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The Women Farmer Stress Inventory: Examining women farmer stress in the United States Corn Belt

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Abstract

Purpose: While women identifying as primary farmers have increased in the United States, there has not been research focused on the antecedents of stress and quality of life among women farmers in particular. This study set out to construct a Women Farmer Stress Inventory (WFSI), test its dimensionality, and assess its criterion-related validity by looking at its relationship with subjective wellbeing as measured by the Satisfaction with Life Scale (SWLS). We then examined sociodemographic and farm-level correlates to assess their relationship with stress.

Methods: We utilized responses from a random sample of 592 Iowan women farmers who responded to a mailout survey that included the WFSI. We conducted exploratory factor analysis to identify the factorial structure of the WFSI, and used linear regression to evaluate how sociodemographic and farm-level characteristics were related to each factor.

Results: The analysis revealed 5 unique factors that reflected different aspects of women farmer stress: time pressures and workload, environmental concern, external stressors from governments and market, interpersonal relationships, and rural amenities. All factors except rural amenities had high levels of internal consistency (Cronbach's alpha >0.80) and were validated using the external criteria of SWLS measures. Young age, being married, and engagement in off-farm work, and smaller farm size were associated with greater levels of stress across most domains.

Conclusion: The WFSI is a promising tool that shows high internal consistency and is validated with life satisfaction. Our study also finds certain sociodemographic and farm characteristics associated with different stress domains, which could inform both future research and community-based interventions.

KEYWORDS
farm stress, life satisfaction, mental health, Midwest, women's health

PURPOSE

Farming is known to be a stressful occupation. Common stressors have been identified as time pressure/high workload, debt/financial concerns, climate variability, drought, concerns with government regulation/policies, physical isolation, and interpersonal conflict.[1–8] Higher levels of stress among farmers in high-income countries[i] have been linked with increased risk for depression,

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anxiety,[4,9–11] burnout and hopelessness,[5] suicide,[12] and poor physical health.[13]

While a considerable amount of research exists on farm stress, there have been scant studies specifically investigating stress among women farmers.[1] This is a major gap considering that women make up more than 1/3rd of the agricultural workforce in the United States and closer to 40%-50% globally.[14,15] While there are debates on whether the actual share of women in agriculture is increasing,[15,16] there is consensus that their labor is increasingly being "counted" and that women have been historically overlooked by farm extension service providers. Moreover, the research examining farmer stress that has small numbers of women in their samples, frequently, but not always[10,17] find them to be at higher risk of stress (and other mental health disorders) than their male counterparts.[1,3,4,7,9,11,13,18–21] Broader research on gender differences in mental health, stress, and rural living suggests that women may have unique stressors from men due to difference in social expectations around caretaking and household upkeep, yet they are also more likely to seek care or support when distress arises, thereby putting them at lower risk for dying by suicide.[ii 1,22–24] Yet, women are also not a homogenous group and there may be important sociodemographic or farm-level variables that shape women farmer stress.[16,24] There is thus a critical need to better understand the types of stressors women farmers find most pressing as well as the conditions and context associated with the greater levels of stress.

To address this gap, the present study set out to construct a Women Farmer Stress Inventory (WFSI), to test its dimensionality, and assess its criterion-related validity by looking at its relationship with subjective wellbeing as measured by the validated and widely used Satisfaction with Life Scale (SWLS).[25] Recent systematic reviews[26] have found there is a gap in farm stress research that looks at *positive* aspects of mental health such as resilience or life satisfaction, and other research suggests the utility of understanding farm stress within the broader context of wellbeing rather than a biomedical lens.[26,27] Our study examined sociodemographic and farm-level correlates to assess their relationship with women farmer stress.

METHODS

Participants

We constructed our sample through purchasing 2,100 contacts for women farmers from FarmMarketID—a marketing firm that collates farmer contact information based on government and private sources. We requested contacts for woman farmers who farmed 5+ crop acres and/or had 20 head livestock. Our request was stratified by age groupings proportional to the 2017 US agricultural census to have maximum generalizability; however, due to data availability, our sample frame had a smaller proportion of farmers under age 55 than the state population (9% in our frame vs 20% in the population) and slightly larger over age 75 population than the state (19% vs 12%, respectively). We, thus, supplemented the sample frame with women producers listed on the USDA Organics Registry Database (n = 100) as well as the Iowa State University (ISU) Extension-maintained lists of CSA and Farm Stand operators (n = 200). In total, we distributed the survey to 2,400 women farmers.

