

# Belief in the myth of an American Indian/ Alaska Native biological vulnerability to alcohol problems among reservation-dwelling participants with a substance use problem

Vivian M. Gonzalez, Monica C. Skewes

This is the peer reviewed version of the following article: [Belief in the myth of an American Indian/ Alaska Native biological vulnerability to alcohol problems among reservation - dwelling participants with a substance use problem. *Alcoholism: Clinical and Experimental Research* 45, 11 p2309-2321 (2021)], which has been published in final form at <https://doi.org/10.1111/acer.14703>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions: <https://authorservices.wiley.com/author-resources/Journal-Authors/licensing/self-archiving.html#3>.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26

**Belief in the Myth of an American Indian/Alaska Native Biological Vulnerability to  
Alcohol Problems Among Reservation-Dwelling Participants with a Substance Use  
Problem**

Vivian M. Gonzalez<sup>1</sup> and Monica C. Skewes<sup>2</sup>

<sup>1</sup> Department of Psychology, University of Alaska Anchorage

<sup>2</sup> Department of Psychology, Montana State University

**Author Note**

This research was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number 5P20GM104417-02. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The authors express sincere gratitude to the Community Advisory Board for their guidance and feedback on this project, and to the participants who generously shared their time and experiences. Correspondence concerning this article should be addressed to Monica C. Skewes, Montana State University, Department of Psychology, 320 Traphagen Hall, Bozeman, Montana 59717. Email: monica.skewes@montana.edu.

27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50

### Abstract

**Background:** Belief in the myth of an American Indian/Alaska Native (AIAN) specific biological vulnerability (BV) to alcohol problems is associated with worse alcohol outcomes among AIAN college students who drink, despite also being associated with greater attempts to reduce drinking. This study examined the association of belief in a BV with alcohol use among reservation-dwelling AI adults with a substance use problem. **Methods:** Participants ( $n=141$ ) who drank alcohol in the past 90 days were selected from a larger AI sample who self-identified as having a substance use problem. Moderated-mediation analyses examined whether belief in a BV was positively associated with alcohol use and substance use consequences, as well as whether self-efficacy and craving mediated the association of belief in a BV with alcohol use. **Results:** Among participants who reported using alcohol but not hard drugs (e.g., methamphetamine, opioids), greater belief in a BV was associated with greater drinking days, which in turn was associated with greater consequences. Among participants who used alcohol only, belief in a BV was also significantly associated with greater craving, and in turn with greater drinking days. Among those who used both alcohol and hard drugs, greater belief in a BV was associated with fewer drinking days, but was not significantly associated with consequences. No association was found between belief in a BV and self-efficacy to avoid alcohol or drug use. **Conclusions:** Among those who use only alcohol, belief in a BV may contribute to greater drinking days and consequences through its association with greater craving. This study provides further evidence of the potential harm of internalizing the belief that being AIAN contributes to risk for alcohol problems, a notion that lacks scientific evidence despite decades of research. The findings highlight the importance of combatting societal myths regarding AIAN peoples and the internalization of these stereotypes.

**Keywords:** American Indian, alcohol, stereotype, biological vulnerability, firewater myth

51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73

## Introduction

American Indians and Alaska Natives (AIANs) have higher rates of current and lifetime abstinence from alcohol compared with non-AIANs in the U.S. (Beals et al., 2003; Cunningham et al., 2016). However, among those who drink there is evidence of greater alcohol consumption and alcohol use disorder (AUD; Beals et al., 2003; Vaeth et al., 2017). There also is evidence of greater alcohol-related morbidity and mortality, and greater severity of AUD for AIANs than for non-AIANs (Grant et al., 2015; Vaeth et al., 2017; Whitesell et al., 2012).

There are a number of factors contributing to alcohol-related health disparities for AIANs. These include inequities in the social determinants of health, such as greater poverty and unemployment, lower attainment of formal education, greater exposure to trauma, and more limited access to health care (Brave Heart et al., 2016; Castor et al., 2006; Collins, 2016; Vaeth et al., 2017; Whitesell et al., 2012). Other contributing factors include the negative effects of discrimination on health and the lasting effects of historical trauma that are associated with the violent colonization and forced assimilation of AIANs by European descendants (Cheadle & Whitbeck, 2011; Whitbeck et al., 2001, 2004). In a national epidemiological dataset, Brave Heart et al. (2016) found that when socioeconomic variables were adjusted for, differences in the rates of AUD between AIANs and non-Hispanic Whites were no longer significant, suggesting that socioeconomic variables largely account for observed racial differences.

Based on the high lifetime rate of AUD in the U.S. (29.1%), many people struggle with moderating their drinking and experience impairing alcohol consequences (Grant et al., 2015). Controlling for demographics (e.g., age, marital status, income, and education), the lifetime rate of AUD among White Americans is at least double that of Hispanics, African Americans, and Asian Americans (Grant et al., 2015), a difference that does not appear to be attributed to race by

74 scientists or the general population. In contrast, AIANs are often subjected to biological and  
75 genetic explanations for alcohol-related health disparities (Skewes & Lewis, 2016) and these  
76 explanations also have been applied to Indigenous peoples in Canada (Johnson, 2016; Thatcher,  
77 2004). Despite a number of studies attempting to identify biological markers of risk for AUD  
78 among AIANs, there is a notable lack of evidence to support the notion that biological or genetic  
79 factors play a greater role in AUD among AIANs compared to other racial groups (Ehlers &  
80 Gizer, 2013; Enoch & Albaugh, 2017). However, many people still believe that there is an AIAN  
81 specific biological vulnerability (BV) to alcohol problems (Gonzalez & Skewes, 2018).

82         While biogenetic explanations for mental health issues, such as alcohol and other  
83 substance use disorders, have been thought to hold promise for reducing the stigma of these  
84 disorders, research suggests that attributing mental health problems to biogenetic causes does not  
85 reduce public stigma (Angermeyer et al., 2011). For example, between 1996 and 2006, while  
86 genetic or chemical imbalance causal attributions increased for AUD in the U.S., there was no  
87 reduction in social stigma. Rather, there was an increase in attributions regarding sufferers' "bad  
88 character" as causal in AUD (Pescosolido et al., 2010). One potential problem with biogenetic  
89 explanations is that they may contribute to the misperception that mental health issues are  
90 incurable (Andersson & Harkness, 2018).

91         Placing causal explanations for alcohol-related health disparities in racially-based  
92 biogenetic differences may negatively affect AIANs who choose to drink. Such causal  
93 attributions also may increase racial bias and discrimination against AIAN peoples, regardless of  
94 drinking behavior (LaMarr, 2003). For AIANs who are not abstinent, the implicit message is that  
95 they drink at their own peril, which may negatively affect attempts to moderate drinking  
96 (Gonzalez & Skewes, 2016). Thus, an internalized belief in a BV may contribute to the future

97 fulfillment of that expectation among those who are not lifetime abstainers (LaMarr, 2003).

### 98 **BV Belief and Alcohol Outcomes in College Drinkers**

99         To date, research on belief in a BV and alcohol outcomes among AIANs who drink has  
100 been conducted only with college students, and findings suggest that this belief is associated with  
101 harmful outcomes (Gonzalez et al., 2019, 2021; Gonzalez & Skewes, 2016, 2018). For example,  
102 belief in a BV is associated with greater depression and drinking to cope (Gonzalez et al., 2021);  
103 lower self-efficacy to avoid drinking heavily; greater heavy episodic drinking and temptation to  
104 drink heavily; and greater negative alcohol consequences, despite also being associated with  
105 guilt for drinking even small amounts of alcohol and greater attempts to control drinking  
106 (Gonzalez & Skewes, 2016). In addition to potentially influencing affect and cognition about  
107 alcohol as well as self-efficacy to control intake, this belief also may contribute to greater  
108 drinking and consequences through its effect on strategies used to avoid alcohol consequences.  
109 Among AIAN students who drink, greater BV belief was associated with greater use of  
110 abstinence-based strategies, which were ineffective or even counterproductive for avoiding  
111 alcohol consequences (Gonzalez & Skewes, 2018), less use of effective strategies that minimize  
112 consequences (i.e., protective behavioral strategies; Gonzalez et al., 2019), and lower self-  
113 efficacy to use harm reduction strategies (Gonzalez et al., 2019).

### 114 **Potential Influence of BV Belief on Recovery**

115         Studies with college students suggest that for AIANs who drink, there may be negative  
116 psychological and behavioral health ramifications of believing in the myth of an AIAN-specific  
117 BV, which may make this belief a risk factor for developing problematic alcohol use (Gonzalez  
118 et al., 2019, 2021; Gonzalez & Skewes, 2016, 2018). This myth also may negatively affect  
119 AIAN individuals who are trying to overcome alcohol problems (Gonzalez & Skewes, 2016). To

120 date, no studies have examined belief in a BV with AIAN community, clinical, or recovery  
121 samples.

