ALCOHOL-RELATED VULNERABILITY IN IDAHO: AN EPIDEMIOLOGICAL ASSESSMENT

February 2025

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RECOMMENDED CITATION: Lewis O., Shrestha S., and Stopka TJ. February 20, 2025. Department of Public Health and Community Medicine. Tufts University School of Medicine.

ACKNOWLEDGEMENTS:

The Tufts team would like to thank the following individuals for their contributions to this vulnerability assessment:

Tiffany Prochaska

Natalie Bodine

Karyn Kershaw

Andrew Lahren

Adam Ernst

Rosie Andueza

Joe Pollard

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GLOSSARY OF TERMS

ACS: American Community Survey (U.S. Census Bureau)

AUD: Alcohol use disorder

CDC: Centers for Disease Control and Prevention

DUI: Driving under the influence

ED: Emergency department

GIS: Geographic information system

IDHW: Idaho Department of Health and Welfare

SUD: Substance use disorder

SVI: Social vulnerability index

EXECUTIVE SUMMARY

The lingering effects of the COVID-19 pandemic, which include increased social isolation, negative economic consequences, and mental health issues, have been linked to increased alcohol use across the United States.[1] The state of Idaho faces pressing issues related to alcohol use; in 2021, the prevalence of alcohol use disorder (AUD) reached 11.6% among Idahoans 12 years of age or older, higher than the national prevalence of 10.6%.[2] In addition, from 2020 to 2022, alcohol-induced motor vehicle crashes increased from 6.6 to 7.7 crashes per 10,000 residents in Idaho.[2] Numerous programs and policies to curb alcohol use have been employed in Idaho, including screening and intervention programs, reducing the hours and days alcohol can be sold, controlling the geographic placement of retail alcohol outlets, and taxing alcohol sales.[3–7] While alcohol-related mortality in Idaho decreased from 26.1 to 23.9 deaths per 100,000 population from 2021 to 2022, indicators of risky alcohol-related behaviors, including binge drinking and heavy drinking, continue to increase.[2,8]

By partnering with the Idaho Department of Health and Welfare (IDHW), our team at the Tufts University School of Medicine, Department of Public Health and Community Medicine, conducted a multi-methods assessment to determine the counties most susceptible to alcohol-related morbidity and mortality and identify priority areas for increasing access to treatment for AUD in Idaho. We used alcohol-related mortality as our outcome measure and nonfatal suspected alcohol-related emergency department (ED) visits, alcohol-related crimes, retail alcohol outlets, alcohol-related crashes, and gallons of alcohol sold as core indicators of alcohol-related vulnerability. We used the social vulnerability index (SVI), median age, and percent male population as covariates. We ran bivariate regressions to determine which indicators would be used in our final model and multivariable regressions to obtain correlation coefficients to use as weights. For measures included in the final model, we multiplied the quartile value of the selected indicators by the weights to determine alcohol-related vulnerability for each county. We ranked them using a scale from one (low vulnerability to alcohol-related harms) to five (high vulnerability).

We employed a geographic information system (GIS) to map our outcome measure, all core measures, and covariates included in the final model at the county level by quintile ranks. We generated drive-time service areas around centers that provided treatment for AUD to map geographic access to treatment. We mapped our vulnerability scores by county and overlaid treatment centers for AUD to pinpoint areas with high vulnerability to alcohol-related harms but low access to alcohol-related treatment. We overlaid tribal land boundaries on top of our vulnerability scores to determine overlap. We also created descriptive contextual maps included in the report body and appendix, highlighting population density, locations of major cities, national forest boundaries, and interstate highways.

We identified Benewah, Clearwater, Custer, Lemhi, Lewis, Nez Perce, Shoshone, and Valley Counties as the most vulnerable to alcohol-related harms. Alcohol-related ED visits, alcohol-related crashes, alcohol outlet density, gallons of alcohol sold, and median age were significantly associated with alcohol-related deaths at the county level. Geographic access to treatment for AUD was limited in many rural, high-vulnerability counties. All tribal lands except for

Duck Valley intersected counties in the highest or second-highest quintile rank for alcohol-related vulnerability.

We recommend several public health strategies to reduce alcohol-related vulnerability throughout Idaho. Targeted interventions built around local contexts should be implemented to improve access to treatment for AUD in rural regions. Alternative transportation options such as taxi vouchers or rideshare programs should be expanded in rural areas to reduce the occurrence of alcohol-related motor vehicle crashes. In addition, the state should focus on tailored interventions to reduce alcohol-related deaths in older populations and American Indian and Alaska Native communities.

We ultimately hope that this assessment will inform targeted policies, programs, and funding decisions to combat alcohol-related harms and expand access to treatment in the state's most vulnerable areas. In addition, we aim to provide a basis for future alcohol-related vulnerability assessments in Idaho and other states and encourage more in-depth research into alcohol-related patterns and harms throughout Idaho.

BACKGROUND

Alcohol use continues to present major health challenges across the U.S. From 2016-2021, alcohol-related deaths increased from 38 to 48 deaths per 100,000 population nationwide.[9] In 2021, 10.6% of U.S. adults reported having alcohol use disorder (AUD).[10] As of 2022, across all U.S. states, a median of 16.9% of adults reported binge drinking.[11] Moderate to heavy drinking greatly increases risks for morbidity and mortality tied to cancer, heart disease, fetal alcohol syndrome, birth defects, mental health conditions, diabetes, strokes, and violent injuries and accidents.[12–14] In addition, alcohol is commonly detected in opioid overdose deaths, especially in deaths linked to synthetic opioids or heroin.[15,16] For teenagers, underage drinking increases the risk of smoking, using illicit drugs, and being sexually active.[17] In 2021, 22.7% of U.S. high school students had consumed alcohol in the last 30 days, and 10.5% reported binge drinking.[18]

Idaho faces significant challenges related to alcohol consumption. While alcohol-related death rates in Idaho are lower than those of the U.S., rates still increased in the state, from 15.7 to 26.1 per 100,000 population between 2016 and 2021; however, in 2022, deaths decreased to 23.9 per 100,000.[3,9] In 2021, 11.6% of Idahoans were living with AUD, higher than the national average in the same year (10.6%).[2] More than fifteen percent (15.5%) of Idaho residents reported binge drinking in 2022, slightly lower than the national average (16.9%). Rates of underage drinking in Idaho have also been high. In 2021, 23.3% of high school students in Idaho reported recent drinking, slightly higher than the national average (22.7%).[18] Finally, alcohol-induced crashes have increased from 6.6 to 7.7 crashes per 10,000 population in Idaho from 2020 to 2022.[2]

Idaho has implemented several policies to curb alcohol use and related harms. Idaho has enacted excise taxes on liquor, wine, and beer, and limits the sale of alcohol to certain days of the week and times of day.[19,20] Idaho also controls the sale of liquor; for example, only state-licensed stores can sell wine, beer, or liquor that is more than 16% alcohol by volume.[21] Penalties for driving under the influence of alcohol include misdemeanors, fines, license suspensions, and felonies.[22] Alcohol retailers are liable for any consequences that stem from overserving customers or selling to those under the legal drinking age.[8] The state also requires that alcohol outlets be located at least 300 feet from schools.[8] In an attempt to decrease the risks related to underage drinking, police do not press charges against those under the legal drinking age when they call for help to address a medical emergency tied to alcohol use.[23]

In addition, several Idaho policies aim to expand the availability of treatment for substance use disorders in the state. Idaho funds numerous centers which provide treatment for AUD, including detox, counseling, and oral or injected medications, such as disulfiram and vivitrol, and provides free eligibility screening for state-funded treatment services.[24–26] In response to the COVID-19 pandemic, Idaho approved Medicaid Section 1135, 1915c, and 1115 waivers. These policies all expand access to medical care for behavioral health issues by supporting alternative options to institutional treatment, increasing the number of available providers patients can see as well as facilities where patients can receive treatment, and expanding the availability of evidence-based treatment for those with substance use disorders.[27–29]

To date, numerous opioid overdose-related jurisdictional-level vulnerability assessments have been conducted across the U.S.[30–34] These assessments used a wide range of risk indicators, including drug-related crimes, disease outcomes, and socioeconomic measures, to calculate vulnerability scores for each jurisdiction (e.g., county) in a respective state. These reports often assessed substance use treatment access to identify areas with high susceptibility to substance use-related harms and low treatment availability. To the best of our knowledge, there have not been similar assessments performed to determine alcohol-related vulnerability. This assessment aims to identify the counties in Idaho at the highest risk of alcohol-related morbidity and mortality and areas with low access to treatment for AUD. Our assessment will inform resource planning and funding efforts to reduce risks related to alcohol use in Idaho and provide a model for assessments of vulnerability to alcohol-related morbidity and mortality that other states can adapt for their own needs.

METHODS

Data Sources and Measures

Our team included faculty and research staff from the Tufts University School of Medicine and public health experts with IDHW. We conducted biweekly meetings from June 2024 to February 2025 to set timelines, determine indicators of alcohol-related vulnerability, identify appropriate data sources, discuss analyses and results, and interpret and contextualize our findings. Partners at IDHW facilitated access to alcohol-related indicators from the IDHW Bureau of Vital Records and Health Statistics, the IDHW Division of Public Health, the Idaho Transportation Department, the Idaho State Police, and the Idaho Statistical Analysis Center.

To calculate alcohol vulnerability scores by county, we adapted a statistical model originally used by Van Handel et al. (2016) to determine vulnerability to infectious diseases related to injection drug use at the county level.[35] This framework utilized an outcome measure of vulnerability (in this case, acute hepatitis C viral infections), as well as several related indicators and covariates, to test associations with the outcome measure and ultimately develop a vulnerability index by county.[35] We had previously modified this framework for use in several opioid overdose vulnerability assessments at the county level in Idaho and other states.[30–33] For this assessment, we determined alcohol-related deaths to be our outcome measure, and our core variables included nonfatal suspected alcohol-related ED visits, alcohol-related motor vehicle crashes, alcohol-related crimes, retail alcohol outlets, and gallons of alcohol sold. We used the Centers for Disease Control and Prevention (CDC) social vulnerability index (SVI) as a covariate to broadly capture factors that could make communities more vulnerable to harm from alcohol use. Both in Idaho and nationwide, drinking and associated harms have been most prevalent among men and those in older age groups.[8,9,36] Therefore, we included the median age and percent male population from the U.S. Census Bureau's American Community Survey (ACS) as covariates.

