



# Behavioral and Mental Health outcomes from an RCT of a Youth Entrepreneurship Intervention among Native American Adolescents

Lauren Tingey<sup>a,\*</sup>, Francene Larzelere<sup>a</sup>, Novalene Goklish<sup>a</sup>, Summer Rosenstock<sup>a</sup>, Larissa Jennings Mayo-Wilson<sup>b</sup>, Victoria O'Keefe<sup>a</sup>, Elliott Pablo<sup>a</sup>, Warren Goklish<sup>a</sup>, Ryan Grass<sup>a</sup>, Feather Sprengeler<sup>a</sup>, Allison Ingalls<sup>a</sup>, Mariddie Craig<sup>c</sup>, Allison Barlow<sup>a</sup>

<sup>a</sup> Center for American Indian Health, Johns Hopkins University, Bloomberg School of Public Health, United States

<sup>b</sup> Center for Sexual Health Promotion, Indiana University School of Public Health, United States

<sup>c</sup> White Mountain Apache Tribe, United States

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## ABSTRACT

**Purpose:** This study reports the impact of an entrepreneurship education intervention designed and evaluated specifically for its impact on substance use, suicide and violence-related outcomes among Native American adolescents.

**Methods:** This randomized controlled trial included N = 394 Native Americans ages 13–16. Participants were randomly assigned 2:1 (n = 267:127) to the Arrowhead Business Group intervention versus a control condition. Logistic mixed effects regression models examined within group and between group differences in trajectory from baseline to 24 months follow-up.

**Results:** Fewer intervention vs. control participants used marijuana at 6-, 12- and 24-months post-intervention (19.6% vs. 28.0%, p = 0.032; 20.4% vs. 31.8%, p = 0.01; and 24.1% vs. 31.4%, p = 0.047). All violence-related measures (suicide attempts, carrying a weapon, missing school because felt unsafe, fighting, and fighting at school) statistically significantly declined between baseline and 24 months for both groups. Positive between group differences favoring intervention participants were observed at 6-months for missing school because felt unsafe, and at 24-months for fighting at school. While alcohol use increased for both groups over time, control participants experienced a two-fold higher increase in binge alcohol use than intervention participants (control: 7.1–16.7% vs. intervention: 8.1–13.0%).

**Conclusions:** This is the first report in the US literature of a youth entrepreneurship intervention designed and evaluated to promote behavioral and mental health outcomes. It shows promise for reducing substance abuse and violence toward self and others, the largest health disparities for Native American youth.

## 1. Introduction

The White Mountain Apache Tribe (Apache/WMAT) has been a leader in cutting-edge public health research since the early 1980s—demonstrating tribal self-determination and innovative solutions now scaled to the world (Barlow et al., 2015; Cwik et al., 2016; Mullany et al., 2012; Santosham et al., 2007; What is Home Visiting Evidence of Effectiveness). The WMAT upholds a collective commitment to care for one another that is reflected in their pursuit of public health solutions. Their latest focus is tackling the intertwining issues of youth suicide, substance use and violence. Apache and other Native

American (NA) youth living on tribal reservation lands sustain the highest rates of suicide, drug use, violence and related morbidity and mortality of all races or ethnic groups in the US (Indian Health Service, 2009; Swaim & Stanley, 2018). It is essential to contextualize the root causes of these issues and attend to a growing body of theoretical and empirical literature connecting the unique patterns of Native American (NA) youth suicide, substance use and violence to the intergenerational impacts of colonization and historical trauma. This literature traces current traumas (including suicide, substance use and violence) to the massive group genocide and ethnocide from colonization and its ongoing intergenerational effects through historical trauma ([8]; Gone

**Abbreviations:** Apache/WMAT, White Mountain Apache Tribe; NA, Native American; YRBS, Youth Risk Behavior Survey; CBPR, Community Based Participatory Research; ABG, Arrowhead Business Group; CAB, Community Advisory Board; ACASI, Audio Computer Assisted Self-Interview technology; ITT, Intent to treat

\* Corresponding author at: 415 N. Washington St. Baltimore, MD 21231, United States.

E-mail address: [Ltingey1@jhu.edu](mailto:Ltingey1@jhu.edu) (L. Tingey).

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**Table 1**  
Description of outcome variables by category.

