

FARMWORKER HEALTH IN CALIFORNIA

HEALTH IN A TIME OF CONTAGION, DROUGHT, AND CLIMATE CHANGE



COMMUNITY AND
LABOR CENTER
—
UC MERCED



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Acknowledgement

The Farmworker Health Study (FWHS) survey was funded by the California Department of Public Health and conducted by researchers at the University of California, Merced with active engagement of researchers from other institutions. This community-based study included the active involvement of farmworker-serving organizations from across the state (the Community Advisory Board) as well as the participation of representatives from a number of unions, philanthropic foundations, local health departments, representatives from agricultural growers, and health care providers who work closely with the farm working communities across the state.

A primary strength of this study was the active engagement between researchers and the community groups representing farmworkers. That is, the active involvement of the Community Advisory Board throughout the process was critical to the success of the survey. Their involvement helped ensure the study addressed questions that were pertinent to the farmworkers and was conducted in a manner that reflected the constraints that farmworkers face in their everyday lives. Their dedication and professionalism cannot be overstated, especially given the survey was conducted in the time of a pandemic. The success of the project is mainly due to their active contributions.

The success of the study is also due to the dedication and tireless efforts of a number of staff, especially Melissa Renteria, Imrinder Toor, Keila Luna Monterrey, Rodrigo Alatraste-Diaz, and Reyna Villalobos. Additional special thanks go to Nimrat Sandhu, Derry Ridgway, and Joel Diringer, all of whom contributed countless hours to help make the project a success.

The primary thanks, of course, goes to farmworkers and organizations that represent them. One of the key objectives upon completion of the report is to plan townhalls to release the findings, and to engage with farmworker organizations, public agencies, and other farmworker stakeholders to develop policies, programs, medical plans, and other activities that will improve the lives of farmworkers. We look forward to continuing this work long after this report.

Finally, we would like to thank the California Department of Public Health, particularly Jessica Nunez de Ybarra, Catrina Taylor, and Diana Ramos, for providing the means and the trust to complete this project. They have been supportive and positive throughout the entire process, and continually supported our desire to both have a scientifically rigorous survey but also work closely with the farmworker organizations and communities. Their dedication to doing good science while promoting health equity is laudable.

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Executive Summary

The Farmworker Health Study (FWHS) was funded by the California Department of Public Health and conducted by researchers at the University of California, Merced with active engagement of researchers from other institutions. This community-based study included the active involvement of farmworker-serving organizations from across the state (the Community Advisory Board) as well as the participation of representatives from a number of philanthropic foundations, local health departments, representatives from agricultural growers, and health care providers who work closely with the farm working communities across the state. The survey was conducted between July 2021 and April 2022, with the majority of the surveys completed between September and December 2021. While this was more than a year after the beginning of the COVID-19 pandemic, infection rates across the region were still high, especially for essential workers such as farmworkers, due to the newly arrived Delta variant. Because of the challenges created by the COVID-19 pandemic, a convenience sampling technique was used. The survey used a convenience sample, with community groups or clinics from around the state recruiting the participants. The research team selected the community groups using two criteria: the region in which they operated and their capacity and experience working with farmworkers. The clinics were selected because of their geographical location and/or their ability to collect medical data from the participants. As a result, the overall number of surveys collected in each region of California was roughly proportional to the number of farmworkers in the region. The study also oversampled women and Indigenous farmworkers (those who self-identified as belonging to Native American communities) to ensure a large enough sample was collected to focus specifically on health issues that directly impact women and Indigenous farmworkers. The survey covered several topics, and the key findings from the survey include:

I. Farmwork Social and Economic Organization

- Nearly one in six farmworkers (15%) did not receive the minimum number of 10-minute rest breaks under state law.
- Nearly half (43%) reported that their employer “never” provided a heat illness prevention plan as mandated under law.

- Almost one in five (19%) experienced, at one point or another, not being paid wages they earned by an employer.
- Nearly one in six farmworkers reported that smoke made it difficult to breathe either often (8%) or very often (7%). Almost one-third (32%) claimed respirators were lacking but “always” needed when working in agriculture.
- Only 12 percent of farmworker women who continued to breastfeed after returning to work had a designated area at the workplace where they could breastfeed (or pump). A total of 688 female farmworkers were surveyed in our study.
- More than one-third (36%) of farmworkers said they would not be willing to file a report against their employer for workplace non-compliance.
- Of those who would be unwilling to file a report against an employer, about two-thirds (64%) said they would be unwilling to file a report due to fear of retaliation or job loss.
- Two-thirds (67%) expressed the highest level of fear of family separation due to deportation on a scale from “never” to “always.”
- Nearly two-thirds (62%) of respondents reported difficulty paying for food or bills since the pandemic.
- 19 percent of respondents reported very low food security, 23 percent reported low food security, and 57 percent reported high or marginal food security.
- More than one in three respondents experienced problems keeping a house cool (39%) or warm (36%), issues that will only increase in time as climate change exacerbates the temperature extremes.

II. Current Health of Farmworkers

Women’s and Reproductive Health

- 24 percent of women reported not having regular periods.
- 8 percent of females and 4 percent of males reported suspected fertility issues.
- 30 percent of females and 33 percent of males reported not using birth control.
- 22.1 percent of women reported having a miscarriage at some point in the past.
- 14 percent of women report having a preterm birth and 15 percent of women reported having a baby with low birthweight.

Physical Health

- 36 percent of the respondents rated their health as only fair or poor and 23 percent reported their health had gotten better or somewhat better in the past year and 16 percent saying that it had worsened or somewhat worse in the past year.
- 37 percent of men and 47 percent of women reported having at least one chronic condition, diabetes (20%), hypertension (19%) and anxiety (10%) being the most common.
- 87 percent of the respondents reported having at least one Adverse Childhood Experiences (ACEs).
- Based on self-reported height and weight, 31 percent would be categorized as being overweight and 43 percent as being obese.
- Based on physical measurements, 30 percent would be categorized as being overweight and 59 percent as being obese.
- Based on non-fasting blood test, 56 percent exhibited pre-diabetic or diabetic levels of hemoglobin A1c (HbA1c).
- Based on non-fasting blood test, 42 percent had values indicating concerning levels of chronic inflammatory changes.

COVID-19

- Based on self-reports, 40 percent had a confirmed case and 29 percent a positive COVID-19 test.
- Using self-report and non-fasting blood test, 60 percent were positive for COVID-19, including 29 percent who reported no known history of COVID-19.
- 40 percent of those with COVID-19 reported continuing, long-term health problems.
- 31 percent of those with COVID-19 that reported having continued problems with smell, and 21 percent reported having continued problems with taste.
- 81 percent had received at least one vaccination against COVID-19.
- Those not vaccinated cited concern about side effects as the most common reason for not being vaccinated (26%).

Mental Health

- 19 percent of respondents reported feeling nervous or anxious, 15 percent reported feelings of uncontrollable worry, and 14 percent of workers reported feeling depressed or hopeless.
- 7 percent reported being diagnosed with depression and 10 percent diagnosed with anxiety.
- 13 percent of workers reported having restless or very restless sleep.
- 5 percent of workers reported the need to seek professional help and 3% reported actually receiving professional care.

III. Future Health of Farmworkers

Use of Preventive Health Services

- 43 percent reported having visited a doctor's clinic, 35 percent were seen by the dentist, 24 percent had a vision checkup, and 17 percent had a hearing checked in the last 12 months.
- 21 percent reported ever being screened for colorectal cancer, including 26 percent for those over 45.
- 16 percent reported ever having been checked for skin cancer.
- 76 percent reported having routine blood tests.
- 31 percent of males reported having ever received a testicular examination, including 33 percent of those over 45.
- 88 percent of females reported having ever received a Pap smear and 71 percent reported receiving a breast exam.

Health Behaviors

- 10 percent of respondents, including 19 percent of males and 3 percent of females, reported being regular tobacco users.
- 1 percent reported vaping regularly and 2 percent reported marijuana use.
- 16 percent reported having consumed high levels of alcohol in the past 30 days, including 29 percent of males.

- 33 percent reported having used prescription drugs and 1 percent reported having used methamphetamine.
- 53 percent perceived themselves to be at the right weight while 31 percent considered themselves slightly overweight and 10 percent very overweight.
- 37 percent were diagnosed by a physician with obesity, of whom 66 percent reported trying to lose weight.

Healthcare Insurance and Access

- 49 percent reported being without health insurance at some point in the previous 12 months.
- 41 percent of those with insurance had Medi-Cal or Medi-Cal with another type of insurance plan.
- For those with children, 74 percent reported having insurance coverage for their children and 26 percent do not.
- 78 percent reported having a usual source of care, with 58 percent reporting they visit a Community Health Center or a Migrant Clinic and 29 percent see a doctor in a clinic.
- 23 percent reported delaying medical care at some point in the previous 12 months.
- 39 percent of the participants reported needing an interpreter for a medical treatment, with 90 percent of those reporting receiving support.

While farmworkers have lower self-reported rates of chronic conditions than the general Latino population in California, this might be partly due to immigrants historically being healthier than native-born Latinos (the Latino Paradox) and in part because farm work is a strenuous occupation, and thus those with poor health tend to drop out of the workforce. That said, the results indicated that there is concern about future health given the lack of health insurance, health access, and lack of screening for chronic conditions; as well as high levels of obesity and the associated risk of heart disease, stroke, and diabetes.

Farmworker health issues are likely to be exacerbated in following years, due to public health crises, such as the COVID-19 pandemic, or climate change, such as heat waves and wildfire smoke. This report concludes by outlining the implications of this study's findings, and by offering policy recommendations for lifting industry workplace health and safety standards in agricultural work as well as expanding access to the healthcare safety net.

Introduction

California agricultural workers are on the frontlines of major economic and environmental crises in the twenty-first century. While California agricultural workers have long experienced some of the most challenging working conditions, widening social inequalities and climate change are creating new challenges for the state's most disenfranchised workforce. A once-in-a-hundred-year global pandemic, as well as record heat, catastrophic wildfires, and a lack of a safety net pose major evolutions in the challenges facing farmworkers and their health.

The purpose of this report is to examine dynamic challenges facing farmworker health and their implications. In 2020, UC Merced initiated the study to examine the health and well-being of agricultural workers. With funding from the California Department of Public Health (CDPH), and support from the California Endowment, the FWHS collected data from 1,242 agricultural workers in six languages, across five California regions, from August 2021 to June 2022.

Scientific studies have documented a range of poor health outcomes among farmworkers, such as diabetes, hypertension, obesity, asthma, and psychological distress. Public health literature has linked many of these conditions to “social determinants of health” (Blane 1995) including socio-economic status, lack of access to primary care and health insurance coverage, cultural and linguistic barriers, transportation, affordable housing, legal status, and other factors.

At the same time, much literature on farmworker health is still lacking research on key social factors, such as work, sex, and race. Farmworkers have among the fewest social and economic rights, and among the highest rates of occupational injury and illness, despite the Latino health paradox—and a demographic profile that would otherwise predict above average health (Markides and Coreil 1986; Markides and Eschbach 2005; Taningco 2007; Saenz and Garcia 2021).

The FWHS goals were ambitious—to examine agricultural worker health and well-being, in addition to healthcare access, local and state policies, and health and training needs. This study adds to the current literature by examining key health-related processes in the context of farmwork. We examine processes and determinants that have often been overlooked, such as working conditions and women’s reproductive health. This study also examines farmworker health in the changing context of the COVID-19 pandemic, heat, drought, and wildfire smoke.

