

A Cross-Sectional Study of Stressors Among Farmers in Eastern North Carolina

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BACKGROUND Agriculture is a hazardous, stressful occupation that can adversely affect farmers' health. Identifying stressors among farmers may help health professionals improve health outcomes by developing targeted intervention strategies and services.

METHODS Over a 4-month period, we conducted a cross-sectional study of 128 farmers in an economically disadvantaged, 29-county region of Eastern North Carolina. We used a modified version of the Farm Ranch Stress Inventory to measure farmers' self-reported reactions to potential stressors.

RESULTS The majority of farmers surveyed were aged 40–59 years, had farmed for more than 20 years, and worked more than 40 hours per week on the farm. Large proportions of respondents identified the following factors as "very stressful": concern about the weather (60.2%), concern over the future of the farm (29.7%), outsiders not understanding the nature of farming (25.2%), problems with machinery (23.4%), market prices for crops/livestock (45.3%), taxes (38.3%), health care costs (32.5%), and not having enough time to spend with family in recreation (13.3%). Experiencing 8 or more factors as "very stressful" was found to be positively associated with working more than 40 hours per week on the farm ($P = .008$) and with being a farm manager or a farm worker who does not operate equipment ($P = .001$).

CONCLUSIONS Information about perceived stressors among farmers may help health professionals develop targeted interventions for reducing stress. More research is needed to better evaluate health outcomes, to reduce farm-related injuries, and to improve psychosocial well-being.

Farming consistently ranks as one of the most hazardous and stressful jobs in the United States [1, 2]. In addition to bearing the physical burdens associated with long and strenuous work hours, farmers experience stress related to the environment, psychological states, social factors, and potential illnesses [2, 3]. Levels of stress may be compounded by other issues that indirectly contribute to these factors, such as the farm serving as both home and office, and having to work with family members who share in the burden of stress [3, 4]. Factors such as the cost of medical care, insufficient income, or lack of health insurance may also contribute to stress. A number of studies of occupational and work-related stress have found that levels of stress are higher among women, minorities, unmarried individuals, and those with a lower socioeconomic status [5, 6].

Contrary to the common belief that farming yields a lifestyle that is often peaceful, easygoing, and healthy, farmers actually experience some of the highest rates of mortality from stress-related illnesses, including heart and artery disease, hypertension, ulcers, and nervous disorders [1, 7]. A wide range of physical responses from stress can influence health and disease [8]. A stressor is a chemical or biological agent, environmental condition, stimulus, or event that triggers stress in an organism [8–10]. The physiological outcomes of stress include the stressor-induced release of catecholamine hormones, such as adrenaline and noradrenaline, which facilitate immediate physical reactions associated with preparation for muscular action [10]. These reactions, referred to collectively as the "fight or flight" response, can

eventually result in increased fatigue. Chronic diseases usually take a long time to develop and can be influenced by many factors. However, accumulating evidence suggests that prolonged periods of stress may play a significant role in the development (or progression) of cardiovascular disease, hypertension, depression, and anxiety disorders [8–10].

Over the past 30 years, a number of research studies have examined the role that stressors play in the lives of farmers and the relationship between stressors and various health outcomes, including mental health problems [11–14], suicide [15–18], injuries [19–20], working conditions [21], job satisfaction [22], and general well-being [2, 21–27]. Human stress reactions have a common physiological basis, but individuals manifest stress differently depending on their situation [8]. Although the effects of chronic stress on the incidences of occupational illnesses and injuries among farmers have been fairly well documented [1, 9, 11, 18, 19, 26], Freeman and colleagues [2] have noted that health conditions associated with stress have not been extensively addressed among farmers and farmworkers and that more work is needed in this area.