Variable	Number of Items	Response Options	Alpha
<b>Substance use</b>			
Substance use			
Cigarette, last 30 days	1	0 days/1 + days	NA
Alcohol, last 30 days	1	0 days/1 + days	NA
Marijuana, last 30 days	1	0 times/1 + times	NA
Binge drinking, last 30 days	1	0 days/1 + days	NA
<b>Violence to self and others</b>			
Attempted suicide, last 12 mos	1	0 times/1 + times	NA
Carried weapon, last 30 days	1	0 times/1 + times	NA
Missed school-felt unsafe, last 30 days	1	0 times/1 + times	NA
Physical flight, last 12 mos	1	0 times/1 + times	NA
Physical flight on school property, last 12 mos	1	0 times/1 + times	NA

et al., 2019; Heart, 2003; Walls & Whitbeck, 2012). Historical trauma impacts youth at the individual level (e.g., experiencing mental health or substance use problems), family level (e.g., breakdown of traditional family roles, practices, attachment styles), community level (e.g., erosion of tribal traditions that guide children to adulthood) (Campbell & Evans-Campbell, 2011), and societal level (e.g., the continued failure of the federal government to uphold its trust responsibility to support health, education, and economic well-being of tribal nations) (U.S. Commission on Civil Rights. *Broken Promises: Continuing Federal Funding Shortfall for Native Americans*, 2018). It is vital for tribal communities to have resources to seek multi-level, culturally based solutions to youth's behavioral and mental health problems, particularly as many tribal value systems recognize youth as sacred carriers of their communities' well-being into the future (Cajete, 2000).

### 1.1. Suicide

Historical records and stories from many tribes show that suicide was a rare event within communities (Pine, 1981). However, trends over the past 50 years show that suicide rates have increased, and are uniquely concentrated among NA youth, peaking at age 24 compared with ages 50–60 and again at age 80 for the general US population (CDC; Swaim & Stanley, 2018). There appear to be unique social, psychological and historical forces that are influencing NA youth to take their lives as they face a transition to adulthood.

While youth suicide rates are increasing nationally, NA rates are highest, and deserve special attention considering the immense toll a youth suicide takes on a community, in addition to the potential to uncover solutions that are relevant to other high risk groups of youth.

### 1.2. Substance use

European contact and colonization introduced substances as tools of violence and exploitation. Many times, the settlers and traders promoted heavy alcohol use among NAs to swindle them out of lands or resources—that may have caused a binge-use comportment among Indigenous North Americans, who prior to this time rarely used fermented substances, and generally, only in small quantities for ceremonial purposes (Mail & Johnson, 1993). Overtime, the colonists propagated negative stereotypes about NAs and heavy substance use, and ultimately discriminately banned alcohol among NAs, but not other peoples in the colonies and states. Thus, the historic relationship between NAs and White man's alcohol has been laden with systematic racism and self-destruction (see Barlow et al., 2012).

Today, rates of substance use vary significantly by tribe and community (SAMHSA, 2016), while the NA population still has the greatest per capita abstinence rates from substance use (Greenfield & Venner,

2012). Nevertheless, there are concerning substance use patterns among NA youth across many communities. Tribal youth, in general, have higher substance use rates and earlier initiation—portending higher risk of dependence and related consequences in adulthood. Marijuana use is of notable concern (Swaim & Stanley, 2018). Marijuana is the most commonly used illicit drug among NA youth (Whitesell et al., 2007). Marijuana disparities appear to be increasing; (Whitesell et al., 2007) currently, past 30-day marijuana use among NA youth is 4.8 to 1.6 times higher between 8th and 12th graders than national samples of general population youth (Swaim & Stanley, 2018). Early and frequent marijuana use is associated with short-term effects on motor coordination and judgement, as well as long-term impacts on educational outcomes, cognition and risk of mental health disorders (Volkow, Baler, Compton, & Weiss, 2014). In addition, among NA youth, early marijuana initiation has been associated with other illicit drug use, including methamphetamines and cocaine (Barlow, Mullany, & Neault, 2010).

### 1.3. Violence

National and local Youth Risk Behavior Survey (YRBS) data indicate NA youth shoulder greater disparities in conduct problems or violence toward others than in other populations (CDC, 2018; Pavkov, Travis, Fox, King, & Cross, 2010). Conduct problems are associated with poor school achievement and serious behavioral issues across the life course (Webster-Stratton, 1998). Substance misuse and conduct problems are also precipitants for injuries, suicide and homicide, the three leading causes of death for 15-to-24 year-old NAs today. Due to the magnitude of these deaths, the NA population in the US has the highest rate of premature mortality of any ethnic group (Shiels et al., 2017). The combined effects of suicide, substance use and violence are a woefully unaddressed public health crisis, cutting short quality of life for NA youth and the communities who value them.

