

# Suicide Among Young Alaska Native Men: Community Risk Factors and Alcohol Control

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Indigenous residents of Alaska (Alaska Natives) die by suicide at a rate nearly 4 times the US average and the average for all American Indians and Alaska Natives (AI/ANs).<sup>1-3</sup> An astonishing 7% of Alaska respondents to a 2003 international household survey of Arctic Indigenous people indicated that they had seriously contemplated suicide within the past year.<sup>4</sup> Studies have shown that alcohol is directly or indirectly involved in most of these deaths.<sup>5-9</sup>

Although Alaska Natives have encountered alcohol for well over a century, the high suicide risk is an entrenched but comparatively recent phenomenon affecting only the past 2 generations.<sup>9,10</sup> Figure 1 shows that crude suicide rates for this group rose rapidly in the decade after Alaska achieved statehood in 1959. The 3-year moving average rate peaked at more than 50 per 100 000 in the early 1980s, before declining to a level of about 40 per 100 000 during the past decade. The dip in suicide rates in the late 1970s likely represents faulty data rather than a real departure from the secular trend.<sup>11</sup>

An emerging new pattern of risk drove the increase in suicide rates in the 1960s. Higher suicide rates among young men led the rise in suicide as a whole.<sup>9,12,13</sup> More recently, another important pattern of differential risk emerged as more Alaska Natives moved to the state's growing urban areas in search of jobs. Suicide rates among Alaska Native residents remaining in small rural communities are more than twice as high as those among Native residents of urban areas and vary greatly among communities even in the same region (Alaska Bureau of Vital Statistics, unpublished data).<sup>13</sup> In fact, suicide rates may have declined since the peak in the 1980s (Figure 1) only because the lower risk population of urban-dwelling Alaska Natives has grown relative to the more vulnerable rural population. The large disparities among populations with similar ethnicity and histories suggest that the

**Objectives.** I examined community risk factors that explained variation in suicide rates among young rural Alaska Native men, evaluating the effectiveness of local alcohol control as a public health policy to reduce this population's historically high vulnerability.

**Methods.** I compiled suicide data, alcohol control status, and community-level social, cultural, and economic characteristics for Alaska Native men aged 15 to 34 years in 178 small Alaska communities from 1980 to 2007. Poisson regression equations explained variation in suicide rates as a function of endogenous alcohol control and community characteristics.

**Results.** Suicide rates were higher in communities prohibiting alcohol importation under state law, but the effect was not significant after controlling for other community characteristics. More remote communities, those with fewer non-Natives, and those with evidence of cultural divides had higher suicide risks. Communities with higher incomes, more married couples, and traditional elders had lower risks.

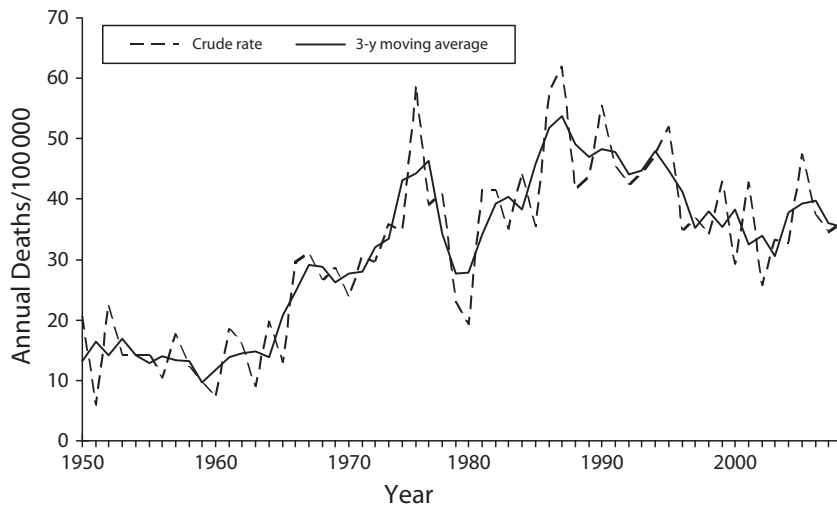
**Conclusions.** Alcohol control is ineffective in preventing suicide among Alaska Natives; suicide instead appears related to particular complex community characteristics that are either protective or increase risk. Communities have limited means to pursue economic and cultural development strategies that might offer more protection. (*Am J Public Health.* 2014;104:S329-S335. doi:10.2105/AJPH.2013.301503)

elevated suicide risk is not simply an unfortunate side effect of rapid social change but may be influenced directly by contemporary living conditions.

