

RESEARCH ARTICLE

Prevalence of Anxiety Symptoms by Sociodemographic and Employment Characteristics in a National Sample of Hired Crop Workers: Evidence From the National Agricultural Workers Survey (2018–2022)

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Received: 9 May 2025 | **Revised:** 11 November 2025 | **Accepted:** 14 November 2025

Funding: The National Agricultural Workers Survey is funded and conducted by the US Department of Labor. Funding for anxiety questions was provided by the National Institute for Occupational Safety and Health.

Keywords: agricultural workers | anxiety | crop workers | farmworkers | mental health | national survey | occupational health

ABSTRACT

Background: Hired crop workers face harsh working conditions, including physical, economic, and social challenges. We present a population-based assessment of anxiety symptoms among a large national sample of hired crop workers in the United States.

Methods: In-person interviews were conducted with 6108 crop workers during 2018–2022. Generalized anxiety disorder (GAD-2) questions were included in the National Agricultural Workers Survey to provide weighted prevalences of anxiety symptoms and prevalence ratios for the association between anxiety symptoms and crop worker demographics and employment characteristics.

Results: The prevalence of anxiety symptoms was 20.6% for scoring ≥ 1 on the GAD-2, and 7.7% for scoring ≥ 3 on the GAD-2. Women had a 73% excess risk of any anxiety (GAD-2 ≥ 1) and an 84% higher risk of severe anxiety (GAD-2 ≥ 3) than men. Men with a medium level of English language ability had a 28%–31% increased risk of anxiety symptoms compared to those with a lower English language ability. Not having workers' compensation insurance was associated with a 56% reduced risk of having severe anxiety symptoms among men. However, total family income, working directly for an agricultural employer or farm labor contractor, method of payment, unemployment insurance, and health insurance were not significantly associated with anxiety symptoms. Compared to working in California, men working in the Northeast showed a 57% reduced risk of more severe anxiety symptoms.

Conclusions: Based on a large national sample of hired crop workers, nearly one in four crop workers suffered from anxiety, with women having a much higher prevalence than men, suggesting the need for mental health services for this population.

1 | Introduction

A number of studies have documented challenges faced by hired crop workers in the United States. Crop workers face harsh working conditions comprising many physical, economic, and

social challenges. These include exposure to pesticides, air pollutants, physical hazards as risk factors for injury [1–7], heat stress [8–10], poverty, inadequate housing, and food insecurity [11–16]. Additional stressors include acculturative stress [17–28] and immigration concerns [2, 21, 24, 28]. Several smaller studies

have identified additional risk factors including contribution to the decision to live as a migrant farmworker [18, 19] and exposure to substance use at work [21, 29].

According to the World Health Organization, anxiety and depressive disorders were the most common mental health disorders, affecting one in five people worldwide in 2021. In 2021, it was estimated that 4.4% of the global population experienced an anxiety disorder [30]. Vahratian et al. reported anxiety prevalence figures of 40.2% and 47.1% for two 2-week data collection periods between August 19, 2020 and February 2021 among Hispanic/Latino participants who completed the US Household Pulse Survey [31]. In 2021, based on the BLS Current Population Survey, people of Hispanic/Latino ethnicity made up 18% of the total labor force in the United States [32].

Earlier studies, often using small samples, showed variability in anxiety prevalence. Alderate et al. found that the lifetime prevalence for any psychiatric disorder in a Mexican migrant farmworker sample in California was 16.3% for women and 27.6% for men [33]. Anxiety disorders were 15.1% for men and 12.9% for women [25]. Grzywacz et al. interviewed farmworkers from 26 sites in North Carolina and found that approximately 17% suffered from potentially significant anxiety that might impair functioning, and found some support for the theory that ambivalence with regard to migration was associated with anxiety [34].

Rigid work demands and poor housing were significantly associated with high levels of anxiety symptoms in migrant farmworkers in northwest Ohio and southern Michigan [35]. Hiott et al. found that 18.4% of migrant farmworkers in East Central North Carolina experienced levels of anxiety that might impair functioning [21]. Crain et al. found a prevalence of 16.4% for anxiety in 12 camps of farmworkers in both the eastern and western regions of North Carolina [36]. Among Latino farmworkers in California interviewed in 2020, about 15% reported symptoms of anxiety [16]. Farmworkers who were married or living as married, spoke a language other than English at home, and worked in the fields had a lower prevalence of anxiety symptoms [16]. Female farmworkers who had lived more years in the United States, and those with one or more COVID-19 related symptoms in the 2 weeks preceding the study interview showed a higher risk of anxiety symptoms [16]. Economic difficulties were associated with depression and anxiety symptoms among Latino farmworkers recruited from farmworker campsites in Nebraska [11]. Findings using the generalized anxiety disorder scale (GAD-7) among 3487 farm women in England and Wales showed a prevalence of 23.3% having medium or severe anxiety and 34.6% mild anxiety [37].

Sussell et al. analyzed data on mental distress and depression from the Behavioral Risk Factor Surveillance System for 37 states by industry and occupation. Workers in agriculture, forestry, fishing, and hunting had 9.3% lifetime-diagnosed depression, 9.6% frequent mental distress, and 4.1% extreme distress [38]. Specific data on anxiety were not presented. However, hired crop workers, many of whom are Latino, are likely very different from farm owners and farm managers.

Despite the contributions of these studies, most were based on either small sample sizes or subpopulations of crop workers; hence, we do not have a full assessment of the prevalence of anxiety symptoms among a large national sample of crop workers. This study provides a population-based assessment of anxiety symptoms among a large sample of hired crop workers in the United States and helps develop a greater understanding of their mental health. Data were used to document the prevalence of anxiety symptoms in crop workers and examine that prevalence in association with their sociodemographic and employment characteristics.