In this study, we evaluated the perceptions of stress among a sample of farmers living in a 29-county region of

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Eastern North Carolina (ENC-29). The ENC-29 region is primarily characterized as rural and economically disadvantaged, with a high unemployment rate and a large percentage of families having incomes below the federal poverty guidelines [28-30]. In addition, the region has the highest age-adjusted mortality rates in the state for several major chronic health conditions associated with stress, including heart disease, stroke, and diabetes [30, 31]. Within the ENC-29 area, there are an estimated 8,300 farms [32], many of which are located in rural, isolated areas where farmers may have limited access to primary health care services. The chief agricultural crops and livestock produced in the region are sweet potatoes, tobacco, cotton, corn, soybeans, swine, and poultry [32, 33].

As public health researchers at East Carolina University (ECU), we developed this exploratory study to evaluate perceived stressors among farmers in the ENC-29 region. We also wanted to look for associations between high stress levels and demographic characteristics, farming characteristics, or health variables in order to identify potential risk factors for poor physical or mental health outcomes among farmers. After summarizing these findings, we provide suggestions for addressing the important but often overlooked issue of stress among farmers.

Methods

Participants and Study Design

The participants for this project were selected from the North Carolina Department of Agriculture and Consumer Services' certified private (noncommercial) pesticide applicator database. This is a public database containing the names, addresses, and phone numbers of approximately 43,000 pesticide applicators in the state. This database was used because a large proportion of the state's farmers are state-certified pesticide applicators (this certification allows them to apply restricted-use pesticides to their crops) and because this database includes the contact information we needed to conduct a telephone survey. We extracted 4,817 records that contained valid contact information for private pesticide applicators living in the ENC-29 region. Telephone interviews were conducted between March 12 and June 12, 2012, by the ECU Center for Survey Research. Phone calls were made in the afternoon and evening hours; multiple attempts were made if no one answered.

Measures

The survey administered during the telephone interview included 45 questions related to sociodemographic factors and health conditions and 28 questions related to perception of stress. The survey also included 1 open-ended question: "Please list any other items you find stressful in relation to farming and rate them."

Sociodemographic measures. The sociodemographic characteristics included in this study were age, sex, educational

attainment, race/ethnicity, annual household income, marital status, size of farm (total number of acres owned and/or operated), and health insurance status. Characteristics related to primary work activities included the number of years spent farming (20 or less, or more than 20), primary farming activity (grains, soybeans, cotton, tobacco, poultry or livestock, vegetables and/or fruits, or other specialty area), and job position on the farm.

For the survey questions related to physical and mental health, respondents were asked to rate their overall physical health (excellent/very good, good, or fair/poor) and to indicate the number of days of poor physical and mental health they had experienced within the past 30 days (none, or 1 or more). The survey also sought dichotomous responses for 2 questions: Have you had an injury in the past 12 months (yes/no), and have you taken a vacation away from the farm in the past 2 years (yes/no).

Stress scale. Stress was assessed using a modified version of Welke's Farm Ranch Stress Inventory [22, 34]; items were added from the Farm Stress Survey developed by Eberhardt and Pooyan [35] and the Farm/Ranch Stress Scale developed by Ide and colleagues [36]. The final inventory (reproduced in Appendix 1; online version only) consisted of 28 potential stressors, each of which subjects were asked to rate on a scale of 1-4, where 1 = "no stress," 2 = "a little stressful," 3 = "moderately stressful," and 4 = "very stressful." These 28 items have been used and validated in previous studies [22, 34-37].

APPENDIX 1. Farm/Ranch Stress Inventory

This appendix is available in its entirety in the online edition of the NCMJ.

In the analytical stage of our project, we grouped these items into 3 categories: farm-related factors, financial factors, and social factors. Each item was primarily related to a potential stressor that farmers may encounter as part of their daily lives but which they have limited control over. Specifically, the survey asked about 14 farm-related factors (eg, the weather, problems with livestock or crops, farm accidents or injuries, operating hazardous machinery), 9 financial factors (eg, market prices for crops or livestock, taxes, financing for retirement), and 5 social factors (lack of time to spend together as a family in recreation, distance from doctors or hospitals, distance from shopping centers/schools/recreation, limited opportunities for social interaction, and lack of close neighbors).