Table 1: Data Sources

Outcome variable	**Unit or Rate**	**Year(s)**	**Source**
Alcohol-related deaths*	Per 100,000 population	2020-2022	Bureau of Vital Records & Health Statistics, IDHW
Core variables			
Non-fatal suspected alcohol-related ED visits**	Per 10,000 ED visits	2020-2022	ESSENCE, NSSP Biosense Platform
Alcohol-related motor vehicle crashes	Per 10,000 Population	2020-2022	Idaho Transportation Department
Alcohol-related crimes†	Per 100,000 population	2020-2022	Idaho State Police
Retail alcohol outlets‡	Per 10,000 population	2022	Division of Public Health, IDHW
Gallons of alcohol sold	Per 100,000 population	2022	Division of Public Health, IDHW
Covariates			
Social Vulnerability Index	0-1	2018-2022 5-Year Estimates	U.S. Census American Community Survey

Median age	Years	2018-2022 5-Year Estimates	U.S. Census American Community Survey
Male population	%	2018-2022 5-Year Estimates	U.S. Census American Community Survey
Other			
Treatment centers for AUD	Longitude (X) and latitude (Y) coordinates	2024	SAMHSA
Tribal land boundaries		2020	IDHW
Adults who reported binge drinking (by Public Health District)	%	2020-2022	BRFSS, Idaho Statistical Analysis Center
Adults who reported heavy drinking (by Public Health District)	%	2020-2022	BRFSS, Idaho Statistical Analysis Center
Deaths with alcohol listed as a contributing cause	Per 100,000 population	2020-2022	Bureau of Vital Records & Health Statistics, IDHW
Social Vulnerability Index themes	0-1	2018-2022 5-Year Estimates	U.S. Census American Community Survey
Liquor store locations	Street-level address	2022	Division of Public Health, IDHW
HPSA scores		October 2023	Health Resources and Services Administration
HPSA facilities	Longitude (X) and latitude (Y) coordinates	October 2023	Health Resources and Services Administration
Population density (by census tract)	Per square mile	2018-2022 5-Year Estimates	U.S. Census American Community Survey
Urban/rural classification		2013	Centers for Disease Control and Prevention, National Center for Health Statistics
National forest administrative boundaries		2024	United States Department of Agriculture, Forest Service

*Alcohol-related deaths were defined as deaths with alcohol listed as an underlying cause; county of residence was used for location

**For nonfatal suspected alcohol-related ED visits, patient location was used to determine county-level rates

†Alcohol-related crimes were defined as arrests for liquor law violations, driving under the influence (DUI), and drunkenness

‡Retail alcohol outlets were defined as any establishment that was licensed to sell alcohol, including but not limited to liquor stores, restaurants, and bars

Definitions: ED: emergency department; IDHW: Idaho Department of Health and Welfare; ESSENCE, NSSP: Early Notification of Community-Based Epidemics, National Syndromic Surveillance Program; AUD: Alcohol use disorder; SAMHSA: Substance Abuse and Mental Health Services Administration; BRFSS: Behavioral Risk Factor Surveillance System; HPSA: Health Professional Shortage Area

Data Cleaning and Preparation

We calculated all population-based rates using population denominators from the IDHW Bureau of Vital Records and Statistics. We calculated annual average rates from 2020-2022, the most recent years for which complete data were available at the time of our analyses, for all health and crime-related indicators to minimize zeroes and low counts in less populated counties. We geocoded all address-level data, obtaining the longitude and latitude coordinates for addresses, ultimately allowing us to place locations on maps like pushpins. We mapped the geo-locations of liquor stores, AUD treatment centers, and health professional shortage area (HPSA) facilities using the ArcGIS Pro online geocoding service (version 3.3.0; Esri, Redlands, CA). We used Python 3.11.9 (Python Software Foundation, Wilmington, DE) to prepare all data for use in descriptive maps and statistical analyses.

Descriptive Mapping

We created descriptive maps of our outcome measure, core variables, and covariates at the county level. For health and crime-related indicators, we suppressed counties with non-zero total counts less than five to protect the privacy of residents and their loved ones and avoid unstable rates in counties with low populations. We organized all counties into five equal groups (quintiles) when mapping each variable. We overlaid tribal land boundaries on vulnerability score maps to determine the overlap of these areas with high-vulnerability counties. We mapped deaths with alcohol listed as a contributing cause by county to visualize the geographic distribution of alcohol-related mortality in Idaho. We mapped the locations of liquor stores, the number of retail alcohol outlets by county, and retail alcohol outlet density per square mile to further analyze supply of alcohol across the state. We mapped the percentages of adults who reported heavy drinking and binge drinking at the public health district level to determine the spatial distribution of behaviors that indicate a high risk of alcohol-related morbidity and mortality. To determine areas with fewer primary care providers, we mapped the geographic dispersion of HPSA facilities by type and visualized HPSA scores at the county level. We mapped the distribution of SVI themes (racial and ethnic minority status, household characteristics, socioeconomic status, and housing type and transportation) by county to examine regional patterns of sociodemographic characteristics. We developed contextual maps depicting interstate highways, major roadways, populous cities, population density, national forest boundaries, and urban/rural classifications to provide a sense of the underlying landscape and inform the interpretation of our results. All maps were developed using ArcGIS Pro v3.3.0 (Esri, Redlands, CA).

Statistical Analyses

We calculated alcohol-related vulnerability scores by county, adapting a statistical approach from our previous opioid-related vulnerability assessments based on a framework originally developed by Van Handel et al. (2016), and employing a regression-weighted summed risk score calculation.[35] Due to a low sample size (N=44 counties), we divided counties into four equal groups (quartiles) and ranked them using categorical values (e.g., one if a county was in the group with the lowest values) for all covariates and core indicators to examine associations between our pre-determined indicators and alcohol-related deaths. To select variables for inclusion, we first ran bivariate ordinary least square regressions for all variables as quartile ranks (e.g., one, two, three, four) to test associations with our outcome measure, alcohol-related death rates, as values (e.g. 13 deaths per 100,000 population). We selected core measures and covariates significant at the $p<0.2$ level for inclusion. Regardless of significance, we included SVI scores in our final model to account for aggregated sociodemographic measures that indicate high vulnerability to public health emergencies. To determine weights for our final vulnerability score calculation, we ran multivariable regressions for all variables selected for inclusion in the final model. We then multiplied each variable's coefficient from the multivariable regressions by its quartile rank. We then added the weighted values of all variables for each county, resulting in a final vulnerability score. We divided counties into five equal groups (quintiles) based on their scores to obtain a vulnerability rank for each county.

Geographic Access to Treatment for AUD

We mapped the street-level addresses of all centers that provided treatment for AUD throughout Idaho in 2024. We generated service areas showing 30 and 60-minute driving times toward centers that provided treatment for AUD. Cutoffs were based on conversations with the IDHW about realistic travel times. In addition, while there is limited peer-reviewed literature on travel times to treatment for AUD, studies assessing access to substance use disorder or medication for opioid use disorder found one-way average travel times to be well over one hour in Idaho.[37] We mapped the locations of treatment centers and the drive-time service areas across Idaho to show the geographic distribution of alcohol-related treatment and identify areas with low geographic access to treatment for AUD. We also juxtaposed centers that treat AUD with our vulnerability scores by county to identify high-vulnerability counties with limited treatment options.

RESULTS

DESCRIPTIVE MAPPING

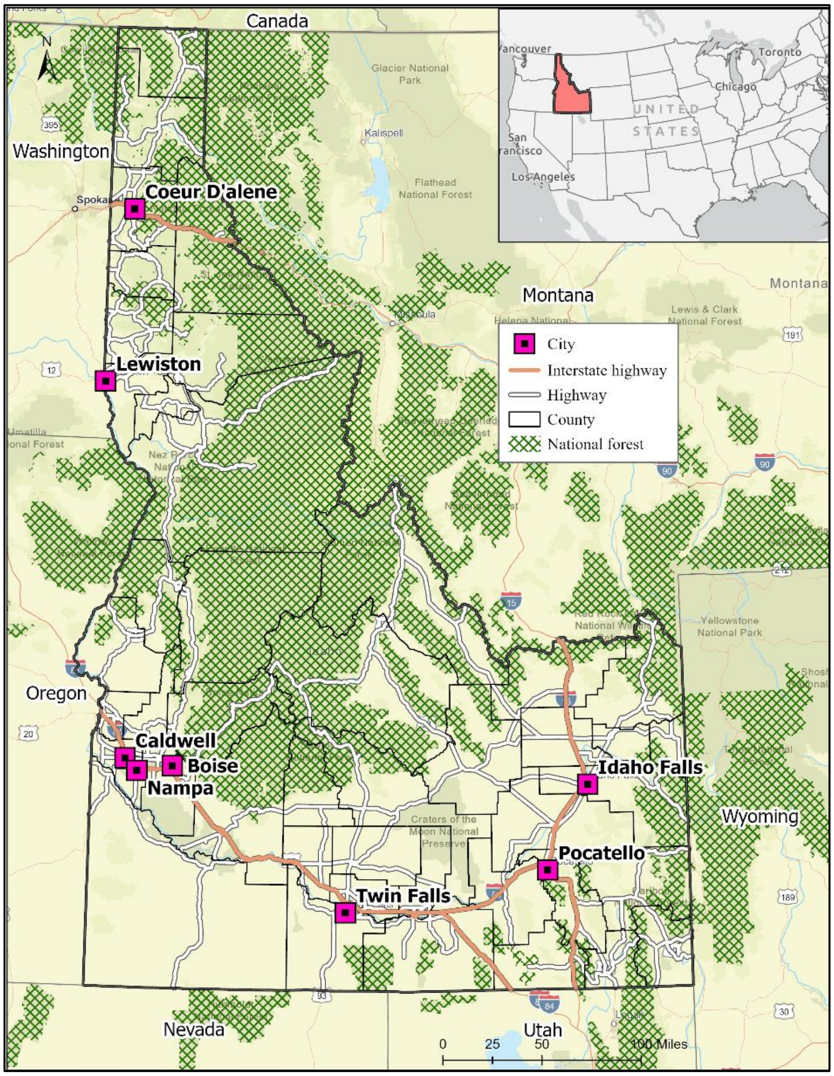

Figure 1: State of Idaho

Idaho borders Oregon, Washington, Montana, Utah, Nevada, and the Canadian border to the north (Figure 1). Much of the land area in rural north-central Idaho is covered by national forests with sparse highway access. In contrast, more populous urban areas such as Coeur d'Alene, Lewiston, Caldwell, Nampa, Boise, Twin Falls, Pocatello, and Idaho Falls are connected to the rest of the state through numerous state and interstate highways 90, 84, 86, and 15.

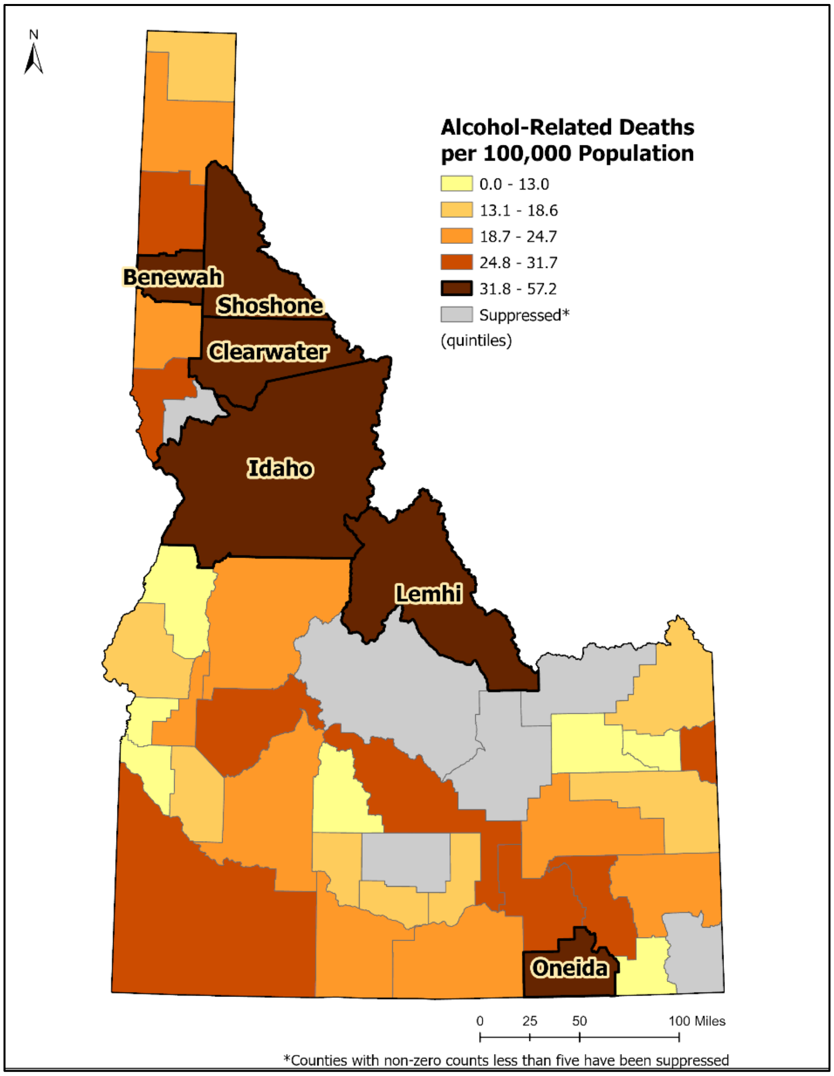

Figure 2: Alcohol-Related Deaths, Idaho Counties, 2020-2022 (Annual Average)

Alcohol-related deaths ranged from 0-57.2 deaths per 100,000 population from 2020-2022 across Idaho counties (Figure 2). The counties with the highest rates of alcohol-related deaths were Benewah, Shoshone, Clearwater, Idaho, Lemhi, and Oneida. Most of these counties were rural with low population densities (Appendix 1).