A preponderance of nationally scaled solutions to youth's drug use and related violence toward self or others have been anchored in western value systems and focused on risk reduction (i.e., Zero Tolerance, “Scared Straight”, and DARE); none of these has proven effective for NA youth (Provini). Because of the multi-level historical, social and structural determinants of NA youth's behavioral and mental health problems, more thoughtful, community-driven approaches must be demanded from public health prevention science.

### 1.4. Toward a protective factor approach

Since establishing a tribally mandated suicide and binge substance use surveillance system in 2001, the WMAT and their longtime university partners have engaged in a continuous line of risk and protective factors research for these intersecting problems (Barlow et al., 2012). Two studies showed Apache youth who had suicide attempts and binge substance use episodes shared similar risk profiles (Barlow et al., 2012), including: (1) low educational achievement and dropout, (2) hopelessness about the future, and (3) negative peer pressure (Barlow et al., 2012; Cwik et al., 2015; Tingey et al., 2014, 2016, 2017).

Trying an entrepreneurship approach emerged from community roundtable meetings interpreting these aforementioned study findings. More specifically (and as described in prior publications by our tribal-academic partnership) (Barlow et al., 2010; Pavkov et al., 2010), entrepreneurship education was identified as a positive youth development approach documented in the literature to promote self-efficacy, positive relationships with caring adults and role models; social support; positive attachment to school; cultural connectedness; and hope and optimism (Lee, Chang, & Lim, 2005; O'Keefe & Wingate, 2013; Stiffman, Alexander-Eitzman, Silmere, Osborne, & Brown, 2007; Youth Entrepreneurship Strategy Group (2008) (2008), 2008), and which held promise from the community's perspective as a strengths-based solution for reducing Apache youth suicide, substance use and violence

behaviors. Additional rationale came from social determinants research in marginalized US and international populations linking poverty and low education status to health, social and behavior problems (Conroy, Sandel, & Zuckerman, 2010). Apache Elders participating in the community discussions explained that entrepreneurship is core to Apache ways of living and survival in the face of adversity; and, that small businesses including craft making and trading of personally cultivated goods have long been a part of the Apache economic system (Riley). Further thought was given to the idea that promotion of broad-based entrepreneurship skill development in NA communities could lead to job creation and ultimately reduce social and behavioral problems related to poor personal/community agency and low economic status (Adamson & King, 2002).

In sum, the overarching foundation for this work was that the problems of adolescent substance use, suicide, and violence coupled with poverty and hopelessness about the future were creating barriers for Apache youth to reclaim health, economic, educational and social equity. This rationale steered community stakeholders toward the goal of designing and evaluating a broad-based protective-factor intervention model focused on culturally congruent youth entrepreneurship education. Arrowhead Business Group (ABG) was therefore designed to enhance multiple and interrelated empirically supported protective factors to promote Apache youth's positive behavioral and mental health development.

The development and theoretical model underpinning ABG has been described in detail in two previous publications (see (Tingey, Larzelere-Hinton, & Goklish, 2016; Larzelere, Tingey, & Ingalls, 2020)). In brief, these papers explain that entrepreneurship education uses a positive youth development framework to increase motivation for under-resourced groups to complete formal education, promote vocational and social skills, and help youth contribute to their community's economic development. Prior entrepreneurship education evaluations with US youth have shown increases in motivation to complete formal education, and improvements in positive life outcomes including security, autonomy, identity, achievement, confidence, knowledge, and capacity (Lee et al., 2005; Youth Entrepreneurship Strategy Group (2008) (2008), 2008). However, no rigorous studies of such interventions to date have explicitly targeted or reported behavioral or mental health outcomes (Barnett, 1995; Lee et al., 2005; Nakkula et al.). This gap is surprising given that low school attachment and dropout are strongly linked to substance abuse (Register, Williams, & Grimes, 2001; Townsend, Flisher, & King, 2007), including among NA youth.

A focus on promoting protective factors over risk factor reduction is not new to community-based participatory researchers (CBPR) working with North American Indigenous youth (Borowsky, Resnick, Ireland, & Blum, 1999; Chandler and Lalonde). Yet, this study is the first of its kind in any US population to specifically design and evaluate a strength-based youth entrepreneurship intervention to prevent suicide, substance use and violence and targets of entrepreneurship models, including economic/educational aspirations and the social skills noted above.

### 1.5. The current study

This paper reports primary behavioral and mental health outcomes from a 5-year randomized controlled trial of ABG with  $N = 394$  Apache youth ages 13–16. The original aims of the study were to longitudinally evaluate ABG impacts on: (1) adolescent behavioral and mental health outcomes including substance use, suicide, and violence to self and others; (2) psychosocial; (3) educational and (4) entrepreneurship outcomes. This paper focuses on Aim 1: behavioral and mental health outcomes.

