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Characteristics and Contextual Stressors in Farmer and Agricultural Worker Suicides in Georgia From 2008–2015

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Farmers and agricultural workers are at elevated risk of suicide. The majority of farmer suicide research has been completed in Australia; less is known about farmer suicide in the United States and in specific regions of the country. This study addressed this knowledge gap by examining suicide data for farmers and agricultural workers from the Georgia Violent Death Reporting System, 2008–2015. We found that farmers who died by suicide were predominantly male, White, non-Hispanic, and older, with slightly fewer than half being married, and half having a high school education or less. The most common means of death was gunshot wound (78%), followed by hanging (16%). The contextual factors most frequently reported to be associated with suicide were relationship conflict or loss (25%) and health problems (25%), including chronic pain and decreased function. Financial problems (12%) and substance use (11%) also were associated with suicides. In 21% of cases, the individual was reported to have made prior suicidal threats; however, family members were reported to often discount these indicators. These findings suggest that suicide prevention programs might include suicide education for community members in rural areas. Rural health care providers could be trained in suicide risk detection and referral actions for farmers with illness, pain, or loss of functioning, and service providers who may be aware of farmer relationship problems—clergy, funeral home directors—also could be trained. Additional research is needed to gain deeper understanding of risk factors for farmer suicide and to design and test possible interventions.

Keywords: suicide, farmer, agricultural worker, mental health, rural

Farmers and agricultural workers, that is, those who operate, own, or work on an agricultural enterprise involving livestock or crops, are at elevated risk of suicide, both in the United States and internationally. A study of violent deaths by occupation from the Centers for Disease Control and Prevention (CDC) found that the occupational group Farming, Fishing, and Forestry had the third highest rate of suicide (CDC, 2018a). Other studies have found similarly elevated rates nationally (Ringgenberg, Peek-Asa, Donham, & Ramirez, 2018) and in three Southeastern states (Browning, Westneat, & McKnight, 2008). At a more granular level, an examination of suicides among Georgia workers found that those in the occupational group Farming, Fishing, and Forestry had a rate of 50.7 per 100,000 in comparison with 14.9 per 100,000 for the overall population of workers ages 16 and above (Lavender, Ramirez-Irizarry, Bayakly, Koplan, & Bryan, 2016). International data show similar patterns, with elevated rates of suicide in farmers noted by the World Health Organization (2006), in England (Booth, Briscoe, & Powell, 2000), and in India (Merriott,

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2016). Farmer suicide has been studied extensively in Australia, with rates significantly above that seen for the overall employed population (Andersen, Hawgood, Klieve, Kõlves, & De Leo, 2010), although significant regional variation has been noted (Arnautovska, McPhedran, Kelly, Reddy, & De Leo, 2016).

Multiple factors may contribute to the elevated risk of suicide in farmers and agricultural workers. Using a social ecological framework (Cramer & Kapusta, 2017), these factors can be seen at the individual, interpersonal, community/local environmental, and larger societal levels. Issues within the individual may include health problems, especially those linked with the physical demands of farming, injury, and pain (Kunde, Kõlves, Kelly, Reddy, & De Leo, 2017; Rayens & Reed, 2014). In addition, farmers may experience elevated rates of depression and mental illness, although findings in this area are mixed (Arnautovska et al., 2016; Fraser et al., 2005; Judd et al., 2006). Farmers have been shown to experience high levels of stress (often because of factors at the interpersonal, local, and societal levels, as discussed below), which can lead to depression (Kutek, Turnbull, & Fairweather-Schmidt, 2011; Sturgeon & Morrissette, 2010; Swisher, Elder, Lorenz, & Conger, 1998; Truchot & Andela, 2018). Finally, farmers are predominantly older and male; research has demonstrated higher rates of suicide among men than women and elevated rates in older populations (Garnham & Bryant, 2014), suggesting that internalized expectations of masculinity and struggles with identity and old age may be risk factors for suicide in farmers (Garnham & Bryant, 2014; Hogan, Scarr, Lockie, Chant, & Alston, 2012; Roy, Tremblay, & Robertson, 2014; Roy, Tremblay, Robertson, & Houle, 2017).

