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RESEARCH ARTICLE

Suicide Rates in Rural Ohio: The Role of Population Density, Social Association, and Healthcare Access

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ABSTRACT

Background: This study explores differences between adult suicide rates in counties in Ohio from 2007-2016, specifically differences between urban and rural counties. Nationally, the least densely populated states in the nation have the highest rates of completed suicide, and that same trend was hypothesized to exist in the least densely populated counties in Ohio.

Methods: Simple demographics and rates for sub-populations and counties were retrieved for adults over 18 years of age, and separated by rural and urban counties. A random effects meta-regression model was developed to assess the association among suicide death rate, rate of emergency rooms, rate of mental health providers, rate of social associations, and rural or urban counties.

Results: There were differences in suicide rate between urban and rural counties. Suicide death rates were significantly associated with rate of mental health facilities, rate of social associations, and type of county (e.g., rural versus urban). As the rate of mental health providers increased, there was a significant decrease in the rate of suicide deaths.

Conclusions: This study illustrates the positive effect that access to mental health service providers can have on decreasing suicides in rural areas. More studies are needed focusing on unmet needs in rural areas, specifically those looking at individual level predictors of suicide.

Key words: Suicide, Population Density, Social Association, Mental Health, and Rural

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INTRODUCTION

Suicide rates in rural areas are an understudied public health issue, particularly in areas far from urban centers. In recent years, this phenomenon was studied internationally,[1,2] and is an area of growing interest for suicidologists. At the macro level in the United States, the problem is most glaring in the most remote parts of Wyoming and Montana and practically inaccessible corners of Alaska. These states have higher suicide rates than the rest of the nation and lower population densities.[3] However, rates similar to these are found in the rural Midwest as well. Nationally, states with lower population densities tend toward higher rates of suicide than more populous states,[3] and we hypothesized that same trend would exist in Ohio counties with lower population densities. This study examines differences in suicide rates by county in Ohio from 2007-2016, specifically differences in adult rates of suicide between urban and rural counties. Other factors explored include demographic differences, availability of emergency medical services, and access to mental health treatment providers and social associations. Our intention was to explore different demographic and population factors associated with completed suicides in the state of Ohio and suggest what directions future research might take in further analyzing the relationship between those differences.

Suicide is the tenth leading cause of death in the United States.[4] For the purpose of this study, suicide is defined as a form of intentional self-directed violence resulting in death. Suicide rates in the United States are currently the highest they have been in three decades, with a climbing trend in recent years.[5] Suicide was the cause of more than 40,000 deaths in 2013, with a rate of 12.7 per 100,000 people.[6] Completed suicides are part of a larger pattern of suicidal behavior that includes suicidal ideation, at-

tempts, and completed suicide. We use the term "completed" as a conscious step away from moral models of understanding the behavior (e.g. "committing" suicide). Intuitively these actions are often understood as a progression with completed suicide the result of ideation and attempts. However, it is important to distinguish between them, and understand that these three behaviors are not necessarily causally ordered.[7,8] There is contention among suicidologists, with some arguing that regardless of differences, these behaviors are etiologically similar.[9] Commonly accepted risk indicators do not precede many completed suicides, and attempts are 10-25 times more common than completed suicides in the United States,[10] making suicides rare compared to the population that would seem to be at risk. These factors combined with the likelihood of underreporting, make this area of study as complex and varied as the people whose lives are being affected. This complexity is further exacerbated by the scarcity of national data on non-fatal behaviors and the difficulty of obtaining complete and accurate data after a suicide.[4]

Suicidologists traditionally look to a lack of social connectedness as one way to explain suicides in isolated populations. The study of suicide as a sociological phenomenon is relatively recent, starting with Durkheim's work in France.[4,11] From these early studies, several ideas explaining suicide formed, and they drive our modern understanding to the present day. While Durkheim described suicides as "anomic, altruistic, fatalistic, or egoist,"[11] it is this last idea that is of interest most often in studies of rural suicide.[12,13,14] At the macro level, egoistic suicides are a consequence of weak social bonds, occurring when there is a lack of social connectedness.[15] Researchers are now looking more closely at individual level indicators of isolation, in addition to macro-level factor explanations to explain suicidal behaviors.[9] This meso-level study uses population density as an indicator of

