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Farmer Suicides Among States Reporting Violent Deaths, 2003 – 2017

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Abstract

Research suggests that farmer suicide rates are at least two-fold higher than the general population. In estimating rates, prior research considered suicide events among farmers together with farmworkers, fishing, and forestry occupations and included non-farming populations in the defined at-risk populations (i.e., denominators). In this study, we sought to define and differentiate farmer suicide decedents from other agricultural occupations, estimate U.S. farmer suicide rates, and evaluate rate time trends. Farmer suicide decedents were ascertained from the 36 states in the National Violent Death Reporting System (NVDRS) from 2003–2017 using NVDRS occupation data. Farmers were defined as persons responsible for day-to-day farm decisions and operations. An expert panel was convened to classify farmer occupations. Rates were calculated using Census of Agriculture-identified farmers as the rate denominator, and time trends were evaluated using regression. Due to a low number of female decedents, female farmer suicide rates were not estimated. We identified1,575 male farmer suicide decedents and 77 female farmer decedents from the NVDRS during the study period. Aggregated age-specific male farmer suicide rates were highest among farmers ages 65 years and older (22.0/100,000). Estimated suicide rates for male farmers were highest during 2003 (31.8/100,000) and lowest during 2005 (19.2/100,000). Trend analysis revealed a statistically significant 2.4% annual percent change (APC) in rates over the 15-year study period. Suicide rates among male farmers showed evidence of an increase from 2003–2017. Farmer suicide rates parallel the rates of the U.S. population; thus, farmer suicide remains a public health concern.

Keywords

agriculture; farmers; farmer suicide; rural mental health challenges

Farmers are the foundation of agricultural production and are responsible for day-to-day farm operations (National Agricultural Statistics Service, 2019). Most farmers report strong emotional ties to their land and view farming as a lifestyle, although it is a stressful and

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hazardous occupation (Amshoff & Reed, 2005). The physical, chemical, and environmental hazards of farming are well-documented, with farming exposures demonstrating associations for increased traumatic injuries; musculoskeletal disorders; chronic respiratory disease; certain cancers; and mental health challenges, such as depression and high stress (Blair et al., 2005; Nordgren & Bailey, 2016; Osborne et al., 2012). Worldwide, farmers report and attribute elevated stress to unpredictable forces linked to adverse weather patterns, fluctuating commodity markets, machinery breakdowns, social isolation, and fiscal and interpersonal relationship problems (Booth & Lloyd, 2000; Fraser et al., 2005; Kearney et al., 2014). The combined exposure to farm hazards and stress is linked to increased farmer suicide (Judd et al., 2006; Malmberg et al., 1999).

Several studies of Australian farmer suicide have documented elevated suicide mortality among farmers compared to the general population (Arnautovska et al., 2014; Page & Fragar, 2002). More recently, Arnautovska et al. (2014) documented elevated suicide incidence for farmers aged 34 and younger (incidence rate ratio [IRR]=3.7) and over age 55 (IRR=2.0) compared to non-farming populations, with a total of 5,608 farmers dying by suicide during the study period. India's farmers are experiencing the deleterious effects of socioeconomic factors, shifting agricultural production, and subsequent fiscal problems resulting in about 16,000 farmers dying by suicide, annually (Merriott, 2016). Similar findings have been reported for Canadian farmers and farmers in the United Kingdom, showing that farmer suicide is both a global and national concern (Fraser et al., 2005; Pickett et al., 1999).

In the U.S., suicide is an ongoing public health concern with national rates rising by 30% between 1999 and 2017 (National Institute of Mental Health, 2019). The growing body of epidemiologic literature uniformly documents elevated suicide rates for occupations like farming, and shows occupational exposures are associated with excess suicide mortality. However, suicide studies are inconsistent when comparing farming to similar occupations and the general population (Browning et al., 2008; Peterson et al., 2018; Ringgenberg et al., 2018; Stallones et al., 2013). Further, agriculture-specific suicide studies show disproportionate suicide mortality among older male versus female farming populations (Kennedy et al., 2021; Miller & Burns, 2008).

