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# Impact of COVID-19 Pandemic on California Farmworkers' Mental Health and Food Security

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**ABSTRACT**

Objectives: To examine the mental health and economic impact of the COVID-19 pandemic on Latino farmworkers in California. Methods: We conducted a cross-sectional study of adult farmworkers (n = 1,115) between July 16 and November 30, 2020. We collected information via phone interviews. We used the Patient Health Questionnaire-2 and the Generalized Anxiety Disorder-2 scales to assess depression and anxiety symptoms. We adapted the U.S. Department of Agriculture six-question scale to assess household food insecurity. Results: Nearly 20% of study participants reported symptoms of depression and 15% reported symptoms of anxiety. Six percent reported increasing an increase in their substance use and 37% experienced food insecurity during the pandemic. Depression and anxiety symptoms were more frequent among women or those who had experienced ≥1 recent COVID-19 related symptom, but less frequent among those who were married and/or worked in the fields. Increased substance use was more common among farmworkers who had ≥1 COVID-19 related symptom, but less common among women and those who spoke a language other than English at home, were born outside the U.S., or lived in crowded housing. Food insecurity was common among those who were born outside the U.S. or lived with children <18 years, but less common among those with more education, a higher income, or who had lived longer in the U.S. Conclusions: The pandemic has exacerbated challenges affecting mental health and and food security among farmworkers. Interventions and prevention efforts, led by respected and trusted members of the community, should include on-the-spot supplemental income, increased mental health services, and food support services.

**KEYWORDS**

Farmworker health; anxiety; depression; substance use; food insecurity; COVID-19; Latino

## Introduction

Farmworkers in the U.S., most of whom are Latino,[1] have experienced a disproportionate burden of COVID-19 morbidity and mortality.[2] In Monterey County, California, we observed a 4-fold higher severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) test positive fraction among farmworkers tested in community clinics in Monterey County, California, between June and November 2020 (22%)[3] than in the county population at large (6%).[4] A recent study also found that agricultural and food workers of Latino backgrounds in California experienced a 60% increase in all-cause mortality between March and October 2020 relative to the same period in 2019.[5]

In addition to an increased COVID-19 disease burden, farmworkers have been affected by the economic instability and abrupt disruption to the agricultural supply chain produced by the pandemic in the U.S. and around the world. For instance, it was estimated that, by May 2020, California farmers had lost an estimated $2 billion due to disturbances in export markets, distribution supply chains, reductions in the food service industry, and consumers' shift to shelf-stable items during the pandemic.[6,7] Inevitably,

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the economic losses of the agricultural sector trickled down to the farmworkers and, between April 2019 and April 2020, farmworker employment in California decreased by 23%.[6] In the COVID-19 Farmworkers' Study (COFS), a cross-sectional statewide study of 915 farmworkers conducted between May and July 2020 in California, 52% of those surveyed reported a decrease in employment due to worker concerns (e.g., fear of getting sick and lack of childcare) or employer-based decisions (e.g., decreased market demand, closures due to workplace precautions, and safety measures).[8] These losses were reflected in the greater economic hardships reported by farmworkers in the study.[9] More specifically, 70% of workers surveyed experienced more difficulty paying for food than in pre-pandemic times, 63% reported more difficulty paying rent, and 60% had more difficulty paying utilities.[8] The economic impact of the COVID-19 pandemic on farmworkers and their families is not limited to California; smaller studies in Oregon[10] and North Carolina[11] reported similar loss of employment and economic hardship among farmworkers.