Interpersonal risk factors for suicide commonly experienced by farmers include the social isolation of rural areas and resultant dependency on a few family members and friends for support (Kennedy, Maple, McKay, & Brumby, 2014; McLaren & Challis, 2009). This dependency may make farmers more vulnerable to stressors resulting from family tensions (Swisher et al., 1998). Research also has indicated that in rural husband/wife dyads, stress in one member significantly impacts both (Rayens & Reed, 2014).

Multiple risk factors exist in the local farming environment, both physical and cultural. Much has been written about the farming culture, which includes strong pride in independence, stigma in help-seeking, and disregard for issues of mental health (Broffman et al., 2017; Hayslip, Maiden, Thomison, & Temple, 2010; Judd et al., 2006). The physical environment of the farm also is one of risk, with easy access to firearms as a lethal means of suicide (Kennedy et al., 2014; Kunde et al., 2017). Some research has suggested a link between depression and exposure to pesticides as well (Onwuameze, Paradiso, Peek-Asa, Donham, & Rautiainen, 2013). Finally, rural communities often lack adequate health and behavioral health services, making help-seeking challenging for those farmers who may wish to obtain services (Broffman et al., 2017; Byrne, Happell, & Reid-Searl, 2017; Fraser et al., 2005).

Beyond the immediate context of the farming community, larger societal and environmental factors can increase stress and thus risk for depression and suicide in farmers. Farmers experience high stress as a result of acute weather events and longer-term climate change, because of fluctuations in market prices for their crops, and in response to ever-changing government regulations and legislation (Perceval, Kolves, Ross, Reddy, & De Leo, 2018; Sturgeon & Morrissette, 2010; Truchot & Andela, 2018). Given the farming culture's emphasis on self-sufficiency and self-determination through work, these factors, which are totally beyond the control of farmers, may be particularly stressful (Hogan et al., 2012).

Although many risk factors are common across the farming experience, there is evidence that stressors, rates, and means of suicide can vary geographically (Arnautovska et al., 2016). Farmer suicide has been studied around the world; however, the majority of research has been completed in Australia. Less is known about farmer suicide in the United States, and about the characteristics and risk factors of farmer suicide in geographic regions within the United States.

To begin to address this gap in knowledge, we examined data from the Georgia Violent Death Reporting System from 2008 to 2015. All suicide data for farmers and agricultural workers were extracted from this database, and examined to capture demographic information,

substance involvement, and means of suicide. In addition, careful analysis was made of law enforcement reports and coroner or medical examiner report summaries, to provide greater insight into possible factors and contexts that may have led to suicide. This information may be useful in better understanding the risk factors and antecedents to suicide in farmers and agricultural workers in the United States, and thus in designing interventions to provide supports and services to prevent farmer suicides.

Method

Data Source

Data for this study were obtained from the Georgia Violent Death Reporting Systems (https://dph.georgia.gov/GVDRS), a statewide surveillance system that is part of the Centers for Disease Control and Prevention National Violent Death Reporting System (NVDRS; https://www.cdc.gov/violenceprevention/nvdrs/index.html). The NVDRS is a state-based surveillance system that integrates violent death data from multiple sources into one anonymous database. Violent deaths include homicides, suicides, death by law enforcement in the line of duty, and unintentional firearm deaths. Data are collected from available sources including death certificates, coroner/medical examiner reports, law enforcement reports, and toxicology reports (National Violent Death Reporting System, 2014).

Data from 2008 to 2015 were examined, and all cases positive for the variable "suicide" were extracted. This variable was based on ICD-10 codes, manner of death on death certificate, manner of death on coroner/medical examiner and law enforcement investigative reports, and by comparing the narratives on those reports. A search then was completed within these data using the terms "farm," "farmer," or "agriculture," and each entry containing one or more of these words was reviewed. Entries with one of these terms in the industry or occupational category, or where the narrative indicated that the individual was an agricultural worker or farmer, were included in the final farmer suicide dataset. A total of 106 cases were identified, out of 9175 suicides for this time period. Throughout this article the term "farmer" will be used for this category.

