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Environmental Health Threats to Latino Migrant Farmworkers

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Abstract

Approximately 75% of farmworkers in the United States are Latino migrants, and about 50% of hired farmworkers do not have authorization to work in the United States. Farmworkers face numerous chemical, physical, and biological threats to their health. The adverse effects of these hazards may be amplified among Latino migrant farmworkers, who are concurrently exposed to various psychosocial stressors. Factors such as documentation status, potential lack of authorization to work in the United States, and language and cultural barriers may also prevent Latino migrants from accessing federal aid, legal assistance, and health programs. These environmental, occupational, and social hazards may further exacerbate existing health disparities among US Latinos. This population is also likely to be disproportionately impacted by emerging threats, including climate change and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Latino migrant farmworkers are essential to agriculture in the United States, and actions are needed to protect this vulnerable population.

Keywords

Latino; farmworkers; migrants; agriculture; immigration

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AUTHOR CONTRIBUTIONS

F.C., A.M.M., and B.E. developed the concept of the article, guided the writing process, and edited the final manuscript. F.C. and C.H. drafted the introduction; A.M.M. and C.H. drafted the section on chemical hazards; G.K., J.V., and A.R.Y. drafted the sections on physical and biological hazards; F.C. and B.E. drafted the section on social hazards; J.V. and B.E. drafted the section on emerging hazards; and A.M.M. and B.E. drafted the conclusion. All authors provided critical feedback and helped to shape the manuscript.

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INTRODUCTION

Latino migrants represent a large proportion of farmworkers in the United States. In the most recent survey (2015–2016) of more than 5,000 hired crop workers surveyed from the National Agricultural Workers Survey (NAWS) (49), 83% were Hispanic and nearly 70% were born in Mexico (Table 1). While immigration status is difficult to measure and not often asked in farmworker surveys, data from NAWS and the US Department of Agriculture (USDA) indicate that about 50% of hired farmworkers do not have authorization to work in the United States (Table 1) (49, 50, 108). The states with the largest Latino migrant farmworker populations are California, Texas, Florida, Washington, Michigan, Oregon, North Carolina, and Georgia (86), which is due in part to the labor-intensive nature of the crops grown in those states (108).

Various laws and regulations in the United States have been introduced to protect farmworkers. The primary set of federal regulations aimed at protecting farmworkers from pesticides is the Worker Protection Standards (WPS), first issued by the US Environmental Protection Agency (EPA) in 1974 (14). Agricultural policy in the United States is shaped largely by the Farm Bill, a legislation package that is renewed by Congress approximately every five years, with the last bill being passed in 2018 (37). Additionally, the Migrant and Seasonal Agricultural Protection Act (MSPA), established in 1983, aims to protect migrant and seasonal agricultural workers by creating employment standards for wages, housing, transportation, discourses, and recordkeeping (135). Full implementation of these regulations, particularly the reporting of work-related injuries, is irregular at best (89). Thus, it is expected that injury data reported here and elsewhere are an artificially low estimate and should be viewed with caution.

Farmworkers face numerous environmental threats to their health, including chemical hazards such as pesticides (20, 29) and air pollutants (53, 122, 134); physical hazards, such as those causing injuries (31, 105, 126) and the effects of heat (119); and biological hazards, such as inadequate access to drinking water, basic sanitation, and hygiene and exposure to viruses, bacteria, parasites, and fungi (91, 118, 121). These threats are of particular concern among Latino migrant farmworkers, as they may interact with psychosocial stressors [e.g., housing and food insecurity, family separation, discrimination, lack of social support (100, 147)] to synergistically impact their health. In addition to chronic exposure to occupational, environmental, and social stressors, Latino migrant farmworkers are a uniquely vulnerable population owing to factors such as documentation status and potential lack of authorization to work in the United States, as well as language or cultural barriers. Because of the immigration status of many Latino farmworkers, they may also be unable to access federal aid, legal assistance, and health programs and often live in fear of deportation (22, 100, 131). The adverse effects of these hazards may be further amplified by emerging threats to farmworker health, including climate change and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19).

