

# Substance Use Disorder and Suicidal Ideation in Rural Maryland

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## Abstract

**Background:** Rural areas in the United States have been disproportionately burdened with high rates of substance use, mental health challenges, chronic stress, and suicide behaviors. Factors such as a lack of mental health services, decreased accessibility to public health resources, and social isolation contribute to these disparities. The current study explores risk factors to suicidal ideation, using emergency room discharge data from Maryland.

**Methods:** The current study used data from the Healthcare Cost and Utilization Project (HCUP) State Emergency Department Databases (SEDD) from the State of Maryland. Logistic regression was used to assess the association between ICD-10 coded opioid use disorder, alcohol use disorder, cannabis use disorder, major depressive disorder, and the outcome variable of suicidal ideation discharge. We controlled for income, race, age, and gender.

**Results:** Lifetime major depressive disorder diagnosis (odds ratio [OR] = 79.30; 95% confidence interval [CI] 51.91–121.15), alcohol use disorder (OR = 6.87; 95% CI 4.97–9.51), opioid use disorder (OR = 5.39; 95% CI 3.63–7.99), and cannabis use disorder (OR = 2.67; 95% CI 1.37–5.18) were all positively associated with suicidal ideation.

**Conclusions:** The study highlights the strong link between prior substance use disorder, depression, and suicidal ideation visit to the emergency room, indicating the need for prevention and intervention, particularly among those in rural areas where the burden of suicidal ideation and chronic stress are high. As health disparities between rural and urban areas further widened during the COVID-19 pandemic, there is an urgent need to address these issues.

## Keywords

suicidal ideation in rural areas, chronic stress in rural areas, substance use and suicide risk, opioid use disorder and suicide risk, cannabis use in rural areas

## Introduction

In the United States, the rates of suicide are growing at an alarming rate with a variety of compounding factors influencing the circumstances.<sup>1–4</sup> Rural areas have been particularly burdened with higher rates of suicide, stemming from factors including substance use,<sup>5</sup> lack of mental health services,<sup>6</sup> social isolation,<sup>7</sup> poverty, unstable housing, and other factors.<sup>8,9</sup> Approximately 1 in 5 US residents live in rural areas, that includes a vastly changing demographic.<sup>10</sup> These disparities were even further exacerbated during the recent COVID-19 pandemic.<sup>11,12</sup>

In comparison to urban populations, rural communities are disproportionately burdened with substance use and

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suicide problems.<sup>13–16</sup> Less urbanized regions have decreased accessibility to public health resources and overall healthcare and are associated with lower levels of health literacy.<sup>1,17</sup> Lower levels of health literacy may be due to limited access of health information, healthcare access, and health communication in rural areas. Such disparities were paramount during the COVID-19 pandemic. Additionally, rural regions lack mental health services and pharmacological support which leads to increased trends in substance abuse, a strong risk factor for suicidal ideation.<sup>6,7</sup> Cultural factors among vulnerable populations further contribute to the substance use behaviors, thus limited addiction treatment availability creates a vulnerable population.<sup>18</sup> Individuals engage in substance use as a coping mechanism for poor mental health symptoms, creating a high-risk behavior.<sup>19</sup>

Risk factors such as substance use disorders and alcohol abuse further increase rates of suicidal ideation.<sup>20</sup> In addition, other factors including biological, genetic, and other social factors are associated with suicidal ideation.<sup>21–23</sup> This includes neurobiological mechanisms, intergenerational transmission, and social factors such as access to psychiatric services, income, race, and other factors.<sup>24–27</sup> First-contact patients who were admitted to the hospital for a suicide attempt often are associated with substance abuse from both prescribed and nonprescribed medications.<sup>28</sup> Compounding psychopathologies, such as drinking problems, mental health conditions, and trauma, which markedly impact the suicide trends.<sup>29</sup> When evaluating perspective suicide risk factors, predictors such as recent conflict, substance use, medical comorbidities, and isolation all put the individual at most harm for suicide attempt.<sup>30</sup>