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isolation in a general way, and bridges the gap between studies that focus on the individual or the society as a whole. This is a conscious step away from Durkheim's egoist explanation, and points to a need for alternative explanations of those differences in suicide rates in rural areas, and suggests that a lack of access to care may explain more of that difference than a lack of social connectedness. In addition to population density this study explores social associations at the county level as an indicator of isolation, and a lack of access to care, both of which can be consequences of living in rural areas. Population density is not the only factor to consider, but it may be the driving force behind other factors that contribute to increased rates of suicide in rural areas.[16] This isolation from services and support impacts the entire population of a rural county and differences in suicides rates may be but one aspect of a larger problem.

As one considers the differences between rural and urban settings, pertaining to suicide, the simple lack of other people in large numbers would lead to concerns that developing social connectedness could be difficult. Fewer people in general can mean fewer people with whom to connect and a decreased chance of finding a person with whom to develop meaningful social associations and bonds. Nevertheless, humans have connected socially in small groups for thousands of years and other forces must be at play to explain the differences completely. This is further complicated because assessing that connectedness is difficult after death. However, another area of connectedness exists in a more formalized manner that can be measured. Availability of mental health treatment and emergency room services may have a more direct bearing on a person's access to support. In the case of mental health services, a person at risk who is many miles away from the nearest service provider, living in an area where the number of such providers is low, has fewer opportunities to access such services.[6,17,18] Similarly, proximity to emergency medical services plays a role in the lethality of methods, making methods more lethal in rural areas when that method might be non-lethal in an urban setting.

Typically suicide is explained from the standpoint of the individual; however, this study examines differences between the rates of suicide in counties in Ohio and how those differences affect those counties' access and availability of services for members of their communities. If these differences can more accurately predict changes in suicide rates, then future studies can explore how the idea of isolation may be simply masking a public health service shortcoming. More equitably providing services in rural areas, rather than pointing to individual pressures could relieve such shortcomings.

Commonly accepted risk factors (social isolation, abuse or other trauma, alcohol or drug abuse, anxiety, and depression) precede some completed suicides,[4,10,19,20,21] and represent areas that must be considered when exploring differences between counties. Early access to mental health services is important for more than suicide prevention and is often a challenge in rural areas.[16,22] Access to emergency medical services is also important for all members of a community, and the distance from that care can be the difference between an attempt and a completed suicide, depending on the method of the attempt. Some methods are more lethally reliable (e.g. firearms)[13,14,23] and proximity to emergency medical care is less of a mitigating factor when compared with methods that take comparatively longer to be fatal (e.g. overdose). Although accounting for all of these factors at the county level is beyond the scope of this study, these factors remain an import part of understanding the complexity of the problem.

METHODS

Setting

This study focuses specifically on rates of suicide by adults in the state of Ohio from 2007-2016. Due to the low total number of suicides in areas with very low populations, a period of ten years was chosen in order to retrieve stable suicide rates for all 88 counties in Ohio. Counties were classified as urban or rural using the 2013 Rural-Urban Continuum Codes (RUCC).[24] These Codes form a classification scheme that distinguishes metropolitan (urban) counties by the population size of their metro area, and nonmetropolitan (rural) counties by degree of urbanization and adjacency to a metro area or areas.

Design

This is an ecological study of death by suicide. This meso-level study uses population density, social association, and access to mental-health providers to explore differences in suicide rates in rural and urban counties. This is a secondary data analysis using county-level data collected for 2007-2016, from the Ohio Public Health Data Warehouse.[25]

Participants

Ohio county-level data were retrieved for suicide deaths for the years 2007-2016, and included adults 18 years of age or older. Population data for 2005-2009 was retrieved from Ohio Public Health Data Warehouse[25] (OPHDW) July 1, 2005 - July 1 2009: Revised Bridged-Race Intercensal Population Estimates (released 6/26/2014). Population data for 2010-2016 was retrieved from OPHDW[25] July 1, 2010 - July 1, 2016: Vintage 2016 Bridged-Race Postcensal Population Estimates (released 6/26/2017).