## 2. Materials and methods

### 2.1. Study design

A RCT using a 2:1 randomization design (e.g. 2 participants were randomized to receive the ABG program for every 1 participant randomized to receive the control program) was used to evaluate the ABG program. The study design was reviewed and approved by the Apache Tribal Council and Health Advisory Board, as well as academic and Indian Health Service research review boards. This manuscript was approved by the Tribal Council and Health Advisory Board.

### 2.2. Participants

Participants were eligible if they were 13–16 years old, NA (self-identified), living on the Fort Apache Indian Reservation and enrolled in middle or high school. Schools were the primary recruitment sites, although the intervention took place elsewhere at spaces selected for their natural beauty, resource capacity, and lack of distractions. Informed consent/assent was obtained from a parent/legal guardian and the adolescent participant. Participants were enrolled in three successive cohorts, mean size of  $n = 131$  per year, from eight middle and three high schools (when participants were in 8th or 9th grades). Each cohort experienced the ABG intervention or the control condition, and were followed for two years post-intervention. The study was conducted from May 2014 to June 2019.

### 2.3. Arrowhead Business group intervention

ABG consists of 16 lessons delivered by Native paraprofessionals through a residential summer camp (10 lessons), followed by 6 monthly follow-on workshops held in local well-equipped conference rooms, each 4–6 h in length, to further develop skills and business plans. Lessons were taught by two Apache facilitators to groups of 25 participants, with Elders and local Native entrepreneurs making guest presentations.

ABG content, in successive order, includes: Apache culture and history and historic and modern examples of local entrepreneurship; problem solving and coping skills; communication, decision making, and goal setting; financial literacy, entrepreneurship training, and small business design, marketing and development. The initial emphasis on Apache historical survival and cultural values was recommended by the Community Advisory Board (CAB) and Apache program staff who identified the importance of cultural grounding and soft skills (i.e., coping, problem solving and communication) development before delivering the more didactic entrepreneurship training, which they thought youth may perceive as irrelevant or unattainable without the introductory components. For further details about ABG, please see previously published manuscripts (Tingey, Larzelere-Hinton, & Goklish, 2016; Larzelere, Tingey, & Ingalls, 2020).

### 2.4. Control condition

The control condition consisted of three sports field days each lasting 3–4 h. Participants in both study groups were included in the control program activities so between-group differences could be attributed to ABG. Control activities were selected by the CAB and Apache research staff as a beneficial service for youth.

### 2.5. Randomization & blinding

After baseline assessment, participants were randomized 2:1 to intervention or control. While equal randomization (1:1) is the most statistically strong model, 2:1 randomization (two participants randomized to receive the intervention for every one participant randomized to receive the control condition) was chosen by the CAB and Apache

**Table 2**  
Baseline characteristics.

	Total (N = 394)	Intervention (N = 267)	Control (N = 127)	p-value
Demographic Characteristics				
Age, Mean (SD)	14.38 (0.87)	14.37 (0.84)	14.41 (0.93)	0.6503
% Girls	58.1% (229)	57.7% (154)	59.1% (75)	0.7957
Years since last move, %(n) <sup>1</sup>				
In last year	19.9% (78)	20.2% (54)	19.0% (24)	
1–5 years ago	24.7% (97)	26.6% (71)	20.6% (26)	
> 5 years ago	55.5% (218)	53.2% (142)	60.3% (76)	0.3542
Food security, %(n) <sup>2</sup>				
High food security (0–1 items)	63.7% (247)	65.0% (171)	60.8% (76)	
Low food security (2–3 items)	19.6% (76)	20.2% (53)	18.4% (23)	
Very low food security (4–5 items)	16.8% (65)	14.8% (39)	20.8% (26)	0.3374
Behavioral Health <sup>3</sup>				
% Smoked Cigarettes, Last 30 Days <sup>4</sup>	13.5% (52)	14.3% (37)	12.1% (15)	0.5525
% Drank Alcohol, Last 30 Days	11.1% (43)	11.0% (29)	11.5% (14)	0.9836
% Used Marijuana, Last 30 Days	18.5% (73)	19.8% (53)	16.1% (20)	0.3687
% Engaged in Binge Drinking, Last 30 Days	7.8% (28)	8.1% (20)	7.1% (8)	0.6168
Violence Towards Self and Others <sup>3</sup>				
% Attempted Suicide, last 12 months	15.1% (61)	15.4% (42)	14.5% (19)	0.8098
% Carried a Weapon, last 30 days	17.0% (75)	18.5% (55)	14.1% (20)	0.2815
% Missed School, Felt Unsafe, Last 30 Days	11.1% (44)	12.4% (33)	8.7% (11)	0.2696
% Fight, Last 12 Months	34.1% (136)	36.3% (98)	29.5% (38)	0.1778
% Fight on School Property, Last 12 Months	20.2% (81)	22.7% (61)	15.6% (20)	0.1033

<sup>1</sup> N = 393, Intervention: 267, Control: 126.