The association between Alaska statehood and rising Native suicide rates may not be entirely coincidental. The early statehood period included a number of critical cultural, political, and economic transitions for Alaska Natives. These changes included state takeover of rural governance from the federal government, the discovery of oil—first in the Cook Inlet region and later at Prudhoe Bay—that brought many new residents as well as new wealth to the state, and the settlement of land claims in the Alaska Native Claims Settlement Act. Despite Alaska's overall rapid economic growth since statehood, about 10% of the state's population continues to live in small, rural, predominantly Alaska Native communities. Characteristics of these communities generally include lack of road connection to urban centers, a weak cash economy limited to natural resource extraction and government,

and continued strong subsistence hunting and fishing traditions.<sup>14-16</sup> The natural question, then, is do certain indicators of living conditions in these communities correlate with persistent high suicide rates for Native residents? If so, which indicators appear to increase risk, and which offer some protection?

Given the widely recognized role of alcohol abuse in many of these suicides, an important research question is whether the availability of alcohol affects the risk in this population. One potentially significant change associated with the state government assuming jurisdiction over rural Alaska from the federal Bureau of Indian Affairs related directly to alcohol availability. Before statehood, the bureau, in administering Native affairs, had generally recognized village council authority to prescribe rules for local communities, including prohibition of alcohol importation, regardless of territorial statutes. After statehood, village councils found they could no longer enforce rules that kept alcohol out of their communities because the state constitution included a strong



Source. Alaska Division of Vital Statistics, unpublished data on deaths by cause. Population estimated from US Census data.

**FIGURE 1—Crude suicide death rates of Alaska Natives: Alaska, 1950–2007.**

individual right to privacy and there were no state laws against alcohol importation.<sup>17</sup> The state refused to recognize that tribal legal authority existed in Alaska beyond 1 small congressionally designated Indian reservation on Annette Island, a view affirmed by the US Supreme Court in 1998.<sup>18</sup>

Although larger incorporated communities in Alaska had long-standing rights to control alcohol sales within their boundaries, most rural villages were unincorporated and had no rights under state law. Amid a rising tide of violence blamed on alcohol and in response to repeated requests from rural communities,<sup>19</sup> the Alaska legislature passed a series of laws beginning in 1980 permitting unincorporated communities to control alcohol via a local referendum. Options included no local restrictions, prohibiting sale but allowing importation, prohibiting sale and importation, and allowing sale only by a community-operated or licensed outlet. A 1986 amendment added an option to prohibit alcohol possession, enacted to facilitate enforcement.<sup>20</sup> By 1999, more than 100 small communities had used the local option law to control alcohol sales or importation.<sup>21</sup> Alaska's local option law has been credited with reducing injury morbidity and mortality and improving public safety.<sup>22–24</sup> However, its effect on suicide remains unclear.<sup>24</sup>

I examined the role of community alcohol control as a public health policy in mitigating or

exacerbating suicide risks among rural Alaska Natives. I sought to identify community-level risk factors that explain observed variation in suicide risks among communities and may confound the effects of alcohol control.

