ORIGINAL RESEARCH

Suicidal ideation, suicide attempt, and self-injury among American Indian, Alaskan Native, and Native Hawaiian college students in the United States from 2015 to 2019

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Abstract

Background: Suicide is a major driver of mortality among college students and is the leading cause of death among American Indian, Alaska Native, and Native Hawaiian (AI/AN/NH) young adults.

Methods: Data on suicidal ideation, suicide attempt, and self-injury among AI/AN/NH college students ($n = 8103$) were analyzed via multivariable logistic regressions employing the American College Health Association National College Health Assessment survey from 2015 to 2019. Adjusted odds ratios (aORs) were used to assess how opioid misuse may act as a risk or protective factor for suicidality and self-injury.

Results: Between 2015 and 2019, suicidal ideation was the most prevalent dimension of suicidality affecting AI/AN/NH college students (ranges from 12.69% to 18.35%), followed by self-injury (7.83%–11.41%) and suicide attempt (2.40%–4.10%). AI/AN/NH college students who reported opioid misuse were significantly more likely to experience suicidal ideation (aOR: 1.417; 95% confidence interval [CI]: 1.154–1.740) and self-injury (aOR: 1.684; 95% CI: 1.341–2.116) than those who did not engage in such behavior.

Conclusions: We identified opioid misuse as a potential risk factor for suicidal ideation and intentional self-injury among populations of AI/AN/NH college students. Programs seeking to reduce suicide prevalence among Indigenous college students may benefit from the inclusion of evidence-based interventions that prevent and treat issues related to opioid use.

KEYWORDS
college students, Native Americans, opioid misuse, self-injury, suicide

1 | INTRODUCTION

More than three-quarters of a million deaths are attributed to suicide annually, constituting a major global public health crisis.[1] In the United States, this crisis extends into the realm of higher education, where suicide is a leading cause of death among college students. This broader context of rising concerns about mental health and suicidality in US college campuses sets the stage for a more focused examination of a particularly vulnerable subgroup. Suicide and suicidal behavior are growing issues in the United States; between 2000 and 2020, there was a 30% increase in suicides across the general population.[2] Young adults aged 18–25 have disproportionately higher rates of suicide and suicidal behavior than any other age group.[3] With 40% of young adults enrolled in a higher educational institution, it comes as little surprise that suicide is the second leading cause of death among college students.[4,5]

Among young adults, American Indian and Alaskan Native (AI/AN) populations are disproportionately affected by suicide.[6] Suicide ranks as the leading cause of death for AI/AN populations aged 15–19 and the second leading cause of death for those aged 20–24.[7] AI/AN individuals aged 15–24 have a suicide rate four times higher than the general population in the same age bracket (37.7 vs. 9.9 per 100,00).[6] This alarming trend underscores the critical need for research focused on AI/AN youth, particularly in the higher education setting.

Research on other US populations suggests opioid misuse and opioid use disorder may be risk factors for suicide.[8-10] This study aims to investigate the potential link between opioid misuse and suicide among AI/AN college students, a demographic with high rates of opioid misuse.

In exploring suicide among AI/AN populations, this study references models like those by Tingey et al.[11] and Cwik et al.,[12] which consider individual, familial, community, and societal factors. These models highlight key issues such as emotional dysregulation, interpersonal conflicts, trauma exposure, and the protective roles of social support and cultural connectedness. Additional empirical literature supports the emphasis of these models on social support and cultural connectedness as protective factors against suicide among Native youth.[12-17] Other important factors to investigate among American Indian, Alaska Native, and Native Hawaiian (AI/AN/NH) college students include gender and sexual minority status, mental illnesses/disorders, eating disorders, sleeping disorders, and other substance use disorders, which are associated with suicide risk in other studies.[18-25] Among AI/AN/NH college students, 22.1% report suicidal ideation, 11.8% attempt suicide, and 19.6% report self-injury.[22] Despite the high prevalence of these issues, there is a notable gap in understanding the modifiable risk and protective factors specific to this population's suicidality. In response to this gap, the primary aim of our study is to explicitly investigate the association between opioid misuse and various measures of suicidality (suicidal ideation, suicide attempts, and self-injury) among AI/AN/NH college students. This research endeavors to elucidate how opioid misuse correlates with these measures of suicidality, while also considering key risk and protective factors within the framework of Cwik et al.'s conceptual model of social spheres of influence. Utilizing data from the National College Health Assessment (NCHA), a comprehensive survey conducted across US higher education institutions, this study seeks to provide valuable insights into these associations and contribute to the development of targeted interventions for this demographic.

2 | METHODS

2.1 | Data source and sample

This study utilized aggregated data from fall 2015 to spring 2019 from the American College Health Association NCHA IIc (ACHA-NCHA IIc) survey. The ACHA-NCHA IIc is a national research survey organized to monitor and provide data on a broad array of health statuses and behaviors among college students. The survey covers questions on health and safety, health education, tobacco and substance use, sexual health, mental health, and impediments to academic performance.

The original sample from the fall 2015 to spring 2019 ACHA-NCHA IIc survey included 426,425 participants. For the purpose of this study, the sample was restricted to students identifying as AI/AN/NH, which totaled 8103 individuals. In line with the definitions provided by the Centers for Disease Control and Prevention, our study adopted a specific approach for categorizing students with multiple racial or ethnic identifications. Specifically, students who identified as both Hispanic and AI/AN/NH were classified under the AI/AN/NH category. This decision was made to ensure a focused examination of the AI/AN/NH population, acknowledging their unique health disparities and social issues.

The final analysis included 8095 AI/AN/NH respondents who answered questions about suicidal ideation, 8041 respondents who answered a question about suicide attempt, and 8051 respondents who answered a question about intentional self-injury.

