COVID-19 Prevalence and Prevention Behaviors Among US Certified Organic Producers

Daisy V. Rosero, BA, Francisco Soto Mas, MD, PhD, MPH, Rachel Sebastian, MA, Steve Guldan, PhD, Vanessa Casanova, PhD, and Laura Nervi, PhD, MPH, MSSc

Objective: There is a scarcity of data on the impact of the pandemic in farmers. **Methods:** Cross-sectional survey of certified organic producers through a 28-item self-reported paper or electronic survey. Analysis included descriptive statistics, Cronbach α to measure the internal consistency of a six-item prevention scale, and correlation and regression analyses. **Results:** A total of 344 records were computed. Infection rate among producers was 6.4%. Sex and farm size were the most statistically significant predictors of prevention behaviors. Women reported more use of prevention methods ($\beta = 0.333$, $P < 0.001$) and those with 50 or more certified organic acres reporting less use of prevention methods ($\beta = -0.228$, $P < 0.001$). Mask wearing was significantly related to lower COVID-19 prevalence. **Conclusions:** Determining prevalence and understanding how farmers follow prevention behaviors is essential for health care and public health interventions and policies.

Keywords: COVID-19, disease prevention, farmer health, health behavior, organic agriculture, organic producers

BACKGROUND

The food and agriculture sector is an essential service and critical to food availability and access. An increasingly important farming system is organic agriculture. The market for organically grown food continues to grow in the Unites States (US). According to the US Department of Agriculture (USDA), more than 62% of the certified organic operations worldwide (or 28,400+ farms) are located in the United States,[1] and the number of organic farms, organic acreage, and the value of organic products sold are all increasing.[2] This growth is driven by demand. A 2016 Pew Research Foundation study reported 73% of Americans bought locally grown fruits and vegetables in the past month,[3] and organic products are available in nearly three out of four conventional grocery stores.[4]

The emergence of the COVID-19 pandemic caused a health and economic crisis. As of September 2021, more than 42.5 million cases and 680,000 deaths had been confirmed.[5] Lockdown restrictions set in motion to prevent the spread of disease caused a significant economic collapse, and the US lost 22.1 million jobs between January 2020 and April 2020.[6] While most of the unemployed came from jobs that require person-to-person interactions such as the leisure and hospitality industry, primary sectors, such as agriculture, were also significantly impacted. Producers reduced their workforce to comply with social distancing recommendations and workers reported reluctance to test for COVID-19 for fear of losing their jobs.[7,8]

Despite initial disruption, the Farm Bureau reported that food production went back to normal levels relatively quickly because increased supermarket, food-delivery, and household food demand and preparation increased.[9,10] Similarly, there was a significant increase in buying local and organic fresh produce and sales of organic and fresh produce experienced significant growth in 2020 and 2021.[11–14] Thus, farmers, including organic producers and farmworkers were quickly back to work. While mechanized production (eg, corn) implies a lower risk of transmission and infection, crops that require more individual/human handling (eg, berries) constitute an increased risk. For these workers, prevaccine prevention relied on recommendations to avoid transmission, such as social distancing, mask wearing, and hygiene.

The US Occupational Safety and Health Administration (OSHA) did release guidance to prevent COVID-19 in the workplace, including the use of personal protective equipment (PPE), physical distancing, hand washing, and face covering.[15] How faithfully these guidelines were followed by employers and employees is unknown.

AGRICULTURE AND COVID-19

In 2020, early reports from health and agricultural outlets began disseminating information about the impact of the COVID-19 global pandemic on the farming community. Although this body of literature is steadily growing, currently few national or industry-wide reporting of positive COVID cases among agricultural workers are being systematically conducted, and only a snapshot of infection rates in agriculture exists. In September 2021, The Purdue University Food and Agriculture Vulnerability Index conservatively estimated more than 900,000 positive COVID-19 cases among all agricultural workers nationally, including producers, hired workers, unpaid workers, and migrant workers.[16] The estimated infection incidence in this population was approximately 9%.[17] A study with farmworkers (defined as "all persons engaged in work in agriculture") in central California reported a 22% prevalence of COVID-19.[18]

Similarly, few studies have explored the impact of the pandemic and related safety and prevention methods on farmers. The COVID-19 Farmworker Study (COFS), conducted in California, Oregon and Washington, found farmworkers experienced labor shortages, loss of income, and a lack of access to healthcare. The study also reported low numbers of employers providing Personal