<sup>2</sup> N = 388, Intervention: 263, Control: 125.

<sup>3</sup> Adjusted for gender.

<sup>4</sup> N = 393, Intervention: 266, Control: 127.

research staff to increase the number of youth exposed to the intervention's potential benefits. The most practical reason supported in the statistical literature for this randomization scheme is when there is strong belief that an intervention is efficacious, which there was among community stakeholders (Hey & Kimmelman, 2014; Tingey et al., 2016). The data manager created the randomization sequence. Neither research staff nor study participants were blinded to randomization status.

## 2.6. Outcome measures

Data included in this outcome analyses were collected at baseline, and at 6-, 12- and 24-months post-intervention through self-report questionnaires via Audio Computer Assisted Self-Interview technology (ACASI) or hard copy. Hard copies had to be used more frequently during follow-up periods when youth were too scattered geographically to collect self-reports on a minimum number of available tablets. However, roughly the same number of ACASI vs. hard copy assessments were collected in each study arm at each timepoint. Our primary outcome measure was the Youth Risk Behavior Survey (YRBS), a culturally validated, widely used measure in public health research and practice, including with reservation-based NA populations. The YRBS measures frequency of behaviors during time windows (past month, past six months, past year). All questions were piloted with Apache youth prior to utilization (see Table 1).

## 2.7. Statistical analysis

Stata 14 was used to conduct all analyses (StataCorp., 2015). Baseline demographic data were assessed for between-group comparability using t-tests for continuous variables and chi-squared tests for categorical variables. Baseline equivalence of outcome measures was assessed using logistic regression. We conducted an intent to treat analysis (ITT), meaning all collected data were included in analyses according to study group regardless of dosage. Dosage was good, with 81.7% of intervention participants completing at least 10 of 16 lessons, the portion deemed to be “completers”. Logistic mixed effects

regression models examined within and between study group differences from baseline to endpoint for key study outcomes. Models included study group, time point, and an interaction term between study group and time point. All models controlled for sex and included a random effect at the individual level, adjusting for repeated measures. Although participants were recruited through schools, we did not adjust for clustering within schools because the intervention was not implemented by schools and participants moved frequently between schools. With a final sample size of N = 394, 267 in the intervention group and 127 in the control, we calculated a minimum detectable between-group difference of 11% in the outcomes presented in this manuscript at each time point, assuming cross sectional comparisons, with 80% power, 95% confidence, and expected attrition. This provided a conservative estimate of between-group differences given the available sample size. Using longitudinal analysis methods and specifically mixed effects models adjusted for repeated measures, rather than cross-sectional logistic regression models, improved power to detect smaller between-group differences and provided better insight change over time in the outcomes of interest. As in most longitudinal studies, there are missing data at each follow up time point. Mixed effects regression models make use of all available data to produce estimates at each time point, and resulting estimates are robust to missing data when data are missing at random. We have no reason to believe that data are not missing at random as baseline equivalence was maintained with available sample size at each time.

## 3. Results

### 3.1. Baseline characteristics

394 participants enrolled (n = 267 in the intervention: 127 in the control). Baseline data were collected from all participants (see Table 2); 6-month follow-up was completed with 72% (N = 283; intervention: n = 192, control: n = 91); 12 month follow-up with 75% (N = 294; intervention: n = 202, control: n = 92); 24 month follow-up with 85% (N = 335; intervention: n = 230, control: n = 105). There were no between-group differences in attrition at any time point. At