2 | Methods

2.1 | Data

The National Agricultural Workers Survey (NAWS) is the primary source of data on US workers in crop agriculture and is administered by the United States Department of Labor (DOL) Employment and Training Administration. The NAWS is designed to address the information needs of various Federal agencies that oversee crop worker programs. As the only national information source on the employment, demographic, and health characteristics of hired crop workers, NAWS data are central for informing these programs. Stakeholders include agencies concerned with occupational injury and health surveillance. Since 1989, NAWS interviewers have conducted interviews with a national probability sample of workers employed in crop agriculture, not including workers with a temporary work permit (H-2A). Activities include all phases of crop production (preharvest, harvest, and postharvest), including operating machinery. A detailed description of the NAWS sampling and weighting can be found at <https://www.dol.gov/agencies/eta/national-agricultural-workers-survey/methodology>. In addition, reports describing findings from the NAWS are available from the DOL website (dol.gov). Data are made publicly available by request at the DOL website. This activity was reviewed by the U.S. Centers for Disease Control and Prevention (CDC), deemed not research, and was conducted consistent with applicable federal law and CDC policy.

The NAWS uses stratified multi-stage sampling to account for seasonal and regional fluctuations in the level of farm employment. The stratification includes three interviewing cycles per year (February, June, and October) and 12 geographic regions, resulting in 36 cycles by region. For each interviewing cycle, NAWS staff draw a random sample of locations within all 12 regions from the universe of farm labor areas (FLAs). FLAs are single- or multi-county sampling units which form the primary sampling units (PSUs). Employers within PSUs are the secondary level, and workers within employers are the tertiary level of sampling units. The sampling frame of establishments (usually farms) engaged in Crop Production (NAICS code 111) and Support Activities for Crop Production (NAICS 1151) is constructed primarily from the Quarterly Census of Employment and Wages (QCEW), a census of establishments that pay unemployment insurance taxes on behalf of their employees. In states where unemployment insurance coverage is not universal, the sampling frame is supplemented with

farm establishments drawn from commercial lists of agricultural employers, administrative data sources, internet searches, and discussions with local, knowledgeable sources.

A simple random sample of agricultural employers is selected from a list of employers. Once the sample of employers is drawn, interviewers contact the selected growers or contractors to obtain access to the work site. Once interviewers have a worker frame, a random sample of workers is chosen. The interviewers, who generally work in pairs, approach workers directly to set up interview appointments on the farm where the crop work is sampled, usually during a break, or before or after a shift, so that normal work activities are not disrupted. Employer and respondent cooperation rates were similar across the 4 data collection years. Cooperation rates for employers ranged from 48% to 67% and for crop workers, 91%–92% over the 4-year period. Interviewer COVID-19 precautions were added at the start of the pandemic in 2020. These included requiring interviewers in the field to wear masks (covering both the nose and the mouth), practice social distancing by staying six feet away, eliminate direct hand-to-hand contact (e.g., avoid handing out a brochure), and practice hand hygiene, that is, handwashing or use of hand sanitizer.

Questions and variables included are part of the ongoing NAWS. Using a household grid (interview subsection), interviewers record basic demographic information about respondents and all household members, including age, sex, relationship to respondent, place of birth, education level, and the month and year the respondent and household members first entered the United States, if foreign-born. Respondents report their race and ethnicity, primary language, and ability to read and speak English. Using a work grid, the interviewer compiles a 12-month retrospective employment and migration profile that covers the primary crop and farm task, type of nonagricultural work if employed off the farm, periods of unemployment, and time spent outside of the United States. In other parts of the questionnaire, interviewers record hourly earnings, including payment method (piece or hourly), insurance benefits (health insurance, workers compensation, and unemployment insurance), use of health services, lifetime diagnosis of chronic disease, along with a series of questions on personal and family income, assets in and outside of the United States and use of social services.

2.2 | Anxiety Symptom Measurement

Also included during the years 2018–2022 were two questions from the GAD-7 that provide early detection or screening of probable GAD cases [39–41]. The two-item version referred to as the generalized anxiety disorder scale-2 (GAD-2) has been culturally adapted and is available in Spanish [41]. The core GAD symptom is chronic, excessive, and uncontrolled worry. GAD is frequently associated with other psychiatric disorders. The GAD-2 is scored between 0 (never) and 6 (almost every day) and can be used to assign respondents to the following severity levels (0–2) minimal and severe (3–6). Using a cut-off value of ≥ 3 , sensitivity = 0.64, specificity = 0.85, and Cronbach's $\alpha = 0.81$ have been reported [39]. The stem question asks, “Over the last 2 weeks, how often have you been

bothered by the following problems?” Two problems are asked about: (1) Feeling nervous, anxious, or on edge, and (2) Not being able to stop or control worrying. Responses range from (0) not at all, (1) several days, (2) more than half the days, to (3) nearly every day. For this study, we present results separately for scoring at least one or at least three on the GAD-2 (see Table 2).

2.3 | Statistical Analysis

Weighted prevalences and prevalence ratios for the association between anxiety symptoms and hired crop worker demographics and employment characteristics were calculated using Stata 16.1 for all workers combined, and then separately by sex. Confidence intervals for prevalence ratios that cross 1.0 are not significant at $\alpha = 0.05$. All estimates presented are adjusted for the complex sampling design of the NAWS. Post-sampling adjustments adjust the relative value of each interview for national estimates to be obtained from the sample. A year adjustment to the weights allows different cycles and sampling years to be combined for statistical analysis. Sex differences were calculated using *t*-test for the difference in means and *p* values were derived from chi-square tests. Analyses were conducted using a score on the GAD-2 of ≥ 1 (any anxiety symptoms) and GAD-2 ≥ 3 (more severe anxiety symptoms). Prevalence figures for anxiety symptoms were also examined for differences between the pre-COVID-19 period and during the COVID-19 epidemic using March 11, 2020, as the start of the pandemic (<https://www.who.int/news/item/27-04-2020-who-timeline-covid-19>).

3 | Results

Table 1 presents descriptive statistics for sociodemographic and work characteristics for hired crop workers in the sample. A total of 6108 interviews were completed. Of these, 67.5% were men and 76.6% were Hispanic/Latino. There was a slight plurality of workers in the 35 to 44-year age range, followed by 25–34 years. More than half (51.2%) of hired crop workers were either married or cohabiting. Thirty-three percent of men and 43.4% of women had children younger than 15 years old in the home. The largest percentage (36.8%) of workers had 6 years or fewer of education, followed by 30.0% of men having a high school education compared to only 22.3% of women. Among men, 31.2% had low English language ability compared to 41.4% of women. The highest overall prevalence for total family income in the previous year was \$20,000–\$29,000 (23.2% of men and 21.4% of women). More women (24.4%) than men (16.7%) earned less than \$20,000 per year. The majority of hired crop workers were employed by growers (84.5%) and paid by the hour (85.2%). About half of the hired crop workers had unemployment insurance (49.5%), and 91.6% had workers' compensation insurance. Almost half (48.2%) did not have health insurance, and 12.6% had employer-paid health insurance, with an additional 39.2% of insurance paid by another source. The largest group of crops had entered the US more than 15 years before the interview (46.8%), and

TABLE 1 | Descriptive statistics for participant characteristics (National Agricultural Workers Survey, 2018–2022).