Background Factors
Sex
Age
Race/Ethnicity
Occupation
Income
Culture
Education
Social network
Life experience
Work environment

Intrapersonal Factors

Perception
Attitudes
Beliefs
Self-Efficacy
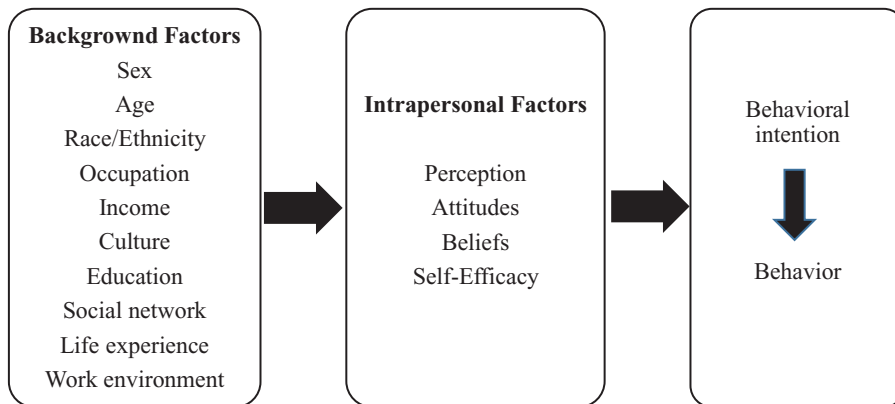
Behavioral
intention

Behavior

FIGURE 1. Conceptual framework.

Protection Equipment (PPE): only slightly more than half (54%) of worksites provided face-coverings and 43% did not provide them at all.[19] A study that analyzed data from a national sample of US food retail workers concluded that many did not feel ''well-protected by COVID-19 controls.''[20]

With consumers' increasing reliance on local products, it is important to understand the impact of the pandemic on organic farmers. In this study, we examine COVID-19 prevalence and observance of recommended prevention practices among USDA certified organic producers in the United States. The study was approved by the Institutional Review Board at the University of New Mexico. All participants were provided with an informed consent and voluntarily consented to participate.

CONCEPTUAL FRAMEWORK

Behavior theory, including the Health Belief Model (HBM),[21] the Theory of Planned Behavior (TPB),[22] the Theory of Reasoned Action (TRA),[23] and the Social Cognitive Theory (SCT)[24] argue that constructs such as perception, attitudes, beliefs, and self-efficacy influence behavior, and that these constructs are shaped by intrapersonal and social background factors. For instance, perceptions and behavior may be influenced by factors such as sex, age, race/ethnicity, occupation, income, culture, education, social network, and life experience. These factors influence what people believe, the actions they take, and how they perceive circumstances (Fig. 1).

Perceived threat of illness or disease and the potential benefits of following recommended health behavior is a key component of the HBM. Central to this theory is the assumption that an action will prevent illness. The level of action is determined by the perceived level of risk and benefit, barriers, and confidence in performing an action. Perception is influenced by a variety of psychosocial and contextual factors, including work environment.[25] In fact, the HBM has been used to explore impact of COVID-19 among workers. A study with food workers found that ''safety climate and enforcement were associated with workers' COVID-19 safety perceptions.''[20] Another study applied the HBM to frame the mental health impact of COVID-19 on health workers.[26]

The TPB and TRA predict how individuals will behave based on their pre-existing attitudes and behavioral intentions, which are also influenced by psychosocial and contextual factors.[27] Aspects of SCT may also apply to our understanding of the relationship between experience (ie, education, years in agriculture, COVID-19 infection) and prevention behavior. SCT describes behavior in the social context: the influence of individual experiences, the actions of others, and environmental factors on individual health behaviors.[24] In summary, the HBM, TPB, TRA, and SCT consider

sociodemographics as background factors having an influence in behavior.

METHODS

We conducted a cross-sectional survey between September 2020 and May 2021. The study was integrated into an ongoing project funded by the National Institute for Occupational Safety and Health (NIOSH) through the Southwest Center for Agricultural Health, Injury Prevention, and Education (SW Ag Center) at the University of Texas Health Sciences Center at Tyler. The overall purpose of the primary project was to develop, validate, and administer a survey to typify the certified organic producer and identify multilevel factors that may contribute to safety, heath, and wellbeing in this population. It was conducted in the SW Ag Center region, including Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. The project developed the Organic Farmer Safety, Health and Life Survey (OFSHL), a multidimensional tool that is consistent with NIOSH's Total Worker Health model and includes a comprehensive sociodemographic section.