Concerns have arisen that the occupational instability and disease burden experienced by Latino farmworkers during the COVID-19 pandemic, as well as their suboptimal living and working conditions, may impact the mental health and economic well-being of this vulnerable population.[2,9] For example, a weighted population survey of over 1,000 adults conducted in April and May 2020 revealed greater psychosocial stress among Latinos than individuals of other racial and ethnic groups.[12] Suicidal thoughts/ideations were four times higher among Latinos (23%) than among non-Latino Black (5%) and White (5%) respondents. About 40% of Latinos reported symptoms of depression compared with 25–31% of non-Latino respondents. Latinos also reported greater psychological stress related to food and housing insecurity than adults from other ethnic groups. Higher rates of depression, anxiety, and substance use were also reported among Latinos in a web-based survey of over 5,000 adults conducted in June 2020.[13]

In this study, we examined the mental health (depression, anxiety, and substance use) and economic (food insecurity) impact of the COVID-19 pandemic on farmworkers from Monterey County, California, and investigated differences in these impacts among individuals with differing degrees of socio-economic vulnerability prior to and during the pandemic.

## Methods

### Study setting

The Salinas Valley is a 90-mile stretch of agricultural land in Monterey County, California. It is home to a workforce of approximately 50,000 resident farmworkers, with ~40,000 additional migrant workers during the peak summer and fall agricultural seasons.[14] This study was undertaken through a collaboration between Clinica de Salud del Valle de Salinas (CSVS) and the School of Public Health at UC Berkeley. CSVS is a federally qualified community health center and the main health-care provider for Monterey County's farmworkers and their families. This study was reviewed and approved by the Office for the Protection of Human Subjects at UC Berkeley. Patients and the public were not involved in the design, implementation, or data analyses of our study.

### Study enrollment

Recruitment for this cross-sectional study occurred between July 16 and November 30, 2020,[3,15] in advance of California's most severe wave of infections from December 2020 to January 2021. Individuals were eligible to participate if they were ≥18 years old, were not pregnant, and were sufficiently proficient in English or Spanish to give consent and complete study procedures. From July 16 to October 7, we limited enrollment to individuals who had engaged in agricultural work within the two weeks preceding their testing date. Due to the ending of the harvest season, from October 8 onward we enrolled anyone who had worked in agriculture since March 2020. We invited eligible farmworkers getting tested for SARS-CoV-2 infection or receiving medical care at CSVS clinics (n = 565) or at community outreach events (n = 550), such as community health fairs and farmworker housing complexes, to participate in our study. We enrolled a convenience sample of 1,115 farmworkers in the study. All participants

provided informed written consent, completed a phone interview, and received a $50 incentive via cash-value debit card.

## Study interviews

Forty-five-minute computer-guided interviews were conducted by phone by bilingual and bicultural research assistants drawn from the local Salinas Valley community and trained by the authors. Almost all interviews (99.2%) were completed within 48 hours of the enrollment visit and before SARS-CoV-2 testing results were available. Surveys were conducted in Spanish (n = 1,000) or English (n = 115).

We collected data on socio-demographic, household, occupational, and health-related characteristics (Table 1): sex, age, language spoken at home, country of birth, years spent in the U.S. (for non-native residents), community of residence, education level, annual household income, marital status, overcrowded housing (as defined by the U.S. Department of Housing and Urban Development; ≤2 vs >2 persons per bedroom),[16] living with unrelated roommates, living with children <18 years; type of agricultural work since the pandemic started (field work vs other); and agricultural work in the preceding two weeks. We also asked study participants whether they had experienced any COVID-19 related symptom (see list of symptoms in **Table S1**) in the two weeks preceding the study interview.