Characteristics	Total				Men			Women		
	<i>n</i>	Percent	95% CI		Percent	95% CI		Percent	95% CI	
<i>Demographics</i>										
Male	6108	100.0	—		67.5	62.6	72.0	32.5	28.0	37.4
Ethnicity										
Hispanic	4585	76.6	71.1	81.3	76.2	70.5	81.0	77.5	69.5	83.9
Non-Hispanic White	1220	20.4	16.3	25.3	20.0	16.0	24.9	21.1	15.0	29.0
Other	180	3.0	1.7	5.3	3.8	2.0	7.2	1.4	0.7	2.7
Age										
14–24 years	950	15.6	13.4	18.1	14.6	11.8	17.3	17.7	13.4	23.0
25–34 years	1408	23.1	20.8	25.5	23.7	18.6	26.6	21.8	18.7	25.3
35–44 years	1459	23.9	21.6	26.4	20.8	18.0	25.5	30.4	26.5	34.6
45–54 years	1165	19.1	17.1	21.3	19.5	16.4	22.5	18.4	15.2	22.0
55+ years	1119	18.3	16.4	20.5	21.5	19.8	25.5	11.8	9.2	14.9
Marital status										
Single	1966	32.2	28.8	35.9	30.7	27.2	34.4	35.4	28.7	42.8
Married or cohabiting	3126	51.2	47.3	55.1	52.1	48.1	56.1	49.4	41.4	57.4
Other	1010	16.6	14.1	19.4	17.2	14.8	19.9	15.2	11.3	20.3
Children younger than 15 years old										
No	3896	63.8	60.3	67.2	67.2	64.0	70.3	56.6	50.1	62.9
Yes	2212	36.2	32.9	39.7	32.8	29.7	36.0	43.4	37.1	49.9
<i>Socioeconomic status</i>										
Education level										
Primary (≤ 6 years)	2240	36.8	33.9	39.8	36.9	33.6	40.4	36.6	32.3	41.1
Middle (7–9 years)	1325	21.8	18.8	25.1	21.5	18.1	25.5	22.3	18.4	26.7
High school (10–12 years)	1669	27.4	24.3	30.9	30.0	26.4	33.8	22.3	18.4	26.6
Post-secondary (13–16 years)	849	14.0	11.2	17.3	11.6	9.2	14.5	18.9	13.6	25.5
English language ability										
Low	2103	34.5	29.8	39.5	31.2	26.7	36.1	41.4	35.6	47.4
Medium	1874	30.7	27.3	34.4	32.7	28.5	37.1	26.8	22.7	31.3
High	2120	34.8	29.9	40.0	36.2	31.3	41.4	31.9	24.9	39.7
Total family annual income										
Did not work in previous year	261	4.5	3.2	6.4	4.1	2.7	6.4	5.4	3.3	8.5
< \$20,000	1103	19.2	16.8	21.8	16.7	14.2	19.5	24.4	19.8	29.7
\$20,000–29,999	1299	22.6	20.3	25.1	23.2	20.2	26.5	21.4	17.9	25.2
\$30,000–39,999	1088	19.0	17.1	20.9	20.1	17.9	22.5	16.7	13.3	20.6
\$40,000–54,999	936	16.3	14.3	18.5	16.5	14.5	18.7	15.9	11.6	21.3
\$55,000 or more	1056	18.4	16.1	21.0	19.4	16.9	22.2	16.4	13.1	20.2
<i>Work characteristics</i>										
Employer										
Farm labor contractor	891	15.5	10.0	23.4	16.5	10.4	25.2	13.5	8.4	20.9
Grower, packing house, nursery	4853	84.5	76.6	90.1	83.5	74.8	89.6	86.5	79.1	91.6
How worker is paid										
By the hour	5125	85.2	81.8	88.1	84.9	81.6	87.8	85.9	78.7	90.9

(Continues)

TABLE 1 | (Continued)

Characteristics	Total				Men			Women		
	<i>n</i>	Percent	95% CI		Percent	95% CI		Percent	95% CI	
By the piece or hourly and piece	622	10.3	7.6	14.0	8.8	6.3	12.3	13.4	8.4	20.8
Salary	267	4.4	3.3	6.0	6.3	4.6	8.4	0.7	0.3	1.7
Unemployment Insurance										
No	2964	50.5	45.2	55.9	46.7	41.8	51.7	58.4	49.2	67.1
Yes	2901	49.5	44.1	54.9	53.3	48.3	58.2	41.6	32.9	50.8
Worker's compensation										
No	511	8.4	6.6	10.7	7.7	5.8	10.1	10.1	6.7	14.8
Yes	5575	91.6	89.3	93.4	92.4	89.9	94.2	89.9	85.2	93.3
Health insurance										
No	2936	48.2	44.4	52.2	49.0	44.9	53.0	46.8	40.3	53.3
Yes, employer pays	765	12.6	10.4	15.2	14.4	11.8	17.4	8.9	6.4	12.3
Yes, other insurance	2385	39.2	35.2	43.3	36.7	32.9	40.6	44.4	37.2	51.8
<i>Immigration characteristics</i>										
Current status										
Citizen	2229	36.9	31.7	42.4	38.6	33.4	44.0	33.3	26.3	41.1
Has work authorization	1315	21.7	18.5	25.4	22.4	19.7	25.4	20.4	13.9	28.8
Undocumented	2504	41.4	35.8	47.3	39.0	34.1	44.2	46.4	37.5	55.4
Number of years since first entered the US										
Born in United States	1878	30.8	25.8	36.3	31.9	26.7	37.6	28.5	21.9	36.1
0–15 years	1367	22.4	19.3	25.8	19.4	16.7	22.4	28.7	23.7	34.3
More than 15 years	2853	46.8	42.6	51.1	48.7	43.7	53.8	42.8	37.1	48.7
<i>Region</i>										
Northeast	646	10.6	8.0	13.8	9.3	6.9	12.4	13.3	9.4	18.4
Southeast	625	10.2	7.3	14.1	10.1	7.1	14.1	10.6	7.0	15.9
Midwest	780	12.8	9.8	16.5	12.6	9.6	16.4	13.2	8.9	19.0
Southwest	375	6.1	4.5	8.4	6.7	4.8	9.2	5.1	3.2	8.0
Northwest	975	16.0	11.5	21.8	15.4	10.9	21.2	17.2	11.7	24.8
California	2706	44.3	34.7	54.4	46.1	36.4	56.1	40.6	28.1	54.5

