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BRIEF REPORT



Medically Attended Suicidality in Youth Who Live on Farms

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ABSTRACT

Suicides are increasing in U.S. youth, particularly in rural areas. The influence of farming, however, is unclear, as suicide rates are higher in individual adult farm workers, but lower in farming-reliant counties. Early recognition of suicidality (suicidal ideation, intent, or attempt) is a key element of prevention, but there are no prior studies comparing suicidality in farm vs. non-farm youth. The purpose of this study was to examine associations between farm/rural residence and suicidality. Medical records were reused from an existing cohort of child and adolescent patients under surveillance for agricultural injuries in a Wisconsin healthcare system. The sample included 2,010 youth who lived on farms and 51,900 youth who did not live on farms (57% rural). The outcome was medically attended suicidality in 2017–2022 per a composite of diagnoses for suicidal ideation, attempt, or intentional self-harm that presented to ambulatory, emergency, or inpatient care settings. Suicidality was observed in 0.8% of farm, 1.8% of non-farm rural, and 1.6% of non-farm non-rural youth. After covariate adjustment, farm youth had significantly lower odds of suicidality (adjusted odds ratio [aOR] [95% confidence interval; CI] = 0.55 [0.33, 0.91], $P = .019$), while non-farm rural youth had significantly greater odds of suicidality (aOR [CI] = 1.21 [1.05, 1.40], $P = .007$), relative to non-farm non-rural youth. Children and adolescents who live on farms are about half as likely to (medically) present for suicidality as compared to their non-farm counterparts, both rural and non-rural. Future research should identify causal suicide protection factors in farm youth.

KEYWORDS

Farm; youth; suicidality; cohort

Introduction

Suicide is among the top three causes of death in U.S. youth age 9–17 years,¹ and the United States has the seventh highest youth suicide rate across developed nations.² There have been some reductions in suicides in U.S. youth and young adults,³ but compared to their urban and suburban counterparts, suicide rates remain ~50% higher in rural U.S. adolescents.⁴ The influence of farming on youth suicides is unclear. Some national data suggest farm workers have the fourth highest suicide rate among employed adult males,⁵ but others found farmer suicide rates trend close to the general population.⁶ Ecological analyses have observed lower suicide risk in counties that are economically dependent on farming.⁷ To the extent suicide risk differs in farm youth, it could reflect differences in cognitive-behavioral or socio-environmental risk factors.

Increased youth suicides are concerning, but suicidal behavior is elusive to predict.⁸ Early recognition of suicidal ideation is among the key elements of prevention.⁹ There are no known prior studies comparing suicidality in farm vs. non-farm youth, though. The purpose of this study was to compare medically attended suicidality between youth who live on farms and in rural/non-rural areas.

Methods

Design and setting

Cross-sectional analyses were conducted using data from the Wisconsin National Children's Center for Rural and Agricultural Health and Safety Surveillance (WINS) system. As described elsewhere,¹⁰ WINS is a cohort of youth patients of

the Marshfield Clinic Health System (MCHS; Marshfield, WI) who are under surveillance for agricultural injuries across a 20-county region of north-central Wisconsin.

Participants

The sample included individuals who, between January 1, 2017 and December 31, 2022, (1) were age 5–17 years of age for ≥ 90 days, (2) had ≥ 1 MCHS medical encounter, and (3) had reasonably complete capture of their medical care within MCHS data systems, as evidenced by (a) medically home to a MCHS medical center, (b) member of the MCHS-affiliated Security Health Plan of Wisconsin, or (c) resident of the Marshfield Epidemiologic Study Area.¹⁰ All procedures were approved by the MCHS Institutional Review Board, with waivers of HIPAA authorization and informed consent.

Suicidality

The outcome was medically attended suicidality, ascertained from MCHS electronic health records (EHR) and claims data. We screened for the International Classification of Diseases (ICD) version 10 diagnostic codes indicative of suicidal ideation or attempt that presented to ambulatory, urgent/emergency, or inpatient care settings. Healthcare Cost and Utilization Project Clinical Classification Software (HCUP-CCS) was used,¹¹ which roles-up 367 unique ICD codes mapped to suicidal ideation and intentional self-harm (5.13). Any individual with a suicidality code observed during 2017–2022 was defined as a case. There were 40 cases randomly selected for chart audit by the first author, which included review of clinical notes to confirm suicidality.