Data Analysis

Farmer demographics, including age, race, gender, education level, and marital status were described including rates and measures of central tendency. Means of death were reviewed, collapsed into categories, and rates calculated. A composite variable "substance use at time of death" was created by coding "Yes" if variables indicating presence of alcohol or drugs were positive, if substances were indicated in a toxicology report, or if substances were noted in either the coroner/medical examiner or the law enforcement report summary, and then rates were calculated.

Narrative summaries of coroner/medical examiner reports and law enforcement reports were reviewed using thematic analysis (Braun & Clarke, 2006), to capture factors that may have contributed to or been related to the individual's suicide. Following Braun and Clarke's guideline, the principal investigator and a second investigator first reviewed the summaries carefully. The principal investigator then generated initial codes for the summaries, reviewed the codes, and sorted them into potential themes. The two investigators reviewed these potential themes and their associated texts to refine themes, clarify their meaning, and ensure they captured the coded data. When investigators did not agree on a theme, they discussed it until they came to consensus. Discussion included exploration of possible bias in researchers' interpretation of the data, however, as in any qualitative study, the potential for author bias was still present.

Results

Characteristics of Farmers

Farmers who died by suicide in Georgia between 2008 and 2015 were predominantly male (97.17%), White (89.62%), non-Hispanic (91.51%), and older, with a mean age of 53.63 years (STD 19.98). Nearly 41% of the farmers were married, with a second large group (30.19%) never married, almost 18% were divorced, and a small proportion (4.72%) were widowed. Data on educational levels were limited, with levels unknown for 39% of the group. Of those where education levels were recorded, 26% had less than a high school education, 55% had a high

school degree or GED, and slightly under 19% had some college education or beyond.

Means of Suicide

The means of suicide for the overwhelming majority of farmers was by a firearm. Over three quarters of the deaths were the result of gunshot wound—nearly 58% by gunshot wound to the head, over 13% by gunshot wound to the chest, and 6.6% by gunshot to other parts of the body. The next most common means of suicide was by hanging (16.04%). A few other means were also observed, including two individuals who died by poisoning, and one each by jumping from a window, stabbing, throwing himself in front of a car, and disconnecting himself from life-supporting medical devices in order to go into medical crisis and die.

Substance Use at Time of Event

In the vast majority of cases (75.47%) there was no information about the use of alcohol or drugs by the individual at or immediately preceding the time of suicide. For those 26 cases where data were collected, in 12 cases (46.15%) there was evidence of substance use. In all cases, the substance was alcohol.

Factors Associated With Suicide

Qualitative analyses of coroner/medical examiner and law enforcement reports revealed a number of major themes related to factors associated with the suicide events. It is important to note that in 21 (19.81%) cases, no coroner/medical examiner or law enforcement summaries were entered, indicating that in these cases the reports had not been received by the GA VDRS (National Violent Death Reporting System, 2014). In an additional 17 (16.04%) cases, the summaries contained descriptions of the fatal injury but no further details about contextual factors. To clarify this, Table 1 shows the actual number of cases containing each theme, the percentage of all cases (106) containing each theme, and the percentage of cases without missing summaries (68) containing each theme.

Table 1
Contributing/Related Factors from Coroner/Medical Examiner and Law Enforcement Reports

Factor	*n*	% of total *N*	% of *N* with data
Relationship Issues	27	25.47%	39.71%
Health Issues	26	24.53%	38.23%
Suicidal Threats	22	20.75%	32.35%
Missing	21	19.81%	30.88%
Factors Unknown	17	16.04%	25.00%
Mental Health Issues	15	14.15%	22.06%
Financial Problems	13	12.26%	19.11%
Signs and Behavioral Indication	8	7.55%	11.76%
Recently Depressed	7	6.60%	10.29%
Criminal Justice Involvement	5	4.72%	7.35%

Note. Total *N* for study = 106. *N* with data from coroner/medical examiner or law enforcement reports = 68.