The Farmworker Health Study Community Advisory Board (CAB), comprised of twenty-six farmworker-serving organizations, participated in dozens of meetings that informed the development of the study and made this study possible. In addition to collecting data, the CAB also contributed to the development of the study, recommending survey questions about compliance with workplace health and safety standards, women’s reproductive health, non-Western healing practices, and many more issue areas.

This report is an important step in providing sustained research, education, and public service on issues related to farmworker health and well-being. This report is intended to inform diverse stakeholders working on issues related to improving farmworker health and well-being—from community, labor, and environmental organizations to local, state, and federal public agencies.

California Agriculture and Social Organization

Anchoring this study is a theoretical framework that centers the social and economic organization of farmworkers. We examine data on social factors traditionally examined in relation to farmworker health, such as income, housing, and food insecurity—while also examining areas with gaps in the farmworker health literature, such as work, race, and gender. Our study advances the literature on farmworker health by explicitly examining employer compliance with workplace health and safety standards, reproductive health, and the experiences of Indigenous farmworkers (to be explored in later fact sheets and briefs), among other topics.

Issues of low-wage work and health have long been at the center of American social science literature. The first social science study in the United States (U.S.) examined how racism shaped differential health outcomes for impoverished residents of a segregated, urban Black neighborhood and its relationship with social and economic organization (Du Bois 2014[1899]). Subsequent analyses further examined the social organization of work in a rural context, particularly the high prevalence of Black tenant farmers (who were dependent on white landowners) in the deep South and their lack of capital accumulation (Du Bois 1901, Du Bois 1904, Du Bois 2003[1906]). Such research gave rise to the Chicago school of sociology and the scholarly concepts of social organization, social ecology, assimilation and acculturation—though the Chicago school downplayed racism as a feature of such processes. (Morris 2015).

The Mexican experience in California agricultural work ran parallel to the southern Black experience in tenant farming. As far back as the 19th century, Mexicans (and their descendants) formed the majority of the workforce in California agriculture, and experienced diminished social and economic rights, such as legal segregation (Nakano Glenn 2001). Just as Black tenant farmers in the south experienced lack of land ownership and dependence on whites, so too did Mexican agricultural workers laboring in California's large industrial farms (Fox 2012). And when Southern legislators negotiated for exemptions for agricultural and domestic workers in the New Deal (Katznelson 2013)—the most comprehensive improvement ever in American worker rights and working conditions—both Black and Mexican agricultural workers became excluded from such rights.

Across the twentieth century, key social science studies highlighted the labor struggles faced by California agricultural workers (Galarza 1957, Taylor 1983, Goldschmidt 1978, Kerr 1983, Fujimoto 1977). In contrast to the Midwest's tendency of small family farms that emerged from a history of homesteading, California's large number of industrial farms emerged from a history of wealthy Americans buying and corporatizing large Spanish landholdings and water resources (Nodín Valdés 1994; O'Connell and Peters 2021). In one study, a community with large industrial farms were characterized by a greater concentration of agricultural workers, less

capital circulating in the local economy, and fewer community-based organizations and civic engagement than a community characterized by small family farms (Goldschmidt 1978). Yet, the relationship between agricultural work and health has not been examined by such scholars.

Despite the long and ongoing history of social science studies on work and health, few large-scale health studies have systematically examined factors of social and economic organization among the most disadvantaged workers. In recent years, there has been a greater shift towards examining "social determinants of health," which may include socioeconomic status and housing, yet such research is limited in advancing understandings of the central role of social and economic organization. One example includes the growing scholarly interest in acculturation to explain Latino health care disparities, when socio-economic factors remain a stronger predictor of health disparities (Zambrana and Carter-Pokras 2010).

Agriculture is among the most dangerous occupations in the United States. An estimated 19.4 deaths per 100,000 workers due to agriculture related injuries in 2019 (Centers for Disease Control and Prevention 2021). Workers are exposed to multiple occupational hazards including exposure to toxic chemicals such as pesticides which can lead to cancer, cardiovascular disease, and neurological disorders (Curl et al, 2020). They work with dangerous farm instruments often without being provided with necessary Personal Protective Equipment (PPE) and inadequate training which makes them highly vulnerable to fatal and non-fatal injuries (Keifer et al, 2009). The nature of their work requires them to stay outdoors for long hours under conditions of elevated temperature and humidity, making them vulnerable to the development of heat related illnesses. In California's inland regions where farmworkers concentrate (the Central Valley, Inland Empire, and Coachella Valley/Imperial Valley) temperatures can exceed 110 degrees Fahrenheit during heat waves. Furthermore, during wildfire season, they are often asked to work without any PPE thereby increasing their risk of developing a variety of respiratory illnesses (El Khayat et al, 2022).

Any serious study of California agricultural workers and their health and well-being should therefore include social and economic organization. In this study, we examine agricultural workers' health, but also different facets of California agricultural workers' social and economic organization, including working conditions, housing, food insecurity and healthcare access.

Health Access as a Right

Farmworkers are less likely to utilize healthcare services than the general population despite their increased likelihood of developing a variety of acute and chronic illnesses. The term healthcare utilization is defined as the “quantification or description of the use of services by persons for the purpose of preventing and curing health problems, promoting maintenance of health and wellbeing, or obtaining information about one’s health status and prognosis” (Carrasquillo, 1970). It can be studied in different ways including the number of emergency room (ER) admissions, in-patient admissions, use of primary care services and preventive screening services. But it is clear that workers who reported having some type of health insurance coverage are more likely to use healthcare services in comparison to workers who were uninsured. Insured workers were more likely to visit a private provider while uninsured workers were more likely to utilize a community health center or migrant health clinic. The most reported reason for avoidance of healthcare services was lack of insurance coverage and high costs associated with medical visits (NAWS, 2021).

Thus, to understand the health of agricultural workers, it is important to understand the right to access health care. The Patient Protection and Affordable Care Act (ACA) was intended to increase health insurance coverage for American citizens and those with legal immigration status in the U.S. The ACA significantly increased health insurance coverage for agricultural workers at the national level, with the rates of insurance coverage rising from 32 percent in 2011-12 to 56 percent in 2017-18 according to the National Agriculture Worker Survey (NAWS, 2021, Hernandez and Gabbard, 2022). However, a significant proportion of agricultural workers are undocumented, and the ACA does not provide coverage for individuals without legal immigration status through either Medicaid/ Medicare, or the government run health insurance exchanges (Shaw et al, 2014).

While large growers (more than 50 employers) are legally obligated to offer health insurance to their workers, small growers with fewer than 50 employees or employees who work for less than 120 days (such as migrant workers) are not (Ortega et al, 2018; Guild et al, 2016). And many large growers struggle to provide health care that is affordable to their workers. As a result of these terms and conditions, the ACA had a different impact on agricultural workers compared to their peers who were employed in other industries. Since 2016; however, there has also been a change in the rhetoric around the treatment of undocumented workers, particularly in relation to the Public Charge rule which denies eligibility to apply for citizenship to individuals who have used government benefits in the past (Katz and Chokshi, 2018). Such policies have discouraged workers from applying for health insurance coverage. Such policies have also discouraged workers from applying for health insurance coverage. (Batalova, Fix and Greenberg 2018; Jimenez 2021; Marrow and Joseph 2015; Van Natta 2019; and Van Natta et al. 2019). The period after 2016 was also associated with numerous attempts to weaken or repeal the ACA. This rule has now been revoked but continues to have a sustained impact on healthcare access for agricultural workers (California Healthcare Foundation, 2022).

UC Merced's Farmworker Health Study

The current study has attempted to achieve three goals. First, the study measured different facets of California agricultural workers' social and economic organization, including working conditions, housing, food insecurity, and civic participation (a topic to be covered in later briefs and fact sheets). Second, the study attempts to assess the current health of farmworkers by focusing on the experiences with COVID-19, physical health, mental health, and women's and reproductive health. And third, the study attempts to identify the future health by measuring healthcare insurance and access, use of preventive health services, and health behaviors. Understanding the linkages between these areas can help not only assess the current and future health, but also provide insights into actions that can be taken to improve health outcomes in the future.

Methods

The Farmworker Health Study: A Community-Engaged Research Approach

The FWHS was conducted between June 2020 and June 2022 and led by a team of researchers at UC Merced (the Farmworkers Research Team; Appendix E), including members of the UC Merced Community and Labor Center. The project utilized a community-engaged research approach, and a convenience-based, stratified sampling frame. The study established two advisory boards: An Advisory Committee consisting of key stakeholders (i.e., farmworker-serving community-based organizations, a farmworker union, researchers, a local and state public health officials; See Appendix E) to provide oversight of the project, and a Farmworker Community Advisory Board (Appendix F). Both groups were instrumental in the development of every major stage of the study, including planning, study design, methodology, data interpretation, and dissemination plans. The Farmworker Community Advisory Board (CAB) was particularly instrumental in ensuring that the survey was appropriate and covered the topics that are important to farmworkers and the farm working communities. The Farmworker CAB members recruited and conducted the interviews (1.5 to 4 hours) in six languages (Spanish, Triqui, Mixteco, Zapotec, Ilocano, and English) with 1,242 farmworkers. The only eligibility requirements for respondents in the study were that they be a California resident, have worked in agriculture in the last 12 months, and be age 18 or older (see Appendix A for definition of a farmworker).

This large academic study on the health and well-being of the nation's most disenfranchised workforce involved an extensive engagement with the CAB (with greater description of the community-engaged research approach in Appendix). The project involved several phases: an inaugural meeting, formation of workgroups, a letter of recommendation for study topics/questions, feedback on the survey instrument, development of a request for proposal for data collection, training interviewers on data collection, conducting data collection, weekly check-ins for data collection, and planning to share the report and dissemination.

In June 2020, the UC Merced Community and Labor Center invited leaders from seventy of the state's leading farmworker-serving organizations to a (virtual) public event introducing the study. In attendance at the inaugural meeting were leaders and directors representing forty-eight organizations serving California farmworkers, including community, labor, and environmental justice organizations. At the meeting, attendees were asked about interest in specific issue areas regarding farmworker health, and later opened an online survey for representatives from the farmworker organizations. The UC Merced Community and Labor Center established the Farmworker Community Advisory Board (CAB) and encouraged members to fill out the survey and to share their interest in issue areas the study might examine.

The UC Merced Community and Labor Center then created nine workgroups to meet and discuss twelve issue areas that emerged from the survey. In July and August 2020, twenty-six CAB members participated in the nine work groups and discussed issue areas and questions they were interested to see in the FWHS's survey instrument. In September 2020, nine work groups' recommendations were formalized in a letter, outlining issue areas and questions they were interested to see in the survey instrument. The study co-PIs (Paul Brown, Edward Flores, Ana Padilla) then created and revised the study's 331-question survey instrument dozens of times, with input from the CAB on several different occasions.

In March 2021, the UC Merced Community and Labor Center convened the CAB several times to discuss the development of a Call for Proposals for data collection. They were presented with several sampling methodologies (e.g., community-engaged, household-based, snowball, convenience, stratified) and ideas for funding CAB members to partner with the study and conduct data collection. Twenty-six CAB members regularly attended meetings and provided feedback. One of the most instrumental suggestions the CAB provided was that the study team should work with organizations that serve farmworkers. When the Call for Proposals was released in April 2020, one of the requirements was that applicants have organizational leadership and/or board members that were current or former farmworkers.