To understand participants' own assessment of the impacts of the pandemic, we asked two general questions: "How much of a negative impact has the COVID-19 pandemic had on your life?" and "How concerned are you about COVID-19?" (Table 2). We asked study participants whether they had increased their use of alcohol, tobacco, marijuana, and other substances like pills or other drugs "as compared to before the COVID-19 pandemic"; and then created a composite measure indicating an increase in use of any of these substances. We also asked study participants about changes in other behaviors, such as less physical activity, overeating or eating more unhealthy food, and sleeping problems during this time frame. For assessment of household food insecurity, we adapted the U.S. Department of Agriculture (USDA) six-question scale[17] by altering the time period to be "since the pandemic started (March 2020)" rather than the last 12 months. For analyses, levels of food insecurity defined using USDA cut-offs were collapsed into the two lowest food insecurity groups (low and very low: no food insecurity) and the two highest (high and marginal: presence of food insecurity). In addition, we added a global question "do you feel that your ability to buy food for you and/or your household is the same as, less than, or more than before the COVID-19 pandemic?". Midway through the study period, we added the question "Have you had more difficulty paying your bills (including water, gas and electricity, rent, and childcare) since the COVID-19 pandemic started?"; hence, the sample size is smaller for this question (n = 624, 56% of the study population). We asked whether participants had sent remittances to family members outside the U.S. just prior to the pandemic, and among those who had (n = 584, 52%) we asked whether they were now sending less, more, or the same. To ascertain symptoms of depression and anxiety in the two weeks preceding the study interview, we used the Patient Health Questionnaire-2 (PHQ-2)[18] and the Generalized Anxiety Disorder-2 (GAD-2) scale,[19] respectively. We defined the symptoms of depression as a score of ≥2 on the PHQ-2[20] and symptoms of anxiety as a score of ≥2 on the GAD-2 scale.[21]

## Data analysis

We performed bivariate analyses for socio-demographic, household, occupational, and health-related characteristics known or suspected to be associated with four mental health and economic impact outcomes: (i) depression symptoms, (ii) anxiety symptoms, (iii) increased use of any substance, and (iv) household food insecurity (**Table S2**). We also assessed the correlation between the different mental health and economic impact outcome variables (**Figure S1**). In our

**Table 1.** Socio-demographic, household, and occupational characteristics of farmworkers enrolled in a cross-sectional study, Monterey County, California, 2020 (n = 1,115).

| | n (%) or mean ± SD |
|---|---|
| Sex | |
| Male | 529 (47.4) |
| Female | 586 (52.6) |
| Age (years) | 39.7 ± 12.6 |
| 18–29 | 277 (24.8) |
| 30–39 | 274 (24.6) |
| 40–49 | 298 (26.7) |
| >50 | 266 (23.9) |
| Education | |
| Primary school or less | 492 (44.1) |
| More than primary school | 622 (55.8) |
| No answer | 1 (0.1) |
| Marital status | |
| Not married or living as married | 411 (36.9) |
| Married or living as married | 703 (63.0) |
| No answer | 1 (0.1) |
| Annual household income | |
| <$25,000 | 560 (50.2) |
| ≥$25,000 | 499 (44.8) |
| No answer | 56 (5.0) |
| Language spoken at home[a] | |
| Spanish | 948 (85.0) |
| English | 57 (5.1) |
| Indigenous | 110 (9.9) |
| No answer | 0 (0.0) |
| Country of birth | |
| Mexico | 929 (83.3) |
| United States | 142 (12.7) |
| Other | 44 (4.0) |
| Years in U.S | 20.6 ± 11.2 |
| <20 | 456 (46.9) |
| ≥20 | 516 (53.0) |
| No answer | 1 (0.1) |
| Community of residence | |
| Salinas | 492 (44.1) |
| Greenfield | 316 (28.3) |
| Other | 307 (27.5) |
| Children <18 years living in the home | |
| No | 278 (24.9) |
| Yes | 836 (75.0) |
| No answer | 1 (0.1) |
| Living with unrelated roommates | |
| No | 909 (81.5) |
| Yes | 206 (18.5) |
| Household crowding | |
| ≤2 persons per bedroom | 708 (63.5) |
| >2 persons per bedroom | 407 (36.5) |
| Worked in the fields since the pandemic started | |
| No | 275 (24.7) |
| Yes | 830 (74.4) |
| No answer | 10 (0.9) |
| Agricultural work in the preceding two weeks | |
| No | 201 (18.0) |
| Yes | 914 (82.0) |
| COVID-19 related symptoms in the preceding two weeks | |
| None | 807 (72.4) |
| ≥1 | 301 (27.0) |
| No answer | 7 (0.6) |

[a]Participants who were bilingual in Spanish and an indigenous language were considered to be indigenous speakers.