**Table 3**  
Behavioral Health.<sup>1</sup>

	N (Int; Cont)	Intervention	Control	p-value <sup>4</sup>
% Smoked Cigarettes, Last 30 Days				
Baseline	266; 127	14.3%(37)	12.1%(15)	
6-Months	190; 91	15.6%(25)	11.0%(9)	0.6300
12-Months	202; 91	13.0%(23)	14.1%(9)	0.5074
24-Months	230; 105	14.3%(31)	15.8%(15)	0.4168
% Drank Alcohol, Last 30 Days				
Baseline	267; 127	11.0%(29)	11.5%(14)	
6-Months	190; 91	15.8%(26)	12.8%(9)	0.4883
12-Months	202; 91	16.3%(27)	15.4%(10)	0.7790
24-Months	230; 105	18.0%(37)	19.1%(18)	0.9405
% Used Marijuana, Last 30 Days				
Baseline	267; 127	19.8%(53)	16.1%(20)	
6-Months	190; 91	19.6%(35)	28.0%(26)	0.0317
12-Months	202; 91	20.4%(37)	31.8%(26)	0.0102
24-Months	230; 105	24.1%(53)	31.4%(31)	0.0471
% Engaged in Binge Drinking, Last 30 Days				
Baseline	267; 127	8.1%(20)	7.1%(8)	
6-Months	190; 91	14.1%(19)	7.3%(5)	0.2619
12-Months	202; 91	13.1%(18)	10.7%(6)	0.8724
24-Months	230; 105	13.0%(23)	16.7%(13)	0.3176

<sup>2</sup>Between group comparison of trajectory from baseline.<sup>1</sup> Adjusted for repeated measures and gender.

baseline mean age was 14.38 years and 58.1% (n = 229) were female; 44.5% (n = 175) had moved homes in the past 5 years, and 19.9% (n = 78) in the past year. Over one-third (35.9%) reported low or very low food security. There were no between-group differences in demographic characteristics or outcome measures at baseline. We examined baseline equivalence using the available sample size at each time point (accounting for attrition). Baseline demographic and outcome variables remained equivalent with the exception of one: fighting on school property at the 12-month follow-up point only.

### 3.2. Substance Use (Table 3)

There were no significant differences between or within group changes in cigarette use (approximately 15%) from baseline to 24 months follow-up. There was a significant increase in reported alcohol use in the past 30 days within both the intervention and control groups, but no between-group difference between baseline to 24 months post-intervention. Binge alcohol use in the past 30 days increased within both study groups, reaching statistical significance at 6 months post-intervention in the intervention group and at 24 months post-intervention in the control group. While between group trajectory differences did not reach statistical significance, over the two-year follow-up period, there was a 60% increase in binge drinking in the past 30 days within the intervention group compared to a 135% increase in the control group (75% higher).

For marijuana use, there was no significant increase in past 30 day marijuana use within the intervention group from baseline to 24 months post intervention (baseline: 19.8%, 6 mos: 19.6%, 12 mos: 20.4%, 24 mos: 24.1%, p = 0.1536), however there were significant increases in marijuana use at every timepoint for the control group (baseline: 16.1%; 6 mos: 28.0%, p = 0.0093; 12 mos: 31.8%, p = 0.0011, 24 mos: 31.4%, p = 0.0009). There were significant between group differences in change over time at all follow-up time points (e.g. baseline to 6 months). While marijuana use increased in both study groups over time as participants aged, the intervention group reported a significantly smaller increase from baseline in past-month marijuana than the control group at: 6 months (p = 0.0317), 12 months (p = 0.0102), and 24 months (0.0471) post-intervention.

**Table 4**  
Violence toward self and others.<sup>1</sup>

	N (Int; Cont)	Intervention	Control	p-value <sup>2</sup>
% Attempted Suicide, Last 12 Months <sup>3</sup>				
Baseline	267; 127	15.4%(42)	14.5%(19)	
12-Months	202; 91	9.4%(18)	10.5%(9)	0.6685
24-Months	230; 105	8.8%(20)	9.3%(10)	0.7557
% Carried a Weapon, Last 30 Days				
Baseline	267; 127	18.5%(55)	14.1%(20)	
6-Months	190; 91	14.1%(29)	11.1%(12)	0.8919
12-Months	202; 91	15.8%(34)	11.2%(10)	0.8821
24-Months	229; 105	9.2%(26)	7.6%(10)	0.7651
% Missed School, Felt Unsafe, Last 30 Days				
Baseline	267; 127	12.4%(33)	8.7%(11)	
6-Months	190; 91	4.9%(9)	11.2%(9)	0.0211
12-Months	202; 91	6.0%(11)	2.8%(2)	0.6659
24-Months	229; 105	5.4%(11)	4.7%(5)	0.6379
% Fight, Last 12 Months <sup>3</sup>				
Baseline	267; 127	36.3%(98)	29.5%(38)	
12-Months	202; 91	18.4%(37)	19.2%(15)	0.2657
24-Months	230; 105	12.2%(30)	15.7%(17)	0.0729
% Fight on School Property, Last 12 Months <sup>3</sup>				
Baseline	267; 127	22.7%(61)	15.6%(20)	
12-Months	202; 91	8.4%(17)	6.1%(5)	0.7739
24-Months	229; 105	5.1%(12)	12.0%(13)	0.0029

<sup>1</sup> Adjusted for repeated measures and gender.<sup>2</sup> Between group comparison of trajectory from baseline.<sup>3</sup> 6-month assessment is not included because the timeframe of the question exceeds the time elapsed between time points.