122         Given the association of belief in a BV with lower self-efficacy in college students who  
123 drink (Gonzalez & Skewes, 2016), this belief may likewise impact self-efficacy among those in  
124 recovery. Self-efficacy, or confidence in one's ability to avoid substance use in tempting  
125 situations, is an important predictor of treatment success, including reduced substance use  
126 (Kadden & Litt, 2011) and longer time to relapse (Greenfield et al., 2000). Belief in a BV may  
127 lead those experiencing substance use problems to feel that their use is due to biogenetic factors  
128 that are out of their control, negatively impacting self-efficacy to avoid substance use.

129         Craving (i.e., temptation or urges to use substances and experiencing these as difficult to  
130 control) is another variable that robustly predicts treatment outcomes in clinical populations and  
131 may be affected by belief in a BV. Studies show that greater alcohol craving prospectively  
132 predicts treatment dropout among people with AUD (O'Connor et al., 1991) as well as relapse  
133 following treatment (Chong & Lopez, 2008; Gordon et al., 2006; Stohs et al., 2019). In previous  
134 research with college students, belief in a BV was positively associated with greater temptation  
135 to drink (Gonzalez & Skewes, 2016); belief in a BV may be similarly associated with greater  
136 craving and alcohol use among those experiencing more serious substance use issues.

### 137 **Current Study**

138         In this study, we examined the associations of belief in a BV with alcohol use and  
139 substance use consequences among reservation-dwelling AI adults who self-identified as having  
140 a substance use problem. First, we examined whether belief in a BV was associated with alcohol  
141 use (i.e., number of drinking days and drinks per drinking day) and whether alcohol use in turn  
142 was associated with greater substance use consequences. This study then focused on

143 understanding how BV belief may impact alcohol use through its association with self-efficacy  
144 and craving. We hypothesized that greater belief in a BV would be associated with greater  
145 craving, which in turn would be associated with greater alcohol use. We further hypothesized  
146 that greater belief in a BV would be associated with lower self-efficacy to avoid substance use in  
147 tempting situations, which in turn would be associated with greater alcohol use.

148 Hypotheses for the study were based on research and theory for people who use alcohol,  
149 and it was unknown how using hard drugs (e.g., methamphetamine, opioids) in addition to  
150 drinking might change the nature of the associations. Therefore, moderation by substance use  
151 group (alcohol only vs. both alcohol and hard drugs) was examined to avoid a potential  
152 aggregation error in which one fails to identify subgroups that may differ, leading to errors in  
153 inference (Osborne, 2019); these comparisons were exploratory in nature.

## 154 **Method**

### 155 **Participants**

156 The data for the present study came from a survey administered as part of an ongoing  
157 community based participatory research (CBPR) project that aimed to understand substance use  
158 and develop culturally grounded intervention strategies for tribal members from a rural AI  
159 reservation (Skewes et al., 2020). Participants in the larger survey study were 198 AI adults from  
160 the reservation where the research took place who self-identified as “having a substance use  
161 problem and trying to recover.”

162 Given the focus of the current study on the associations of belief in a BV with alcohol use  
163 and substance use consequences, only individuals who reported having at least one drink in the  
164 90 days prior to the survey were included in analyses examining alcohol use ( $n=141$ ). Seven  
165 participants in the larger survey who were missing substance use assessments due to researcher

166 error were excluded from all analyses.

167       Among participants who reported alcohol use, 47.5% were women and 52.5% were men,  
168 with a mean age of 38.0 years (see Table 1 for other participant characteristics). Participants  
169 were abstinent from alcohol the majority of days, with a mean of 70.5% days abstinent in the 90-  
170 day assessment period ( $SD=31.4$ ,  $Md=86.7$ ). In this sample, 40.4% ( $n=57$ ) used “hard drugs”  
171 (i.e., drugs other than cannabis). Among those who used hard drugs, the most commonly used  
172 was methamphetamine (96.5%,  $n=55$ ) with a small minority reporting opioid use (12.3%,  $n=7$ ).  
173 Participants who used hard drugs were abstinent the majority of days, with a mean of 67.5% of  
174 days abstinent from hard drugs ( $SD=29.3$ ,  $Md=74.4$ ).

### 175 **Procedure**

176       This project represents a long-term collaboration between academic and community  
177 research partners from a reservation in the Northern Plains region of the U.S. Using a CBPR  
178 framework (Israel et al., 2008; Wallerstein & Duran, 2010, 2016), we sought input from a  
179 community advisory board (CAB) of AI community members and a local project manager who  
180 were instrumental in the project. The CAB and the tribal IRB approved the study, including the  
181 procedures, measures, and this manuscript.

182       Recruitment began when the local project manager made an in-person announcement to a  
183 group of eight patients at a recovery support group at the on-reservation outpatient treatment  
184 center. The project manager described the history of the project and the CBPR approach, gave a  
185 summary of findings from the formative qualitative phases of the project (see Skewes & Blume,  
186 2019; Skewes et al., 2019, 2020), and extended an invitation to contact the research team at the  
187 local tribal college if interested in participating. After this initial recruitment effort, news of the  
188 survey spread rapidly across the reservation, with subsequent recruitment taking place

189 exclusively through word of mouth.

190 Data were collected during in-person one-on-one interviews conducted by a member of  
191 the research team, which included the non-AI academic partners, the AI project manager, and  
192 two AI members of the CAB. Following an introduction to the larger project and informed  
193 consent, participants completed interview and self-report measures. For participants who  
194 reported problems with reading, all items were read aloud by the interviewer. After the survey  
195 was complete, participants received a referral sheet with contact information for local substance  
196 use disorder (SUD) and other mental health treatment, and were thanked with a \$50 gift card.

### 197 **Measures**

198 **Substance use.** Substance use in the previous 90 days was assessed with the Timeline  
199 Followback interview (TLFB; Sobell & Sobell, 1992). The TLFB is a widely used calendar-  
200 based daily recall method that yields valid and reliable estimates of alcohol and drug  
201 consumption (Robinson et al., 2014; Sobell et al., 1992, 2003). Variables calculated from TLFB  
202 data included number of drinking days and number of standard drinks per drinking day (total  
203 standard drinks/drinking days) in the 90-day assessment period. Standard drinks were defined as  
204 12 oz. of beer, 5 oz. of wine, 8 to 9 oz. of malt liquor, or 1.5 oz. of 80-proof liquor.

205 **Substance use consequences.** An adapted version of the Drinker Inventory of  
206 Consequences (DrInC; Miller et al., 1995) was used to assess alcohol and drug consequences in  
207 the month prior to assessment. This adaptation was based on the Drinker Inventory of  
208 Consequences for Alaska Natives (DrInC-AN; Allen, 2007), which is itself a modified version of  
209 the DrInC (Miller et al., 1995) that was designed to increase cultural sensitivity and relevance for  
210 Indigenous participants. The DrInC-AN includes at least minor linguistic or cultural  
211 modifications for the majority of DrInC items (e.g., including giving away too much money to

212 the consequence of losing or spending too much money) as well as items that were added (e.g.,  
213 having been disrespectful of people as a consequence). In the current study, the 50 item DrInC-  
214 AN was further modified to refer to alcohol or drug use, making the scale similar to the  
215 Inventory of Drug Use Consequences (InDUC-2R; Miller et al., 1995) which has established  
216 test-retest reliability and validity with individuals who use substances (Blanchard et al., 2003;  
217 Tonigan & Miller, 2002). For this study, items were rated as present (1) or absent (0) in the past  
218 30 days and summed to yield a total score. Internal consistency in the present sample was high,  
219 with a Cronbach's alpha of .98.

220       **Craving.** Craving was assessed using a modified version of the Penn Alcohol Craving  
221 Scale (PACS; Flannery et al., 1999). The PACS is a valid and reliable measure that includes five  
222 items assessing subjective experiences of craving alcohol and difficulty controlling urges in the  
223 past week (Flannery et al., 1999). In the present study, items were modified to assess craving for  
224 alcohol or drugs. Items were rated on a scale from 1 to 7, with unique response options for each  
225 item. Responses were summed to yield a total score, with higher scores indicating greater  
226 craving. Internal consistency was high in the present sample, with a Cronbach's alpha of .92.

227       **Self-efficacy.** Self-efficacy was assessed using a modified version of the 8-item Brief  
228 Situational Confidence Questionnaire (BSCQ; Breslin et al., 2000), an instrument with good  
229 psychometric properties that was derived from a longer version (Annis & Graham, 1988; Breslin  
230 et al., 2000). The BSCQ assesses confidence in one's ability to avoid drinking heavily across a  
231 variety of tempting situations. In the present study, the scale was modified to refer to ability to  
232 resist drinking heavily or using their drug of choice. Each item was rated on a scale from 0% (*not*  
233 *at all confident*) to 100% (*totally confident*). A mean score was calculated to yield an overall  
234 self-efficacy score. Internal consistency was high in the present sample (Cronbach's alpha = .89).