There is an ecological association on suicide rates.<sup>31</sup> Individuals of lower socioeconomic status and higher social isolation are more likely to be associated with higher risk of suicide attempts,<sup>32</sup> that are common characteristics of rural areas. Homelife and income levels, which can both be shaped by geographic locations, are strong influences on suicidal ideations.<sup>33</sup> Additionally, availability of healthcare resources varies based on locale and lack of services such as mental healthcare can be detrimental to suicide attempt deterrence among at-risk populations.<sup>34</sup>

High-risk behaviors for suicidal ideation are associated with increased substance use risk factors. Young adults in rural areas are more likely to engage in substance abuse, alcohol abuse, and illicit drug use, which correlate with increased likelihood of suicide.<sup>35</sup> Cannabis, one of the most commonly misused drugs, is associated with suicidal ideation among adolescents.<sup>36</sup> This association is further exaggerated among individuals living in low-income and middle-income regions, where public health initiatives are lacking.<sup>37</sup> Similarly, the likelihood of cocaine use in suspected suicide cases was increased in comparison to general reported suicide cases.<sup>38</sup> Hallucinogen use is associated with substance use in high rates and have been

associated to increased suicide attempts among individuals.<sup>39</sup> Although least common compared to alcohol abuse and opioid overdose, psychoactive substances are often detected in toxicology reports of individuals who attempt suicide or are successful in dying by suicide.<sup>40</sup> Individuals engaging in adverse behaviors, such as excess alcohol consumption and opioid abuse, are at high risk for suicide attempts.<sup>41</sup>

While, prior work has found strong links between substance use and suicidal behaviors, less is known about how these factors contribute to suicide related discharges, particularly in rural areas. As rural areas have been disproportionately impacted by opioid-related mortality and suicide, it is more important than ever to explore this topic. The current study examines the association between prior substance use disorder diagnosis and depression with suicidal ideation related discharges, using emergency discharge data from the state of Maryland.

## Methods

### Data and Sample

The current study used data from the Healthcare Cost and Utilization Project (HCUP\_ State Emergency Department Databases [SEDD]) from the 2017 State of Maryland. The SEDD includes all treat-and-release and transfer ED visits from short-term, acute-care, nonfederal community hospitals across the state. Overall, we identified all ED visits regardless of disposition. Additional details of the SEDD can be found elsewhere.<sup>42</sup> The state of Maryland was selected due to its diverse population, wide socioeconomic distribution, and adequate sample rural sample size. Additionally, Maryland is only 1 of 22 states that make race data available through SEDD.

### Study Population

We identified all residents in Maryland who resided in rural counties with at least 1 ED visit in 2017. Rural counties were identified based on living in counties classified as “Micropolitan counties” or “Not metropolitan” or micropolitan counties. The rural status of the patients’ residence was defined according to the National Center for Health Statistics.<sup>43</sup>

## Measures

### Primary Outcome

Suicidal ideation discharges were used as the primary outcome variable. Suicidal ideation discharges were coded positive based on patients with the “R45.851” International Classification of Diseases, 10th edition (ICD-10) code in the primary diagnosis field.

## Independent Variables

ICD-10 codes of alcohol use disorder,<sup>44</sup> opioid use disorder,<sup>45</sup> major depressive disorder,<sup>46</sup> and cannabis use disorder,<sup>47</sup> were included based on their known risk to suicide behaviors. Each was coded positive based on positive diagnosis in the previous diagnosis 1 through 10 fields. Alcohol use disorder was coded positive based on the following ICD-10 diagnosis: F10.1-F10.99; opioid use disorder (F11.1-F11.21), major depressive disorder (F33.0-F33.9), and cannabis use disorder (F12.1-F12.99).