Rigorous testing of the effects of alcohol control and other community factors on suicide risks requires overcoming several significant methodological challenges. Communities changed their alcohol status in different years. Some reversed course, and others changed their status several times.<sup>21</sup> Populations of rural Alaska communities are small—generally less than 1000 persons—and have experienced substantial demographic change during the 3 decades since the local option became available. The percentage of the rural population that is Alaska Native is changing, and demographic change has reduced the population percentages of the age cohorts most at risk. The standard practice of age-adjusting death rates, however, could lead to inaccurate measurements for small populations measured only once every 10 years. Given the large gender disparity in suicide rates and observed gender differences in out-migration,<sup>25–27</sup> adjusting only by age could miss potential effects of gender ratio differences associated with varying migration rates. Because alcohol control status on average correlates with time, demographic change could produce spurious correlations between alcohol status and suicides,

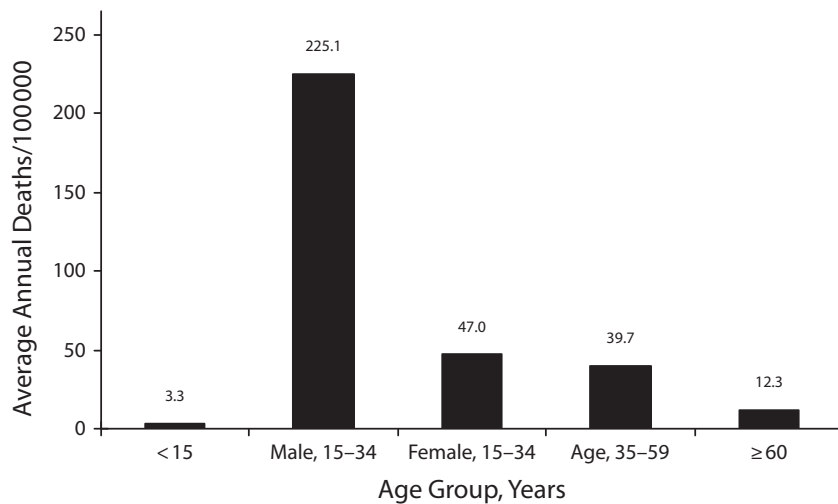
even in studies using the community as its own control.<sup>24</sup>

Alcohol availability represents only 1 of potentially many community risk factors for suicide. Local option regulation is not externally imposed or a random event; rather, it is a community choice that requires substantial local organizing effort, including collection of signatures on a petition from a large percentage of registered voters before a referendum may be held.<sup>21</sup> Alcohol control is therefore an endogenous policy change. If some of the same factors that affect suicide risks at the community level also affect the likelihood that a community decides to adopt a strong alcohol control measure, then failing to address the endogenous nature of the local alcohol policy could produce biased results.<sup>28</sup> In this study, I adopted strategies to address all these important methodological challenges as I tested associations among alcohol control status, other specific observable community characteristics, and suicide risks.

## METHODS

I compiled suicide deaths by race, age, gender, and community from 1980 to 2007 from death records maintained by the Alaska Division of Vital Statistics. The starting point corresponds to the date when the official cause of injury death was deemed reliable.<sup>11</sup> Suicides of Alaska Natives residing in the 178 communities with an Alaska Native population of at least 25 persons and composing at least 25% of the total population were selected for further statistical analysis. These criteria exclude all urban places and correspond to the population historically at the highest risk<sup>13</sup> (also Alaska Bureau of Vital Statistics, unpublished data).

Rural Alaska Native suicide rates are highest for young adults, especially young men, whose rate exceeds 200 per 100 000 (Figure 2). Consequently, I focused on suicides among men aged 15 to 34 years. Between 1980 and 1987, 66% of rural Alaska Native suicides (545 deaths) occurred in this population cohort, which constituted on average 17% of the rural Alaska Native population. Limiting the analysis to deaths among young men addresses demographic change in the population in a simple and transparent way without formal age adjustment that could be inaccurate



Source. Alaska Division of Vital Statistics, unpublished data on deaths by cause. Population estimated from US Census data.

**FIGURE 2—Suicide rates of Alaska Natives by age and gender: Alaska, 1980–2007.**

for small populations measured only periodically.