235           **Belief in a biological vulnerability.** Belief in an AIAN BV to alcohol problems was  
236 assessed using three items from the 9-item BV subscale of the Revised Firewater Myth Scale  
237 (RFMS; Gonzalez & Skewes, 2016). These items were selected because they had the strongest  
238 factor loadings on the subscale (Gonzalez & Skewes, 2016) and were central to the construct of a  
239 BV. Items included the following: “Alaska Natives and American Indians feel the effects of  
240 alcohol, or feel intoxicated, more easily than people of European descent,” “Alaska Natives and  
241 American Indians metabolize alcohol differently than non-Native people,” and “Alaska Natives  
242 and American Indians are more likely to have a genetic vulnerability to problems with alcohol.”  
243 Items were rated from 1 (*strongly agree*) to 6 (*strongly disagree*), then reversed scored. A mean  
244 score was calculated, with higher scores indicating greater belief in a BV. In this sample, internal  
245 consistency was high (Cronbach’s alpha=.89) as were inter-item correlations (.74 to .78).

#### 246 **Analyses**

247           Prior to analyses, data were screened following the procedures outlined in Tabachnick  
248 and Fidell (2014). Six participants were extreme univariate outliers ( $z > 3.29$ ) on drinks per  
249 drinking day. Outlying scores were changed to be a unit higher than the next most extreme score  
250 in the distribution, thereby reducing the score’s influence while maintaining its position in the  
251 distribution of scores (Tabachnick & Fidell, 2014). Drinking days, drinks per drinking day, and  
252 substance use consequences were positively skewed and were square-root transformed prior to  
253 analyses. Missing data were minimal (< 2%). Missing scores were imputed using expectation  
254 maximization in SPSS 25 for three cases missing consequence scores and one case missing the  
255 PACS.

256           Moderated-mediation analyses were conducted using bias-corrected bootstrap resampling  
257 (10,000 bootstrap samples) to test the significance of the indirect effects using the Hayes

258 PROCESS macro (version 3.5; Hayes, 2018). Statistical significance of the indirect effects was  
259 determined by 95% bias-corrected unstandardized bootstrapped confidence intervals that did not  
260 contain zero. Separate analyses were conducted to examine whether greater belief in a BV was  
261 associated with (a) more drinking days and (b) more drinks per drinking day (*a* paths in separate  
262 models), and whether these alcohol use variables in turn were associated with greater substance  
263 use consequences (*b* paths). Next, moderated-mediation models were used to examine whether  
264 self-efficacy and craving mediated the association of belief in a BV with alcohol use. Four  
265 separate models were conducted to examine associations between each potential mediator (self-  
266 efficacy and craving) and alcohol use variables (drinking days and drinks per drinking day).  
267 Potential differences in the nature of the associations between those who used alcohol only (AO;  
268  $n=84$ ; coded 0) and those who used both alcohol and hard drugs (HD;  $n=57$ ; coded 1) were  
269 examined for all paths of the mediation models. Continuous variables that formed interaction  
270 terms were mean centered to avoid multicollinearity. Gender and age were included as covariates  
271 in all models.

## 272 Results

273 Means, standard deviations, ranges, and intercorrelations of the study variables are  
274 presented in Table 2. Mean drinking days in the past 90 days was 26.57 ( $SD=28.26$ ;  $Md=12$ ).  
275 Drinks per drinking day on average was 17.97 ( $SD=13.16$ ;  $Md=14$ ). Mean belief in a BV was  
276 3.86 ( $SD=1.58$ ; median and mode=4.00), with 59.6% ( $n=84$ ) endorsing some degree of belief in  
277 a BV with a mean score of “slight agreement” (rating of 4) or higher. There was no significant  
278 difference between substance use groups in belief in a BV or in alcohol use (see Table 2).

### 279 Association of Belief in a BV with Abstinence

280 To examine whether belief in a BV covaried with abstinence, as alcohol abstainers were

281 excluded from analyses examining the association of belief in a BV with alcohol use, multiple  
282 regression analyses were conducted with the full sample who completed the TLFB ( $n=191$ ),  
283 controlling for age and gender. No difference in belief in a BV was found between those who  
284 were abstinent from alcohol (regardless of drug use;  $n=50$ ) and those who drank ( $n=141$ ;  
285  $B[SEB]=-0.15 [0.26]$ ,  $\beta=-0.04$ ,  $p=.559$ ,  $f^2=.00$ ). Likewise, abstainers from all substances (alcohol,  
286 hard drugs, cannabis;  $n=24$ ) compared with non-abstainers ( $n=167$ ) did not differ in belief in a  
287 BV ( $B[SEB]=-0.03 [0.34]$ ,  $\beta=-0.01$ ,  $p=.918$ ,  $f^2=.00$ ).

### 288 **Belief in a BV → Alcohol Use → Substance Use Consequences**

289 **Drinking days.** In the *a* path of the model examining drinking days as a mediator of the  
290 association between belief in a BV and substance use consequences, belief in a BV was  
291 significantly associated with drinking days (see Table 3 and Figure 1), but this relationship was  
292 moderated by substance use group. In the AO group, as belief in a BV increased so did number  
293 of drinking days ( $B[SE]=0.42[0.17]$ ,  $\beta=.25$ ,  $p=.015$ ,  $f^2=.05$ ). In contrast, for the HD group,  
294 greater belief in a BV was associated with fewer drinking days ( $B[SE]=-0.44[0.21]$ ,  $\beta=-.26$ ,  
295  $p=.038$ ,  $f^2=.03$ ; see Figure 2).

296 In the *b* path of the model, participants with greater drinking days experienced  
297 significantly greater consequences and substance use groups did not differ in this association.  
298 However, the HD group had significantly greater substance use consequences than the AO  
299 group. Examining the model *c* ' path, there was not a significant direct association of belief in a  
300 BV with substance use consequences for either group. For the AO group there was a significant  
301 indirect association between belief in a BV and substance use consequences through BV's  
302 positive association with drinking days ( $B[SE]=0.10[0.05]$ , 95% CI[0.01, 0.20]), while for the  
303 HD group no indirect association was found ( $B[SE]=-0.13[0.10]$ , 95% CI[-0.35, 0.01]).

304           **Drinks per drinking day.** In the model examining drinks per drinking day as a mediator  
305 of the association of belief in a BV with substance use consequences, belief in a BV and its  
306 interaction with substance use group were not significantly associated with drinks per drinking  
307 day, nor was substance use group (see Table 3).

308           Examining the *b* path of the model, drinks per drinking day and the interaction of drinks  
309 per drinking day by substance group were not significantly associated with consequences.  
310 Further, there was no direct association between belief in a BV and substance use consequences  
311 for either group, nor was there a significant indirect effect for either the AO ( $B[SE]=0.00[0.03]$ ,  
312 95% CI[-0.07, 0.04]) or HD group ( $B[SE]=-0.01 [0.03]$ , 95% CI[-0.09, 0.05]).

### 313 **Belief in a BV → Self-Efficacy → Alcohol Use**

314           **Drinking days.** In the model examining self-efficacy as a mediator of the association of  
315 belief in a BV with drinking days, belief in a BV and its interaction with substance use group  
316 were not significantly associated with self-efficacy (see Table 4). The HD group had  
317 significantly lower self-efficacy than the AO group.

318           Examining the *b* path of the model, lower self-efficacy was significantly associated with  
319 more drinking days. Substance use groups did not differ in the association between self-efficacy  
320 and drinking days. Belief in a BV was directly associated with drinking days, but substance use  
321 groups differed significantly in the nature of this association. There was a significant direct  
322 association of belief in a BV with greater drinking days for the AO group ( $B[SE]=.45[.16]$ ,  
323  $\beta=.27, p=.006, f^2=.06$ ); however, belief in a BV was negatively associated with drinking days for  
324 the HD group ( $B[SE]=-0.40[.20]$ ,  $\beta=-.24, p=.046, f^2=.03$ ). The indirect effect was not significant  
325 for either the AO ( $B[SE]=-0.03[0.07]$ , 95% CI[-0.22, 0.08]) or HD group ( $B[SE]-0.04 [0.08]$ ,  
326 95% CI[-0.19, 0.14]).

327           **Drinks per drinking day.** For this model, the association of belief in a BV with self-  
328 efficacy was identical to that reported for the drinking days model (see Table 4). Self-efficacy  
329 and substance use group were not significantly associated with drinks per drinking day. There  
330 was no direct effect of belief in a BV with drinks per drinking day and substance use groups did  
331 not differ significantly in this association. The indirect effect of belief in a BV on drinks per  
332 drinking day through self-efficacy was not significant for either the AO ( $B[SE]=-0.004[0.02]$ ,  
333 95% CI[-0.04, 0.03]) or HD group ( $B[SE] = -0.002[0.02]$ , 95% CI[-0.04, 0.06]).

#### 334 **Belief in a BV → Craving → Alcohol Use**

335           **Drinking days.** Greater belief in a BV was associated with higher reported craving for  
336 alcohol and/or drugs (see Table 5 and Figure 1). The HD group reported significantly greater  
337 craving. The interaction of belief in a BV with substance use group was not significant,  
338 suggesting that the positive association of belief in a BV with greater craving did not differ by  
339 substance use group. Examining the *b* path of the model, greater craving was significantly  
340 associated with a greater number of drinking days, with no significant difference found between  
341 substance use groups in the effect of craving on drinking days.