After conducting 13 in-depth interviews with a purposefully diverse group of women farmers in July 2020, we drafted and piloted the survey for distribution.[iii] The survey was distributed from November 2020 to February 2021 in 4 waves using the Dillman Tailored Design Method.[28] We sent an initial letter introducing the study accompanied with a $2 dollar incentive, a copy of the survey questionnaire, and a post-paid return envelope. In all 4 mailings, there was also a link to an identical survey on Qualtrics for women to respond to if they chose. After sending a postcard reminder, a second survey packet was mailed to nonresponders in early December and followed with a final postcard reminder.

Of the 2,400 surveys sent out, 365 people responded as being ineligible due to not identifying as a woman or no longer being active in farming. An additional 98 individuals were excluded as they responded that they were not actively operating or making decisions for a working farm (eg, they were landowners or retired). After excluding these women, we were left with an eligible sample population of 1,937. Our final study population included 592 responses from eligible farmers, or a 31% response rate (592/1,937).

Measures

The survey collected information in 6 key domains.

Farmer demographics: We collected information on farmer age, race/ethnicity, education, marital status, and tenancy status for their operation.

Farm characteristics: We collected information on the respondent's farm including acres farmed, gross revenue in 2019, major crops, whether they used 5 major conservation practices (cover crop utilization, no till or conservation till, organic production, buffer strip utilization, or land in the Conservation Reserve Program), and whether they belonged to an agricultural cooperative.

On-farm and off-farm activities: To measure the ways women engaged on the farm, we asked their level of off-farm work using the USDA census categories (no days, 1-49 days, 50-99 days, 100-199 days, 200 or more days). Due to low response numbers in the middle 3 categories, we recoded them into 1 category, 1-199 days, for analysis. We asked respondents to rate their level of engagement in 5 house/care-focused tasks and 7 farm-related tasks using a 3-point scale of "*not involved*, *somewhat involved*, *and completely involved*" (see online Appendix A1 for a full list of tasks), which were transformed into a binary variable of (1) some or complete involvement and (2) no involvement with the task. Finally, we asked whether respondents were engaged in 4 different types of community or farm-related organizations, such as church/community associations, farm-related boards, women-focused farm groups, or industry-specific groups.

Respondent identity: Research on women farmers has highlighted they occupy different identities within the family farm[29] and so we asked respondents whether they identified with 8 different roles that

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were identified in formative interviews and the literature search. Respondents ranked whether they identified on a 3-point scale (*Do not identify, somewhat identify, completely identify*), which were transformed into a binary variable of (1) some or complete identification and (2) no identification with the role.

Stress Inventory: The Women Farmer Stress Inventory (WFSI) was constructed with 36 items based on a review of farmer stress inventories,[2–6] particularly Truchot and Andela's Farmer's Stress Inventory[5] and 13 in-depth interviews with women farmers purposefully selected to capture a range of farm types. After reviewing the literature and conducting a thematic analysis of interview transcripts, a list of stressor items was produced and sent to the interview respondents for review. We revised the inventory based on respondent feedback to produce the current 36-item list. Respondents were asked to rate how much each of the situations caused stress in their life using a 5-point scale ranging from *no stress (1) to extreme stress (5)*.

Subjective wellbeing: Respondent wellbeing was measured with the SWLS which is a 5-item scale developed to measure global cognitive judgment of subjective wellbeing.[25] It has been validated in multiple populations and has high levels of reliability.[30] Participants indicate how much they agree or disagree on a 7-point scale that ranges from strongly agree (7) to strongly disagree (1). Respondent answers were scored using standardized cutoffs presented in Diener et al.[25]; however, to assure adequate numbers of participants were in each satisfaction category for analysis, we combined the neutral and slightly satisfied category into a single group.

Data analysis

Exploratory factor analysis was conducted using oblique promax rotation as we assumed the factors were not independent of each other. Factor loadings were used to group individual survey questions into a construct. A max number of factors was set based on the number of factors that had an eigenvalue greater than 1 based on the Kaiser criterion. Internal consistency was evaluated for each construct using Cronbach's alpha. Statements were removed from the construct when their deletion improved the standardized Cronbach coefficient. Each construct was assigned a descriptive name based on the concepts covered in each survey question included in the construct.

Validity of each stress factors was assessed for correlation with quality of life as measured by the SWLS. A linear regression model was built regressing categorical levels of SWLS with each stress factor. Additionally, linear regression models were built to evaluate how each stress factor was related with demographics, tasks, identity, and practices. Normality of each factor was assessed by skewedness and interpreted as normal when skewedness was between −1 and 1. Linear regression models were also run only including highly engaged farmers. Highly engaged farmers were those who reported being highly involved in the day-to-day and land use decisions. The data analysis for this paper was generated using SAS software. Copyright 2016 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc.