Pain in Relationships

Painful relationship issues were a common theme, noted in over 27 cases (25.47%). In 10 of these cases (37.04%), these were conflicts with a primary relationship such as a wife or girlfriend, including situations such as this:

> Victim and his [primary relationship] were fighting about Victim's heavy drinking, [with the primary relationship] wanting Victim to get help for his drinking . . . [primary relationship] stated that they cooked dinner and they were still fighting about his drinking and the Victim stated he would just kill himself . . . she then heard the gun go off.

An extreme example of this was seen in one case where the individual shot his primary relationship (with whom there was a long history of intimate partner violence) and then died by suicide.

In 7 (25.92%) of the cases with relationship issues, the conflict was with other family members, exemplified by the case of an unemployed farm worker where "The decedent's [parent] got onto him about 'needing to get a job and starting to act more like a responsible adult.' Before the event took place he had also stolen $20 from [a family member] a few days prior."

Another common relationship issue was that of loss, seen in 7 (25.92%) of the cases. As with conflict, the most common subject of loss was a primary relationship, such as a wife or girlfriend. This occurred in 5 cases (18.51%). In two situations, the loss was because of the partner's illness, as when "The Victim was upset because his [primary relationship] was placed in an out-of-state assisted living home," or when "Victim's [primary relationship] had a stroke

recently and had been staying with their child in another state. He had a hard time adjusting with his [primary relationship] not being there with him and had been upset and depressed." In three others, the primary relationship had chosen to leave. In one such case,

> The Victim's [primary relationship] of 23 years recently left the Victim for another man approximately 3 weeks ago. The Victim was reportedly very upset with the situation. The date of the incident is actually the [primary relationship's] birthday. Included in the note were apologies to his children for not being able to go on and also stating that now his [primary relationship] was free to marry.

Although much less frequent, loss of a family member was twice (7.41%) noted as a precipitant, as in the incident where it was noted that the victim's child "had committed suicide 1 week prior and that the Victim 'just couldn't take it anymore, so he shot himself.'"

Struggles With Health

In 26 cases (24.53%), reports indicated that the individual struggled with health problems. In 12 of these cases (46.15%), chronic health problems and associated loss of functioning seemed to be a precipitator of suicide, such as in the individual who experienced loss of function after a stroke, where it was reported "he had a stroke 2–3 weeks prior, which left him with limited mobility on the left side of his body." This was also seen in other cases, such as the individual who ". . .had been complaining about his 'medical problems that he had no control of,' stemming from his days in the military." Another individual had a history of diabetes and cardiac problems and required personal care assistance; he reportedly told his family he was "tired of being a burden to them."

In 6 of the cases (23.07%), a new diagnosis or acute illness was associated with the individual's suicide, such as the case where, according to the victim's immediate relative, "[the] Victim was agitated about his condition and started talking suicide after his lung surgery [which revealed cancer]." A similar situation was seen in the case where the individual was found ". . . with a note taped to the lamp . . . stating the Victim had been diagnosed with colon cancer."

In 6 of the cases (23.07%), health problems resulted in chronic pain that was overwhelming to the individual. In one situation, "the Victim had been depressed about chronic back pain. The victim had three back surgeries in the past 2–3 years and was on pain management medication." Another report noted,

> The Victim's [close relative] advised that the decedent was depressed and voiced suicidal ideation in the past month because he was "hurting so badly and did not want to live anymore". . . The Victim's medical history included cardiovascular issues, chronic pain, degenerative arthritis, knee replacement, shoulder surgery, and ostomy due to colitis.

Financial Stress

Financial problems were mentioned in 13 (12.26%) of the cases in this study. Losing one's job was a common financial stressor, seen in 6 (46.15%) of the cases. One individual ". . . was let go from the family ranch (ranch keeper) after 10 years employment. Victim was due a trust fund issued by the employer, but after V[ictim]'s employer passed, the employer's (family) refused to issue it." Inability to care for one's family as a result of unemployment was a concern noted in 2 (15.38%) of the cases. In one situation, it was noted that "Victim was out of work and couldn't support his family." In another case, the report stated, "Per the Victim's [child], they were having to move soon because they were being evicted."