Participants and Eligibility

Participants included US certified organic producers listed in the USDA Organic Integrity Database (OID). The USDA defines the farm producer as the person who runs the farm, making day-to-day management decisions for the farm operation. She/he may be the owner, a member of the owner's household, a hired manager, a tenant, a renter, or a sharecropper.[28] Qualifying criteria for this study included: (a) 18 years of age or older, (b) currently operating an organic farm in the United States, including crop, livestock, and wild crops, and (c) listing a valid postal and email address in the OID. Excluded were operations that solely engaged in handling and processing organic consumer products.

The OID is a publicly available, internet-based comprehensive database of certified organic operations. It includes a variety of operations (eg, crop, handling, livestock, and wild crops) and certification status (eg, as surrendered, suspended, revoked, other). Contact information consists of name (producer), phone, email, website, and physical and mailing address. Email address is not a mandatory field, and only a portion of listed operations include an email address.

Recruitment

An advanced search of the OID returned over 27,000 US organic operations. Operations that did not meet the inclusion criteria were discarded. Additionally, since the primary recruitment approach consisted of email and electronic messaging (websites and social media) we prioritized operations listing an email address. This resulted in a total of 3559 eligible operations.

Recruitment efforts consisted of two phases. Phase I was integrated into the ongoing regional organic farming project, consisted of electronic messaging only, and reached out to qualified producers in the SW Ag Center region between September and November 2020. They were sent an introductory message about the study, a unique link to access the survey and the informed consent. A second recruitment wave was launched in early December for regional producers who only listed a postal address or did not complete the electronic survey in the first wave. It included both electronic messaging and postal mail consisting of a packet containing a cover letter, a copy of the informed consent, the paper survey and a stamped self-addressed return envelope. A total of 399 packets were mailed out. Phase II, conducted between January and May 2021, consisted of recruitment of both non-responding regional and national producers. Those who did not respond were sent electronic messages and a second paper survey.

Recruitment efforts included dissemination of the study and survey through our institutional website and social media outlets, dissemination through partners such as extension agents and farm organizations, and scheduled reminders via email, phone, and postcards. Participation incentives included merchandise cards from a national hardware and home improvement store.

Data Collection and Management

Data were collected through a survey developed by the research team. The development process included a search of the literature on COVID preventive behavior, reiterated prototype versions, and a final draft that was reviewed by experts in public health, social and behavioral sciences, epidemiology, occupational health, and an agricultural researcher. The final survey consisted of 28-items including qualifying and standard demographic questions (Table 1) and COVID-19 specific items on prevalence (being diagnosed with COVID-19 by a healthcare professional) and preventive behavior. Response options consisted of Likert-type scales measuring quality, agreement, and frequency. Both electronic and paper versions were developed simultaneously.

TABLE 1. Social Demographic and Selected Characteristics of Respondents

	Count	Percent	Valid N
Age			
55 years of age or older	171	49.7%	344
Sex			
Female	118	34.4%	343
Race/Ethnicity			
Hispanic or Latino	16	4.7%	304
Non-Hispanic White	288	89.7%	321
Place of birth			
USA	330	96.8%	341
Education level			
4-year degree or more	232	67.8%	342
Annual household income			
$50,000 or more	245	73.8%	332
Household size			
Two or more other people	174	50.9%	342
Marital status			
Married or cohabitating	287	83.9%	342
Years in organic age			
More than 10 years	163	47.5%	343
Acreage			
At least 50 acres	166	49.1%	338
Health insurance status			
Health insurance	312	91.0%	343
Non-COVID healthcare delays			
Delays in healthcare	125	36.5%	342

TABLE 2. Prevalence of COVID-19 Among Respondents and Household Members by Selected Demographic Characteristics

	%	Significance[†]
Respondent and/or household member had COVID-19	**9.6%**	–
Sex		
Not female	11.6%	0.094
Female	5.9%	
Ethnicity		
Not Hispanic	9.0%	0.641
Hispanic	12.5%	
Race—Non-Hispanic White or Not		
Not Non-Hispanic White	6.1%	0.531
Non-Hispanic White	9.4%	
Birthplace		
Born outside of US	9.1%	0.947
Born in US	9.7%	
Age		
Under 55 years	9.2%	0.828
55 years or over	9.9%	
Education level		
Less than 4-year college degree	**15.5%**	**0.012**
4-year college degree or more	**6.9%**	
Marital status		
Not married or cohabitating	5.5%	0.251
Married or cohabitating	10.5%	
Household size		
Lives alone or with one other person	10.1%	0.773
Lives with two or more other people	9.2%	
Annual household income		
Under $50,000	6.9%	0.364
$50,000 or more	10.2%	
Health insurance status		
No health insurance	6.9%	0.598
Any health insurance	9.9%	
Years of organic farming		
10 years or less	9.4%	0.908
More than 10 years	9.8%	
Organic acres		
Less than 50 acres	**5.8%**	**0.019**
50 or more acres	**13.3%**	

[†]Bolded items had $p < 0.05$.