Data Analysis

Prior to calculating the percentage distribution of responses for the 28 individual stress factors, we combined

the categories “a little stressful” and “moderately stressful,” so that there were only 3 response categories instead of 4. We then calculated the median and range of the percentage distributions for these 3 response categories (“no stress,” “a little stressful or moderately stressful,” and “very stressful”) for each of the 3 stressor categories (farm-related, financial, and social). To identify the farmers who were experiencing very high levels of stress, we summed the number of stressors that each farmer had rated as “very stressful” and then used the 75th percentile for this sum as the cutoff value for the new indicator variable; thus farmers who rated 8 or more factors as “very stressful” were identified by a new variable, which was termed “very high stress.”

In the bivariate analysis, we performed a Pearson chi-square test or Fisher’s exact test (when counts were less than 5) to look for associations of “very high stress” with demographic characteristics (age, sex, household income, education level, marital status), farm-related characteristics (years of farming experience, number of acres farmed, primary farming activity, hours per week worked on the farm, position on the farm) and health characteristics (general health, number of poor physical health days out of the past 30 days, number of poor mental health days out of the past 30 days, having had an injury that prevented working during the past year, and having taken a vacation away from the farm during the past 2 years). *P*-values less than .05 were considered to be statistically significant. Data analysis was performed using SAS software version 9.2. This study was approved by the institutional review board of the Brody School of Medicine at ECU.

Results

Sample Characteristics

From the sample of 4,817 private pesticide applicators, 148 persons completed the interview. Of these, 15 people reported that they were not active farmers; therefore they were not included in this analysis. An additional 5 people did not rate the 28 stressors in the stress inventory or replied “not applicable.” This left a working sample of 128 active farmers.

Of the 128 respondents included in the analysis, 28.0% were aged 18–39 years, 39.2% were aged 40–59 years, and 32.8% were aged 60 years or older (see Table 1). Most (74.8%) of the respondents were male; 81.1% reported being married; 96.9% reported that their race/ethnicity was non-Hispanic white; and 42.5% reported that the highest education level they had attained was a high school diploma or less. Almost half (42.0%) reported an annual household income of \$51,000–\$100,000; 89.0% reported having health insurance; and 86.6% reported having farmed more than 50 acres in the past 12 months.

When describing their farm work, the majority of respondents (64.1%) said that they had been farming for more than 20 years, and 71.6% reported that they worked 40 or more hours per week on the farm. Nearly 1 respondent in 5

TABLE 1.
Sociodemographic, Farm Work, and Health Characteristics of Active Farmers in a 29-County Region of Eastern North Carolina (N = 128)

Characteristic	No. (%) (N = 128)
Sociodemographic characteristics	
Mean age ± standard deviation (years)	50.02 ± 15.96
Age	
18–39 years	35 (28.0)
40–59 years	49 (39.2)
≥60 years	41 (32.8)
Sex	
Male	95 (74.8)
Female	32 (25.2)
Marital status	
Married	103 (81.1)
Not married	24 (18.9)
Race/ethnicity	
Non-Hispanic white	124 (96.9)
Non-Hispanic black	1 (0.8)
Hispanic	1 (0.8)
Other	2 (1.5)
Highest education level attained	
High school diploma or less	54 (42.5)
At least some college	73 (57.5)
Annual household income	
≤\$50,000	31 (33.3)
\$51,000–\$100,000	39 (42.0)
>\$100,000	23 (24.7)
Health insurance status	
Has insurance	113 (89.0)
No insurance	14 (11.0)
Farm-work characteristics	
Years of farming experience	
≤20	46 (35.9)
>20	82 (64.1)
No. of hours per week that individual works on farm	
≤40	36 (28.4)
>40	91 (71.6)
Position on farm	
Farm worker or manager (does not operate equipment)	24 (18.7)
Farm operator or covers all positions on farm (operates equipment)	88 (68.8)
Other	16 (12.5)
Primary farming activity	
Grains and soybeans	49 (38.9)
Cotton	25 (19.8)
Tobacco	20 (15.9)
Poultry or livestock	17 (13.5)
Vegetables and/or fruits	6 (4.8)
Other specialty area (not listed above)	9 (7.1)
Farm size (total no. of acres owned and/or operated)	
≤50	17 (13.4)
>50	110 (86.6)
Physical and mental health characteristics	
Overall physical health	
Excellent/very good	77 (60.2)
Good	43 (33.6)
Fair/poor	8 (6.2)
No. of days out of past 30 days that individual experienced poor physical health	
None	112 (88.9)
1 or more	14 (11.1)
No. of days out of past 30 days that individual experienced poor mental health	
None	119 (95.2)
1 or more	6 (4.8)
Experienced an injury during past 12 months that prevented working	
Yes	117 (91.4)
No	11 (8.6)
Took a vacation away from the farm during past 2 years	
Yes	93 (73.2)
No	34 (26.8)