## Controls

We controlled for income, gender, race, and age. Income was based on zip code income quartile of patients' residence. Income was coded binary with 1 representing low-income zip code, with the lower quartile of income level for the zip code at <\$44 000 per year, and 0 representing incomes of \$44 000 or higher. Gender was coded binary, with 1 representing male and 0 representing female. Race was dummy coded as "White non-Hispanic," "Black non-Hispanic," "Hispanic," "Asian," and "American Indian/Alaska Native," with "White non-Hispanic" used as the referent group.

## Analysis

Data cleaning and recoding of variables were conducted in SAS (version 9.4), with analyses performed in Stata Version 14 (Stata Corp LP, College Station, TX, USA). Descriptive statistics and prevalence for the sample are presented in Table 1. Logistic regression (Table 2) analysis was used to assess the association between key substance

use and mental health disorders and the outcome variable of suicidal ideation discharges. Variables assessed included prior opioid use disorder, alcohol use disorder, cannabis use disorder, and depression diagnosis.

## Results

Table 1 shows descriptive statistics. The sample consisted of 44.1% males (n = 36 822) and 55.9% females (n = 46 773). Low income was reported for 32.9% (n = 27 501) of patients. In terms of race/ethnicity, 68.6% were White non-Hispanic (n = 57 262), 25.6% Black non-Hispanic (n = 21 323), 3.2% Hispanic (n = 2689), 0.3% Asian (n = 222), and 0.7% American Indian/Alaska Native (n = 62). Overall, 0.7% (n = 548) of patients were admitted for suicidal ideation. The highest prevalence for substance use disorders was alcohol use disorder (n = 984; 1.2%), followed by opioid use disorder (n = 680; 0.8%), and cannabis use disorder (n = 310; 0.4%). The prevalence for major depressive disorder was 7.7% (n = 6437).

The results of the logistic regression model are presented in Table 2. The logistic regression model revealed significant associations between several variables and the likelihood of emergency room discharge for suicidal ideation. Gender differences are evident, as males are 1.60 times more likely (odds ratio [OR] = 1.60; 95% confidence interval [CI] 1.10-2.32) to be discharged for suicidal ideation compared to females. Among racial and ethnic groups, Asian patients are approximately 3.06 times more likely (OR = 3.06; 95% CI 1.24-7.51) to be discharged for suicidal ideation, while Black non-Hispanic and Hispanic patients are less likely, with ORs of 0.59 (OR = 0.59; 95% CI 0.46-0.74) and 0.24 (OR = 0.24; 95% CI 0.10-0.54), respectively, compared to

**Table 1.** Descriptive characteristics of sample (N = 83 595).

Variable	N (%)
Gender	
Male	36 822 (44.1)
Female	46 773 (55.9)
Low income <sup>a</sup>	27 501 (32.9)
Race/ethnicity	
White non-Hispanic	57 262 (68.6)
Black non-Hispanic	21 323 (25.6)
Hispanic	2689 (3.2)
Asian	222 (0.3)
American Indian/Alaska Native	62 (0.7)
Suicidal ideation	548 (0.7)
Alcohol use disorder	984 (1.2)
Cannabis use disorder	310 (0.4)
Opioid use disorder	680 (0.8)
Major depressive disorder	6437 (7.7)

<sup>a</sup>Low income is based on income <\$44 000 for patient's zip code of residence.

**Table 2.** Logistic regression using emergency room discharge for suicidal ideation as outcome.

Variable	OR (95% CI)
Alcohol use disorder	6.87 (4.97-9.51)*
Cannabis use disorder	2.67 (1.37-5.18)*
Opioid use disorder	5.39 (3.63-7.99)*
Major depressive disorder	79.30 (51.91-121.15)*
Low income	0.76 (0.63-0.93)
Gender (male)	1.60 (1.10-2.32)*
Race <sup>a</sup>	
Black non-Hispanic	0.59 (0.46-0.74)
Hispanic	0.24 (0.10-0.54)
Asian	3.06 (1.24-7.51)*
American Indian/Alaska Native	1.19 (0.34-2.02)
Age	0.98 (0.97-0.98)*

\*P ≤ .05.

<sup>a</sup>White non-Hispanic used as reference group.