Observations on alcohol control status over time from previous studies<sup>29,30</sup> were updated from archival records maintained by the Alaska Alcoholic Beverage Control Board. To increase power for statistical tests, I combined the various local option alternatives to create 2 summary binary variables. The first measure, dry status (1 = sale and importation or possession prohibited, 0 = any other status), tested the effect of prohibition. The second, any local option adopted (1 = yes, 0 = no), tested the more general hypothesis that local control of alcohol policy matters, regardless of the form it takes.<sup>31</sup>

A variety of public sources provided information on possible access modes to the community from urban centers and distance to alcohol outlets by transportation mode. Access and remoteness could affect the availability and cost of alcohol, regardless of legal status. US Census data, interpolated between census years to address changes over time, provided community characteristics to test for their effects on suicide risk. Census variables included (1) demographic and social characteristics (percentage AI/AN persons, average household size, and percentage of married-couple households), (2) economic opportunity (full-time workers per person in the community, percentage of households with at least 1 person working, median income, percentage of

households in poverty, percentage receiving public assistance income), and (3) language measures (percentage not speaking English at home, percentage of linguistically isolated households [households with no members older than 14 years who speak English well, typically elder households]). An interaction variable—the minimum of the percentage who were linguistically isolated or the percentage speaking only English—represented the level of integration of traditional and modern cultures.

Table 1 summarizes sources and descriptive statistics for the variables used in the statistical analysis. Except for total population and percentage AI/AN persons, all community characteristics represent AI/AN residents. I included the square of the percentage AI/AN persons to test for nonlinear ethnicity effects, along with the natural logarithms of income and population.

Poisson regression equations estimated the annual number of suicides for Alaska Native men aged 15 to 34 years as a function of alcohol control measures and community characteristics. I estimated the offset variable representing the population at risk from decennial census counts with log-linear interpolation between census years. Annual observations were split into separate periods when community alcohol status changed during the year, with the offset variable multiplied by the respective fraction of a year. I included a yearly

time trend to distinguish long-term trends from patterns across communities.

I estimated logistic regressions and probit equations to test whether alcohol status under the Alaska local option law correlated with potential community suicide risk factors. I estimated Poisson regressions for suicide risks controlling for endogenous treatment effects by incorporating the probit equation for the treatment (alcohol control status) in a simultaneous equation system.<sup>32</sup> The resulting endogenous-switching Poisson equation system was estimated in Stata version 10 (Stata Corp. LP, College Station, TX) by full-information maximum likelihood using the procedure developed by Miranda,<sup>33</sup> modified to include the offset. I used 10 quadrature points for the Gauss-Hermite approximation.

The suite of explanatory variables incorporating access modes, remoteness, and social, economic, and cultural characteristics appeared highly correlated at the community level and over time. The resulting multicollinearity created unstable results from applying the computationally intensive statistical procedure. Consequently, I tested the explanatory variables in Table 1 with stepwise entry and removal, keeping in the final set of equations only those variables with a *P* value of less than 20%.

## RESULTS

Table 2 shows results for the probit equations for alcohol control status, which were very similar to the corresponding logit equations. The probit equations are displayed because the endogenous-switching Poisson procedure uses the probit equation for the treatment variable. Although the 4740 observations allow for changing status every year, standard errors are conservatively adjusted upward to reflect 1 observation for each of 178 communities. The results show a strong association of community characteristics with the choice of alcohol status, consistent with the hypothesis that it is endogenous. Communities choosing formal alcohol controls by referendum under the state local option law were generally larger, with a higher percentage of Alaska Native residents, and more remote. Communities with lower median incomes were more likely to choose prohibition.