We used REDCap (Research Electronic Data Capture), a secure web application, to build the survey and to collect and manage data. The University of New Mexico is a REDCap institutional partner and the platform is UNM IRB approved. Each qualified participant was assigned a unique alphanumeric ID to maintain anonymity. Online survey data were electronically captured. Paper survey data were manually entered into REDCap by trained project staff. Those who answered no to qualifying questions, did not answer the sociodemographic or any of the COVID items were classified as incomplete and excluded from the analysis. When performing regression analyses, cases were excluded if they did not have valid data for all variables included in the model.

Data Analysis

We analyzed data using SPSS 25.0 (IBM Corp. Armonk, NY). We conducted descriptive analyses to summarize respondent demographic characteristics (Table 1) and COVID-19 prevalence among respondents and household members (Table 2). We measured the frequency with which respondents reported performing specific COVID-19 prevention methods and calculated Cronbach α to assess the reliability of the prevention methods scale (Table 3). We then performed correlation analyses between the frequency of following prevention methods and demographic characteristics

TABLE 3. COVID-19 Prevention Methods Scale

	Valid N	% Most of the Time or Every Time	Mean	Std. Dev.	Cronbach's Alpha (If Item Removed)
All prevention methods	339	44.8%	3.10	0.73	0.888
Avoiding close contact with people outside of my home	339	81.1%	3.18	0.92	0.862
Practicing social distancing	339	83.5%	3.31	0.86	0.854
Avoiding touching my eyes, nose, and mouth	339	62.8%	2.72	0.90	0.874
Wearing face coverings in public settings	339	80.8%	3.43	0.94	0.859
Cleaning or disinfecting frequently touched objects and surfaces	339	60.2%	2.73	0.93	0.872
Washing hands with soap and water for at least 20 seconds	339	79.4%	3.20	0.88	0.890

(Table 4). Finally, we conducted an ordinary least squares (OLS) regression analysis of demographic characteristics and farm size as predictors of the frequency of using recommended COVID-19 prevention methods (Table 5).

RESULTS

Of the 3559 qualified producers who were sent an email or paper survey, a total of 387 responded. The estimated response rate was 11%. Respondents represented 40 states. Texas had the highest response rate (12.9% of total respondents), followed by New Mexico (12.1%) and New York (10%). Of these, 43 were classified as incomplete and excluded, resulting in 344 unique records that were used for analysis. The demographic characteristics of the sample are presented in Table 1. About half (49.7%) of respondents were 55 years of age or older. A third of the sample identify as female (34.4%). The majority of respondents were non-Hispanic white (89.7%) and born in the US (96.8%). Half of respondents (50.9%) said they lived with two or more other people and most (83.9%) are married or cohabitating. A majority had a 4-year college education or greater (69.9%) and a quarter (28.1%) had a graduate degree. Slightly more than half (52.5%) were new or beginning organic farmers (10 years or less) and 29.4% had 5 or fewer years of organic farming experience. A little over one quarter (26.2%) reported an annual family income below $50,000. Over half of all operations had a farm size less than 50 acres (52.1%). Most respondents had some form of insurance coverage (91%) and over one-third (36.3%) experienced delays in non-COVID-19 related delays in healthcare.

Among producers and their household, 9.6% reported having a confirmed case of COVID-19 that included either themselves, someone in their household, or both themselves and someone in their household (Table 2). Among producers alone prevalence was 6.4% (self/self and someone in household), and among members of their household, 7.3% (household/self and someone in household). Only two social demographic characteristics had a statistically significant association with COVID-19 prevalence. By education level, 15.5% of those with less than a 4-year college degree reported COVID-19 among themselves or household members, compared

TABLE 4. Correlations Between Frequency of Following Prevention Methods and Selected Demographic Characteristics