### 3.3. Suicide (Table 4)

Reported suicide attempts over the past 12 months significantly decreased within the intervention group from baseline (15.4%) to 12 months (9.4%, p = 0.0294) and 24 months (8.8%, p = 0.0108) post-intervention. While there were also decreases observed in the control group, they were smaller and not statistically significant. There were no significant between group differences in suicide over the follow-up period.

### 3.4. Violence toward others (Table 4)

Violence related outcomes, including carrying a weapon, feeling unsafe on school property and fighting (in general and on school property) decreased in the intervention and control groups over time.

There were significant decreases among intervention participants who reported fighting in the past 12 months at every time point compared to baseline (baseline: 36.3%, 12 months: 18.4%, 24 months: 12.2%, all p-values < 0.0001). There were also smaller, yet statistically significant decreases within the control group from baseline to 12 and 24 months post-intervention (baseline: 29.5%; 12 months: 19.2%, p-value = 0.0379; 24 months: 15.7%, p-value = 0.0029). Likewise, intervention participants reporting fighting on school property in the past 12 months was significantly decreased at every time point compared to baseline (baseline: 22.7%, 12 months: 8.4%, p-value < 0.0001, 24 months: 5.1%, p-value < 0.0001). There was also a significant decrease observed in the control group from baseline to 12 months (baseline: 15.6%, 12 months: 6.1%, p-value = 0.0255), but not maintained in the control group at 24 months (12.0%, p-value = 0.3905). The within group change (baseline to 24 months) was statistically significantly greater in the intervention group, with fewer intervention participants reporting fighting on school property between baseline and 24 months post-intervention (p = 0.0029) (Table 4). Similarly, the intervention vs. control group reported significantly less missing school due to feeling unsafe between baseline and 6 months post-intervention (p = 0.0211).

#### 4. Discussion

This is the first study applying an RCT design to evaluate behavioral and mental health outcomes of a youth entrepreneurship intervention among Native American youth. ABG is novel in seeking to address multiple and related empirically supported protective factors for suicide and substance use from prior tribal-specific studies to promote positive behavioral and mental health for NA youth during a period of intensifying risk for suicide, substance use and violence. Overall, the study had high retention, with 85% of participants completing assessments at 24 months post-intervention. Given high household and school mobility and general demographic risk factors, retention rates reflect the skill of Apache research staff to engage participants longitudinally.

Intervention youth compared to control reported significantly lower marijuana use at all follow-up timepoints. They also reported significantly less violent behavior, including missing school due to feeling unsafe and fighting on school property. Within group analyses showed intervention youth had greater decreases in suicide attempt compared with controls, but trajectory comparisons did not reach significance. Suicide attempt is a rare event and generally would require large sample sizes to detect differences. In the meantime, alcohol use went up for both groups—during a developmental period of increasing alcohol use among all US youth, with no detectable between group differences in trajectories. However, the increase in binge drinking in the control group was double that observed in the intervention group (9.6% in control vs. 4.9% in intervention) between baseline and 24 months post-intervention.

Decreases in marijuana use bear important public health significance due to recent documentation of high and increasing use among NA youth, and severe short- and long-term effects. (ref) Avoiding or reducing the consequences of frequent marijuana use during a key time of adolescent brain development has potential to promote a healthier transition from adolescence to productive adulthood.

Results for alcohol use are also worth further discussion. Reported past-month alcohol use increased significantly in both groups. However, the binge alcohol findings are an important focus, as research suggests that NA youth experience higher rates of binge use with worse consequences, including intentional and unintentional injury, a major source of mortality in this age group (Swaim & Stanley, 2018). There was more than a two-fold increase in binge alcohol use within the control group (135%) compared to the intervention group (60%); however, between group trajectory differences were not large enough to reach significance. Because of more ubiquitous and normative exposure to alcohol during adolescence for NA youth, the measurement of more harmful binge use may be a better indicator of public health impact.

The significant reduction in violence toward others both between and within groups, with particular relevance to the school context, begs interpretation. Decreases in fighting within both groups may relate to diffusion effects. All participants, regardless of study arm assignment, eventually attended one of three participating high schools during the course of data collection. Thus, if the intervention group is moved to less fighting, it follows that there may be fewer fights in the overall school population, including among control participants.