We partnered with ten CAB members to conduct data collection (nine community-based organizations and one labor union), as well as two clinics. These included: Californians for Pesticide Reform, Campesinas Unidas Del Valle De San Joaquin, Central California Environmental Justice Network (CCEJN), Central Coast Alliance United for a Sustainable Economy (CAUSE), Central Valley Empowerment Alliance, Inc. (CVEA), Centro Binacional para el Desarrollo Indígena Oaxaqueño (CBDIO), Lideres Campesinas, Training Occupational Development Educating Communities (TODEC) Legal Center, United Farm Workers of America (UFW), Vo Neighborhood Medical Clinic, Valley Voices, and Salinas Valley (UCB CERCH & Clinica de Salud del Valle de Salinas).

The study utilized a community-engaged research approach with stratified sampling (based upon geographic density of farmworkers across California regions). We estimated completing 1,450 interviews and provided funding for organizations to complete interviews based on their geographical location and their region's proportion of the state's estimated number of farmworkers. The five regions were: the San Joaquin Valley, North Central Coast (Salinas Valley), Imperial Valley and/or Coachella Valley, South Central Coast (Santa Barbara), and Napa-Sonoma counties. The final number of interviews collected from each region are shared below (Table 3), along with an estimated percentage of the region's share of the farmworker population.

From June 2021 to August 2021, we held several half-day trainings with CAB staff (and two clinics) on conducting in-person interviews with COVID-19 protocols (see Appendix D). Data collection then began in September 2021 and ended in December 2021. Throughout the course of the study, our center staff met with CAB staff weekly for online check-ins regarding data collection. A total of 98 check-in meetings (30-60 minutes) and 44 office hours (2-hour gap periods) were held, and CAB members offered useful feedback throughout the process that the study team drew upon to continuously improve the research process.

At the end of the study, we had a dataset of 1,242 interviews with 331 survey questions (many of them with multiple items) in three languages (Spanish, English and Ilocano). We spent six months cleaning the data. This report presents the basic findings of the study, in descriptive statistics—mostly in frequency counts and some cross-tabulations.

The plans for dissemination include publicly presenting findings at a townhall, with an aim of generating discussion with CAB members and other farmworker stakeholders. The dissemination plan includes presentations to local and state public agencies, health care providers (Federal Qualified Health Centers, community/migrant health centers, and hospitals that service farm working communities), and health plans. The UC Merced Community and Labor Center will then examine issue areas that are of greatest public interest and produce publicly accessible research products (e.g., fact sheets, policy briefs) that inform capacity-building efforts among farmworker organizations and policy change.

Results: Facets of California Agricultural Workers' Social and Economic Organization

Profile of California Farmworkers

The FWHS sample consisted of 1,242 participants across five major California regions, with a profile very similar to that of the broader farmworker population. The FWHS sample was largely Latino (99%), foreign-born (91%), and low-income—the very profile that the Latino paradox would predict to have above-average health outcomes.

In this section, we closely examine the various demographic, background, and household characteristics of our sample, and compare them with California farmworker estimates from other major data sources, such as a National Agricultural Worker Study (NAWS) 2014-2018 and the American Community Survey (ACS) 2019.

Our sample is not random but has characteristics very similar to that of the ACS, which is drawn from a random sample and is representative of the broader farmworker population, and the

NAWS. The main exceptions were in sex, race, and income; the FWHS sample had more women and Indigenous workers, and a lower income than the ACS sample. This is possibly due to women and Indigenous workers (whom our study over-sampled) being paid less for the same type of work. Research has indicated that women are more likely to work for Farm Labor Contractors (FLCs) and have lower wages and promotion than men (Hobbs and Cooper 2017, and Reid and Schenker).

Demographics

Two major differences between the FWHS sample and the broader farmworker population were that the FWHS sample was disproportionately female and Indigenous—two demographics that we sampled in greater numbers to fill gaps in existing literature. The FWHS survey sample was mostly women (56%), in a rate much higher than the NAWS 2014-2018 (21%) and ACS 2019 (32%) samples. Very few (1%) participants refused to answer the question regarding their sex assigned at birth.

One major similarity between the FWHS and other major studies was age. In the FWHS, the median age was 41 years old compared to the ACS median age of 39 years old. In the FWHS, the percentage of married farmworkers was 67 percent, only slightly higher than the 53 percent reported in the ACS (Table 1).

The FWHS had a higher rate of Latinos and foreign-born respondents. FWHS respondents who identified as Latino were 99 percent of the sample, higher than in the ACS (95%). In addition, the FWHS share of immigrants was 91 percent, much higher than in the NAWS (72%) and ACS (79%). However, in one striking similarity, immigrant farmworkers from both the FWHS and ACS reported median years living in the U.S between 20 and 18 years, respectively.

Table 1. Demographics: Age, Sex, and Sexuality

	FWHS 2021	ACS 2019
<i>Age (median)</i>	41	39
N=	975	1648
<i>Age Cohort</i>		
18-44	59%	63%
45+	41%	37%
N=	975	1648
<i>Sex</i>		
Female	56%	32%
Male	43%	68%
Refused to answer	1%	--
N=	1218	1648
<i>Sexuality</i>		
Heterosexual	98%	--
Lesbian/Gay/Bisexual	2%	--
N=	885	--
<i>Married or living with partner</i>	67%	53%
N=	1242	1648

While more FWHS respondents were born in Mexico than in the ACS and NAWS, fewer were born elsewhere. In the FWHS study, 89 percent of respondents were born in Mexico, another 9 percent were born in the U.S., and none were born in other countries. In the ACS, by comparison, 74 percent of farmworkers were born in Mexico, another 21 percent were born in the U.S., and two percent were born in other countries. Central Americans are a growing proportion of the U.S. Latino population and among farmworkers. Two percent of the farmworkers in the FWHS sample were Central American, a smaller percent, than both NAWS (5%) and ACS (3%).

A large majority of FWHS respondents, and similar numbers in the ACS and NAWS, spoke Spanish at home (Table 2). When asked about their home language, most farmworkers in our study spoke Spanish (88%), another five percent spoke English or both languages (English/Spanish), another seven percent spoke an Indigenous language, and less than one percent spoke other language. However, reflecting our sampling strategy, more respondents in

our study spoke an Indigenous language at home. In the ACS, 88 percent of California farmworkers spoke Spanish, another nine percent spoke English, one percent spoke a Native language, and one percent spoke other languages.

Geography

Farmworkers in California are primarily concentrated in the Central Valley and the Central Coast (Table 3). Other regions of significant agricultural production include the Bay Area (which includes Napa Valley), Sacramento Valley, Inland Empire (which includes Coachella Valley), and Imperial Valley/San Diego. Table 3 lists the distribution of the FWHS sample by regions in California.

According to ACS estimates, over half of the state's farmworker population lives in the San Joaquin Valley (61%), and another third of the population lives in the Central Coast (31%). The Sonoma/Napa region accounted for three percent of the farmworker. The FWHS purposive sampling method prioritized regions with the largest farmworker populations. In the FWHS sample, the San Joaquin Valley accounted for 42 percent of surveys, followed by the Central Coast (26%), and the Imperial Valley/San Diego (20%).

Housing

Farmworkers in our study were most likely to be renters (92%), to live in single-family homes (55%), and very few renters relied on employers to pay any or all of their rent (2%). Research suggests that farmworkers generally experience substandard housing (e.g., older homes, apartments, mobile homes, motels, garages, or other similar spaces), often requiring repairs such as new roofs, plumbing, heating and cooling systems, and termite clean-up. Poor ventilation and crowded spaces put farmworkers at increased risk for respiratory illnesses such as asthma and infectious diseases like tuberculosis and COVID-19.

Table 2. Demographics: Race, Year of Last Arrival, Primary Language

	FWHS 2021	ACS 2019
<i>Race</i>		
Latino	99%	95%
Indigenous	25%	0%
White	1%	4%
Other	0%	--
Black/African American	0%	0%
Asian/Pacific Islander	0%	1%
Two or more races	---	0%
N=	994	1648
<i>Nativity</i>		
Born outside the U.S.	91%	79%
Born in the U.S.	9%	21%
N=	1013	1648
<i>Country of birth</i>		
Mexico	89%	74%
U.S.	9%	21%
Central America	2%	3%
Other	0%	2%
N=	1025	1648
<i>Last Arrived at US</i>		
Median Year	2001	2001
N=	860	1648
<i>Primary Language</i>		
Spanish	88%	88%
Indigenous	7%	1%
English	3%	9%
English and Spanish	2%	---
Other	0%	1%
N=	1209	1648

Table 3. Geography of Farmworkers

	FWHS 2021	ACS 2019
<i>Region</i>		
San Joaquin Valley	42%	61%
N=	521	--
Upper Central Coast	21%	17%
N=	266	--
Imperial and Coachella Valley	20%	6%
N=	242	--
Sonoma/Napa	12%	3%
N=	147	--
Lower Central Coast	5%	14%
N=	66	--
Total N=	1242	1648

Table 4. Housing

<i>Home type</i>	
Single-family home	55%
Apartment	31%
Labor camp/boarding/motel	9%
RV/car	4%
Garage	0%
Unspecified- renting a room	0%
N=	1205
<i>Pays rent or mortgage</i>	
Rent	92%
Mortgage	8%
Neither	0%
N=	1172
<i>Rent paid by employer</i>	
None	98%
All or part	2%
N=	1225
<i>Access to water inside home</i>	90%
N=	1224

Farmworkers faced issues related to the built environment of their homes. More than one-third (37%) reported a "taste of water at home" that was either very bad (24%) or bad (13%) — an indicator of poor water quality and possibly health risks. More than one in three also experienced problems keeping a house cool (39%) or warm (36%), issues that will only increase in time as climate change exacerbates the temperature extremes. Farmworkers also encountered problems related to water and moisture—such as rotting wood (16%), mold (14%), water damage (13%), and water leaks (12%). Lastly, many farmworkers experienced problems with cockroaches (24%) and rodents (17%).

Farmworkers in our study contrast with migrant agricultural workers on an H2-A visa. For example, H2-A workers are required to live on premises paid for by an employer, farmworkers in our study were most likely to be renters (92%), to live in single-family homes (55%), and very few renters relied on employers to pay any or all their rent (2%).

Household Characteristics

FWHS respondents lived in large, overcrowded households with low incomes and several household problems, arrangements associated with decreased mental health. Farmworkers households were larger than the California average (3.0 persons per household), with a median household size of four persons. Over one-fourth (29%) of farmworkers' households had six or more persons. More than half (55%) of farmworkers reported that two persons (including themselves) slept in their room—a figure somewhat less than the percent married (67%)—but more than one-fourth (25%) slept in a room with three or more persons indicating overcrowding.

Children were a significant part of respondents' households. More than two-thirds (70%) of farmworkers lived in households with one or more children under the age of 18. The median number of children per household was two, and more than two in five (42%) households had three or more children. Only two percent of farmworkers lived in households with children who worked.