(18.7%) was a farm manager or worker who did not operate equipment; 68.8% were farm operators or they covered all positions on the farm (and did operate equipment). The primary farming activity reported most frequently was grains and soybeans (38.9%), followed by cotton (19.8%), tobacco (15.9%), poultry and livestock (13.5%), vegetables and/or fruits (4.8%), and other (7.1%).

When asked about their physical and mental health, 60.2% of respondents reported being in excellent or very good health, and only 11.1% reported having experienced 1 or more days of poor physical health within the past 30 days. Only 8.6% reported having had an injury that prevented them from working within the past 12 months, and 73.2%

reported having taken a vacation away from the farm within the past 2 years.

Stress Factors

As Table 2 shows, financial stressors had the highest median percentage of “very stressful” responses, at 21.9% (range, 15.1-45.3). The median percentage of “very stressful” responses was 16.8% for farm-related factors and 1.6% for social factors. Only 6.3% of farmers reported that it was very stressful dealing with non-relative help (incompetent help, finding good help, supervising help).

For farm-related stressors, the weather was described as “very stressful” by the greatest percentage of respondents

TABLE 2.
Percentage Distribution of Stress Inventory Responses Given by 128 Active Farmers in a 29-County Region of Eastern North Carolina

Stress factor ^a	Response (stress rating)			Total ^c No. (%)
	“No stress” No. (%)	“A little stressful” or “moderately stressful” ^b No. (%)	“Very stressful” No. (%)	
Farm-related factors				
The weather	13 (10.1)	38 (29.7)	77 (60.2)	128 (100.0)
Concern over the future of the farm	31 (24.2)	59 (46.1)	38 (29.7)	128 (100.0)
Outsiders not understanding the nature of farming	39 (30.7)	55 (43.3)	32 (25.2)	127 (99.2)
Problems with machinery	33 (25.8)	65 (50.8)	30 (23.4)	128 (100.0)
Problems with livestock or crops	35 (27.6)	62 (48.8)	29 (22.8)	127 (99.2)
Having too much work for 1 person	41 (32.3)	62 (48.8)	24 (18.9)	127 (100.0)
Seasonal variations in workload	45 (35.1)	60 (46.9)	23 (18.0)	128 (100.0)
Government export policy	45 (35.2)	57 (44.6)	20 (15.6)	128 (95.3)
Farm accidents and injuries	52 (40.6)	59 (46.1)	15 (11.7)	128 (98.4)
Balancing roles as a family member and farmer	57 (44.5)	57 (44.5)	14 (11.0)	128 (100.0)
Working with extended family in farm operation	69 (53.9)	45 (35.1)	14 (10.9)	128 (100.0)
Not having the manpower to operate the farm	46 (36.2)	67 (52.8)	12 (9.4)	127 (98.4)
Operating hazardous machinery	68 (53.1)	47 (36.7)	11 (8.6)	128 (98.4)
Dealing with non-relative help	56 (44.1)	61 (48.0)	8 (6.3)	127 (98.4)
<i>Median % (range) for farm-related factors</i>	<i>35.2 (10.1-53.9)</i>	<i>46.1 (29.7-52.8)</i>	<i>16.8 (6.3-60.2)</i>	
Financial factors				
Market prices for your crops/livestock	15 (11.7)	55 (43.0)	58 (45.3)	128 (100.0)
Taxes	22 (17.2)	56 (43.8)	49 (38.3)	128 (99.3)
Health care costs	32 (25.4)	51 (40.4)	41 (32.5)	126 (98.3)
High debt load	48 (37.5)	46 (35.9)	31 (24.2)	128 (97.6)
Not enough money for day-to-day expenses	37 (28.9)	59 (46.1)	28 (21.9)	128 (96.9)
Not enough cash/capital for unexpected problems	35 (27.8)	67 (53.2)	24 (19.0)	126 (100.0)
Financing for retirement	46 (37.1)	52 (41.9)	23 (18.5)	124 (97.5)
Working with bankers and loan officers	55 (43.3)	51 (40.2)	19 (15.0)	127 (98.5)
Government farm price supports	45 (35.7)	59 (46.8)	19 (15.1)	126 (97.6)
<i>Median % (range) for financial factors</i>	<i>28.9 (11.7-43.3)</i>	<i>43.0 (35.9-53.2)</i>	<i>21.9 (45.3-15.1)</i>	
Social factors				
Not enough time for family	58 (45.3)	52 (40.6)	17 (13.3)	128 (99.2)
Distance from doctors or hospitals	84 (65.6)	38 (29.7)	5 (3.9)	128 (99.2)
Distance from shops/schools, etc.	101 (78.9)	23 (18.0)	2 (1.6)	128 (98.5)
Limited social interaction opportunities	94 (73.4)	28 (21.9)	3 (2.3)	128 (97.6)
Lack of close neighbors	109 (85.2)	13 (10.2)	1 (0.8)	128 (96.2)
<i>Median % (range) for social factors</i>	<i>73.4 (45.3-85.2)</i>	<i>21.9 (10.2-40.6)</i>	<i>2.3 (13.3-0.8)</i>	