Note: Total *n* = 6108; *n* for men = 4389; *n* for women = 1719.

California workers had the highest share of respondents (44.3%).

Table 2 provides weighted prevalence for responses to the GAD-2 by item and by scale cut-off scores. The prevalence of having a GAD-2 score ≥ 1 was 20.6% for both sexes combined, and 16.6% for men and 28.7% for women. For scoring ≥ 3 (more severe symptoms), the combined prevalence was 7.7% with a prevalence of 6.1% for men and 11.2% for women.

Table 3 shows the weighted prevalence of scoring ≥ 1 and ≥ 3 on the GAD-2 by sociodemographic and employment characteristics. The prevalence of any anxiety symptoms (GAD-2 ≥ 1) was higher in women (28.7%) than in men (16.6%). The pattern was similar for scoring ≥ 3 , with women (11.2%) having a higher prevalence of severe anxiety symptoms than men (6.1%). For a GAD-2 score ≥ 1 , the prevalence of anxiety symptoms was 18.0% for Hispanic/Latino men and 26.9% for

Hispanic/Latina women. For GAD-2 scores ≥ 3 , the prevalence of anxiety symptoms for Hispanic/Latino men was 6.6% and was 10.7% for Hispanic/Latina women. In addition, each of the sociodemographic and employment variables showed statistically significant ($p < 0.001$) sex differences with GAD-2 scores ≥ 1 and ≥ 3 . For example, for workers with GAD-2 ≥ 1 , the prevalence of anxiety for those who had unemployment insurance was 16.2% in men and 30.6% in women, and for GAD-2 ≥ 3 , the prevalence of anxiety for workers who had unemployment insurance was 7.1% in men and 12.1% in women. For GAD-2 scores ≥ 1 , the prevalence of anxiety among workers with workers' compensation was 16.2% in men and 26.4% in women. For GAD-2 score ≥ 3 , the prevalence of anxiety for workers with workers' compensation was 6.5% in men and 9.8% in women.

Table 4 shows prevalence ratios for scoring ≥ 1 and ≥ 3 on the GAD-2. Prevalence ratios are considered statistically significant

TABLE 2 | Descriptive statistics for generalized anxiety disorder (GAD-2) dependent variables used in the analysis (National Agricultural Workers Survey, 2018–2022).

Variable	Codes/ range	Total (n = 6108)				Men (n = 4389)				Women (n = 1719)						
		Weighted prevalence (% or mean)	SE	95% CI	n	Weighted prevalence (% or mean)	SE	95% CI	n	Weighted prevalence (% or mean)	SE	95% CI				
In past 2 weeks felt nervous, anxious, or on edge																
Not at all	0	5018	82.2	1.19	79.7	84.4	3775	86.0	1.19	83.5	88.2	1275	74.2	2.19	69.6	78.3
Several days	1	646	10.6	0.84	9.0	12.3	362	8.3	0.72	6.9	9.8	265	15.4	1.7	12.4	19.1
More than half the days	2	222	3.6	0.42	2.9	4.6	116	2.6	0.35	2.0	3.4	98	5.7	1.14	3.8	8.4
Nearly every day	3	222	3.6	0.79	2.4	5.6	136	3.1	0.9	1.8	5.5	81	4.7	0.83	3.3	6.6
In past 2 weeks not been able to stop or control worrying																
Not at all	0	5045	82.6	1.17	80.2	84.8	789	86.3	1.28	83.6	88.7	1286	74.8	1.93	70.8	78.5
Several days	1	624	10.2	0.81	8.7	11.9	350	8.0	0.77	6.6	9.6	255	14.9	1.77	11.7	18.7
More than half the days	2	220	3.6	0.42	2.9	4.5	109	2.5	0.41	1.8	3.4	101	5.9	1.01	4.2	8.2
Nearly every day	3	220	3.6	0.81	2.3	5.6	141	3.2	0.89	1.9	5.5	76	4.4	0.86	3.0	6.5
Two-item scale (GAD-2)	0–6	6108	0.57	0.05	0.47	0.67	4389	0.45	0.06	0.34	0.57	1719	0.81	0.07	0.67	0.94
Scored at least 1 on GAD-2																
No	0	4852	79.4	1.25	76.9	81.8	3659	83.4	1.32	80.6	85.8	1226	71.3	2.07	67.0	75.2
Yes	1	1256	20.6	1.25	18.2	23.1	730	16.6	1.32	14.2	19.4	493	28.7	2.07	24.8	33.0
Scored at least 3 on GAD-2																
No	0	5635	92.3	0.93	90.2	93.9	4122	93.9	0.98	91.7	95.6	1527	88.8	1.46	85.6	91.4
Yes	1	473	7.7	0.93	6.1	9.8	267	6.1	0.98	4.4	8.3	192	11.2	1.46	8.6	14.4

TABLE 3 | Weighted prevalence figures for GAD-2 scores ≥ 1 and GAD-2 scores ≥ 3 by participant characteristics (National Agricultural Workers Survey, 2018–2022).