While there is much agreement in the farmer suicide literature, there is also heterogeneity. In a study using NVDRS data, farmers over age 65 had higher adjusted odds (aOR=2.01) of suicide relative to farmers ages 15–24, while the odds of suicide for male farmers was five-fold higher (aOR=5.53) compared to female farmers (Kennedy et al., 2021). Lavender et al. (2016), in a study of violent deaths among Georgia workers, estimated that suicide mortality for farming, fishing, and forestry workers was more than double (SMR=2.9) that of all other occupations. A Colorado study showed that suicide rates among farming, fishing, and forestry workers were 73% higher than construction and extraction occupations, and 8% higher than production occupations (Stallones et al., 2013). By contrast, another study using NVDRS data reported that farming, fishing, and forestry worker suicide rates were 49% lower than construction and extraction occupations (Peterson et al., 2018). Further, the rates for farm managers were higher than construction and extraction occupations during 2012 but 49% lower for 2015. Arif et al. (2021), however, documented higher modeled

rate estimates for farmworkers (28.7 per 100,000) than for farmers (22.3/100,000), farm managers (21.6/100,000), and farming, fishing, and forestry (15.3/100,000) occupations.

When farmer suicide decedents are classified using standardized occupation codes, the suicide rate estimates are distorted because farmers are combined with farmworkers and other agricultural occupations. Farmers experience unique suicide exposures, but prior research has not differentiated the suicide mortality between farmers, farm workers, and other agricultural workers (Fraser et al., 2005; Judd et al., 2006; Kennedy et al., 2021; Scheyett et al., 2019). Most farmer suicide studies include farmworkers in their numerator and denominator to estimate suicide rates. However, incidence rates should reflect the number of new cases in a given time period, while the denominator should reflect the population at-risk, i.e., giving rise to the cases. Further, non-farmer denominator populations are not representative of background suicide risk, and non-farmer populations cannot give rise to farmer suicides. In the current study, we aimed to estimate farmer-specific suicide rates for 2003–2017 by using numerators and denominators restricted to farmers, defined as the persons responsible for day-to-day farm decision-making and operation. Lastly, we sought to compare farmer suicide rates to the general population and assess farmer suicide rate trends.

Methods

Data Sources

Study data were obtained from the NVDRS and the quinquennial Census of Agriculture (National Agricultural Statistics Service, 2004, 2009, 2014, 2019; National Center for Injury Prevention and Control, 2020). The NVDRS is a population-based surveillance system that collects violent death data from CDC-funded participating states using multiple sources, including death certificates, coroner and medical examiner reports, and law enforcement reports (Centers for Disease Control and Prevention, 2018). Data were abstracted from state-based records, then standardized to ensure accuracy of coding, and entered in the NVDRS with a manner of death reported by CDC-trained abstractors based on all available data. The NVDRS began reporting in 2003, and at the time of this study, 2017 was the most recent data year; thus, numerator data were obtained from the NVDRS for 2003–2017, with the total sample representing data from 36 participating states (National Center for Injury Prevention and Control, 2020). The study was approved by the University of Kentucky Institutional Review Board (IRB). Informed consent was not required by the IRB or CDC, as all study data were drawn from decedents.

Denominator data were obtained from the quinquennial Census of Agriculture for 2002, 2007, 2012, and 2017 to estimate the total number of farmers for each NVDRS participating state throughout the study period. The National Agricultural Statistics Service (NASS), a division of the US Department of Agriculture, completes the Census of Agriculture every five years, which aims to conduct a complete count of U.S. farms and ranches and the people who operate them (National Agricultural Statistics Service, 2004, 2009, 2014, 2019). Farm-level data are reported for farms and ranches and the persons operating them “if $1,000 or more of agricultural products were produced and sold, or would normally have been sold, during the census year” (National Agricultural Statistics Service, 2004).

Suicide Ascertainment

Suicide decedents were initially ascertained from the NVDRS using the "death manner per abstractor" variable; this identified 196,747 suicide decedents for the study period.

Farmer occupation ascertainment—An initial list of terms derived from the Bureau of Labor Statistics (BLS) Standardized Occupational Codes (SOC) and major commodity types listed in the Census of Agriculture were used to create a list of terms to search the NVDRS industry and occupation text variables for agricultural occupations (National Agricultural Statistics Service, 2004, 2019; Office of Management and Budget, 2018). Our final sampling process used 78 agricultural-specific occupational terms to systematically search the industry and occupation text variables and create a "farmer" indicator variable. Approximately 2,883 decedents were identified with agricultural occupations. Decedents were excluded if they did not have an agricultural occupation, or where their industry or occupation text fields indicated the decedent was unemployed, a student, an inmate, or where both industry and occupation text fields were missing data.