342           For the AO group, there was a significant indirect association between belief in a BV and  
343 drinking days through BV's positive association with craving ( $B[SE]=0.11[0.07]$ , 95% CI[0.01,  
344 0.26]). For the HD group, no indirect association was found ( $B[SE]=0.03[0.09]$ , 95% CI[-0.15,  
345 0.22]). Moderation by substance use group was also found for the direct effect of BV to drinking  
346 days, with no significant association found for the AO group ( $B [SE]=0.32 [0.17]$ ,  $\beta=.19$ ,  
347  $p=.063$ ,  $f^2=.03$ ); however, as in previous models for the HD group, a significant negative  
348 association was found ( $B[SE]=-0.45[0.20]$ ,  $\beta=-.28$ ,  $p=.021$ ,  $f^2=.04$ ).

349           **Drinks per drinking day.** Craving was not significantly associated with drinks per

350 drinking day (see Table 5). There was no direct effect of belief in a BV with drinks per drinking  
351 day, and substance use groups did not differ significantly in this association. The indirect effect  
352 of belief in a BV on drinks per drinking day through craving was not significant for either the  
353 AO ( $B[SE]=-0.00[.02]$ , 95% CI $[-0.05, 0.05]$ ) or the HD group ( $B[SE]=-0.001[0.03]$ , 95% CI $[-$   
354  $0.05, 0.08]$ ).

### 355 Discussion

356 To date, studies examining the association of belief in an AIAN specific BV to alcohol  
357 problems have focused on college students who drink. These studies have found either direct  
358 associations of belief in a BV with greater alcohol use and consequences (Gonzalez & Skewes,  
359 2016) or indirect associations of belief in a BV with these alcohol outcomes through less use of  
360 effective protective behavioral strategies (Gonzalez et al., 2019). This study sought to expand  
361 this research by examining the associations of belief in a BV with alcohol use and substance use  
362 consequences among reservation-dwelling AIs who self-identified as having a substance use  
363 problem, most of whom also reported being in recovery. We found a relatively high rate of belief  
364 in the notion of an AIAN specific BV in this sample (60%), similar to the rate found in AIAN  
365 college student drinkers (53%; Gonzalez & Skewes, 2018). We also found positive associations  
366 between belief in a BV, alcohol use, and substance use consequences in this sample, although  
367 these associations depended on whether participants used alcohol only or used both alcohol and  
368 hard drugs.

369 Among participants who used alcohol only, belief in a BV had a small association with  
370 greater drinking days in the past 90 days, which in turn was associated with greater past month  
371 substance use consequences. Among those who used both alcohol and hard drugs, greater belief  
372 in a BV was associated with *fewer* drinking days but there was not a significant indirect

373 association of belief in a BV with reduced substance use consequences. While this potentially  
374 could be considered a positive effect of belief in a BV, participants who used hard drugs had  
375 worse outcomes including lower self-efficacy, greater craving, and worse substance use  
376 consequences. Thus, any benefit in this regard would appear to be insubstantial.

377         This study also explored potential mechanisms by which belief in a BV may affect  
378 alcohol use. In our prior studies with college students who drink, greater belief in a BV was  
379 associated with lower self-efficacy for avoiding heavy drinking in tempting situations (Gonzalez  
380 & Skewes, 2016) as well as lower self-efficacy for using harm reduction strategies (Gonzalez &  
381 Skewes, 2018). However, in the current study belief in a BV was not significantly associated  
382 with participants' self-efficacy to resist drinking heavily or using their drug of choice in tempting  
383 situations. It may be that among participants in this sample, who were older and had more  
384 serious substance use problems compared with college students, self-efficacy was more  
385 influenced by their substantial personal struggles with substance use, such as unsuccessful  
386 attempts to quit or moderate their use and a disheartening accumulation of consequences despite  
387 change efforts. Consistent with other studies that have found a positive influence of self-efficacy  
388 on outcomes (Chong & Lopez, 2008; Greenfield et al., 2000; Kadden & Litt, 2011), in this study  
389 greater self-efficacy was associated with fewer drinking days for both substance use groups.

390         While no association was found between belief in a BV and self-efficacy in this study,  
391 greater belief in a BV had a small association with greater substance use craving, which previous  
392 studies have shown has a negative influence on recovery efforts following treatment in primarily  
393 White samples (Gordon et al., 2006; Stohs et al., 2019) as well as among AI women (Chong &  
394 Lopez, 2008). No difference was found between groups in the positive association of belief in a  
395 BV with craving or the association of greater craving with greater drinking days. However, in the

396 HD group there was no indirect effect from belief in a BV to greater drinking days through  
397 substance use craving, while in the AO group greater belief in a BV was indirectly associated  
398 with greater drinking days through its association with greater craving. This is consistent with  
399 findings with AIAN college students who drink, where greater belief in a BV was associated  
400 with greater temptation to drink heavily despite also being associated with efforts to reduce  
401 drinking (Gonzalez & Skewes, 2016). Believing that struggles to control alcohol use are  
402 ingrained or “hard wired” for AIANs by biogenetics may affect how alcohol craving is  
403 experienced. Craving may be experienced as more intense (stronger subjective urges) or as more  
404 difficult to control when BV belief is high. In fact, the notion of AIAN people having particular  
405 difficulty controlling their drinking is a stereotype that is related to the notion of a BV (LaMarr,  
406 2003). Given the cross-sectional nature of the study, it is important to consider the possibility  
407 that individuals who experience stronger craving may interpret this as evidence that there is a BV  
408 for AIAN people.

409 In this study, drinks per drinking day was used as a measure of intensity of drinking. In  
410 contrast to our findings that greater belief in a BV was associated with drinking days, there were  
411 no associations found between belief in a BV and drinks per drinking day. There also was no  
412 association of drinks per drinking day with substance use consequences. In fact, with the  
413 exception of women drinking significantly fewer drinks compared with men, this variable was  
414 not correlated with any other study variable. This was contrary to our expectation and may  
415 indicate issues with the validity of drinks per drinking day in this sample as measured or as  
416 calculated by the TLFB. In a prior study comparing the accuracy of TLFB drinking estimates  
417 relative to a smartphone-based daily diary record of drinking among individuals with an AUD  
418 (Dulin et al., 2017), the TLFB retrospective recall of drinks per drinking day tended to diverge

419 more from participants' daily diary recordings of drinking than did frequency estimates. The  
420 discrepancy between the two measures increased quickly the further back participants were  
421 asked to remember (i.e., declines within two weeks of retrospective recall). This suggests that  
422 recalling drinks per drinking day is more difficult than recalling the frequency of drinking days.

### 423 **Limitations and Future Directions**

424         The primary limitation of this study is its cross-sectional design. Although we examined  
425 indirect effects using mediation analyses, there are significant limitations to this approach with  
426 cross-sectional data and causal inferences cannot be made regarding the temporal order of  
427 constructs (O'Laughlin et al., 2016). To date, no study has examined change in BV belief over  
428 time. It is possible that, barring a direct intervention or presentation of contrary evidence, this  
429 belief would be static, making it difficult to study as a causal variable. Future research is needed  
430 to examine the stability of BV belief, how change in this belief may be related to changes in  
431 alcohol outcomes or factors such as self-efficacy and craving, and how malleable this belief is  
432 with intervention efforts to debunk it.

433         Other limitations include the use of multiple tests and the possibility of Type I error  
434 inflation, as well as a sample size that may have limited power to detect small effects.

435         Additionally, it is important to note that lifetime abstainers were not included in this study.

436         While it is possible that belief in a BV may be protective for some individuals who abstain due to  
437 alcohol-related stereotypes and awareness of the role of alcohol in the colonization and  
438 oppression of AIAN peoples (Daisy et al., 1998), we did not find an association between belief  
439 in a BV and abstinence in the larger sample. Future studies are needed to understand whether  
440 belief in the BV myth is protective for some individuals or under certain circumstances. The  
441 evidence to date suggests that this belief is associated with negative outcomes.

442 Another limitation is that this study used a word-of-mouth strategy to recruit participants  
443 who self-identified as having a problem with substances and trying to recover. While many  
444 participants reported “trying to recover” during the interview, definitions of recovery vary, as do  
445 definitions of having a “substance use problem.” It is unknown if belief in a BV is associated  
446 with recovery efforts among those in treatment, or if these study results would generalize to  
447 those diagnosed with a SUD.