2.2 | Measures

2.2.1 | Suicidal ideation, suicide attempt, and self-injury

The three primary outcomes of interest were: (a) suicidal ideation, (b) suicide attempt, and (c) intentional self-injury. Suicidal ideation is a binary outcome and was identified by a positive response to either one of the following survey questions: "Within the last 12 months, have you seriously considered suicide when drinking alcohol?" and "Have you ever seriously considered suicide?" Suicide attempt is also a binary outcome and was identified with a positive response to the question "Have you ever attempted suicide?" Intentional self-injury is also a binary outcome and was identified with a positive response to the question "Have you ever intentionally cut, burned, bruised, or otherwise injured yourself?" Detailed variable construction is outlined in Supporting Information S1: Table 1.

2.2.2 | Opioid misuse

The primary exposure of interest in this study was opioid misuse. Opioid misuse is a binary variable and was identified with a positive response to either of the following survey questions: "Within the last 30 days, on how many days did use: Opiates (heroin, smack)" and "In the last 12 months, have you taken pain killers (e.g., OxyContin, Vicodin, Codeine) that were not prescribed to you?" In-depth details on the construction of the variable opioid misuse are outlined in Supporting Information S1: Table 1. A previous study using the ACHA-NCHA IIc survey data from 2015 to 2019 found a high percentage of concomitant illicit/nonprescription opioid use and prescription opioid misuse (64.29%). Based on this finding, the variable opioid misuse was created as a dichotomous combination of illicit and prescription opioid misuses to yield a more powerful analysis.[26]

2.2.3 | Other independent variables

Guided by Cwik et al.'s conceptual model, this study created a framework for analyzing suicide among AI/AN/NH college students that adjusts for key social spheres influencing suicide, namely individual, familial, communal/institutional, and cross-cutting factors potentially associated with suicide (see Supporting Information S1: Table 1). Based on this framework, the study assessed the association between predisposing characteristics, such as gender minority and sexual minority status, and suicide due to the association between relevant crosscutting factors, namely sexual/gender minority status and discrimination (i.e., transphobia and homophobia).[27,28] Also, on the individual level, the study investigated the potential impact that mental illnesses/disorders, eating disorders, sleeping disorders, and symptoms of emotional dysregulation have on suicidality in AI/AN/NH college students. The survey questions used to construct the variable "symptoms of emotional dysregulation" have been used in other studies as indicators of psychological distress and depression.[29,30] Therefore, this variable encompasses individuals who have mental distress or may have an undiagnosed mental illness. Additionally, on the familial or interpersonal level, strained interpersonal relationships were investigated as a potential risk factor for suicidality. The study also investigated several additional crosscutting risk factors for suicidality, including violence and abuse, alcohol use, discrimination, and trauma. Lastly, the analysis investigated university-led suicide prevention as a community/institutional protective factor and utilization of mental health services as a crosscutting protective factor.

2.3 | Statistical analysis

Logistic regression models were chosen for this analysis due to their suitability for examining associations between a binary outcome (such as suicidal ideation, suicide attempt, and intentional self-injury) and one or more predictor variables (such as opioid misuse). This method is particularly effective in estimating the likelihood of occurrence of an event by fitting data to a logistic curve. Additionally, all statistical tests in this study are conducted at a 5% significance level, ensuring that the findings are robust and reliable.

Descriptive and inferential statistics were used to gauge the prevalence of suicide and determine if there is an association between opioid misuse and suicidal ideation, suicide attempt, and intentional self-injury among AI/AN/NH college students. Frequencies (n) and percentages (%) were used to describe crude associations between individual, familial, communal, and cross-cutting identities, and experiences among AI/AN/NH college students with suicidal ideation, suicide attempt, and self-injury (Table 1). To visualize the trend in suicidal ideation, suicide attempt, and self-injury amongst this cohort, the prevalences of the primary outcomes were plotted across academic semesters (Figure 1).

Three multivariable logistic regression models were created and used to evaluate the association between opioid misuse and the primary outcomes of suicidal ideation, suicide attempt, and self-injury. These models were adjusted for various factors to ensure a comprehensive understanding of these associations. Unadjusted odds ratios (uOR) adjusted odds ratios (aOR), and their corresponding 95% confidence intervals (CI) were reported (Tables 2A and 2B) and assessed to see if there is a significant association between each independent variable and the primary outcomes. Goodness-of-fit was assessed with the Hosmer–Lemeshow test and area under the receiver operating characteristic curve (AUC). All analyses were conducted through SAS version 9.4 (SAS Institute Inc.).

2.4 | Sensitivity analysis

A sensitivity analysis was conducted to specifically assess the direct effect of opioid misuse on suicidal ideation, suicide attempt, and self-injury, independent of the potential mediating influence of "symptoms of emotional dysregulation." To achieve this, "symptoms of emotional dysregulation" were removed from the logistic regression models. This approach was taken to evaluate whether the association between opioid misuse and the primary outcomes is direct or potentially mediated by emotional dysregulation.

The aOR and their corresponding 95% CI for this sensitivity analysis were reported (Supporting Information S1: Table 2), providing insights into the direct relationship between opioid misuse and the primary outcomes without the confounding effect of emotional dysregulation.

Additionally, to further explore the robustness of our findings, a post hoc analysis was carried out. This analysis involved creating logistic regression models for all possible combinations of opioid misuse with the confounding variables to predict suicide attempt. The purpose of this post hoc analysis was to document and understand any changes in the significance of the association between opioid misuse and suicide attempt when considering the inclusion of various confounding variables. The aORs and their corresponding 95% CI, pvalues, and

TABLE 1 Characteristics of American Indian, Alaskan Native, and Native Hawaiian college students in the United States by status of suicidal ideation, suicide attempt, or intentionally self-injury using aggregated data from the 2015–2019 ACHA-NCHA IIc survey.