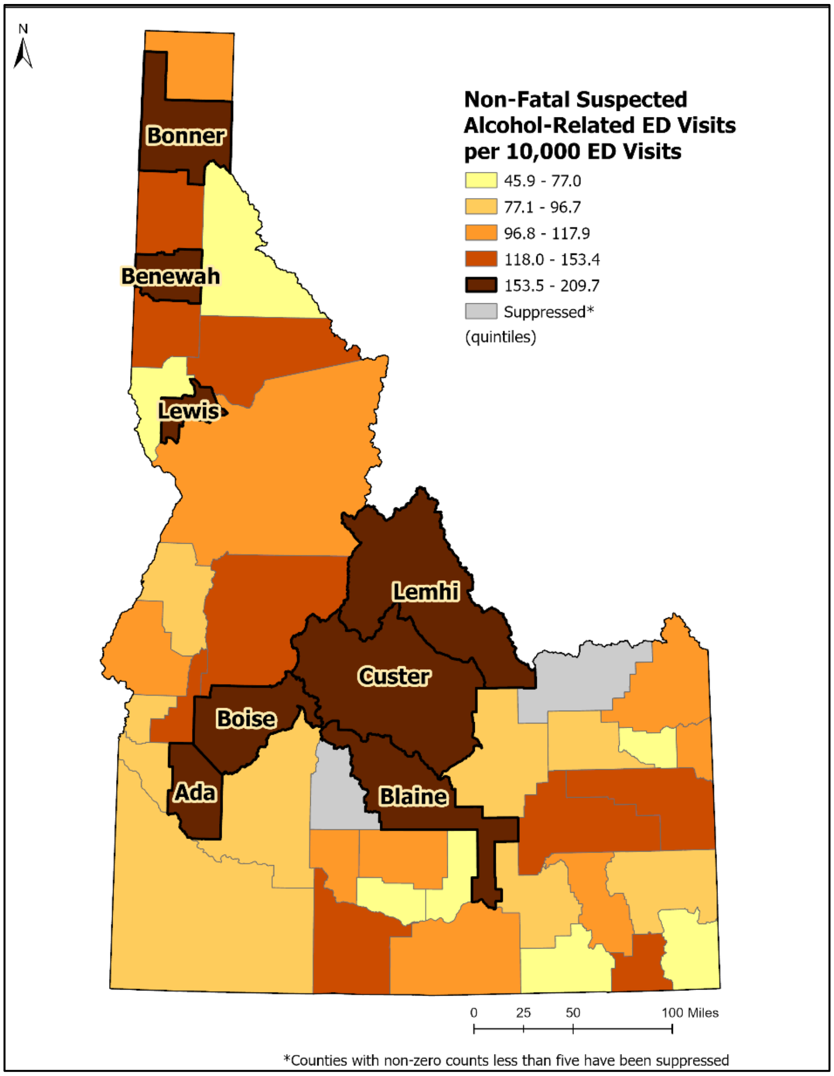

Figure 3: Alcohol-Related Emergency Department (ED) Visits, Idaho Counties, 2020-2022 (Annual Average)

The counties with the highest rates of alcohol-related ED visits were Bonner, Benewah, Lewis, Lemhi, Custer, Boise, Ada, and Blaine (Figure 3). These counties were a mix of urban and rural jurisdictions, and many were located in central Idaho (Appendix 1). Lemhi and Benewah Counties were also in the top quintile rank for alcohol-related deaths, indicating elevated risk (Figure 2).

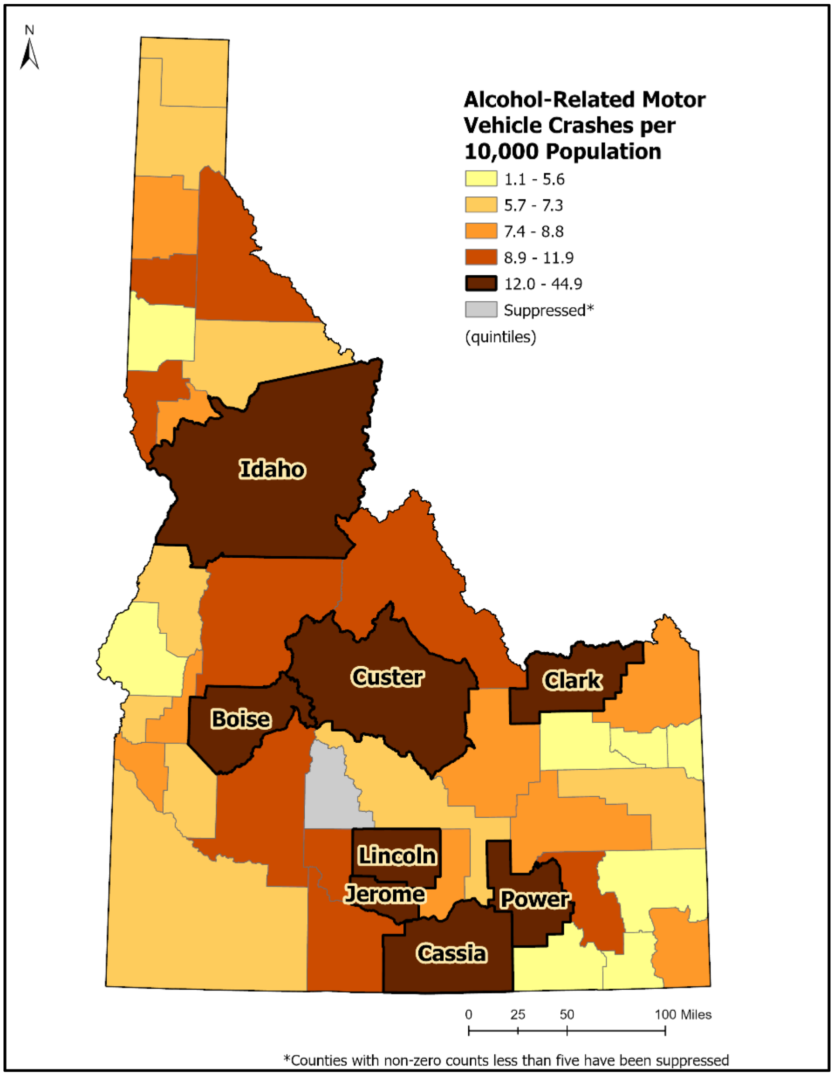

Figure 4: Alcohol-Related Motor Vehicle Crashes, Idaho Counties, 2020-2022 (Annual Average)

Alcohol-related crash rates were highest in Idaho, Custer, Boise, Clark, Lincoln, Jerome, Power, and Cassia Counties (Figure 4). While rates ranged from 0-18 alcohol-related crashes per 10,000 population in most counties, Clark County had the highest rate of alcohol-related crashes at 44.9.

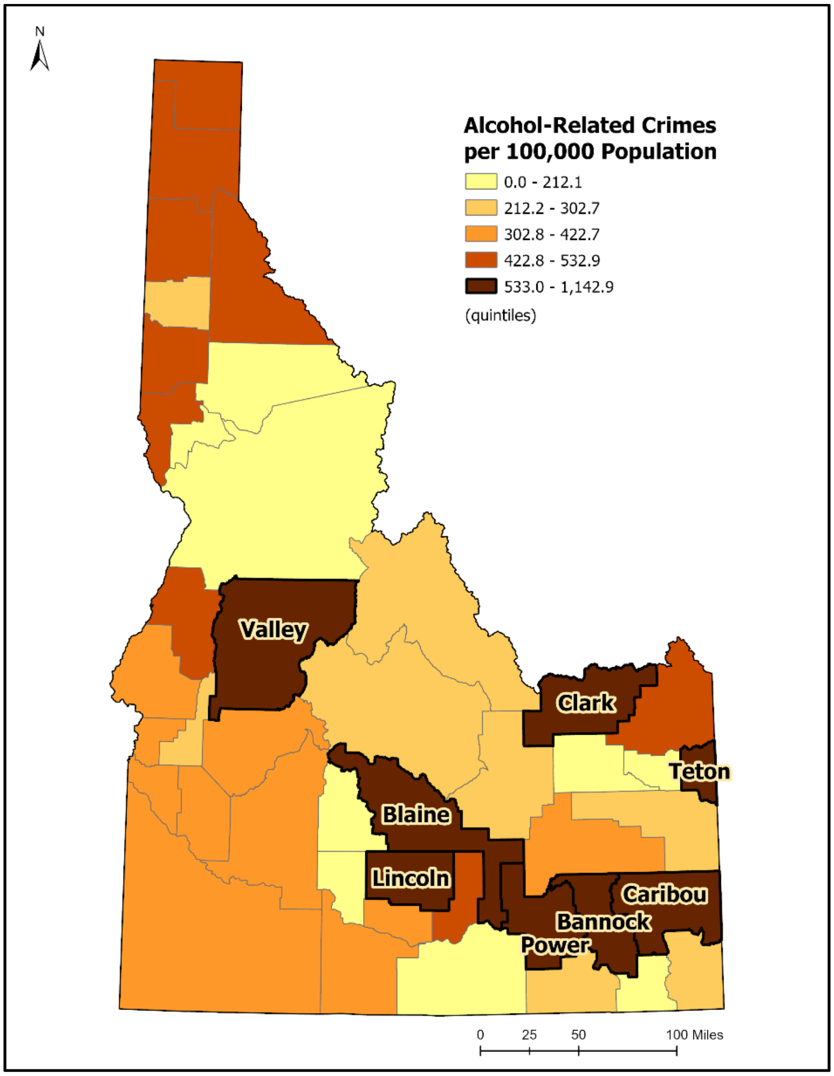

Figure 5: Alcohol-Related Crimes, Idaho Counties, 2020-2022 (Annual Average)

Rates of alcohol-related crime were highest in the southeastern region of Idaho in Blaine, Lincoln, Power, Bannock, and Caribou Counties, as well as in Valley, Clark, and Teton Counties (Figure 5). Alcohol-related crash rates were also among the highest in Clark County (Figure 4). Counties throughout northern Idaho had rates in the second highest quintile rank (dark orange).