448 The grand majority of participants in the HD group were using methamphetamine, thus  
449 results may not generalize to other types of hard drugs use (e.g., opioids). Further, participants  
450 were grouped into only two categories given the sample size, but drug use varied within these  
451 groups, including cannabis use in both groups and varied drug use in the HD group. It also is  
452 important to note that assessments of consequences, self-efficacy, and craving referred to alcohol  
453 and/or drugs rather than to each substance separately. In the AO group, participant ratings were  
454 more specific to alcohol, whereas ratings were influenced by multiple substances in the HD  
455 group. This may have obscured some associations, or in the case of the findings for craving, may  
456 indicate that belief in a BV is associated with an increase in alcohol and/or drug use craving.  
457 Future studies are needed to examine alcohol-specific measures with individuals who use both  
458 alcohol and drugs. In addition, future studies are needed to examine whether belief in a BV is  
459 uniquely associated with the use of drugs other than alcohol. Finally, this study used quantitative  
460 methods to examine how belief in a BV is associated with substance use outcomes. Qualitative  
461 research exploring individuals’ experiences, attributions, and beliefs may help to shed more light  
462 on the nature of the associations or put these findings into context, elucidating how this belief  
463 may affect experiences and outcomes.

464

**465 Conclusion**

466 Many Americans struggle with alcohol use and problems (Grant et al., 2015). Attributing  
467 these struggles to race is inaccurate, unhelpful for change efforts, and may lead to discrimination  
468 as well as potentially misguided prevention or intervention efforts. These could inadvertently  
469 contribute to problems rather than helping to relieve them—for example, by promoting the  
470 notion that AIANs cannot drink alcohol in any amount without developing an AUD, or that harm  
471 reduction interventions that are effective with many problematic drinkers would be ineffective  
472 for AIANs. Focusing on immutable biological risk characteristics also distracts from efforts to  
473 address the social determinants of health known to contribute to alcohol problems, such as  
474 poverty, trauma, discrimination, and more limited access to healthcare.

475 The current study was the first to examine belief in a BV with an AI reservation  
476 community sample and focused on individuals who self-identified as having a substance use  
477 problem. In the current sample, similar results were found to our previous work with college  
478 students who drink and provides further evidence of the potential harm incurred by internalizing  
479 the belief that being AIAN contributes to a vulnerability to alcohol problems due to biology or  
480 genetics, which may become a self-fulfilling prophecy (LaMarr, 2003). It is important to combat  
481 not only internalized stereotypes, but larger societal myths of AIAN peoples' unique biogenetic  
482 vulnerability to alcohol problems. While this study found that belief in a BV was associated with  
483 greater craving and alcohol use among the AO group, future research is needed to examine  
484 whether debunking the myth of an AIAN BV during substance use interventions helps to  
485 improve outcomes.

486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508

## References

Allen, J. (2007). The Drinker Inventory of Consequences for Alaska Natives (DrInC-AN): An instrument for assessing adverse consequences of alcohol abuse preliminary manual. Unpublished manuscript.

Andersson, M. A., & Harkness, S. K. (2018). When do biological attributions of mental illness reduce stigma? using qualitative comparative analysis to contextualize attributions. *Society and Mental Health, 8*, 175-194. <https://doi.org/10.1177/2156869317733514>

Angermeyer, M. C., Holzinger, A., Carta, M. G., & Schomerus, G. (2011). Biogenetic explanations and public acceptance of mental illness: Systematic review of population studies. *British Journal of Psychiatry, 199*, 367-372. <https://doi.org/10.1192/bjp.bp.110.085563>

Annis, H. M., & Graham, J. M. (1988). *Situational confidence questionnaire (SCQ-39) user's guide*. Toronto: Alcoholism and Drug Addiction Research Foundation.

Beals, J., Spicer, P., Mitchell, C. M., Novins, D. K., Manson, S. M., Big Crow, C. K., Buchwald, D., Chambers, B., Christensen, M. L., Dillard, D. A., DuBray, K., Espinoza, P. A., Fleming, C. M., Frederick, A. W., Gurley, D., Jervis, L. L., Jim, S. M., Kaufman, C. E., Keane, E. M., Klein, S. A., Lee, D., McNulty, M. C., Middlebrook, D. L., Moore, L. A., Nez, T. D., Norton, I. M., Orton, H. D., Randall, C. J., Sam, A., Shore, J.H., Simpson, S.G., Yazzie, L. L., & AI-SUPERPPF Team. (2003). Racial disparities in alcohol use: Comparison of 2 American Indian reservation populations with national data. *American Journal of Public Health, 93*, 1683-1685.

Blanchard, K. A., Morgenstern, J., Morgan, T. J., Lobouvie, E. W., & Bux, D. A. (2003). Assessing consequences of substance Use: Psychometric properties of the Inventory of Drug

- 509 Use Consequences. *Psychology of Addictive Behaviors*, 17(4), 328–  
510 331. <https://doi.org/10.1037/0893-164X.17.4.328>
- 511 Brave Heart, M. Y. H., Lewis-Fernandez, R., Beals, J., Hasin, D. S., Sugaya, L., Wang, S., Grant,  
512 B. F., & Blanco, C. (2016). Psychiatric disorders and mental health treatment in American  
513 Indians and Alaska Natives: Results of the national epidemiologic survey on alcohol and  
514 related conditions. *Social Psychiatry and Psychiatric Epidemiology*, 51, 1033-1046.  
515 <https://doi.org/10.1007/s00127-016-1225-4>
- 516 Breslin, F. C., Sobell, L. C., Sobell, M. B., & Agrawal, S. (2000). A comparison of a brief and  
517 long version of the situational confidence questionnaire. *Behaviour Research and Therapy*,  
518 38, 1211-1220. [https://doi.org/10.1016/s0005-7967\(99\)00152-7](https://doi.org/10.1016/s0005-7967(99)00152-7)
- 519 Castor, M. L., Smyser, M. S., Taulii, M. M., Park, A. N., Lawson, S. A., & Forquera, R. A.  
520 (2006). A nationwide population-based study identifying health disparities between  
521 American Indians/Alaska Natives and the general populations living in select urban  
522 counties. *American Journal of Public Health*, 96, 1478-1484.  
523 <https://doi.org/10.2105/AJPH.2004.053942>
- 524 Cheadle, J. E., & Whitbeck, L. B. (2011). Alcohol use trajectories and problem drinking over the  
525 course of adolescence: A study of north American indigenous youth and their caretakers.  
526 *Journal of Health and Social Behavior*, 52, 228-245.  
527 <https://doi.org/10.1177/0022146510393973>
- 528 Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence  
529 Erlbaum Associates.
- 530 Collins, S. E. (2016). Associations between socioeconomic factors and alcohol outcomes.  
531 *Alcohol Research: Current Reviews*, 38, 83-94.

- 532 Cunningham, J. K., Solomon, T. A., & Muramoto, M. L. (2016). Alcohol use among Native  
533 Americans compared to whites: Examining the veracity of the 'Native American elevated  
534 alcohol consumption' belief. *Drug and Alcohol Dependence*, *160*, 65-75.  
535 <https://doi.org/10.1016/j.drugalcdep.2015.12.015>
- 536 Daisy, F., Thomas, L. R., & Worley, C. (1998). Alcohol use and harm reduction within the  
537 Native community. In G. A. Marlatt, & G. A. Marlatt (Eds.), *Harm reduction: Pragmatic  
538 strategies for managing high-risk behaviors* (pp. 327-350). New York, NY: Guilford Press.
- 539 Dulin, P. L., Alvarado, C. E., Fitterling, J. M., & Gonzalez, V. M. (2017). Comparisons of  
540 alcohol consumption by timeline follow back vs. smartphone-based daily interviews.  
541 *Addiction Research & Theory*, *25*, 195-200.  
542 <https://doi.org/10.1080/16066359.2016.1239081>
- 543 Ehlers, C. L., & Gizer, I. R. (2013). Evidence for a genetic component for substance dependence  
544 in Native Americans. *The American Journal of Psychiatry*, *170*, 154-164.  
545 <https://doi.org/10.1176/appi.ajp.2012.12010113> [doi]
- 546 Enoch, M., & Albaugh, B. J. (2017). Review: Genetic and environmental risk factors for alcohol  
547 use disorders in American Indians and Alaskan Natives. *American Journal on Addictions*,  
548 *26*, 461-468. <https://doi.org/10.1111/ajad.12420>
- 549 Flannery, B. A., Volpicelli, J. R., & Pettinati, H. M. (1999). Psychometric properties of the Penn  
550 Alcohol Craving Scale. *Alcoholism: Clinical and Experimental Research*, *23*, 1289-1295.  
551 <https://doi.org/10.1111/j.1530-0277.1999.tb04349.x>
- 552 Gonzalez, V. M., Bravo, A. J., Crouch, M. C., & Protective Strategies Study Team. (2019).  
553 Endorsement of the “firewater myth” affects the use of protective behavioral strategies  
554 among American Indian and Alaska Native students. *Addictive Behaviors*, *93*, 78-85.

