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Adverse Childhood Experiences and Their Association with Alcohol Abuse by Alaska Adults

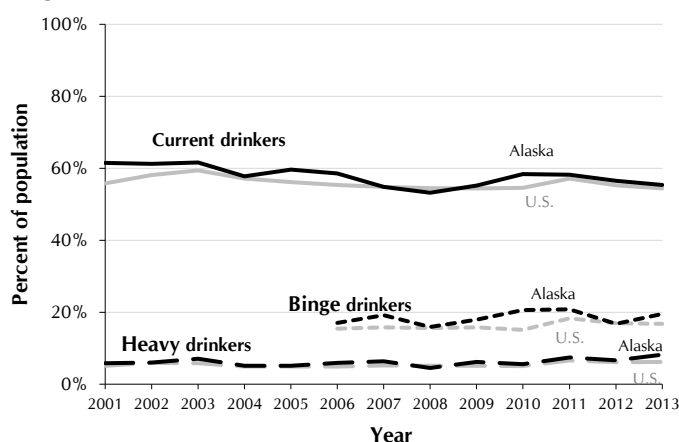
Marny Rivera and Patrick Sidmore

Alaska has a costly substance abuse problem. The prevalence of alcohol consumption in Alaska is high (Figure 1), part of a problem costing Alaskans an estimated \$1.2 billion annually in lost productivity and expenditures associated with traffic crashes, criminal justice and protective services, health care, and public assistance and social services, according to a 2012 report by the McDowell Group. In Alaska there are also elevated rates of the following Adverse Childhood Experiences (ACEs) (Table 1)—childhood abuse (verbal/emotional, physical, and sexual) and other forms of household dysfunction (mental illness or substance abuse in the home, separation or divorce, witnessing domestic violence, and having an incarcerated family member)—all of which impact individuals, communities, and the economy. One indication of the long-term effect of ACEs can be seen in a recent nationwide study by the Perry-

man Group which estimated that each first-time incident of child abuse in 2014 would cost \$1.8 million dollars over a lifetime. The personal and economic impacts are substantial.

In this article we examine the relationship between abuse and household dysfunction in childhood and the increased likelihood of problem alcohol drinking by Alaska adults. The behavioral health of Alaskans could be improved by addressing the association between ACEs and health-risk drinking behaviors, and es-

Figure 1. Alcohol Use in Alaska and the U.S., 2001–2013



Source of data: Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BFRSS)

establishing an integrated prevention system.

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Table 1. Adverse Childhood Experiences (ACEs) Types and Questions

Category and ACE type	Question asked in Alaska
Abuse	
1. Verbal/emotional abuse	Did a parent or adult in your home ever swear at you, insult you, or put you down?
2. Physical abuse	Did a parent or adult in your home ever hit, beat, kick, or physically hurt you in anyway? (Do not include spanking)
3. Sexual abuse	Did anyone at least 5 years older than you, or an adult, ever touch you sexually? Did anyone at least 5 years older than you, or an adult, try to make you touch them sexually? Did anyone at least 5 years older than you, or an adult, force you to have sex?
Neglect	
4. Physical neglect	[question not asked in Alaska survey]
5. Emotional neglect	[question not asked in Alaska survey]
Household dysfunction	
6. Mental illness in the home	Did you live with anyone who was depressed, mentally ill, or suicidal?
7. Substance abuse in the home	Did you live with anyone who was a problem drinker or alcoholic? Did you live with anyone who used illegal street drugs or who abused prescription medications?
8. Witnessing domestic violence	Did your parents or adults in your home ever slap, hit, kick, punch, or beat each other up?
9. Incarcerated family member	Did you live with anyone who served time or was sentenced to serve time in prison, jail, or other correctional facility?
10. Separation or divorce	Were your parents separated or divorced?