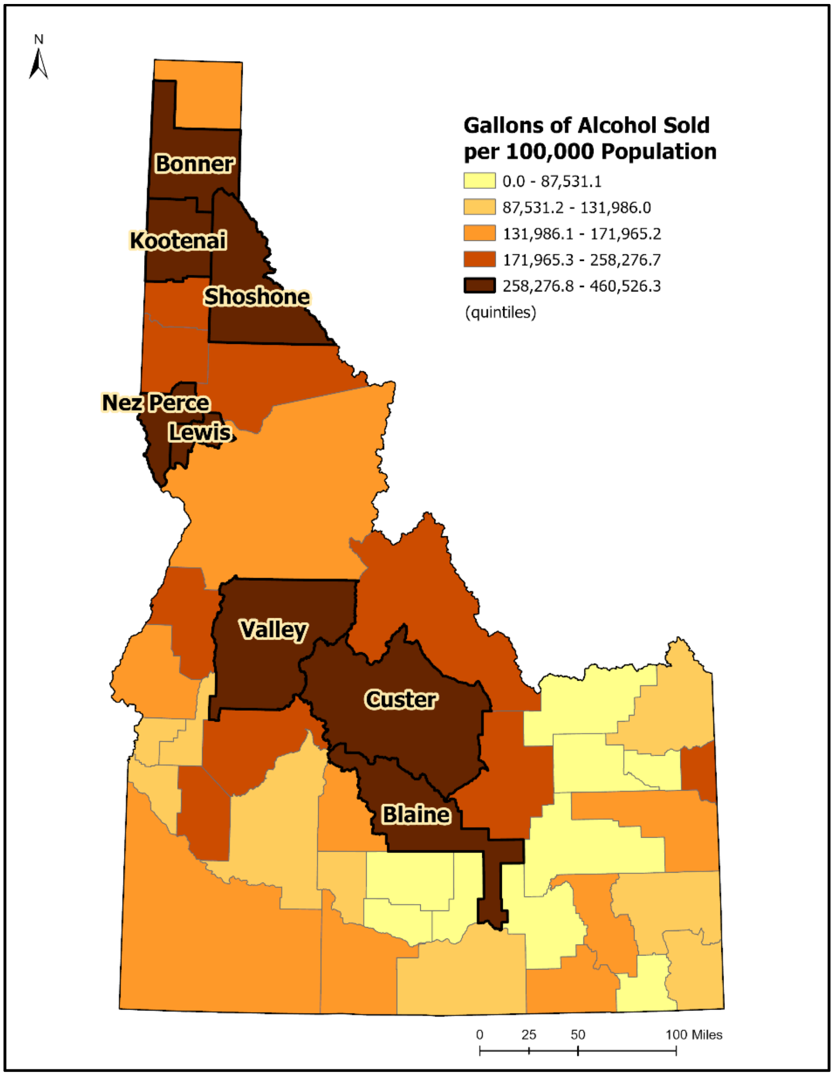

Figure 6: Gallons of Alcohol Sold, Idaho Counties, 2022

The counties with the most gallons of alcohol sold per 100,000 population in 2022 were Bonner, Kootenai, Shoshone, Nez Perce, Lewis, Valley, Custer, and Blaine (Figure 6). Kootenai County had the third highest rate of retail alcohol outlets per square mile of all counties, following Ada and Canyon Counties (Appendix 4). Shoshone County also had one of the highest rates of alcohol-related deaths (Figure 2). Custer County had very high rates of alcohol-related ED visits and alcohol-related motor vehicle crashes (Figures 3 and 4).

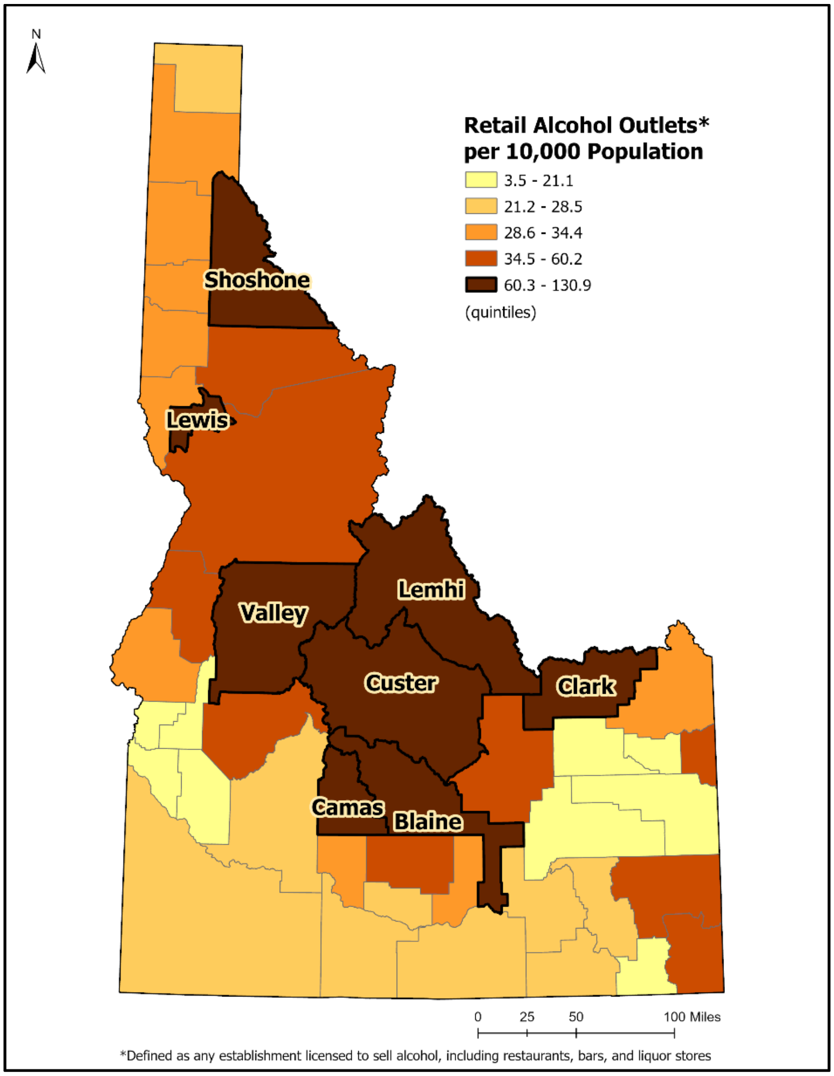

Figure 7: Retail Alcohol Outlets, Idaho Counties, 2022

Shoshone, Lewis, Valley, Lemhi, Custer, Clark, Camas, and Blaine Counties had the highest rates of retail alcohol outlets per 10,000 population in 2022 (Figure 7). Shoshone, Lewis, Valley, Custer, and Blaine Counties also had the most gallons of alcohol sold per population in the same year (Figure 6). Custer County had very low retail alcohol outlet density per square mile yet high density per 10,000 population (Appendix 4). Lemhi and Shoshone also had high rates of alcohol-related deaths (Figure 2).

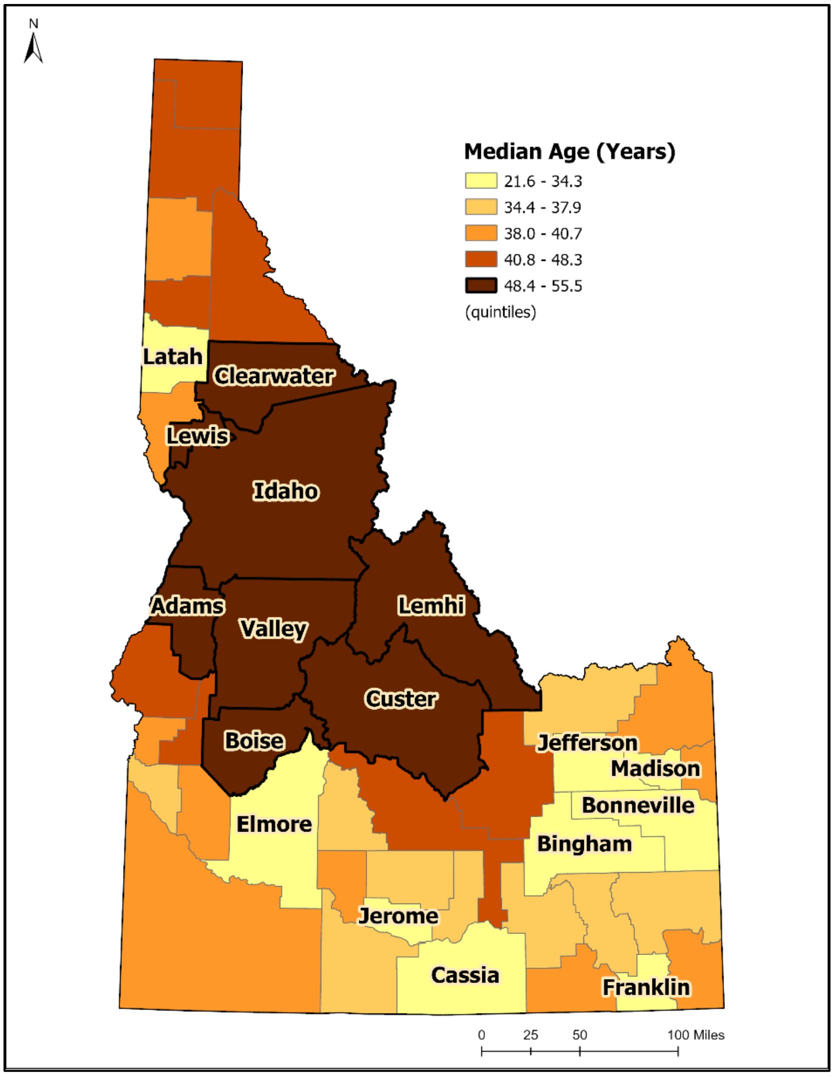

Figure 8: Median Age (Years), Idaho Counties, 2018-2022 (Annual Average)

Median age by county ranged from 21.6 to 55.5 years old from 2018-2022 (Figure 8). Many counties in southern and southeastern Idaho, such as Jefferson, Madison, Bonneville, Bingham, Franklin, Cassia, Jerome, and Elmore Counties, had a younger median age, in addition to Latah County in northeastern Idaho. Jefferson, Madison, Bonneville, and Bingham Counties are located in the greater Idaho Falls area, a region with higher urbanicity (Figure 1 & Appendix 1). The counties with the highest median age were all in north-central Idaho: Clearwater, Lewis, Idaho, Adams, Valley, Lemhi, Custer, and Boise. All counties with the highest median age were rural, except for Boise (Appendix 1).