**Table 2.** Mental health and economic impact of COVID-19 pandemic among farmworkers enrolled in a cross-sectional study, Monterey County, California, 2020 (n = 1,115).

| | n (%) |
|---|---|
| COVID-19's overall impact on life | |
| Not negative at all | 127 (11.4) |
| Somewhat negative | 322 (28.9) |
| Moderately negative | 375 (33.6) |
| Extremely negative | 263 (23.6) |
| No answer | 28 (2.5) |
| Concern about COVID-19 | |
| Not or a little concerned | 161 (14.4) |
| Moderately concerned | 481 (43.1) |
| Very concerned | 469 (42.1) |
| No answer | 4 (0.4) |
| ***Mental health impact***[a] | |
| Depression symptoms (≥2 on PHQ-2) in the two weeks preceding the study interview | |
| No | 895 (80.3) |
| Yes | 204 (18.3) |
| No answer | 16 (1.4) |
| Anxiety symptoms (≥2 on GAD-2) in the two weeks preceding the study interview | |
| No | 943 (84.6) |
| Yes | 166 (14.9) |
| No answer | 5 (0.5) |
| Felt unhappy with life | |
| No | 964 (86.5) |
| Yes | 150 (13.5) |
| No answer | 1 (0.1) |
| Had more angry outbursts | |
| No | 874 (78.4) |
| Yes | 240 (21.5) |
| No answer | 1 (0.1) |
| More arguing in household | |
| No | 962 (86.3) |
| Yes | 152 (13.6) |
| No answer | 1 (0.1) |
| Had difficulty sleeping | |
| No | 843 (75.6) |
| Yes | 271 (24.3) |
| No answer | 1 (0.1) |
| Less physical activity or exercise | |
| No | 494 (44.3) |
| Yes | 620 (55.6) |
| No answer | 1 (0.1) |
| Overate/ate more unhealthy food | |
| No | 794 (71.2) |
| Yes | 320 (28.7) |
| No answer | 1 (0.1) |
| Increased use of alcohol | |
| No | 1068 (95.7) |
| Yes | 44 (4.0) |
| No answer | 3 (0.3) |
| Increased use of tobacco | |
| No | 1107 (99.3) |
| Yes | 7 (0.6) |
| No answer | 1 (0.1) |
| Increased use of marijuana | |
| No | 1106 (99.2) |
| Yes | 8 (0.7) |
| No answer | 1 (0.1) |
| Increased use of other substances | |
| No | 1095 (98.2) |
| Yes | 19 (1.7) |
| No answer | 1 (0.1) |
| Increased use of any substance[b] | |
| No | 1045 (93.7) |
| Yes | 69 (6.2) |

(*Continued*)

**Table 2.** (Continued).

| | n (%) |
|---|---|
| No answer | 1 (0.1) |
| Increase in health problems | |
| No | 1007 (90.3) |
| Yes | 107 (9.6) |
| No answer | 1 (0.1) |
| Difficulty getting medical care or medications | |
| No | 885 (79.4) |
| Yes | 229 (20.5) |
| No answer | 1 (0.1) |
| Loved one became sick or died from COVID-19 | |
| No | 821 (73.6) |
| Yes | 294 (26.4) |
| ***Economic impact***[c] | |
| Household food insecurity | |
| No (high or marginal security level) | 707 (63.4) |
| Yes (low or very low security level) | 408 (36.6) |
| Reduced ability to buy food for household | |
| No | 665 (59.6) |
| Yes | 449 (40.3) |
| No answer | 1 (0.1) |
| More difficulty paying bills[d] | |
| No | 303 (27.2) |
| Yes | 321 (28.8) |
| No answer | 491 (44.0) |
| Sent less money in remittances[e] | |
| No | 159 (14.3) |
| Yes | 425 (38.1) |
| Not applicable | 531 (47.6) |

[a]Unless indicated, these outcomes indicate changes in feeling or behaviors compared to before the COVID-19 pandemic.
[b]Includes increased use of alcohol, tobacco products, marijuana, or other substances.
[c]These outcomes indicate changes since the COVID-19 pandemic started.
[d]Question was not asked until midway through data collection.
[e]Question was only asked to participants who were sending remittances prior to the start of the COVID-19 pandemic.