The above factors can exacerbate the existing health disparities observed among US Latinos. Data from the Centers for Disease Control and Prevention (CDC) indicate that Latinos have higher rates of adverse health outcomes such as overweight/obesity, type 2 diabetes, and

nonalcoholic fatty liver disease (NAFLD) than do other ethnicities (24). For example, the CDC reported that 14.7% of US Latinos have type 2 diabetes, compared with 11.9% in non-Hispanic whites (NHW), with the highest proportion among Mexican Americans (25). The unique psychosocial challenges facing Latino migrants may also result in high levels of stress, depression, and anxiety (147).

Herein, we describe the various chemical, physical, biological, and social hazards faced by Latino migrant farmworkers and their potential impact on farmworkers' health and safety.

CHEMICAL HAZARDS

Pesticides

More than one-billion pounds of pesticide active ingredients are used annually in US agriculture to increase crop yield and to meet food production demands (5, 46). Organophosphate (OP), pyrethroid, and neonicotinoid pesticides are among the most commonly applied insecticides, and glyphosate (Roundup) is the most commonly applied herbicide (5, 46). Widespread use of these pesticides results in ubiquitous exposure, particularly in agricultural populations, via pesticide drift from treated fields to nearby homes (33,34), through the take-home exposure pathway (i.e., when workers who have applied or come into contact with pesticides carry pesticides into the home on their clothing or shoes, potentially exposing other household members) (56, 71), and by consumption of contaminated food and water (34). Elevated occupational exposures are also a concern, as farmworkers who apply pesticides and/or work in treated fields—particularly seasonal and migrant farmworkers—often receive inadequate training on safe pesticide handling practices and lack adherence to appropriate hygiene practices at work (49). In addition, most farmworkers have limited control over some factors that lead to their elevated pesticide exposure, such as early reentry into pesticide-treated areas, off-target pesticide drift, and presence in the treated area at the time of the pesticide application (20). Farmworkers also tend to live near or on the fields.

Pesticides are an important source of injury and acute illness among farmworkers (20). For example, estimates show that between 10,000 and 35,000 farmworkers suffer acute pesticide poisonings every year in the United States (20, 50). However, the real number of acute pesticide poisonings is likely much higher owing to incomplete reporting. Long-term occupational exposure to pesticides, such as OPs and carbamates, has been linked to a broad range of chronic health effects, including impaired neurobehavioral function (e.g., cognitive and behavioral disorders) (29, 85, 127) and cancer (e.g., prostate, brain, and skin cancers, and lymphohematopoietic malignancies) (12, 65). Occupational studies on the respiratory effects of pesticides are sparse (19, 73), and more research is warranted regarding cardiometabolic (40) and endocrine outcomes (43, 44).

Both observational and intervention studies have shown that increasing personal protective equipment (PPE) access and use (17), strengthening educational programs on safe use of pesticides (67, 115), and promoting the implementation of integrated pest management and organic farming practices (136) are effective measures to reduce pesticide exposure and its potential for adverse health effects in farmworkers. In addition, greater compliance with and

more stringent enforcement of laws and regulations for pesticide application are needed to reduce farmworkers' exposure to pesticides (20).

Air Pollution

Farmworkers are exposed to numerous air pollutants, including black carbon, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and diesel-related emissions from farm activities, such as tractor driving, maintenance and repair of machinery and equipment, and agriculture crop residue burning (122, 134). These exposures increase the risk of adverse respiratory and cardiopulmonary outcomes among farmworkers, including lung cancer, wheeze, asthma, and chronic obstructive pulmonary disease (COPD) (63, 122, 134).

An emerging threat to farmworker health is exposure to smoke, dust, and poor air quality from wildfires, which are expected to increase in frequency and intensity in the coming years (9, 109). Latino migrant farmworkers may have disproportionately higher exposures to wildfire-related toxicants owing to their work outdoors and long shifts during an active fire and during cleanup and recovery (97), to their lack of access to PPE, and to inadequate training on safety and protection measures. In a recent analysis of interviews and focus groups with farmworkers in California, workers indicated that their ability to protect themselves from wildfire smoke depended on their supervisors and highlighted the importance of educating employers to provide PPE and implementing better safety practices (109).

