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Disparities in Alcohol, Drug Use, and Mental Health Condition Prevalence and Access to Care in Rural, Isolated, and Reservation Areas: Findings From the South Dakota Health Survey

Melinda M. Davis, PhD^{1,2}, Margaret Spurlock, MPH^{2,3}, Kristen Dulacki, MPH⁴, Thomas Meath, MPH³, Hsin-Fang (Grace) Li, PhD⁴, Dennis McCarty, PhD⁵, Donald Warne, MD, MPH⁶, Bill Wright, PhD⁴, K. John McConnell, PhD^{2,3,7}

¹Department of Family Medicine, Oregon Health & Science University, Portland, Oregon

²Oregon Rural Practice-based Research Network, Oregon Health & Science University, Portland, Oregon

³Center for Health Systems Effectiveness, Oregon Health & Science University, Portland, Oregon

⁴Center for Outcomes Research & Education, Providence Health & Services, Portland, Oregon

⁵Department of Public Health and Preventive Medicine, Oregon Health & Science University, Portland, Oregon

⁶Master of Public Health Program, North Dakota State University, Fargo, North Dakota

⁷Department of Emergency Medicine, Oregon Health & Science University, Portland, Oregon

Abstract

Purpose: Research on urban/rural disparities in alcohol, drug use, and mental health (ADM) conditions is inconsistent. This study describes ADM condition prevalence and access to care across diverse geographies in a predominantly rural state.

Methods: Multimodal cross-sectional survey in South Dakota from November 2013 to October 2014, with oversampling in rural areas and American Indian reservations. Measures assessed demographic characteristics, ADM condition prevalence using clinical screenings and participant self-report, perceived need for treatment, health service usage, and barriers to obtaining care. We

For further information, contact: Melinda M. Davis, PhD, Research Assistant Professor, Department of Family Medicine, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Mail Code: FM, Portland, OR 97239, davismel@ohsu.edu; Tel: 503-494-4365.

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[†]Five of the 7 participating reservation towns/tribal areas required targeted oversampling because the tribal lands/reservation only made up part of the county. Two reservations did not require oversampling because their geographic areas covered 1 or more counties in their entirety.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site.

Appendix 1. Study Instrument, The South Dakota Health Survey (SDHS).

tested for differences among urban, rural, isolated, and reservation geographic areas, controlling for participant age and gender.

Findings: We analyzed 7,675 surveys (48% response rate). Generally, ADM condition prevalence rates were not significantly different across geographies. However, respondents in isolated and reservation areas were significantly less likely to have access to primary care. Knowledge of treatment options was significantly lower in isolated regions and individuals in reservation areas had significantly lower odds of reporting receipt of all needed care. Across the sample there was substantial discordance between ADM clinical screenings and participant self-reported need; 98.1% of respondents who screened positive for alcohol or drug misuse and 63.8% of respondents who screened positive for a mental health condition did not perceive a need for care.

Conclusion: In a predominantly rural state, geographic disparities in ADM conditions are related to differences in access as opposed to prevalence, particularly for individuals in isolated and reservation areas. Educational interventions about ADM condition characteristics may be as important as improving access to care.

Keywords

health disparities; health services research; mental health; rural health; substance use

Rural populations in the United States experience significant health disparities, routinely ranking poorly on mortality, morbidity, and quality of care measures.^{1–5} Urban-rural differences have been documented for a variety of health indicators, including obesity,^{6,7} suicide,⁷ heart disease,⁶ general chronic disease,⁷ cancer mortality,⁸ cancer diagnosis and treatment,⁹ diabetes,^{6,10} renal disease,¹¹ and injury and trauma.¹² In one study, death rates in rural counties were 40% higher than rates in counties on the fringe of urban centers.¹³ However, the evidence for rural-urban disparities in the prevalence and treatment of alcohol, drug use, and mental health (ADM) conditions—and for variation across different *kinds* of rural areas—is less clear.

Annually, one-fourth of adults (26%) meet diagnostic criteria for a mental health disorder and almost half (46%) will develop one in their lifetime.¹⁴ Lifetime and 12-month prevalence rates for alcohol use disorders are 30.3% and 8.5%, respectively,¹⁵ and they are 10.3% and 2.0% for drug use disorders.¹⁶ Although use of ADM services in the United States has increased in recent decades, the majority of individuals with a mental health condition do not receive any treatment,¹⁷ and only one-third of those in treatment receive minimally adequate care.¹⁸ Treatment gaps for patients with a DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th edition) substance use disorder may be even greater; national studies indicate that the 12-month treatment rates were 6.1% for drug abuse¹⁶ and 3.1% for alcohol abuse.¹⁶ There is strong evidence that prevalence of ADM conditions varies with sociodemographic characteristics such as age, sex, race/ethnicity, and household income.^{15,16,19–21} Although urban versus rural residence is commonly cited as a risk factor for the development of ADM conditions, the evidence regarding the directionality of such associations is inconsistent or nonexistent.^{15,16,22–24}

Detailed data on geographic variation in ADM condition prevalence and treatment patterns have the potential to play a critical role in how we prioritize and implement interventions to improve health care delivery. Current health care transformation efforts, through implementation of Patient Centered Medical Home (PCMH) Principles, the Affordable Care Act (ACA), and the Mental Health Parity and Addiction Equity Act (MHPAEA), are poised to dramatically change the landscape of ADM service provision.^{25–29} PCMH Principles emphasize the importance of providing patient-centered, coordinated, whole person care with attention to ADM conditions.^{29–31} The ACA expands coverage and requires mental health and addiction services to be part of the “essential health benefits” for plans offered under the ACA. The MHPAEA requires plans that offer ADM services to provide benefits at the same level as those provided for medical-surgical services. Together, the PCMH, ACA, and MHPAEA create the potential for millions of Americans to obtain access to a comprehensive set of ADM benefits. This impact may be amplified for rural populations based on patterns of Medicaid coverage expansion^{32–34} and rural health care provision.^{35,36}