Source: Centers for Disease Control and Prevention

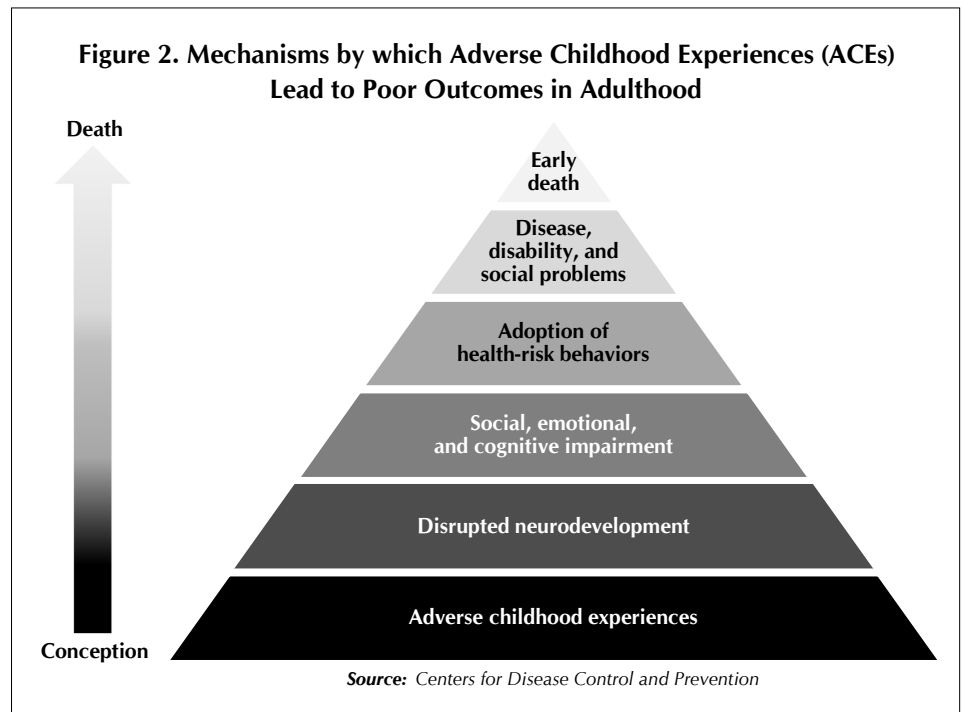
ACEs

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**Adverse Childhood Experiences
Linked to Adult Outcomes**

Research on Adverse Childhood Experiences (ACEs) conducted by the Centers for Disease Control and Prevention (CDC), Kaiser Permanente, and others over the last twenty years has documented links between adverse experiences in childhood and outcomes later in life. Research studies involving surveys of adults have consistently found a number of undesirable outcomes in populations reporting exposure to a larger number of adverse events in their childhood. These outcomes include: chronic disease, reproductive health and sexual behavior problems, health-risk behaviors, mental health problems, and criminal victimization and perpetration. (See “Adult Health Outcomes of Adverse Childhood Experiences (ACEs),” below.)

Researchers developed a dose response method for analyzing the impact of adverse childhood experiences on various outcomes. An ACE score is computed by totaling exposure to any of ten types of ACEs (Table 1). Experiencing a single type of the ten identified ACE types results in a score of “one ACE.” A higher ACE score results from reported exposure to multiple ACE



types but not multiple exposures to one ACE type. It is important to keep in mind that ACE scores are derived from the number of types of adverse childhood experiences, not the total number of experiences. Researchers have found that for those who experienced any particular type of ACE, the likelihood of experiencing multiple types of ACEs is high.

How Adverse Experiences Impact the Developing Brain

Research about the developing brains of children has established the causal mechanisms that link adverse experiences in childhood with undesirable outcomes in adulthood. Traumatic experiences alter brain chemistry (neurotransmitter and hormone levels) and brain structure, and thereby impact brain function. The toxic stress of repeated trauma produces a dys-regulated biological stress response in affected individuals who then frequently cope by self-medicating through health-risk behaviors such as alcohol and tobacco use. Stress-induced brain changes can also impact executive cognitive function and self-regulation which increase the likelihood of impulsive behaviors. Current research studies are exploring the different adverse experiences and their occurrences at critical periods in a child’s development to determine their impacts on different adolescent and adult outcomes.

The diagram in Figure 2 integrates the ACEs research with neurobiological studies to illustrate the mechanism which leads to poor outcomes in adulthood. In this article, we focus on the connection between the first or base level of the pyramid (adverse childhood experiences) and the fourth level (adoption of health-risk behaviors) using data from Alaska adults.