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3											
	Total			Men			Women			Total			Men			Women		
	Percent	95% CI		Percent	95% CI		Percent	95% CI		Percent	95% CI		Percent	95% CI		Percent	95% CI	
Demographics																		
Sex*	—			16.6	14.2	19.4	28.7	24.8	32.9	—			6.1	4.4	8.3	11.2	8.6	14.4
Ethnicity**																		
Hispanic	20.9	18.3	23.8	18.0	15.0	21.4	26.9	23.0	31.2	7.9	5.9	10.5	6.6	4.5	9.6	10.7	8.0	14.2
Non-Hispanic White	20.2	15.9	25.3	13.0	9.6	17.6	34.5	24.4	46.3	7.7	5.1	11.5	5.1	3.0	8.4	12.9	6.8	23.1
Other	6.1	2.0	17.3	6.7	2.0	20.4	2.5	0.4	13.4	1.7	0.5	5.8	1.7	0.4	6.8	2.1	0.3	14.9
Age**																		
14–24 years	17.1	13.1	22.1	11.9	8.5	16.6	26.1	17.2	37.3	5.9	3.6	9.4	4.8	2.6	8.6	7.7	3.4	16.5
25–34 years	18.6	14.9	23.0	14.0	10.2	19.0	29.1	21.2	38.5	7.9	5.2	11.8	5.4	2.8	10.0	13.6	7.8	22.7
35–44 years	21.5	17.6	25.9	18.0	13.8	23.1	26.5	19.5	34.8	8.5	6.2	11.6	6.3	4.0	9.9	11.6	6.9	18.8
45–54 years	22.8	18.9	27.4	19.9	14.7	26.5	29.2	23.6	35.6	9.0	5.6	14.3	8.0	3.7	16.5	11.2	7.8	15.9
55+ years	22.4	18.2	27.4	18.5	14.3	23.6	37.3	27.6	48.2	6.8	5.1	9.1	5.8	4.1	8.1	10.9	6.6	17.6
Marital status**																		
Single	17.0	14.2	20.2	13.7	10.8	17.2	22.9	17.6	29.1	5.7	4.1	7.7	5.0	3.5	7.1	6.9	4.1	11.4
Married or cohabiting	21.1	17.9	24.7	16.8	13.4	20.9	30.5	25.1	36.5	8.1	5.6	11.4	6.2	3.8	10.0	12.2	8.3	17.5
Other	30.8	21.1	31.3	21.4	15.7	28.4	36.4	28.1	45.6	10.7	7.3	15.3	7.7	3.9	14.6	17.7	12.8	24.1
Children younger than 15 years old**																		
No	19.7	17.3	22.2	16.2	13.7	19.0	28.3	23.9	33.3	6.9	5.3	8.9	5.7	4.0	8.1	9.7	7.2	12.9
Yes	22.1	18.3	26.5	17.6	13.4	22.8	29.2	23.5	35.7	9.3	6.7	12.7	6.9	4.3	10.8	13.1	8.6	19.6
Socioeconomic status																		
Education level**																		
Primary (≤ 6 years)	20.6	17.2	24.4	18.2	14.6	22.4	25.6	19.6	32.6	7.2	5.1	10.2	5.4	3.6	8.0	11.0	6.9	17.0
Middle (7–9 years)	22.4	17.8	27.9	17.8	13.2	23.5	31.6	22.1	43.0	8.3	5.3	12.7	6.9	3.3	13.7	11.0	6.6	17.9
High school (10–12 years)	18.0	14.7	21.9	14.7	11.1	19.1	27.3	21.5	34.0	7.5	5.3	10.5	6.7	4.3	10.5	9.5	6.5	13.8
Post-secondary (13–16 years)	22.7	17.7	28.7	15.2	10.8	20.9	32.4	22.4	44.4	9.0	5.7	13.9	5.2	2.8	9.4	13.8	7.3	24.6
English language ability**																		
Low	18.7	15.5	22.3	14.3	11.2	17.9	25.6	20.4	31.7	6.6	5.3	8.1	4.2	3.2	5.5	10.3	7.6	13.7

(Continues)

TABLE 3 | (Continued)

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3					
	Total			Men			Total			Men		
	Percent	95% CI	Percent	95% CI	Percent	95% CI	Percent	95% CI	Percent	95% CI	Percent	95% CI
Medium	25.4	21.5	29.7	23.8	19.4	28.7	29.5	23.4	36.4	9.5	5.7	15.4
High	18.2	15.0	22.0	12.4	9.6	15.7	32.1	24.6	40.6	7.4	5.4	10.0
Total family annual income**												
Did not work in previous year	16.3	10.1	25.2	11.3	4.8	24.3	24.3	12.8	41.3	5.2	2.4	11.2
<\$20,000	20.0	15.2	25.8	17.1	10.5	26.7	24.0	17.9	31.3	9.6	5.7	15.9
\$20,000–29,999	22.8	19.1	26.9	19.5	15.3	24.5	30.1	22.3	39.2	8.8	6.7	11.4
\$30,000–39,999	23.3	18.3	29.1	19.1	15.0	24.1	33.6	22.9	46.2	7.9	5.5	11.2
\$40,000–54,999	19.1	15.4	23.4	17.2	13.2	22.0	23.1	14.9	34.0	5.5	3.6	8.4
\$55,000 or more	21.6	16.0	28.6	14.8	10.0	21.2	38.3	27.2	50.8	8.8	5.0	15.2
Work characteristics												
Employer**												
Farm labor contractor	20.3	15.1	26.7	17.3	11.6	24.9	28.0	21.1	36.1	8.6	4.6	15.6
Grower, packing house, nursery	20.6	18.2	23.3	16.5	14.2	19.1	28.8	24.3	33.8	7.6	6.2	9.3
How worker is paid**												
By the hour	21.5	19.1	24.2	17.4	14.8	20.3	29.9	25.6	34.7	8.3	6.4	10.7
By the piece or hourly and piece	16.1	10.1	24.8	11.5	6.4	19.9	22.3	13.7	34.2	5.3	3.2	8.8
Salary	19.5	12.5	29.0	18.8	11.6	28.9	32.0	10.8	64.8	5.2	2.8	9.3
Unemployment insurance**												
No	21.3	18.4	24.5	17.9	15.1	21.1	26.9	21.9	32.6	7.4	5.9	9.2
Yes	20.1	16.5	24.4	16.2	12.6	20.6	30.6	24.3	37.8	8.5	5.5	12.8
Worker's compensation**												
No	20.5	13.8	29.3	13.5	8.5	20.7	32.4	18.8	49.7	7.8	3.5	16.1
Yes	19.3	16.8	22.1	16.2	13.7	19.1	26.4	22.2	31.2	7.5	5.6	10.0
Health insurance**												
No	20.1	17.2	23.4	16.1	13.1	19.6	29.0	24.1	34.4	7.2	5.7	9.1
Yes, employer pays	20.0	16.0	24.7	18.2	13.7	23.9	25.7	16.8	37.2	7.0	4.5	10.8