Demographic characteristic	Suicide ideation			Suicide attempt			Intentional self-injury			Total
	No	Yes	p Value[a]	No	Yes	p Value[a]	No	Yes	p Value[a]	
	$\bar{x}$ (SD)	$\bar{x}$ (SD)	<0.0001	$\bar{x}$ (SD)	$\bar{x}$ (SD)	0.7518	$\bar{x}$ (SD)	$\bar{x}$ (SD)	<0.0001	$\bar{x}$ (SD)
Age	23.6 (7.6)	22.3 (6.8)		23.4 (7.4)	23.1 (10.2)		23.6 (7.7)	21.5 (5.8)		23.4 (7.5)
	n (%[b])	n (%[b])	p Value[c]	n (%[b])	n (%[b])	p Value[c]	n (%[b])	n (%[b])	p Value[c]	n (%[b])
Total	6799 (84.0)	1296 (16.0)		7791 (96.9)	250 (3.1)		7201 (89.4)	850 (10.6)		8103 (100.0)
Opioid misuse			<0.0001			<0.0001			<0.0001	
No	6316 (85.6)	1067 (14.5)		7151 (97.5)	183 (2.5)		6666 (90.8)	676 (9.2)		7386 (91.3)
Yes	480 (67.8)	228 (32.2)		638 (90.6)	66 (9.4)		532 (75.5)	173 (24.5)		708 (8.8)
Gender			<0.0001			<0.0001			<0.0001	
Cisgender female	4427 (84.6)	807 (15.4)		5082 (97.6)	126 (2.4)		4670 (89.6)	544 (10.4)		5237 (64.9)
Cisgender male	2068 (87.2)	303 (12.8)		2289 (97.2)	67 (2.8)		2192 (92.9)	167 (7.1)		2373 (29.4)
Gender diverse	158 (66.7)	79 (33.3)		205 (88.7)	26 (11.3)		169 (73.2)	62 (26.84)		237 (2.9)
Transgender	119 (54.1)	101 (45.9)		190 (87.2)	28 (12.8)		146 (66.7)	73 (33.3)		220 (2.7)
Sexual orientation			<0.0001			<0.0001			<0.0001	
Heterosexual	5389 (88.4)	709 (11.6)		5947 (98.0)	119 (2.0)		5645 (93.0)	427 (7.0)		6102 (75.9)
Gay/lesbian	195 (72.2)	75 (27.8)		252 (94.4)	15 (5.6)		221 (82.5)	47 (17.5)		270 (3.36)
Bisexual	494 (68.4)	228 (31.6)		671 (93.4)	46 (6.4)		553 (77.1)	164 (22.9)		722 (9.0)
Unsure/other	670 (71.0)	274 (29.0)		870 (92.9)	67 (7.2)		737 (78.4)	203 (21.6)		944 (11.7)
Mental illnesses/ disorders			<0.0001			<0.0001			<0.0001	
No	4912 (90.4)	523 (9.6)		5343 (98.7)	68 (1.3)		5099 (94.2)	317 (5.9)		5436 (67.3)
Yes	1872 (70.9)	768 (29.1)		2442 (93.1)	182 (6.9)		2097 (79.8)	532 (20.2)		2640 (32.7)
Eating disorders			<0.0001			<0.0001			<0.0001	
No	6617 (85.3)	1145 (14.8)		7558 (97.8)	168 (2.2)		7024 (90.8)	713 (9.2)		7762 (96.4)
Yes	146 (50.9)	141 (49.1)		204 (71.3)	82 (28.7)		154 (53.7)	133 (46.3)		287 (3.6)
Sleeping disorders			<0.0001			<0.0001			<0.0001	
No	6222 (86.7)	955 (13.3)		6989 (98.0)	141 (2.0)		6529 (91.5)	609 (8.5)		7185 (88.7)
Yes	577 (62.9)	341 (37.2)		802 (88.0)	109 (12.0)		672 (73.6)	241 (26.4)		918 (11.3)
Symptoms of emotional dysregulation			<0.0001			0.0001			<0.0001	
No	503 (99.4)	3 (0.6)		497 (99.8)	1 (0.2)		503 (99.8)	1 (0.2)		507 (6.3)
Yes	6282 (82.9)	1292 (17.1)		7294 (96.7)	249 (3.3)		6698 (88.8)	849 (11.3)		7575 (93.7)
Strained interpersonal relationships			<0.0001			<0.0001			<0.0001	
No	3894 (89.2)	472 (10.8)		4261 (98.1)	82 (1.9)		4042 (93.0)	304 (7.0)		4366 (54.3)
Yes	2863 (77.8)	819 (22.2)		3496 (95.5)	165 (4.5)		3127 (85.3)	541 (14.8)		3682 (45.8)