**ACEs and Risky Drinking:
Definitions and Measurement**

In 2013 Alaska adults 18 years and older

Adult Health Outcomes of Adverse Childhood Experiences (ACEs)

There are a variety of health outcomes associated with experiencing ACEs. The CDC website <http://www.cdc.gov/violenceprevention/acestudy/outcomes.html> provides links to publications focusing on the health outcomes listed below:

Chronic disease

- Auto immune disease
- Chronic obstructive pulmonary disease
- Frequent headaches
- Health-related quality of life
- Ischemic heart disease
- Liver disease
- Lung cancer

Health-risk behaviors

- Alcohol abuse
- Drug abuse
- Obesity
- Smoking

Mental health

- Autobiographical memory disturbance
- Depression/depressed affect

- Hallucinations
- Neurobiology
- Suicidality
- Work absenteeism

Reproductive health/sexual behavior

- Fetal death
- Promiscuity
- Sexual behaviors in women
- Sexually transmitted diseases
- Teen pregnancy
- Unintended pregnancy

Special populations

- Children of alcoholics
- Child sexual abuse victims

Other

- Intimate partner violence

Table 2. Demographic Characteristics of Alaska Adults, 2013

Variables	N	Percent
Sex		
Female	265,803	48.1 %
Male	287,214	51.9
Total	553,017	
Age		
18 to 44	278,317	50.7 %
45 and older	270,588	49.3
Total	548,905	
Race/ethnicity		
Caucasian	376,230	70.0 %
Minority*	161,320	30.0
Total	537,550	
Education		
High school grad/GED or less	168,527	35.8 %
Some college or higher	302,022	64.2
Total	470,549	
Income		
\$49,999 or less	225,057	45.1 %
\$50,000 or more	274,002	54.9
Total	499,059	

* Minorities include: Black or African American, Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, other, and multiracial.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)

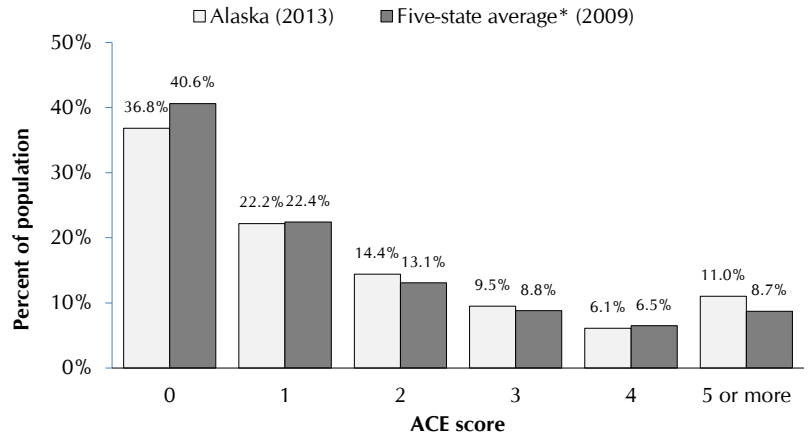
were surveyed about their exposure to ACEs. These questions were asked through the Behavioral Risk Factor Surveillance System (BRFSS), a statewide telephone survey which measures the prevalence of diseases and risk factors in adults (18 years of age and older). The BRFSS is conducted annually by the Alaska Department of Health and Social Services, Division of Public Health, Section of Chronic Disease Prevention and Health Promotion. In 2013, the BRFSS reached approximately 4,000 Alaskans through both landlines and cell phones. Data are weighted to increase the representativeness of estimates based on the demographic makeup of the state's population and prevalence of landlines and/or cell phones.

Table 3. Binge Drinking by Age Group in Alaska, 2013

Age group	Row percentages				Total
	Yes		No		
	N	Percent	N	Percent	
18 to 24	19,046	25.6 %	55,374	74.4 %	74,420
25 to 34	29,678	28.7	73,763	71.3	103,441
35 to 44	22,022	25.0	65,910	75.0	87,932
45 to 54	16,083	15.8	85,926	84.2	102,009
55 and older	16,385	8.6	174,766	91.4	191,151
Total	103,214	18.5 %	455,739	81.5 %	558,953

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)

Figure 3. ACE Scores Prevalence: Alaska and Five-State Average



Note: Percentages are unweighted.