To classify decedent occupation as a farmer, we defined farmers based on BLS occupational definitions and the NASS definition for operators and producers, which classifies a farmer as the person primarily responsible for day-to-day decision-making for farm operations and management (National Agricultural Statistics Service, 2014, 2019; Office of Management and Budget, 2018). We convened a panel of agricultural and occupational research experts, consisting of three authors and one collaborator, with over 50 years of combined experience evaluating health and safety risks of farming populations, to independently classify the 2,883 suicide decedents with agricultural occupations as a "farmer" versus "farm, ranch, or other agricultural worker". Interrater classifications were compared, and where there was discrepancy in classification, the panel debated until a consensus was reached about the occupation classification. Decedents were excluded from case counts if the raters coded the occupation as a farm, ranch, or other agricultural worker based on BLS and NASS definitions. Examples of decedent industry and occupations excluded from case counts included those with an occupational designation as a "cowboy," "logger," farm laborer," "ranch hand," and "tree trimmer." Examples of accepted occupations included decedents whose industry and occupation text fields included "agriculture supervisor," "dairy farmer," "farmer," "rancher," or "farming manager."

Decedent characteristics—Decedents were characterized by incident year, reporting state, death manner per abstracter, age (in years) at death, sex, marital and education status, and occupation and industry text reported on the death certificate. We created categorical variables for race (white=1 and non-white=0), educational attainment (no degree/diploma=0; high school diploma/GED=1; some college/associates degree=2; and bachelor's degree and above=3); and relationship status (married/civil union/domestic partnership=0; single/never married=1; widowed=2; and divorced/separated=3). Similarly, we created three age groups (18–44, 45–64, and >64) from the decedent's age at the time of death reported in years; categories were selected to prevent small cell sizes and correspond to biological life epochs.

Defining the at-risk populations—Rate denominators were obtained from the Census of Agriculture for 2002, 2007, 2012, and 2017. We defined the at-risk population in two ways. Our first at-risk denominator population included operators and producers with demographic data reported in the Census of Agriculture for 2002, 2007, and 2012 and 2017, hereafter referred to as "farmers." To exclude farmers not solely dependent on farm income, we restricted the second at-risk denominator population to principal operators and producers reporting $5,000 or more in annual income receipts, hereafter referred to as "primary farmers." Our decision to restrict operators and producers to those reporting $5,000 or more in income was based on the median reported farm income during the study period and authors' field and research experience.

We used the EXPAND procedure in SAS 9.4® to interpolate the denominator population for intercensal years, thus estimating the total number of farmers at-risk annually throughout the study period (SAS Institute Inc, 2014). The 2010 U.S. Census and U.S. intercensal population estimates were used for rate standardization.

Analysis

We obtained frequencies for male and female farmer suicide decedents and compared those by age, race, educational level, and relationship status. Direct standardization was employed to estimate annual age-standardized farmer suicide rates. Because of low decedent counts, female farmers were excluded from rate calculations. Aggregated male farmer age-standardized rates were estimated for each NVDRS reporting state. States with 20 or fewer decedents throughout the study period were excluded from state-based rate calculations. We were unable to calculate age-standardized rates for "primary" male farmers because age categories were unavailable for the "primary" male farmer denominator population when restricting the reported farm income. Therefore, crude rates were calculated to compare "primary" male farmer suicide rates to U.S. male suicide rates.

We employed joinpoint regression to evaluate farmer suicide rates for points of inflection and assess for statistically significant rate trends. The National Cancer Institute initially developed joinpoint regression software to assess cancer trends; however, several studies have used the software to assess suicide trends (Bando et al., 2012; Thomas et al., 2011; Vichi et al., 2008). The analysis uses Poisson regression with an application of a Monte-Carlo permutation test to sample the rate data and identify trend line (points) changes both in direction and magnitude (Bando et al., 2012; Kim et al., 2000). The regression model starts with the least number of joinpoints and tests if one or more joinpoints are statistically significant, then adds them to the model. Joinpoints indicate a statistically significant shift in the slope (Bando et al., 2012; Kim et al., 2000; Thomas et al., 2011) and thus a change in the rate. Further, the regression model delivers a precise mortality trend estimate based on non-probability analysis and calculates the annual percent change (APC) for the identified time segments on each side of the inflection points (Bando et al., 2012; Kim et al., 2000). Based on preliminary analyses, we directed the model to assess for three joinpoints and applied a probability of 0.05 to the permutation and trend test. All data cleaning, coding, and rate calculations used SAS 9.4® software for Windows, while trend analysis employed the

joinpoint regression program, Version 4.8.0.1 for Windows (Joinpoint Regression Program, Version 4.8.0.1, 2020; SAS Institute Inc., 2013).