multivariable models, we included covariates with a p-value <0.2 from a chi-square test (for categorical variables) or t-test (for continuous variables) in the bivariate analyses. We used backward stepwise elimination (with a threshold of p <0.1) to select covariates for inclusion in the final models. Categorical risk factors were modeled as shown in Table 1, with the exception of language spoken at home (modeled as English vs. Spanish or other), country of birth (U.S. vs. outside the U.S.), and city of residence (Salinas vs. outside Salinas). Age and years in the U.S. were modeled as continuous variables. We used multiple imputation with chained equations to account for the missing values (<2.5% missing for all variables) in our multivariable analyses.

To account for differences between those recruited at clinics vs. community outreach events and for changes in the background positivity rate in Monterey County over the course of the study period,[3] we grouped participants into strata by recruitment site and period (i.e., 16 July-31 August, 1–30 September, 1–31 October, or 1–30 November). We used conditional fixed-effects Poisson models[22] to estimate adjusted risk ratios (aRRs) for the four mental health and economic impact outcomes mentioned above while accounting for differences among strata and calculating robust standard errors using the Huber-White estimator.

## Results

Most of the study participants were born in Mexico (83%), spoke Spanish at home (85%), and worked in the fields (75%; Table 1). The average (standard deviation (SD)) age of all participants was 39.7 (12.6) years. Education level was low with nearly half (44%) having only primary school or lower levels of attainment. Many of the study participants lived in overcrowded housing (37%) and reported ≥1 symptom potentially related to COVID-19 in the two weeks preceding enrollment (27%).

Many farmworkers reported that they were extremely negatively impacted by COVID-19 (24%) and that they were very concerned about COVID-19 (42%) (Table 2). Only 6% of our study participants reported increasing their use of any substance since the COVID-19 pandemic started, whereas a significant number reported that they had experienced food insecurity (37%). In general, half of the farmworkers who were asked reported having more difficulty paying bills since the pandemic started; this economic toll was also reflected in lower contributions to family members abroad (73% among those sending remittances before the pandemic). About 18% and 15% of farmworkers reported symptoms of depression and anxiety, respectively, in the two weeks preceding the study interview. As expected, we observed that mental health impact variables were highly correlated with each other (**Figure S1**); economic impact outcomes were also highly correlated with each other.

In our bivariate analyses, we observed that participants who were female, lived with children <18 years, and had ≥1 COVID-19 related symptom in the two weeks preceding the study interview had a higher prevalence of depression symptoms (**Table S2**). We also found that farmworkers who were married or living as married, spoke a language other than English at home, worked in the fields, and were working in agriculture at the time of enrollment had a lower prevalence of depression symptoms during the two weeks preceding the study interview. We observed that all risk factors identified in the bivariate analyses remained associated with depression symptoms in our final multivariable models (which accounted for recruitment venue and enrollment period) (Figure 1A). Specifically, female farmworkers (aRR = 1.56; 95% CI: 1.13, 2.15), those who lived with children <18 years (1.28; 0.96, 1.72), and those who had ≥1 COVID-19 related symptom (2.00; 1.40, 2.88) had a higher risk of depression symptoms. In contrast, those who were