PHYSICAL HAZARDS

Machine-Related Injuries

Addressing physical hazards is critical for ensuring farmworker safety. Machine-related injuries from the equipment used in agriculture are among the top occupational risks for farmworkers (92). According to the National Institute for Occupational Safety and Health (NIOSH), transportation-related incidents, including tractor accidents, were a leading cause of death for farmworkers in 2017 (92). The US Department of Labor's Occupational Safety and Health Administration (OSHA) reports that tractor incidents cause the most farmworker injuries and deaths (94), with tractor overturns causing about 130 deaths per year (93). Hearing loss and eye injuries are common occupational hazards associated with the use of agricultural machinery. For example, a study of 1,568 rural residents from southeast Iowa found a significant relationship between hearing loss and specific agricultural tasks, such as the use of electrical equipment (55). In a study in North Carolina, investigators found a higher incidence rate of lost work time due to occupational-related eye injuries among the 300 migrant farmworkers surveyed compared with the agricultural crop production industry as a whole (105).

According to OSHA employers are responsible for installing engineering and administrative controls and providing appropriate PPE to reduce the risk of machine-related injuries (93). This responsibility includes equipping machinery with protective structures, such as seatbelts or roll bars on tractors, and educating their employees on how to operate heavy machinery safely (94). Further research is needed to evaluate methods that prevent machine-

related morbidity and mortality and to explore how these machine-related injuries disproportionately affect different farmworker subgroups, including Latino migrant, undocumented, and foreign-born workers.

Musculoskeletal Injuries

Agricultural work requires a great amount of physical exertion and repetitive motions, which can cause physical stress and injury (31, 126). Actions such as constant bending, kneeling, and carrying (81) can cause musculoskeletal disorders and injury. A 2007 review of musculoskeletal disorders among agricultural workers found that farmworkers experienced high rates of back, shoulder, and upper extremity disorders (31). More recently, a study of 153 Latino farmworkers in North Carolina found that 19% had epicondylitis, 16% had rotator cuff syndrome, and 14% had lower back pain (81).

Ergonomics training is especially important for farmworkers so that they can avoid musculoskeletal injuries (8). NIOSH has published a booklet that outlines proper ergonomics for farmworkers (8), but there is currently no legislation in place to protect farmworkers from physical strain. Additional legislation that includes education, training, and more stringent enforcement of ergonomics guidelines may help prevent agricultural-related physical injuries, particularly among Latino migrant farmworkers, who may be afraid or unable to seek appropriate resources to protect themselves.

Heat Exposure

According to data reported from 2005 to 2014, 20% of heat-related deaths among non-US citizens occurred on a farm, and almost 95% of these deaths took place in Texas, Arizona, and California (128). Agricultural workers are at risk of prolonged heat exposure—and thus heat stress and strain—owing to their outdoor work, physical exertion, and limited water intake (119). Heat tolerance varies, with risk factors including preexisting illness (e.g., cardiovascular or kidney disease), age, certain medications or drugs, clothing, body composition, type of activity performed, and sex (28).

Heat exposure can lead to severe heat-related illnesses, such as heat exhaustion or heat stroke (119) and acute kidney injury (145). In addition, emerging research suggests that chronic kidney disease of unknown origin (CKDu) may be associated with heat strain in agricultural workers (59). CKDu has been identified in places such as Central and South America and Asia (59), and additional research is needed regarding its impacts in the United States. Globally, cases of CKDu have grown steadily over the past decade, and evidence has indicated that populations with higher rates of hypertension and diabetes, including Latino migrant farmworkers, may be at even higher risk (90).

Excessive heat and sun exposure may also cause skin disorders, such as photoallergic reactions or heat rashes (15). For example, a 2014 study of 100 migrant farmworkers in Oregon found that 10% of those surveyed reported skin rashes and bumps (11), which are symptoms of heat-related illness. In another study of 300 farmworkers in North Carolina, sunburns were one of the most frequently reported skin problems (140). Increased body temperatures and sun exposure can also adversely affect cognitive performance in outdoor

workers, thus decreasing task performance and dexterity and increasing the likelihood of physical injuries, such as those outlined above (101).

While OSHA field sanitation standards require agricultural employers to provide potable drinking water (96), research across the country suggests that farmworkers do not consume sufficient water to replace water lost (32, 80, 84, 123). The California Department of Industrial Relations states that workers must be able to drink at least one quart of water per hour, although this requirement is difficult to enforce (32). A study of 474 farmworkers in California's Central Valley found that while more than 90% of the workers received training on heat illness, including the importance of hydration, water consumption was low (123). Similarly, an investigation of hydration status by measuring urine-specific gravity in 192 agricultural workers in Florida showed that 53% of workers exhibited dehydration before starting their shift, and 81% of workers were dehydrated by the end of their shift (80).