^aFactors chosen for rating were derived from the Farm Ranch Stress Inventory [22, 34].

^bResponses for the rating categories “a little stressful” and “moderately stressful” were combined.

^cPercentages may not sum to 100% because of “not applicable” responses.

(60.2%), followed by concern over the future of the farm (29.7%), outsiders not understanding the nature of farming (25.2%), problems with machinery (23.4%), and problems with livestock or crops (22.8%). The farm-related stressors with the greatest percentage of respondents indicating that it caused them “no stress” were working with extended family (53.9%) and operating hazardous machinery (53.1%).

The financial stressors rated as “very stressful” by the greatest percentage of respondents were market prices for crops and livestock (45.3%), taxes (38.3%), and health care costs (32.5%). High debt load and inadequate money for day-to-day expenses were both factors labeled “very stressful” by more than 20% of farmers surveyed. The financial stressors reported as causing “no stress” by the greatest percentage of respondents were working with bankers and loan officers (43.5%), high debt load (37.5%), and financing for retirement (37.1%).

Respondents reported that social factors caused less stress than farm-related stressors or financial stressors. High proportions (from 45.3% to 85.2%) of participants reported that various social stressors caused them “no stress.” Of these factors, lack of close neighbors was the factor most commonly cited as causing no stress (85.2%), followed by distance from shopping centers/school/recreation, etc (78.9%) and limited social interaction opportunities (73.4%). Not having enough time to spend together as a family in recreation was the social factor cited as “very stressful” by the greatest percentage of respondents (13.3%). When respondents were asked to list and rate any other items they found stressful in relation to farming, they mentioned “lack of government support for farming” and “loss of rural life to new development.”

As Table 3 shows, bivariate analysis found statistically significant positive associations between “very high stress” (reporting 8 or more factors as “very stressful”) and working 40 or more hours per week on the farm, compared with working less than 40 hours per week ($P = .008$). Job position on the farm was also associated with “very high stress”; more than half (54.2%) of the farm managers or farm workers who did not operate equipment were classified as experiencing very high stress, compared with only 19.3% of those who were farm operators or who covered all positions on the farm ($P = .001$). Lack of health insurance was the only sociodemographic characteristic associated with “very high stress”; those with no insurance were nearly 3 times as likely to experience very high stress compared with those who had insurance (64.3% versus 23.9%; $P = .003$).