* The five states are: Arkansas, Louisiana, New Mexico, Tennessee, and Washington.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013); "Adverse Childhood Experiences Reported by Adults — Five States, 2009," Centers for Disease Control and Prevention (2010)

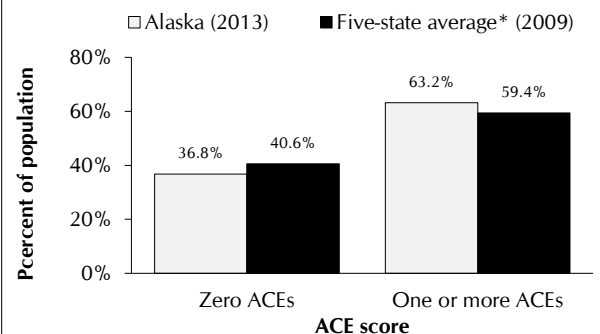
Alaska used an ACE Module of 11 questions developed by the CDC specifically for the BRFSS survey. These questions focused on eight out of the ten types of ACEs. Alaska became the twentieth state to use this module which allows for easy comparisons among states. The module used in Alaska differs from both the

original ACE study and other studies in that it does not include questions about emotional or physical neglect. The results, therefore, allow for a maximum ACE score of eight rather than ten. The existence of substance abuse in the home was determined based on a composite of two questions (alcohol and illegal drugs) and sexual abuse was based on a composite of three questions. The other six ACEs were each determined based on a single question. Each of the questions in Table 1 was prefaced with the reminder that the individual should provide answers regarding events prior to their eighteenth birthday.

Health-risk behavior data on heavy and binge drinking also came from BRFSS. Rates of heavy and binge drinking in Alaska were based on definitions of heavy and binge drinking used by the Centers for Disease Control and Prevention (CDC). *Heavy drinking* is defined as anything in excess of moderate drinking. The CDC defines *moderate drinking* as no more than 2 drinks per day for males and no more than 1 drink per day for females. In other words, heavy drinking involves consuming on average 15 or more drinks per week for males and 8 or more drinks per week for females. Researchers for a number of years have reported heart health benefits from moderate alcohol consumption, particularly

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Figure 4. Average Prevalence of ACE Scores of Zero vs. One or More: Alaska and Five-State Average

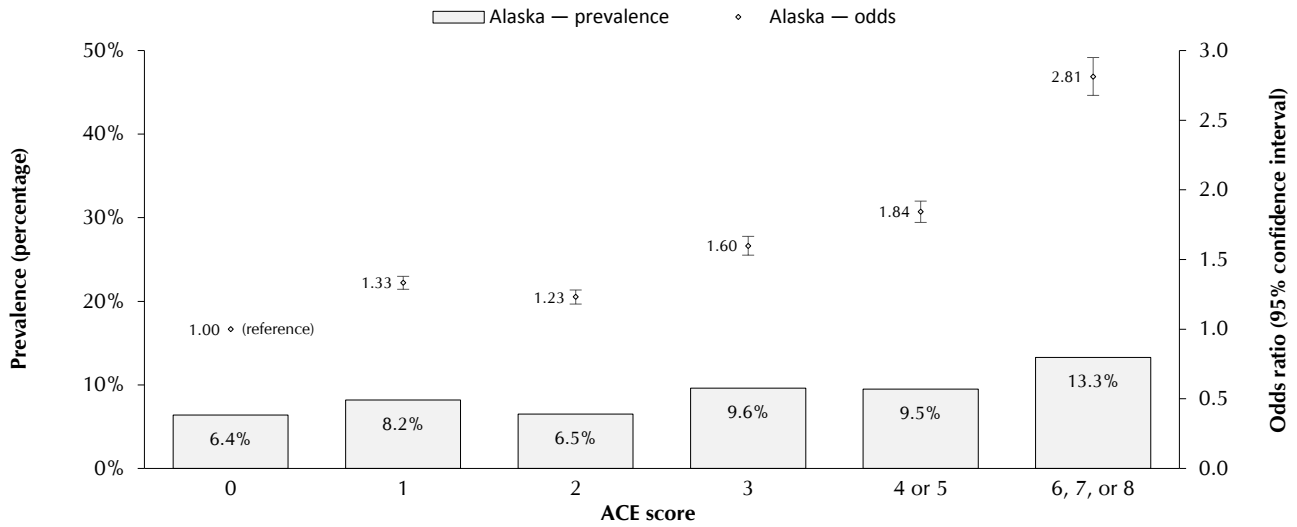


Note: Percentages are unweighted.