**TABLE 1—Sources and Descriptive Statistics for Variables Used in the Study: Alaska, 1980–2007**

Variable	Mean (SD)	Minimum	Maximum
Suicide deaths, Alaska native men aged 15–34 y <sup>a</sup>	0.115 (0.389)	0	5
Community access mode <sup>b</sup>			
Accessible by all-terrain vehicle	0.070 (0.255)	0	1
Accessible by boat year round	0.126 (0.332)	0	1
Accessible in winter by snow machine	0.488 (0.500)	0	1
Accessible only by air	0.035 (0.185)	0	1
Road access to community	0.073 (0.260)	0	1
Scheduled air service	0.435 (0.496)	0	1
Distance to alcohol outlet <sup>b</sup>			
Miles by road to nearest bar	3.132 (16.28)	0	145
Miles off road system to nearest bar	107.1 (117.1)	0	500
Miles to bar by all-terrain vehicle	9.620 (43.61)	0	300
Miles to bar by boat year round	12.48 (41.51)	0	240
Miles to bar by boat or snow machine	83.90 (118.9)	0	500
Miles to bar by seasonal road	1.105 (11.49)	0	145
Miles to bar by year-round road	2.027 (11.73)	0	120
Miles to nearest bar by any mode	109.1 (115.8)	0	500
Community social characteristics <sup>c</sup>			
Average household size	3.627 (0.839)	0.983	10.12
Full-time workers per person	0.188 (0.129)	0	1.383
Median income, per \$1000 <sup>d</sup>	13.68 (7.315)	1.746	64.41
Total population	385.8 (601.3)	26	6097
Households, ≥ 1 person worked, %	78.30 (11.60)	21.21	100
Households linguistically isolated, %	6.56 (9.39)	0	86.52
Households with married couple, %	47.74 (16.00)	0	100
Households with public assistance, %	23.19 (13.68)	0	64.75
People not using English at home, %	48.38 (31.66)	0	100
Alaska Native population, %	83.66 (16.13)	25.10	97.09
Households in poverty, %	27.8 (17.3)	0	100
Linguistically divided community, %	4.11 (5.47)	0	54.29
Alcohol control status <sup>e</sup>			
Alcohol prohibited under federal law	0.018 (0.132)	0	1
Alcohol prohibited by local option	0.404 (0.491)	0	1
Any alcohol regulation under state law	0.509 (0.500)	0	1
Any local option alcohol regulation	0.527 (0.499)	0	1
Bar in community	0.119 (0.324)	0	1
Bar open seasonally	0.014 (0.117)	0	1
Bar open year around	0.105 (0.307)	0	1
Liquor store open year round	0.160 (0.367)	0	1

<sup>a</sup>Alaska Division of Vital Statistics, unpublished data.

<sup>b</sup>Author estimate.

<sup>c</sup>US censuses of 1980, 1990, and 2000.

<sup>d</sup>2009 dollars.

<sup>e</sup>Alaska Alcoholic Beverage Control Board.

Table 2 also shows the Poisson equation results for the endogenous-switching Poisson regressions. The associated full-information

maximum likelihood probit equation results are not shown because they are virtually identical to the respective single-equation

results displayed in the first 2 columns. The middle 2 columns of Table 2 associate alcohol control status with suicide risk, without considering other potentially confounding community characteristics. Results show that young men's suicide risks were significantly higher ( $P < .01$ ) when alcohol was prohibited under the state local option law. The association between adoption of any local alcohol control option and suicide was even stronger ( $P = .001$ ). However, communities using federal Indian law to ban alcohol had significantly lower suicide risks ( $P < .05$ ). The negative and significant correlation of the probit and Poisson equations suggests that suicide rates under prohibition in communities that were not predicted to become or remain dry were higher than suicide rates in other dry communities, and suicide rates were lower than expected in communities that were predicted to be dry but were not.

Finally, Table 2 shows results for Poisson regressions that controlled for other community characteristics as well as alcohol status. The incremental relative risk for dry status became statistically insignificant and that for any local option almost completely disappeared. Community characteristics associated with lower suicide risks (protective factors) included location on the road system, higher income, more married couples, more households receiving public assistance, and more linguistically isolated households. Community risk factors associated with higher suicide rates included a relatively high percentage of Alaska Native population (highest risk at 81% AI/AN for the dry option), more remote location, and the language division interaction variable. Given other risk factors, the trend in suicide risk was downward, but not significant ( $P = .09$ , dry option;  $P = .14$ , any local option).