Table 5. Household Characteristics

	FWHS 2021	ACS 2019
<i>Median Household Size</i>	4	4
<i>Household size</i>		
1	3%	4%
2	11%	11%
3	15%	15%
4	23%	23%
5	18%	19%
6	14%	15%
7+	15%	14%
N=	992	1648
<i>Number of people sleeping in one room</i>		
1	20%	--
2	55%	--
3	19%	--
4	5%	--
5-6	1%	--
N=	995	--
<i>Households with children</i>	70%	62%
N=	1217	1648
<i>Median household with children</i>	2	1
N=	1217	1648
<i>Number of children in household</i>		
0	30%	38%
1	18%	17%
2	23%	21%
3	17%	14%
4	8%	7%
5+	4%	3%
N=	1242	1648
<i>Median people financially supported outside of household</i>	1	--
N=	950	--
<i>Median household income</i>	\$25,000	\$62,021
N=	522	1648

The size of households likely underestimates farmworkers' obligations to provide for family members (Table 5). More than half (57%) of respondents financially supported one or more family members outside of the household. Nearly one in five supported one family member (19%) outside the household, one in five supported two family members (20%), and nearly one in five (18%) supported three or more.

The median household income reported by respondents was \$25,000 per year—a figure sharply different from that reported in the ACS by California farmworkers (\$62,021). This figure may have only accounted for immediate family members' earnings rather than those of all persons living under the same roof.

Most respondents reported financial difficulties. Nearly two in three (62%) reported difficulty paying for food or bills since the pandemic. When we scored responses to the USDA six-item food insecurity questionnaire, we found that 19 percent reported very low food security, 23 percent reported low food security, 11 percent reported marginal food security, and forty-six percent received the most favorable score (i.e., high food security or marginal food security). Similarly, research has found that over 60 percent of farmworker households are food insecure.

California Farmworkers at Work

Immigrant Latinos, despite having a healthier profile than the general population, have health that declines relative to other groups the longer they are in the U.S (Finch, Fran and Vega 2004; Lopez et al. 2019). In this section we examine farmworkers' experiences with economic organization and its implications for health outcomes.

Farmworkers often experience complex work arrangements. In our sample, over two in three (68%) were not employed directly by a grower, but by a farm labor contractor or other third-party employers—substantially higher than the NAWS 2015-19, which found 28 percent of California farmworkers were employed by a farm labor contractor. More than one-fifth (22%) traveled for farm work more than 75 miles at any point in the past year, meeting the federal definition of a migrant worker. In our sample, 84 percent of farmworkers worked in agricultural fields, while another 11 percent worked in packing houses, two percent in nurseries, and three percent in other agricultural work sites.

The median number of hours worked in the past week was 40, the same as in the ACS (Table 6). At the 25th percentile, farmworkers worked 30 hours the previous week, and at the 75th percentile, farmworkers had worked 43 hours per week. The median number of hours worked in a typical shift was 8.5 hours, and most of the sample had similar shift lengths; at the 25th percentile, farmworkers worked 8 hours per day and at the 75th percentile 9 hours per day.

Farmworkers' median personal wages were \$16,000 per year. This was substantially lower than the ACS median of \$21,915 and may have been in part because our sample had a much high proportion of women than the ACS (56% vs 31%), who are often paid less than men for the same work. One-fourth of farmworkers earned less than \$10,000, and one-fourth earned more than \$24,000. ACS figures were nearly 1.5x higher at the 25th, 50th, and 75th percentile.

Table 6. Worker Characteristics

	FWHS 2021	ACS 2019
<i>Median Hours Worked</i>	40	40
	825	1648
<i>Migrant Worker</i>	22%	--
N=	1170	--
<i>Median Personal Wage</i>	\$16,000	\$21,915
N=	624	1648
<i>Worker was paid all or part in cash</i>	15%	--
N=	1225	--
<i>Employer Type</i>		
Contractor	68%	--
Grower	32%	--
N=	1224	--
<i>Work Type</i>		
Field Work	84%	--
Packing House	11%	--
Nursery	2%	--
Other	3%	--
N=	1220	--

The median commute to work (one way) was 30 minutes, though more than one in four had commutes longer than 40 minutes. For most farmworkers employers did not provide transportation; only nine percent of farmworkers traveled to work in transportation provided by the employer. In most of those cases respondents reported that, in compliance with the California COVID-19 Emergency Temporary Standard (ETS), windows were kept rolled down; however, most reported not keeping 6 feet of distance from others in the vehicles (likely due to the number of farmworkers carpooling in vehicles), in non-compliance with the COVID-19 ETS.

Occupational Risks

Farmworkers work in extreme environmental conditions in conjunction with heavy machinery and equipment, and California farmworkers experience occupational injuries at nearly double the rate (6.0 per 100,000 FTE) of other private sector workers (3.2 per 100,000) (U.S. Bureau of Labor Statistics 2020a). Common farmworker injuries include Musculoskeletal disorders, low back, hand, and wrist pain, and ligament tears can be caused by prolonged and repetitive

stopping (Tonelli 2016). Farmworkers also experience higher rates of death, however. In 2019, farmworkers accounted for 48 of 451 of officially recorded worker deaths in California, despite only comprising about 1 percent of the state's workforce (U.S. Bureau of Labor Statistics 2020b).

Farmworkers in our sample experienced exposure to health risks on the job: heat, pesticides, wildfire smoke, and COVID-19. One in twelve farmworkers reported working near pesticides either often (5%) or very often (3%). Nearly one in six reported that smoke made it difficult to breathe either often (8%) or very often (7%). And one in six reported they were often (6%) or very often (11%) told that there was "no risk" of contracting COVID-19—despite farmworkers having one of the state's highest pandemic-related death rates for workers—suggesting that employers may have underestimated the risk of COVID-19 spread and thereby placed workers at greater risk.

In the next sections we examine farmworkers' experiences with workplace compliance with wage and hour provisions, and health and safety standards. Farmworkers experienced varying rates of non-compliance in the workplace with regard to wage and hour regulations, as well as workplace health and safety standards pertaining to sanitation, heat, wildfire smoke, and pesticide training.

Wage and Hour Provisions

The survey asked farmworkers how often employers refused to pay complete wages, on a scale of 1 to 5 (1- Never, 2- Rarely, 3- Sometimes, 4- Often, and 5- Very Often). Nearly one in five (19%) experienced some frequency of wage theft. One in thirteen farmworkers experienced wage theft sometimes (4%), often (2%), or very often (2%). Nearly one in six (15%) of farmworkers claimed they were paid either all or part in cash, suggesting employers did not report some or all worker earnings to the state.

The survey also asked farmworkers their usual shift start time and end time, and the number of lunches and breaks they were typically given. When we applied Cal/OSHA wage and hour

standards (e.g., two 10-minute rest breaks and one 30-minute lunch per eight-hour shift), we found that 96 percent of farmworkers received the minimum number of 30-minute lunch breaks, but that 15 percent did not receive the minimum number of 10-minute rest breaks.

Table 7. Workplace Compliance: Wage and Hour

	Never	Rarely	Sometimes	Often	Very Often	N=
Employer reduced hours if asked about conditions	88%	5%	6%	1%	1%	743
Employer threatened to reduce hours if asked about conditions	88%	5%	6%	1%	0%	743
Employer threatened to reduce hours if took sick leave	88%	4%	6%	1%	1%	738
Employer refused to pay complete wages	81%	11%	4%	2%	2%	1221

The findings on lack of 10-minute rest breaks have profound implications for workplace health and safety, which we turn to next.

Heat Compliance

Farmworkers work outside where they are exposed to direct sunlight and are impacted by heat illness thirty-five times more than other workers (Gubernot et al., 2015). From 1992-2006, agricultural workers were twenty times more likely to die from heat stroke compared to workers in other industries (Centers for Disease Control and Prevention 2008). To mitigate heat illness and wildfire smoke inhalation, the California Division of Occupational Health and Safety (Cal/OSHA) has established a Heat Standard to protect workers from heat. Agricultural workplaces are mandated to provide written procedures for emergency response, weather monitoring, and employee and supervisor training. A temperature of 80°F triggers regulations for heat stress measures and remedies, including access to water and shade.

Farmworkers in our study however, reported substantial non-compliance with the California Heat Standard (Table 8). While many farmworkers reported receiving heat illness training, not all who received training claimed to have done so within the past twelve months (as

mandated). About sixty-nine percent (69%) received heat illness training within the past twelve months, but 31 percent of farmworkers received heat illness training that was not within the past twelve months while another 15 percent did not receive any heat illness training at all.

Table 8. Workplace Compliance Training

<i>Received heat-related illness training</i>	85%
N=	1225
<i>Received heat-related illness training within the past year</i>	69%
N=	994
<i>Applied pesticides</i>	9%
N=	1225
<i>Given training on the safe use of pesticides</i>	75%
N=	116
<i>Understood pesticide training</i>	79%
N=	86
<i>Language of pesticide training</i>	
Spanish	91%
English	6%
Spanish and English	4%
N=	86

Nearly half (43%) of respondents reported on a scale of 1-5, that their employer "never" provided a heat illness prevention plan as mandated under law. On the same scale, significant numbers of respondents also reported that employers "never" did the following: monitor temperature with a thermometer on hot days (20%), provide enough shade during breaks when it was 80 degrees or higher (15%), monitor for heat illness when the outside temperature reaches 95 degrees or higher (22%).

The health-related consequences of heat-related illness can be both acute and chronic. Morris et al. (2019) identified 80 degrees Fahrenheit as the heat index threshold to begin heat-related interventions for farmworkers. However, symptoms of heat-related illness build in the body the longer the exposure occurs. Initial acute signs and symptoms of a heat-related illness can be cramps in the body, a rash, or fatigue. Then, if relief is not sought, it can extend to profuse sweating, headache, dizziness, nausea, irritability, and tachycardia. If the farmworker continues

to work once these symptoms occur, they are at risk of heat stroke, which can lead to confusion, seizures, unconsciousness, and even death (Seda & Liebman, 2022). Furthermore, kidney disease is a chronic health-related illness, noted in farmworkers, that occurs from repeated volume depletion and heat stroke (Moyce et al., 2017). Exposure to elevated temperatures during pregnancy among female agricultural workers has been associated with increased incidence of premature birth and congenital defects in the baby, as well as an increased incidence of neurodevelopmental defects in children (Lin et al. 2018).

Sanitation

Farmworkers also reported a fair amount of non-compliance with workplace sanitation standards. Depending upon the sanitation standard asked about, a large minority (between 27% to 43%) reported non-compliance. Among sanitation practices, compliance was highest for employer-provided disposable cups (every time 76%). Yet, more than one in ten workers lacked consistent access to clean drinking water at work (never 2%, almost never 1%, sometimes 8%). This is a major issue considering the high rates of acute heat illness injury and death, and long-term health consequences of heat illness in farm work.

Access to hand sanitizer was lowest (every time 63%) among all items related to sanitation. Nearly one in three lacked consistent access to hand sanitizer (never 12%, almost never 3%, sometimes 13%), nearly one in five lacked consistent access to towels for hand-drying (2%, 3%, 13%) or liquid soap (2%, 3%, 13%), nearly one in six lacked consistent access to water for handwashing (1%, 1%, 11%), nearly one in six lacked consistent access to toilet paper (1%, 2%, 13%), and nearly one in four lacked consistent access to clean toilets (2%, 4%, 18%).

In addition, less than half (47%) of farmworker women who gave birth continued to breastfeed after returning to work. In striking contrast to state law, only 12 percent of those who continued to breastfeed after returning to work had a designated area at the workplace where they could breast-feed (or pump).

Wildfire Smoke

The counties in which farmworkers live and work are already considered some of the most polluted places to live by the American Lung Association (2022). Nearly one in six farmworkers in our sample reported that smoke made it difficult to breathe either often (8%) or very often (7%).