* The five states are: Arkansas, Louisiana, New Mexico, Tennessee, and Washington.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013); "Adverse Childhood Experiences Reported by Adults — Five States, 2009," Centers for Disease Control and Prevention (2010)

Figure 5. Prevalence and Relative Odds of Heavy Drinking by ACE Score, Alaska (2013)



Note: Odds ratio adjusted for age, sex, race/ethnicity, education, income.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)

ACEs

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red wine. A 2010 article from the *Journal of Cardiovascular Disease Research* concludes that there are demonstrated cardiovascular benefits to red wine as a diet supplement. However, the CDC does not recommend initiating or increasing alcohol use for heart health benefits because those potential benefits are offset by increased health and safety risks associated with alcohol consumption. *Binge drinking* is defined for males as drinking 5 or more drinks on a single occasion, and as 4 or more drinks on a single occasion for females. Binge drinking was more commonly reported by

younger Alaskans under 45 years of age than by older Alaskans.

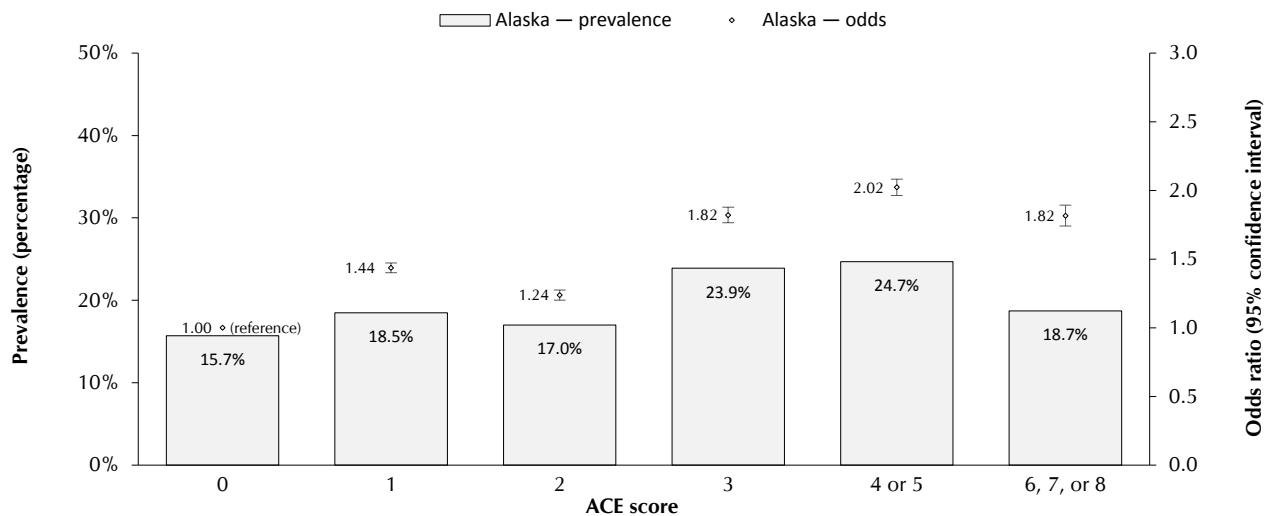
Results: ACEs and Risky Drinking in Alaska

Table 2 describes the demographic characteristics of Alaska adults which were used to weight the Behavioral Risk Factor Surveillance System (BRFSS) survey data discussed above. Just under half of Alaskans were females and just over half of Alaskans were males. Roughly half of Alaskans were 18 to 44 years old and the other half were 45 years or older. A majority of Alaskans were Caucasians (70%). Nearly two-thirds of Alaskans had some college education or

were college graduates. Fifty-five percent of Alaskans had an annual household income of \$50,000 or more.