(Continues)

TABLE 3 | (Continued)

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3					
	Total			Men			Women			Total		
	Percent	95% CI		Percent	95% CI		Percent	95% CI		Percent	95% CI	
Yes, other insurance	21.1	17.4	25.4	16.5	12.5	21.4	29.1	23.5	35.4	8.3	5.1	13.2
<i>Immigration characteristics</i>												
<i>Current status**</i>												
Citizen	17.6	14.6	21.1	11.8	9.4	14.8	31.5	24.3	39.8	6.6	4.8	9.0
Has work authorization	25.6	18.8	33.8	22.7	15.6	31.7	32.3	22.9	43.2	11.4	5.9	20.7
Undocumented	20.4	17.6	23.6	17.9	15.0	21.4	24.8	19.8	30.6	6.9	5.6	8.5
<i>Number of years since first entered the US**</i>												
Born in United States	18.3	14.8	22.4	12.1	9.3	15.7	32.7	24.8	41.7	7.1	5.0	10.0
0–15 years	22.4	17.9	27.7	18.3	13.5	24.3	28.1	20.3	37.5	7.4	4.9	11.1
More than 15 years	21.3	18.3	24.5	19.1	15.6	23.1	26.5	21.8	31.8	8.4	5.7	12.2
<i>Region**</i>												
Northeast	21.5	14.8	30.1	18.6	12.7	26.4	25.7	15.1	40.3	5.9	2.9	11.8
Southeast	23.1	16.6	31.3	17.7	11.8	25.8	33.7	23.8	45.3	9.9	7.0	13.9
Midwest	19.8	14.1	27.2	11.0	7.0	17.1	37.3	23.5	53.5	7.5	4.6	11.8
Southwest	19.5	14.3	26.1	16.2	11.2	22.8	28.6	17.3	43.3	7.5	5.0	11.0
Northwest	23.7	18.7	29.4	21.5	15.7	28.7	27.6	20.7	35.9	9.2	6.2	13.5
California	19.0	15.4	23.2	16.0	12.1	20.9	26.1	20.4	32.7	7.3	4.4	11.7

Note: Total $n = 6108$; n for men = 4389; n for women = 1719. p value for sex refers to a two-tailed t -test for differences in means between men and women. p values for all other variables derived from chi-squared tests of the null hypothesis that the bivariate distribution of prevalence by categories of the row variable is equal for men and women. Data in bolded italics estimated from fewer than 50 respondents.

* $p < 0.001$; ** $p < 0.0001$.

TABLE 4 | Weighted prevalence ratios for scoring at least a 1 on the GAD-2 scale, by participant characteristics and sex (National Agricultural Workers Survey, 2018–2022).

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3					
	Total			Men			Women			Total		
	Ratio	95% CI		Ratio	95% CI		Ratio	95% CI		Ratio	95% CI	
<i>Demographics</i>												
Sex												
Women	1.73***	1.43	2.09							1.84***	1.34	2.53
Men (ref)												
Ethnicity												
Hispanic (ref)												
Non-Hispanic White	0.97	0.75	1.25	0.73	0.51	1.03	1.28	0.91	1.81	0.97	0.59	1.59
Other	0.29*	0.10	0.88	0.37	0.11	1.24	0.09**	0.02	0.54	0.22*	0.06	0.77
Age												
14–24 years	0.80	0.59	1.08	0.66*	0.45	0.98	0.98	0.61	1.60	0.69	0.39	1.23
25–34 years	0.87	0.68	1.11	0.78	0.52	1.17	1.10	0.75	1.60	0.93	0.57	1.53
35–44 years (ref)												
45–54 years	1.06	0.85	1.33	1.11	0.84	1.47	1.11	0.76	1.61	1.07	0.64	1.76
55+ years	1.04	0.81	1.35	1.03	0.73	1.45	1.41	0.96	2.08	0.81	0.55	1.18
Marital status												
Single	0.80	0.64	1.01	0.82	0.59	1.12	0.75*	0.56	1.00	0.70	0.43	1.14
Married or cohabiting (ref)												
Other	1.23	0.98	1.53	1.27	0.90	1.79	1.19	0.89	1.59	1.32	0.85	2.07
Children younger than 15 years old												
No	0.89	0.73	1.08	0.92	0.69	1.21	0.97	0.76	1.24	0.74	0.53	1.02
Yes (ref)												
<i>Socioeconomic status</i>												
Education level												
Primary (≤ 6 years)	0.92	0.72	1.17	1.02	0.78	1.33	0.81	0.51	1.29	0.87	0.61	1.24
Middle (7–9 years) (ref)												
High school (10–12 years)	0.80	0.61	1.06	0.82	0.54	1.25	0.86	0.59	1.26	0.90	0.51	1.61
Postsecondary (13–16 years)	1.01	0.73	1.41	0.85	0.54	1.33	1.02	0.64	1.65	1.08	0.58	2.03
English language ability												

(Continues)

TABLE 4 | (Continued)