Data on ADM conditions can be used to inform policies, resource allocation, and intervention selection. This data may be particularly important in rural settings given research demonstrating that rural populations are generally disadvantaged compared to their urban counterparts in the central tenants of access to care: availability, accessibility, affordability, and acceptability.^{37–43} However, comparative studies on the prevalence and treatment of ADM conditions in rural settings are often limited by small sample sizes that may hinder or complicate systematic inferences. Research further suggests that rural adults may be less likely to be diagnosed or treated for ADM conditions.^{37,44–46} There may also be variation in these conditions by region (eg, opioid use in Appalachian states, methamphetamines in Western and Midwestern states)^{47–50} and/or across different *kinds* of rural areas—which can include remote or isolated regions that are especially far from urban centers^{51,52} and American Indian reservations.

Therefore, we conducted a statewide health needs survey in South Dakota and oversampled rural, isolated, and reservation communities to assess disparities in ADM condition prevalence, perceived need, and access to care across diverse types of rural areas. The data support an extensive assessment of ADM conditions and treatment across an expanded set of urban/rural geographic categories, with a focus on a predominantly rural state.

Methods

We conducted a cross-sectional statewide health needs assessment from November 2013 to October 2014, using a combination of mail, telephone, and in-person surveys administered to a geographically representative random sample of noninstitutionalized adults across the state of South Dakota. South Dakota, a predominantly rural state, has a total population of 853,175 according to 2014 US Census estimates;⁵³ 14.8% of the population is over 65 years of age and 10.5% report American Indian race/ethnicity.⁵⁴

Our study team engaged regional and tribal service providers in the design and content of survey questions. To facilitate data collection within the American Indian population, team members gained formal approvals from 7 of the 9 tribes in South Dakota prior to data

collection; data were not collected in counties that fall within the boundaries of the 2 nonparticipating tribes. We also hired and trained local community members as research assistants to support in-person data collection within reservation communities. Finally, study findings were shared in regional meetings across South Dakota and with the leadership of each participating tribe. This study was approved by the Institutional Review Board at Oregon Health & Science University; the National Institute of Mental Health under the authority of the United States Department of Health and Human Services issued a Certificate of Confidentiality to protect the privacy of research participants.

Eligibility Criteria

Minimal participation eligibility criteria were: (1) age 18 years or older; (2) a primary owner/occupant of the household; and (3) presence of ZIP code/sample strata in study data.

Sampling

We used address-based sampling to produce county-level and statewide estimates while ensuring sufficient representation within rural and American Indian reservation subpopulations. Each of South Dakota's 66 counties was considered the primary sampling unit. We set minimum sampling targets around several populations of interest, including the state's 2 metropolitan areas (minimum sample size of 1,000 each), regional population centers with at least 10,000 residents (minimum sample size of 200 each), and American Indian reservations (minimum sampling size of 200 each).

As displayed in Figure 1 and summarized below we identified the sample in 3 steps: (1) standard counties; (2) counties with oversamples (ie, some reservation/tribal areas, urban centers); and (3) statewide random sample. First, for standard counties (ie, those without an embedded oversample) we started with a list of all valid, noninstitutional USPS residential mailing addresses and pulled 200 randomly sampled households. Second, for counties with an embedded oversample (reservation/tribal areas), we split the "host" county into 2 mutually exclusive sampling units based on a review of regional ZIP codes: 1 for the town/tribal area itself, and 1 for all households in the county outside of the town/tribal area/ We sampled up to the goal of 200 households in the town/tribal area cell and then sampled at least 100 additional households from outside the town/tribal area. This created an effective minimum sample size of 300 in counties where the targeted town/tribal oversamples reside while ensuring that we achieved our targets in both the county and town/tribal sampling units. In addition, for the state's 2 metropolitan statistical areas (ie, Minnehaha and Pennington counties), which are key access points for specialty care in the state, we included an additional random sample of 1,000 households. Our third step, after filling these county and regional minimums, was to fill the rest of our sampling quota with a simple random sample of households across the state. This approach yielded a representative, stratified random sample of 17,341 South Dakota households. This sampling frame included 2,874 households in reservation towns/tribal areas (16% of the total sample compared with 9% of the actual state population) and over 9,000 households located outside of towns with 10,000 or more residents.

Data Collection

We used a multimode fielding protocol including mail, telephone, and in-person data collection to maximize response rates and facilitate data collection in hard-to-reach populations. A prescreening postcard was sent to inform respondents that the survey was coming and test for valid addresses. A multiwave mailing protocol followed, with 2 survey attempts that provided both prepaid mail and web-based response options. Automated reminder calls were used to prompt participation. Nonresponders to the mail survey were advanced into a telephone completion arm, with multiple calls to each household occurring over a several-week period.

Nonresponders in reservation areas were advanced to a special “face-to-face” completion arm based on an expectation that these communities might be less responsive to mail and phone surveys. This approach was designed to be compatible with the mail surveys; local research assistants approached residents at their homes, invited them to fill out a paper survey in private, and instructed them to return the completed survey to the research assistant in a sealed envelope.

Respondents were paid a modest cash stipend for their time; a \$5 bill was included in the original mailed survey and those completing the survey in person received \$20 in cash. We removed 1,340 invalid addresses from our initial sample of 17,341, resulting in a final sample of 16,001 households.

Measures

Our survey consisted of 79 questions that collected data on participant demographics, prevalence of physical and ADM conditions, perceived need, access, and barriers to care. We used previously validated questions and response scales when available. The survey instrument was refined using stakeholder feedback and cognitive testing with 7 participants with demographic characteristics similar to the sampling target. The full survey instrument is available in Appendix 1 (online only).