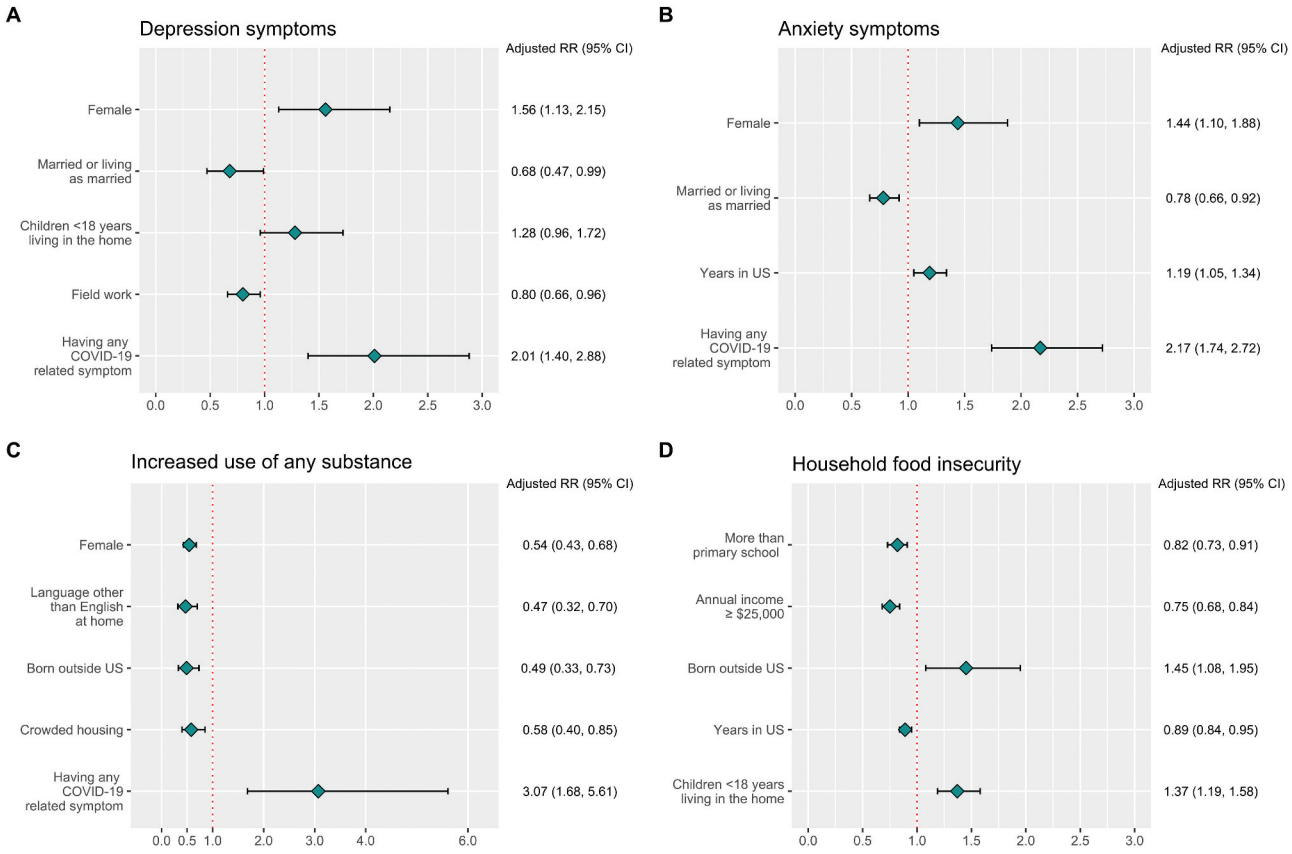


**Figure 1.** Predictors of (A) depression symptoms in the last 2 weeks, (B) anxiety symptoms in the last 2 weeks, (C) increased use of any substance compared to before the COVID-19 pandemic, and (D) household food insecurity since the COVID-19 pandemic started [aRR (95% CI)] among farmworkers enrolled in a cross-sectional study, Monterey County, California, 2020 (n = 1,115). Final models accounted for recruitment venue and enrollment period.

married or living as married (0.68; 0.47, 0.99) and those who worked in the fields (0.79; 0.66, 0.96) had a lower risk of depression symptoms.

Female participants, those who had lived more years in the U.S., and those with ≥1 COVID-19 related symptom in the two weeks preceding the study interview showed a higher prevalence of anxiety symptoms in our bivariate analyses (**Table S2**). In our bivariate analyses, we also found that farmworkers who were married or living as married, spoke a language other than English at home, worked in the fields, and were working in agriculture at the time of enrollment had a lower prevalence of anxiety symptoms. We observed that all risk factors identified in the bivariate analyses remained associated with anxiety symptoms in our final models (which accounted for recruitment venue and enrollment period) (Figure 1B). Specifically, female farmworkers (aRR = 1.49; 95% CI: 1.11, 2.01), those who had spent more years in the U.S. (for a 10-year change = 1.19; 1.06, 1.34), and those with ≥1 COVID-19 related symptom (2.18; 1.75, 2.72) had a higher risk of anxiety symptoms during the two weeks preceding the study interview. Conversely, only farmworkers who were married or living as married (0.78; 0.66, 0.93) had a lower risk of anxiety symptoms.