Farm and rural residence

Using linked data in WINS,¹⁰ the exposure was farm and rural residence. Youth who lived at a residential address that had evidence of agricultural production (per a commercially available listing of area farm producers, and/or state dairy licensing information) anytime in 2017–2022 were categorized in the farm group. The non-

farm group was further divided by those who lived in rural vs. non-rural ZIP codes, per Rural Urban Commuting Area scores from Census-estimated population density and commuter volume to metropolitan areas.¹²

Analyses

Multivariable logistic regression was used to examine the association between suicidality and farm/rural residence. The model included several *a priori* specified covariates based on their potential to confound suicidality-farm/rural associations, including age (quartiles) at last follow-up, sex, race/ethnicity, health insurance, and a composite measure of chronic medical conditions (indicative of diabetes, cardiovascular disease, asthma, and others – diagnostic codes available upon request).

Results

The sample included 2,010 youth who lived on farms, plus 29,648 non-farm rural, and 22,252 non-farm non-rural youth. Differences between the three groups were most notable for race/ethnicity and health insurance (Table 1). In the two non-farm groups, there were more individuals with non-White or Hispanic race/ethnicity and public-assisted health insurance. Suicidality cases ($n = 898$) were observed in 0.8% of farm, 1.8% of non-farm rural, and 1.6% of non-farm non-rural youth. Among suicidality cases, 68% were female, with 1% aged 5–8 years, 3% aged 9–11 years, 29% aged 12–13 years, and 67% aged 14–17 years. Cases mainly presented in ambulatory (57%) or emergency room (33%) settings. Suicidality was confirmed in 38 (95%) of the 40 randomly selected cases for chart audit. One was undeterminable due to insufficient clinical data, and the other was a miscode of self-injurious behavior without suicidal intent.

Relative to non-farm non-rural youth, farm youth had significantly lower odds of suicidality (adjusted odds ratio [aOR] [95% confidence interval; CI] = 0.55 [0.33, 0.91], $P = .019$), while non-farm rural youth had significantly greater odds of suicidality (aOR [CI] = 1.21 [1.05, 1.40], $P = .007$) (Table 2). With the exception of race/ethnicity, all covariates

Table 1. Characteristics of north-central Wisconsin youth age 5–17 years who live on farms, as well as non-farm youth who live in rural and non-rural areas.

	Farm (<i>n</i> = 2,010)	Non-farm, rural (<i>n</i> = 29,648)	Non-farm, not rural (<i>n</i> = 22,252)
Age (y)	11.7 ± 3.7	11.1 ± 3.7	11.3 ± 3.8
Gender			
Female	946 (47%)	14,494 (49%)	10,791 (48%)
Male	1,064 (63%)	15,154 (51%)	11,461 (52%)
Race/Ethnicity			
White, non-Hispanic	1,658 (82%)	22,341 (75%)	15,796 (71%)
Non-White or Hispanic	127 (6%)	3,810 (13%)	4,030 (18%)
Unknown	225 (11%)	3,497 (12%)	2,426 (11%)
Health insurance			
Private	762 (38%)	8,782 (30%)	6,391 (29%)
Public-assisted	1,122 (56%)	19,526 (66%)	14,879 (67%)
None or unknown	126 (6%)	1,340 (5%)	982 (4%)
Chronic medical condition	475 (25%)	8,370 (28%)	5,819 (26%)

Values are reported as mean ± SD or frequency (% of total).

were significant independent predictors of suicidality. To better illustrate this association, model-based estimates of suicidality risk per 10,000 youth aged 5–17 years are summarized in Figure 1. Youth who lived in a rural area, but not on a farm, had the highest risk of suicidality at 37 (CI: 29, 48) per 10,000, whereas farm youth had the lowest risk of suicidality at 17 (CI: 10, 29) per 10,000.