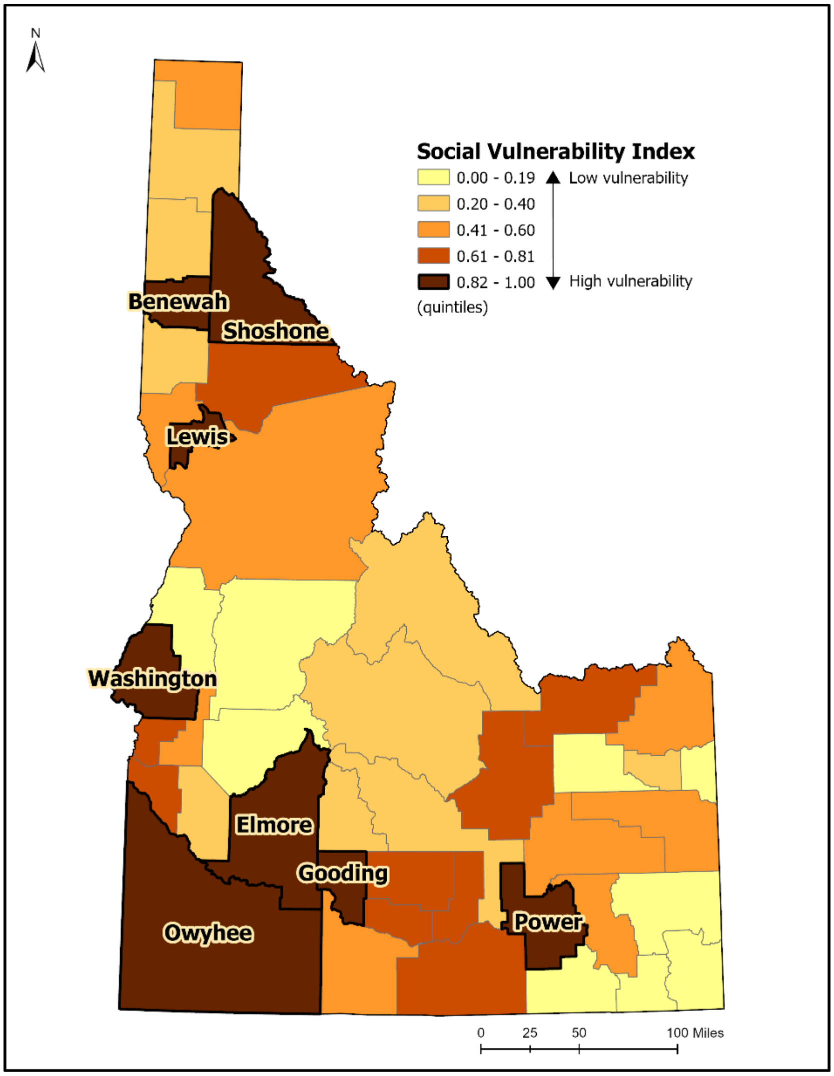

Figure 9: Social Vulnerability Index, Idaho Counties, 2018-2022 (Annual Average)

Benewah, Shoshone, Lewis, Washington, Elmore, Gooding, Owyhee, and Power had the highest SVI scores (Figure 9). These counties included a mix of urban and rural jurisdictions with high-density cities and interstates meandering through isolated areas (Figure 1 & Appendix 1).

STATISTICAL ANALYSIS

Table 2: Bivariate Model*: Factors Associated with Alcohol-Related Deaths

Variables	Mean (SD)	Range	Beta Coefficient	p-value**
Outcome Variable				
Alcohol-related deaths per 100,000 population	24 (14.2)	(0 - 57.2)		
Core Indicators				
Alcohol-related ED visits per 10,000 ED visits	114.93 (41.83)	(45.87 - 209.66)	2.73	**0.156**
Alcohol-related crashes per 10,000 population	9.11 (6.55)	(1.13 - 44.9)	4.52	**0.016**
Alcohol-related crimes per 100,000 population	392.82 (223.30)	(0 – 1,142.86)	0.31	0.875
Retail alcohol outlets per 10,000 population	38.92 (24.69)	(3.46 - 130.94)	4.06	**0.032**
Gallons of alcohol sold per 100,000 population	170,209.2 (93,806.05)	(0 – 460,526.3)	6.31	**0.001**
Covariates				
SVI (0-1)	0.5 (0.3)	(0 - 1)	1.53	0.429
Male Population (%)	50.97 (1.54)	(45.29 - 55.75)	1.49	0.444
Median Age (Years)	40.39 (7.45)	(21.6 - 55.5)	5.71	**0.002**

*Bivariate regressions were run with all predictor variables as defined categorical measures, organized by quartiles. All summary statistics (mean, standard deviation, range) were generated using continuous values.

**Variables that were significant at the $p<0.2$ level were considered for inclusion in the multivariable model.

The core indicators analyzed in our bivariate analyses include alcohol-related ED visits, alcohol-related crashes, alcohol-related crimes, retail alcohol outlets, and gallons of alcohol sold (transformed to quartiles). We found that alcohol-related ED visits ($\beta = 2.73$, $p = 0.156$), alcohol-related crashes ($\beta = 4.52$, $p = 0.016$), retail alcohol outlets ($\beta = 4.06$, $p = 0.032$), and gallons of alcohol sold ($\beta = 6.31$, $p = 0.001$) were significant at $p<0.02$ for inclusion in the final multivariable model. However, alcohol-related crimes ($\beta = 0.31$, $p = 0.875$) were not significant for inclusion.

Among the covariates, SVI score (β = 1.53, p = 0.429) and the percentage of the population that was male (β = 1.49, p = 0.444) were not significantly associated with alcohol-related deaths. Median age (β = 5.71, p = 0.002) was associated with alcohol-related deaths per 100,000 population. We included SVI (selected a priori regardless of significance) and median age as covariates along with other significant (p<0.02) core variables for our final model.

Table 3: Multivariable Model: Factors Associated with Alcohol-Related Deaths

Variables	Coefficient	Std. err.	P value	Confidence Interval
Alcohol-related ED visits per 10,000 (quartile)	-0.47	2.01	0.816	-4.54 - 3.60
Alcohol-related crashes per 10,000 (quartile)	3.81	1.91	**0.053**	-0.05 - 7.67
Retail alcohol outlets per 10,000 (quartile)	-0.91	2.25	0.687	-5.48 - 3.65
Gallons of alcohol sold per 100,000 (quartile)	6.40	2.79	**0.027**	.75 – 12.04
Median age (quartile)	0.87	2.68	0.748	-4.56 - 6.30
SVI (quartile)	1.04	1.82	0.573	-2.66 - 4.75

Std. err.: Standard Error

In the multivariable model (Table 3), alcohol-related crashes per 10,000 population (β = 3.81, p = 0.053) and gallons of alcohol sold per 100,000 population (β = 6.40, p = 0.027) were statistically significant or achieved borderline significance, suggesting a positive relationship with alcohol-related health outcomes. Alcohol-related ED visits per 10,000 ED visits (β = -0.47), retail alcohol outlets per 10,000 population (β = -0.91), median age (β = 0.87), and SVI overall score (β = 1.04) were not significantly associated with alcohol-related death rates. We used the coefficients from the regression model to predict overall county-level vulnerability scores.

Alcohol-Related Vulnerability Maps

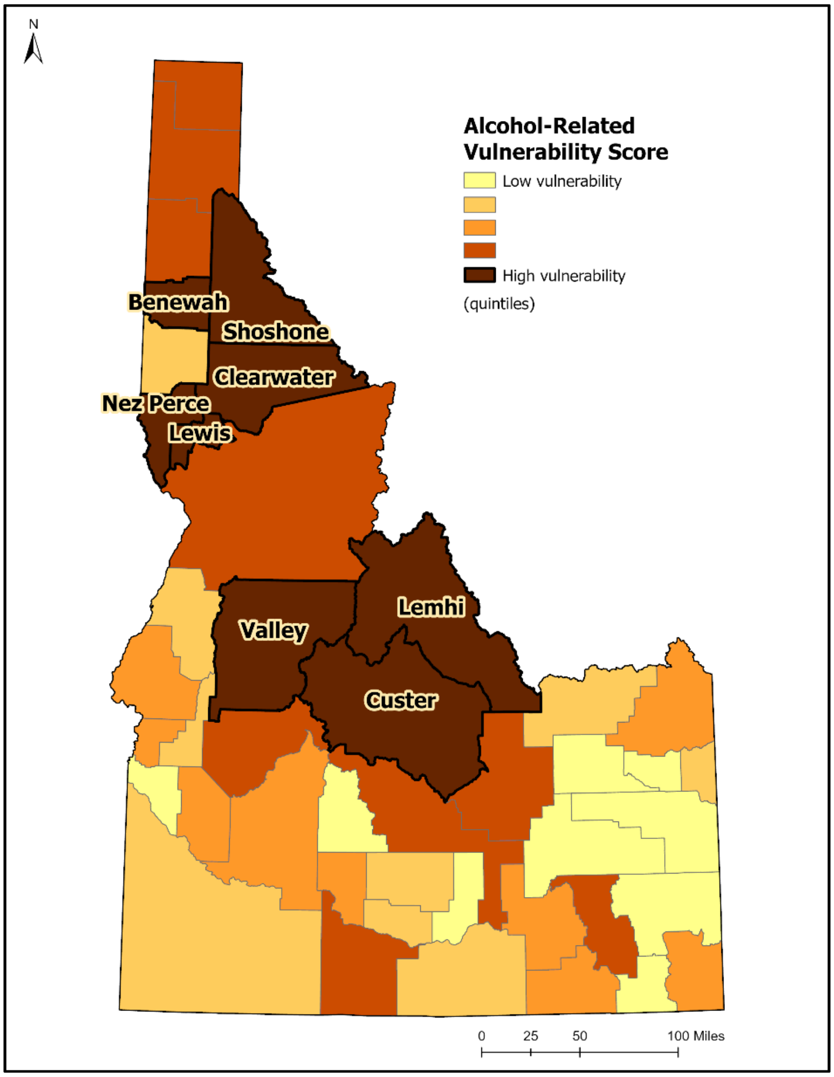

Figure 10: Alcohol-Related Vulnerability Scores, Idaho Counties, 2020-2022

Our vulnerability models show that Benewah, Clearwater, Custer, Lemhi, Lewis, Nez Perce, Shoshone, and Valley Counties had the highest vulnerability to alcohol-related morbidity and mortality from 2020-2022 (Figure 10). Almost all counties in the highest and second-highest quintile for vulnerability were in the central or northern part of the state. All counties except for Nez Perce were rural and had a large portion of land covered by national forests (Figure 1 & Appendix 1). Custer County was in the top quintile rank for almost all core variables, including alcohol-related ED visits, alcohol-related crashes, gallons of alcohol sold, retail alcohol outlets, and median age (Figures 3, 4, & 6-8). Valley and Shoshone Counties were in the top two quintile ranks for nearly all core variables (Figures 2-7). Lemhi County was also in the top quintile rank for alcohol-related deaths, alcohol-related ED visits, retail alcohol outlets, and median age (Figures 2, 3, 7 & 8).

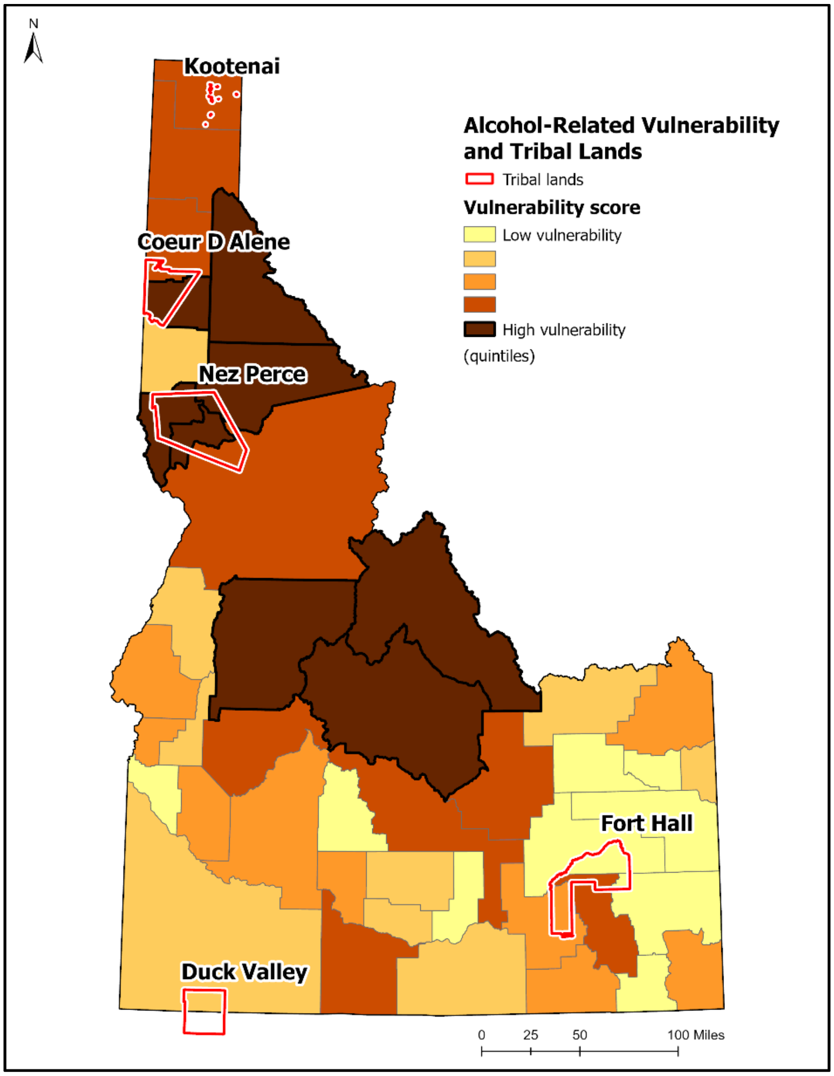

Figure 11: Alcohol-Related Vulnerability Scores and Tribal Lands, 2020-2022

The Coeur D'Alene and Nez Perce tribal lands intersected with multiple counties in the highest or second-highest quintile rank for alcohol-related vulnerability, while the Kootenai and Fort Hall tribal lands intersected with counties in the second-highest tier for alcohol-related vulnerability scores (Figure 11). Duck Valley was the only tribal land area in a county with a lower vulnerability score.