Demographics—We asked standard questions to determine participants’ self-reported age in years, gender, educational attainment (less than high school, high school diploma or GED, vocational training or 2-year degree, 4-year college degree, advanced or graduate degree), living arrangement (alone, with other relatives including children, with spouse or partner, with parents, with friends or roommates), health insurance coverage (no insurance, private coverage through employer, private coverage through myself, Medicare, Medicaid, Military health care, Indian Health Service, other), and employment status (employed by someone else, self-employed, not currently employed, retired).

Geographic Area—We categorized household locations into 4 mutually exclusive geographic clusters: urban, rural, isolated, and reservation. We used the ZIP code version of the Rural-Urban Commuting Areas (RUCAs) taxonomy to cluster respondents into 3 classifications based on population density, urbanization, and daily commuting patterns: urban (50,000 or more), rural (2,500–49,999), and isolated areas (<2,500).^{51,52} We combined small (2,500–9,999) and large (10,000–49,999) micropolitan areas into one

“rural” category because our initial analysis showed response similarities and a limited number of responses from small micropolitan areas. We created a fourth distinct “reservation” category for ZIP codes fully or partially overlapping with American Indian tribal land. Additional details on this classification scheme appear in Figure 2.

Prevalence of ADM Conditions—We assessed prevalence of depression with the 2-question version of the Patient Health Questionnaire (PHQ-2),^{55,56} anxiety with the 2-item General Anxiety Disorder scale (GAD-2),^{55,57} and post-traumatic stress disorder (PTSD) with the Primary Care PTSD Screen (PC-PTSD).⁵⁸ Alcohol misuse was assessed with the 3-item Alcohol Use Disorders Identification Test (AUDIT-C). Positive AUDIT-C screens were defined as scores of 4 or more for males and 3 or more for females.^{59–61} Because a relatively large percentage (>30%) of the population typically screens positive using this scale, we also tested for less sensitive and more specific cutoffs for both genders using AUDIT-C scores greater than 6 or 9. In addition, heavy drinking was defined as drinking over weekly recommended limits or an average of 8 or more drinks per week for women or 15 or more drinks per week for men. Binge drinking was defined as drinking 5 or more drinks on any one occasion in the past year. Measures from the National Survey on Drug Use and Health (NSDUH) were used to assess use of marijuana, methamphetamines, and nonmedical prescription painkillers.⁶² In addition to these screenings, respondents were asked to self-report whether they had ever been told by a health professional that they had depression, anxiety, PTSD, bipolar disorder, addiction issues, or other mental health conditions.⁶³

Perceived Need and Access to Medical and ADM Services—We used questions modeled from the Consumer Assessment of Healthcare Providers and Systems (CAHPS) to assess perceived need for and access to general medical care, prescription medications, mental health services, and alcohol or drug treatment.⁶⁴ All respondents were asked these initial questions. For example, perceived need for medical care was assessed with the following yes/no survey question: “Was there a time in the last 12 months when you needed medical care?” Primary care access and health care coverage measures were based on the Behavioral Risk Factor Surveillance System questionnaire (BRFSS).⁶³ We also assessed self-reported emergency department or inpatient hospitalization for mental health or substance use problems in the last 12 months using questions modeled after examples from CAHPS and the National Health and Nutrition Examination Survey (NHANES).^{65,66} Only participants who reported a need for medical, mental, and/or alcohol and drug treatment were asked to respond to a series of follow-up questions regarding the level of care received in the last 12 months using 4 response options: “I got all the [type of] care needed,” “I got some but not all needed [type of] care,” “I got no [type of] care at all,” and “I don’t know.”

Barriers to Care—Respondents who indicated they went without needed care were asked to identify the main reasons by selecting from a list of common barriers from the published literature including variables assessing the 4 dimensions of access identified by Penchansky and Thomas: availability (eg, didn’t know where to go, couldn’t get an appointment), accessibility (eg, I didn’t have transportation), affordability (eg, no health insurance, insurance wouldn’t cover), and acceptability (eg, could handle it without treatment, was

worried about what people would think).⁴³ The list of barriers was developed through an initial review of the literature and refined in a series of studies by members of our team over the last 10 years.^{67,68}

Specific questions assessed knowledge of treatment locations and distance to care for ADM conditions. Questions probing perceived stigma associated with receiving treatment for mental illness, drug use, and alcohol use were based on the Perceived Discrimination Devaluation Scale and the Stigma Concerns about Mental Health Care questionnaire.⁶⁹ To assess perceived discrimination respondents were asked: “How much do you agree or disagree with the following statements? I think most people around here would think badly of someone who ... has been treated for [a mental illness, drug abuse, alcohol abuse].” Perceived stigma was assessed using the following yes/no question: “Would you avoid getting help for any of the following because you are afraid of what others might think?” with prompts for mental illness, drug abuse, and alcohol abuse.

Data Analysis

We used SAS version 9.2.2.2 (SAS Institute Inc., Cary, North Carolina) for all statistical analyses, using survey specific functions in SAS to correct for finite survey population and correlations among survey strata. Responses were weighted to account for oversampling and to accurately represent the state’s true population distribution. First, we weighted each response by the inverse of the probability of selection of the address and a nonresponse adjustment for each sampling unit. We then applied a post-stratification weight adjustment to account for age group differences between our respondents and 2010 census data, because our respondents tended to be older than the actual South Dakota population, potentially impacting prevalence estimates in the absence of these adjustments.