- 555 <https://doi.org/10.1016/j.addbeh.2019.01.027>
- 556 Gonzalez, V. M., Burroughs, A., & Skewes M.C. (2021). Belief in the American Indian/Alaska  
557 Native biological vulnerability myth and drinking to cope: Does stereotype threat play a  
558 role? *Cultural Diversity and Ethnic Minority Psychology*, 27(1), 37–46. [https://doi.org/](https://doi.org/10.1037/cdp0000366)  
559 [10.1037/cdp0000366](https://doi.org/10.1037/cdp0000366)
- 560 Gonzalez, V. M., & Skewes, M. C. (2016). Association of the firewater myth with drinking  
561 behavior among American Indian and Alaska Native college students. *Psychology of*  
562 *Addictive Behaviors*, 30, 838-849. <https://doi.org/10.1037/adb0000226>
- 563 Gonzalez, V. M., & Skewes, M. C. (2018). Association of belief in the "firewater myth" with  
564 strategies to avoid alcohol consequences among American Indian and Alaska Native college  
565 students who drink. *Psychology of Addictive Behaviors*, 32, 401-409.  
566 <https://doi.org/10.1037/adb0000367>
- 567 Gordon, S. M., Sterling, R., Siatkowski, C., Raively, K., Weinstein, S., & Hill, P. C. (2006).  
568 Inpatient desire to drink as a predictor of relapse to alcohol use following treatment.  
569 *American Journal on Addictions*, 15, 242-245. <https://doi.org/10.1080/10550490600626556>
- 570 Grant, B. F., Goldstein, R. B., Saha, T. D., Chou, S. P., Jung, J., Zhang, H., Pickering, R. P.,  
571 Ruan, W. J., Smith, S. M., Huang, B., & Hasin, D. S. (2015). Epidemiology of DSM-5  
572 alcohol use disorder: Results from the national epidemiologic survey on alcohol and related  
573 conditions III. *JAMA Psychiatry*, 72, 757-766.  
574 <https://doi.org/10.1001/jamapsychiatry.2015.0584>
- 575 Greenfield, S. F., Hufford, M. R., Vagge, L. M., Muenz, L. R., Costello, M. E., & Weiss, R. D.  
576 (2000). The relationship of self-efficacy expectancies to relapse among alcohol dependent  
577 men and women: A prospective study. *Journal of Studies on Alcohol*, 61, 345-351.

- 578 <https://doi.org/10.15288/jsa.2000.61.345>
- 579 Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis*  
580 (Second edition ed.). New York ; London: Guilford Press.
- 581 Israel, B. A., Schulz, A. J., Parker, E. A., & Becker, A. B. (2008). Critical issues in developing  
582 and following community-based participatory research principles. In M. Minkler, & N.  
583 Wallerstein (Eds.), *Community-based participatory research for health* (pp. 47-62). San  
584 Francisco: Jossey-Bass.
- 585 Johnson, H. R. (2016). *Firewater: How alcohol is killing my people (and yours)*. University of  
586 Regina Press.
- 587 Kadden, R. M., & Litt, M. D. (2011). The role of self-efficacy in the treatment of substance use  
588 disorders. *Addictive Behaviors*, 36, 1120-1126.  
589 <https://doi.org/10.1016/j.addbeh.2011.07.032>
- 590 LaMarr, C. J. (2003). *"Firewater myth": Fact, fantasy or self-fulfilling prophecy (doctoral*  
591 *dissertation)*. ProQuest Dissertations Publishing). Retrieved from  
592 <https://search.proquest.com/docview/305277338>
- 593 O'Laughlin, K. D., Martin, M.J., & Ferrer, E. (2018). Cross-sectional analysis of longitudinal  
594 mediation processes. *Multivariate Behavioral Research*, 53(3), 375-402. doi:  
595 10.1080/00273171.2018.1454822.
- 596 Miller, W. R., Tonigan, J.S. & Longabaugh, R. (1995). The Drinker Inventory of Consequences  
597 (DrInC): An instrument for assessing adverse consequences of alcohol abuse. Project  
598 MATCH Monograph Series, Vol. 4. DHHS Publication No. 95-3911. Rockville, MD:  
599 National Institute on Alcohol Abuse and Alcoholism.
- 600 O'Connor, P. G., Gottlieb, L. D., Kraus, M. L., Segal, S. R., & Horwitz, R. I. (1991). Social and

- 601 clinical features as predictors of outcome in outpatient alcohol withdrawal. *Journal of*  
602 *General Internal Medicine*, 6, 312-316. <https://doi.org/10.1007/BF02597427>
- 603 Osborne, J. W. (2019). *Best practices in data cleaning*.
- 604 Pescosolido, B. A., Martin, J. K., Long, J. S., Medina, T. R., Phelan, J. C., & Link, B. G. (2010).  
605 “A disease like any other”? A decade of change in public reactions to schizophrenia,  
606 depression, and alcohol dependence. *The American Journal of Psychiatry*, 167, 1321-1330.  
607 <https://doi.org/10.1176/appi.ajp.2010.09121743>
- 608 Robinson, S. M., Sobell, L. C., Sobell, M. B., & Leo, G. I. (2014). Reliability of the Timeline  
609 Followback for cocaine, cannabis, and cigarette use. *Psychology of Addictive Behaviors*, 28,  
610 154-162. <https://doi.org/10.1037/a0030992>
- 611 Skewes, M. C., & Blume, A. W. (2019). Understanding the link between racial trauma and  
612 substance use among American Indians. *The American Psychologist*, 74, 88-100.  
613 <https://doi.org/10.1037/amp0000331>
- 614 Skewes, M.C., Gonzalez, V.M., Gameon, J.A., FireMoon, P., Salois, E., Rasmus, S.M., Lewis,  
615 J.P., Gardner, S.A., Ricker, A., & Reum, M. (2020). Health disparities research with  
616 American Indian communities: The importance of trust and transparency. *American Journal*  
617 *of Community Psychology*, <https://doi.org/10.1002/ajcp.12445>
- 618 Skewes, M. C., Hallum-Montes, R., Gardner, S. A., Blume, A. W., Ricker, A., & FireMoon, P.  
619 (2019). Partnering with Native communities to develop a culturally grounded intervention  
620 for substance use disorder. *American Journal of Community Psychology*, 64, 72-82.  
621 <https://doi.org/10.1002/ajcp.12354>
- 622 Skewes, M. C., & Lewis, J. P. (2016). Sobriety and alcohol use among rural Alaska Native  
623 elders. *International Journal of Circumpolar Health*, 75, 1-8.

- 624 Sobell L.C., & Sobell M.B. (1992) Timeline Follow-Back: A technique for assessing self-  
625 reported alcohol consumption (pp. 41-72). In R.Z. Litten & J.P. Allen (Eds.), *Measuring*  
626 *Alcohol Consumption*. Humana Press. [https://doi.org/10.1007/978-1-4612-0357-5\\_3](https://doi.org/10.1007/978-1-4612-0357-5_3)
- 627 Sobell, L. C., Sobell, M. B., Connors, G. J., & Agrawal, S. (2003). Assessing drinking outcomes  
628 in alcohol treatment efficacy studies: Selecting a yardstick of success. *Alcoholism: Clinical*  
629 *and Experimental Research*, 27, 1661-1666.  
630 <https://doi.org/10.1097/01.ALC.0000091227.26627.75>
- 631 Sobell, M. B., Sobell, L. C., Bogardis, J., & Leo, G. I. (1992). Problem drinkers' perceptions of  
632 whether treatment goals should be self-selected or therapist-selected. *Behavior Therapy*, 23,  
633 43-52. [https://doi.org/10.1016/S0005-7894\(05\)80307-7](https://doi.org/10.1016/S0005-7894(05)80307-7)
- 634 Stohs, M. E., Schneekloth, T. D., Geske, J. R., Biernacka, J. M., & Karpyak, V. M.  
635 (2019). Alcohol craving predicts relapse after residential addiction treatment. *Alcohol and*  
636 *Alcoholism*, 54(2), 167–172. <https://doi.org/10.1093/alcalc/agy093>
- 637 Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics* (6th ed.). Pearson.
- 638 Thatcher, R. W. (2004). *Fighting firewater fictions: Moving beyond the disease model of*  
639 *alcoholism in First Nations*. University of Toronto Press.
- 640 Tonigan, J. S., & Miller, W. R. (2002). The Inventory of Drug Use Consequences (InDUC):  
641 Test-retest stability and sensitivity to detect change. *Psychology of Addictive Behaviors*,  
642 16(2), 165–168. <https://doi.org/10.1037/0893-164X.16.2.165>
- 643 Vaeth, P. A., Wang-Schweig, M., & Caetano, R. (2017). Drinking, alcohol use disorder, and  
644 treatment access and utilization among U.S. racial/ethnic groups. *Alcoholism, Clinical and*  
645 *Experimental Research*, 41, 6-19. <https://doi.org/10.1111/acer.13285> [doi]
- 646 Wallerstein, N. B., & Duran, B. (2010). Community-based participatory research contributions to