GEOGRAPHIC ACCESS TO TREATMENT FOR ALCOHOL USE DISORDER

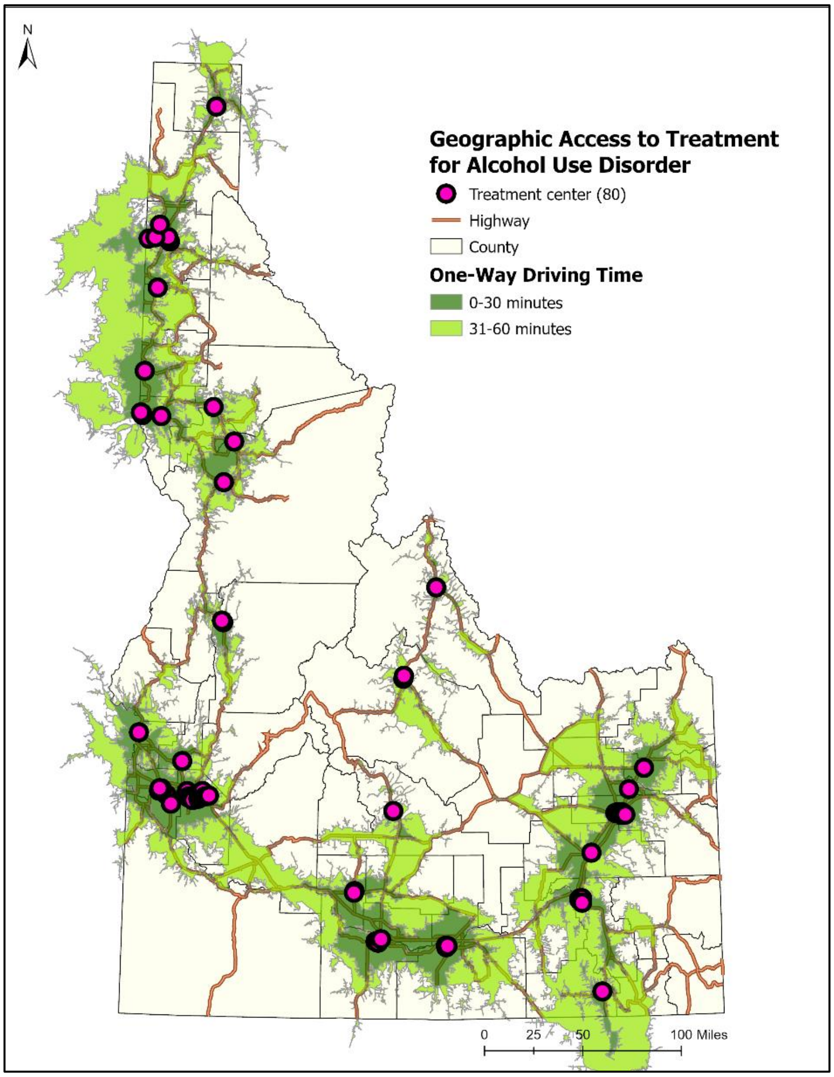

Figure 12: Geographic Access to Treatment for Alcohol Use Disorder, Idaho, 2024

Geographic access to treatment centers for AUD was widespread in Coeur d'Alene, Nampa, Boise, Pocatello, and Idaho Falls, as well as along the interstate crescent (Figures 1 & 12). Almost all of Shoshone County, which was in the top quintile rank for alcohol-related deaths and alcohol-related vulnerability, was more than an hour driving one-way to the closest treatment center (Figures 2 & 10). Large parts of rural, high-vulnerability counties, including Lemhi, Custer, Idaho, and Valley Counties, were further than an hour driving time one-way to any treatment center (Figure 10).

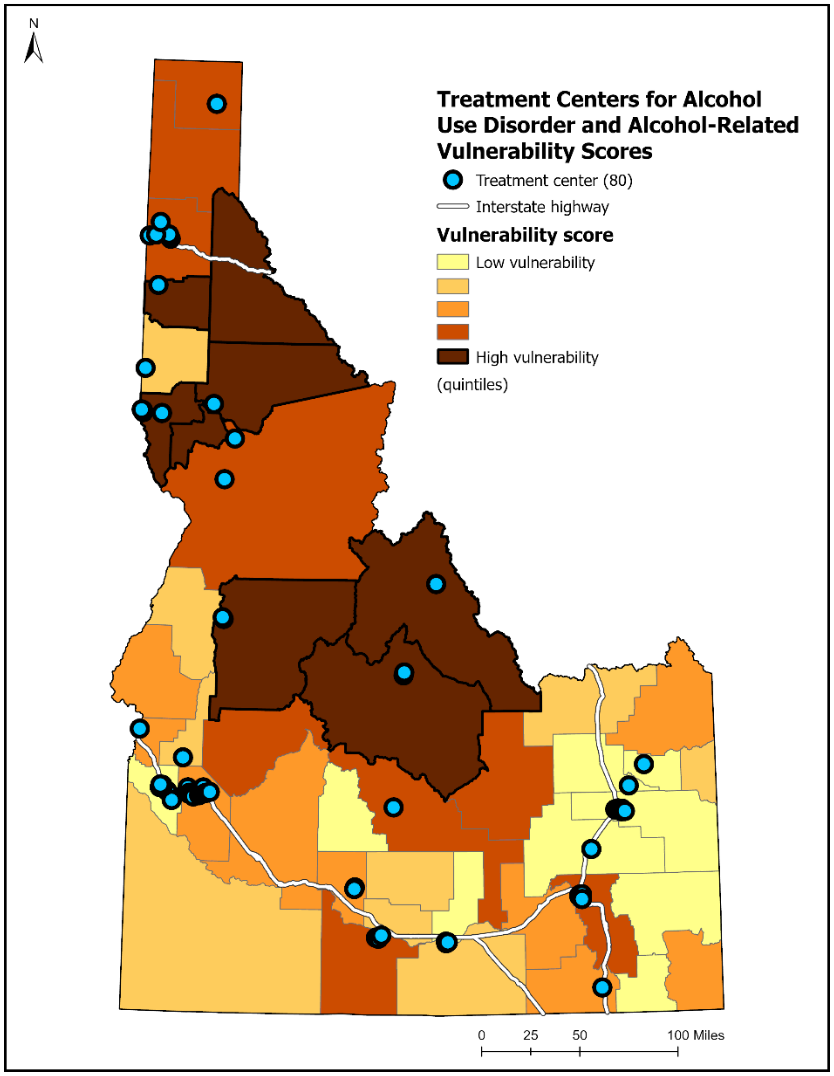

Figure 13: Treatment for Alcohol Use Disorder and Alcohol-Related Vulnerability Scores

Most of the rural counties with the highest alcohol-related vulnerability scores had few centers that provided treatment for AUD (Figure 13). Shoshone County had no treatment centers, and only one or two centers were in Valley, Custer, Idaho, and Benewah Counties. Similarly, several counties in the second-highest quintile for alcohol-related vulnerability also had few treatment options.

DISCUSSION

The jurisdictions we identified as having the highest vulnerability to alcohol-related harms were Benewah, Clearwater, Custer, Lemhi, Lewis, Nez Perce, Shoshone, and Valley Counties. With the exception of Nez Perce, all counties with the highest vulnerability scores were primarily rural and contained a large portion of uninhabitable land and national forests. Almost all tribal lands in Idaho intersected counties in the top two quintile ranks for alcohol-related vulnerability. We found that geographic access to treatment for AUD was limited throughout the state, and many high-vulnerability counties had few to no centers that offered treatment for AUD. We identified statistically significant associations between alcohol-related ED visits, alcohol-related crashes, retail alcohol outlets, gallons of alcohol sold, and median age with alcohol-related deaths at the county level in Idaho.

We determined that all high-vulnerability counties except Nez Perce were primarily rural recreational areas. Literature shows that consumption of alcohol and related morbidity and mortality are often more prevalent in rural communities compared to higher-density areas.[38–40] Community-level norms and social pressure in rural areas can promote dangerous drinking patterns, and teenagers and youth who live in rural and remote areas are more likely to binge drink.[39,41] Counties with the lowest vulnerability scores were primarily in southeastern Idaho. These counties have high percentages of the population who are members of the Church of Jesus Christ of Latter-Day Saints, who may avoid drinking for religious reasons.[42]

Another significant but anticipated finding was that alcohol-related crashes per population were significantly associated with alcohol-related deaths. Many of the counties with the highest rates of alcohol-related motor vehicle crashes were rural, and studies have found that aspects of rural life, such as lack of transportation options other than driving oneself home after drinking, limited law enforcement presence, and family and peer influence, can promote drinking and driving.[39,43,44] In Idaho, rates of alcohol-induced crashes increased from 6.6 to 7.7 crashes per 10,000 people from 2020 to 2022, indicating a need for interventions to reduce drinking and driving in the state.[2]

Geographic access to treatment for AUD was limited in rural parts of the state; trips from some of the sparsely populated, high-vulnerability counties would total more than two hours roundtrip by car. It is well-documented that people in need of treatment for AUD in rural regions have a lower likelihood of participating in treatment than those in urban areas.[45,46] Lack of nearby health care options, AUD treatment slots, and transportation are commonly reported barriers to access in rural and remote regions, in addition to limited awareness of treatment options.[46–48] Furthermore, stigma around treatment for substance use disorders in rural areas can inhibit people from participating in treatment.[48]

Median age was strongly associated with alcohol-related deaths at the county level. According to recent data published by the IDHW, of all age groups, alcohol-related mortality rates were highest (46.8 per 100,000 population) in Idahoans aged 55-64 years in 2024.[8] During the COVID-19 pandemic, there was an increase in risky patterns of alcohol use among older adults, likely tied to worsening mental health and social isolation.[49–52] Furthermore, substance use disorders are often misdiagnosed or undetected in older adults, and as a result, many older adults who need treatment for AUD do not receive care.[53]

We identified disproportionate risks of alcohol-related harms on or around American Indian and Alaska Native lands, as indicated in our maps that highlighted numerous tribal regions intersecting high-vulnerability counties. As of 2016, American Indian and Alaska Native communities in Idaho faced a disproportionate risk of alcohol-related death, reflecting a national trend of higher alcohol-related mortality in this population.[54,55] However, there is a lack of reports or information from more recent years on alcohol-related harms in American Indian and Alaska Native communities in Idaho; this is an especially important gap to fill, considering how alcohol-related deaths rose during the COVID-19 pandemic across the U.S.[56]