Research on the occupational health of Latino migrant farmworkers is particularly challenging because study participants may be hesitant to report their injuries to avoid retribution from their employers (68, 102), and undocumented migrants may not report health issues at all or seek health care owing to fear of deportation (72). Furthermore, many of the above heat-related illnesses are exacerbated by the piecemeal pay of many migrant farmworkers, in which they are paid on the basis of the quantity of crop harvested (84). Piecemeal pay incentivizes farmworkers to exert a greater physical effort at a faster rate. With limited water, shade, and rest breaks, these workers are at an increased risk of heat-related illness and injury (84,120). As a case in point, among 283 agricultural workers in California, female workers hired by piece rate had increased odds of developing acute kidney injury compared with those hired at hourly rates (84).

Requirements and guidelines regarding heat-related illness in the agricultural industry differ by state, resulting in varying levels of protections for workers (98). Some recommendations that have been made regarding how farmworkers can avoid heat-related illnesses include a focus on hydration, use of proper clothing (e.g., PPE, lightweight clothing, and clothing that is light in color), more frequent rest periods, and health education (28, 137). To avoid excessive heat exposure, changes to work shifts have been adopted in some locations. This adaptation strategy, however, has resulted in hours of work lost and consequently reduction in pay (141). Prevention measures such as farm-level administrative controls to ensure provisions for adequate cooling, rest, recovery, and water could be implemented more broadly to protect farmworkers and minimize their time in intense heat. Additional clinical and field-based research is needed to examine the feasibility of these measures by examining how factors such as schedule changes, access to shade, and additional water breaks may impact heat strain–related outcomes and productivity.

BIOLOGICAL HAZARDS

Access to Water, Sanitation, and Hygiene

As discussed above, it is important for agricultural workers to have access to regular water breaks with safe drinking water, basic sanitation, and hygiene (e.g., water and soap for handwashing) in the workplace and in their place of residence (79, 96, 99). Access to basic

water, sanitation, and hygiene (WaSH) services prevents the spread of disease and biological hazards, specifically bacteria, viruses, and intestinal parasites (27, 38). OSHA field sanitation standards require agricultural employers to provide at least one toilet and handwashing station for every 20 workers (96). Data from NAWS indicate that more than 90% of farmworkers surveyed have access to handwashing water, drinking water, and toilets; yet, farmworkers born outside of the United States, including Mexico, those who were undocumented, and those hired by piece rate were significantly less likely to have access to water for handwashing and toilets (99). While research from NAWS exists on the presence of WaSH on farms, there is limited research on the safety of drinking water and the use of water breaks, toilets, and handwashing stations (with water and soap) by Latino migrant farmworkers in the United States.

Other Biological Threats

Additional biological threats to farmworkers include endotoxins and mycotoxins. Previous studies have shown that there are high rates of endotoxin exposure within the agricultural industry and that inhalation of certain endotoxins can lead to serious lung issues such as COPD (118). Mycotoxins produced by microfungi also pose a serious threat to the pulmonary health of farmworkers because they can be found in wheat dust and grain (91, 130). A 2017 study of 136 Costa Rican grain production workers found that, within these grain storage facilities, there were elevated levels of inhalable dust concentrations (111). Such exposure has also been shown to be associated with incidence of asthma and eczema (112).

Farmworkers also face serious biological hazards caused by agents such as bacteria, fungi, viruses, or parasites owing to close contact with sources such as infected livestock, plants, or soil (121). Workers in the agricultural sector are at a higher risk of contracting zoonotic diseases such as anthrax, bovine tuberculosis, rabies, and certain bacterial infections (87, 95). For instance, a study of 86 pig farmers in northern Germany found evidence for a bacterial transmission (i.e., *Staphylococcus aureus* and *Enterobacterales*) from swine to humans (18). While some research outlines how these biological threats endanger the health of farmworkers (18, 110), future research should focus on their effects on migrant farmworker populations.