Correlation of the alcohol status probit error with the suicide risk Poisson equation error was still negative, but statistically much weaker. The likely explanation for the weaker negative error correlation when considering other community characteristics is that 2 community characteristics—income and remoteness—significantly affected the risk of suicide as well as the likelihood of a community choosing to control alcohol, but with opposite signs.

**TABLE 2—Poisson Regression Results for Suicide Relative Risk and Probit Results for Local Option Status under State Law: 178 Communities, Alaska, 1980–2007**

Variable	Alcohol Local Option (Probit)		Suicide Risk by Alcohol Control Status (Poisson Regression)		Suicide Risk by Community Characteristic and Alcohol Control Status (Poisson Regression)	
	Dry Status, <i>r</i> (95% CI)	Any Local Option, <i>r</i> (95% CI)	Dry Status, RR (95% CI)	Any Local Option, RR (95% CI)	Dry Status, RR (95% CI)	Any Local Option, RR (95% CI)
Alcohol control status						
Alcohol prohibited, local option			1.37** (1.08, 1.72)		1.26 (0.86, 1.83)	
Any local option under state law				1.61** (1.22, 2.12)		1.07 (0.63, 1.80)
Alcohol prohibited, federal law			0.42* (0.18, 0.97)	0.36* (0.15, 0.85)	0.40* (0.17, 0.93)	0.39* (0.16, 0.95)
Community access mode						
Road access to community					0.37* (0.16, 0.85)	0.34* (0.14, 0.80)
Accessible only by air	2.91** (0.90, 4.93)	1.57 (-0.16, 3.31)				
Year-round water access	0.62 (-0.47, 1.70)					0.65 (0.39, 1.07)
Winter snow machine access	1.33** (0.51, 2.15)					
Distance to alcohol outlet × 10						
Miles to nearest bar, any mode		0.03* (0.00, 0.05)				
Miles to bar, boat or snow machine					1.01* (1.00, 1.02)	1.01* (1.00, 1.02)
Miles to bar, boat, year-round	0.08* (0.00, 0.15)				0.97 (0.92, 1.01)	
Miles to bar, all-terrain vehicle	0.10 (-0.05, 0.24)					1.12* (1.03, 1.22)
Miles to bar, road						
Community social characteristics						
Natural log of total population	0.50** (0.14, 0.85)	0.65*** (0.36, 0.94)				1.09 (0.93, 1.26)
Alaska Native population, %	0.03* (0.00, 0.05)	0.02* (0.00, 0.04)			1.10** (1.08, 1.13)	1.11** (1.08, 1.14)
Alaska Native population squared, %					0.94* (0.90, 0.99)	0.94* (0.90, 0.99)
Households with married couple, %	-0.01 (-0.03, 0.01)	-0.02 (-0.03, 0.00)			0.99** (0.98, 1.00)	0.99** (0.98, 1.00)
Median income, 2009 \$	-0.08* (-0.16, -0.01)	-0.04 (-0.09, 0.00)				
National log of median income, %					0.68** (0.52, 0.90)	0.64** (0.47, 0.87)
Households in poverty, %	-0.02 (-0.04, 0.00)					
Households with public assistance, %					0.98*** (0.97, 0.99)	0.98*** (0.97, 0.99)
Not using English at home, %	0.01** (0.00, 0.02)	0.01* (0.00, 0.02)				
Households linguistically isolated, %					0.97*** (0.95, 0.98)	0.97*** (0.95, 0.98)
Linguistically divided community, %					1.03* (1.01, 1.06)	1.03* (1.01, 1.06)
Annual time trend					0.99 (0.98, 1.00)	0.99 (0.97, 1.00)
Correlation coefficient ( <i>r</i> )			-0.37* (-0.62, -0.04)	-0.51** (-0.74, -0.15)	-0.41 (0.23, -1.80)	-0.44 (-0.83, 0.25)
Log likelihood	-1613	-1990	-3168	-3469	-3128	-3428
Wald $\chi^2$	613.9***	501.7***	11.9**	16.9***	83.8***	89.7***
Degrees of freedom	12	8	2	2	14	15

Note. CI = confidence interval; RR = relative risk. The sample size was *n* = 4740 observations. \**P* < .05; \*\**P* < .01; \*\*\**P* < .001.