Finally, retail alcohol outlets and gallons of alcohol sold were significantly associated with alcohol-related deaths. In early 2025, the U.S. Surgeon General issued an advisory report warning that alcohol use is tied to multiple types of cancer risk, highlighting increased risks even with low to moderate consumption.[14] During the COVID-19 pandemic, retail alcohol sales increased throughout the U.S., demonstrating high levels of drinking during isolation.[57] While lower than that of the U.S., per-capita consumption of distilled spirits in Idaho steadily rose from 2010-2020, and liquor sales increased from 2016-2020; however, both of these indicators began declining after the pandemic in Idaho, indicating progress.[58] In addition to alcohol sales, high alcohol outlet density is generally associated with increased alcohol-related morbidity and mortality.[59–62] Idaho has several strategies in place to control alcohol sales, but tighter regulation of outlet access per capita can serve as an important strategy to reduce alcohol-related harms.[62]

LIMITATIONS

Our findings should be considered in light of several limitations. First, we had a small sample size of 44 counties, which could have exaggerated or minimized associations between our indicators and alcohol-related deaths. In addition, using SVI as a broad measure of sociodemographic indicators prevented us from examining relationships between individual socioeconomic and demographic variables already accounted for in the SVI and alcohol-related deaths. However, using the SVI provided a more robust measure of social vulnerability, given that it incorporates 16 different socioeconomic measures. Using the SAMHSA locator to identify centers that treat AUD may have led us to miss centers that did not opt-in for inclusion in the dataset. Furthermore, the SAMHSA locator only had data for 2024, which may not represent availability of treatment for AUD in the state during all years of the study period (2020-2022). Lastly, the SAMHSA locator did not differentiate between different types of treatment for AUD, such as psychological counseling and oral or injected medication, which may be important for resource targeting and planning.

RECOMMENDATIONS

Based on our assessment, we have several recommendations to reduce alcohol-related vulnerability throughout the state:

1. *Increasing availability and utilization of treatment for AUD in rural regions*: Treatment centers for AUD were limited in many rural, high-vulnerability counties, and residents in rural and remote regions face challenges in access to treatment for AUD.[48] Increasing access to treatment by encouraging the utilization of telehealth services could reduce alcohol-related vulnerability in rural regions.[48,63] Promoting the use of medication for AUD

treatment such as naltrexone, which can be prescribed by primary care providers, could combat barriers related to a lack of nearby physicians specializing in mental health or substance use.[48] Interventions to increase the availability and utilization of medications for AUD should also address the stigma surrounding treatment for AUD in rural areas and work to combat negative perceptions through raising awareness and facilitating discussions about mental health and substance use disorders.[48] Programs in rural areas should also utilize unique local strengths to combat alcohol-related harms, such as strong communities centered around religion.[48]

2. *Improve options for alternative transportation:* A lack of transportation options, besides driving oneself, is commonly reported as a reason for drunk driving in rural areas.[39,43] Literature shows that creating systems for alternative transportation to reduce drunk driving by building trust and working with local leaders and organizations can reduce alcohol-impaired driving.[64] Alternative transportation initiatives, which can include rideshare programs (e.g., Uber, Lyft), taxi vouchers offered at bars, or increased public transportation service hours, should be chosen according to local context and realistic options.[64]
3. *Increase screening and treatment for AUD in older populations:* AUD is commonly undetected in older populations despite their high vulnerability to alcohol-related mortality.[53] Increased screening of older adults in primary care settings using tools such as the AUD Identification Test and Screening, Brief Intervention, and Referral to Treatment is needed to reduce alcohol-related deaths.[65,66] Treatment interventions aimed at reducing AUD in older adults should account for challenges unique to this population, such as difficulties with managing technology, lack of access to adequate technology and dependable internet connections, and aversion to telehealth.[67]
4. *Target interventions to reduce alcohol-related vulnerability in American Indian and Alaska Native communities:* Disproportionate mental health and substance use-related harms among American Indian and Alaska Native communities need to be addressed in Idaho. The ongoing effects of colonialism, generational trauma, and discrimination are tied to mental health and substance issues in American Indian and Alaska Native communities[68,69]; however, programs that emphasize the strengths of local communities and promote cultural connectedness and positive mental health can help combat disproportionate substance use-related harms.[68–72] In addition, more research is needed to examine the impact of the COVID-19 pandemic on substance use in American Indian and Alaska Native communities in Idaho.

CONCLUSION

We identified Benewah, Clearwater, Custer, Lemhi, Lewis, Nez Perce, Shoshone, and Valley Counties as most vulnerable to alcohol-related morbidity and mortality. With the exception of Nez Perce, all of these counties were rural, and many lacked adequate access to treatment for AUD. In addition, we found that alcohol-related ED visits, median age, retail alcohol outlets, gallons of alcohol sold, and alcohol-related crashes were significantly associated with alcohol-related deaths at the county level in Idaho. To combat high levels of alcohol-related risks, which were exacerbated by the COVID-19 pandemic, targeted interventions that acknowledge local contexts and challenges related to rurality are needed to improve screening and access to treatment for AUD. As more evidence comes to light on the associations between alcohol use and cancer risk, these interventions are increasingly important to combat susceptibility in high vulnerability counties and among populations at disproportionate risk of alcohol-related harms. [14]

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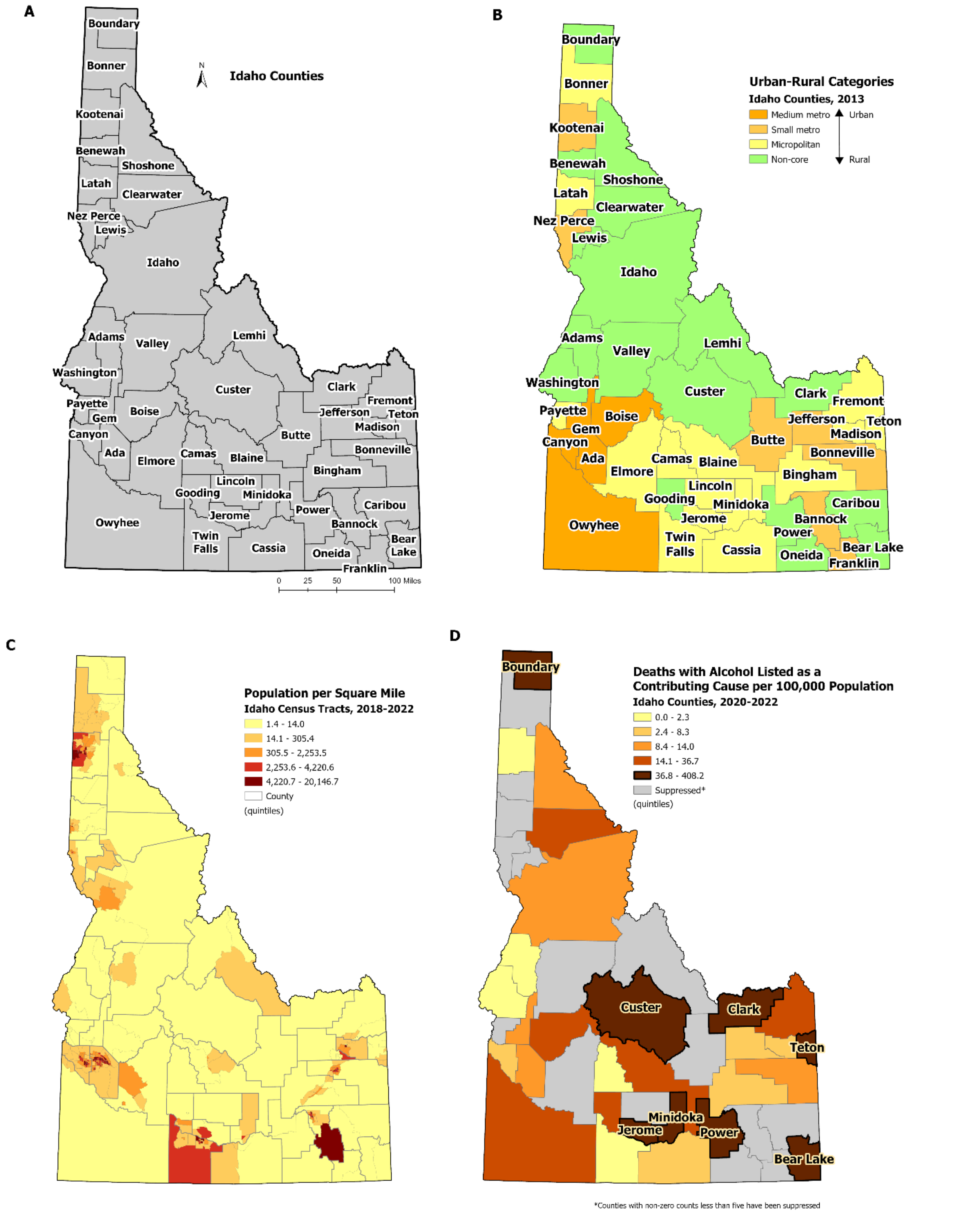
APPENDIX



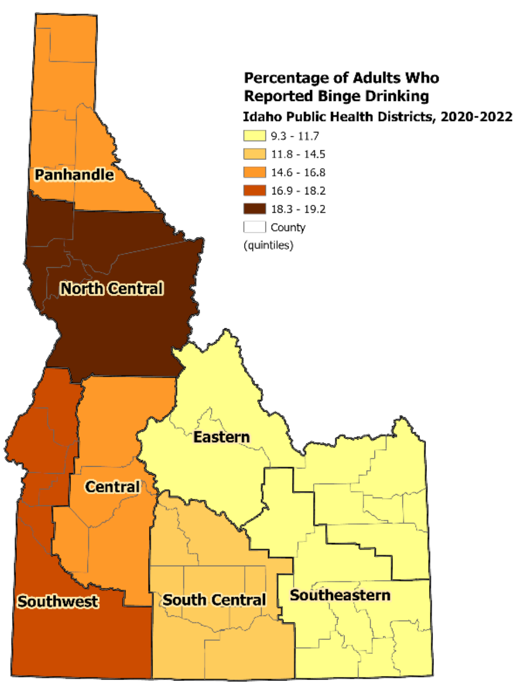
Appendix 1: Idaho County Names (A), Urban-Rural Status (B), Population Density (C), and Deaths with Alcohol Listed as a Contributing Cause (D)

A

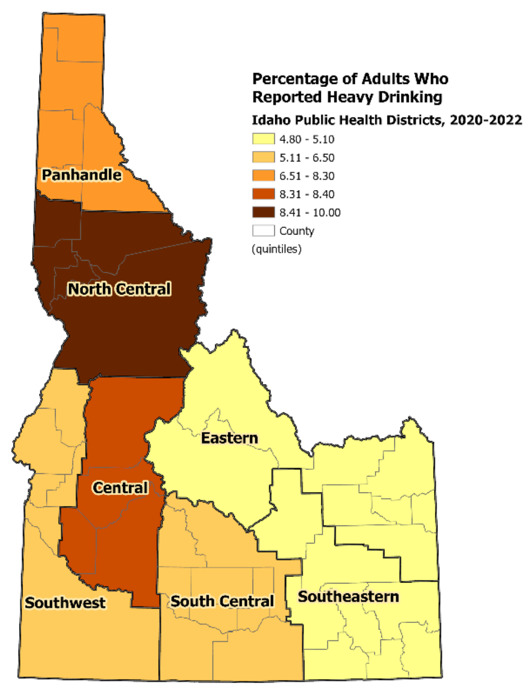
Low Vulnerability → **High Vulnerability**