Procedures

Demographic data for suicides in Ohio were retrieved from the OPHDW query system, by selecting for cause of death and demographics (sex, age, marital status, and race).[25] State suicide data were analyzed for differences in demographics and variation in suicide rates compared to population density. Cause of suicide death rates by urban/rural county were retrieved from the Center for Disease Control and Prevention (CDC) WONDER Online Database.[26] Cause of death was queried using the International Classification of Diseases, Tenth Revision (ICD-10) codes for suicide. ICD-10 codes for suicide included X60-X84 and Y87. Codes with less than 10 deaths were suppressed by CDC Wonder and are grouped together as "other unspecified means."

Suicide rates were calculated in aggregate for all years to increase sample size (n ≥ 20) for counties with smaller populations, and population density for each county was calculated based on 2010 US Census data Suicide rates were mapped by county using ArcGIS 10.5. All data used in the study is publicly available and can be accessed by anyone interested in conducting similar analyses in this area for other states.

Measures/Outcomes

Descriptive statistics were retrieved and summarized to describe the study population, with frequencies and percentages for all categorical variables and means for all continuous variables Suicide rates were calculated per 100,000. Variables used in descriptive statistics included sex, age, marital status, and race.

For the meta-analysis model, the following variables were included; access to emergency medical treatment, rate of social associations, mental health provider rate, and rural/urban county. Access to emergency medical treatment in each county includes hospitals and stand-alone emergency rooms. The rate of social associations per county was retrieved from the Robert Wood Johnson's County Ranking website.[27] Social association rate is

defined as the number of membership associations per 10,000. Mental health provider rate by county was also retrieved from Robert Wood Johnson's County Ranking website.[28] Mental health provider rate is the ratio of the county population to the number of mental health providers including psychiatrists, psychologists, licensed clinical social workers, counselors, marriage and family therapists, mental health providers that treat alcohol and other drug abuse, and advanced practice nurses specializing in mental health care. Counties were classified as urban or rural using the 2013 RUCC.

Statistical Analysis

To examine associations between suicide death rates and county level variables, meta-analysis techniques were used. A random effects meta-regression model was developed to assess an association among suicide death rate, rate of emergency rooms, rate of mental health providers, rate of social associations, and rural or urban counties. The meta-regression was conducted using SAS version 9.4 (Cary, NC) and p-values <.05 were regarded as statistically significant.

Institutional Review Board Approval

Although no institutional review board (IRB) approval is required for secondary data research conducted on deceased persons, all identifiable information was safeguarded and every reasonable precaution was taken to maintain the security of the data, as well as ensure respectful treatment commensurate with the seriousness of the subject matter.

RESULTS

Between January 1, 2007 and December 31, 2016, there were 14,885 completed suicides among Ohio residents. After data cleaning, there were 14,353 completed suicides by adults used in this study (Table 1). The average age among this aggregate group was 47.4 years (SD = 17.38; range = 18 to 101). The group is disproportionately male (79.6%, n = 11,423) with female completed suicides accounting for only 20.4% (n = 2,930). The largest numbers of suicides were by those between the ages of 45 and 54 (n = 3,166), comprising 22.1% of the sample. Those from the ages of 18 to 24 (n = 1,489) had the smallest numbers of suicides (10.4%). Within these age groups, the largest numbers of suicides were by adult males between the ages of 45 and 54 (n = 2,381),

or 16.6% of the sample. Women between the ages of 18 to 24 (n = 243) had the smallest numbers of suicides, representing only 1.7%. Suicides by those aged 65 and older (n = 2,357) represented 16.4% of overall suicides and showed the greatest differences between rural (19.5%, n = 601) and urban (15.6%, n = 1,756) suicides.