Results

We identified 1,652 farmer suicide decedents from 196,747 suicide decedents in the NVDRS between 2003 and 2017. Table 1 shows there were 1,575 male farmer suicide deaths and 77 female farmer suicide deaths. The average age of male farmer decedents was 61.3 years (SD=19.6) and was 54.2 years (SD=17.5) for female farmer decedents. Most deaths occurred among males older than 65 years (47%), followed by males between 45 and 64 (31.6%). Female farmer suicide deaths were most common among those between 45 and 64 years of age. Ethno-racial distributions showed that most farmer suicide deaths occurred among white farmers. The majority of male (36.7%) and female (45.3%) farmer decedents held a high school diploma or GED, with a smaller proportion holding a bachelor's degree or above. Most decedents were married, while 23.5% of male decedents were single or never married. A small proportion (22.1%) of female decedents were widowed.

As shown in Table 2, the age-standardized male farmer suicide rates ranged from 8.81/100,000 to 19.37/100,000 throughout the 15-year period. Aggregated age-specific suicide rates were highest among male farmers 65 years and older (22.03/100,000), followed by those between 18 and 44 (15.9/100,000), with lowest rates for those 45 to 64 (9.96/100,000). Table 3 shows state-based rates, which varied considerably throughout the study period.

As shown in Figure 1, the lowest suicide rate for "primary" male farmers was 19.2/100,000 during 2005, and highest was 31.8/100,000 in 2003. The rates for "primary" male farmers were comparable to U.S. male suicide rates but exceeded the suicide rates of U.S. males during 2003, 2004, and 2007. Both "primary" male farmers and U.S. male suicide rates were 26.0/100,000 in 2010 and 2014. By contrast, the suicide rates for male farmers were lower than those of U.S. males.

Visualization of the rates revealed potential joinpoints in the rates for 2005, 2007, and 2008. However, the joinpoint regression analysis did not indicate statistically significant joinpoints in the crude or age-standardized rates. The regression analysis demonstrated a statistically significant increasing slope ($p<0.05$) for age-standardized rates for male farmers between 2003 and 2017. Further, the model showed a statistically significant APC of 2.44 ($p<0.05$) for age-standardized male farmer suicide rates for the 15-year study period.

Discussion

This study reports the total number of farmer suicide decedents and estimates rates over 15 years using violent death data and a farming population as the denominator. The critical contributions of this study include identification of farmer suicide decedents, age-specific male farmer suicide rates, a comparison of "primary" farmer suicide rates to U.S. male suicide rates, and an evaluation of rate trends.

As found in other studies, the highest proportion of suicides in this study occurred among older white male farmers (Browning et al., 2008; Ringgenberg et al., 2018). Additionally, prior farmer suicide studies using similar study periods reported higher counts of farmer suicide decedents; whereas, studies using national and occupational violent death data documented lower counts of suicide decedents for farming, fishing, and forestry occupations (Kennedy et al., 2021; Peterson et al., 2018; Ringgenberg et al., 2018; Scheyett et al., 2019). The lower counts for farmer suicide decedents in our study suggest methodological differences between studies attributable to the occupational classification of decedents.

The two main occupational classification methodologies employed by most studies include using BLS SOC codes, which group farmers and agricultural workers with fishing and forestry occupations, or restricting the sample to persons who meet the BLS SOC code definition of a farmer, farm manager, and farmworker (Peterson et al., 2018; Stallones et al., 2013). Here, we operationalized BLS occupational definitions, along with the operator and producer definitions from the Census of Agriculture, and convened an interrater panel to classify occupations for those decedents who fit those definitions. For this study, it is important to note that the denominator for calculating rates includes individuals who fit this definition of farm decision-making including farm management. However, because the NASS census includes any farm which produces $1000 or more in agricultural products, many individuals in the denominator may not depend upon farming for substantial income and thus may not then have the same risk factors as individuals who depend largely upon farming for their income (National Agricultural Statistics Service, 2019). Also, it is possible that decedents who may have managed smaller farms would not have been noted to have a farming occupation. Therefore, farmer suicide case counts were likely lower in our study because other studies used national and state-based violent death counts that included agricultural, forestry, and fishing workers (Kennedy et al., 2021; Scheyett et al., 2019). Farmer suicide counts from the current study, however, were higher than those reported by Ringgenberg et al. (2017), who employed data from the Census of Fatal Occupation Injuries (CFOI). CFOI reports suicide deaths that occur on the job; thus, decedents are not counted if they died by suicide at a non-farm job (Ringgenberg et al., 2018). The higher counts and rates of farmer suicide reported in our study versus those documented by Ringgenberg et al. (2018) may be explained by the fact that most U.S. farmers live and work on their farms (National Agricultural Statistics Service, 2019).