Franklin	Latah	Oneida	Boundary	Clearwater
Jefferson	Teton	Bear Lake	Idaho	Lemhi
Madison	Clark	Power	Bannock	Lewis
Caribou	Adams	Fayette	Butte	Valley
Canyon	Lincoln	Fremont	Twin Falls	Custer
Camas	Owyhee	Gooding	Blaine	Benewah
Bonneville	Cassia	Washington	Boise	Nez Perce
Minidoka	Jem	Elmore	Bonner	Shoshone
Bingham	Jerome	Ada		

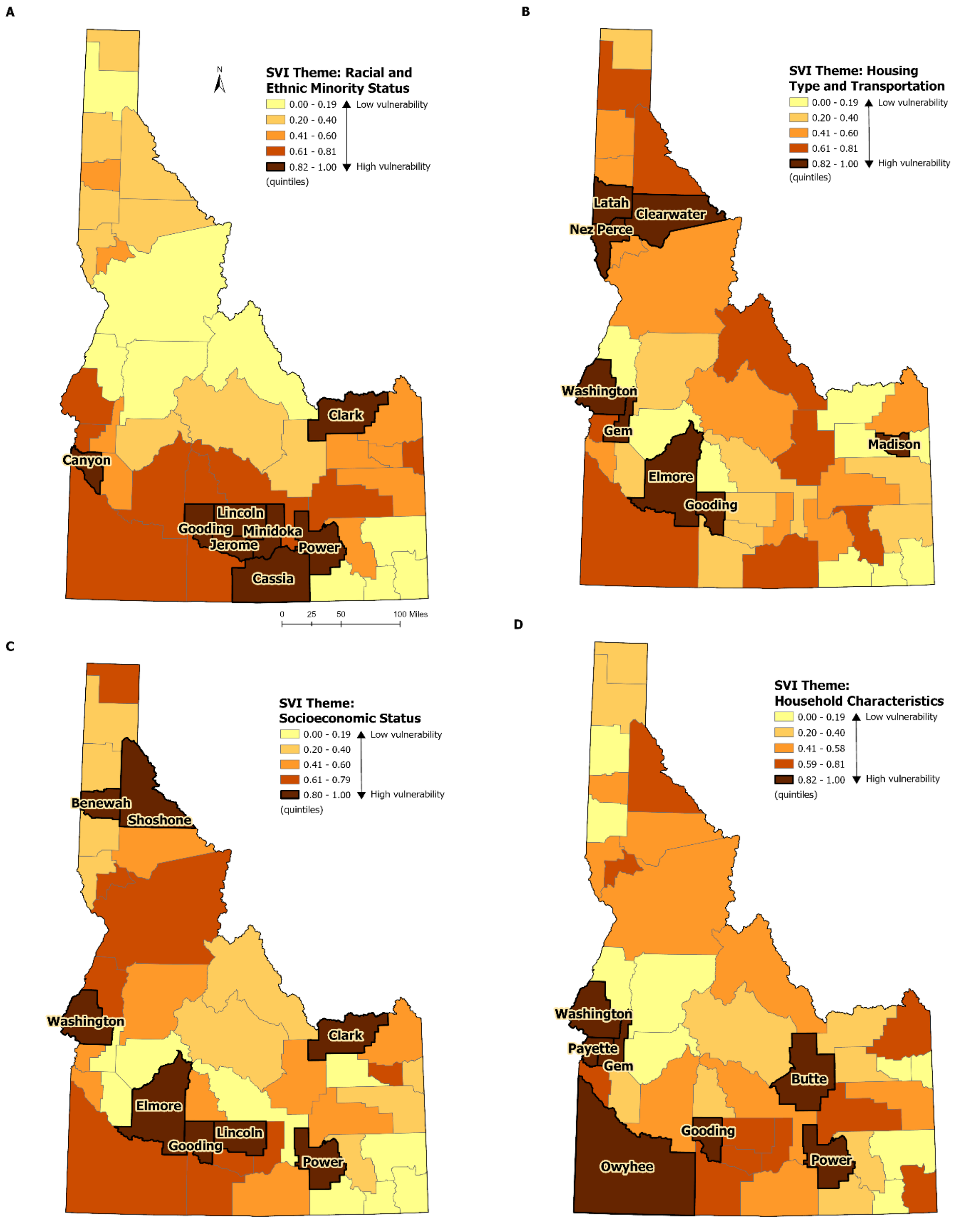
B



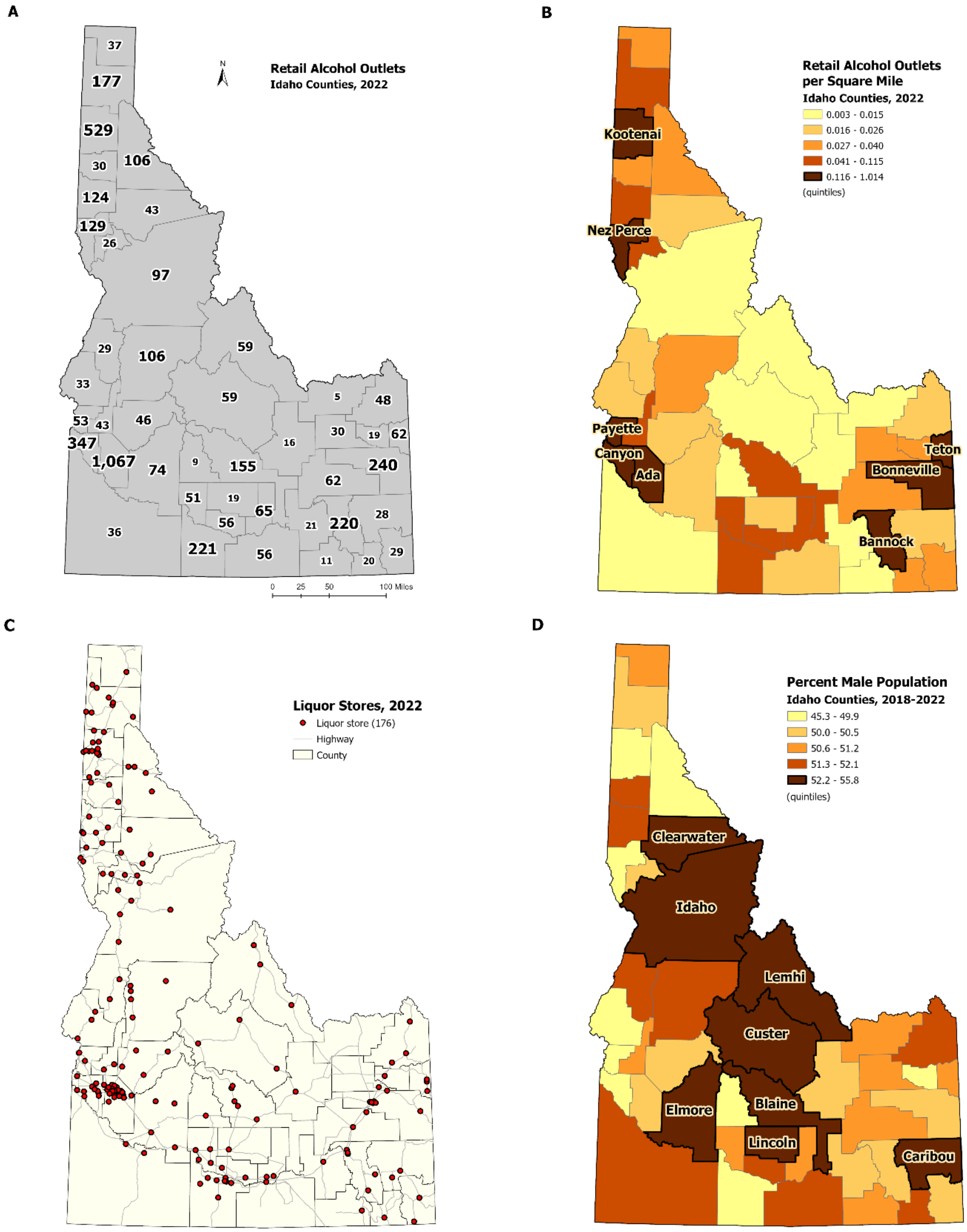
C



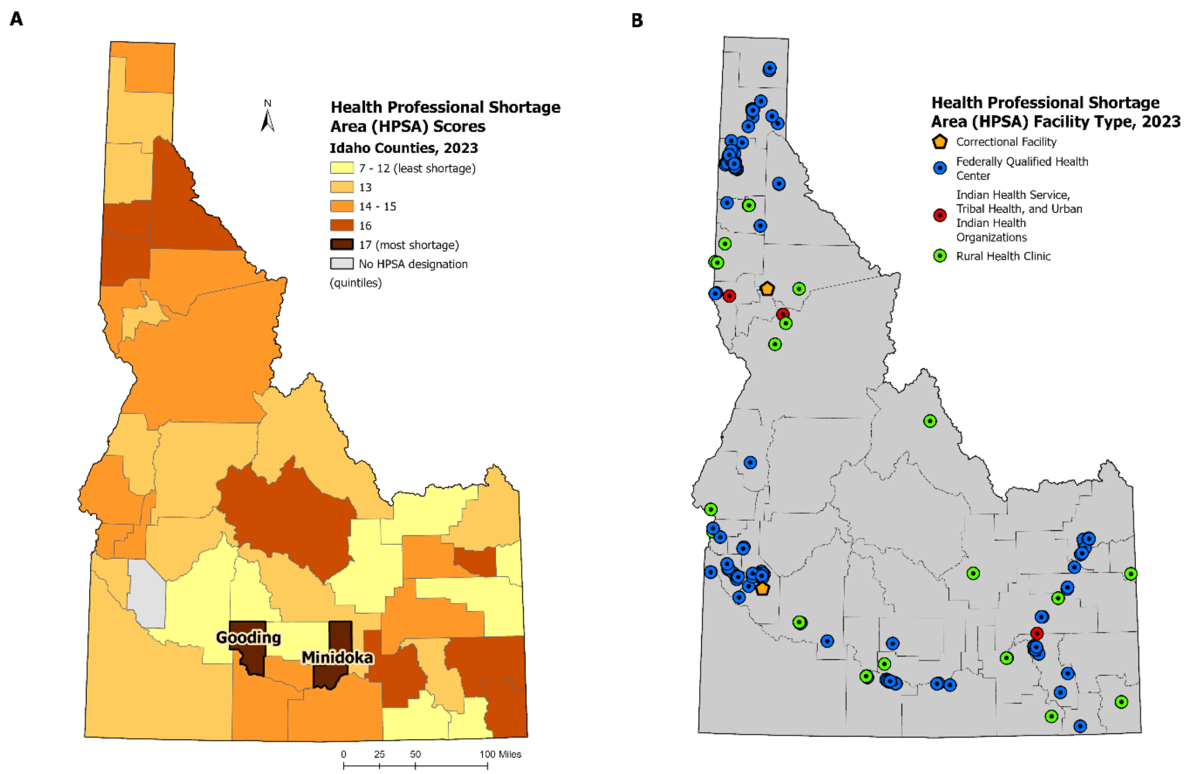
Appendix 2: Counties by Vulnerability Quintile, 2020-2022 (A), Prevalence of Binge Drinking (B) and Heavy Drinking (C)



Appendix 3: Social Vulnerability Index (SVI) Themes, Idaho Counties, 2018-2022



Appendix 4: Retail Alcohol Outlets (A), Retail Alcohol Outlets Per Square Mile (B), Liquor Stores (C), and Percent Male Population (D)



Appendix 5: HPSA Scores (A) and Facilities (B)