youths. Using means restriction to reduce Apache hangings is not feasible because youths used common household items including ropes, belts, and electric cords for strangulation. Similar to firearms, hanging is a highly lethal method. The current development of prevention strategies within the Apache community is being informed by increased exploration of Apache means selection vis-à-vis desired outcome (i.e., the intensity of intent to die [see Andrus

et al.¹⁴]), and the unique social or cultural factors that are driving hanging as a preferred method within the young Apache population.

Suicide among Apache youths happened most frequently on Saturdays; weekend alcohol and drug abuse could intensify impulsivity³⁸ and lethality of suicidal behavior among at-risk youths. Suicide deaths were also most common in August, a month coincident with the start of school and seasonal festivities associated with increased alcohol and drug use. Prior research has linked negative family factors to elevated substance use among AIAN youths.³⁹ Surveillance results also revealed family conflict as the most common precipitant for youths' suicidal behavior. Thus, prevention strategies currently under development are targeting home-based outreach to promote family strengthening, conflict resolution, and problem-solving skills as means to prevent both substance use and suicide among at-risk Apache youths.

The tribe's unique surveillance system was born from Apache leaders' and community members' commitment to reservation-wide prevention in the face of excessive mortality and morbidity from suicidal behavior among youths. The system is the first in the nation to capture characteristics of suicidal behavior

among youths beyond clinical settings. The only other known existing nonlethal-suicide surveillance system of youths in the United States was developed in Oregon, and limited to data from youths younger than 18 years who are treated at hospitals for suicide attempts.¹⁴ Community-based surveillance is critical to quantifying the burden of suicide morbidity in rural populations with barriers to clinical care. The Apache system also has the unique capability of capturing the continuum of suicidal behaviors (ideation, attempt, and suicide) at both a single point in time and across the trajectory of individuals' lifetimes.

A by-product of the suicide surveillance system is that it has demonstrated the feasibility and utility of employing indigenous paraprofessionals to lead surveillance efforts in a reservation setting. The Apache–Johns Hopkins continued CBPR process has also identified Apache paraprofessionals as the preferred providers of prevention interventions informed by patterns of behaviors and risk identified by surveillance data. For example, based on the fact that approximately 35% of attempts identified by the surveillance system presented through the local emergency department, an evidence-based emergency department intervention^{40–42} has been adapted for use with youths who are brought to the hospital for attempted suicide. This intervention aims to increase awareness among youths and their families about the seriousness of suicide attempts and the importance of compliance with culturally appropriate treatment plans. Additionally, a family-based, home-visiting suicide prevention intervention based on the previously validated American Indian Life-Skills Development Curriculum^{43,44} has been adapted for use with youths who have recently attempted suicide. The specific content for both of these interventions has been guided by the White Mountain Apache Tribal Guidance Council for Parents and Youth, consisting of tribal elders and stakeholders who convene regularly to provide input on the ongoing development of the tribe's suicide prevention program.

Limitations

Several limitations exist in this study. There are weaknesses in both the surveillance system and in the calculation of rates. First, the registry relies on individuals to observe and report

suicidal events. There are frequent injury deaths among youths in this population, especially motor vehicle and pedestrian incidents, in which cause of death is unknown. Stigma regarding public knowledge of individuals' suicidal behavior may also contribute to incomplete reporting of suicidal events. Suicidal behavior among residents with few interpersonal interactions and low access to community services may have been missed. Finally, information related to exact time and place where suicidal behaviors occurred was limited. More-advanced temporal and geographical data collection has since been incorporated into the surveillance system.

Some degree of misclassification (both false positives and false negatives) may be present in reporting attempts. Intent to die cannot always be determined with full confidence; thus, self-injurious behaviors lacking information about intent to die may have been incorrectly classified. Our consensus procedure, based on all sources of registry, medical chart, and police report information available, identified that the vast majority of suicide attempts (90.03%) were "definite," whereas the remaining approximately 10% were "probable" or "possible."

Because of the small population of the tribe, incidence and prevalence rates are likely to be relatively unstable. To maximize the stability of the rates, annual average rates were calculated over multiple years (2001 to 2006 for suicides; 2005 and 2006 for attempts). Similarities with 1990 to 1993 published rates²⁹ lend credibility to our findings.

Another potential limitation is the utilization of the Whiteriver Service Unit User Population for estimating population size denominators. The Whiteriver Service Unit User Population is considered to be the most reliable data for the Apache population and yields the closest comparisons to US Census figures,⁴⁵ but only includes individuals who have used IHS services in the past 3 years. The true population may be larger, which could result in minor overestimates.

The comparison of Apache youths' suicide attempt rates to other published rates is hampered by methodological differences across studies. Compared with surveillance studies that use hospital-based or vital events data, the Apache surveillance system is more inclusive because all tribal service providers and community members are mandated to report

suicide attempts. However, it is unlikely that the magnitude of rate differentials between the Apache and the 2 other surveillance-based incidence studies^{13,14} is because of reporting differences alone, especially considering the elevated rates of suicide among Apache youths.

Conclusions

Suicide rates among Apache youths are considerably higher than those found among the US all-races, all-AIAN, and IHS Service Area populations. Characteristics of Apache suicidal behavior also contrast with those of the US and some AIAN populations with respect to age distribution, gender patterns, and methods. The tribe's mandated reporting system for suicidal behavior has been an innovative and culturally congruent strategy for the White Mountain Apache people to address a persistent mental health disparity for their youths. The continued refinement of the surveillance system, utilization of surveillance data to inform community-based prevention interventions, and engagement of indigenous paraprofessionals in data collection and intervention delivery may help address national suicide prevention goals and have important public health applicability for other tribal and rural populations worldwide. ■

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Contributors

B. Mullany conducted the data analyses and led the writing with A. Barlow and J. T. Walkup. M. Craig, A. Barlow, and J. T. Walkup originated the study and joined M. Cwik in supervising its implementation. N. Goklish and F. Larzelere-Hinton implemented the project and collected the data. All authors contributed significantly to the interpretation of findings and writing of the article.

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Human Participant Protection

This study protocol was reviewed and approved by the White Mountain Apache Tribal Council and Health Board, the Whiteriver Indian Health Services Unit, Johns Hopkins institutional review board, and Phoenix Area Indian Health Service institutional review board.

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