Discussion

Between 2017 and 2022, medically attended suicidality affected nearly 2% of WINS youth aged 5–17 years. How this compares to studies in broader regions is difficult to estimate, given wide-ranging methodological differences in data sources and definitions. Suicidal ideation or attempt is typically

Table 2. Multivariable logistic regression model of suicidality risk among north-central Wisconsin youth age 5–17 years who live on farms, as well as non-farm youth who live in rural and non-rural areas.

	Suicidality (yes vs. no) Multivariable adjusted odds ratio (95% confidence interval), <i>P</i> -value
Residence	
Farm vs. Non-farm, not rural	0.55 (0.33, 0.91) <i>P</i> =.019
Non-farm, rural vs. Non-farm, not rural	1.21 (1.05, 1.40) <i>P</i> =.007
Age	
Q1: 5–8 yrs vs. Q4: 14–17 yrs	0.01 (0.01, 0.02) <i>P</i> <.001
Q2: 9–11 yrs vs. Q4: 14–17 yrs	0.05 (0.04, 0.08) <i>P</i> <.001
Q3: 12–13 yrs vs. Q4: 14–17 yrs	0.44 (0.38, 0.51) <i>P</i> <.001
Sex	
Male vs. female	0.43 (0.37, 0.50) <i>P</i> <.001
Race/ethnicity	
Non-White or Hispanic vs. White, non-Hispanic	1.03 (0.86, 1.23) <i>P</i> =.774
Unknown vs. White, non-Hispanic	0.82 (0.61, 1.09) <i>P</i> =.168
Health insurance	
Public-assisted vs. private	3.25 (2.63, 4.01) <i>P</i> <.001
None or unknown vs. private	0.18 (0.05, 0.75) <i>P</i> =.019
Chronic medical condition	
Yes vs. no	2.81 (2.45, 3.23) <i>P</i> <.001

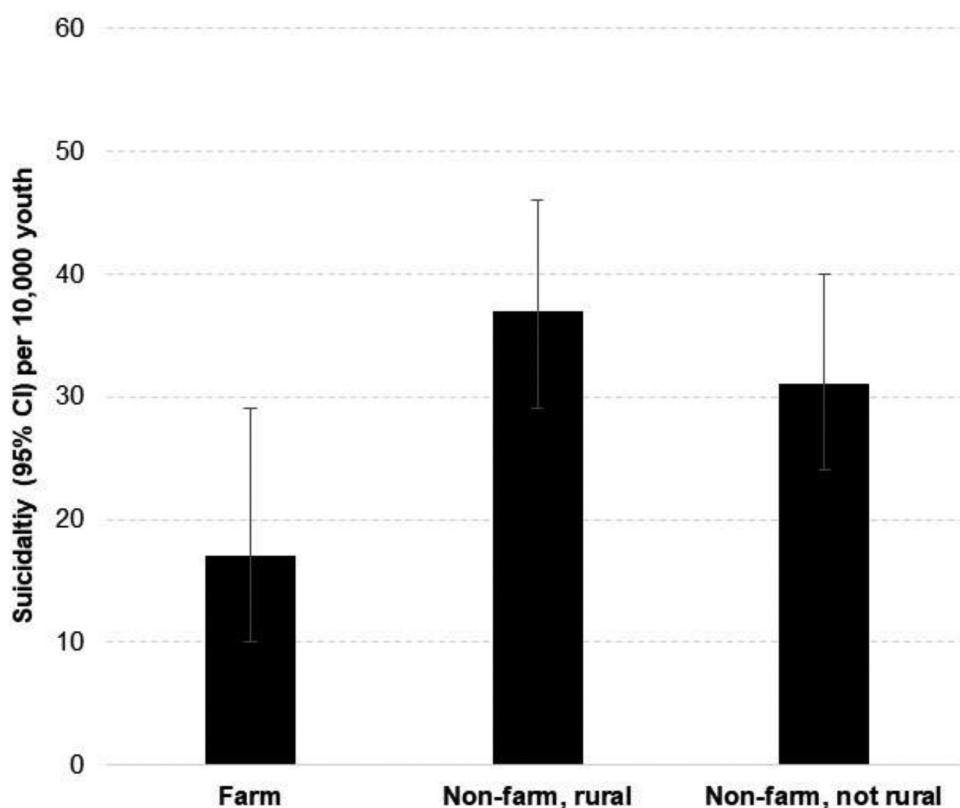


Figure 1. Estimated period prevalence (2017–2022) of medically attended suicidality in north-central Wisconsin youth age 5–17 years who live on farms, as well non-farm youth who live in rural and non-rural areas.