In 2 (15.38%) cases, financial problems were linked with health problems, as with the Individual who

> was depressed because of financial problems & declining health. Victim had a heart attack 3 months prior. V[ictim]'s [primary relationship] had lost her job and there were hospital bills. V[ictim] . . . did not leave a note, however, there was an unopened First Bank envelope on the kitchen table and Hartford life insurance policy.

In 6 (46.15%) of the cases where finances were a concern, the reports simply noted that the individual was having "financial problems" without giving details.

Suicidal Threats and Signs

Prior suicidal threats were common in the cases, with 22 (20.75%) individuals identified as having made suicide threat(s) prior to their death. An example of this is a report stating, "V[ictim] had suicidal ideation on a constant basis. Law enforcement had been called to the residence numerous times for past suicide at-

tempts by the Victim." Sometimes these prior threats reportedly resulted in family and friends not fully attending to the individual's current suicide threats. One report stated of a victim, "He threatened to kill himself, but none of his family took it seriously because he had made similar threats in the past." Of the 22 individuals who made suicidal threats, in 14 cases (63.63%) it was documented that family or friends were aware of this prior to the individual's suicidal action. In one case, the individual "had a mental illness that prevented him from working and had been very depressed. V[ictim] had a conversation with his pastor some days prior about his depression" and expressed thoughts of suicide. One victim's close family member reported that "Something was wrong with him [the victim] and he kept having suicidal thoughts." Only in 3 of these 14 cases (21.43%) was it noted in the report that family or friends had taken the individual for mental health services.

In addition to verbal threats of suicide, in 6 cases (5.66%) the individual engaged in behavior that was suggestive of suicidal ideation, by somehow providing for friends, family, or estate in an unusual way. This included giving things to family, or reaching out and leaving messages. One family member reported the victim "had signed a blank check, and I (family member) should have known what was going on." In another case, it was reported that the victim "showed [a close family member] where he kept all of his important papers and will the night prior to the incident." In one case it was reported that "The victim had called a friend and left a message that simply said, 'My wallet is on the mantel and will you please take care of my cows.'"

Mental Health Issues

Past or current diagnosed mental health issues were noted in 15 (14.15%) cases, indicated by statements where the coroner/medical examiner or law enforcement had been told that "the Victim had a long history of mental illness" or "the Victim had recently been released from a psychiatric facility." In an additional 7 cases (6.60%), it had been reported that the individual recently "was feeling depressed," with no additional information or indication of a formal mental health issue.

Reports of receiving mental health services were not common. In 9 cases (8.49%), there was information suggesting the individual was receiving or had received mental health services. In these cases, the reports stated that family said that the individual had either received counseling, been prescribed psychotropic medication, or been hospitalized for a mental health condition.

Criminal Justice Involvement

In 5 (4.72%) cases, individuals were involved with the criminal justice system. In 2 (40.00%) of these cases, the individual was in jail and died by suicide, and in one the individual was in a hospital but in jail custody. All hanged themselves. An additional individual was about to be arrested, and another was on probation.

Multiple Factors Are Often Present

A final observation is that in a number of cases, multiple themes were noted within one individual's data. This occurred in over a third (34.90%) of individuals. Common combinations included health struggles and suicidal threats and signs, seen in 10 cases (9.43%); relationship issues and suicidal threats and signs (10 cases, 9.43%); and painful relationships and substance use (8 cases, 7.55%).

Discussion

This study provides a deeper look into the characteristics and factors associated with suicide in farmers and agricultural workers in a Southern state of the United States. Although there has been substantial research on farmer suicide, much of it has occurred outside the United States (Andersen et al., 2010; Arnautovska et al., 2016; Booth et al., 2000; Kennedy et al., 2014; Merriott, 2016). In addition, most studies have been quantitative (Lavender et al., 2016) or have gathered qualitative data on farmer stressors or thoughts of suicide (Sturgeon & Morrissette, 2010). Few studies have gathered qualitative information on factors perceived to be associated with farmer suicide after the suicide has occurred. Thus, this study deepens our understanding of farmer suicide in the U.S. and also provides more information about the contexts and factors surrounding the

suicides—giving a glimpse into the stories behind the numbers.