A similar diffusion phenomenon may be affecting changes in suicide attempt in both groups over time. Reported suicide attempt decreased steadily in both groups, though only significantly within the intervention group. Prior research by our study team identified that a suicide attempt by a peer in the past six months was a primary risk factor for suicide attempt in an index case (Cwik et al., 2015). Reducing suicide attempts in the intervention group should theoretically reduce suicide attempts among socially connected peers, such as those in the same schools or tight-knit reservation neighborhoods.

There are several important directions to further explore intervention impact. This report is an ITT analysis of behavioral and mental health outcomes prioritized due to the urgency of these disparities and

the potential innovation of a youth entrepreneurship, protective-factor social determinants approach for NA communities. Further analyses regarding ABG's psychosocial, educational and entrepreneurship outcomes are underway. It will also be important to conduct completer and responder analyses to examine differences in outcomes by intervention dosage and factors contributing to greater program responsiveness. We also plan to conduct a path analysis of what factors mediate behavioral and mental health changes. Nevertheless, the success of the ABG program for impacting several key behavioral and mental health outcomes of interest and that it was designed and evaluated with Native youth suggests it may be a relevant public health solution for other Native communities. As such, the ABG program is currently being replicated in partnership with Indian Health Service at the Chinle Service Unit on the Navajo Nation. The Chinle Health Promotion and Disease Prevention Program has successfully delivered the ABG program through two summer camps and is planning future implementation in partnership with Diné College. Tribal Colleges may be ideal settings for ABG replication and sustainability efforts as implementation in this setting could foster increased connection to not only entrepreneurship education but undergraduate and graduate opportunities as well.

#### 5. Limitations

The study design (including 2:1 randomization) lowered our ability to detect statistically significant changes (increases or decreases) between groups. However, all trends appeared to favor the intervention group. Furthermore, we appreciated that the CAB—after designing ABG, felt the strength of its promise, and wanted to afford as many Apache youth as possible to receive it. Balancing scientific rigor with the community's ways of knowing is imperative to successful CBPR in NA communities and beyond. While we considered a wait-list control design, it was not feasible within the 5-year study period because we wanted to follow participating youth through a developmental period when suicide, substance use and violence are rapidly increasing. Because we completed this study with one tribe, results may not be generalizable to other diverse tribal communities. Further, many factors support the idea that diffusion effects over time dampened our ability to detect between group differences for all observed outcomes. Justification for diffusion effects include: (1) this study took place in a small, highly networked community, (2) frequent interaction between intervention and control participants during control group activities, in school, and in small reservation neighborhoods and extended family networks, and (3) ABG itself spawned small businesses and related activities, including a youth-run café and marketplace, that were open to all and popular among community members (a topic of forthcoming publication).

#### 6. Conclusion

The ABG youth entrepreneurship program targeting broad-based protective factors designed for and by a NA community shows promise for improving behavioral and mental health outcomes of high priority for the participating and other tribal communities. Observed effects on substance use, suicide and violence suggest that culturally congruent youth entrepreneurship interventions may be viable prevention strategies to address the linked hazards of poverty, low employment and educational opportunities, and behavioral and mental health disparities in historically disenfranchised US communities.

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## CRediT authorship contribution statement

**Lauren Tingey:** Conceptualization, Methodology, Validation, Data curation, Visualization, Project administration, Funding acquisition. **Francene Larzelere:** Conceptualization, Methodology, Validation, Investigation, Resources, Supervision, Project administration, Funding acquisition. **Novalene Goklish:** Conceptualization, Methodology, Validation, Investigation, Resources, Supervision, Project administration, Funding acquisition. **Summer Rosenstock:** Methodology, Software, Validation, Formal analysis, Visualization. **Larissa Jennings Mayo-Wilson:** Conceptualization, Methodology, Validation, Formal analysis, Data curation. **Victoria O'Keefe:** Conceptualization, Validation, Visualization. **Elliott Pabl:** Software, Validation, Investigation, Data curation, Project administration. **Warren Goklish:** Software, Validation, Investigation, Data curation, Project administration. **Ryan Grass:** Software, Validation, Investigation, Data curation. **Feather Sprengeler:** Software, Validation, Investigation, Data curation, Supervision, Project administration. **Allison Ingalls:** Conceptualization, Methodology, Validation, Resources, Project administration. **Mariddie Craig:** Conceptualization, Methodology, Validation, Resources, Supervision, Funding acquisition. **Allison Barlow:** Conceptualization, Methodology, Validation, Visualization, Project administration, Funding acquisition.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.childev.2020.105603>.

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