SOCIAL HAZARDS

Food Insecurity

Food insecurity is a widespread problem in the United States and has been consistently associated with adverse health outcomes such as gastrointestinal infections, obesity asthma, and mental disorders (74, 146). Estimates showed that 11% of the US population was food insecure in 2016; however, the prevalence of low and very low food security differs significantly across racial and ethnic lines (106). Latinos have the highest rates of food insecurity in the United States, with some studies indicating that more than 25% are food insecure (60). While studies on food insecurity in the rural sector have been limited and largely cross-sectional, they have shown a consistent pattern of higher incidence of food insecurity for migrant workers in the rural/agricultural sector. A study conducted in

California's Central Valley found that 45% of migrant worker households comprised primarily of farmworkers had poor food security (110), whereas a study of farmworker families in the Salinas Valley observed that 29% and 10% of households had low and very low food security, respectively (114). Additionally, a study of 100 migrant and seasonal farmworkers living on the US-Mexico border found that 82% of households reported food insecurity (146). The drivers of food insecurity are low income, lack of permanent employment, educational levels, discrimination, lack of access to healthful food, and constant mobility while finding work, which may impact Latino migrant farmworkers in particular (69, 117, 142).

Migrants working in the United States under the H-2A program are to be provided with food, housing, and transportation to and from the country of origin. Despite the worker-friendly nature of this program, a study indicated that, while workers with an H-2A visa were three times less likely to be food insecure compared with those without an H-2A visa, they were still four times more likely to experience food insecurity than was the general US population (52).

Lack of Quality Housing

The quality and accessibility of housing are social determinants of health and are of particular concern among migrant farmworkers, as housing is linked directly to farmworkers' employment as part of their compensation in certain communities (139). Housing opportunities for migrant farmworkers are limited and include options such as short-term rentals in the private market and living in group quarters or trailer parks that are regulated by the entity hiring them (e.g., farm, labor contractor). Although data on farmworker homelessness are not widely available, there is anecdotal evidence of farmworkers reporting having slept in their cars for an extended period of time or other makeshift housing (124). There are regional differences in housing options; most farmworkers on the East Coast live in housing provided by the hiring entity and farmworkers on the West Coast live in their own housing (103).

Previous studies in migrant farmworker populations have consistently reported high rates of overcrowded housing (16, 36, 143). For example, a farmworker housing study conducted in California estimated the people per room (ppr)—a measure of crowding—to average 2.3 (143), an estimate well above the cutoff ppr for no-crowding of 1 as determined by the US Department of Housing and Urban Development (13). This study found severe crowding conditions regardless of whether the farmworker lived alone, with family, or with nonfamily members (143).

Farmworkers also live in substandard housing conditions, including structural deficiencies (149), rodent or insect infestations (16), mold and water damage (16), and lack of necessities, such as plumbing, kitchen facilities, and washing machines (36, 42, 139, 149). Notably, a study in *colonias* of South Texas found that many farmworkers severely lacked access to clean water and sanitation (58). Injury risk is also common in farmworker housing; sources of injury risk include lack of fire extinguishers, poor flooring, and poor electrical systems (42, 103).

The poor conditions of most migrant farmworker housing contribute to various adverse health outcomes, such as dermatitis and poor skin conditions, lack of sleep, and high transmission of infectious diseases, including tuberculosis (103, 116, 139). Furthermore, substandard housing conditions can amplify the negative effects of the various environmental and occupational threats facing farmworkers, including exposure to environmental pollutants, poor working conditions resulting from farm management practices, and the effects of heat waves and extreme working conditions related to climate change (47, 104). Policies aimed at improving housing conditions and reducing crowding—which are frequent in migrant farmworker housing—are likely to result in less transmission of infectious diseases and improved mental health outcomes (4).

Research on farmworker housing conditions also shows that a family's well-being is impacted negatively not only by poor housing conditions but also by the correlated negative characteristics of the neighborhood where their home is located, such as heavy traffic, lack of access to healthy food, and longer driving time to a grocery store (3, 75). The joint negative effects of poor housing and neighborhood characteristics include lack of sleep, elevated stress and family conflict, and social isolation (particularly in rural settings) (3, 82). Interventions to reduce social isolation are warranted because it has been associated with adverse mental health outcomes and increased family violence (6, 10).