To protect workers from wildfire smoke, CAL/OSHA implemented a Wildfire Standard that is triggered where the current Air Quality Index (AQI) for air particulate matter 2.5 micrometers or smaller (PM2.5) is 151 or greater. Protection from wildfires includes identification of harmful exposure, communication of hazard, training and instruction, and mitigation. Mitigation of exposure to hazards must be done by providing an enclosed location with filtered air, relocating to another worksite, or providing respiratory protective equipment. Additionally, employers are to anticipate that employees may be exposed to wildfire smoke.

However, despite experiencing such health risks on this job, farmworkers were not necessarily provided with support to mitigate such risks. When asked on a scale of 1-5 how often a respirator was "lacking but needed," nearly one in three (32%) farmworkers claimed that respirators were lacking but "always" needed. Several other protective items were lacking but "always" needed for a substantial percentage of farmworkers, including suits (8%), masks (7%), thick gloves (8%), goggles (5%), thin gloves (8%), and cloth gloves (8%). Access to such protective items can be helpful in preventing injuries.

Air pollution further worsens for farmworkers when temperatures rise and there is smoke in the air that is contaminated with chemicals and particulate matter. This contributes to farmworkers' development of respiratory disorders such as asthma. Exposure to particulate matter has been noted to increase "risks of heart attacks, and sudden death from cardiac arrhythmia, heart failure, or stroke" (United States Environmental Protection Agency 2009).

Pesticide Training Standards

Farmworkers are regularly exposed to toxic chemicals such as pesticides, weedicides, and fumigants as a part of their occupation. Exposures to such toxic substances have been linked with the development of adverse health outcomes such as cancer, cardiovascular disease, and neurological disorders (Curl et al. 2020).

Data from this study indicate that a substantial proportion of workers experienced non-compliance with pesticide-related workplace health and safety standards. Nearly one in ten workers (9%) reported applying pesticides within the past twelve months. Among those who had applied pesticides, most had applied pesticides only rarely (24%) or once a month (48%), while a substantial minority applied pesticides on a weekly (18%) or daily (11%) basis (Table 9).

Table 9. How Often Workers Applied Pesticides

<i>How often applied pesticides</i>	
Rarely	24%
Once a month	48%
Weekly	18%
Every day	11%
N=	113

Among farmworkers who had applied pesticides, only three in four (75%) reported receiving training on the safe use of pesticides, while one in four (25%) had not received any training. Unfortunately, among those who had received pesticide training 21 percent reported not understanding the training.

As a whole, only 57 percent of workers who had applied pesticides in the past twelve months had received training on the safe use of pesticides in a way they felt they understood. It should be noted that under state law, pesticide safety training must be delivered in a language that is understandable to farmworkers—yet some farmworkers speak Indigenous languages, each with several variants and no standard written form.

Non-compliance with pesticide standards has profound implications for the health of farmworkers and particularly farm working women and families. Previous studies have found that a gendered division of labor by crops and work duties expose women to different forms of safety and health risks and that acute pesticide poisoning among women working in agriculture was double compared to men. (Calvert et al. 2008, Kasner et al. 2012). In turn, pesticide exposure during pregnancy has been associated with an increased incidence of neurodevelopmental defects, cerebral palsy and autism in children (Eskenazi 2007, von Ehrenstein et al. 2019, Liew et al. 2020).

Rights and Retaliation

Most farmworkers reported being aware of their right to file a complaint in relation to employer non-compliance with labor laws. However, many claimed to not be aware of such rights. More than one in three (35%) claimed they were not aware of their right to file a wage and hour complaint with the labor agency. Over one in four (27%) claimed they were not aware of their right to COVID-19 paid sick leave. Nearly one in four (23%) claimed they were not aware of their right to three days of paid sick leave. When farmworkers who had ever received a positive COVID-19 test (376 out of 994 respondents) were asked if they had ever applied for COVID-19 paid sick leave, 13 percent said they had applied and been denied COVID-19 paid sick leave.

Farmworkers also displayed a similar incidence of lack of awareness of workplace health and safety rights. More than one in four (27%) farmworkers said they were unaware of their right to file a workplace health and safety complaint with Cal/OSHA. And nearly half (44%) said they were unaware of their right to file a complaint related to a health order with the county department of public health.

When asked if they would be willing to file a report on an employer if they had witnessed non-compliance, more than one in three (36%) farmworkers said they would not be willing to file a report. Then, when asked why they would not be willing to file a report (if they had indicated unwillingness), nearly two in three (64%) said they would be unwilling to file a report due to

fear of retaliation or job loss. Lack of understanding of rules or laws (5%) was another cause for workers' unwillingness to file a report.

Some farmworkers reported retaliation, or threats of retaliation, in relation to asking about working conditions or taking paid leave. When asked on a scale of 1-5 if an "employer had reduced hours because [respondent] asked about [working] conditions," most (88%) reported they had not experienced retaliation. However, almost one in seven (13%) workers reported some frequency of retaliation, whether it was rarely (5%), sometimes (6%), often (2%) or very often (1%). Nearly identical numbers of farmworkers reported threats of retaliation when asking about working conditions (never 88%, rarely 5%, sometimes 6%, often 1%, very often 0%), or when taking sick leave (never 88%, rarely 4%, sometimes 6%, often 1%, very often 1%) (Table 11).

Social and Economic Rights

Social and economic rights refers to access to the social and economic safety net—those rights that are beyond political rights, such as voting. We asked several questions related to social and economic conditions, and findings indicated that farmworkers faced great social and economic challenges and limited rights.

Table 11. Rights and Retaliation

Aware of right to three days paid sick leave	77%
N=	1206
Aware of right to COVID-19 paid sick leave	74%
N=	1202
Aware of right to file a complaint with Cal/OSHA	73%
N=	1211
Aware of right to file wage and hour complaint	65%
N=	1207
Aware of right to file a complaint related to health order	56%
N=	1203
Unwilling to file a report on employer	36%
N=	1208
<i>Reason unwilling to file a report</i>	
Fear of retaliation or job loss	64%
Other reasons	23%
Lack of work status	7%
Lack of understanding rules or laws	5%
Fear of being ridiculed	1%
N=	262

When we asked how they would cover a \$400 expense in an emergency, about one in eight (12%) farmworkers stated they would be able to “pay in full” (Table 12). Nearly two-thirds (65%) said they would have to pay over time, and nearly one in four (23%) said they would not be able to pay. Surprisingly, when asked if in 2020 anyone from their household did not accept food stamps or medical benefits they qualified for, only one in nine farmworkers (11%) agreed; a figure lower than that anticipated considering the amount of published work suggesting fear of public charge driving down acceptance of food stamps and medical benefits among immigrants.

The survey also uncovered limited rights related to the immigration status of farmworkers or their family members. When we asked about qualifying for unemployment benefits, only four in ten (41%) farmworkers said they would qualify for such benefits. In addition, most respondents expressed the highest level of fear (67%) when asked how often they worry about

family separation due to deportation. Another 16 percent reported “often” (the second highest response on the scale) being worried about family separation due to deportation.

Table 12. Safety Net/Social and Economic Rights

<i>How to cover a \$400 expense in an emergency</i>	
Pay over time	65%
Cannot pay	23%
Pay in full	12%
N=	1208
<i>Household did not accept aid they qualified for</i>	11%
N=	1208
<i>Would qualify for unemployment benefits</i>	41%
N=	1126
<i>Worry about family separation due to deportation</i>	
Always	67%
Often	16%
Sometimes	9%
Rarely	4%
Never	4%
N=	1211

Results: Health of Farmworkers

Women’s Reproductive, Maternal and Child Health

Approximately twenty-one percent (20.8%) of women of reproductive age reported not having a regular period (Table 13). When women of all ages are included, the proportion of women reported not having a regular period is 24 percent and ranges from 17 percent in the San Joaquin Valley to 36 percent in the lower central coast area (see Appendix F). According to the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, approximately 14 percent to 25 percent of women have an irregular menstrual cycle (HHS, 2022).

About 88 percent of women reported ever been pregnant with 86 percent among reproductive aged women and 89 percent among those 45 years or older. Table 14 presents pregnancy plans and fertility status by sex and age. Among females of reproductive age, approximately 4

percent reported they plan to become pregnant within the next year, 4 percent reported they are currently pregnant, and 5 percent are unable to become pregnant.

Table 13. Women’s Reproductive Health by Age

	Female Overall	Female 18-44	Female 45+
Regular period			
Yes	58.5%	70.9%	39.9%
No	24.0%	20.8%	29.2%
Refused/don’t know	17.5%	8.3%	30.9%
N=	642	399	243
Ever been pregnant?			
Yes	87.8%	86.1%	88.8%
No	9.1%	11.4%	5.2%
Refused/don’t know	3.1%	2.5%	6.0%
N=	651	402	249

Approximately 44 percent of females and 30 percent of males of reproductive age reported they have ever purposely delayed having children (Table 14). On the other hand, 8 percent of females and 3.8 percent of males of reproductive age reported they may have had infertility defined by the failure to conceive within 12 months of trying.

Among reproductive age participants who reported they were not planning to become pregnant within the next 12 months, 29.8 percent of females and 31.0 percent of males mentioned they were not using a birth control method to prevent pregnancy (Table 15). These numbers are consistent with a large survey across 19 community health centers, which reported that 30 percent of women who did not desire a pregnancy did not use contraception (Beeson, et al, 2019). Among female respondents those that were on contraception, intrauterine device, tubal ligation (for male partner), implants, condoms (for male partner), and birth control pills were among the most reported. Among males, tubal ligation, implants (for female partner), intrauterine device (for female partner), and condoms were among the more prevalent choices.

Table 14. Pregnancy Plan and Fertility Status by Gender and Age

	Overall	Female		Male	
		18-44	45+	18-44	45+
Pregnancy plans within the next 12 months					
No	52.4%	62.8%	53.5%	46.3%	48.4%
Yes	2.8%	4.4%	0.0%	5.2%	0.5%
Currently pregnant	1.7%	3.9%	0.0%	1.4%	0.5%
Unable to get pregnant	6.0%	5.1%	9.5%	2.4%	9.0%
Don't know	22.1%	12.7%	26.8%	25.4%	22.9%
Refused	9.2%	8.8%	5.5%	13.2%	7.2%
Unknown	5.9%	2.4%	4.7%	5.9%	11.7%
N=	1175	411	254	287	223
Ever purposely delayed having children					
Yes	35.3%	43.6%	36.2%	30.3%	28.3%
No	59.9%	53.5%	61.8%	63.8%	63.2%
Missing	4.8%	2.9%	2.0%	5.9%	8.5%
N=	1175	411	254	287	223
Tried to become pregnant for over 12 months but unsuccessful					
Yes	5.2%	7.8%	5.5%	3.8%	1.8%
No	70.0%	78.1%	74.0%	62.4%	66.4%
Unknown	24.8%	14.1%	20.5%	33.8%	31.8%
N=	1175	411	254	287	223

Table 15. Contraception Use Among Reproductive-Age Participants Who Are Not Planning to Become Pregnant Within the Next 12 Months

	Overall	Female	Male
Yes	46.9%	47.2%	46.5%
No	31.0%	29.8%	33.1%
Unknown	22.1%	23.1%	20.4%
N=	648	403	245

During the last pregnancy/delivery, 37 percent of women reported that their doctor told them they should stop working at any point during pregnancy (Table 16). This proportion varied from 27 percent in the Imperial/Coachella Valley to 58.3 percent in the lower central coast. The

median gestation weeks at which the doctor told these women to stop working was approximately 16 weeks (interquartile range: 4-28), and they stopped working about four weeks later at a median of about 20 weeks' gestation (interquartile range: 4-28) (Table 17). Women, on average, were advised by their doctor to return to work when their baby had a median of 8 weeks (interquartile range: 4-12), but they reported returning to work when their baby was about 12 weeks old (median: 12, interquartile range: 6-25). In addition, about half (~47%) of the women reported they continued to breastfeed after returning to agricultural work (Table 16).