Of the total population of adult suicides, 6.5% (n = 930) were African American and 92.1% (n = 13,219) were Caucasian. All other races combined accounted for 1% (n = 151) of the completed suicides, with Asian/Pacific Islanders (n = 16) making up less than one percent of the sample in the next largest category. Other racial and ethnic groups were even less represented in the sample. African American suicides in rural counties showed the greatest differences between rural (1.6%, n = 930) and urban (7.8%, n = 881) suicides, compared to other races. Of the total population of adult suicides, 35.6% (n = 5,105) were married, 33% (n = 4,738) were single, and 22.7% (n = 3,253) were divorced.
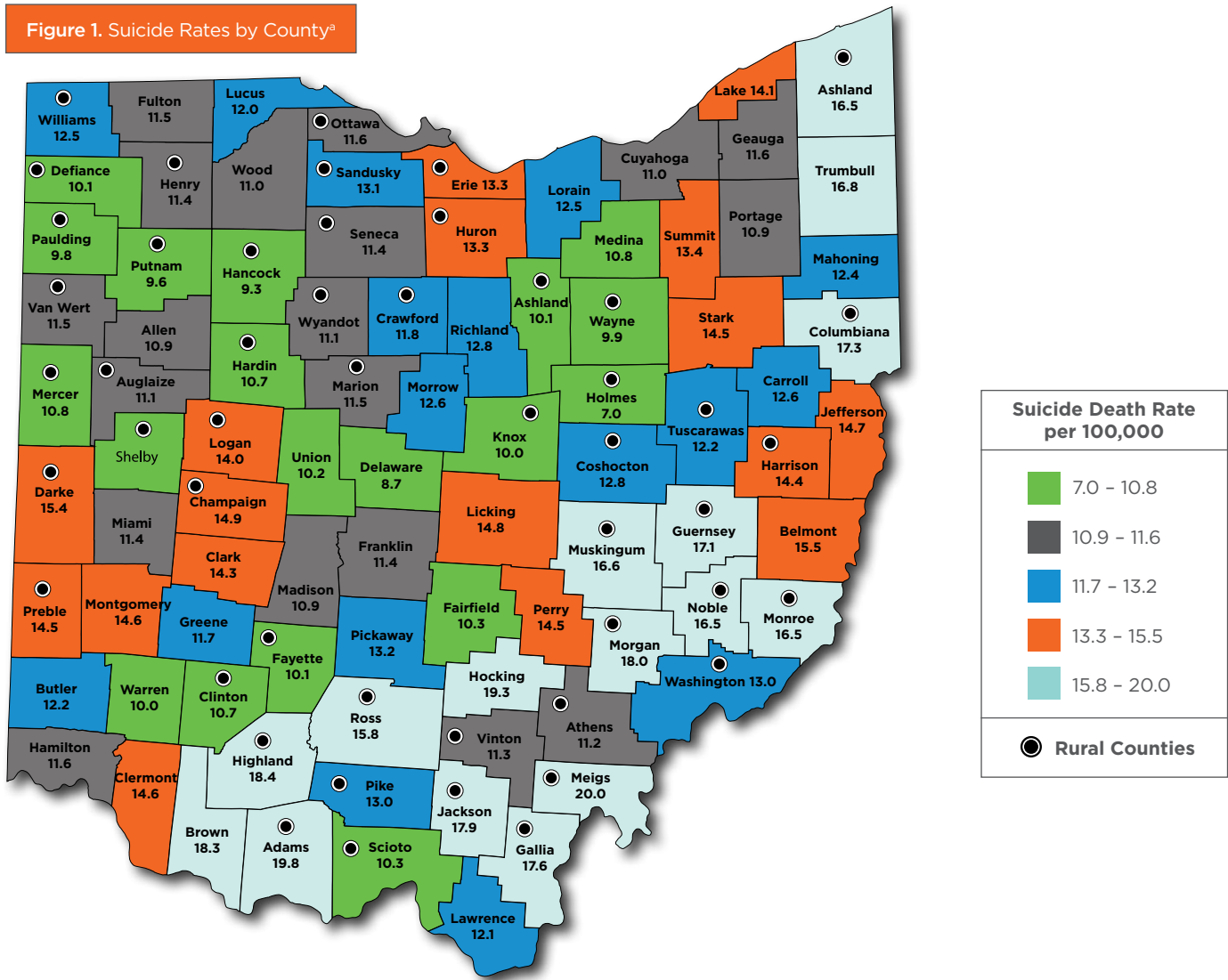
The most common causes of death are listed in Table 2, and broken down by ICD-10 code, separated by rural and urban counties. The leading cause of death was firearm injury (handgun, rifle, shotgun, or unspecified), accounting for 51.5% (n = 7,390) of all suicides, followed by hanging, strangulation, or suffocation accounting for 25.2% (n = 3,613). Drug and alcohol overdose was the cause of death for 12.4% (n = 1,775) of suicides.