The primary outcomes for this analysis focused on the findings from common clinical ADM screens (eg, depression, anxiety, PTSD, alcohol misuse, drug use), self-reported diagnosis of medical and ADM conditions, perceived need for ADM treatment, access to primary care and ADM treatment services, and reported barriers to care. To test for differences by geography, we used weighted logistic regression with strata clustered errors and a finite population correction to calculate adjusted odds ratios and 95% confidence intervals for each outcome after controlling for age and sex. In accordance with the Institute of Medicine’s definition of disparities (ie, a difference not justified by differences in health status or preferences),^{70,71} we did not include indicators of socioeconomic status (eg, race/ethnicity, education, income) in our analyses. While these indicators are likely to be correlated with both rurality and ADM conditions, the IOM definition includes these factors as components of the disparity, and not as factors that should be conditioned on or adjusted for in estimating the extent of the disparity. Sensitivity analyses that included race/ethnicity, income, employment status, and education were qualitatively similar to our main analyses, which restrict statistical adjustment to variables recommended by the IOM.

Results

We obtained a 48% response rate ($n = 7,675$); 86% of the returned surveys were completed by mail, 4% by phone, 4% online, and 6% in-person. After adjusting for the sampling

weights, respondents represented urban (44.4%), large/small rural (33.3%), isolated (17.6%), and reservation (4.7%) areas, proportions comparable to South Dakota's overall population distribution. As summarized in Table 1, compared to census data on the overall South Dakota population, respondents tended to be female (57% vs. 50% statewide) and white (89% vs. 83% statewide). Respondents were also less likely to have been unemployed (9.6% vs. 15.3%) or to have not completed high school (3.9% vs. 13.4%). American Indian respondents made up 9.3% of the total sample and completed 64.4% of the surveys from reservation areas.

Prevalence of ADM Conditions

Table 2 displays prevalence for ADM conditions across the 4 rural-urban classifications. We display the prevalence as identified by validated screening mechanisms (eg, PHQ-2) as well as self-reported diagnosis measures. There were no significant differences between individuals in urban and rural, isolated, and reservation areas in terms of the prevalence rates for mental health conditions based on clinical screenings. Based on self-reported diagnoses, respondents in rural areas had significantly lower odds of reporting PTSD, bipolar disorder, and other mental health conditions. Respondents in isolated areas had lower self-reported diagnoses of anxiety (OR 0.61, 95% CI: 0.44-0.84) when compared to their urban counterparts.

Relative to mental health conditions, rural-urban differences in substance use patterns were slightly more common. In analyses of the AUDIT-C screen for alcohol abuse, only respondents in isolated areas had significantly lower odds of screening positive than respondents in urban areas (OR 0.80, 95% CI: 0.65-0.98). However, analyses that used a higher threshold of 9 or more on the AUDIT-C to indicate alcohol abuse found significantly higher odds for all 3 rural categories when compared to urban respondents: rural OR 2.84, 95% CI: 1.50-5.39; isolated OR 2.13, 95% CI: 1.17-3.89; reservation OR 2.28, 95% CI: 1.20-4.33. Compared to urban respondents, respondents from reservation areas also had significantly higher odds of marijuana (OR 2.81, 95% CI: 1.66-4.74) and methamphetamine use (reservation OR 7.33, 95% CI: 1.89-28.41), although the absolute level of methamphetamine use was only 1.7% in reservation areas.

Perceived Need and Health Service Use

Table 3 displays perceived need for health care in the last year. Statewide, 75.1% of respondents perceived a need for medical care within the past year, 9.7% perceived a need for mental health care, and 1.6% perceived a need for substance use treatment. Although prevalence of ADM conditions was similar across geographies, respondents in rural or isolated areas were significantly less likely to report needing care. For example, respondents in isolated areas were significantly less likely to report needing medical (OR 0.64, 95% CI: 0.51-0.80) or substance use treatment (OR 0.41, 95% CI: 0.18-0.92), and respondents in rural areas were less likely to report perceived need for mental health care (OR 0.65, 95% CI: 0.43-0.99).

We found significant disparities across the 4 rural/urban geographies when assessing receipt of care for those who perceived a need. Compared to urban respondents, respondents in

reservation areas were significantly less likely to receive all needed medical (OR 0.27, 95% CI: 0.18–0.39) or mental health care (OR 0.32, 95% CI: 0.13–0.80). Respondents in isolated and reservation areas were less likely to have a primary care provider (isolated OR 0.67, 95% CI: 0.52–0.87; reservation OR 0.23, 95% CI: 0.17–0.31). Residents in isolated areas were also less likely to know where to go for mental health care (OR 0.67, 95% CI: 0.55–0.82) and substance use treatment (OR 0.67, 95% CI: 0.55–0.81).

Despite low perceived need for ADM condition treatment, emergency department (ED) and inpatient admissions were high across the study population (Table 3). Statewide, 11.2% of respondents reported 1 or more visits to the ED and 5.7% reported 1 or more inpatient visits for a mental health problem over the past year. Respondents in reservation areas were twice as likely to report 1 or more visits to the ED for mental health as compared to those from urban areas (OR 2.04, 95% CI: 1.40–2.97). In contrast, respondents in rural and isolated areas had significantly lower odds of reporting 1 or more visit in the past year to the ED for substance use.

Barriers to Care

Table 4 displays barriers to care and perceived stigma for ADM treatment. Although prevalence of ADM conditions was generally similar across geographies, respondents in rural and isolated areas had significantly higher odds of going without needed mental health care due to reasons associated with cost (rural OR 2.52, 95% CI: 1.06–6.00; isolated OR 2.65, 95% CI: 1.03–6.84). Respondents in reservation areas were significantly more likely than urban participants to report problems with the availability of mental health treatment or logistical issues in obtaining care (availability OR 14.9, 95% CI: 2.94–75.62; logistics OR 3.51, 95% CI: 1.08–11.39).