TABLE 1 (Continued)

	n (%[b])	n (%[b])	p Value[c]	n (%[b])	n (%[b])	p Value[c]	n (%[b])	n (%[b])	p Value[c]	n (%[b])
Exposure to physical/verbal violence or abuse			<0.0001			<0.0001			<0.0001	
No	4860 (89.4)	575 (10.6)		5322 (98.6)	77 (1.4)		5057 (93.5)	351 (6.5)		5437 (67.2)
Yes	1937 (72.9)	720 (27.1)		2468 (93.5)	173 (6.6)		2143 (81.1)	499 (18.9)		2659 (32.8)
Sexual violence or interpersonal violence (IPV)			<0.0001			<0.0001			<0.0001	
No	5460 (89.2)	662 (10.8)		5998 (98.6)	85 (1.4)		5671 (93.1)	420 (6.9)		6125 (75.7)
Yes	1338 (67.9)	633 (32.1)		1792 (91.6)	165 (8.4)		1529 (78.1)	430 (22.0)		1972 (24.4)
Alcohol use			<0.0001			0.1618			<0.0001	
No	1606 (89.4)	191 (10.6)		1738 (97.4)	46 (2.6)		1656 (92.8)	129 (7.2)		1798 (22.3)
Yes	5164 (82.5)	1099 (17.6)		6026 (96.8)	201 (3.2)		5516 (88.5)	718 (11.5)		6264 (77.7)
Discrimination			<0.0001			<0.0001			<0.0001	
No	6014 (87.2)	886 (12.8)		6730 (98.0)	137 (2.0)		6281 (91.4)	592 (8.6)		6900 (86.2)
Yes	708 (64.3)	394 (35.8)		989 (90.3)	106 (9.7)		851 (77.5)	247 (22.5)		1102 (13.8)
Traumatic events			<0.0001			0.0002			<0.0001	
No	1391 (97.2)	40 (2.8)		1394 (98.5)	22 (1.6)		1383 (97.5)	35 (2.5)		1432 (17.7)
Yes	5393 (81.2)	1253 (18.9)		6391 (96.6)	228 (3.4)		5812 (87.7)	815 (12.3)		6646 (82.3)
Received suicide prevention education			0.0397			0.8048			0.1878	
No	3301 (83.1)	671 (16.9)		3820 (96.8)	125 (3.2)		3515 (89.0)	436 (11.0)		3975 (49.5)
Yes	3440 (84.8)	617 (15.2)		3912 (96.9)	124 (3.1)		3629 (89.9)	409 (10.1)		4058 (50.5)
Received mental health services			<0.0001			<0.0001			<0.0001	
No	3481 (91.4)	327 (8.6)		3716 (98.1)	72 (1.9)		3597 (94.8)	196 (5.2)		3808 (47.2)
Yes	3302 (77.4)	967 (22.65)		4069 (95.9)	178 (4.2)		3598 (84.6)	654 (15.4)		4269 (52.9)

Note: Bold p values indicates statistical significance at the 5% significance level.

Abbreviations: ACHA, American College Health Association; n, sample size; NCHA, National College Health Assessment; SD, sample standard deviation; x̄, sample mean.

[a]Satterthwaite p value from two sample t test.

[b]% = Row percentage.

[c]p Value from χ^2 test for independence.

c-values for this post hoc analysis were reported (Supporting Information S1: Table 3), allowing for a comprehensive assessment of the significance of the relationship between opioid misuse and suicide attempt in the context of these confounding variables.

3 | RESULTS

AI/AN/NH college students made up 1.9% (n = 8103) of the original 2015–2019 ACHA-NCHA IIc survey sample. Of these students, 16.0% (n = 1296) reported experiencing suicidal ideation, 3.1% (n = 250) reported attempted suicide, and 10.6% (n = 850) reported intentional self-injury within the last 12 months. Between the fall of 2015 to the spring of 2019, suicidal ideation was the most prevalent dimension of suicide amongst AI/AN/NH students (from 12.7% to 18.4%), followed by self-injury (7.8%–11.4%) and then suicide attempt (2.4%–4.1%) (Figure 1). Between the fall of 2018 and the spring of 2019, there was a 5.7% increase in the prevalence of suicidal ideation. The proportion of respondents who reported having experienced self-injury increased between the fall of 2015 to the spring of 2017 and then remained relatively stable into the spring of 2019. The prevalence of suicide attempts between the fall of 2015 through the spring of 2018 exhibited an oscillating trend with prevalence increasing in the fall and decreasing in the spring.
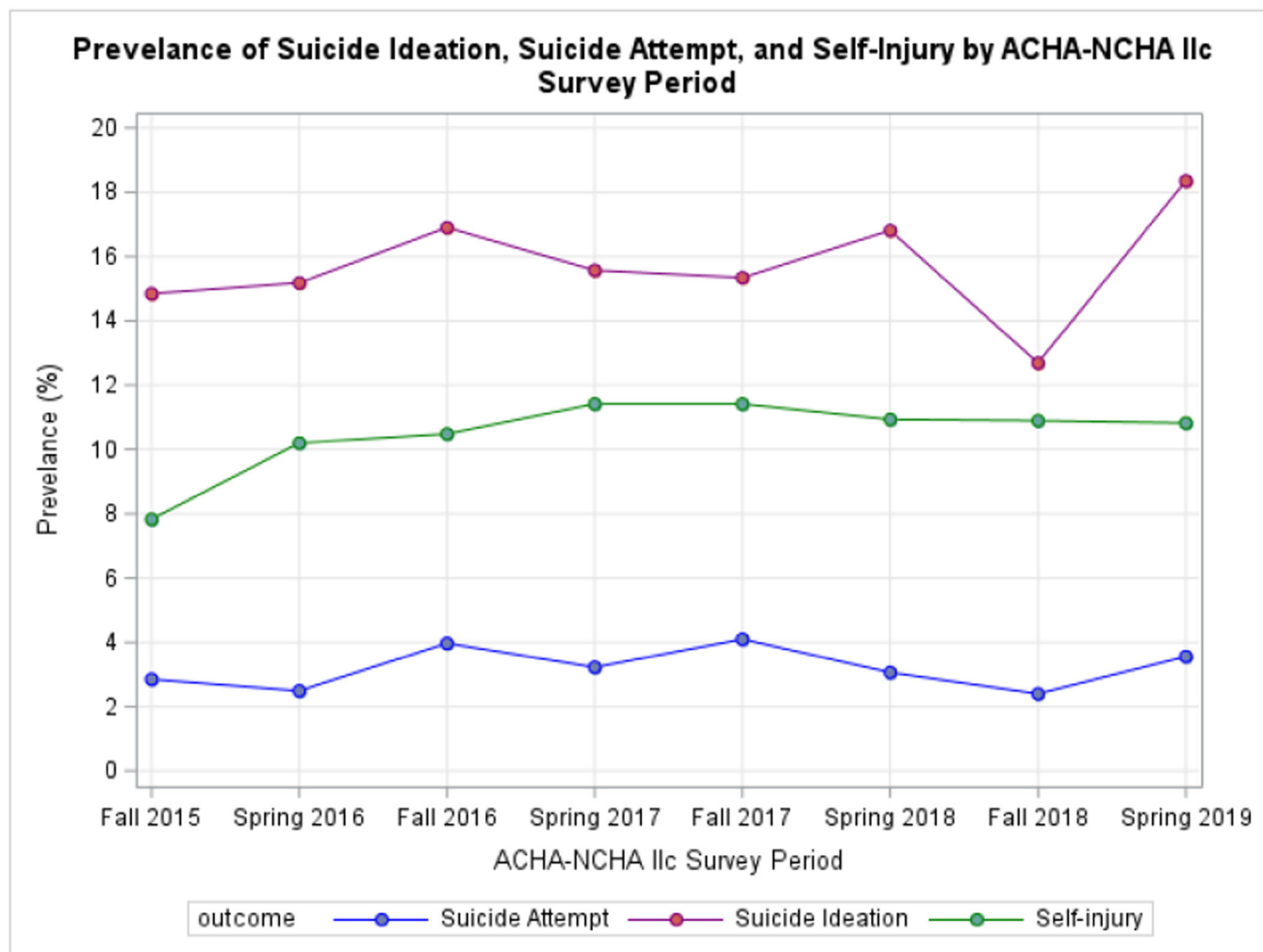
FIGURE 1 Trend in suicidal ideation, suicide attempt, and self-injury over time. ACHA, American College Health Association; NCHA, National College Health Assessment.