Fear of Deportation

As stated in the introduction, estimates indicate that approximately half of all farmworkers in the United States are undocumented (49). The United States has not offered congressionally supported amnesty to undocumented immigrants since the 1990s [under the Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act of 1998; Pub. L. 105-119]. The Deferred Action for Childhood Arrivals (DACA) policy of 2012 offered some protections to undocumented immigrants brought to the United States as children. The Trump administration has put forth efforts to end citizenship by birth (30, 125). During this same time frame, Mexican immigrants have been characterized as criminals (144), there have been numerous attempts to rescind DACA protections (133), and children have been forcibly separated from migrant parents (54, 107). These actions have created anxiety in the immigrant community (70), including among migrant farmworkers, and there is growing evidence that fear of deportation of themselves or loved ones may impact the health of this population. Prior cross-sectional studies have reported associations among deportation fear and poorer self-rated health (23, 41), depression and anxiety (138, 148), lower rates of health care utilization (51, 72, 83), and higher levels of inflammation (77). In the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study, having "a lot" of worry about deportation even before the 2016 US presidential election was associated with greater body mass, larger waist circumference, and higher pulse pressure (131). Nearly half (48%) of these women, most of whom were born in Mexico and were of unknown documentation status, reported "a lot" of worry about deportation. Higher worry at baseline was associated with steeper increases in blood pressure over the subsequent four-year period (which bracketed the 2016 election); the most robust findings were for systolic pressure and mean arterial pressure (132). Additionally, women who reported higher levels of worry about deportation had a twofold

higher risk of incident hypertension than did those who reported low deportation worry over the same period (132). Nearly half of these women's adolescent children—all of whom were born in the United States and are therefore citizens—worried at least sometimes about the personal impact of the post-2016 election immigration policies, and this worry was associated with higher anxiety levels and poorer sleep (39).

In addition, fear of deportation can cause undocumented farmworkers to have higher risks related to occupational health hazards (68, 102) because they may be afraid to speak up. They also have limited access to health care and worker's compensation and are low-income (35). Their limited rights and the high portion of the labor supply that they provide for agriculture in the United States increase their risks from occupational hazards and make them a vulnerable population (35, 66). US immigration policy should consider the impact of the uncertainty of deportation on the health of this community and the importance of this workforce for US food supply.

EMERGING HAZARDS TO LATINO MIGRANT FARMWORKERS

Emerging hazards such as climate change and SARS-CoV-2 may disproportionately impact Latino migrant farmworkers and further amplify the adverse effects of the hazards outlined above. These threats highlight the particular vulnerabilities of this population.

Climate Change

The agriculture sector faces serious threats from climate change, with rising temperatures increasing the intensity and frequency of extreme events such as heat waves, which exacerbates agricultural-related issues of heat exposures, droughts, and floods (45). As global temperatures rise, farmworkers will face a greater risk of heat exposure and thus heightened heat illness and related effects (61, 129). Without considerable adaptation efforts, climate change will result in disruptions of crop viability and production, with consequent effects on employment levels and reductions in worker productivity and wages due to extreme heat (64, 78). In addition, drought can lead to the contamination and depletion of water sources (62), impacting low-income populations, including farmworkers. Moreover, migrant workers—along with *colonias* on the US–Mexico border and homeless and tribal communities—are disproportionately affected by a decrease in and lack of consistent access to potable drinking water in rural agricultural areas and by contaminated water related to climate change (7, 57).

Limited capacity of low-income populations to adapt to expected weather extremes will result in an ever more challenging and shifting environment for the US agricultural sector, with lasting negative socioeconomic impacts on the horizon. Outdoor workers have specifically been deemed "climate canaries," owing to the heightened frequency, duration, and intensity of climate-related exposures (113). Farming and rural communities in the United States are more vulnerable to the mental health outcomes associated with a changing climate, such as depression and suicide related to the financial implications of drought. The negative effects of heat waves are compounded by impacts of heavy pesticide use (Figure 1). The convergence of these climate-related issues will increasingly affect health, economic,

and environmental systems impacting Latino migrant populations. There is a need to use basic and applied research to develop real-world and region-specific solutions for adaptation.