assessed through self-reporting, where it is clear that suicidality is more common (impacting ~one in six adolescents annually).¹³ Youth suicidality in WINS typically presented as an initial parent call to an MCHS clinic, followed by referral to the emergency room. Compared to self-report, medically attended suicidality is perhaps more severe or proximally associated with suicidal behavior, as there remains a stigma to disclose suicidal thoughts to doctors.¹⁴

WINS youth who lived on farms were less likely to experience suicidality as compared to their non-farm counterparts, particularly in rural areas. This was somewhat surprising given prior research that implied higher rates of rural suicides are partially driven by farm-related factors (e.g., agricultural economy downturns, firearms ownership),¹⁵ as well as national data showing adult male farmers have higher suicide rates than other employed groups.⁵ Notably, youth in WINS were farm residents. While they lived in a farming environment and were likely exposed to

some degree of farm work, they were mainly children of farm owners/operators. Thus, their socioeconomic background may be more favorable than families of hired farm laborers. Our findings were more consistent with ecological analyses that found suicide rates were higher across U.S. rural counties, but lower in the subset of counties most economically dependent on farming.⁷

Farms may be something of an enclave within rural regions, but reasons for possible protection against medically attended suicidality remain speculative. Children who grow up on farms are likely exposed to green space and its associated emotional benefits,¹⁶ and typically have early life exposures to animals that confer health benefits such as less asthma, atopic disease, and obesity.^{17–19} Social support, familial connectedness, and shared norms may also be stronger in farm families and could protect against affective disorders.^{20,21} In contrast, some cross-sectional surveys found farm adolescents have more depression and anxiety symptoms compared to general

adolescent populations.²² Such symptoms are not synonymous with suicidality, but our outcome was dependent on medical presentation, and our findings could also reflect farm parents' greater propensity to avoid seeking care for mental health conditions in their children, as has been observed in some adult farmers²³ (along with fewer clinical warning signs before suicide).²⁴

Strengths of this study included the reuse of data within an existing surveillance system that tracks agricultural injuries.¹⁰ Individual-level regional healthcare data in WINS offer some advantages (e.g., "upstream" precursors, farm attribution) over typical aggregate suicide surveillance systems in federal or other area-level datasets.^{7,25} The assessment of suicidality was a strength insofar as it relied on objective EHR and claims data from multiple medical settings, but this approach is less sensitive than self-report, because it only captures the subset of youth with clinically recognized suicidality. In addition, some fraction of suicidality cases are likely miscoded due to self-harm without suicidal intent. Generalizability is limited by WINS' north-central Wisconsin catchment area. The farm group was defined by residency, thus future research, in addition to looking at unmeasured potential confounders (e.g., parents' mental healthcare attitudes), should examine youth who do not live at the farm on which they or their parent(s) work. Suicidality risk could also vary by different farm types (e.g., commodity, acreage, employees, revenue), and it would be informative to stratify suicidality outcomes by ideation (cognition) vs. attempt (behavior).

Despite increased suicides across the United States,^{1,2} youth who live on farms are less likely to experience medically attended suicidality. Causal explanations are unknown, but underscore the need for more studies on child-rearing elements that differentiate farms, including socio-familial cohesion, interactions with livestock, or lower propensity to seek mental healthcare. This could help inform future interventions designed to better recognize and prevent suicide in youth.

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Disclosure statement

The authors have no relevant financial or non-financial competing interests to report(s).

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Data availability statement

The data that support the study conclusions are unavailable for public access because informed consent to share said data (beyond the research team) was not obtained from study participants.

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