In addition to low self-reported need for mental health or substance use treatment (Table 3), we observed substantial discordance between positive screening results and self-reported need for ADM treatment across the state. Almost all respondents (98.1%) who screened positive for substance use did not perceive a need for care (95% CI: 96.75–98.99) and 63.8% of respondents who screened positive for a mental health condition did not perceive a need for care (95% CI: 56.02–71.49).

Discussion

This study suggests that relatively similar prevalence rates for ADM conditions exist across urban, small/large rural, isolated, and reservation geographic regions in South Dakota. Our findings add to a growing body of literature exploring rural/urban disparities in ADM condition prevalence. However, findings from epidemiologic research and community-based studies are inconsistent, suggesting that prevalence of ADM conditions may not vary between rural and urban areas.^{22,23,48} Some of this uncertainty may be driven by different ways of analyzing rural/urban differences—through bivariate comparisons versus more nuanced geographic levels—and in how ADM conditions are measured. For example, a 2010 meta-analysis of 20 “higher quality” population surveys in developed countries found that the pooled urban prevalence rate for various mental health conditions (eg, any psychiatric disorder, mood disorders, or anxiety disorders) was higher than that in rural

telehealth for ADM services, which may overcome barriers related to logistics, travel distance, and provider shortages.^{83–85}

However, interventions that enhance access to care without adequate attention to the factors that shape perceptions of ADM treatment need may be ineffective. Our team conducted a qualitative follow-up study of survey participants to explore the discordance we detected between positive clinical screens and an individual's perceived need for care. We conducted key informant interviews with 33 rural and American Indian respondents who recommended that in addition to improving access to and quality of ADM treatment, community-level interventions were needed to (a) educate the population about the conditions and opportunities for recovery; (b) reduce the stigma associated with pursuing care; and (c) create social structures that facilitate prevention and early detection.⁸⁶ Community-level education and outreach interventions have the potential to complement large-scale national changes such as implementation of the ACA and MHPAEA which are designed to improve access to care for individuals with ADM disorders.

Limitations

Our study has a few important limitations. First, we relied on self-report data, which are subject to recall bias and may result in under reporting of ADM condition prevalence. Second, using multiple fielding procedures we obtained a 48% response rate. Population survey response rates are typically between 40% and 80% and are generally considered acceptable within this range.^{87–89} However, our survey sample differed slightly from the overall population in South Dakota, with respondents more likely to be older and female. Individuals with significant ADM conditions may have been unwilling or unable to respond to the survey; using an address-based sampling method also precluded the engagement of homeless populations who may be at higher risk for these conditions.^{90,91} Third, our cross-sectional data captured a moment-in-time snapshot, limiting our ability to detect temporal relationships. Mental health and substance use are not static constructs and our study does not follow the longer-term consequences of ADM conditions and poor access to services.

Conclusion

The South Dakota Health Survey represents the largest survey of its kind conducted within a state with a predominantly rural population; extensive oversampling and outreach provided sufficient granularity to assess differences in ADM conditions across urban, rural, isolated, and reservation areas. Our results suggest relatively similar prevalence rates for ADM conditions across the 4 geographic areas. However, we found significant geographic differences in access to care as well as discordance between findings on ADM clinical screenings and a participant's perceived need across the full sample. Detailed data on ADM conditions offer critical insights for improving health service delivery, particularly in rural areas where this information is often not available. Although current health transformation efforts such as the PCMH, ACA, and MHPAEA have the potential to rapidly transform access and coverage for ADM conditions, these policy changes may be inadequate to improve ADM outcomes if we do not concurrently implement interventions to raise awareness of treatment need. Our study provides a careful assessment of ADM needs in

South Dakota, highlighting the need for improved access to care in rural, isolated and reservation areas as well as locally relevant, targeted education around ADM conditions and treatment.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 2

Detailed Description of Geographic Clustering Procedure for South Dakota Health Survey.

We clustered responses in 4 distinct geographic clusters to analyze differences: urban, rural, isolated, and reservation areas. We used a 3-category rural/urban classification based on the ZIP code version of the Rural-Urban Commuting Areas (RUCAs) taxonomy to capture variation in the type of rurality based on population size and commuting patterns.^{51,52} Small (2,500–9,999) and large (10,000–49,999) micropolitan areas were combined into one “rural” category due to response similarities and limited number of small micropolitan areas. Isolated regions were kept distinct. A fourth “reservation” category was created for ZIP codes fully or partially overlapping with AI tribal land. The RUCA codes for these 4 designations follow:

1. **Urban:** Metropolitan cores and commuting patterns to areas with populations of 50,000 or more [RUCA: 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1]
2. **Rural:** Micropolitan areas and commuting patterns to or within population centers of 2,500–49,000 and not overlapping with AI tribal land. Includes both small and large micropolitan area RUCA codes. [RUCA: 4.0, 4.2, 5.0, 5.2, 6.0, 6.1, 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2]
3. **Isolated:** Commuting flow to areas without population centers of 2,500 or more, no commuting flow to urban areas, and no overlap with AI tribal land. [RUCA: 10.0, 10.2, 10.3, 10.4, 10.5, 10.6]
4. **Reservation:** ZIP code fully or partially overlapping with tribal land of an AI tribe. Includes ZIP codes that would otherwise be categorized as rural or isolated.