TABLE 2A uORs and CI of primary exposure by suicidal ideation, suicide attempt, and intentional self-injury of American Indian, Alaskan Native, and Native Hawaiian college students in the United States: ACHA-NCHA IIc survey, 2015–2019.

	Suicide ideation uOR (95% CI)	Suicide attempt uOR (95% CI)	Intentional self-injury uOR (95% CI)
Opioid misuse			
No	Reference = 1	Reference = 1	Reference = 1
Yes	**2.812 (2.371–3.334)**	**4.043 (3.017–5.419)**	**3.208 (2.656–3.875)**

Note: Bold uOR and 95% CI indicates statistical significance at the 5% significance level.

Abbreviations: ACHA, American College Health Association; CI, confidence interval; NCHA, National College Health Assessment; uOR, unadjusted odds ratio.

However, this trend dissipated in 2018, with a drop in the fall (2.4%) and then an increase in the spring (3.6%).

The sociodemographic characteristics of AI/AN/NH college students who did and did not experience suicidal ideation, suicide attempt, and self-injury are displayed in Table 1. On average, the students in this sample were 23.4 years old (SD = 7.5 years). The majority identified as cisgender female (64.9%), and most reported being heterosexual (75.9%). Over three quarters of the students reported alcohol use (77.7%) and nearly 10% reported opioid misuse (8.8%). Almost a third of respondents identified as having a mental illness/disorder and over 90% reported symptoms of emotional dysregulation. Nearly half of the sample reported having strained interpersonal relationships (45.8%), a third faced physical or verbal violence (32.8%), and around a quarter experienced sexual or intimate partner violence (24.4%). Furthermore, trauma was prevalent amongst

TABLE 2B   aORs and CIs of primary exposure and confounding variables by suicidal ideation, suicide attempt, and intentional self-injury of American Indian, Alaskan Native, and Native Hawaiian college students in the United States: ACHA-NCHA IIc survey, 2015–2019.

	Suicide ideation aOR (95% CI)	Suicide attempt aOR (95% CI)	Intentional self-injury aOR (95% CI)
Opioid misuse			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.417 (1.154–1.740)	1.257 (0.860–1.840)	1.684 (1.341–2.116)
Age	0.958 (0.947–0.969)	0.991 (0.972–1.010)	0.933 (0.917–0.948)
Gender			
Cisgender female	Reference = 1	Reference = 1	Reference = 1
Cisgender male	1.199 (1.017–1.415)	1.523 (1.072–2.164)	0.935 (0.761–1.150)
Gender diverse	1.785 (1.251–2.548)	2.187 (1.213–3.942)	1.963 (1.336–2.885)
Transgender	2.632 (1.852–3.741)	2.095 (1.171–3.746)	2.379 (1.638–3.456)
Sexual orientation			
Heterosexual	Reference = 1	Reference = 1	Reference = 1
Gay/lesbian	1.978 (1.430–2.737)	1.432 (0.740–2.768)	2.193 (1.497–3.212)
Bisexual	1.815 (1.486–2.216)	1.631 (1.084–2.454)	2.071 (1.651–2.598)
Unsure/other	1.689 (1.381–2.066)	1.458 (0.963–2.206)	1.967 (1.565–2.472)
Mental illnesses/disorders			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.730 (1.469–2.038)	2.237 (1.504–3.327)	1.668 (1.370–2.030)
Eating disorders			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.642 (1.221–2.210)	4.281 (2.886–6.351)	2.727 (2.015–3.690)
Sleeping disorders			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.594 (1.316–1.930)	1.607 (1.121–2.306)	1.434 (1.152–1.786)
Symptoms of emotional dysregulation			
No	Reference = 1	Reference = 1	Reference = 1
Yes	14.932 (3.509–63.547)	8.443 (1.117–63.825)	20.341 (2.724–151.880)
Strained interpersonal relationships			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.234 (1.068–1.426)	1.103 (0.800–1.522)	1.232 (1.036–1.465)
Exposure to physical/verbal violence or abuse			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.446 (1.247–1.676)	1.838 (1.308–2.582)	1.632 (1.368–1.947)
Sexual violence or interpersonal violence			
No	Ref = 1	Reference = 1	Reference = 1
Yes	1.854 (1.591–2.162)	2.766 (1.968–3.886)	1.614 (1.346-1.934)
Alcohol use			
No	Reference = 1	Reference = 1	Reference = 1
Yes	1.177 (0.974–1.421)	0.813 (0.551–1.199)	1.122 (0.896–1.406)