The finding that older farmers have higher rates of suicide is consistent with prior farmer suicide research in the U.S., while rates for farmers between 18 and 44 years follows age-specific distributions for Australian and Canadian farmers (Browning et al., 2008; Stallones, 1990). In a study of Australian farmers, the aggregated rate for male farmers was highest among male farmers under 35 years of age (44.85/100,000), which did not exceed combined study rates (Arnautovska et al., 2014). Comparably, Canadian male farmer suicide rates showed the highest rates for males between 40 and 59 years (Pickett et al., 1999). The risk of suicide among older male farmers are well-documented to include poor physical health, relationship and fiscal problems, farm stress, and farm loss (Booth et al., 2000; Booth & Lloyd, 2000; Freeman et al., 2008; Scheyett et al., 2019). However, elevated rates among male farmers under 44 is concerning given that suicide is the second leading cause of death for persons between ages 18 and 34.

Circumstantial factors associated with farmer suicide include access to lethal means, poor physical health, and fiscal and relationship problems; however, circumstantial factors do not explain the higher rates of suicide in younger farmers. In the U.S., younger adults are more likely than older adults to report stress from world events and fiscal problems and experience suicidal ideation from psychological work stressors (American Psychological Association, 2018; Choi, 2018). Arguably, younger farmers accepting more farm responsibilities may experience greater levels of job strain, job insecurity, and increased psychological demands, which are associated with suicide ideation (Choi, 2018; Rudolphi et al., 2020). Further, younger farmers may incur higher debt-to-income ratios and experience increased vulnerability to farming demands and unpredictable forces (Rudolphi et al., 2020). The elevated rates among younger farmers warrant further investigation.

The estimated annual male farmer suicide rates show distinct differences when using "primary" male farmers versus male farmers in the denominator compared to U.S. male suicide rates. Suicide rates calculated using male farmers in the denominator are inconsistent with prior research. Picket et al. (1999), however, suggested suicide rates for Canadian farm operators were lower than those of the general Canadian population (Browning et al., 2008; Peterson et al., 2018; Pickett et al., 1999; Stallones et al., 2013). Farmers working large farm operations with several farm managers and workers may not experience the same levels of social isolation, farm stress, and job strain compared to farmers on smaller, family-operated farms. By contrast, the elevated suicide rates using "primary" male farmers in our denominator are analogous to the rates of U.S. males and align with prior research. Moreover, the rates estimated by Arif et al. (2021) were comparable to "primary" male farmer suicide rates reported in this study, which potentially resulted from disaggregating farmers from farmworkers in that study.

There is concern about lower rates from 2003 through 2009 and the overall rate fluctuations throughout the study; however, trends analysis confirmed a statistically positive trend and positive annual percent change in farmer suicide rates. The early fluctuations in farmer suicide rates may result from incomplete data collection during the onboarding of states to the NVDRS. Unquestionably, there are cultural stigmas associated with suicide leading to underreporting of suicide deaths, which may contribute to the lower rates for male farmers than the general male population (Rockett, 2010). Nevertheless, underreporting, differing reporting periods for NVDRS states, and establishing best practices for reporting and abstracting violent deaths do not fully explain the notable shifts in farmer suicide rates.

In general, farmers report elevated stress from commodity losses, financial burdens, production changes, farm hazards, and commodity market prices. Moreover, farmers report they also have off-farm employment, with more than half of U.S. farmers reporting they worked 200 days or more on an off-farm job (National Agricultural Statistics Service, 2014, 2019). The underlying lower rates of farmer suicide, given the number of days worked off the farm, indicates that there is a bi-vocational nature to farming, thus farmers may be occupationally misclassified. However, the notable peaks in farmer suicides are plausibly attributable to underlying national and agricultural economic shifts in the U.S. that may have increased stress and mental health problems associated with farmer suicide (Booth & Lloyd, 2000; Fraser et al., 2005; Reed & Claunch, 2020).