- 647 intervention research: The intersection of science and practice to improve health equity.  
648 *American Journal of Public Health, 100*, S40-S46.  
649 <https://doi.org/10.2105/ajph.2009.184036>
- 650 Wallerstein, N. B., & Duran, B. (2016). Using community-based participatory research to  
651 address health disparities. *Health Promotion Practice, 7*, 312-323.  
652 <https://doi.org/10.1177/1524839906289376>
- 653 Whitbeck, L. B., Chen, X., Hoyt, D. R., & Adams, G. W. (2004). Discrimination, historical loss  
654 and enculturation: Culturally specific risk and resiliency factors for alcohol abuse among  
655 American Indians. *Journal of Studies on Alcohol, 65*, 409-418.  
656 <https://doi.org/10.15288/jsa.2004.65.409>
- 657 Whitbeck, L. B., Hoyt, D. R., McMorris, B. J., Chen, X., & Stubben, J. D. (2001). Perceived  
658 discrimination and early substance abuse among American Indian children. *Journal of*  
659 *Health and Social Behavior, 42*, 405-424. <https://doi.org/10.2307/3090187>
- 660 Whitesell, N. R., Beals, J., Crow, C. B., Mitchell, C. M., & Novins, D. K. (2012). Epidemiology  
661 and etiology of substance use among American Indians and Alaska Natives: Risk,  
662 protection, and implications for prevention. *The American Journal of Drug and Alcohol*  
663 *Abuse, 38*, 376-382. <https://doi.org/10.3109/00952990.2012.694527>

**Table 1***Participant Characteristics (N = 141)*

Characteristics	<i>n</i>	%
Gender		
Female	67	47.5
Male	74	52.5
Education, <i>n</i> (%)		
Some college/college degree	14	9.9
High school graduate/GED	38	27.0
Some high school	66	46.8
Middle school (7-8 grade)	12	8.5
Not reported	11	7.8
Monthly income		
>\$2,000	7	5.0
\$1,000-\$2,000	9	6.4
\$500-\$1,000	19	13.5
\$1-500	22	15.6
\$0	55	39.0
Not reported	29	20.6
Time in recovery		
Over a year	43	30.5
Less than a year	47	33.3
Less than a month	17	12.1
Not yet in recovery or just beginning	25	17.7
Not reported	9	6.4
Previous substance use treatment <sup>a</sup>		
Cannabis use <sup>b</sup>	59	41.8

664 <sup>a</sup> Previous substance use treatment included formal treatment (*n* = 77), Alcoholics Anonymous (*n*  
665 = 73), and/or Narcotics Anonymous (*n* = 28).

666 <sup>b</sup> No significant difference was found in cannabis use between those who used alcohol only and  
667 those who reported both alcohol and hard drug use ( $\chi^2=3.21, p=.073$ ).

668 **Table 2**669 *Bivariate Correlations Among Study Variables*

	1	2	3	4	5	6	7	8	<i>M</i>	<i>SD</i>	Range
1. Belief in a biological vulnerability	—								3.86	1.58	1-6
2. Self-efficacy	.07	—							52.69	20.73	1-100
3. Craving	.16	-.40***	—						16.76	7.53	5-34
4. Drinking days <sup>a</sup>	.08	-.34***	.39***	—					26.57	28.26	1-90
5. Drinks per drinking day <sup>a</sup>	-.03	-.05	.06	.10	—				17.97	13.16	1-60
6. Substance use consequences <sup>a</sup>	.09	-.39***	.46***	.37***	.12	—			17.57	14.95	0-50
7. Substance use group <sup>b</sup>	-.09	-.18*	.21*	.04	.06	.25**	—		—	—	—
8. Age	.09	-.14	.25**	.28***	-.09	.16	-.18*	—	37.98	11.76	18-63
9. Gender <sup>c</sup>	-.09	-.02	-.03	-.14	-.28***	.03	.08	.03	—	—	—

670 <sup>a</sup>Correlations were calculated using the square-root transformed variable, while the mean and standard deviation shown represent the  
 671 untransformed variable.

672 <sup>b</sup>Substance use group was coded: alcohol use-only group=0 and alcohol and hard drug use group=1.

673 <sup>c</sup>Gender was coded: men=0 and women=1.

674 \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

675 **Table 3**676 *Alcohol Use as a Mediator of the Association of Belief in an AIAN Specific Biological*677 *Vulnerability (BV) with Substance Use Consequences*

Belief in BV → alcohol use models	Drinking days ( $R^2 = .18$ )			Drinks per drinking day ( $R^2 = .10$ )		
	B (SE)	$\beta$	$f^2$	B (SE)	$\beta$	$f^2$
Belief in BV	0.42 (0.17)	.25*	.05	-0.02 (0.10)	-.02	.00
Substance use group	0.59 (0.43)	.23	.01	0.19 (0.25)	.13	.00
BV × Substance use group	-0.86 (0.27)	-.51**	.07	-0.06 (0.16)	-.07	.00
Covariates						
Age	0.07 (0.02)	.30***	.11	-0.01 (0.01)	-.07	.00
Gender	-1.03 (0.42)	-.39*	.04	-0.86 (0.24)	-.59**	.09
Alcohol use → consequence models	Consequences ( $R^2 = .21$ )			Consequences ( $R^2 = .14$ )		
	B (SE)	$\beta$	$f^2$	B (SE)	$\beta$	$f^2$
Drinking days	.23 (0.09)	.29*	.05	—	—	—
Drinks/day	—	—	—	0.24 (0.17)	.16	.01
Belief in BV	0.15 (0.14)	.11	.01	0.25 (0.14)	.18	.02
Substance use group	1.12 (0.34)	.52**	.08	1.23 (0.36)	.57**	.09
Drinking days × Substance use group	0.07 (0.13)	.08	.00	—	—	—
Drinks/day × Substance use group	—	—	—	-0.08 (0.24)	-.05	.00
BV × Substance use group	-0.05 (0.22)	-.04	.00	-0.26 (0.23)	-.19	.01
Covariates						
Age	0.02 (0.02)	.13	.01	0.04 (0.01)	.22**	.05
Gender	0.22 (0.34)	.11	.00	0.12 (0.37)	.06	.00

678 *Note.* Substance use group was coded: alcohol use-only group=0 and alcohol and hard drug use  
679 group=1. Gender was coded: men=0 and women=1. Substance use consequences, drinking days,  
680 and drinks per drinking day were square-root transformed prior to analyses. An effect size ( $f^2$ ) of  
681 .02 is conventionally interpreted as small, .15 as moderate, and .35 as large (Cohen, 1988).

682 \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

683 **Table 4**684 *Self-Efficacy as a Mediator of the Association of Belief in an AIAN Specific Biological*685 *Vulnerability (BV) with Drinking Days and Drinks Per Drinking Day*

Belief in BV → self-efficacy model	Self-efficacy ( $R^2 = .07$ )					
	B (SE)	$\beta$	$f^2$			
Belief in BV	0.80 (1.43)	.06	.00			
Substance use group	-8.75 (3.58)	-.42*	.04			
BV × Substance use group	0.13 (2.26)	.01	.00			
Covariates						
Age	-0.32 (0.15)	-.18*	.03			
Gender	0.36 (3.51)	.02	.00			
Alcohol use → consequence models	Drinking days ( $R^2 = .26$ )			Drinks per drinking day ( $R^2 = .10$ )		
	B (SE)	$\beta$	$f^2$	B (SE)	$\beta$	$f^2$
Self-efficacy	-0.04 (0.01)	-.31**	.07	-0.01 (0.01)	-.08	.00
Belief in BV	0.45 (0.16)	.27**	.06	-0.01 (0.10)	-.02	.00
Substance use group	0.25 (0.42)	.10	.00	0.16 (0.25)	.11	.00
Self-efficacy × Substance use group	0.00 (0.02)	.00	.00	0.00 (0.01)	.05	.00
BV × Substance use group	-0.86 (0.26)	-.51**	.08	-0.06 (.16)	-.07	.00
Covariates						
Age	0.05 (0.02)	.24**	.07	-0.01 (0.01)	-.08	.01
Gender	-1.02 (0.40)	-.38*	.05	-0.86 (0.24)	-.59**	.09

686 *Note.* Substance use group was coded: alcohol use-only group=0 and alcohol and hard drug use  
687 group=1. Gender was coded: men=0 and women=1. Drinking days and drinks per drinking day  
688 were square-root transformed prior to analyses.