(Continues)

TABLE 2B (Continued)

	Suicide ideation aOR (95% CI)	Suicide attempt aOR (95% CI)	Intentional self-injury aOR (95% CI)
Discrimination			
No	Reference = 1	Reference = 1	Reference = 1
Yes	**1.607 (1.353–1.909)**	**1.598 (1.138–2.242)**	1.167 (0.950–1.432)
Traumatic events			
No	Reference = 1	Reference = 1	Reference = 1
Yes	**3.966 (2.731–5.760)**	1.040 (0.594–1.819)	**2.250 (1.518–3.333)**
Received suicide prevention education			
No	Reference = 1	Reference = 1	Reference = 1
Yes	0.905 (0.790–1.038)	1.053 (0.787–1.410)	0.921 (0.784–1.083)
Received mental health services			
No	Reference = 1	Reference = 1	Reference = 1
Yes	**1.377 (1.164–1.629)**	**0.674 (0.463–0.981)**	**1.463 (1.190–1.798)**

Note: Bold uOR and 95% CI indicates statistical significance at the 5% significance level.

Abbreviations: ACHA, American College Health Association; aOR, adjusted odds ratio; CI, confidence interval; NCHA, National College Health Assessment; uOR, unadjusted odds ratio.

respondents, with 82.3% reporting some form of trauma within the last 12 months.

3.1 | Suicidal ideation

Among AI/AN/NH students, opioid misuse was a risk factor for suicidal ideation with 32.2% of those who misused opioids reporting suicidal ideation compared to 14.5% of those who did not misuse opioids (Table 1). Results from the multivariable logistic regression model on suicidal ideation (Table 2B) revealed a significant association between opioid misuse and an increased risk of suicidal ideation. Specifically, AI/AN/NH students who misuse opioids have a 41.7% increase in the odds of experiencing suicidal ideation than those who do not misuse opioids (aOR: 1.417; 95% CI: 1.154–1.740).

Various individual, familial, and cross-cutting risk factors identified in the adjusted analyses were significant, including having a mental illness/disorder, eating disorder, sleeping disorder, symptoms of emotional dysregulation, strained interpersonal relationships, have been exposed to physical/verbal violence or abuse, have experienced sexual violence or interpersonal violence (IPV), have faced discrimination, or have trauma (Table 2B). AI/AN/NH students who used alcohol also showed increased odds of suicidal ideation, but this association was on the boundary of significance (Table 2B). The study hypothesized that use of mental health services would serve as a cross-cutting protective factor for suicidal ideation, however we found the opposite to be true. Those who received mental health services were significantly more likely to experience suicidal ideation than those who did not receive these services (Table 2B).

Among demographic variables, age, gender identity, and sexual orientation were related to suicidal ideation. For every 1-year increase in age, there is a 4.20% decrease in the odds of suicidal ideation (Table 2B). For gender identity, cisgender males, gender-diverse individuals, and transgender individuals had greater odds of suicidal ideation compared to cisgender females (Table 2B). Across sexual orientation, those identifying as gay/lesbian, bisexual, and unsure/other have an increased odds of suicidal ideation compared to heterosexual students (Table 2B). The Hosmer–Lemeshow test showed adequate fit ($p = 0.4602$), and the AUC (0.800) showed good fit and classification ability of the multivariable model.

3.2 | Suicide attempt

Opioid misuse was also a risk factor for attempted suicide, with 9.4% of those who misused opioids attempting suicide compared to 2.5% of those who did not misuse opioids (Table 1). There is a strong, positive crude association between opioid misuse and suicide attempt (uOR: 4.043; 95% CI: 3.017–5.419; Table 2A), but this association became nonsignificant after adjustment for other risk and protective factors for suicide attempt (aOR: 1.257; 95% CI: 0.8:60–1.840; Table 2B). Several other variables adjusted for in the multivariable model were found to be risk factors including, AI/AN/NH college students who have a mental illness/disorder, eating disorder, sleeping disorder, symptoms of emotional dysregulation, have been exposed to physical/verbal violence or abuse, have experienced sexual violence or IPV, or have faced discrimination (Table 2B). The results confirmed that receiving mental health services did indeed act as a protective factor against suicide attempt,

with the odds of suicide attempt being 32.6% lower in those who received mental health services than those who did not (Table 2B). However, receipt of suicide prevention education was not significantly associated with attempted suicide. The Hosmer–Lemeshow test showed adequate fit (p = 0.7581), and the AUC (0.840) showed good fit and classification ability of the multivariable model.