RESULTS

Exploratory factor analysis

Results indicated that the 36 statements sort into 5-factor solution after dropping all factors with eigenvalue less than 1. The 5-factor solution collectively explained 94% of the variation. Mean response for level of stress reported for each statement is presented in Table 1 with the factor loadings for each factor. Statements that received the highest stress scores include "having to juggle too many activities," "being confronted with market instability," "having difficulty making a profit," and "feeling concern about lack of healthcare insurance."

The first factor accounted for 60% of the total variance and consisted of 8 statements that were determined to be related to time pressure and workload. We dropped 3 statements because their removal showed an improvement in internal constancy as measured by Cronbach's alpha (see online Appendix A2). The mean stress score for this set of statements was 2.6, the highest for any factor. The subsequent 4 factors accounted for 12%, 9%, 7%, and 6% of the total variance.

Responses for the fifth factor were not normally distributed, and were, therefore, excluded from the linear regression modeling. The least amount of stress was reported for the questions included in the fifth factor.

Criterion-related validity

Table 2 shows the relationship between the WFSI factors and levels of life satisfaction as measured by the SWLS. We see that respondents who have greater stress in each factor are also more likely to be dissatisfied with life. Factor 1, pressure and workload, was 0.92 higher for those dissatisfied relative to female farmers who were very satisfied as measured by the SWLS. A 0.92 increase is nearly an entire stress level higher (eg, "little stress" to "moderate stress") for each statement measured by factor 1. Overall, women were mostly satisfied with their lives and the majority had SWLS scores that categorized them as "very satisfied" (23.3%) or "satisfied" (41.7%).

Regression analysis

The demographics for the cohort are described in Table 3. Most of the women included in the survey were between the ages of 51 and 64 (43.3%) and married (63.5%). Across all stress factors, married women reported higher stress relative to the nonmarried groups. Most women (60.5%) had worked on the farm in the prior year and these women generally reported more stress for each of the factors compared to women who did not work. The effect was strongest for the first factor: time pressure and workload. Income was not related to most of the factors, but the highest income group ($100,000+) did have higher stress for factors 3 and 4. Being a full-owner was associated with less stress in relation to market/government shocks, but had no significant

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TABLE 1 Stress construct factor analysis.

	Coef.	C-alpha*	Mean	Std Dev
Time pressure and workload				
Having to juggle too many activities	0.923		3.0	1.2
Lack of time to complete tasks properly/to do the job well	0.911		2.7	1.1
Lack of time to spend with or take care of my family/loved ones	0.801		2.4	1.1
Having too much workload on the farm	0.770		2.6	1.1
Lack of time to take care of my health and myself	0.756	0.91	2.4	1.1
Environmental concern				
Water quality/water pollution	0.848		2.1	1.0
Soil fertility decline and/or erosion	0.818		2.2	1.0
Increased droughts	0.723		2.4	1.1
Pesticide/chemical exposures	0.699		2.3	1.1
Concern about weather unpredictability	0.646		2.5	1.1
Increased flooding	0.638		1.7	1.0
Feeling uncertainty due to climate change/increasing weather variability	0.581	0.888	2.6	1.1
External stressors				
Being confronted with market instability	0.832		2.9	1.2
Fear of making a mistake on a marketing decision	0.748		2.5	1.2
Having to comply with environmental regulations	0.742		2.1	1.0
Feeling uncertainty about Federal farm policy	0.652		2.5	1.1
Feeling harassed by environmental activists or advocacy groups	0.478		1.6	0.9
Having difficulty making a profit	0.472		2.8	1.2
Having to always control everything for fear of making a mistake	0.449		2.4	1.2
Feeling concern about ability to access enough land	0.347		1.9	1.1
Feeling concern about lack of affordable health insurance	0.282	0.875	2.7	1.4
Interpersonal relationship				
Having difficult conversations or negotiations with relatives over farm successions	0.927		2.0	1.1
Concern over legal/financial aspects of farm transition	0.697		2.3	1.1
Conflicts/tensions with extended family members or neighbors	0.686		1.9	1.0
Feeling responsibility/obligation to continue family farm	0.644		2.3	1.2
Concern/tension with immediate family members in farm decisions	0.617		1.9	1.0
Conflicts/tension with farm employees or tenant farmers	0.260	0.837	1.4	0.7
Rural amenities				
Suffering from the lack of shops or services nearby	0.751		1.4	0.7
Suffering from lack of community in immediate vicinity	0.730		1.4	0.8
Suffering from lack of quality schools/childcare providers in the vicinity	0.543		1.3	0.7
Suffering from lack of health services	0.533	0.785	1.5	0.8

Abbreviations: C-alpha, Cronbach's alpha; Coef, standardized regression coefficient.
*Cronbach's alpha for questions that were used for each factor.

relationship with other stress domains. Having childcare or eldercare responsibilities was related to an increase in many of the stress factors. Most strongly, those with childcare responsibilities also reported a higher stress related to pressure and workload (factor 1, $\beta = 0.53$) and those involved in eldercare reported higher stress regarding external factors (factor 3, $\beta = 0.52$).