	Mean	Correlation Coefficient	Significance[†]
Sex			
Not female	2.92	0.353	**0.000**
Female	3.45		
Ethnicity			
Not Hispanic	3.10	0.140	**0.015**
Hispanic	3.52		
Race—Non-Hispanic White or Not			
Not Non-Hispanic White	3.47	−0.180	**0.001**
Non-Hispanic White	3.04		
Birthplace			
Born outside US	3.24	−0.038	0.486
Born in US	3.09		
Age			
Under 55 years	3.01	0.124	**0.022**
55 years or over	3.19		
Education level			
Less than 4-year college degree	2.93	0.151	**0.005**
4-year college degree or more	3.17		
Marital status			
Not married or cohabitating	3.15	−0.030	0.558
Married or cohabitating	3.09		
Household size			
Lives alone or with one other person	3.22	−0.164	**0.002**
Lives with two or more other people	2.98		
Annual household income			
Under $50,000	3.18	−0.061	0.268
$50,000 or more	3.07		
Health insurance status			
No health insurance	2.96	0.053	0.331
Any health insurance	3.10		
Years of organic farming			
10 years or less	3.03	0.109	**0.046**
More than 10 years	3.18		
Organic acres			
Less than 50 acres	3.36	−0.358	**<0.001**
50 or more acres	2.84		

[†]Bolded items had *p*< 0.05.

TABLE 5. OLS Regression Analysis of Demographic Characteristics and Farm Size as Predictors of Frequency of Using COVID-19 Prevention Methods

	b	β	Significance[†]
Sex—female	**0.494**	**0.333**	**<0.001**
Ethnicity—Hispanic	0.122	0.039	0.625
Race—Non-Hispanic White	**−0.409**	**−0.170**	**0.036**
Born in US	−0.152	−0.038	0.501
Age—55 years or over	0.104	0.072	0.222
Education level—4-year degree or more	0.032	0.021	0.721
Marital status—married or cohabitating	0.055	0.027	0.637
Household size—two or more other people	**−0.215**	**−0.151**	**0.011**
Annual household income—$50,000/year+	−0.014	−0.009	0.875
Any type of health insurance	0.161	0.063	0.245
Years in organic farming—more than 10	**0.165**	**0.115**	**0.042**
Farm size—50 or more organic acres	**−0.325**	**−0.228**	**<0.001**

[†]Bolded items had *p*< 0.05.

with only 6.9% of those with a 4-year college degree or more. Farm size was also associated with prevalence, such that 13.3% of those with 50 or more acres reported COVID-19 cases compared with just 5.8% of those with fewer than 50 acres.

Table 3 shows the percentage of respondents who reported following specific prevention methods most or every time. Among the most followed practices, 83.5% reported practicing social distancing with people outside of their household most of the time or every time. In comparison, only 60.2% said that they cleaned or disinfected frequently touched objects or surfaces most of the time or every time. Under half (44.8%) reported that they followed all six practices most of the time or every time. The six prevention items were used to create a scale of the mean frequency with which respondents followed the prevention methods. A reliability analysis using Chronbach α showed that the six items display a high level of internal consistency ($\alpha = 0.88$) (Table 3).

Several demographic characteristics of the respondents were correlated with frequency of following prevention methods (Table 4). Being women, 55 years of age or older, having a 4-year college degree or greater, Hispanic, and 10 years or more in agriculture were positively correlated with the frequency of practicing prevention methods ($r = 0.35$, $P < 0.001$; $r = 0.12$, $P < 0.022$; $r = 0.15$, $P < 0.0005$; $r = 0.14$, $P < 0.015$; $r = 0.046$ respectively). Negatively correlated were race (Non-Hispanic White), farm size greater than 50 acres and household size of two or more ($r = -0.18$, $P < 0.001$; $r = -0.36$, $P < 0.001$; $r = -0.16$, $P < 0.002$). When examining correlations between the frequency of following prevention methods and confirmed cases of COVID-19 in the household (data not shown), mask wearing ($r = -0.115$, $P < 0.033$) was the only prevention method with a statistically significant relationship to COVID-19 prevalence, such that those who reported wearing a face mask or covering in public more often were less likely to report cases of COVID-19 among themselves or household members.

We conducted an Ordinary Least Squares (OLS) regression to analyze the associations between social demographic characteristics and the overall frequency of following prevention methods (Table 5). In the OLS regression model, only four social demographic characteristics had statistically significant relationships with the frequency of prevention methods: being women ($\beta = 0.0333$, $P < 0.001$); being non-Hispanic White ($\beta = -0.170$; $P = 0.036$); having a household size of two or more ($\beta = -0.151$, $P = 0.001$); and having a farm size 50 acres or more ($\beta = -0.228$, $P < 0.001$).