Table 1: Demographics of Suicide Deaths in Ohio, 2007-2016 (N = 14,353)[a]

	Urban	Rural	Total
Sex			
Male	79% (n = 8,898)	81.8% (n = 2,525)	79.6% (n = 11,423)
Female	21% (n = 2,370)	18.2% (n = 560)	20.4% (n = 2,930)
Age			
18 to 24	10.5% (n =1,179)	10% (n = 310)	10.4% (n = 1,489)
25 to 34	16.8% (n = 1,888)	15.3% (n = 472)	16.4% (n = 2,360)
35 to 44	17.9% (n = 2,572)	18% (n = 555)	17.9% (n = 2,572)
45 to 54	22.2% (n = 2,501)	21.6% (n = 665)	22.1% (n = 3,166)
55 to 64	17.1% (n = 1,927)	15.6% (n = 482)	16.8% (n = 2,409)
65 and older	15.6% (n = 1,756)	19.5% (n = 601)	16.4% (n = 2,357)
Marital Status			
Separated	0.8% (n =93)	1.3% (n = 39)	0.9% (n = 132)
Single	34.5% (n = 3,892)	27.4% (n = 846)	33% (n = 4,738)
Married	34.4% (n = 3,878)	39.8% (n = 1,227)	35.6% (n = 5,105)
Divorced	22.7% (n = 2,553)	22.7% (n = 700)	22.7% (n = 3,253)
Widowed	6.5% (n = 737)	7.8% (n = 240)	6.8% (n = 977)
Unknown	1% (n = 115)	1.1% (n = 33)	1% (n = 148)
Race			
White	90.5% (n = 10,194)	98.1% (n = 3,025)	92.1% (n = 13,219)
Black	7.8% (n = 881)	1.6% (n = 49)	6.5% (n = 930)
Asian	0.1% (n = 13)	0.1% (n = 3)	0.1% (n = 16)
Other	1.1% (n = 129)	0.2% (n = 6)	0.9% (n = 135)
Unknown	0.5% (n = 51)	0.1% (n = 2)	0.4% (n = 53)

[a]2007-2016 Ohio Public Health Data Warehouse[25]

Table 2: Cause of Suicide Deaths in Ohio, 2007-2016 (N = 14,353) [a]

Cause	Urban	Rural	Total
Antiepileptic, sedative-hypnotic, antiparkinsonism, and psychotropic	2.44% (n = 275)	1.39% (n = 43)	2.22% (n = 318)
Crashing of motor vehicle	0.45% (n = 51)	0.42% (n = 13)	0.45% (n = 64)
Drowning and submersion	0.75% (n = 85)	0.42% (n = 13)	0.72% (n = 104)
Handgun	4.83% (n = 544)	5.87% (n = 181)	5.05% (n = 725)
Hanging, strangulation and suffocation	25.43% (n = 2,866)	24.21% (n = 747)	25.17% (n = 3,613)
Jumping from a high place	1.85% (n = 208)	0.55% (n = 17)	1.57% (n = 225)
Jumping or lying before moving object	0.81% (n = 91)	0.97% (n = 30)	0.84% (n = 121)
Narcotics and psychodysleptics (hallucinogens)	1.43% (n = 161)	1.33% (n = 41)	1.41% (n = 202)
Non-opioid analgesics, antipyretics, and antirheumatics	0.39% (n = 44)	0.36% (n = 11)	0.38% (n = 55)
Organic solvents and halogenated hydrocarbons and their vapors	0.41% (n = 46)	0.23% (n = 7)	0.37% (n = 53)
Other and unspecified drugs medicants and biological substances	8.56% (n = 964)	7.03% (n = 217)	8.23% (n = 1,181)
Other gases and vapors	4.01% (n = 452)	2.85% (n = 88)	3.76% (n = 540)
Other Specified Means	0.33% (n =37)	0.39% (n = 12)	0.34% (n = 49)
Other Unspecified Means	0.42% (n = 47)	0.36% (n = 11)	0.40% (n = 58)
Rifle, Shotgun, or Larger	5.19% (n = 585)	6.97% (n = 215)	5.57% (n = 800)
Sharp object	1.74% (n = 196)	0.91% (n = 28)	1.56% (n = 224)
Smoke, fire and flames	0.41% (n = 46)	0.52% (n = 16)	0.43% (n = 62)
Unspecified firearm/gun	39.87% (n = 4,493)	44.47% (n = 1,372)	40.86% (n = 5,865)