Limitations

There were several limitations to this study. Our definition of "farmer" was based on the definitions set forth by BLS occupational classifications and operator or producer definitions utilized in the Census of Agriculture (National Agricultural Statistics Service, 2014, 2019; Office of Management and Budget, 2018). Although we believe that our occupational definition more accurately defines farmers, we cannot determine the number of decedents working off-farm jobs from the existing NVDRS database, nor can we draw inferences about off-farm occupational exposures for suicide. We cannot rule out underreporting of farmer suicide decedents, given that over half of U.S. farmers report working an off-farm occupation (National Agricultural Statistics Service, 2019). This study defined farmers based on occupation; however, young farmers and farm spouses responsible for day-to-day farm operations are likely undercounted because they may not self-identify as farmers (Brasier et al., 2014; National Institute of Statistical Sciences, 2017). Similar to problems identifying young and female farmers, only a small number of racial minority decedents were identified in this study. Research suggests minority farmers are undercounted and unrecognized, thus further investigation of suicide mortality among minority farmers is needed (Finkel, 2002; Hinson & Robinson, 2008; Wood & Gilbert, 2000). The ecological nature of the study prevents readers from drawing inferences about individual farmers and associated risk factors for suicide. Moreover, we could not report regional differences because of the low number of aggregated farmer suicide decedents among NVDRS participating states.

The NVDRS relies on CDC-funded states to gather and report violent death data for abstraction; however, practices and policies for investigation and reporting of violent deaths vary by state; therefore, the quality of data and reporting by the NVDRS may vary geographically and over time. Although occupation is a standard piece of information documented on death certificates, there are scant resources devoted to suicide investigations (Rockett, 2010). Public officials investigating suicides may not have resources to pursue decedent details or may not realize the importance of occupation data. Structured interviews may not always be conducted in suicide investigations. The possibility of cultural stigma surrounding suicide in rural and farming communities could also influence ruling the manner of death as a suicide and potentially reduce disclosure of self-directed violence behaviors or the presence of mental health problems by decedents to family and friends.

Public Health Implications

To help reduce farmer stress, and suicide risk, there are several evidenced-based and best practice prevention recommendations for rural communities and rural mental, medical, and public health professionals to consider. Recommendations include: 1) improving rural primary care providers' ability to detect and manage suicide risk; 2) improving public awareness through local events and media to reduce stigma and facilitate help-seeking behaviors, using farmers as key opinion leaders; 3) training farmers and rural community members as suicide prevention gatekeepers, social support facilitators, and peer-support specialists to reduce social isolation and stigma among farmers and to recognize mental health challenges, crisis, and suicide behaviors; 4) using evidence-based programs like QPR suicide prevention or LivingWorks ASIST to train gatekeepers that include specific

prevention actions, such as professional referrals and restricting access to lethal means during crisis; 5); providing targeted self-help and professional services for high-risk populations like farmers, rural youth, and older rural adults; 6) improving rural access to mental health care via telehealth and crisis hotlines; and 7) providing post-vention services in rural areas (Hogan & Grumet, 2016; Mohatt et al., 2018; Suicide Prevention Resources Center, 2017; van der Feltz-Cornelis et al., 2011).

In collaboration with public health professionals, medical and mental health professionals should consider integrative collaborations to increase concomitant pharmacologic and talk-therapy for mental health conditions. Systems-level prevention considerations should include implicit bias training about mental health conditions and suicide, zero suicide programs, educating social workers and health professionals about early use of evidenced-based mental health and suicide screenings, and the development of protocols to expedite mental healthcare consultation each of which are among best-practice recommendations for suicide prevention (Brodsky et al., 2018; Suicide Prevention Resources Center, 2017). Licensed mental health practitioners can provide suicide prevention gatekeeper training to social and healthcare professionals, such as medical assistants and administrative assistants and nurses (Tsai et al., 2011). Further, mental health and medical professionals can explore implementing screenings to identify farmers and their families who may utilize their services.

The alarming rise of farmer suicide rates is gravely concerning given the heightening input cost associated with farming, like fuel prices, along with commodity market volatility and farm production losses associated with climate change and natural disasters here in the U.S. and worldwide. In addition to the disturbing rise in farmer suicide, the occurrence of a suicide death has devastating emotional consequences on families and rural communities (Cerel et al., 2019). When a suicide death occurs, survivors can experience complicated grief and a reduction in emotional and fiscal resources leading to greater incidence of mental health conditions and future suicide behavior among persons close to the decedent. Not only is more research needed on the predictors of farmer suicide, but also on the efficacy of tailored interventions to bolster protective factors and reduce risk factors for farmer suicide.

Given the national focus on farmer suicide, farm stress, and rural mental health, it is important to train rural community members in early intervention due to the shortage of mental health professionals in rural areas and associated access barriers. To help eliminate access barriers, policy makers can recommend modification to payer systems that restrict mental health access and reimbursements for those services.

Lastly, a collaborative priority among policy makers, licensed professionals and their professional organization should include expanding the mental health workforce to meet the increasing needs of rural communities. Culturally sensitive training and continuing education is an imperative practice consideration because of the stigma about rural communities that are often held in urban settings and training programs (Magnus & Advincula, 2021). Consequently, urban residents and trainees do not face the same practice access and availability challenges found in rural communities and thus, they may not fully comprehend the rural barriers to receiving mental health services.