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3					
	Total			Men			Total			Men		
	Ratio	95% CI		Ratio	95% CI		Ratio	95% CI		Ratio	95% CI	
Low (ref)												
Medium	1.36**	1.09	1.69	1.67***	1.28	2.18	1.15	0.85	1.56	1.45	0.89	2.37
High	0.98	0.76	1.25	0.87	0.61	1.22	1.25	0.91	1.73	1.12	0.78	1.62
Total family annual income												
Did not work in previous year	0.72	0.45	1.15	0.58	0.25	1.34	0.81	0.42	1.57	0.60	0.26	1.35
<\$20,000	0.88	0.65	1.19	0.88	0.51	1.52	0.80	0.54	1.18	1.10	0.63	1.91
\$20,000–29,999 (ref)												
\$30,000–39,999	1.02	0.78	1.34	0.98	0.70	1.37	1.12	0.74	1.69	0.90	0.57	1.43
\$40,000–54,999	0.84	0.64	1.09	0.88	0.65	1.19	0.77	0.45	1.30	0.63	0.39	1.03
\$55,000 or more	0.95	0.70	1.29	0.76	0.49	1.16	1.27	0.88	1.85	1.01	0.57	1.78
<i>Work characteristics</i>												
Employer												
Grower, packing house, nursery (ref)												
Farm labor contractor	0.98	0.74	1.32	1.04	0.72	1.51	0.97	0.69	1.36	1.14	0.65	1.99
How worker is paid												
By the hour (ref)												
By the piece or hourly and piece	0.75	0.48	1.16	0.66	0.38	1.15	0.75	0.46	1.21	0.64	0.36	1.15
Salary	0.91	0.58	1.41	1.08	0.66	1.77	1.07	0.43	2.68	0.63	0.32	1.25
Unemployment insurance												
No	1.06	0.83	1.34	1.11	0.83	1.47	0.88	0.65	1.18	0.87	0.54	1.42
Yes (ref)												
Worker's compensation												
No	1.06	0.71	1.59	0.83	0.52	1.34	1.22	0.73	2.06	1.04	0.46	2.34
Yes (ref)												
Health insurance												
No	1.01	0.75	1.35	0.88	0.61	1.28	1.13	0.73	1.74	1.03	0.60	1.77
Yes, employer pays (ref)												
Yes, other insurance	1.06	0.80	1.40	0.90	0.63	1.30	1.13	0.74	1.74	1.18	0.64	2.17

(Continues)

TABLE 4 | (Continued)

Characteristics	GAD-2 score ≥ 1						GAD-2 score ≥ 3					
	Total			Men			Women			Total		
	Ratio	95% CI		Ratio	95% CI		Ratio	95% CI		Ratio	95% CI	
<i>Immigration characteristics</i>												
Current status												
Citizen	0.69*	0.49	0.98	0.52**	0.34	0.79	0.98	0.64	1.49	0.58	0.29	1.18
Has work authorization (ref)												
Undocumented	0.80	0.56	1.13	0.79	0.53	1.18	0.77	0.51	1.16	0.61	0.31	1.20
Number of years since first entered the US												
Born in United States	0.86	0.68	1.10	0.64**	0.46	0.88	1.23	0.90	1.69	0.85	0.50	1.44
0–15 years	1.05	0.83	1.34	0.96	0.70	1.32	1.06	0.73	1.53	0.89	0.51	1.54
More than 15 years (ref)												
<i>Region</i>												
Northeast	1.13	0.75	1.71	1.16	0.74	1.84	0.99	0.57	1.71	0.81	0.34	1.93
Southeast	1.22	0.83	1.78	1.11	0.69	1.79	1.29	0.87	1.93	1.36	0.75	2.47
Midwest	1.05	0.71	1.54	0.69	0.41	1.17	1.43	0.89	2.30	1.03	0.52	2.02
Southwest	1.03	0.71	1.48	1.01	0.65	1.59	1.10	0.65	1.84	1.03	0.55	1.92
Northwest	1.25	0.92	1.69	1.35	0.89	2.02	1.06	0.74	1.53	1.27	0.68	2.37
California (ref)												

Note: Total $n = 6108$; n for men = 4389; n for women = 1719. Two-tailed tests. All estimates are adjusted for the complex sampling design of the NAWS. Data in bolded italics are estimated from fewer than 50 respondents. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

if their confidence interval excludes 1.0. This paragraph summarizes some of the findings for GAD-2 scores ≥ 1 . Women had a 73% excess risk of having anxiety symptoms compared to men. The prevalence ratio for non-Hispanic/Latino White compared to Hispanic/Latino was not statistically significant. Younger male hired crop workers ages 14–24 had a 34% lower risk of experiencing anxiety symptoms compared to male crop workers in the 35 to 44-year range. Single women had a 25% reduced risk of anxiety symptoms compared to those who were married or cohabiting. Having children younger than 15 years old in the home was not significantly associated with increased anxiety symptoms. There were no significant differences in the prevalence of anxiety symptoms due to the level of education. Men who described their English language ability as medium had a 67% excess risk of anxiety symptoms compared to men with low English language ability. None of the work characteristics (total family income and directly hired or farm labor contractor, method of payment, unemployment insurance, workers' compensation, and health insurance) were significantly associated with anxiety symptoms. Men who were born in the United States had a 36% lower risk of anxiety symptoms compared to men who first entered more than 15 years ago. The specific regions where the participant was interviewed were not associated with anxiety symptom scores ≥ 1 on the GAD-2.

For GAD-2 scores ≥ 3 , women had an 84% higher risk of anxiety symptoms compared to men. The prevalence of anxiety symptoms for a GAD-2 score ≥ 3 was reduced among women who were single (45%) compared to women who were married or cohabiting. For both men and women combined, workers who were separated, divorced, or widowed were almost twice as likely to experience anxiety symptoms compared to workers who were married or cohabiting. For both male and female workers, having children younger than 15 years old in the home was not significantly associated with having a score of ≥ 3 . Education level was not associated with a severe anxiety symptom score. Men with a medium level of language ability had twice the risk of anxiety symptoms compared to men with a lower language ability. Employer type (direct hire or labor-contracted), method of payment, unemployment insurance, and health insurance were not associated with anxiety symptoms. Not having workers' compensation insurance was associated with a 56% reduced risk of having anxiety among men. The number of years since first entered the US was not associated with anxiety symptoms among workers scoring ≥ 3 . Compared to working in California, men working in the Northeast showed a 57% reduced risk of more severe anxiety symptoms.

A comparison of the anxiety symptom prevalence among workers interviewed before the COVID-19 pandemic was declared on March 11, 2020, with those interviewed on this date or later showed no significant differences ($p > 0.05$) in the prevalence of anxiety symptoms (see Table S1).