In our bivariate analyses, we observed that participants who were younger, had an educational level higher than primary school, had lived more years in the U.S., and had ≥1 COVID-19 related symptom in the two weeks preceding the study interview had increased use of any substance, relative to their use before March 2020 (**Table S2**). In contrast, female participants and those who were married or living as married, spoke a language other than English at home, were born outside of the U.S., lived in crowded housing, and worked in the fields had not increased their substance use. In our multivariable models, which accounted for recruitment venue and enrollment period, we observed that increased substance use was more likely among farmworkers who had had ≥1 COVID-19 related symptom in the two weeks preceding the study interview (aRR = 3.07; 95% CI: 1.68, 5.61), but less likely among females (0.54; 0.43, 0.68) and those who spoke a language other than English at home (0.47; 0.32, 0.70), were born outside the U.S. (0.49; 0.33, 0.73), and who lived in crowded housing (0.58; 0.40, 0.85) (Figure 1C).

Female farmworkers and those who spoke a language other than English at home, were born outside the U.S., lived outside of Salinas, lived with children <18 years or unrelated roommates, lived in crowded housing, and worked in the fields had a higher prevalence of household food insecurity in our bivariate analyses (**Table S1**). Participants who had an educational level higher than primary school, had lived more years in the U.S., and reported earning >$25,000 per year had a lower prevalence of food insecurity. In our multivariable analyses, which accounted for recruitment venue and enrollment period, we found that farmworkers who were born outside the U.S. (aRR = 1.45, 95% CI: 1.08, 1.95) and lived with children <18 years (1.37; 1.19, 1.58) were more likely to experience food insecurity, while farmworkers who had a higher educational level (0.82; 0.73, 0.91), had spent more years in the U.S. (for a 10-year change = 0.89; 0.84, 0.95), and reported earning > $25,000 per year (0.75; 0.68, 0.84) were less likely to be food insecure (Figure 1D).

## Discussion

Our study of farmworkers in Monterey County, California, reveals the impacts of the COVID-19 pandemic extending beyond infection. We observed that a significant number of our study participants reported adverse effects of the pandemic on their mental health, such as depression and anxiety symptoms, whereas only a small number reported an increased use of any substance. Notably, the prevalence of depression and anxiety symptoms in our study population (surveyed in July–November 2020) was lower than estimates for Latinos from nationwide web-based surveys conducted in April–May[12] and June[13] 2020; which is contrary to what we expected given that the mental health impact of the COVID-19 pandemic has been shown to increase over time.[23]

In our study, we observed that both depression and anxiety symptoms were more frequent among women and farmworkers who reported having ≥1 COVID-19 related symptom during the two weeks preceding the study interview, but less frequent among those who were married or cohabitating

and working in the fields. Increased substance use was more common among farmworkers who reported having ≥1 COVID-19 related symptom, but less common among females, and farmworkers who spoke a language other than English at home, were born outside the U.S., and lived in crowded housing. It is interesting that having ≥1 symptom potentially attributable to COVID-19 in the two weeks before the study interview was strongly associated with our three mental health outcomes of interest. We hypothesize that experiencing COVID-19 related symptoms or perhaps the fear of COVID-19 sequelae may have triggered depression and anxiety symptoms, as well as an increase in unhealthy coping measures such as substance abuse.