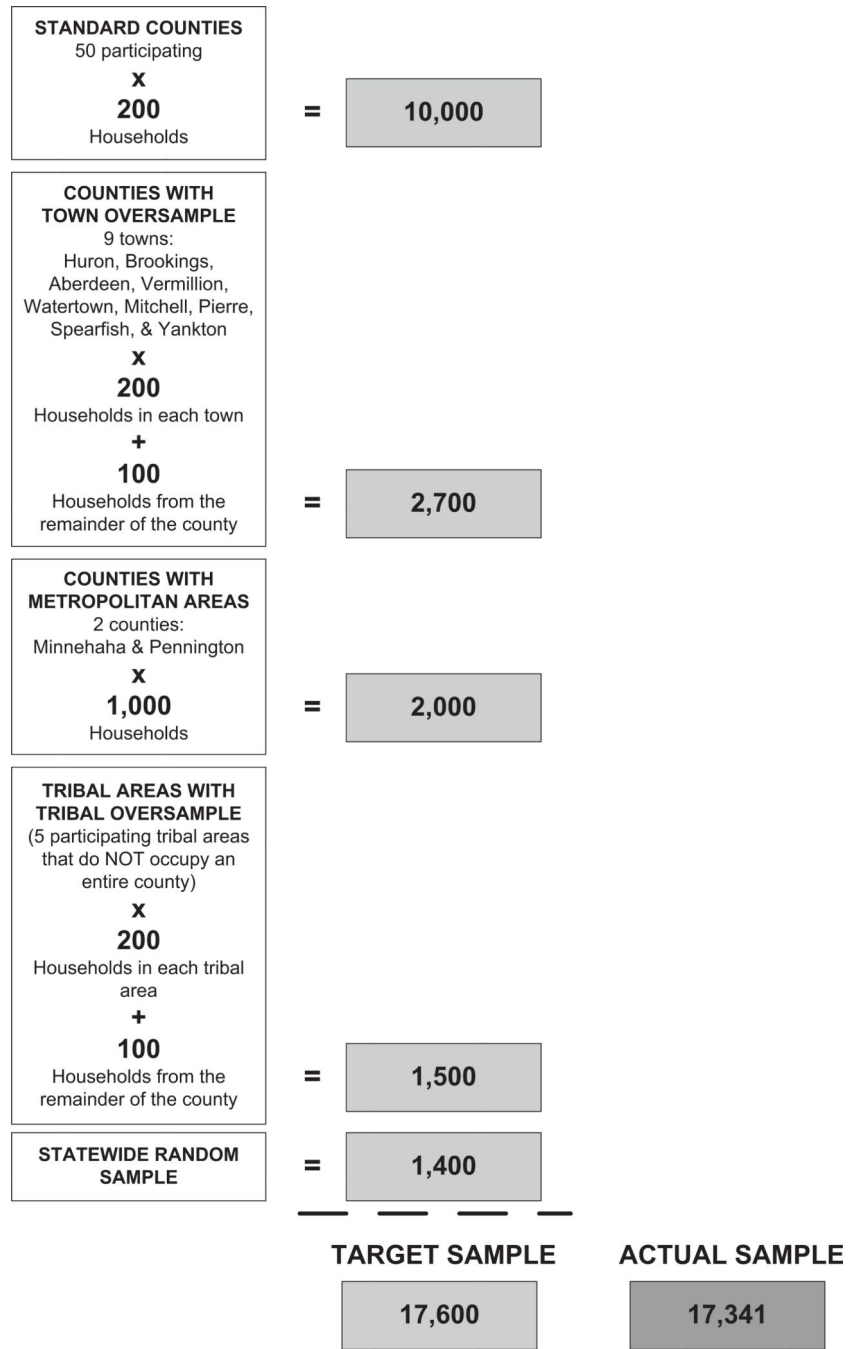


Figure 1. Three-Step Case Selection Approach: Standard Counties, Counties With Oversamples (ie, Reservation Town/Tribal Area, Urban Areas),Statewide Random Sample.

Table 1

South Dakota Health Survey (SDHS) Respondent Characteristics (n = 7,675)

Characteristic	Unweighted SDHS	Weighted SDHS	SD Population ^a	US Population ^a
<i>Age</i>				
18–34	7.6%	30.3%	30.8%	30.6%
35–64	56.0%	50.6%	49.6%	50.9%
65 and older	36.5%	19.1%	19.6%	18.5%
<i>Gender</i>				
Male	47.7%	42.6%	49.8%	48.6%
Female	52.3%	57.4%	50.2%	51.4%
<i>Race/ethnicity</i>				
Hispanic or Latino	1.1%	1.0%	3.2%	17.1%
Non-Hispanic White	91.2%	88.7%	83.4%	62.4%
Non-Hispanic Black	0.1%	0.2%	1.5%	12.3%
American Indian (AI)	6.8%	9.3%	10.5%	1.7%
Other	0.9%	0.8%	2.5%	11.6%
<i>Residential status</i>				
Live alone	24.3%	21.6%	29.2%	27.7%
Live with spouse	64.1%	64.0%	50.3%	48.0%
Other	11.6%	14.4%	14.2%	17.9%
<i>Employment status</i>				
Not employed	6.6%	9.6%	15.3%	25.3%
Employed part time	18.4%	18.9%	19.4%	17.9%
Employed full time	46.3%	54.1%	65.3%	56.8%
Retired	28.7%	17.4%	N/A	N/A
<i>Rural/urban status^b</i>				
Urban (50,000+)	17.5%	44.4%	39.1%	80.8%
Large Rural (10,000–49,999)	19.5%	26.3%	25.2%	9.7%
Small Rural (2,500–9,999)	6.4%	7.0%	9.0%	5.4%
Isolated (<2,500)	41.7%	17.6%	26.6%	4.1%
Reservation (AI tribal lands)	14.9%	4.7%	N/A	N/A

Characteristic	Unweighted SDHS	Weighted SDHS	SD Population ^a	US Population ^a
Education				
Less than high school	6.2%	3.9%	13.4%	8.4%
High school diploma or GED	40.6%	33.1%	31.3%	27.8%
Vocational or 2-yr. degree	23.9%	23.9%	11.4%	8.1%
4-Year college degree	19.6%	25.4%	18.9%	18.4%
Advanced or graduate degree	9.7%	13.8%	7.6%	11.2%

^aFrom United States Census Bureau. 2013 American Community Survey.⁵⁴

^bRural/urban status determined using the University of Washington Rural Urban Community Area (RUCA) codes. Reservation areas were identified based on ZIP codes fully or partially overlapping with American Indian tribal land. We combined small (2,500–9,999) and large (10,000–49,999) micropolitan areas into one “rural” category due to response similarities and limited number of participants in small micropolitan areas.