## DISCUSSION

The results for community risk factors suggested that both opportunities in the modern economy (higher median incomes) and a strong traditional presence (linguistically isolated households) offer some protection against young male suicide. The findings seem consistent with the orthogonal identification model for minority youths proposed by Oetting and Beauvais,<sup>34</sup> who found identification with either the majority or minority culture to be a source of personal and social strength. A strong cash economy and presence of traditional elders provided opportunities and role models for identification and integration with the majority and minority cultures, respectively.

The additional protective effect found for the percentage of households receiving public assistance income seems a contradiction. However, public assistance income in this context mainly consists of Social Security payments to elders and welfare for single women with children. A higher incidence of public assistance, therefore, given the community's median income, suggests relatively better income-earning opportunities for those in the labor force. It also suggests a greater need—and therefore a potential opportunity—for young men to play a meaningful role in the community as providers of food from subsistence harvests to households less able to harvest themselves.<sup>35</sup>

I also found suicide risks to be lower in both communities with an Alaska Native minority and those with few non-Natives, relative to majority Alaska Native but more mixed communities. In addition, the protective effect of linguistically isolated households—typically traditional elders—was negated if many households spoke only English (more linguistically divided community). These patterns suggest that challenges with integration of traditional and modern cultures in some communities may have adversely affected youths to the point of increasing the risk of suicide.

The negative correlation of error terms across the equations for alcohol control status and suicide suggests that some communities may have been motivated to use the local option law to ban alcohol as an attempt at prevention. Such a response does not appear to

provide any mitigating effect on suicide. However, communities may have few other tools available, and prohibition has been associated with reduced interpersonal violence.<sup>22–24</sup> Community remoteness was also associated with increased suicide risk. Remoteness increases the costs and reduces the availability of alcohol, but also increases isolation and living costs generally.

A contrasting finding is the apparent protective effect for communities banning alcohol under federal Indian law. Only 3 Alaska communities were able to do this, so the results are only suggestive. If the difference in suicide risks is real, it likely relates to aspects of tribal jurisdiction and autonomy beyond alcohol control itself<sup>36,37</sup> and is an important subject for future research.

Taken together, the findings suggest that suicide risks do indeed vary systematically among communities. However, the factors determining that variation are complex, potentially involving social structure, economic opportunity, and cultural vitality. Alcohol control appears ineffective as prevention policy but is more likely to be selected by communities with higher suicide risks.

## Conclusions

I tested the hypothesis that community differences in Alaska Native suicide rates observed in 178 rural Alaska communities over a 28-year period were systematically associated with specific observable community characteristics. Results considering alcohol control as a community choice, while ignoring other community characteristics, indicated a positive correlation between suicide rates and dry status. After controlling for other risk factors, alcohol control neither increased nor reduced suicide risks. The results instead suggest that the economic, social, and cultural environment of the community played a strong role in determining the level of risk.

## Implications and Future Research

Community suicide risk is complex, and the results provide no easy answer for prevention policy. Despite the role of alcohol in many Alaska Native suicides, alcohol control is likely ineffective as a prevention measure; however, it is one of the few mechanisms available to Alaska communities. Providing suitable local

job opportunities for young men could save lives, but communities lack resources to pursue this objective. The research also suggests that suicide risks were lower in rural communities that had maintained strong ties to traditional culture and contained social and cultural divisions by bridging generational language gaps. State and local education policy could possibly play a role in assisting intergenerational transmission of Indigenous languages and cultures.

Similar historical patterns of suicide to those in rural Alaska appear among Indigenous peoples in Arctic Canada, Greenland, and Micronesia.<sup>38–41</sup> Future research might productively examine whether these regions also contain large intercommunity differences in suicide risks and whether community characteristics similar to those noted for Alaska communities correlate with those differences. ■

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## Human Participant Protection

Institutional review board approval was not required because only de-identified data from death records were used.

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