Table 4 presents regression results related to identities and farm practices. Women who self-identified with roles associated with farming (land steward, farming, entrepreneur) or off-farm work had greater levels of stress. Involvement with a farming organization (eg, Iowa Farm Bureau) was also associated with higher levels of stress across all stress domains (see online Appendix A3 for full activity results). In short, while

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TABLE 2 Content validity of stress factors* relationship with quality of life.

	Factor 1		Factor 2		Factor 3		Factor 4	
Quality of life	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*
Dissatisfied	0.92 (0.13)	<.001	0.33 (0.12)	.005	0.65 (0.12)	<.001	0.71 (0.11)	<.001
Neutral/slightly satisfied	0.75 (0.12)	<.001	0.22 (0.10)	.036	0.51 (0.10)	<.001	0.43 (0.10)	<.001
Satisfied	0.42 (0.10)	<.001	−0.00 (0.09)	.982	0.22 (0.09)	.012	0.15 (0.08)	.066
Very satisfied	Ref		Ref		Ref		Ref	

*Factor 1: time pressures and workload; Factor 2: environmental concern; Factor 3: external stressors from governments and market; Factor 4: interpersonal relationships.

more involvement in farm activities correlated with higher stress, simply identifying as a farmer was also associated with greater stress. Surprisingly, women who identified as a mother did not report higher stress for any of the factors, and actually reported slightly lower stress for factor 2, statements relating to environmental concern ($\beta = -0.14$).

At the farm level, those with organic production or that used cover drops had higher levels of stress in domains of time use/workload and environmental concern. Co-op membership and implementation of wetland buffers were not significant predictors of stress. Being engaged in farming activities may impact the stress associated with these practices. Therefore, the analysis was repeated with only highly engaged farmers, defined as those completely involved in the day-to-day and land use decisions. The results of this sensitivity analysis were not meaningfully different from the results observed for the entire cohort (see online Appendix A4 for results).

DISCUSSION

This is, to our knowledge, the first female-focused survey that examines the drivers of stress along with sociodemographic and farm-level correlates. We find that stress bundles into 5 latent constructs: time/workload, environmental concern, external market/government factors, interpersonal dynamics, and rural amenities. These factors share many similarities with similar inventories that also found factors of time pressure/workload, physical isolation/rural amenities, government/policy pressure, finances, and interpersonal or community concerns.[2–8] Yet, our factor structure was unique from others in that market/financial concerns and stress around governmental policy grouped together into 1 factor, indicating that farmers had similar orientations to these sets of socially produced factors over which they may have little control. It also may signal how closely tied government policies are to economic conditions on the farm. For example, Waldman et al.[31] found soybean farmers in Indiana were especially stressed by the implementation of Chinese tariffs on agricultural products more so than other common farm stressors.

We also have a unique factor for environmental concerns. Where previously, weather/climate grouped into a factor named "unpredictable interference on the farm,"[2–5] we find this concern groups tightly with other environmental stressors, such as increased drought, concern over water quality, soil quality, or pesticide exposure. As noted by Truchot and Andela,[5] previous studies have not included environmental concerns despite a large body of literature (mostly from Australia) finding that multi-year drought was a major stressor linked with increased mental health concerns.[32–34] Considering this factor was a close third for the highest reported stress level, it demonstrates there is an increased need to study the role of environmental changes and farmer stress and wellbeing.[1]

Regarding the levels of stress, we find most women have low to moderate levels of stress, where the mean ranking for most stress items was between low and moderate stress.[iv] This aligns with other mixed-gender studies utilizing stressor inventories with 5-point scales that find moderate stress the norm among farmers.[4,6] In terms of stressor prevalence, our study finds time pressure and workload to be most common, a striking finding given that most other men-dominated farm stress studies find that government bureaucracy,[2–4] finances,[6] or weather[6,7,35] to be the most salient stressor. While Firth et al.[8] find "workload at peak times" the most prominent stress among New Zealand farmers, other items related to workload and time management ranked lower. Many studies suggest women have to juggle multiple roles in farm households, managing caretaking and off-farm employment while also maintaining the farm enterprise, thereby potentially feeling more time stress than male farmers.[24,27,29,33] Yet, we also find women farmers are quite stressed with the financial aspects of farming, particularly the provisioning of health care. While this stress is common in other US-based studies,[6] this may have special salience for women if they are in charge of managing household appointments and finances as many study respondents reported. One 2007 study of rural Iowans[35] found that women considered lack of health insurance a "high-stress" event, whereas men did not. Interestingly, we find that farmers are not stressed about isolation or lack of rural amenities, which aligns with other mixed-gender studies that find very small shares of farmers feel stress about isolation.[3,4,6,17,35]