DISCUSSION

This study aimed to examine prevalence of COVID-19 and prevention behavior among US certified organic producers. We used sociodemographic indicators as predictors of behavior and to understand factors that may contribute to prevention in this population. Most study participants were 55 years of age or older, predominantly White, non-Hispanic men and had a high level of education. Certain demographic characteristics are fairly similar to those estimated by the 2017 Census of Agriculture-Organic Agriculture and the 2019 Organic Survey: age 45 or older (62%), non-Hispanic White (96%), men (64%).[29–31] Neither the Census of Agriculture nor the Organic Survey currently collect information on educational attainment among organic producers. A qualitative study of New Mexico organic farmers reported that 50% of respondents said they had a college education.[32] This study adds to the limited educational data currently available for this population.

Regarding prevalence, the percentage of self-reported confirmed COVID-19 cases among organic producers in this study was lower than that reported among agricultural producers and farmworkers (6.4% vs 9% and 22% respectively).[17,18] It would be important to produce accurate national rates of COVID-19 infection among conventional and organic farmworkers and producers. This will be important in understanding the impact of the pandemic on this industry, and thus the food supply. The noted variation in prevalence estimates suggests the need for more research in this area.

Correlations between the frequency of following prevention methods and COVID-19 prevalence suggest that mask wearing was a measure of prevention. This is a relevant finding related to the work environment, and the importance of making protective equipment available to workers. A recent study suggested that work climate has an effect on employee attitudes toward COVID-19 prevention guidelines.[33] Other studies with farmers and food workers in the United States concluded that almost half of worksites did not provide face covering and workers did not feel well-protected.[19,20] The present study found that those who reported wearing a mask less frequently had a higher prevalence of infection. In this sample, overall household prevalence of COVID-19 was consistent with infection rates observed nationally (approximately 10%),[5] while prevalence among individual producers was slightly lower than the national average (approximately 6%).

On prevention practices, results indicate that female producers and those who were older, Hispanic, and worked in organic agriculture more than 10 years reported following prevention practices more often than those who were men, younger than 55, non-Hispanic, and with fewer years in organic agriculture. Respondents who reported being non-Hispanic White, had a farm size of 50 acres or more, or with a household of two or more reported following prevention practices less frequently. Results also indicate that sex and education were highly correlated with prevention behavior, particularly mask wearing and social distancing. Similar results were found in a study of a predominantly women and well-educated population of Chinese citizens where there was high adherence by women in at least two prevention measures, mask wearing (98.5%), and social distancing (not going to a crowded place) (96.9%). Also, those who were highly educated about COVID-19 were more likely to engage in COVID-19 prevention.[34]

Ethnicity and age may be relevant, though to a lesser degree. Hispanics reported following prevention methods more often than non-Hispanic White. This finding is consistent with a study of US adults that found significant correlations between race, ethnicity, and adherence to COVID-19 prevention methods, with White men least likely to wear a mask compared with other ethnic groups.[35] Regarding age, this study found that respondents under the age of 55 followed prevention methods less frequently than those over 55 years of age. Early data indicating lower risk for severe infection in younger populations and contradictory messaging may explain these results, as previously reported.[36] Mixed messaging and contextual factors, including work environment and sociopolitical discourse, may have contributed to individual perception and resistance to prevention practices. For instance, two COVID-19 studies found that perceived credibility of information influenced self-protective behavior,[37] and that safety climate and enforcement affected safety perceptions.[20] Future research should confirm and further explore these differences.

LIMITATIONS

This self-reported cross-sectional study does not provide longitudinal data on COVID-19 trends and prevention practices, as they may change over time related to improved prevention, treatment, and political and social discourse. However, it may serve as a baseline for surveillance and reference for future studies. The sample was small and may not represent the entire US organic producer population. However, the response rate is typical of most survey studies and certain sociodemographic characteristics were consistent with data reported by federal, national survey systems. Regarding recruitment, the politicization of numerous social,

health, and economic issues may have impacted the researchers' ability to attract participants and the quality of responses. Furthermore, while a primary recruitment method used by this study involved electronic outreach, email address is not a required field in the OID. This significantly reduced the participant pool. However, most participants completed the electronic version of the survey, and data presented largely reflect participants who had access the internet.