<sup>b</sup>Low income is based on income <\$44 000 for patient's zip code of residence.

Abbreviations: CI, confidence interval; OR, odds ratio.

White non-Hispanic patients. Low income is associated with a reduced likelihood of suicidal ideation discharges (OR = 0.76; 95% CI 0.63-0.93), and each additional year of age slightly decreases the likelihood (OR = 0.98; 95% CI 0.97-0.98).

Patients with major depressive disorder were about 79 times more likely (OR = 79.30; 95% CI 51.91-121.15) to be discharged for suicidal ideation compared to those without this diagnosis. Substance use disorders also show strong associations, with alcohol use disorder increasing the likelihood by about 6.87 times (OR = 6.87; 95% CI 4.97-9.51), opioid use disorder by 5.39 times (OR = 5.39; 95% CI 3.63-7.99), and cannabis use disorder by 2.67 times (OR = 2.67; 95% CI 1.37-5.18).

## Discussion

There has been a clear recognition of higher rates of opioid use in rural communities and nonurban areas.<sup>48</sup> However, the relationship between opioid use and suicide and/or suicidal ideation is less known. This research study has found an elevated risk for suicidal ideation for opioid use disorder in rural areas in comparison to urban regions, however there was no significant difference for cannabis use or alcohol use disorder among the 2 population groups. One possible limitation of the study includes the duration of diagnosis based on the medical chart. Since the data includes the most recent 10 diagnoses in the medical chart, suicidal ideation and substance use disorder could both be present, however the patient may have been diagnosed at different times.

Implications of the results show a greater need for overall education on mental health for the general population in rural areas. The environmental influences of being in a rural area are exaggerated by the limited knowledge and access to healthcare.<sup>48</sup> Therefore, clinicians diagnosing individuals in rural areas for high risk factors such as alcohol use disorder, opioid use disorder, cannabis use disorder, and depression should become more aware of the correlation with suicidal ideation and educate the community. Secondly, health professionals in rural areas should become more aware of the downstream risks of substance use disorder and tailor their medical plans to include more resources and supportive mental health professionals.<sup>49</sup> Incorporating more education during clinician training can help physicians and other healthcare personnel connect patients to resources for suicide prevention and other individuals in substance abuse treatment to create a community of care.<sup>50</sup> Lastly, identifying subpopulations within the rural population can generate for concentrated and effective approaches to addressing suicide prevention and minimizing the stereotyping and stigmatization of substance use.<sup>51</sup>

Next measures should be taken to address the coexisting barriers in rural areas leading to increased opioid use disorder among the at-risk population.<sup>19</sup>

## Education and Mental Health Resources

Many individuals suffering from opioid use disorder lacks an understanding of the condition and therefore are unsure how to pursue education and resources to help manage the disorder. Creating strong relationships within patients and among patients and healthcare professionals can create a sense of connection and engage individuals with community resources.<sup>52</sup> Tailoring resources to the needs of the at-risk community can build strong social networks and treatment options.<sup>53</sup> A better understanding of opioid use disorder in addition to an engaged social community can work towards suicide prevention.

## Screening and Early Identification

Early identification of individuals at-risk for opioid use disorder can address the problem at an earlier stage and allow faster intervention in hopes of minimizing suicidal ideation. One approach to early identification is utilization of screening tools among providers in primary care settings. For example, the OWLS tool measures 4 characteristics with prescribed opioid use: Overuse, Worry, Losing interest, and Sluggish/slowed down/sedated.<sup>54</sup> Screening specifically for opioid use disorder enables earlier identification of affected patients, while additional testing of subgroups for suicidal ideations permits healthcare providers to intervene promptly.<sup>55</sup>