In terms of variables associated with greater stress, we find that off-farm work is associated with greater stress regarding time pressure/workload, and, to a lesser extent with government/market influences and environmental concern. While some studies also find a positive relationship between work hours and stress,[11,36] there are also data showing that off-farm work is associated with less farm-related stress.[7,11,37] These studies suggest the relationship between workload and stress may be complex. For example, Brennan et al.[7] suggest that working off farm might increase social connections

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TABLE 3 Demographic factors associated with stress factors* modeled using linear regression.

			Factor 1		Factor 2		Factor 3		Factor 4	
	N	%	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*
Age										
66-81	204	35.1%	−1.12 (0.10)	<.001	−0.14 (0.09)	.138	−0.34 (0.09)	<.001	−0.11 (0.09)	.247
51-65	252	43.3%	−0.42 (0.10)	<.001	−0.02 (0.09)	.816	0.03 (0.09)	.707	0.07 (0.09)	.409
23-50	126	21.6%	Ref	.	Ref	.	Ref	.	Ref	.
Marital status										
Never married	34	6.2%	−0.45 (0.17)	.008	−0.65 (0.15)	<.001	−0.43 (0.15)	.004	−0.19 (0.14)	.197
Divorced/separated	67	12.2%	−0.61 (0.20)	.003	−0.67 (0.17)	<.001	−0.55 (0.17)	.002	−0.34 (0.17)	.044
Widowed	134	24.4%	−0.95 (0.18)	<.001	−0.68 (0.15)	<.001	−0.52 (0.16)	.001	−0.17 (0.15)	.264
Married	349	63.5%	Ref	.	Ref	.	Ref	.	Ref	
Education										
Some college	134	23.4%	0.08 (0.13)	.535	−0.02 (0.11)	.879	0.06 (0.11)	.563	0.12 (0.11)	.256
College graduate	245	42.8%	0.38 (0.12)	.002	0.19 (0.10)	.053	0.11 (0.10)	.280	0.12 (0.10)	.201
Post-graduate	96	16.8%	0.28 (0.14)	.052	0.20 (0.12)	.094	−0.05 (0.12)	.671	0.12 (0.12)	.280
High school	98	17.1%	Ref	.	Ref	.	Ref	.	Ref	.
Off-farm work										
1-199 days	135	24.1%	0.58 (0.10)	<.001	0.28 (0.09)	.002	0.39 (0.09)	<.001	0.11 (0.09)	.230
200 or more	204	36.4%	0.56 (0.09)	<.001	0.02 (0.08)	.758	0.17 (0.08)	.039	0.07 (0.08)	.376
Did not work	221	39.5%	Ref	.	Ref	.	Ref	.	Ref	.
Tenancy										
Full owners	251	54.6%	−0.24 (0.08)	.004	0.04 (0.07)	.565	−0.33 (0.07)	<.001	−0.13 (0.07)	.054
Part owners	175	38.0%	0.42 (0.09)	<.001	−0.09 (0.07)	.235	0.38 (0.07)	<.001	0.21 (0.07)	.004
Tenants	34	7.4%	0.34 (0.18)	.055	0.35 (0.15)	.017	0.26 (0.15)	.071	0.08 (0.14)	.591
Farm size										
50-179 acres	142	25.0%	−0.47 (0.13)	<.001	−0.34 (0.11)	.002	−0.07 (0.11)	.529	0.21 (0.10)	.040
180-499 acres	174	30.7%	−0.40 (0.12)	.001	−0.17 (0.10)	.098	0.20 (0.10)	.057	0.39 (0.10)	<.001
500-999 acres	73	12.9%	−0.39 (0.15)	.011	−0.21 (0.13)	.090	0.37 (0.13)	.004	0.53 (0.12)	<.001
1,000+ acres	79	13.9%	−0.17 (0.15)	.235	−0.29 (0.12)	.017	0.43 (0.12)	<.001	0.46 (0.12)	<.001
1-49 acres	99	17.5%	Ref	.	Ref	.	Ref	.	Ref	.
Farm revenue										
$10,000-$24,999	79	17.6%	−0.00 (0.15)	.987	0.06 (0.13)	.639	0.19 (0.13)	.152	0.08 (0.12)	.531
$25,000-$49,999	77	17.1%	−0.06 (0.16)	.719	0.01 (0.13)	.928	0.17 (0.13)	.194	0.33 (0.12)	.008
$50,000-$99,999	84	18.7%	−0.13 (0.15)	.399	−0.00 (0.13)	.992	0.12 (0.13)	.344	0.09 (0.12)	.469
$100,000+	125	27.8%	0.11 (0.14)	.434	−0.06 (0.12)	.632	0.45 (0.12)	<.001	0.36 (0.11)	.001
<$10,000	85	18.9%	Ref	.	Ref	.	Ref	.	Ref	.
Highly engaged[a]	217	39.7	0.41 (0.08)	<.001	0.32 (0.07)	<.001	0.25 (0.07)	<.001	0.10 (0.07)	.165