CONCLUSIONS

To our knowledge, this is the first study investigating prevalence and the effects of COVID-19 on organic producers. Despite mixed messaging and sociopolitical discourse, organic producers reported higher compliance with two of the most highly publicized practices: social distancing and wearing a face covering. Mask wearing was positively associated with prevalence. Sex and education appear to be correlated with a higher frequency of following prevention methods. Investigating prevention behavior within essential industries, such as agriculture, is important for effective targeting of public health policies and messaging. Future studies should center on understanding the circumstances that impact and influence organic farmers' preventive behaviors. This information is essential for the allocation of resources, health education, and policy aimed at ensuring appropriate food supply and supporting organic farmers.

REFERENCES

1. United States Department of Agriculture. Growth in the number of certified organic operations continues in 2020. Organic Insider Bulletin. Agricultural Marketing Service, National Organic Program; 2021. Available at: https://content.govdelivery.com/accounts/USDAAMS/bulletins/2ba210e. Accessed August 17, 2021.

2. National Agricultural Statistics Service. Organic farming. Results from the 2019 Organic Survey. 2017 Census of Agriculture Highlights; 2020. Available at: https://www.nass.usda.gov/Publications/Highlights/2020/census-organics.pdf. Accessed August 17, 2021.

3. Pew Research Center. Americans' views about and consumption of organic foods. The new food fights: U.S. public divides over food science; 2016. Available at: https://www.pewresearch.org/science/2016/12/01/americans-views-about-and-consumption-of-organic-foods/. Accessed August 17, 2021.

4. Economic Research Service (ERS). Organic market summary and trends; 2021. Available at: https://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-summary-and-trends/. Accessed August 17, 2021.

5. Centers for Disease Control and Prevention (CDC). COVID data tracker; 2021. Available at: https://covid.cdc.gov/covid-data-tracker/#datatracker-home. Accessed August 17, 2021.

6. Congressional Research Service. Unemployment rates during the COVID-19 pandemic. Congressional Research Service Report-R46554; 2021. Available at: https://fas.org/sgp/crs/misc/R46554.pdf. Accessed August 17, 2021.

7. Gupta A, Fawcett M. Undocumented farmworkers are refusing Covid tests for fear of losing their jobs. Workday Minnesota; 2020. Available at: https://workdayminnesota.org/undocumented-farmworkers-are-refusing-covid-tests-for-fear-of-losing-their-jobs/. Accessed August 17, 2021.

8. The Counter. Migrant farmworkers are getting fired for seeking Covid-19 medical treatment; 2020. Available at: https://thecounter.org/migrant-farmworkers-fired-reporting-covid-19-housing-louisiana. Accessed August 17, 2021.

9. Goldy R, McGarry J, Tritten B. How food purchasing changed in 2020 – did we get it right? Michigan State University Extension Agriculture; 2020. Available at: https://www.canr.msu.edu/news/how-might-covid-19-change-food-purchases-this-summer. Accessed August 17, 2021.

10. Shearing C. COVID-19 continues to drive the evolution of the retail food landscape. Farm Bureau News; 2020. Available at: https://www.fb.org/news/covid-19-continues-to-drive-the-evolution-of-the-retail-food-landscape. Accessed August 17, 2021.

11. Organic Produce Network and Category Partners. 2021 Q2 organic produce performance. Organic Produce Network; 2021. Available at: https://www.organicproducenetwork.com/amass/doc-get-pub/document/29/OPN%20Q2%202021%20quarterly%20report.pdf. Accessed August 17, 2021.

12. Ewing-Chow D. COVID-19 has given consumers five new reasons to eat local. Forbes; 2020. Available at: https://www.forbes.com/sites/daphneewingchow/2020/07/30/covid-19-has-given-consumers-five-new-reasons-to-eat-local/?sh=38fdfb2e3ccc. Accessed August 17, 2021.

13. Askew K. Is Coronavirus changing how we eat? Food Navigator; 2020. Available at: https://www.foodnavigator.com/Article/2020/05/11/Is-coronavirus-changing-how-we-eat?utm_source=newsletter_dailyandutm_medium=emailandutm_campaign=11-May-2020. Accessed August 17, 2021.

14. Askew K. Organic food's coronavirus boost: health crises have a long-term impact on consumer demand. Food Navigator; 2020. Available at: https://www.foodnavigator.com/Article/2020/05/06/Organic-food-gets-coronavirus-boost?utm_source=newsletter_dailyandutm_medium=emailandutm_campaign=06-May-2020. Accessed August 17, 2021.