Table 2

Adjusted Odds Ratios and Prevalence of Alcohol, Drug Use, and Mental Health Conditions by Geographic Category (Urban = Reference, 95% CI), Controlling for Age and Gender

	Total Sample (N = 7675)	Prevalence by Geographic Category				Adjusted Odds Ratios (Urban = Reference)		
		Urban (N = 1346)	Rural (N = 1989)	Isolated (N = 3198)	Reservation (N = 1142)	Rural AOR (95% CI)	Isolated AOR (95% CI)	Reservation AOR (95% CI)
Mental health screening								
Depression (PHQ-2)	5.55%	6.30%	4.30%	5.50%	8.20%	0.67 (0.42–1.07)	0.86 (0.55–1.34)	1.36 (0.83–2.21)
Anxiety (GAD-2)	7.51%	7.80%	7.70%	5.60%	10.30%	0.99 (0.61–1.60)	0.76 (0.47–1.23)	1.31 (0.82–2.10)
Posttraumatic stress disorder (PC-PTSD)	5.98%	6.40%	4.80%	5.90%	10.30%	0.74 (0.45–1.22)	0.99 (0.56–1.74)	1.62 (0.98–2.68)
Alcohol abuse screening								
AUDIT-C positive	42.39%	42.80%	45.50%	35.80%	40.60%	1.13 (0.89–1.42)	0.80 (0.65–0.98)*	0.91 (0.68–1.20)
AUDIT-C breakpoints								
AUDIT 6+	11.49%	11.40%	11.60%	9.80%	17.60%	1.06 (0.71–1.57)	0.90 (0.63–1.28)	1.82(1.07–3.08)*
AUDIT 9+	2.46%	1.40%	3.60%	2.80%	2.80%	2.84 (1.50–5.39)*	2.13 (1.17–3.89)*	2.28 (1.20–4.33)*
Heavy drinking ^a	3.92%	3.40%	5.00%	3.00%	4.10%	1.51 (0.84–2.71)	0.94 (0.57–1.57)	1.21 (0.63–2.33)
Binge drinking ^b	39.10%	38.60%	41.60%	34.90%	41.60%	1.17 (0.90–1.53)	0.96 (0.77–1.20)	1.19 (0.87–1.62)
Drug use screening								
Any drug use	8.33%	9.50%	6.20%	6.40%	21.40%	0.65 (0.36–1.17)	0.75 (0.43–1.31)	2.78 (1.70–4.52)
Marijuana	6.73%	8.00%	4.50%	5.00%	18.70%	0.54 (0.28–1.04)	0.72 (0.39–1.33)	2.81 (1.66–4.74)
Methamphetamine	0.37%	0.20%	0.30%	0.60%	1.70%	1.22 (0.31–4.71)	2.69 (0.40–18.13)	7.33 (1.89–28.41)
Prescription pain killers	1.34%	1.20%	1.30%	1.40%	2.80%	1.21 (0.36–4.13)	1.33 (0.42–4.24)	2.69 (0.92–7.89)
Self-reported medical diagnosis								
Depression	17.04%	18.80%	16.00%	15.00%	15.70%	0.80 (0.58–1.11)	0.77 (0.56–1.06)	0.77 (0.54–1.10)
Anxiety	17.62%	19.60%	17.80%	12.40%	16.90%	0.86 (0.58–1.28)	0.61 (0.44–0.84)*	0.78 (0.54–1.13)
PTSD	3.40%	4.30%	1.90%	3.30%	6.40%	0.43 (0.24–0.77)*	0.81 (0.38–1.73)	1.50 (0.80–2.83)
Bipolar disorder	1.69%	2.30%	0.40%	2.10%	3.50%	0.18 (0.07–0.47)*	1.08 (0.39–2.98)	1.48 (0.55–3.98)
Another MH condition	2.52%	3.10%	1.30%	3.10%	3.30%	0.40 (0.23–0.71)*	1.03 (0.44–2.41)	1.02 (0.49–2.13)
Addiction issues	2.61%	2.30%	2.80%	2.70%	3.30%	1.20 (0.59–2.44)	1.27 (0.52–3.09)	1.43 (0.64–3.20)

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* Indicates significant difference ($P < .05$) as compared to urban respondents.

^a Heavy drinking is defined as drinking over weekly recommended limits or an average of 8 or more drinks per week for women or 15 or more drinks per week for men.

^b Binge drinking is defined as drinking 5 or more drinks on any one occasion in the past year.

Table 3

Perceived Need for Medical, Alcohol, Drug Use, and Mental Health Treatment and Receipt of Care by Geographic Category (Urban = Reference, 95% CI), Controlling for Age and Gender