According to 2013 BRFSS data, 8 percent of Alaska adults are heavy drinkers and 20 percent are binge drinkers (see Figure 1). Binge drinking was more commonly reported by younger Alaskans under 45 years of age than by older Alaskans. While a quarter or more of Alaskans aged 18 to 24 years (26 percent), 25 to 34 years (29 percent) and 35 to 44 years (25 percent) reported binge drinking in the past 30 days, only 16 percent of Alaskans aged 45 to 54 years and 9 percent of Alaskans aged 55 years and older did (Table 3). No association was found between age and rates

Figure 6. Prevalence and Relative Odds of Binge Drinking by ACE Score, Alaska (2013)



Note: Odds ratio adjusted for age, sex, race/ethnicity, education, income.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)

Methodology and Odds Ratio Interpretation

The analyses examining the relationship between ACE scores and drinking behavior were conducted in two phases. In the first phase we used cross tabulation to examine the relative frequency of heavy drinking and the relative frequency of binge drinking for adult Alaskans with each ACE score. In the first phase of analysis involving cross tabulation, an ACE variable with six categories (0 ACE types, 1 ACE type, 2 types, 3 types, 4 or 5 types, and 6 to 8 types) was created from continuous ACE scores that ranged from zero to eight. Grouping the number of ACEs increased the sample sizes at the higher end of the ACE score continuum. The categorical ACE score served as the independent variable and the health-risk behaviors of heavy drinking and binge drinking were examined separately as dependent variables.

In the second phase of analysis, logistic regression was used

to compute odds ratios for heavy or binge drinking based on various ACE scores. An odds ratio of “1” means that the odds of an event occurring is the same for both groups that are being compared. When an odds ratio is greater than “1,” it means that the odds of an event occurring is greater for the first group. The odds of risky drinking behaviors for individuals with ACE scores of one or more were each compared in separate analyses to individuals with an ACE score of zero. Odds ratios were adjusted because each of the demographic variables were significantly associated with ACE scores. Adjusted odds ratios were computed by statistically holding constant the impact of age, race, gender, education, and income on the drinking behavior outcome.

Further statistical detail is available in the web supplement to this article on the Justice Center website at http://justice.uaa.alaska.edu/forum/32/1spring2015/aw1_aces_supplement.html.

of heavy drinking. Results of the Alaska ACE study indicate that the level of adverse experiences in the state are higher than in most states that have conducted the same survey. There are no national statistics on ACEs in the U.S.; however, after the 2009 BRFSS, the CDC released the results of five states’ ACE surveys in aggregate. These states—Arkansas, Louisiana, New Mexico, Tennessee, and Washington—provide a large sample of ACEs in a population base of approximately 26 million people. This broad-based analysis provides context for the Alaska ACE results.

The relative frequency of adult Alaskans who reported experiencing one or more ACE types generally declined with each additional type of ACE, resulting in a stair-step pattern similar to the finding from the ACEs report presenting average figures for the five states (see Figure 3). ACEs are prevalent among adults in Alaska: 63 percent of adult Alaskans surveyed reported one or more types of adverse childhood experiences (Figure 4). This prevalence rate of 63 percent is slightly more than and significantly different from the five-state average in which 59 percent of surveyed adults in the five states reported at least one type of ACE. Higher prevalence rates of ACEs in Alaska relative to the five-state average may partially explain why we have more serious alcohol and substance abuse problems in Alaska—higher ACE scores are generally associated with increased risk behaviors. The Alaska ACEs data allowed us to specifically examine associations between ACEs and the health-risk behaviors of adult heavy and binge drinking.

Results of the analysis (Figure 5) show a significantly increased frequency of heavy drinking in adult Alaskans with higher ACE scores. Whereas 6 percent of adult Alaskans who reported exposure to zero ACEs reported heavy drinking, 13 percent of adult

Alaskans with an ACE score of 6 or higher reported heavy drinking. Prevalence rates for heavy drinking were significantly larger for Alaskans with higher ACE scores, but on a positive note, only a small percentage of Alaskans who reported multiple types of ACEs reported heavy drinking. Logistic regression showed a pattern of increased odds of heavy drinking (adjusted for age, race, gender, education, and income) for each additional ACE type that was experienced relative to no ACEs. The odds of heavy drinking are 1.33 times higher for adult Alaskans with an ACE score of one and 1.84 times higher for adult Alaskans with an ACE score of four or five than for adult Alaskans who experienced zero ACEs. The odds of heavy drinking are 2.81 times higher for adult Alaskans exposed to between six and eight types of ACEs than for adult Alaskans who experienced zero ACEs. (See “Methodology and Odds Ratio Interpretation,” above.)