[a]Highly engaged farmers are defined as those who reported being "completely involved" in both day-to-day operations and land use/cropping decisions.
*Factor 1: time pressures and workload; Factor 2: environmental concern; Factor 3: external stressors from governments and market; Factor 4: interpersonal relationships.

while diversifying incomes for financial security. However, Logstein et al.[11] suggest some high-workload respondents may have less stress because they "enjoy working" (the healthy worker effect[38]), whereas those with greater stress may be working for financial need rather than personal satisfaction. Given that lack of health insurance was a high stressor among respondents and farmers often maintain off-farm employment to receive health benefits, 1 inference could be that off-farm work is done out of need rather than desire for both income and health insurance benefits, which averaged around $1,500 per month for a family of 4 in 2022.[39]

Another important finding is that younger farmers (< age 50) reported greater stress levels related to workload/time pressure

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TABLE 4 Activities, practices, and identities associated with stress factors* modeled using linear regression.

	Factor 1		Factor 2		Factor 3		Factor 4	
	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*	Beta (SE)	*P*
Care-labor activities								
Childcare	0.53 (0.09)	<.001	−0.12 (0.08)	.148	0.14 (0.08)	.081	−0.02 (0.08)	.807
Eldercare	0.35 (0.12)	.003	0.24 (0.10)	.012	0.52 (0.10)	<.001	0.15 (0.10)	.113
Farm practices								
Co-op membership	−0.00 (0.10)	.981	−0.08 (0.08)	.310	0.21 (0.08)	.010	0.18 (0.08)	.024
Organic	0.50 (0.11)	<.001	0.35 (0.09)	<.001	−0.08 (0.09)	.412	−0.04 (0.09)	.646
Cover crops	0.30 (0.08)	<.001	0.26 (0.07)	<.001	0.16 (0.07)	.029	0.13 (0.07)	.053
Wetlands buffer	−0.02 (0.10)	.860	0.06 (0.08)	.471	0.04 (0.08)	.607	0.23 (0.08)	.004
Identities								
Farmer	0.43 (0.07)	<.001	0.22 (0.06)	<.001	0.35 (0.06)	<.001	0.17 (0.05)	.002
Mother	0.01 (0.07)	.939	−0.14 (0.06)	.023	0.01 (0.06)	.906	0.08 (0.06)	.163
Spouse	0.20 (0.06)	<.001	−0.02 (0.05)	.632	0.08 (0.05)	.091	0.06 (0.05)	.224
My off-farm job	0.23 (0.05)	<.001	0.02 (0.04)	.620	0.08 (0.04)	.075	0.07 (0.04)	.077
Community/civic leader	0.24 (0.06)	<.001	0.06 (0.05)	.273	0.12 (0.05)	.028	0.07 (0.05)	.200
Entrepreneur	0.40 (0.05)	<.001	0.11 (0.05)	.013	0.25 (0.04)	<.001	0.12 (0.04)	.005
Land steward	0.28 (0.06)	<.001	0.27 (0.05)	<.001	0.23 (0.05)	<.001	0.16 (0.05)	.001
Daughter	0.32 (0.05)	<.001	0.04 (0.05)	.326	0.15 (0.04)	<.001	0.09 (0.04)	.056

*Factor 1: time pressures and workload; Factor 2: environmental concern; Factor 3: external stressors from governments and market; Factor 4: interpersonal relationship.