[a]2007-2016 CDC WONDER Online Database[26]

Figure 1. Suicide Rates by County[a]

Suicide Death Rate per 100,000	
🟩	7.0 – 10.8
⬛	10.9 – 11.6
🟦	11.7 – 13.2
🟧	13.3 – 15.5
🟦	15.8 – 20.0
◉	Rural Counties

[a]2007-2016 Ohio Public Health Data Warehouse[25]

Ohio's suicide rate, based on the aggregate of data from 2007-2016, showed a rate of 12.4 per 100,000. The rate for adult males overall was 19.7 per 100,000 and the rate for adult females was 4.7 per 100,000. Calculated rates for 88 counties in Ohio showed differences between population density and suicide rate (Figure 1). Of the three most densely populated counties (Cuyahoga, Franklin, and Hamilton) that make up the core of Ohio's three urban centers, all showed suicide rates below the average for the state (12.4 per 100,000) as well as below that of the nation (13.0 per 100,000) aggregated across the same years. Cuyahoga County had a rate of 11.0 per 100,000, Franklin County had a rate of 11.3 per 100,000, and Hamilton County had a rate of 11.6 per 100,000. In contrast to Ohio's major metropolitan areas, eight of the ten counties with the highest suicide rates in Ohio were rural counties with rates ranging from 17.4 per 100,000 in Columbiana County to 19.8 per 100,000 in Adams County.

The results of the meta-regression are presented in Table 3. Suicide death rates were significantly associated with rate of mental health facilities, rate of social associations, and type of county (e.g., rural versus urban). As the rate of mental health facilities increased, there was a significant decrease in the rate of suicide deaths (b = -0.005; β = -0.19; z = -2.24; p = .03). While controlling for the other variables in the regression model, the rate of suicide deaths was lower for rural counties compared to urban counties (b = -0.88; β = -0.19; z = -2.58; p = .01).

Table 3: Meta Regression to Examine Associations with Rate of Suicide Death (N = 88)

Variables	b	SE	B	z	p
Emergency Rooms	-0.017	0.03	-0.04	-0.52	.60
MHP Rate[a]	-0.005	0.002	-0.19	-2.24	.03
SA Rate[b]	0.167	0.05	0.22	3.20	.001
Rural versus Urban County	-0.881	0.34	-0.19	-2.58	.01

[a]Mental Health Providers
[b]Social Associations Rate

DISCUSSION

The intention of this study was to explore different demographic and population factors associated with completed suicides in the state of Ohio and suggest what directions future research might take in further analyzing the relationship between those differences. Suicide rates are slowly rising in the United States. Ohio is very close to the national rate of 13.0 per 100,000, with a suicide rate of 12.4 per 100,000 in this population, and is among the middle states when ranked by age-adjusted suicide rate. Although less racially and ethnically diverse than some other states, Ohio is reasonably similar to much of the nation in other demographic areas.

The population in this sample in particular is appealing for a number of reasons. First, from a demographic standpoint, the makeup of the suicide deaths is roughly comparable to the state of Ohio as a whole, with the exception of the disproportionately large number of male suicides. The average age of adult men and women in the sample (46.9 years and 46.4 years respectively) and distribution by age group is generally representative of the age demographics for adults in Ohio overall. Racially, the sample is somewhat skewed. There are more Caucasian cases than one might expect in Ohio, but this is not surprising when compared with suicide statistics for the United States as a whole. The differences are exaggerated when comparing urban and rural suicides by race, but this too is the result of the demographic makeup of these areas.

The differences between suicide rates in Ohio's most densely populated counties and the rates in many of the most rural counties in the state show patterns similar to those identified by suicidologists looking at state level data.[3] However, after controlling for the rate of mental health providers, the rate of social associations, and urbanity, the expected result (higher population density resulting in lower suicide rates) was reversed. Most interesting of the factors explored is the effect of mental health service provider rates on suicide rates. The increase in number of mental health providers per person in a county was significantly associated with the rate of suicide deaths reported in that county. Access to mental health services in the form of counseling, self-help groups, and psychiatric care are all more limited in rural areas, if they are available at all, and attitudes toward such services are sometimes culturally different for rural populations compared to those in urban areas.[4] Access to alcohol and drug abuse treatment services and support groups can also be lacking in rural areas. Increased rates of substance use disorder can compound the likelihood of a suicide attempt when paired with mental illness.[27] While caution must be exercised before drawing conclusions about the individual reasons behind these changes based on such data, it does suggest that more attention to preventative mental health screenings and services in rural areas would be worthwhile.