Table 16. Occupational Characteristics During Last Pregnancy

	Overall	Lower central coast	Upper central coast	Napa/ Sonoma	SJV	Imperial valley/ Coachella valley
Did your doctor tell you that you should stop working at any point during pregnancy?						
Yes	36.8%	58.3%	45.0%	32.8%	34.3%	27.0%
No	63.2%	41.7%	55.0%	67.2%	65.7%	73.0%
N=	584	36	140	58	239	111
During your last pregnancy, did you continue breastfeeding after returning to agricultural work?						
Yes	36.9%	58.3%	45.0%	33.9%	34.3%	27.0%
No	63.1%	41.7%	55.0%	66.1%	65.7%	73.0%
N=	585	36	140	59	239	111

Table 17. Occupation Characteristics Reported for the Last Pregnancy

Occupational Characteristics	Min	P25	Median	P75	Max
How many weeks did your doctor tell you to stop working?	0	4	16	28	40
How many weeks of pregnancy did you stop working?	0	4	20	28	96
How old was your baby (in weeks) when doctor suggested you return to work?	0	4	8	12	72
How old was your baby (in weeks) when you returned to work?	0	6	12	25	520

Among women who reported ever being pregnant, the proportion who experienced adverse pregnancy outcomes are presented in Table 18. Twenty-two percent (22.1%) reported having a miscarriage or stillbirth at some point in the past. It is estimated that miscarriage occurs in approximately 15 to 20 percent of confirmed pregnancies in the US. The prevalence of preterm birth was ~14 percent, which is significantly higher than the rest of California, which has a rate of 8.8 percent (March of Dimes, 2022). Low birthweight was reported at about 15 percent, approximately two times as high as the average rate of about 7 percent in California based on data from the California Department of Public Health vital statistics and Centers for Disease Control and Prevention- Wonders Natality data (KidsData, 2022). Birth defect of any type was reported among 5.4 percent of women, which is higher than the average California birth defect prevalence of approximately 3 percent based on data from the California Birth Defects Monitoring Program (CDPH, 2022).

Table 18. Adverse Pregnancy Outcomes Among Women Who Reported Ever Pregnant

	Miscarriage/ stillbirth/Stillbirth	Preterm birth (<37 weeks)	Low birthweight (≤5.5lbs)	Birth defects
Yes	22.1%	13.7%	15.1%	5.4%
No	73.2%	84.4%	79.8%	89.3%
Don't know/refused	4.7%	2.0%	5.2%	5.4%
N=	466	461	465	465

Physical Health

The physical health of farmworkers was assessed in a number of different ways. First, participants were asked to self-assess their overall health, both currently and compared to a year ago. As shown in Table 19, approximately 36 percent of the respondents rated their health as only fair or poor. As shown by the average rating (with Excellent having a value of 5 and Poor a value of 1), the health status was fairly consistent across gender and age groups. And when asked to state whether their health had improved or gotten worse over the previous year, 23 percent reported that it was better or somewhat better, and 16 percent said that it was worse or somewhat worse (Table 20).

Table 19. Overall Current Health Status as Reported by California Farmworkers

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Excellent	10.0%	14.7%	6.4%	11.7%	6.3%
Very Good	12.8%	14.9%	11.5%	15.7%	7.1%
Good	41.6%	37.1%	45.2%	44.2%	38.5%
Fair	30.8%	28.9%	32.0%	24.3%	41.6%
Poor	4.8%	4.3%	5.0%	4.0%	6.5%
Average	2.17	2.17	2.19	2.22	2.14
N=	1196	509	660	699	478

Table 20. Health status compared to 1 year ago.

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Better	6.8%	4.9%	8.5%	6.7%	5.7%
Somewhat better	15.8%	13.4%	17.8%	16.4%	14.6%
Same	61.2%	66.3%	57.0%	62.8%	60.5%
Somewhat worse	14.3%	13.4%	14.9%	12.7%	16.5%
Worse	1.9%	2.0%	1.8%	1.4%	2.7%
Average	2.35	2.41	2.33	2.37	2.34
N=	1197	508	663	701	478

A second measure of health was the number of self-reported chronic conditions. Participants were asked to identify whether they had been told by a doctor (i.e., diagnosed) they had each of 11 common medical conditions requiring chronic management and each of nine contagious diseases. As shown in Table 21, nearly 42 percent (37.4% of men and 46.5% of women) reported a history of one or more conditions. Five chronic conditions were reported by more than 5 percent of farmworkers (see Appendix A), with diabetes (19.6%), hypertension (18.6%), anxiety (9.8%), depression (8.0%), and asthma (7.0%).

Table 21. Self-Reported Chronic Conditions

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Percentage of people with chronic disease	41.9%	37.4%	46.5%	33.1%	58.0%
Diabetes	19.6%	16.6%	21.9%	17.4%	23.8%
Hypertension	18.6%	21.0%	16.9%	13.8%	26.4%
Anxiety	9.8%	6.8%	12.0%	10.4%	9.2%
Depression	8.0%	4.6%	10.5%	7.0%	9.3%
Asthma	7.0%	6.3%	7.6%	6.2%	8.6%
N=	1209	523	686	723	442

From a list of nine contagious diseases 2.7 percent (3.6% of men and 4.7% of women) reported a history of one or more conditions. Only tuberculosis (1.5%) was reported by more than 1 percent of farmworkers. There were no important differences in the experience of chronic disorders or infectious diseases based on sex, age, region, or form of employment.

Participants were also asked to complete an ACE questionnaire. The ACE is a commonly used measure to assess whether the individual experienced one of a number of adverse events in childhood (i.e., divorce of parents, death of a close family member, etc.), with the score having been found to be predictive of a number of health conditions. The score ranges from 0 to 10 (see Cameron et al, 2018 for description of the measurement and interpretation of ACE scores).

The results shown in Table 22 suggest that, overall, 87 percent of the respondents reported having at least 1 adverse childhood event, with the average number of adverse events for those who did experience an event was 2.7 events (men 2.5; women 2.8). Both the percentage experiencing an event and the average number of events was higher for women and for those 45 and older.

Table 22. Adverse Childhood Experiences

	Overall	Men	Women	Age 18 to 44	Age 45 plus
% with non-zero ACE score	87.1%	87.1%	88.2%	85.7%	88.0%
ACE Score (average)	2.7	2.5	2.8	2.5	2.8
0	12.9%	12.9%	11.8%	14%	12.0%
1	28.7%	30.1%	28.0%	30.1%	26.3%
2	16.7%	19.0%	15.5%	17.4%	16.1%
3	11.4%	10.5%	11.8%	11.0%	12.0%
4	10.6%	9.7%	11.6%	9.0%	12.6%
5	6.2%	6.1%	6.4%	5.5%	7.3%
6	6.0%	5.6%	6.6%	5.9%	6.1%
7	3.4%	2.6%	3.7%	3.5%	2.9%
8	2.2%	2.1%	2.2%	1.5%	2.6%
9	1.0%	0.6%	1.1%	0.9%	0.9%
10	1.1%	0.9%	1.3%	0.9%	1.2%
N=	823	342	457	455	342

As mentioned above, a subsample of participants were asked to complete a more detailed medical survey, including additional details about their experiences with COVID-19 infection and vaccination against COVID-19, anthropometric measurements (height, weight, waist circumference, calculated BMI, blood pressure) and a smell test. In addition, these participants also provided a non-fasting blood draw. The data from these 205 participants from the Upper Coast population (205 of 263 total participants from that region) differs from other participants in that (i) they were enrolled after the enrollment of the other subjects was complete, (ii) were enrolled in the later winter and early spring, in contrast to the late summer, fall, and early winter seasons, and (iii) were drawn from farmworkers enrolled in a Salinas clinic for medical care.

All subjects provided self-reported weight and height, from which a Body Mass Index (BMI) was calculated. In addition, subjects in the later-enrolled Upper Central Coast sub-population were measured for weight, height, and waist circumference; a BMI was determined from the measured height and weight. Of note, self-reported weight and height for subjects in the later-

enrolled sub-population was recorded after the actual measurements. The self-reported heights and weights of some subjects in the earlier-enrolled (non-measured) subjects were outliers and for that reason we report both the mean and median measures for self-reported weight and height. Both self-reported and measured BMI results were categorized as Normal, Overweight, and Obese, using the standard thresholds from the Centers for Disease Control and Prevention (2022). Mean and median self-reported weights, mean measured waist circumferences, mean measured weights, and calculated BMIs, based on both self-reported and measured data, reveal a population at considerable risk for health consequences related to excess weight.

Tables 23 reports the self-reported BMI and obesity levels of the participants outside of farmworkers outside of Salinas. Overall, the results suggest that 22 percent of respondents reported height and weight numbers that would indicate they would be categorized as normal weight, 31 percent would be categorized as being overweight, and 43 percent would be categorized as being obese. This compares with 8 percent as normal weight, 30 percent as overweight, and 61 percent as obese in the Salinas survey (Table 24). Unlike the survey in other regions, the people in Salinas were asked their height and weight after having them measured at the clinic. The fact that these measures are similar to the actual numbers (Table 24) suggests that either the participants in the Salinas region are more likely to be obese than those in other parts of the state, or that the reported heights and weights in other regions are not as accurate.

Table 23. Mean BMI Cased on Self-Reported Weight and Height for Participants Other Than Salinas

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Mean BMI (kg/m ²)	30.4 kg/m ²	30.1 kg/m ²	30.6 kg/m ²	30.7 kg/m ²	30.5 kg/m ²
Normal weight (BMI < 25)	22.2%	24.3%	20.5%	21.1%	24.4%
Overweight subjects (BMI ≥ 25kg/m ²)	31.2%	31.1%	31.2%	32.4%	29.2%
Obese subjects (BMI ≥ 30kg/m ²)	43.5%	40.7%	44.8%	41.6%	44.9%
N=	885	393	492	495	308

Table 24. Mean BMI Based Self-Reported Actual Weight and Height for Salinas Participants

	Overall	Men	Women	Age 18 to 44	Age 45 plus
<u>Self-Reported</u>					
Mean BMI (kg/m ²)	32.4 kg/m ²	31.6 kg/m ²	33.0 kg/m ²	32.0 kg/m ²	33.0 kg/m ²
Normal weight (BMI < 25)	8.6%	12.0%	6.3%	11.2%	4.2%
Overweight subjects (BMI ≥ 25kg/m ²)	30.0%	33.3%	27.7%	32.8%	25.4%
Obese subjects (BMI ≥ 30kg/m ²)	61.0%	53.3%	66.1%	55.8%	70.2%
<u>Actual measurements</u>					
Mean BMI (kg/m ²)	32.1 kg/m ²	31 kg/m ²	32.7 kg/m ²	31.9 kg/m ²	32.4 kg/m ²
Normal weight (BMI < 25)	10.3%	13.6%	8.1%	12.1%	7.5%
Overweight subjects (BMI ≥ 25kg/m ²)	30.4%	34.6%	27.6%	30.7%	30.0%
Obese subjects (BMI ≥ 30kg/m ²)	59.3%	51.9%	64.2%	57.3%	62.5%
N=	204	82	123	129	76

Participants were asked if they had ever been told by a clinician they were overweight. Among the earlier-enrolled subjects, 64 percent (70.0% of men and 58.8% of women) reported being told by a clinician they were overweight; for the later-enrolled Salinas population, the percentage was 43 percent (34.2% of men, 48.8% of women).