For this research, we used data from the GA VDRS. As with any secondary data analysis, our analyses were limited by the variables provided. Beyond this, the GA VDRS has specific limitations, which must be recognized. In some cases, GA VDRS was not able to obtain coroner/medical examiner and/or law enforcement reports, and data are missing. If coroners/medical examiners and law enforcement did not ask certain questions, gather certain data, or note the information in their reports, it was not in the data set and thus not available to us. In addition, coroner/medical examiners and law enforcement officers vary in what they ask, observe, and record, affecting the reliability of the data.

Given these limitations, we are cautious in our interpretation of the data. We cannot make claims about what the individuals or their family and friends did or said; we can only report what was recorded, acknowledging that the absence of an event (e.g., family taking an individual for mental health treatment) does not necessarily mean that it did not occur, but simply that it was not noted. Similarly, we cannot claim that a factor or issue was not present in a case (e.g., substance use) simply because it was not present in the data; we can only state that it was not present in the GA VDRS data set.

A second limitation of the data is the inability to differentiate farmer from agricultural worker. Given the multiple ways in which employment is noted in the VDRS (formal employment code, descriptor, report summaries), using multiple and sometimes unclear terms, it is impossible to clearly sort individuals into farmer or worker. However, because these groups have different roles and experiences, being unable to distinguish them is a significant limitation. Finally, because the data were from one state and not nationally representative, generalizability of findings also is limited.

Despite these limitations, given that better data are not currently available, the study is a useful next step in exploring the question of farmer suicide and supports and expands upon the existing literature, nationally and internationally. The farmers in this study were primarily older, White, and male, which is similar to what is seen both in farmers in general (Jenner, 2014) and in individuals who have died by suicide (National Institute of Mental Health, 2018). In our study, over 40% percent of the individuals were married, 18% were divorced, and over 30% were never married. This is also similar to the general demographics of individuals who have died by suicide, where 33% were married, 33% never married, and 22% divorced (National Violent Death Reporting System, 2017). This proportion of never married individuals is somewhat different than that reported in some studies on farmer suicides, where 16.7% (Kunde et al., 2017) and 18.1% (Browning et al., 2008) were reported to be never married. The literature suggests that marriage may be a protective factor for suicide, particularly for men (Cutright, Stack, & Fernquist, 2006). Change in marital status also has been associated with increased risk of suicide (Scourfield & Evans, 2015). Given the contradictory findings between our work and the farmer suicide literature, and our study's finding regarding conflict or loss of relationship as a factor in some farmer suicides, the association between farmer suicide and marital status is worth additional exploration.

Firearms were the most common means of death in our study (78.3%), which also is true for all men who die by suicide (56.6%; National Institute of Mental Health, 2018). However, the percentage was much higher in our study than in the literature. This may be explained at least in part by the ease of access to guns in farm settings (Kennedy et al., 2014).

A common factor associated with farmer suicide in our study involved relationship problems (25.47%). Given the isolation seen in rural areas, there may be a resultant increased dependence upon a few significant relationships, particularly with wives or girlfriends. Swisher et al. (1998) described farmers as particularly vulnerable to relationship conflict. Similarly, in this study we found that dissolution of primary relationships, either through conflict or through loss, was described as a stressor and precipitant to suicide. However, in the general population, relationship problems are reported as a factor contributing to suicide in 42% of cases, a much higher rate than our study (CDC, 2018b). This suggests that farmer vulnerability to relationship conflict may be no higher, and could possibly be lower, than the general population. Additional exploration of relationship issues in

farmer suicides is needed to better understand farmer vulnerability to relationship conflict.

A primary factor associated with suicide in this study was an individual's struggle with poor health, seen in nearly 25% of cases. In some situations, the lack of ability to work, to be independent, and not to be a burden to family seems to have been overwhelming. In other cases, the farmers seem to have been worn down by chronic pain and health issues, and simply could not continue to function with that level of discomfort. These findings support some earlier studies identifying physical illness and pain as common factors in farmer suicides (Kunde et al., 2017; Sturgeon & Morrissette, 2010). They also parallel findings from the CDC (2018b), where physical health problems were identified as factors contributing to suicide in 22% of the general population.