3.3 | Intentional self-injury

Opioid misuse was a risk factor for intentional self-injury with 24.5% of respondents who misused opioids reporting intentional self-injury in the past year compared to 9.2% of those who did not misuse opioids (Table 1). Results from the multivariable logistic regression model found that those who misused opioids had a 68.4% increase in the odds of intentional self-injury compared to those who did not misuse opioids (aOR: 1.684; 95% CI: 1.341–2.116; Table 2B).

Other individual, familial, and societal level risk factors include AI/AN/NH college students who have mental illness/disorder, eating, sleeping disorders, symptoms of emotional dysregulation, strained interpersonal relationships, have been exposed to physical/verbal violence or abuse, have experienced sexual violence or IPV, have trauma, or have received mental health services (Table 2B). The Hosmer–Lemeshow test showed adequate fit (p = 0.1169), and the AUC (0.813) showed good classification ability of the multivariable model.

3.4 | Sensitivity analysis

Even though the conceptual model by Cwik et al. characterizing Native American Youth Suicide posited emotional dysregulation as a risk factor for suicidality, other studies have found emotional dysregulation to mediate the relationship between substance use and suicidality.[29–31] Additionally, in the primary analyses for suicidal ideation, suicide attempt, and self-injury, the ORs for symptoms of emotional dysregulation were extraordinarily high, ranging from an aOR of 8.443 (95% CI: 1.117–63.825) up to an aOR of 20.341 (95% CI: 2.724–151.880; Table 2B), which may mask the association between opioid use and suicidality.[32] Therefore, we conducted a sensitivity analysis by removing the variable "symptoms of emotional dysregulation" to determine if the association between opioid misuse and suicidality changes.

Removal of "symptoms of emotional dysregulation" from all three multivariable models yielded negligible changes in the aOR of opioid misuse (Supporting Information S1: Table 2). This parallel in results demonstrates the robustness and strength of the association between opioid misuse and suicidal ideation, suicide attempt, and intentional self-injury. In the sensitivity analysis, those who misused opioids had a 41.7% increase in the odds of suicidal ideation than those who did not misuse opioids (Supporting Information S1: Table 2). Opioid misuse was also associated with an increased risk of suicide attempt; however, the association was still insignificant

(Supporting Information S1: Table 2). Furthermore, the model found that individuals who misused opioids have 68.7% increase in the odds of engaging in self-injury than those who don't misuse opioids (Supporting Information S1: Table 2).

3.5 | Post hoc analysis

Results from the post hoc analysis revealed that the association between opioid misuse and suicide attempt became insignificant when including variables capturing sexual orientation, mental illnesses/disorders, eating disorders, sleeping disorders, symptoms of emotional dysregulation, strained interpersonal relationships, exposure to physical/verbal violence or abuse, sexual violence or IPV, and alcohol use in the model (Model 39; Supporting Information S1: Table 3). Furthermore, the effect size (OR) between opioid misuse and attempted suicide decreased twofold when the variables sleeping disorders, symptoms of emotional dysregulation, strained interpersonal relationships, exposure to physical/verbal violence or abuse, sexual violence or IPV, and alcohol use were incorporated into the model (from an aOR: 4.043; 95% CI: 3.017–5.419 in Model 1 to an aOR: 1.891; 95% CI: 1.366–2.618 in Model 6). The combination of these variables likely provides a more comprehensive perspective on risk factors for suicide attempt than opioid misuse alone, in turn, likely masking the full effect of opioid misuse on suicide attempt among AI/AN/NH college students.

4 | DISCUSSION

Guided by Cwik et al.'s Conceptual Model of Native American Youth Suicide, this study utilized 2015–2019 ACHA-NCHA IIc survey data to provide estimates on the prevalence of suicide among AI/AN/NH college students and identify cohort-specific risk factors for suicide. The analyses presented here indicate that opioid misuse is associated with a greater risk of suicidal ideation and intentional self-injury among AI/AN/NH college students. In the process of accounting for key factors at individual and social levels in our models, we also found several other characteristics are significant risk factors for suicide including having a mental illness, experiencing violence, or having faced discrimination.

The proportions of AI/AN/NH college students in this study reporting suicidal ideation, attempted suicide, and intentional self-injury within the last year are notably higher than the findings of the 2019 National Survey on Drug Use and Health, in which 11.4% of AI/AN young adults reported experiencing suicidal thoughts and 1.8% reported attempting suicide within the past year.[33] This difference may reflect how college in particular poses an array of new challenges and stressors that may increase vulnerability to suicidal risk factors, such as mental illnesses and substance use.[22,34–36] The results of this study provide key estimates of the need for more effective behavioral health interventions for AI/AN/NH college students However, further research is needed to better

understand the role of specific stressors that emerge in higher education and how to address these.

This study aligns with past research showing associations between measures of opioid use and suicide.[37,38] The data used in the present study found AI/AN/NH college students report a higher rate of opioid misuse than their peers, with 8.8% of them engaging in opioid misuse versus 6.4% of all AI/AN individuals aged 18–25 years old.[33,39] This disparity may be reflective of underlying and/or untreated mental illnesses or psychological distress associated with intergenerational, structural trauma and systematic oppression that is disproportionately experienced amongst this cohort, as opioid misuse can operate as coping strategy for such issues.[26,38,40] Higher education institutions serving AI/AN/NH students may address the trends identified in this analysis by providing culturally sensitive behavioral health intervention programs.[41,42] Program interventions should not just be limited to prevention and treatment of opioid-related issues, but an overall comprehensive approach to intervention in mental health problems which should strategically involve related stakeholders and nongovernmental organizations.