Participants in Salinas also had their blood pressure measured. Overall, the participants had a mean systolic and diastolic blood pressure of 123mm/Hg and 79mm/Hg. Fifty-eight percent had elevated values, including 50 percent with values above the thresholds (130mm/Hg and/or 80mm/Hg) for a diagnosis of hypertension (if observed on repeated occasions).

The results from the serologic, hematologic, and immunologic tests of the non-fasting blood samples taken from participants in Salinas are shown in Table 25. The results suggest that most subjects had elevated values for one or more of the lipid parameters: total cholesterol, triglycerides, HLD cholesterol, (calculated) LDL cholesterol. Nearly all subjects had normal values for ALT and AST. All subjects with elevated values for liver functions had mild elevations, < 5XULN. The same was true for serum creatinine as a measure of renal function.

Non-fasting glucose levels showed a concerning number of subjects with values >200mg/dL, a level that would not normally be observed in a person with normal metabolic function during any part of the glucose tolerance cycle. Fifty-six percent of subjects exhibited pre-diabetic or diabetic levels of HbA1c. C-reactive protein (CRP) was evaluated as a non-specific marker for systemic inflammatory disease. When used in routine medical screening, CRP results are positively correlated with the risk of cardiovascular disease. Eighty-six subjects (42%) had values >3.0 mg/L, indicating concerning levels of chronic inflammatory changes. Salinas is not a region where Valley Fever (coccidioidomycosis) is thought to be endemic. Indeed, only 8 subjects (<4%) had circulating IgG antibodies against coccidioidomycosis.

Table 25a. Normal and Abnormal Results of Laboratory Tests (hematology, clinical chemistry, immunology)

Laboratory parameter	Mean +/- SD or n(%)
Triglycerides (mg/dL)	192.2 ± 130.3
Normal (<150)	96 (46.8)
Borderline high (150-199)	36 (17.6)
High (200-499)	66 (32.2)
Very high (≥500)	7 (3.4)
Total cholesterol (mg/dL)	176.6 ± 34.0
Normal (<200)	166 (81.0)
Borderline high (200-239)	31 (15.1)
High (≥240)	8 (3.9)
LDL cholesterol (calculated) (mg/dL) ^b	95.5 ± 25.7
Normal (<130)	176 (91.7)
Borderline high (130-159)	14 (7.3)
High (≥160)	2 (1.0)
HDL cholesterol (mg/dL)	44.5 ± 12.4
Normal (>40)	124 (60.5)
Low (≤40)	81 (39.5)
ALT (SPGT) (U/L)	40.3 ± 36.6
Normal (women: 10.0-72.0, men: 13.0-95.0)	191 (93.2)
High (women: >72.0, men: >95.0)	14 (6.8)
AST (SGOT) (U/L)	31.5 ± 26.9
Normal (women: 14.0-53.0, men: 15.0-59.0)	190 (92.7)
High (women: >53.0, men: >59.0)	15 (7.3)
Glucose (mg/dL)	149.9 ± 56.2
Normal (<130)	101 (49.3)
Borderline high (131-199)	80 (39.0)
High (≥200)	24 (11.7)
Hemoglobin A1C (%)	6.4 ± 1.6
Normal (3.9-5.7)	89 (43.4)
Prediabetes (5.8-6.4)	70 (34.2)
Diabetes (>6.4)	46 (22.4)

Table 25b. Normal and Abnormal Results of Laboratory Tests (hematology, clinical chemistry, immunology) (Cont.)

Laboratory parameter	Mean +/- SD or n(%)
Creatinine (mg/dL)	0.7 ± 0.3
Normal (women: 0.55-1.02, men: 0.70-1.30)	202 (98.5)
High (women: >1.02, men: >1.30)	3 (1.5)
C-Reactive protein (mg/L)	4.2 ± 6.4
Low risk for heart disease (<3.0)	57 (27.8)
Average risk for heart disease (1.0-3.0)	62 (30.2)
High risk for heart disease (>3.0)	86 (42.0)
Hemoglobin (g/dL)	13.9 ± 1.7
Normal (women: 10.6-15.2, men: 12.1-17.4)	199 (97.1)
Low (women: <10.6, men: <12.1)	6 (2.9)
Valley Fever/Coccidioides IgG antibodies (IV)	0.3 ± 0.4
Negative	195 (96.1)
Positive ^c	8 (3.9)
Measles and COVID-19 IgG antibodies	[reported elsewhere]
N=	204

^aReference ranges from Foundation Laboratory were used to create the categories.

^bLDL cholesterol could not be calculated in cases of very high triglycerides; missing for 13 participants.

^cPositive Valley Fever antibodies indicate past or current infection; measurement missing for 2 participants.

COVID-19 Among Farmworkers in California

The Impact of COVID-19 on Farmworker Health

The onset of the COVID-19 pandemic highlighted long-standing inequalities in the health and well-being of California farmworkers (Mora et al, 2022). Research on COVID-19 pandemic-related deaths indicated that such deaths were much higher among Latino workers with low levels of education (likely low-wage workers)—particularly agricultural workers (Riley et al. 2021). Research revealed a higher rate of COVID-19 cases in those counties with both a higher rate of worker households living below a living wage and average household sizes above the state average (Flores and Padilla 2020), as well as a larger population of agricultural workers (Mora et al. 2021). From the onset of the pandemic, farmworkers were frontline essential workers who experienced workplace health and safety practices that significantly increased their risk of contracting COVID-19 (Thomas et al. 2022), coupled with crowded living conditions (Lusk and Chandra, 2021).

It was known before the pandemic that farmwork was associated with higher rates of diabetes, hypertension, obesity, asthma, and exposures to environmental hazards—conditions and risk factors that exacerbated the consequences of COVID-19 infection. In addition, the pandemic exposed challenges farmworkers faced in protecting themselves from unsafe workplace health and safety practices, as well as lack of access to health insurance, healthcare, availability of vaccines and treatments (Mora et al. 2020; Becot et al. 2020).

Most participants (990/1195), including all participants in regions other than those from Salinas, were enrolled in the fall and early winter of 2021. A subset of the subjects in Salinas who had medical exams (205/266) were enrolled in the later winter and early spring of 2022, after the onset of a substantial new outbreak of COVID-19 in California. (Centers for Disease Control and Prevention 2022). The 205 later-enrolled subjects were evaluated with additional questions regarding COVID-19 and with a battery of objective tests. The experience of these later-enrolled subjects with respect to COVID-19 may differ from the experience of the majority because of the difference in enrollment timing.

Incidence of COVID-19 in California Farmworkers

As shown in Table 26, approximately 40 percent of subjects experienced a suspected or confirmed case of COVID-19 and 29.2 percent of subjects reported having had a positive COVID-19 test. There was a higher incidence among female subjects for both suspected and confirmed infection.

Table 26. Subjects Who Suspected and Who Reported Testing Positive for COVID-19

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Suspected or confirmed case of COVID-19	40.3%	35.4%	44.2%	40.6%	40.2%
Positive test for COVID-19	29.2%	25.3%	31.6%	26.7%	31.4%
N=	1195	507	661	558	634

Among subjects with a positive test for COVID-19, nearly all (92.4 % of 317) reported a single episode. Female subjects were more likely to experience moderate or severe disease.

Table 27. Severity of Illness Among Subjects Reporting a History of COVID-19

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Mild	31.6%	35.9%	29.3%	39.1%	25.9%
Moderate	30.9%	29.1%	30.4%	25.6%	34.7%
Severe	37.5%	35.0%	40.3%	35.3%	39.4%
N=	304	103	191	133	170
% Hospitalized	6.0%	6.8%	5.6%	3.3%	9.3%
N=	384	147	232	211	172

The 205 participants in Salinas had serologic testing for antibodies against SARS-CoV-2 nucleocapsid protein (N-protein; Abbott Architect SARS-CoV-2 IgG CMIA test performed by Foundation Laboratory, Pomona, California; FDA COVID-19 Testing 2022). For this sub-population, a refined 3-level definition of a positive history of COVID-19 was constructed using subject-reported history and the results of antibody testing.

Table 28. COVID-19 Antibodies to SARS-CoV-2 Nucleocapsid Protein by Self-Reported COVID-19

	N-protein antibody negative	N-protein antibody positive ^a
Self-reported COVID-19 status ^b		
No known or suspected history	70.6%	29.4%
Suspected case (only)	47.6%	52.4%
Confirmed (diagnosed) case of COVID-19	43.2%	56.8%
Total ^c	57.3%	42.6%
N=	205	205

Note: Numbers in **bold** indicate individuals who are considered as having a positive COVID-19 history.

^a IgG antibodies to SARS-CoV-2 N-protein develop after infection but are not part of the immunologic response to any COVID-19 vaccine in use during the period of our survey [Yang L, Xu Q, Yang B, Li J, Dong R, Da J, Ye Z, Xu Y, Zhou H, Zhang X, Liu L, Zha Y, Yu F. 2021. IgG antibody titers against SARS-CoV-2 nucleocapsid protein correlated with the severity of COVID-19 patients. *BMC Microbiology* 21:351].

^b This is a three-level variable. Participants who reported both diagnosed and suspected cases of COVID-19 were classified in the diagnosed cases category only.

^c Numbers add to 204 due to one missing antibody value - from a participant with a self-reported diagnosed case of COVID-19.

As shown in Table 28, combining reported history and anti-N-protein serology resulted in a 59.5 percent (122 of 204) incidence of COVID-19 in this later-tested population. Of interest, 30 (29.4%) of subjects who reported no known history of COVID-19 had anti-nucleocapsid IgG, likely representing asymptomatic infections. Approximately half of subjects who reported a confirmed history of COVID-19 infections retained detectable anti-N IgG.

Although higher than the incidence estimates for the overall population based on self-report, the 59.5 percent incidence based on self-report and anti-COVID-19 n-protein IgG may be a substantial underestimate. Anti-nucleocapsid COVID-19 IgG peak concentrations are correlated with severity of illness (Yang et al 2021). For all subjects, serum antibody concentrations decrease over time after infection (Lumley et al, 2012). The antibody half-life estimates in the Lumley et al (2012) population was 85 days. Thus, it is likely that at least some subjects with no known history of COVID-19 infection experienced mild or asymptomatic illness and developed anti-nucleocapsid antibodies at low and decreasing concentrations that were not detected at the time of the survey.

Impact of COVID-19 Infection on Health and Activity

As shown in Table 27, 6.0 percent of subjects were hospitalized for COVID-19. The mean length of stay was 8.2 days. Although women were more likely to experience severe disease, men were more likely to be hospitalized. Women reported a longer mean duration of hospitalization (9.45 days, versus 6.67 days for men).

As shown in Table 29, the majority of subjects diagnosed with COVID-19 took time away from work. Most subjects who experienced COVID-19 illness reported full recovery although about 40 percent of subjects reported continuing problems (Table 30). Further discussion of subjects' health after recovering from the acute illness is discussed below.