## Clinical and Treatment Approaches

The need for extensive discussions on treatment approaches for patients with substance use disorder (SUD), suicidal behavior, and comorbid psychiatric disorders is strongly advocated. These conditions often coexist and significantly impact individuals' wellbeing and quality of life. By addressing these topics comprehensively, healthcare professionals can improve patient outcomes and provide holistic and integrated care. Exploring evidence-based treatment options, such as medication-assisted treatment (MAT), counseling, behavioral therapies, and interventions tailored to underlying psychiatric disorders, is crucial. Increasing awareness and understanding of these approaches can reduce stigma and encourage individuals to seek appropriate treatment. Integration of mental health services and addiction treatment is emphasized. Collaborative care models, involving mental health professionals and addiction specialists, provide a comprehensive and coordinated approach for individuals with comorbid conditions. This ensures simultaneous addressing of substance use disorders and psychiatric disorders, leading to improved treatment outcomes and overall wellbeing. Promoting discussions and implementing these treatment approaches enhances the quality of care for patients with SUD, suicidal behavior, and comorbid psychiatric disorders. A comprehensive and integrated approach is believed to

improve patient outcomes, reduce the burden of these conditions, and contribute to overall wellbeing for individuals facing these complex challenges.

### Public Policy Implementation

Current policy measures supporting individuals suffering from opioid use disorder are minimal due to the stigma associated with opioid use and the perception of users by society.<sup>51</sup> To address this issue, one approach includes modifying healthcare curriculum to emphasize responsibly prescribing of opioids and monitoring use among patients, with concurrent education on harm reduction techniques.<sup>50</sup> As health providers gain more education on addiction medicine, they will become more aware of the complexity of the disorder and be able to better support their patients.<sup>49</sup>

### Outreach and Telehealth

One barrier many individuals face in receiving opioid use treatment is the physical accessibility to healthcare providers or clinics to support the population.<sup>48</sup> The introduction of remote clinics and telehealth provide an opportunity to overcome the geographic barrier with sacrificing the quality of care.<sup>56</sup> Virtual health visits expand outreach to more rural areas and allow for more frequent visits, providing support and sustainability in the ongoing treatment process.<sup>57</sup>

The nature of opioid use disorder calls for “multisystemic solutions” in order to address the multiple factors impacting the population and contributing to the rise in suicidal ideation.<sup>58</sup>

### Limitations

Our results should be considered within the limitations of our findings. First, the emergency room discharge data we used is cross-sectional; thus, this study cannot establish temporal relationships. Second, while we are able to derive prior diagnosis for multiple pre-existing conditions (eg, alcohol use disorder and depression), the time of diagnosis, and the persistence of these conditions are not available in these data. In some cases, if a disorder was diagnosed several years ago, it is possible that the individual recovered at some point thereafter. Third, the control variable of income was based on patient zip code characteristic for income and may not reflect the actual household income of the patient. Fourth, risk factors such as childhood trauma and early childhood experiences which are well established risk factors suicidal behaviors are not assessed in the current study, due to HCUP data limitations. Finally, a major limitation is the cross-sectional design, which precludes the inference of a causal relationship between substance use disorder and suicidal ideation. By study design, HCUP are not linked from one year to the next, and temporal relationships cannot be established. Future studies that use medical claims data over

multiple years should be considered, to further investigate suicide behaviors among rural populations. Despite these limitations, the study informs key factors that contribute to suicidal ideation discharges, that may lead to future intervention at earlier stages, particularly on rural populations.

### Conclusion

The study found strong links between depression and all 3 substance use disorders (alcohol, opioids, and cannabis) with suicidal ideation. The results highlight the urgent need for prevention and intervention, especially in rural areas where substance use disorders are more common. As discussed, providing better mental health education, early screening, and integrated care can help reduce the risk of suicidal ideation. Increasing access to healthcare through telehealth and outreach programs can overcome geographic barriers and provide ongoing support. Additionally, tailoring resources to the needs of at-risk communities and training healthcare professionals to recognize and address these issues can improve patient outcomes. By tackling these challenges, we can enhance the wellbeing of those affected and support healthier communities in rural areas.

### Author contributions

All authors provided critical feedback and helped shape the literature review, methods, data analysis, and conclusions of this manuscript.



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