The inability to work precipitated by either acute or chronic health conditions and resultant suicidal action may be understood in part by considering rural attitudes toward independence and the ability to engage in hard work. In one study, nearly 42% of farmers surveyed defined health as the ability to work. (Reed, Rayens, Conley, Westneat, & Adkins, 2012). Laoire (2005) identified a clear link between masculine identity and ability to work on the farm. Loss of health resulting in inability to work, therefore, could lead to both loss of income and loss of identity for farmers.

Much has been written about the financial crisis experienced by many farmers in the U.S. (Sullivan, 2018), and we anticipated that financial stressors would be a common antecedent to suicide in our study. In their study, Sturgeon and Morrissette (2010) found financial concerns present in 55% of farmers with suicidal ideation. Perceval et al. (2018) identified the economic impact of weather, price fluctuations, and crop yields as stressors linked with increased risk of suicide. We found financial stressors were reported far less frequently than anticipated, and we found no specific mention of risk of losing the farm because of financial problems, or concerns about weather, price fluctuations, or poor crops. In a number of cases, the report simply stated that the individual was having "financial problems," so specific financial issues could not be identified. In a few cases, unpaid medical bills merged the stressors of poor health and poor finances.

Substance abuse is frequently seen in connection with suicide. The CDC (2018b) reported that problematic substance use was present in 28% of people who died by suicide. Our study could not identify substance abuse, but could identify the presence of substances at time of death. We found that in 20% of cases, substance use was reported as a factor present at the time of suicide. However, because of the limitations of the data, we cannot with certainty say that farmer suicides are associated with lower rates of substance use than seen in the general public; this is an avenue for further exploration.

A number of individuals in this study (14.15%) were reported to have experienced mental health issues. This relatively small percentage is much lower than that seen in the general population, where 46% of people who died by suicide had a known mental health condition (CDC, 2018b). In only a few cases did we find that the individual was reported to have received mental health treatment. These small numbers could be the result of data limitations and missing information, or could indicate an actual lower rate of mental health issues in this study population. Findings in the literature are mixed on rates of depression in farmers and rural communities (Arnautovska et al., 2016; Fraser et al., 2005; Judd et al., 2006).

In this study, we found that over 20% of the individuals were reported to have made suicidal threats prior to their death. In situations where the individual's suicidal threats were known to family and friends, it was seldom reported that family or friends took action and helped the individual obtain treatment. In fact, documentation stated that in several cases, family and friends with knowledge of an individual's prior suicidal threats dismissed current problems because they had seen the behavior before and did not expect the individual to act on these threats. We found little in the research on suicide threats among farmers; although the general literature shows that the majority of individuals who die by suicide threaten or signal their thinking before acting (CDC, 2018b), this has not been explored in farmer suicides.

Although interesting, these mental-health-related observations must be interpreted with caution. Given the limitations of the data, we cannot know that individuals did not receive mental health treatment nor that family took no action to help them. We can only say that there

is no record of such actions. However, these findings are congruent with the literature, which indicates rural community members often lack understanding of mental health and suicide (Broffman et al., 2017), may have dismissive or stigmatizing attitudes toward mental health problems (Hayslip et al., 2010; Judd et al., 2006), and may have difficulty accessing mental health services (Broffman et al., 2017; Byrne et al., 2017; Fraser et al., 2005). More research is needed to understand the behaviors of families in response to farmers' suicidal threats.

Implications for Research and Practice

Findings from this study provide new information on potential factors associated with farmer suicide in Georgia. In some cases, the findings do not support the existing literature or raise new questions. Because of data limitations, additional research is needed to verify and expand upon our findings. Of particular interest is further exploration of the association between relationship status/change and suicide risk, where our findings show higher proportions of never-married men than other farmer literature and also lower overall rates of relationship problems than seen in suicide in the general population. The role of financial problems in farmer suicide also requires additional study, because our findings show financial problems to be a factor in suicide much less frequently than is seen in the literature. Finally, a series of behavioral-health related questions are raised by our findings and require further study: (a) What are the true rates of substance use associated with farmer suicide? (b) What are the true rates of mental health problems associated with farmer suicide? (c) What is the relationship between suicidal threat and suicidal action in farmer suicides? (d) What are farmer families' attitudes toward and understanding of mental illness and suicide, and how do they act in response to suicidal threats and warning signs? (e) How do farmers and farmer families access mental health care?