	Total Sample (N = 7675)	Distribution by Geographic Category				Adjusted Odds Ratios (Urban = Reference)		
		Urban (N = 1346)	Rural (N = 1989)	Isolated (N = 3198)	Reservation (N = 1142)	Rural AOR (95% CI)	Isolated AOR (95% CI)	Reservation AOR (95% CI)
Perceived treatment need								
Medical	75.11%	77.10%	76.30%	68.60%	72.50%	0.91 (0.70–1.18)	0.64 (0.51–0.80)*	0.76 (0.56–1.04)
Mental Health	9.73%	11.50%	8.00%	8.40%	10.20%	0.65 (0.43–0.99)*	0.74 (0.50–1.09)	0.83 (0.54–1.28)
Substance Use	1.57%	1.80%	1.50%	0.70%	3.00%	0.85 (0.32–2.26)	0.41 (0.18–0.92)*	1.71 (0.65–4.47)
Have PCP	77.42%	78.60%	81.60%	74.20%	48.30%	1.22 (0.88–1.70)	0.67 (0.52–0.87)*	0.23 (0.17–0.31)*
Knowledge of treatment options								
Mental Health	61.96%	65.00%	61.40%	55.40%	61.60%	0.86 (0.68–1.10)	0.67 (0.55–0.82)*	0.87 (0.66–1.16)
Substance Use	51.93%	53.70%	53.80%	43.70%	52.90%	1.02 (0.80–1.29)	0.67 (0.55–0.81)*	0.99 (0.75–1.31)
Received all needed care ^a								
Medical	86.99%	87.80%	88.80%	86.70%	65.80%	1.13 (0.75–1.69)	0.85 (0.57–1.28)	0.27 (0.18–0.39)*
Mental health	64.18%	68.00%	62.60%	62.30%	39.10%	0.84 (0.35–2.03)	0.77 (0.29–2.03)	0.32 (0.13–0.80)*
Substance use	54.39%	56.70%	64.10%	32.70%	37.50%	3.03 (0.79–11.62)	0.50 (0.08–3.20)	0.86 (0.11–6.83)
Hospital utilization for ADM conditions (1 or more visit in past year)								
ED, mental health	11.20%	11.80%	9.40%	10.50%	21.00%	0.76(0.52–1.11)	0.90 (0.63–1.29)	2.04 (1.40–2.97)*
Inpatient, mental health	5.69%	5.80%	4.80%	5.70%	10.80%	0.76 (0.48–1.20)	0.89 (0.60–1.33)	1.99 (0.99–4.02)
ED, substance use	0.74%	1.20%	0.20%	0.10%	2.50%	0.21 (0.05–0.95)*	0.11 (0.03–0.46)*	2.19 (0.65–7.40)
Inpatient, substance use	0.44%	0.50%	0.40%	0.10%	1.20%	0.91 (0.17–4.74)	0.19 (0.04–0.90)*	2.51 (0.56–11.31)

* Indicates significant difference ($P < .05$) as compared to urban respondents.

^a Responses provided for those answering “yes” to perceived need.

Table 4

Barriers to Care and Perceived Stigma for Alcohol, Drug Use, and Mental Health Treatment by Geographic Category (Urban = Reference, 95% CI), Controlling for Age and Gender

	Total Sample (N = 7675)	Geographic Category			Adjusted Odds Ratios (Urban = Reference)			
		Urban (N = 1346)	Rural (N = 1989)	Isolated (N = 3198)	Reservation (N = 1142)	Rural AOR (95% CI)	Isolated AOR (95% CI)	Reservation AOR (95% CI)
Main reasons for going without mental health treatment ^a								
Cost	19.00%	13.50%	25.20%	24.50%	25.80%	2.52 (1.06–6.00)*	2.65 (1.03–6.84)*	2.22 (0.91–5.44)
Personal choice	12.42%	10.30%	16.00%	8.60%	25.30%	1.72 (0.74–3.99)	0.82 (0.36–1.88)	2.87 (1.00–8.27)
Availability	11.18%	9.90%	11.40%	8.70%	29.10%	1.19 (0.32–4.48)	0.91 (0.25–3.32)	3.51 (1.08–11.39)*
Stigma/fear	7.01%	5.00%	10.30%	4.50%	16.70%	2.32 (0.65–8.24)	0.85 (0.28–2.65)	3.79 (0.99–14.45)
Logistical reasons	3.81%	1.80%	2.10%	7.40%	21.20%	1.24 (0.26–6.03)	4.92 (0.87–27.92)	14.92 (2.94–75.62)*
Other reasons	4.98%	4.40%	7.20%	2.50%	6.30%	1.72 (0.39–7.53)	0.47 (0.13–1.77)	1.28 (0.33–5.01)
Distance to treatment								
Over 20 miles to mental Health care	55.54%	41.70%	56.30%	85.20%	68.10%	1.87 (1.46–2.39)*	8.40 (6.49–10.86)*	3.39 (2.38–4.84)*
Over 20 miles to Substance use care	62.45%	52.80%	59.60%	91.00%	67.80%	1.39(1.08–1.80)*	10.87 (8.23–14.34)*	2.10(1.55–2.84)*
Would avoid treatment because of what others would think								
Mental illness	9.41%	10.00%	7.80%	10.90%	9.30%	0.75 (0.50–1.14)	1.22 (0.83–1.79)	0.86 (0.54–1.37)
Alcohol abuse	6.54%	6.20%	6.40%	7.30%	7.50%	1.05 (0.64–1.74)	1.27 (0.82–1.98)	1.20 (0.69–2.09)
Drug abuse	7.00%	7.00%	6.40%	7.80%	8.00%	0.91 (0.56–1.48)	1.21 (0.77–1.90)	1.14(0.66–1.98)
Think badly of others in treatment ^b								
Mental illness	38.42%	38.80%	36.70%	39.10%	44.60%	1.00 (0.77–1.30)	1.10 (0.88–1.37)	1.13 (0.81–1.57)
Alcohol abuse	41.89%	43.00%	41.00%	40.80%	41.90%	1.05 (0.80–1.40)	1.01 (0.81–1.27)	0.89 (0.63–1.25)
Drug abuse	49.53%	50.50%	47.90%	50.70%	47.90%	1.02 (0.77–1.33)	1.07 (0.86–1.35)	0.80 (0.57–1.14)

* Indicates significant difference ($P < .05$) as compared to urban respondents.

^a Responses provided for those answering “yes” to perceived need.

^b Respondents reporting “agree” or “somewhat agree.”