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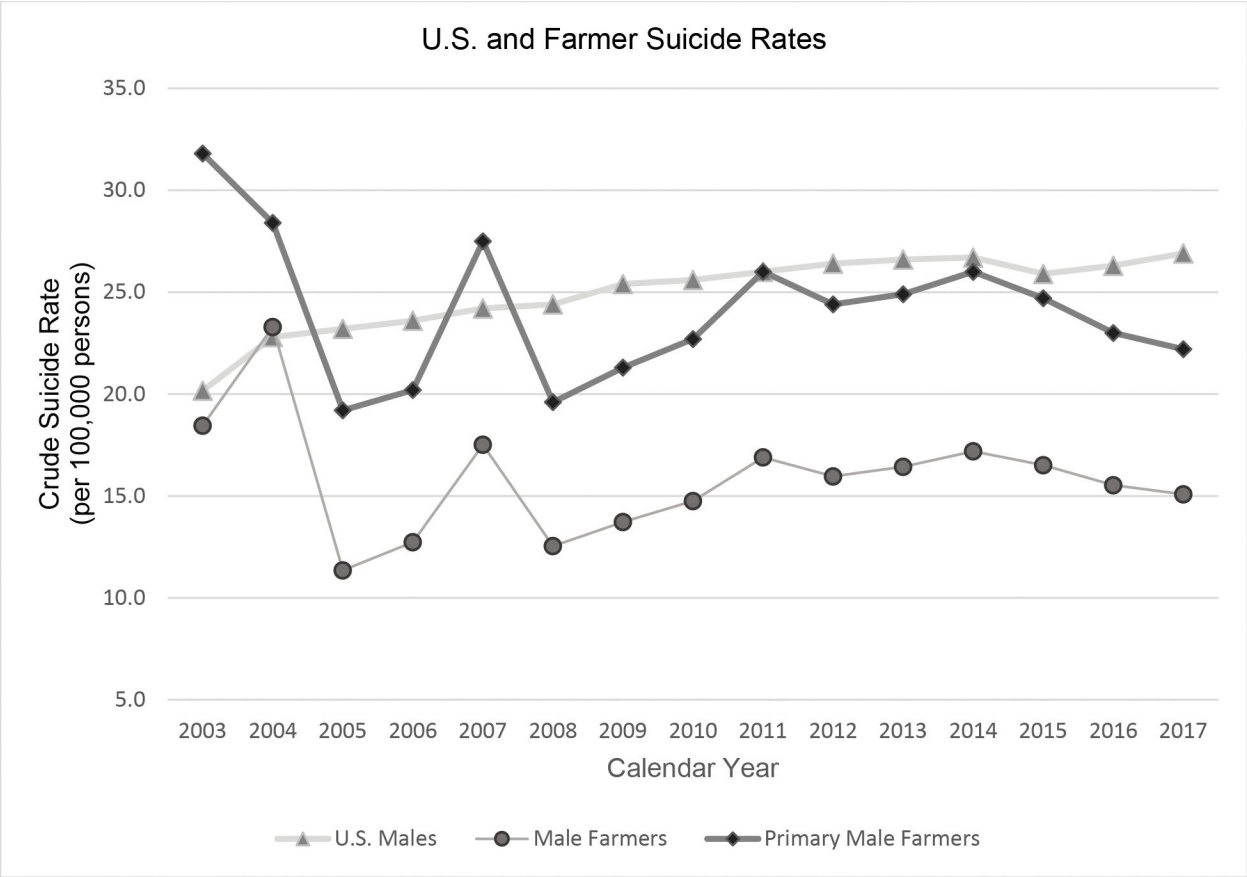

Figure 1.

Note: The figure compares the crude suicide rates for males in the U.S., male farmers, and primary farmers for the study period

Table 1

Farmer Suicide Demographics by Sex – National Violent Death Reporting System – 36 States, 2003–2017

Baseline demographics	Males		Females	
	n	%	n	%
Age Group				
18–44	338	21.46	20	25.97
45–64	497	31.56	39	50.65
>64	740	46.98	18	23.38
Race, N (%)				
White	1478	93.84	74	96.1
Non-White	97	3.9	*	*
Education Level				
No Degree/Diploma	280	18.42	8	10.67
High School Diploma or GED	558	36.71	34	45.33
Some college/Associates degree	222	14.61	16	21.33
Bachelor's degree and above	460	30.26	17	22.67
Marital Status				
Married/Civil Union/Domestic Partnership	681	43.57	33	42.86
Single/Never Married	368	23.54	13	16.88
Widowed	231	14.78	17	22.08
Divorced/Separated	283	18.11	14	18.18

Note. *N=1652* (*n=1575* for males and *n=77* for females). Male farmer decedents were 61.25 years old (*SD=19.62*) while female farmer decedents were 54.17 years old (*SD=17.25*), on average.