than farmers over age 50 and greater stress levels around market/governmental factors than those over age 66. These findings align with the literature surveyed by Yazd et al.,[1] which finds that young farmers tend to be more stressed about financials.[11,17] Particularly in Iowa where farmland prices have grown quickly in recent years, Rudolphi et al.'s[17] study of young Midwestern farmers finds high levels of stress related to farm debt. Greater stress around time pressure is also supported in literature finding younger women farmers may have less control over their time due to household power dynamics,[24,40] and also more responsibilities for child and eldercare.[24,40,41] This inference is supported by our finding that women with more responsibility for child or eldercare reported higher stress related to workload/time pressure, but not other stress domains. The findings that younger women, and off-farm workers all have greater stress related to time pressure/workload and government/market forces should be taken seriously by practitioners who might target interventions through rural workplaces or young farmer associations. These stressors could also be addressed in policy measures by creating more affordable health insurance to minimize the need for off-farm work or better lending and incentive programs for young/beginning farmers who often also work off-farm while they build their farm business.[42]

At the farm level, those with smaller-sized farms (1-49 acres) reported less stress regarding government/market and interpersonal stressors, but greater stress around time/workload and the environment. The average farm size in Iowa is 359 acres,[43] thus a 1-to 49-acre farm is small and likely not a large source of household income, which may necessitate off-farm work or more self-management (resulting in higher time stress). The observation that operators of smaller farms are more concerned with the environment is salient since smaller farms are less likely to be able to adopt conservation practices, despite potentially being adversely impacted by larger farms' pollution.[44] Thus, more research is needed to understand how environmental and conservation regulations might impact farmer stress based on the size of their operation.

Farm operators with the highest reported stress levels around interpersonal and government/market factors have farms in the 500-99 and 1,000+ acre categories or with >$100,000 in gross sales. These farmers likely depend on the farm for a greater share of income and also have greater stakes in continuing a farm "legacy" through generational transitions. Interpretation is limited due to the wide upper-bound categories used in the survey, which reflected USDA census categories. While Swenson[45] finds Iowan "intermediate" farms (defined as <$350,000 in gross sales with someone whose primary occupation is farming) face some financial distress, with net household incomes below the state median, he finds larger family-owned "commercial" farms (>$350,000 in gross sales) have household incomes well above the state median. Because our upper-bound categories would capture both intermediate and commercial family farm types, we cannot say definitively whether it is the "intermediate" farms most experiencing finance-related stress. Future research might more closely examine mid-sized and larger-sized farms to understand financial wellbeing and what levels of income or savings is needed to allay farm-related stress.

We observed each stress factor to be correlated with the SWLS. Women, on the whole, reported being quite satisfied with their lives

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despite facing moderate levels of stress. Those dissatisfied with life were observed to have the greatest difference regarding both "time pressures and workload" and "interpersonal relationships" relative to those who were satisfied with life. Therefore, alleviating stress due to time pressures and workload and interpersonal relationships are potential mechanisms to improve women farmer's quality of life.

Limitations and future research

While this study provides unique information about female farmer stress, as a cross-sectional study, the study has limitations. First, we cannot assess the temporal relationship between the stress factors and farm characteristics. We are, therefore, unable to identify conditions that directly cause or reduce stress. However, we identified several characteristics that occur along with stress. This evidence provides potential next steps for understanding and reducing female farmer stress. Second, in focusing our research on women farmers, we did not sample men farmers thus cannot draw comparisons between genders. Future researchers might address this by using the WFSI to assess differences between genders in similar farming contexts, particularly given the work based on small samples of women that suggest higher levels of stress. Additionally, qualitative researchers might further examine how gender-specific social relationships (eg, with other parents, colleagues, or farm-trade groups) might impact certain stressors such as those with government policy or farm succession. While in-depth interviews informed the construction of the WFSI, we did not include items related to gender-based discrimination or violence, thus our ability to comment on these gender-specific stressors is limited. Future research might include more gender-specific stressors or check to see the relationship with other mental health disorders such as stress, anxiety, or burnout since our study limited itself to subjective wellbeing. Finally, our sample of women farmers lacked racial or ethnic diversity, and given evidence on higher stress and discrimination among Black, Latina, and Native farmers in the United States,[46–49] more research should look at the intersections of gender and race/ethnicity in understanding farmer stressors.

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Notes

[i] The World Bank income classification groups high-income countries as those with a GNI per capital of $13,846 or more and includes countries in North America, Western Europe, and the Asia-Pacific region (eg, Japan and Australia).[50]

[ii] This aligns with robust population-level meta-analyses that find women are significantly more likely to experience generalized stress, depression, or anxiety than men, and that this cannot be attributed to a greater propensity to report symptoms.[51]

[iii] While the data collection period intersected with the first year of the COVID-19 pandemic, the results from the in-depth interviews suggested this did not pose a large stress to commodity farmers in Iowa. Surveys had multiple areas where respondents could right additional stressors and of the 591 respondents, nobody mentioned COVID-19. Nonetheless, we cannot conclusively state that COVID-19 did not impact respondent's occupational stress.