Access to firearms is a recurring theme in suicide research,[3,4,13,14] and one that is more complex than can be satisfactorily explored with existing data, but must be explored to fully understand the problem, particularly in rural areas. In the case of suicides completed with firearms, which make up the overwhelming majority in this study as well as the rest of the United States,[14] the question of access is of interest but difficult to accurately assess. The number of registered firearms is not necessarily a good indicator of the number of firearms in the county, and basing an analysis on that figure would almost certainly underrepresent the actual total as generations of owners passing weapons to relatives and unregistered new purchases would be left out. Even if such figures were available, they would only address ownership and fail to address the real question of access.[3] Some studies have used other indicators (number of concealed carry permits, number of firearms dealers, etc.) to estimate access to firearms with similar shortcomings.[13,23]

Since Durkheim wrote Le Suicide, there have been criticisms about drawing conclusions about individual motivations from large group data relating to suicide, and justifiably so. This study points to a need for alternative explanations (stepping away from egoist explanations) of those differences in suicide rates in rural areas, and suggests that a lack of access to care may explain more of that difference than a lack of social connectedness. Suicidal behavior is complex and influenced by motivations too numerous to address here, but it is understood that there are differences in rates of completed suicide in very rural areas. More analysis with robust methods is needed, as is more complete data related to factors known to be associated with suicide.

Limitations

The first limitation of this study is that we are not looking at individual level indicators of isolation and are not able to accurately measure that isolation after a suicide. Second, some factors are notoriously difficult to study, as is the case with access to firearms and the lethal reliability that goes with them as a means to committing suicide. Third, and perhaps most problematic, is the reliability of correctly identifying a death as a suicide. Lastly, the reliability and completeness of existing data on completed suicide is an issue. Missing data is one of many factors contributing to the possibility of underreporting completed suicides. Many deaths determined to be accidental for lack of evidence pointing to suicidal intent or to spare relatives from perceived stigma and shame associated with suicide in rural areas may result in under-representative data.

Despite these limitations, the increased rates of completed suicides in rural areas are a reality that remains largely unstudied and unaddressed in the United States. While these disparities are most glaring in nearly inaccessible corners of Alaska and very remote areas of Montana and Wyoming, the three states with the lowest population densities and highest suicide rates, they can be found much closer to large metropolitan areas in the Midwest. The farmland of northern Ohio and the rolling hills of the Appalachian plateau are far from blank spots on the map, and yet they share this similarity with the most isolated parts of the United States.

PUBLIC HEALTH IMPLICATIONS

Suicide rates in the United States are at their highest levels in three decades, and have been climbing in recent years.[5] Understanding this health risk and how rates differ across Ohio is important to determining how to distribute resources and direct attention to different parts of the state. Findings from this paper indicate that Ohioans in rural areas are more likely to die by suicide than those in urban areas. However, results from this paper also illustrate the positive effect that access to mental health service providers can have on decreasing suicide rates in rural areas, as well as the populations most at risk in those areas.

Delivering mental health services to rural areas efficiently and effectively presents many challenges, and innovative methods may be needed to increase access to for these populations.[28] Telehealth delivery systems and in-home treatment offer some promise for populations open to that type of service,[22] but more research in this area is needed. A lack of access to care is an addressable public health issue, and this research suggests that it may explain more of the differences in suicide rates in rural Ohio counties than an individual's isolation alone. Research looking at individual level predictors of suicide related to access to care and other demographic factors is also needed to more completely understand the problem.

As more than half of those who completed suicides in the state of Ohio from 2007-2016 had access to a firearm at the time of their death, more research into access to firearms is needed. Gathering information of this type has been difficult in recent decades due

to funding issues and legislation like the Dickey amendment,[31] but is increasingly becoming a priority for organizations like the CDC and the American Public Health Associations. As more research becomes available and the nature of the problem can be understood more completely, researchers will be able to address access to firearms as a lethal means of suicide more accurately.

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