689 \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

690

691 **Table 5**692 *Craving as a Mediator of the Association of Belief in an AIAN Specific Biological Vulnerability*693 *(BV) with Drinking Days and Drinks Per Drinking Day*

Belief in BV → craving model	Craving ( $R^2 = .17$ )					
	B (SE)	$\beta$	$f^2$			
Belief in BV	1.07 (0.49)	.22*	.04			
Substance use group	4.25 (1.23)	.56***	.09			
BV × Substance use group	-0.85 (0.78)	-.18	.01			
Covariates						
Age	0.19 (0.05)	.29***	.10			
Gender	-0.89 (1.20)	-.12	.00			
Craving → alcohol use models	Drinking days ( $R^2 = .26$ )			Drinks per drinking day ( $R^2 = .10$ )		
	B (SE)	$\beta$	$f^2$	B (SE)	$\beta$	$f^2$
Craving	0.10 (0.04)	.28**	.05	-0.00 (0.02)	-.00	.00
Belief in BV	0.32 (0.17)	.19	.03	-0.02 (0.10)	-.02	.00
Substance use group	0.12 (0.43)	.05	.00	0.13 (0.26)	.09	.00
Craving × Substance use group	0.02 (0.06)	.06	.00	0.03 (0.03)	.15	.01
BV × Substance use group	-0.79 (0.26)	-.47**	.07	-0.07 (0.16)	-.08	.00
Covariates						
Age	0.05 (0.02)	.21**	.05	-0.01 (0.01)	-.08	.01
Gender	-0.95 (0.40)	-.36*	.04	-0.88 (0.25)	-.60**	.10

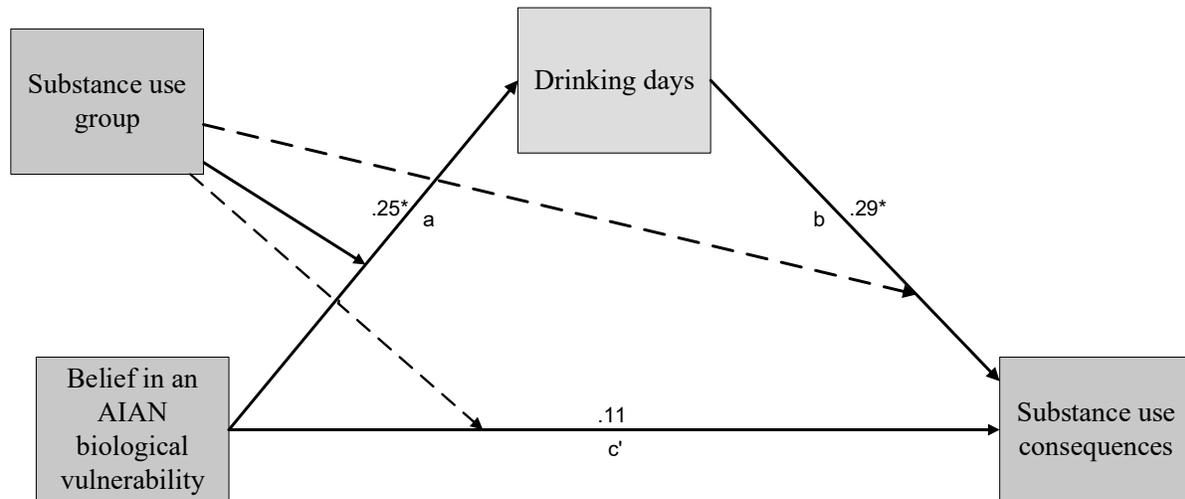
694 *Note.* Substance use group was coded: alcohol use-only group=0 and alcohol and hard drug use  
695 group=1. Gender was coded: men=0 and women=1. Drinking days and drinks per drinking day  
696 were square-root transformed prior to analyses.

697 \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

698

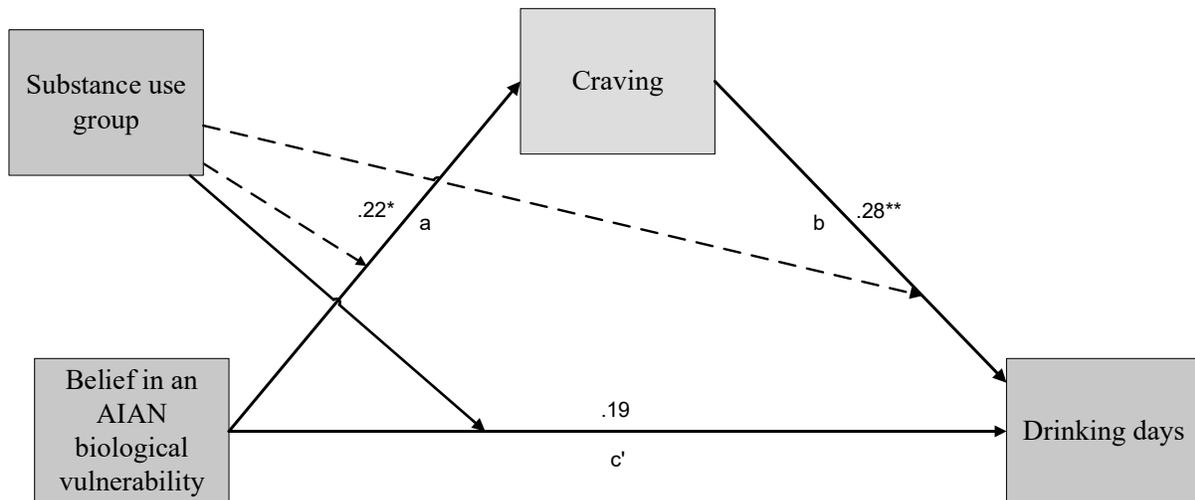
699 **Figure 1**

700 *Moderated-Mediation Models of Belief in an AIAN Biological Vulnerability with Substance Use*  
 701 *Consequences and Drinking Days*



702

703



704

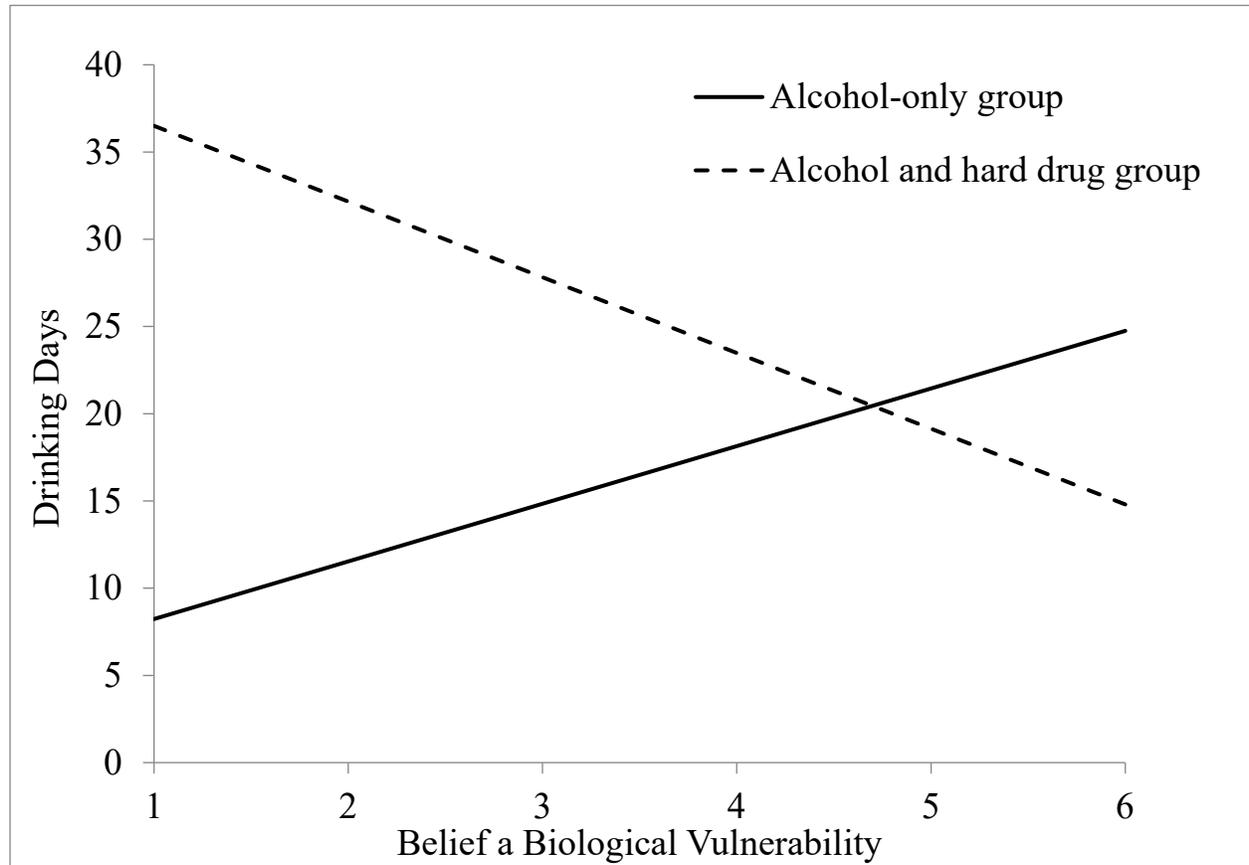
705 *Note.* Depicted above are the standardized regression coefficients for model paths. Significant  
 706 interactions for substance use group are depicted above by a solid line pointing to the given path;  
 707 dashed lines indicate statistical significance was not found. Gender and age were included as  
 708 covariates.

709 \* $p < .05$ . \*\* $p < .01$ .

710

711 **Figure 2**

712 *Relationship of Belief in an AIAN Biological Vulnerability with Drinking Days as Moderated by*  
 713 *Substance Use Group*



714  
 715 *Note.* For the analyses drinking days was square-root transformed. To aid in interpretation,  
 716 drinking days ( $Y'$ ) was backtransformed for the figure.

717

718