*reflects suppressed values due to small cell size. Missing values are excluded.

Table 2

Crude and Age-standardized, Male Farmer Suicide Rates per 100,000 Persons by Year – National Violent Death Reporting System – Census of Agriculture, 2003–2017.

Year	Crude		Standardized	
	Rate	95% CI	Rate	95% CI
2003	18.45	12.16 – 26.85	17.91	9.49 – 26.33
2004	17.61	13.98 – 21.89	15.19	11.11 – 19.27
2005	11.35	8.80 – 14.42	8.81	6.22 – 11.40
2006	12.73	10.01 – 15.96	10.78	7.69 – 13.86
2007	17.51	14.29 – 21.23	16.67	12.62 – 20.72
2008	12.54	9.83 – 15.77	9.56	6.85 – 12.28
2009	13.72	10.86 – 17.10	13.63	9.81 – 17.46
2010	14.75	11.77 – 18.26	14.39	10.45 – 18.34
2011	16.89	13.87 – 20.38	16.18	12.31 – 20.05
2012	15.96	13.02 – 19.38	17.03	12.82 – 21.24
2013	16.43	13.44 – 19.89	19.37	14.73 – 24.00
2014	17.19	14.24 – 20.57	16.67	12.87 – 20.47
2015	16.51	13.99 – 19.36	17.34	13.91 – 20.76
2016	15.52	13.42 – 17.87	15.29	12.67 – 17.92
2017	15.08	13.08 – 17.29	16.52	13.72 – 19.32

Note. Rates use Census of Agriculture denominator data. Age-standardized rates are directly adjusted to the US male population for each year as the referent.

CI denotes the confidence interval.

Table 3

Aggregated Age-standardized Male Farmer Suicide Rates per 100,000 Persons by State – National Violent Death Reporting System – Census of Agriculture, 2003–2017.

State	Crude		Standardized		NVDRS Reporting Period
	Rate	95% CI	Rate	95% CI	Years
California	24.31	14.63 – 37.96	25.55	9.07 – 42.03	2017
Colorado	21.20	17.46 – 25.51	22.45	16.95 – 27.94	2004 – 2017
Georgia	17.41	14.33 – 20.95	17.09	12.77 – 21.41	2004 – 2017
Iowa	14.26	9.40 – 20.74	14.32	7.93 – 20.70	2016 – 2017
Kansas	15.59	10.52 – 22.26	10.01	5.72 – 14.30	2015 – 2017
Kentucky	17.33	14.08 – 21.10	17.82	13.58 – 22.06	2005 – 2017
Maryland	19.23	13.61 – 23.39	17.34	10.18 – 24.50	2003 – 2017
Michigan	19.06	13.61 – 25.95	22.40	14.23 – 30.58	2014 – 2017
Minnesota	18.35	13.28 – 24.72	19.37	12.45 – 26.28	2015 – 2017
New Mexico	20.75	15.91 – 26.60	28.19	19.32 – 37.06	2005 – 2017
New York	21.16	13.41 – 31.75	22.61	11.57 – 33.65	2015 – 2017
North Carolina	21.93	18.81 – 25.54	19.48	15.63 – 23.33	2004 – 2017
Ohio	10.26	7.83 – 13.20	9.18	6.51 – 11.84	2011 – 2017
Oklahoma	11.94	10.04 – 14.09	10.45	8.33 – 12.57	2004 – 2017
Oregon	17.92	14.60 – 21.77	20.16	15.16 – 25.16	2003 – 2017
South Carolina	12.68	9.38 – 16.77	13.35	8.47 – 18.24	2003 – 2017
Utah	10.56	6.96 – 15.36	11.02	5.47 – 16.58	2005 – 2017
Virginia	15.66	12.89 – 18.84	14.08	10.56 – 17.61	2003 – 2017
Wisconsin	16.52	14.20 – 19.11)	16.28	13.56 – 18.99	2004 – 2017

Note. Rates were not calculated for the following states because of low decedent counts. Excluded states include AK, AZ, CT, DE, HI, IL, IN, ME, MA, NV, NH, NJ, PA, RI, VT, WA, and WV.