Discussion

Farmers often have large responsibilities that can cause personal stress. In our survey, farmers in the ENC-29 region identified several factors that they found stressful: the weather, concern over the future of the farm, market prices for their crops and livestock, taxes, health care costs, problems with crops and livestock, outsiders not understanding

the nature of farming, and problems with machinery. These stressors play an important role in farmers’ lives, and health care professionals should consider these risk factors when they are evaluating farmers for mental and/or physical health problems, illnesses, injuries, or influences leading to death. This preliminary groundwork may serve as a starting point for more in-depth investigation of perceived stressors, job strains, and mechanisms that lead to stress among members of the farming community in the ENC-29 region.

In general, the leading stressors identified in this study (the weather, economics of farming, working long hours, equipment failure, etc) were similar to those found in other research studies that have evaluated common stressors among farmers. Welke [34] found that the top 3 stressors among farmers surveyed in South Dakota were market prices for crops and livestock, the weather, and health care costs. Similarly, a New Zealand study conducted by Firth and colleagues [25] identified the following stressors among farmers: increased workloads at peak times, dealing with workers’ compensation, bad weather, and complying with health and safety legislation. Studies of farmers in the United Kingdom [13, 24] have identified the following stressors: worries about finances, bad weather, time pressures, coping with new government regulations and policies, machinery breakdowns at busy times, complying with environmental regulations, amount of paperwork, and media criticism.

We found that the percentage of farmers in the ENC-29 region who rated the weather as “very stressful” was exceptionally high (60.2%) compared with the results of other surveys. We attribute this to the fact that we contacted farmers approximately 7 months after Hurricane Irene struck the region. This large, destructive storm devastated agricultural crops during growing and harvesting season and increased the number of emergency department visits for illnesses and injuries in the ENC-29 region [38]. Following the storm, farming communities and residents throughout the ENC-29 region suffered tremendous economic damage, and substantial cleanup efforts were required.

We speculate that lingering psychological, emotional, and physical trauma related to Hurricane Irene likely compounded the level of stress that would normally have been associated with the weather. Other studies that have been carried out following natural or manmade disasters have documented correlations between post-traumatic stress disorder and psychological factors such as guilt [39], coping strategies [40], and psychiatric comorbidities [41, 42]. Similarly, Fried and colleagues [43] described an increase in the use of mental health services among the Medicaid population in North Carolina following Hurricane Floyd. The impact of mental health and stress on the overall well-being of farmers and rural communities in Eastern North Carolina is an area that has been understudied, and we suggest that future research focus on this topic.

The finding that most of the farmers did not experience much stress related to social factors—for example, the lack

TABLE 3.
Bivariate Analysis of Associations Between “Very High Stress”^a and Demographic, Farming, and Health Characteristics