SARS-CoV-2

During the COVID-19 pandemic, farmworkers have been deemed “essential workers” and therefore continue to work (48). However, as stated above, many farmworkers live in crowded conditions and some without running water, making it difficult to adhere to guidelines that aim to minimize SARS-CoV-2 transmission, including frequent handwashing, isolation, and quarantine (17, 36, 139, 149). Although there are no systematically collected surveys yet, a lack of health insurance and knowledge about federal or state benefits, replacement income programs, and free SARS-CoV-2 health care may contribute to workers’ avoidance of testing or treatment. Concern about immigration status of family or friends may hinder proper contact tracing activities. At work, access to handwashing facilities, space between workers, and access to PPE are critically important to protect workers from SARS-CoV-2 (26, 88). All these factors have likely contributed to the clusters of farmworkers, who have become infected with SARS-CoV-2 (1). Currently, there is little research on the frequency and use of water breaks, toilets, and handwashing stations; the latter are especially important for crop workers and meat packers to reduce the spread of SARS-CoV-2 (88).

CONCLUSION

The health and well-being of migrant Latino farmworkers are affected by multiple chemical, physical, biological, and psychosocial hazards. In addition, these workers are particularly vulnerable to emerging threats as evidenced during the SARS-CoV-2 pandemic. A lack of information on this population exists, in part, because a large segment is hidden. Much of the research we have summarized in this review describes the environmental hazards faced by farmworkers, in general, and does not illustrate the particular hardships of Latino migrant farmworkers. Therefore, our review likely underestimates the specific health risks of this population.

The United States currently depends heavily on Latino migrant farmworkers to bring food to the table of Americans. Because of the 2008–2009 recession, the Trump administration’s immigration policies, and a general increase in wages in Mexico’s rural sector, the flow of new migrant labor into the US agricultural sector has slowed (76). However, even with increasing agricultural technologies and mechanization of crops, the need for migrant agricultural labor force has not decreased (49, 76). In the coming decades, the demands of the agricultural sector will likely change, and there will be a need to train a future generation of farmworkers who are skilled at utilizing newer technologies as a complement to diversified farming systems (2, 21) and who will contribute to the maintenance of a stable labor force. Because the United States will continue to depend on Latino migrant workers to farm its lands, effective and culturally appropriate public health educational interventions should target this workforce, opportunities to learn new technologies should be made available, and policies should be developed to protect these workers. Of utmost importance

is a reformation of our immigration policies so that this hidden workforce will be protected and made visible.

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SUMMARY POINTS

1. Latino migrants represent a large proportion of US farmworkers: Approximately 70% of farmworkers are born in Mexico, and about 50% have no authorization to work in the United States.
2. Farmworkers face numerous environmental hazards, including chemical factors such as pesticides and air pollutants; physical factors such as those causing machine-related injuries and exposure to heat; biological factors from exposures to viruses, bacteria, parasites, and fungi; and social factors such as inadequate access to WaSH services, housing and food insecurity, discrimination, and lack of social and workplace protections.
3. Latino migrant farmworkers are a particularly vulnerable population because of their limited knowledge of occupational health risks and worker rights, inadequate training on protection from environmental hazards, lack of access to medical care, documentation status, and language and/or cultural barriers.
4. Latino migrant farmworkers are predisposed to various adverse health outcomes such as cardiometabolic disease, which may be further exacerbated by chronic exposure to environmental, occupational, and psychosocial hazards.
5. Latino migrant farmworkers are particularly vulnerable to emerging health hazards, including SARS-CoV-2 and climate change.
6. Latino migrants are essential to US agriculture, and actions need to be taken to protect them through the enactment of policies (e.g., immigration reform and workplace protections), training, and education programs aimed at minimizing risks from the environmental hazards outlined in this review as well as through improved access to necessities such as health care, safe housing, water, and food.