A larger percentage of adult Alaskans

reported binge drinking than reported heavy drinking, and results of the cross tabulation (Figure 6) also showed a significantly increased prevalence of binge drinking associated with higher ACE scores. Whereas 16 percent of adult Alaskans who experienced zero ACEs reported binge drinking, 24 percent with an ACE score of 3 reported binge drinking, and 25 percent with an ACE score of 4 or 5 reported binge drinking. Logistic regression showed increased odds of binge drinking (adjusted for age, race, gender, education, and income) with higher ACE scores compared to experiencing no ACEs. The odds of binge drinking are 1.44 times higher for adult Alaskans with an ACE score of 1 than for adult Alaskans who experienced no ACEs. For adult Alaskans with an ACE score of 3 or a score between 6 and 8, the odds of binge drinking are 1.82 times higher than for adult Alaskans with an ACE score of 0. The odds of binge drinking are 2.02

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times higher for adult Alaskans with an ACE score of 4 or 5 than for adult Alaskans who experienced no ACEs.

Conclusion

The prevalence rates of adverse childhood experiences among adult Alaskans are high and these traumatic experiences are associated with health-risk behaviors of heavy and binge drinking. Population attributable risk (PAR) is the percentage of a problem which can be directly attributed to a set of exposures to something or to an event. In this study, the problem is heavy drinking and the set of exposures is adverse childhood experiences. Using the Alaska ACEs data we could expect that if all ACEs were eliminated, this would lead to a population-based reduction in heavy drinking of 20.5 percent (results not shown). Researchers should continue to study other risk factors for high-risk drinking, as well as protective factors that promote resilience in the majority of people with higher ACE scores who do not report high-risk drinking. It is also recommended that researchers study other health outcomes associated with

ACEs in Alaska.

Given the high social and economic cost of alcohol abuse in Alaska, a reduction in ACEs through primary prevention could have significant benefits. Considerable investments in the state have been made to *respond* to the poor behavioral health outcomes researchers have linked to ACEs. Besides addressing the long-term consequences of ACEs, increased attention should be directed to developing a cohesive strategy to more effectively *prevent* the occurrence of ACEs. There are a number of resources currently focused on efforts to prevent child abuse and family dysfunction in Alaska, but these efforts are undertaken by multiple state departments and private agencies often acting independently of each other. Existing prevention efforts could be more coordinated and less fragmented. An integrated system designed to prevent ACEs would more effectively improve the lives and health of Alaskans and would be more cost efficient.

Marny Rivera is an associate professor in the Justice Center. Patrick Sidmore is a Health and Social Services Planner with the Alaska Department of Health and Social Services, Division of Behavioral Health.

Note: The original sources of Behavioral Risk Factor Surveillance System (BRFSS)

datasets for this article are the Alaska Department of Health and Social Services, Division of Public Health, and the Centers for Disease Control and Prevention.

Any analyses, interpretations, or conclusions in this article are those of the authors, and not of the Alaska Department of Health and Social Services, Division of Public Health, or the Centers for Disease Control and Prevention.

Forum to publish 3 times per year

Beginning with this Spring 2015 issue, the *Alaska Justice Forum* is officially changing from a quarterly publication to publishing three times per year. The new schedule will be Spring, Summer/Fall, and Winter.

This change will allow us to better meet the recent budget constraints facing the University of Alaska system-wide. We are also encouraging our readers to consider receiving the early online version of the *Forum*. Email editor@uaa.alaska.edu noting "online Forum" in the subject line to request this. Readers who receive the online version will no longer be mailed a print copy.