Sociodemographic characteristic	No. of respondents with characteristic (subgroup size)	Percentage of respondents in subgroup experiencing “very high stress” ^a	P-value ^b
Completed stress inventory (total group)	128	28.1	
<i>Demographic characteristics</i>			
Age, in years			
18-39	35	34.3	.6328
40-59	49	26.5	
≥60	41	24.4	
Sex			
Male	95	27.4	1.0000
Female	32	28.1	
Annual household income			
≤\$50,000 or less	31	38.7	.2449
\$51,000-\$100,000	39	20.5	
≥\$100,000	23	30.4	
Highest education level attained			
High school diploma	54	24.1	.4277
At least some college	73	31.5	
Marital status			
Married	103	25.2	.1326
Not married	24	41.7	
Health insurance status			
Has insurance	113	23.9	.0033
No insurance	14	64.3	
<i>Farm-work characteristics</i>			
Years of farming experience			
≤20	46	34.8	.2249
>20	82	24.4	
Farm size (total no. of acres owned and/or operated)			
≤50	17	23.5	.7770
>50	110	29.1	
Primary farming activity			
Grains and soybeans	49	22.5	.3801
Cotton	25	24.0	
Tobacco	20	45.0	
Poultry and/or livestock	17	23.5	
Other specialty area	9	44.4	
Vegetables and/or fruits	6	33.3	
No. of hours per week individual works on farm			
<40	36	11.1	.0081
≥40	91	35.2	
Position on farm			
Farm worker or manager (does not operate equipment)	24	54.2	.0014
Farm operator or covers all positions on farm (operates equipment)	88	19.3	
Other position	16	12.5	
<i>Health characteristics</i>			
General health			
Excellent/very good	77	23.4	.0648
Good	43	30.2	
Fair/poor	8	62.5	
No. of days out of past 30 days that individual experienced poor physical health			
None	112	28.6	1.0000
1 or more	14	28.6	
No. of days out of past 30 days that individual experienced poor mental health			
None	119	26.9	.0567
1 or more	6	66.7	
Experienced an injury during past 12 months that prevented working			
Yes	11	36.4	.5020
No	117	27.4	
Took a vacation away from the farm during past 2 years			
Yes	93	24.7	.1816
No	34	38.2	

^aIndividuals were considered to be experiencing “very high stress” if they rated 8 or more factors as “very stressful.”

^bP-values were obtained using the Pearson chi-square test or Fisher’s exact test (when counts were less than 5); P-values less than .05 were considered statistically significant.

of close neighbors and distance from shopping—was an expected result. Other studies have found that farmers tend to have well-connected social networks, and many enjoy working in isolation and solitude [14]. Fewer than 20% of farmers considered financing for retirement and lack of cash or capital for unexpected problems to be “very stressful” factors, which was somewhat surprising given the amount of capital needed to sustain farming and the region’s poor socioeconomic conditions.

Understanding the relationship between stress, mental health, and injuries in farmers is an area that deserves more attention. Studies conducted after the 1980s farm crisis found that farmers in the United States were much more likely to commit suicide than were other groups of men [18, 19]. Recent reports of increasing rates of depression and suicide among farmers [16, 17, 27] suggest that this may be a continuing trend. In addition, poor mental health can present problems for farmers, who are already at higher risk for job-related accidents than are workers in other occupations. Data from the National Institute for Occupational Safety and Health show that in 2004 there were approximately 80,300 injuries to adults working on farms in the United States (9.2 injuries every hour), and that, during the period 2003–2007, an estimated 2,233 workers aged 20 years or older died in agricultural accidents [44].

A strength of our study is that it identified areas of perceived stress among a sample of farmers in a large, rural, predominately underserved region. The Farm Ranch Stress Inventory [44], the Farm Stress Survey [35], and the Farm/Ranch Stress Scale [36] are validated questionnaires, but to our knowledge they have not been previously used to survey farmers in the Southeastern United States. Also, the farmers we contacted in the ENC-29 region were younger, on average, than farmers in the state as a whole (mean age, 50 years versus 57 years) [32]. However, the demographic characteristics of our sample were fairly similar to those of the overall North Carolina farming community in terms of sex and race/ethnicity.

Limitations of our study include self-reporting bias and failure to adjust for other factors that may have influenced participants’ responses. For example, we did not inquire whether the interviewee had recently experienced any other major personal or emotional sources of stress, such as a recent divorce or a death in the family. Also, the study was limited by the small sample size, which was due to the extremely low response rate. We attribute the low response rate to the fact that the survey was conducted during months when farmers tend to be busy and were thus less likely to be available for a telephone interview. Nevertheless, farmers in nearly all of the ENC-29 counties were contacted successfully, so our study had a good geographic distribution of responses. Although our survey population was sufficient for the goals of the study, our results should be interpreted with caution, because our conclusions may not be generalizable to the broader farming population.