Supporting other empirical evidence of the link between forms of trauma and suicidality,[43–47] this study also identified heightened suicidality risk for AI/AN/NH college students who experienced violence, abuse, discrimination, or other trauma. This study found that Native college students who experienced some form of violence or abuse had odds of suicide 1.5–2.8 times greater than those who did not face such adversities. This is a notably stronger association than identified in the 2019 Health Minds study, which found college students of all races and ethnicities with a history of violence or abuse to have an odds of suicide 1.2–1.8 times greater than those who have not experience violence or abuse.[46] The association between discrimination and suicide among AI/AN/NH college students in this study did not yield an effect size as robust as other literature.[47] Research has identified that exposure to violence and discrimination are associated with depression, adverse mental health outcomes, and a reduction in feelings of hope, which are all associated with an increased risk of suicide.[45,47,48] Therefore, efforts to reduce suicide at universities should also focus on evidence-based policies that address violence and discrimination and provide support services to students victimized by these forms of marginalization.

There are several limitations that should be acknowledged and taken into consideration when interpreting the results of this study. While various studies have identified social support, cultural connectedness, and spirituality to serve as protective factors against suicide and self-injury, the scope of the NCHA-ACHA IIc survey data limited out ability to fully analyze these factors.[12,17,49] In constructing our statistical models, we had access to variables such as chronic diseases, and certain interpersonal dynamics. However, our decision to not include all of these variables was driven by the need to avoid multicollinearity, which could compromise the integrity and inter-pretability of our findings. The variables included were chosen based on their direct relevance to the study's focus and their ability to provide a clear, unconfounded picture of the relationships being examined.

Additionally, while the survey included questions on whether respondents attended a tribal or native serving institution, no respondents identifying as AI/AN/NH reported attending such institutions. Also, there were no questions in the survey gauging a student's connection to their culture, such as whether they grew up on a reservation or engage in cultural practices. Furthermore, the NCHA-ACHA II survey does not entail any means to assess feelings and sources of support. Therefore, further investigation into social support and cultural connectedness as potential protective factors against suicide is needed.

The COVID-19 pandemic has significantly impacted mental health and substance use patterns, particularly among college students. The unique stressors, isolation, and disruptions to daily life brought about by the pandemic necessitate a reevaluation of factors influencing mental health outcomes in this demographic. Studies such as those by La Rosa and Commodari,[50] Paton et al.,[53] and Commodari et al.[51] have highlighted the profound impact of the pandemic on mental health outcomes among college students. These findings demonstrate the need for future research to consider the postpan-demic context, particularly in examining the interplay between opioid misuse, mental health, and suicidality. The pandemic's influence on these variables could offer new insights and necessitate tailored interventions to address the evolving mental health needs of college students. Several factors about the nature of the NCHA-ACHA II survey could potentially bias and impact the data obtained from it. For one, the NCHA-ACHA II survey is a self-reporting assessment and therefore the data could be impacted by respondent recall bias and nonresponse. Furthermore, the survey is a tool that postse-condary colleges and institutions can opt to implement but are not required to. Therefore, while the survey encompasses many institu-tions it may not be representative of all US college students. Additionally, as a result of this study utilizing a cross-section design, the causality between opioid misuse and all other adjusted variables cannot be established. Despite the study's limitations, it shed light on the burden of suicide among AI/AN/NH college students and helped identify risk factors at play. In doing such, this study hopes to lay the ground for further research and implementation of intervention.

5 | CONCLUSION

The findings of this study revealed persistently high rates of suicide ideation, attempt, and self-harm affecting AI/AN/NH college students and suggest a significant relationship between opioid misuse and suicide amongst this population. While opioid misuse is an already a pressing public health issue in the United States due to rising overdose rates,[52] the associations identified in this study between suicide and opioid misuse among AI/AN/NH college students highlight the intersection of two behavioral health issues driving significant mortality among this population of young adults.

The implications of these findings are multifaceted and call for a comprehensive response. Colleges serving AI/AN/NH students should adopt a holistic approach to prevention, which goes beyond

providing evidence-based education and mental health and substance use services. There is a critical need for interventions that are culturally sensitive and tailored to the unique experiences and challenges of AI/AN/NH students. These interventions should address not only the symptoms of opioid misuse and suicidality but also the underlying causes, including systemic oppression and trauma.

Moreover, the study highlights the importance of institutional efforts to create a supportive and inclusive environment. This includes implementing policies and practices that actively combat discrimination and promote mental health awareness and resilience among AI/AN/NH students. Additionally, there is a need for further research to explore the specific factors contributing to the high rates of opioid misuse and suicidality in this demographic. Longitudinal studies could provide deeper insights into causal relationships and help in developing more effective prevention and intervention strategies.

In conclusion, while this study sheds light on the critical issues of opioid misuse and suicidality among AI/AN/NH college students, it also opens the door for more comprehensive and culturally informed approaches in higher education settings. By addressing these issues holistically and sensitively, colleges can play a pivotal role in improving the mental health and well-being of AI/AN/NH students.

AUTHOR CONTRIBUTIONS

Fares Qeadan: Conceptualization; data curation; investigation; methodology; project administration; resources; supervision; writing—review and editing. **Sydney Ross**: Formal analysis; investigation; methodology; software; validation; visualization; writing—original draft; writing—review and editing. **William A. Barbeau**: Formal analysis; investigation; methodology; project administration; supervision; writing—review and editing. **Erin F. Madden**: Investigation; validation; writing—review and editing. **Kevin English**: Investigation; resources; writing—review and editing.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the American College Health Association National College Health Assessment (ACHA-NCHA) (Contact Christine Kukich, at ckukich@acha.org).

TRANSPARENCY STATEMENT

The lead author Fares Qeadan affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.