Adverse Childhood Experiences and Their Association with Alcohol Abuse by Alaska Adults — Statistical Web Supplement

The following is statistical information that supplements figures presented in the article “Adverse Childhood Experiences and Their Association with Alcohol Abuse by Alaska Adults.” This supplement includes confidence intervals for prevalence estimates and chi-square statistics for the cross tabulation results.

**Table 4. ACE Scores Prevalence and Confidence Intervals:
Alaska and Five-State Average**

This table is associated with Figure 3 of the print article.

ACE score	Alaska (2013)				Five-state average* (2009)			
	N	%	95% confidence interval		N	%	95% confidence interval	
			Lower limit	Upper limit			Lower limit	Upper limit
0	1,379	36.8 %	35.26 %	38.34 %	10,649	40.6 %	39.5 %	41.7 %
1	832	22.2	20.87	23.53	5,875	22.4	21.5	23.3
2	540	14.4	13.28	15.52	3,436	13.1	12.3	13.9
3	355	9.5	8.56	10.44	2,308	8.8	8.2	9.4
4	229	6.1	5.33	6.87	1,705	6.5	5.9	7.2
5 or more	413	11.0	10.00	12.00	2,282	8.7	8.0	9.4
Total	3,748				26,255			

Note: Percentages are unweighted.

* The five states are: Arkansas, Louisiana, New Mexico, Tennessee, and Washington.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013); "Adverse Childhood Experiences Reported by Adults — Five States, 2009," Centers for Disease Control and Prevention (2010)

**Table 5. Average Prevalence of ACE Scores of Zero vs. One or More
and Confidence Intervals: Alaska and Five-State Average**

This table is associated with Figure 4 of the print article.

ACE score	Alaska (2013)				Five-state average* (2009)			
	N	%	95% confidence interval		N	%	95% confidence interval	
			Lower limit	Upper limit			Lower limit	Upper limit
0	1,379	36.8 %	35.40 %	38.20 %	10,649	40.6 %	39.50 %	41.70 %
1 or more	2,369	63.2	61.66	64.74	15,606	59.4	58.91	60.09
Total	3,748				26,255			

Note: Percentages are unweighted.

* The five states are: Arkansas, Louisiana, New Mexico, Tennessee, and Washington.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013); "Adverse Childhood Experiences Reported by Adults — Five States, 2009," Centers for Disease Control and Prevention (2010)

Table 6. Prevalence and Confidence Intervals for Heavy Drinking by ACE Score, Alaska (2013)

This table is associated with Figure 5 of the print article.

ACE score	N	%	95% confidence interval	
			Lower limit	Upper limit
0	9,754	6.4 %	6.33 %	6.47 %
1	8,009	8.2	8.12	8.28
2	3,925	6.5	6.43	6.57
3	4,266	9.6	9.51	9.69
4 or 5	4,774	9.5	9.41	9.59
6, 7, or 8	3,375	13.3	13.20	13.40

$$\chi^2 (5, N = 430,375) = 1317.9, p = .000$$

Note: Odds ratio adjusted for age, sex, race/ethnicity, education, income. Percentages do not add to 100% because they were computed by dividing the number of adult Alaskans who *reported* heavy drinking by the number of adult Alaskans associated with each ACE score. Percentages exclude the number of adult Alaskans who *did not report* heavy drinking.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)

Table 7. Prevalence and Confidence Intervals for Binge Drinking by ACE Score, Alaska (2013)

This table is associated with Figure 6 of the print article.

ACE score	N	%	95% confidence interval	
			Lower limit	Upper limit
0	23,917	15.7 %	15.59 %	15.81 %
1	18,116	18.5	18.38	18.62
2	10,310	17.0	16.89	17.11
3	10,737	23.9	23.77	24.03
4 or 5	12,410	24.7	24.57	24.83
6, 7, or 8	4,726	18.7	18.58	18.82

$$\chi^2 (5, N = 431,146) = 3008.6, p = .000$$

Note: Odds ratio adjusted for age, sex, race/ethnicity, education, income. Percentages do not add to 100% because they were computed by dividing the number of adult Alaskans who *reported* binge drinking by the number of adult Alaskans associated with each ACE score. Percentages exclude the number of adult Alaskans who *did not report* binge drinking.

Source of data: Alaska Behavioral Risk Factor Surveillance System (BRFSS) data (2013)