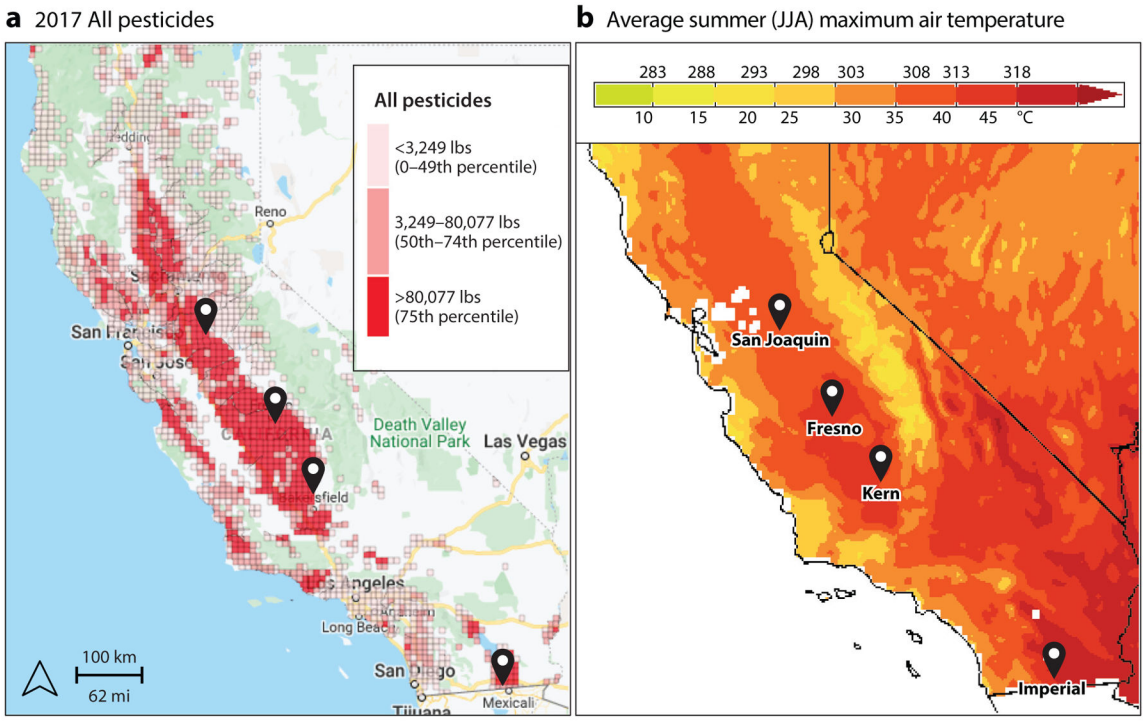

Figure 1.

Example of the potential compounding effects of high exposures to both pesticides and extreme heat on outdoor farmworkers in California, United States. Panel *a* indicates the spatial distribution of total pesticide use in California for 2017 (from http://www.trackingcalifornia.org/pesticides/pesticide-mapping-tool as of June 25, 2020). Panel *b* illustrates the summer [June, July, August (JJA)] average daily temperature maxima (K) during the early twentieth century across California based on ground observations (https://psl.noaa.gov/data/gridded/data.livneh.html). Black markers indicate county locations for both the Central Valley and Imperial Valley, where 2017 estimates show high agricultural production, high agricultural labor force, and high population growth. Map created by Michael Wehner of Lawrence Berkeley National Laboratory.

Table 1

Demographics of hired US farmworkers, 2015–2018

Characteristic	Proportion by category
Ethnicity[a,b]	
Non-Hispanic	17%
Hispanic	83%
Mexican	65%
Mexican American	9%
Other	9%
Birthplace[a]	
Mexico	69%
United States	24%
Central/South America	6%
Other	1%
Employment eligibility[a]	
Did not have work authorization	49%
Had work authorization	51%
US citizen	29%
Legal permanent resident	21%
Work authorization via other visa program	1%
Demographics and family composition[d,e]	
Sex	
Male	75%
Female	25%
Average age	39 years
Housing[a]	
Employer-provided	16%
Rented from someone other than employer	54%
Home owned by themselves or family member	28%
Rented from government, charity, or other organization	1%
Income[a]	
Median income range	US$17,500–19,999
Health insurance[a]	
Had health insurance	47%
Did not have health insurance	53%

[a]Data obtained from National Agricultural Workers Survey research report (49) for 2015–2016 (n = 5,342 hired crop workers surveyed).

[b]Specific ethnicity categories correspond to the 83% of participants who reported being Hispanic.

[c] Specific employment eligibility categories correspond to the 51% of participants who reported having work authorizations.

[d] Data obtained from US Department of Agriculture Economic Research Service, 2018 (49).

[e] Data are specific to hired farmworkers who were farm laborers, graders, and sorters.