Conclusion

This study identified several areas of perceived stress among farmers in Eastern North Carolina and revealed opportunities for future interventions that may help farmers reduce stress in their lives. Having identified these sources of stress, health professionals and health care providers may offer assistance in the development and implementation of educational programs that teach farmers ways of lowering stress. Programs could instruct farmers on how to handle stressful situations and could present other strategies for staying healthy—for example, advice on how to maintain a proper diet and make sound lifestyle choices. Such programs should be offered during the agricultural off-season, when farmers may be more inclined to participate in such activities.

Health care professionals should also actively listen to patients, be alert to signs of stress, and provide simple reminders of ways to manage stress. Providing targeted prevention strategies, health promotion activities, and education for the younger generation of farmers may aid in the reduction of illness, injuries, and stress-related accidents. Existing social support networks, statewide and local commodity meetings, agricultural-related events, and faith-based activities all provide possible opportunities for outreach.

In 1999 the North Carolina Agromedicine Institute (an interinstitutional partnership of ECU, North Carolina State University, and North Carolina Agricultural and Technical State University) was asked by the University of North Carolina Board of Governors to address the health and safety needs of farmers across North Carolina. The institute’s efforts have largely targeted the farming community in the ENC-29 region. Expansion of some of the North Carolina Agromedicine Institute’s programs—the AgriSafe Network of North Carolina, Fit-to-Farm, and North Carolina AgrAbility—are all viable options for providing outreach, as they have strong existing relationships with farmers and farm-related organizations. These programs are able to draw on the expertise of staff members, faculty affiliates, and community partners (in North Carolina and elsewhere in the United States) who have experience working with farm-related mental health issues. NCMJ

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APPENDIX 1.
Farm/Ranch Stress Inventory

DIRECTIONS: Listed below are some of the things that can contribute to farming/ranching related stress. Please rate each item according to how much stress it causes you where (1) = NO STRESS, (2) = A LITTLE STRESSFUL, (3) = MODERATELY STRESSFUL, and (4) = VERY STRESSFUL.

Stressors	No Stress	A Little Stressful	Moderately Stressful	Very Stressful
1. Distance from shopping centers/school/recreation, etc.	1	2	3	4
2. Lack of close neighbors	1	2	3	4
3. Farm/ranch accidents and injuries	1	2	3	4
4. The weather (inadequate/too much rainfall, snow, hail, etc.)	1	2	3	4
5. Market prices for your crops/livestock	1	2	3	4
6. Limited social interaction opportunities	1	2	3	4
7. Seasonal variations in workload (planting season, harvest, calving time, marketing time, etc.)	1	2	3	4
8. Not enough money for day-to-day expenses (purchases, repairs, parts, fence and building maintenance, etc.)	1	2	3	4
9. High debt load	1	2	3	4
10. Working with bankers and loan officers	1	2	3	4
11. Not enough time to spend together as a family in recreation	1	2	3	4
12. Concern over the future of the farm/ranch	1	2	3	4
13. Not having the manpower to operate the farm/ranch	1	2	3	4
14. Government export policy	1	2	3	4
15. Operating hazardous machinery	1	2	3	4
16. Taxes (high taxes, figuring taxes, etc.)	1	2	3	4
17. Distance from doctors or hospitals	1	2	3	4
18. Balancing the many roles I perform as a family member and a farmer/rancher	1	2	3	4
19. Problems with machinery (purchases, repairs, breakdowns)	1	2	3	4
20. Problems with livestock or crops (illness, disease, noxious weeds, rodents)	1	2	3	4
21. Not enough cash/capital for unexpected problems (illnesses, health care, breakdowns, other emergencies)	1	2	3	4
22. Working with extended family members in the farm/ranch operation (parents, in-laws, children)	1	2	3	4
23. Having too much work for one person	1	2	3	4
24. Financing for retirement	1	2	3	4
25. Government farm price supports	1	2	3	4
26. Dealing with non-relative help (incompetent help, finding good help, supervising help)	1	2	3	4
27. Outsiders not understanding the nature of farming/ranching	1	2	3	4
28. Health care costs (direct costs and/or cost of insurance)	1	2	3	4
29. Please list any other items you find stressful in relation to farming and rate them.				