4 | Discussion

A number of studies have been conducted looking at anxiety disorders and symptoms in seasonal crop workers. However, many of these have been with small samples and used a variety

of measures. We present the first assessment of anxiety screenings in a large population-based sample of primarily Hispanic/Latino rural crop workers in the United States. In addition, we estimated the prevalence ratios for differing socioeconomic, employment, and demographic characteristics. Our analysis of a large national sample of hired crop workers showed that the prevalence for scoring ≥ 1 on the GAD-2 was 20.6%, and for scoring ≥ 3 (more severe symptoms) on the GAD-2 was 7.7%. Women had a 73% increased risk of scoring ≥ 1 compared to men, and an 84% higher risk than men of scoring ≥ 3 . Smaller studies primarily from North Carolina and California showed prevalence rates of anxiety among crop workers ranging from 12.9% to 27.6% [33, 34]. However, it is difficult to compare anxiety prevalence between those studies and earlier studies to this study due to measurement and time differences.

Factors related to acculturation, such as language ability, showed significantly elevated prevalence ratios for anxiety symptoms. However, neither employment nor payment type, lack of unemployment, nor health insurance showed significantly elevated prevalence ratios. The prevalence of ≥ 1 scores on the GAD-2 was similar before and during the COVID-19 pandemic ($p > 0.05$, Table S1). These findings suggest that there are other factors that have likely not been identified or could not be included in the survey due to concerns about participant burden that are associated with anxiety symptoms in crop workers. For example, Fergusson and Quandt provide a conceptual model of the stress process for migrant and seasonal crop workers which includes both situational and structural stressors including factors not examined in the current survey such as social marginalization and wage theft [13]. Crop workers were considered essential workers and may have worked similarly before and during the COVID-19 pandemic. Extreme weather events may also affect the mental health of crop workers. Questions on heat stress may be included in future NAWS surveys. OMB approved 30 heat-related illness, prevention, and training questions for the NAWS on April 1, 2025. However, data collection for the NAWS has ended. The NAWS contractor will provide a final data set to the Department of Labor, Employment and Training Administration that will include the last 3 years of data—fiscal years 2022–2025. Option Year 1 of the contract will end February 28, 2026. The data that the NAWS collected, and the research conducted with these data are crucial to public health.

4.1 | Strengths and Limitations

This study has a number of important strengths. We present the first population-based assessment of anxiety symptoms in a large national sample of primarily rural crop workers in the United States. The NAWS uses experienced interviewers to collect a great deal of data on socioeconomic, demographic, and employment conditions. The use of honoraria given to crop workers aids in reducing nonresponse bias.

NAWS data are also subject to some limitations. The data are cross-sectional and include only workers who are currently working in crop agriculture; workers who have been out of work for over a year are not included in the sampling frame.

Except for California, the public data are not reportable at the state level and H-2A visa holders (a temporary-employment visa for foreign agricultural workers) are excluded. This study is subject to limitations often found in cross-sectional interview surveys and associations do not infer causation.

Half of the interviews were collected during the time of the COVID-19 pandemic when sample sizes were smaller, and variances were larger for some variables. Special weights for the COVID-19 years have not been constructed. JBS, the NAWS contractor, together with a team of statisticians at Portland State University, studied the effects of the COVID-affected regions on the sampling design effects and margins of error. They found that while the design effects and margins of error were affected by the pandemic, the effects were not severe enough to warrant special weights, and it was not clear that any special adjustment would be guaranteed to improve on the standard weights.

Fan and Pena using the NAWS data from 2000 to 2018 examined health conditions that were shown to be associated with a higher risk of negative outcomes associated with the COVID-19 pandemic [42]. These included asthma, diabetes, heart disease, and high blood pressure and showed that along with increasing age, the percentage of workers with these conditions increased over time. Women who spoke English and were documented were more likely to have these conditions. They also found that 20% of hired crop workers remained in poor housing, but there was a declining trend for poor field sanitation. However, they suggest that improved field sanitation including water for hand washing and appropriate infrastructure improvement to allow for social distancing both at work and at home, along with education would provide cost savings [33]. Pena used data from the Current Population Survey's COVID-19 monthly core variables from May 2020 through September 2022 to study the impact of COVID-19 on agricultural workers. Results showed that 6.5% of crop workers were unable to work early in the pandemic [43]. The health impact of COVID-19 may be explored in future studies.

The reporting of anxiety symptoms is dependent upon the respondent's willingness to disclose mental health symptoms and may be lower than experienced due to the stigma concerning mental health in these primarily Latino respondents. However, only 10 of 6118 respondents did not complete the GAD-2.

The use of all self-reported measures is a limitation, and responses may be subject to concerns with social desirability and potential bias resulting from the sensitive nature of some questions. The GAD-2 is only a screening instrument, and because of the length of the core NAWS survey, it was not feasible to conduct clinical psychiatric interviews.

4.2 | Conclusion

In conclusion, our findings add weight to the body of evidence suggesting that anxiety is prevalent among hired crop workers and differs by sex and select sociodemographic characteristics. Results of this study suggest that culturally and linguistically appropriate mental health services for these workers may be beneficial.

Author Contributions

Toni Alterman led this study, including conceptualizing the study idea, developing the study methodology, drafting the original manuscript, and revising all versions. Jeffrey M. Timberlake co-conceptualized the study idea, co-developed the study methodology, conducted the statistical analysis, and reviewed all versions of the manuscript. Madeline Flores-Redd participated in data management, study discussions, and revision of the manuscript. Daniel J. Carroll co-conceptualized the study idea, provided the NAWS data and methodology, suggested salient variables to examine, and reviewed all versions of this manuscript.

Acknowledgments

We thank the agricultural employers, farm labor contractors, farmworkers, and interviewers for their participation. Appreciation is extended to the professionals who provided their expertise and advice during several conference calls when planning the survey and during final manuscript review.

Disclosure

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, nor the US Department of Labor.

Ethics Statement

The authors conducted secondary data analysis. No human subjects were involved in the study. This study was determined by the CDC to be public health surveillance and not research.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available through the U.S. Department of Labor, Employment and Training Administration by reasonable request to the last author, Mr. D. Carroll.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supplemental Table I. Weighted prevalences for Generalized Anxiety (GAD-2) dependent variables used in the analysis, by COVID-19 period and sex (National Agricultural Workers Survey, 2018–2022)