[iv] Note that the survey did not offer a standardized definition of "stress" but let individuals interpret it for themselves.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest pertaining to this study.

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APPENDIX

Tables A1–A4

TABLE A.1 Questions used to identify high farm involvement

Land use and/or crop decisions
Livestock decisions
Record keeping/Financial management
Estate/Succession management
Management of farm staff
Marketing decisions

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TABLE A.2 Stress Construct Factor Analysis, Excluded Questions

	Coef.	Mean	Std Dev
Time Pressure and Workload			
Problems with farm equipment breakdown*	0.353	2.3	1.1
Fear of getting injured by machinery or livestock*	0.275	2.1	1.0
Concern about health/safety of myself or other farmers on the operation*	0.219	2.3	1.0
Rural Amenities			
Conflict/tension with professional associates*	0.346	1.5	0.8
Concern about judgement from neighbors or community for not doing one's job well*	0.218	1.6	0.9

Abbreviations: Coef, Standardized Regression Coefficient; C-Alpha, Cronbach's Alpha
*Question excluded due to improved internal constancy as measured by Cronbach's Alpha

TABLE A.3 Additional activities associated with stress factors* modeled using linear regression

	Factor 1		Factor 2		Factor 3		Factor 4	
	Beta (SE)	p	Beta (SE)	p	Beta (SE)	p	Beta (SE)	p
On farm activities								
Day to day decisions	0.39 (0.06)	<.001	0.16 (0.05)	<.001	0.21 (0.05)	<.001	0.05 (0.05)	0.287
Land use and/or crop decisions	0.29 (0.05)	<.001	0.19 (0.04)	<.001	0.19 (0.04)	<.001	0.04 (0.04)	0.384
Livestock decisions	0.38 (0.05)	<.001	0.14 (0.04)	0.002	0.23 (0.04)	<.001	0.07 (0.04)	0.125
Record keeping/Financial management	0.29 (0.07)	<.001	0.15 (0.06)	0.007	0.23 (0.06)	<.001	0.09 (0.05)	0.102
Estate/Succession management	0.05 (0.06)	0.483	0.10 (0.05)	0.062	0.13 (0.05)	0.013	0.13 (0.05)	0.010
Management of farm staff	0.36 (0.05)	<.001	0.21 (0.05)	<.001	0.27 (0.04)	<.001	0.16 (0.04)	<.001
Marketing decisions	0.29 (0.05)	<.001	0.22 (0.04)	<.001	0.26 (0.04)	<.001	0.09 (0.04)	0.022
Organizational engagement								
Community group membership	-0.01 (0.08)	0.895	-0.07 (0.07)	0.308	-0.03 (0.07)	0.630	0.03 (0.07)	0.663
Farm Board membership	0.37 (0.15)	0.014	0.18 (0.13)	0.145	0.05 (0.13)	0.678	-0.01 (0.12)	0.911
Women-focused farm org. member	0.44 (0.14)	0.002	0.37 (0.12)	0.002	0.20 (0.12)	0.094	0.32 (0.12)	0.006
Industry-wide farm org. member	0.39 (0.08)	<.001	0.18 (0.07)	0.012	0.24 (0.07)	<.001	0.16 (0.07)	0.020

TABLE A.4 Practices associated with stress factors* modeled using linear regression, highly engaged** farmers only (n=217)

	Factor 1		Factor 2		Factor 3		Factor 4	
	Beta (SE)	p	Beta (SE)	p	Beta (SE)	p	Beta (SE)	p
Farm practices								
Coop membership	-0.10 (0.17)	0.555	-0.21 (0.16)	0.187	0.16 (0.14)	0.257	0.24 (0.15)	0.100
Organic	0.55 (0.15)	<.001	0.45 (0.15)	0.002	-0.12 (0.13)	0.388	-0.09 (0.14)	0.507
Cover crops	0.35 (0.13)	0.009	0.44 (0.13)	<.001	0.23 (0.11)	0.046	0.19 (0.12)	0.104
Wetlands Buffer	-0.07 (0.15)	0.635	0.18 (0.14)	0.198	0.05 (0.12)	0.683	0.33 (0.13)	0.012

*Factor 1: time pressures and workload; Factor 2: environmental concern; Factor 3: external stressors from governments and market; Factor 4: interpersonal relationships.
**Highly engaged farmers are defined as those who reported being "completely involved" in both day-to-day operations and land use/cropping decisions.

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