Our study has raised questions and pointed direction for future research; these are necessary first steps to designing intervention. A next and crucial step in this work involves gathering better data. We need improved reporting by law enforcement and coroners/medical examiners, which would result in data that are more complete for VDRS. Currently, coroners must request toxicology testing from the state Bureau of Investigation. Anecdotal reports suggest that coroners are reluctant to do this because of the potential stigma for the family. Similarly, some coroners state they do not want to prepare a report with any information about the suicide for fear of hurting the family (personal communication, coroners participating on the Georgia Violent Reporting System Advisory Committee meeting, January 2016). Improved reporting by coroners would provide vital information for future studies.

Findings showed that the path to suicide may be influenced by multiple concurrent or sequential internal, interpersonal, and/or environmental factors. There is much more to learn regarding these factors, their interactions, dosage effects, and pathways, as well as factors that may be protective and promote resiliency. Expanding this current study using larger data sets where modeling may be possible, such as the National Violent Death Reporting System data set, could be an important first step in this work.

Our study found reports of mental health issues among farmers who died by suicide. In law enforcement and coroner/medical examiner reports, it was seldom noted that farmers received any kind of mental health services, even when it was noted that family and friends were aware of the individual's suicidal threats. This may suggest a need for interventions providing family and community education in rural areas regarding suicide and services for farmers. Given the more negative attitudes toward mental health services sometimes noted in rural areas (Hayslip et al., 2010), it is less likely that individuals may participate in programming coming from a mental health service agency. It may be more effective if these interventions are provided through nontraditional sources such as faith-based organizations, agricultural extension offices, the Farm Bureau, or natural social networks. Some work has been done in this area, with phone support groups, hotlines, and even community education through psychoeducational dinner theater (Pross, 2018; Reed, 2018; Weingarten, 2017), but rigorous evaluation of these interventions, as well as development of additional interventions, is needed.

Findings from this study point to other potential targets for intervention. Given that illness, loss of healthy functioning, and pain were

seen to be associated with suicide, medical settings could be opportune sites for preventive interventions. Some studies have indicated that although farmers may be reluctant to seek mental health treatment, they visit general medical practitioners at rates equivalent to nonfarming populations (Booth et al., 2000; Kavalidou, McPhedran, & De Leo, 2015). A study comparing contact with primary health care providers between the general male population and farmers in the three months before their death by suicide found no significant differences in their level of contact (Kavalidou et al., 2015).

Medical providers, as well as nurses, pharmacists, and home health workers, are positioned to identify and provide support and referral to farmers at risk of suicide. To do this, they must become educated regarding the elevated risk of suicide in their farmer patients with serious health conditions and about the elevated risk of suicide among farmers with chronic health conditions that negatively impact their ability to work and be independent. They also should be taught basic suicide risk screening techniques, and provided with the information needed to make referrals. Such a primary-care-led approach to mental health care has been utilized in rural areas of Australia, and was reported to be highly regarded by service recipients (Taylor, Edwards, Kelly, & Fielke, 2009). Extensive exploration of integrated health care models suggests that in general they increase access to behavioral health care and promote more coordinated care in rural areas (Rygh & Hjortdahl, 2007).

In this study, we also found that suicide was associated with farmers who had severed relationships with spouses, partners, or important family members, either through conflict or through loss. Identifying individuals who would be aware of these severed relationships—funeral home directors, assisted living staff, faith leaders, divorce lawyers—and providing suicide risk identification and referral could be an additional effective way to prevent suicides among farmers experiencing an ended relationship.

Despite its limitations, this research provides a richer and more nuanced understanding of the contexts and antecedents to farmer and agricultural worker suicide, and offers insight into possible avenues for further research and intervention. By providing deeper understanding of the factors leading to suicide, it points the way to actions that may be effective in reducing the rates of this preventable tragedy in rural communities.

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