We found that the COVID-19 pandemic resulted in a significant financial burden for many farmworkers, as indicated by their reduced ability to buy food, pay bills, and send money to families abroad. The 37% prevalence of food insecurity reported by farmworkers in our study is more than three times greater than the pre-pandemic estimate of 10.5% in the U.S. population at large,[24] but is comparable to national estimates of food insecurity early in the pandemic.[25,26] In our study, we observed that farmworkers who lived with children aged <18 years were more likely to be food insecure compared to farmworkers without children. Similar results have been reported in other studies of farmworkers[8] and non-farmworkers[27] in the U.S. We also found that farmworkers in our study who were born outside the U.S. were more likely to be food insecure, while those who had a higher educational level, higher income, and who had spent more years in the U.S. were less likely to experience food insecurity. Our findings help to identify subpopulations in greatest need of food assistance or other interventions to mitigate the impacts of the COVID-19 pandemic on food security.

Our study has several limitations. First, all data we collected are self-reported and may be biased due to recall or social desirability. Second, we did not conduct a diagnostic evaluation for depressive or anxiety disorder; however, we used clinically validated screening instruments to assess symptoms. Third, we were not able to ask farmworkers about all the potential effects of this pandemic. For example, we did not ask about what preparations were made to care for children and what pressure this imposed on the families; 75% of the households had children <18 years. Very few schools and childcare facilities were open during the study period, and only 8% of respondents indicated that the children in their home were in school or childcare at the time of their interviews. During the COVID-19 pandemic, parents have had the additional responsibility of facilitating education of their school-age children,[9] for which many of the farmworkers in our study may not have had the proper educational, technological, or language skills. Affordable childcare is difficult to find at the best of times for these farmworker families.[28]

Results of our study may not be generalizable to farmworkers across California, the U.S., or other countries. Our study was not a random sample of the farmworker population, many of whom are hidden due to their informal workforce participation and undocumented status.[29] Also, under the busy conditions of study recruitment in a clinical setting, we could not document refusal rates systematically throughout the study period. Because of our concern about potential bias in a clinic-based population, we recruited about half of the participants from community outreach events. Nevertheless, we found no differences in the mental health and economic impact outcome variables of interest by recruitment venue. Given that our study participants were farmworkers who were willing to get tested for SARS-CoV-2 infection, it is possible that we may not have reached those most impacted by the pandemic: farmworkers who did not want to get tested due to fear of being reported to government authorities, of deportation,[30] or of loss of other benefits (public charge) if found to be COVID-19 cases, such as undocumented workers. It is also important to note that, based on our initial criteria that an individual must have worked in agriculture in the preceding two weeks to enroll, our study population predominantly reflected the experience of currently or recently employed farmworkers, which may subject our findings to biases, such as the healthy worker effect.

Despite federal and state economic assistance and relief programs, such as the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the COVID-19 Disaster Relief Assistance for

Immigrants project, the California Housing for the Harvest Program (modeled after a program in Monterey County organized by the Grower Shipper Association and other agribusiness partners), the COVID-19 Tenant Relief Act, and COVID-19 workers' compensation, launched relatively early in the pandemic (March–June 2020), our study demonstrates that the pandemic exacerbated challenges affecting mental health and economic and food security among farmworkers in Monterey County, California, as of July–November 2020. Evidence suggests that farmworkers in California have struggled to access and benefit from support programs due to cumbersome application processes, limited hours of operation, transportation challenges, and/or employer resistance to cooperating.[9] Others have chosen not to apply for them due to fear of family separation and distrust of federal- or state-sponsored programs.[9] To overcome these challenges, we argue that interventions including on-the-spot supplemental income, increasing mental health services, and providing food support services – coordinated by respected and trusted members of the community (e.g., community-based organizations (CBOs) and clinics) – may be of value for mitigating the impacts of the COVID-19 pandemic on this population. For example, in Monterey County, a collaborative program called VIDA (Virus Integrated Distribution of Aid) employs over 110 community health workers from 10 CBOs to provide outreach, education, and wraparound support to prevent the spread of COVID-19 and promote full recovery by ensuring adequate isolation and quarantine.[31] This program launched in January 2021 and, although it currently reaches about 7,000 Monterey County residents each month through phone calls, information distribution, and personal outreach, its overall impact remains to be assessed.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author, AMM, upon reasonable request.

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