15. Occupational Safety and Health Administration (OSHA). Guidance on preparing workplaces for COVID-19. OSHA 3990-03 2020; 2021. Available at: https://www.osha.gov/sites/default/files/publications/OSHA3990.pdf. Accessed August 17, 2021.

16. Purdue Food and Agriculture Vulnerability Index. Agricultural Economics, College of Agriculture, Purdue University; 2020. Available at: https://ag.purdue.edu/agecon/Pages/FoodandAgVulnerabilityIndex.aspx?_ga=2.49471334.1159720487.1600111458-250602208.1598985334. Accessed August 16, 2021.

17. Lusk JL, Chandra R. Farmer and farm worker illnesses and deaths from COVID-19 and impacts on agricultural output. *PLOS ONE*. 2021; 16:e0250621.

18. Lewnard JA, Mora AM, Nkwocha O, et al. Prevalence and clinical profile of severe acute respiratory syndrome Coronavirus 2 infection among farmworkers, California, USA, June–November 2020. *Emerg Infect Dis*. 2021;27:1330–1342.

19. COVID-19 Farmworkers Study. Preliminary data brief; 2020. Available at: http://covid19farmworkerstudy.org/survey/wp-content/uploads/2020/08/EN-COFS-Preliminary-Data-Brief_FINAL.pdf. Accessed June 7, 2021.

20. Ceryes C, Robinson J, Biehl E, et al. Frequency of workplace controls and associations with safety perceptions among a national sample of US food retail workers during the COVID-19 pandemic. *J Occup Environ Med*. 2021;63:557–564.

21. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the health belief model. *Health Educ Q*. 1988;15:175–183.

22. Ajzen I. From intentions to actions: a theory of planned behavior. In: Kuhl J, Beckmann J, editors. *Action Control: From Cognition to Behavior*. Berlin: Springer-Verlag; 1985. p. 11–39.

23. Ajzen I, Fishbein M. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall; 1980.

24. Bandura A. *Social Learning Theory*. New York: General Learning Press; 1977.

25. Fayanju OM, Kraenzle S, Drake BF, Oka M, Goodman MS. Perceived barriers to mammography among underserved women in a breast health center outreach program. *Am J Surg*. 2014;208:425–434.

26. Mukhtar S. Mental health and emotional impact of COVID-19: applying Health Belief Model for medical staff to general public of Pakistan. *Brain Behav Immun*. 2020;87:28–29.

27. Fishbein M, Ajzen I. *Predicting and Changing Behavior: The Reasoned Action Approach*. NewYork: Psychology Press; 2010.

28. United States Department of Agriculture. Appendix B. General Explanation and Census of Agriculture Report Form. 2017 Census of Agriculture; 2019. Available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usappxb.pdf. Accessed August 17, 2021.

29. United States Department of Agriculture. 2017 Census of Agriculture. Characteristics of all farms and farms with organic sales; 2019. Available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Organics_Tabulation/organictab.pdf. Accessed August 17, 2021.

30. United States Department of Agriculture. 2019 Organic Survey. Data Release. National Agricultural Statistical Service; 2020. Available at: https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Organic_Production/pdf/2019_Organic_Executive_Briefing.pdf. Accessed August 17, 2021.

31. United States Department of Agriculture. 2017 Census of Agriculture. 2019 Organic Survey; 2020. Available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Organics/ORGANICS.pdf. Accessed August 17, 2021.

32. Soto Mas F, Handal AJ, Rohrer RE, Tomalá Viteri E. Health and safety in organic farming: a qualitative study. *J Agromedicine*. 2018;23:92–104.

33. Probst TM, Lee HJ, Bazzoli A, Jenkins MR, Bettac EL. Work and non-work sickness presenteeism: the role of workplace COVID-19 climate. *J Occup Environ Med*. 2021;63:713–718.

34. Zhong BL, Luo W, Li HM, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci*. 2020;16:1745–1752.

35. Hearne BN, Niño MD. Understanding how race ethnicity and gender shape mask-wearing adherence during the COVID-19 pandemic: evidence from the COVID impact survey. *J Racial Ethn Health Disparities*. 2021;1–8. Epub ahead of print.

36. Forsyth DR. Group-level resistance to health mandates during the COVID-19 pandemic: a groupthink approach. *Group Dyn Theory Res Pract*. 2020;24:139–152.

37. Lep Ž, Babnik K, Hacin Beyazoglu K. Emotional responses and self-protective behavior within days of the COVID-19 outbreak: the promoting role of information credibility. *Front Psychol*. 2020;11:1846.