Table 29. Missed Work Due to COVID-19 Infection

	Overall	Men	Women	Age 18 to 44	Age 45 plus
No time off	12.8%	9.7%	14.4%	13.7%	11.8%
Less than a week	2.5%	3.2%	2.1%	1.4%	3.9%
1-2 weeks	19.0%	29.0%	12.3%	20.6%	15.7%
2-4 weeks	32.2%	32.3%	32.9%	37.4%	25.5%
More than a month	23.6%	19.4%	26.0%	14.4%	35.3%
Have not gone back to work	9.9%	6.5%	12.3%	11.5%	7.8%
N=	242	93	146	139	102

Table 30. Recovery After Infection with COVID-19

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Fully recovered	59.4%	67.1%	55.2%	59.5%	57.7%
Not back to normal	40.6%	32.9%	44.8%	40.5%	41.3%
N=	224	76	145	131	92

The Experience of California Farmworkers with COVID-19 Vaccination

Overall, 80.6 percent of subjects reported they had received at least one vaccination against COVID-19, including 79.9 percent of men and 81.5 percent of women. More than 85 percent of vaccinated subjects had received one of the mRNA vaccines (Pfizer/BioNTech or Moderna), approximately 11 percent had received the Johnson and Johnson vaccine, and the remaining subjects received the AstraZeneca vaccine, another vaccine, or could not remember the brand of vaccine. As shown in COVID-19 Table 31, the most common place for farmworkers to receive vaccination was at a mass vaccination site.

Table 31. Site of COVID-19 Vaccination Among COVID-19 Vaccinated Farmworkers

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Workplace clinic	12.6%	12.0%	13.2%	14.0%	11.1%
Health clinic	25.2%	22.2%	27.3%	25.0%	25.3%
Public Health department	5.2%	5.3%	5.3%	5.3%	5.0%
Mass vaccination site	47.1%	51.9%	43.1%	43.8%	50.8%
Other	10.0%	8.6%	11.1%	12.0%	7.8%
N=	763	324	432	400	360

Table 31 excludes the 205 Salinas participants because they were recruited from a previous COVID-19 study and hence nearly all of these subjects were vaccinated at the clinic/study site (see Table 32).

Table 32. Vaccination Status and COVID-19 Infection History for Salinas Participants

	Overall	No COVID-19 history	Positive COVID-19 history
Unvaccinated	5.4%	4.9%	5.7%
Partially vaccinated ^a	2.4%	3.7%	1.6%
Fully vaccinated ^b , no booster	45.9%	36.6%	52.0%
Fully vaccinated ^b with booster	46.3%	54.9%	40.7%
N=	205	82	123

^aA single vaccination with a vaccine that requires two injections (examples: the mRNA vaccines made by Moderna or Pfizer/BioNTech)

^bexposure to one dose of the Johnson & Johnson vaccine or to two injections of a vaccine requiring two injections

Participants were asked about the challenges they experienced in getting vaccinated, their level of concern about COVID-19 vaccines, and, for non-vaccinated subjects, their reasons for not being vaccinated. Commonly reported challenges with getting the COVID-19 vaccination (≥5% of reporting subjects) included inconvenient hours (16.2%), no time off work (12.5%), waiting time too long (8.2%), don't know where to go (7.3%), too far away (7.2%), difficult to find or make appointment (6.6%), and no transportation (5.0%). Among all subjects, when asked

about level of concern about the COVID-19 vaccine, the majority of subjects (63.2%) reported no or only slight concern. Among 232 non-vaccinated subjects, 37.5 percent reported no or slight concern, 32.8 percent reported themselves somewhat or moderately concerned, and 23.7 percent said they were extremely concerned. Table 33 shows the common reasons for non-vaccination among the 232 subjects who had not been vaccinated against COVID-19.

Table 33. Common Reasons (reported by $\geq 5\%$ of responding non-vaccinated subjects) for Not Getting Vaccinated

Reason	%
Concerned about side effects	26.5
Not worried about getting sick with COVID-19	15.5
Don't know if it will work	9.2
Wait and see if it is safe	8.7
Not convenient	6.6
Don't believe I need it	5.5
Don't like vaccines	5.5
Already had COVID-19	5.3
N=	232

Experience with Vaccinations Other Than COVID-19 Among California Farmworkers

Subjects were asked about their general views about vaccination and about their experience with vaccines other than the COVID-19 vaccines. Table 34 shows the percentage of subjects who reported vaccination against influenza, HPV, or tetanus. These rates were lower than would be expected in a population with favorable views about vaccination. As shown in Table 35, only a small percentage of respondents thought that vaccines made them worse off, though a sizable amount (30%) were uncertain.

Table 34. Percentage of Subjects Vaccinated Against Selected Infectious Diseases

Vaccination	Overall	Men	Women
Influenza (within last year)	49.7%	46.8%	51.5%
N=	1194	507	660
HPV (at least one vaccination)	10.9%	4.5%	15.9%
N=	1168	494	647
Tetanus (within 10 years)	58.6%	57.9%	59.5%
N=	1182	503	652

Table 35. California Farmworkers' Views About Vaccinations

Vaccinations made me ...	Overall	Men	Women
Worse off	1.9%	1.8%	2.1%
No difference	23.7%	22.9%	24.5%
healthier	44.6%	44.3%	45.3%
Don't know	29.8%	31.0%	28.1%
N=	1195	506	662

The 205 Salinas participants who underwent objective evaluations had serologic tests for anti-measles IgG antibodies. Anti-measles IgG will develop and persist after exposure to two doses of measles vaccine or following infection. Measles vaccinations are commonly administered as part of the series of childhood vaccinations given before school entry. Among 204 subjects with results, 162 (79.4%) exhibited antibody titers above the threshold for protection from infection. This suggests that approximately 20 percent of the subjects had not completed the standard series of childhood vaccinations. These subjects are likely not protected against adult-acquired measles. Because of the very high R_0 associated with the measles virus (12 to 18), a population in which >5 percent of persons who are susceptible will exhibit sustained transmission during a local outbreak (Chow 2017).

Prolonged Symptoms After COVID-19 Infection Among California Farmworkers

Subjects who reported experience with COVID-19 infection (not including Upper Central Coast subjects who underwent objective testing) were asked about recovery from the illness (Table 36.)

Table 36. Limitation in Health and Activity After Infection by COVID-19

	Overall	Men	Women
No limitations	57.4%	62.2%	54.7%
Negligible limitations	10.4%	11.0%	10.8%
Suffer from limitations every day but can perform everyday activities without assistance	10.0%	12.2%	9.4%
Suffer from limitations every day but can perform everyday activities with assistance	14.4%	8.5%	17.3%
Not able to take care of myself	6.5%	6.1%	6.5%
N=	230	82	139

The Salinas participants who underwent objective evaluations and had a positive COVID-19 history were asked about changes in their sense of smell and taste. The responses showed higher percentages of subjects with taste and smell problems after infection with COVID-19 (Table 37.)

Table 37. Self-Reported Problems with Smell and Taste Sensations in Subjects with and Without a History of COVID-19

	Overall	No COVID-19 history ^a %	Positive COVID-19 history ^a
Self-reported smell problems			
No problems	77.6%	90.2%	69.1%
Problem(s)	22.4%	9.8%	30.9%
Self-reported taste problems			
No problems	84.9%	93.9%	78.9%
Problem(s)	15.1%	6.1%	21.1%
N=	205	82	123

^aSee definition of COVID-19 history in Section (i) of this chapter

This Salinas participants were evaluated with eight formal tests of mental status:

1. T-MOCA Cognitive Screen. (Katz et al, 2022)
2. SF-12 Physical Health Score. (Ware et al, 1996)
3. SF-12 Mental Health Score. (Ware, 1996).
4. PHQ2 Depression. (Kroenke et al, 2003)
5. GADS-2 Anxiety. (Kroenke et al, 2003)
6. Chandler Fatigue Scale (Bimodal). (Chalder et al, 1993)
7. mMRC Dyspnea (Short of Breath). (Bestall et al, 1999)
8. Sensonics Smell Test (8 Item). (Rawal et al, 2015)

Four of the eight formal tests showed a difference between the percentage of abnormal subjects with and without a positive history of COVID-19 (Table 38.) The SF-12 Physical and Mental Health Scores and the GADS-2 test of anxiety showed higher percentages of subjects with abnormal scores among subjects with a history of COVID-19 compared to subjects without a positive history. The Sensonics Smell Test showed superior performance for subjects with a positive COVID-19 history. These observations suggest that California farmworkers are at risk for long duration of symptoms following recovery from COVID-19 (Long COVID-19).

Table 38. Differences in Health and Cognition Indicators Overall and by History of COVID-19

	Overall	No COVID-19 history ^a	COVID-19 history ^a
SF-12 Physical Health Score			
normal	76.6%	76.8%	76.4%
poor health	23.4%	23.2%	23.6%
SF-12 Mental Health Score			
normal	82.0%	87.8%	78.1%
poor health	18.1%	12.2%	22.0%
GADS-2 Anxiety			
Not anxious	91.2%	96.3%	87.8%
Anxious	8.8%	3.7%	12.2%
Sensonics Smell Test (8 Item)			
Normal (6 to 8)	92.7%	87.8%	95.9%
Impaired (≤5)	7.3%	12.2%	4.1%
N=	205	82	123

^a See definition of COVID-19 history in Section (i) of this chapter

Mental Health

This section of the report provides a brief description of the mental health status of agricultural workers in California and their utilization of mental healthcare services.

As seen in Table 39, 19.4 percent of the survey respondents reported feeling nervous or anxious with 22.6 percent female and 15.4 percent male workers reporting feelings of anxiety. Lower levels of anxiety were reported among individuals 45 years of age or older (19.4%) compared to those between 18 to 44 years of age (20.0%). Overall, 14.8 percent survey respondents reported feelings of uncontrollable worry with female workers (17.6%) reporting higher levels of worry compared to male workers (11.3%). Similar feelings of worry were reported among individuals between 18 to 44 years of age (15.2%) and those 45 years of age or above (16.1%). Among the survey respondents, 12.5 percent of the workers reported little interest or pleasure in doing things, with the figures being higher for female workers (14.5%) compared to male workers (9.3%), and workers 45 years of age or older (13.8%) compared to those between 18 to 44 years of age (12.6%). As per the survey results, 13.7 percent of workers reported feeling depressed or hopeless with the figures being higher for female workers (17.0%) compared to male workers (9.5%) and workers between 18 to 44 years of age (15.4%) compared to those 45 years of age or above (13.0%).

As seen in Table 40, based on self-report, 6.8 percent of the survey respondents reported being diagnosed with depression with 9.0 percent of female workers and 3.7 percent of male workers reporting having been diagnosed with the illness by a healthcare provider. These figures were higher for workers 45 years of age or above (8.4%) compared to workers between 18 to 44 years of age (5.3%). According to the survey results, 9.5 percent of the workers reported being diagnosed with anxiety with 11.4 percent among female workers and 7.1 percent among male workers reporting having been diagnosed with the disease. Higher levels of diagnosis were found among individuals 45 years of age or above (10.0%) and those between 18 to 44 years of age (9.0%).

Table 39. Self-Reported Mental Health Status

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Feeling nervous, anxious, or on edge	19.4%	15.4%	22.6%	20.0%	19.4%
N=	1185	507	651	695	471
Not being able to stop or control worrying	14.8%	11.3%	17.6%	15.2%	16.1%
N=	1179	504	648	693	467
Little interest or pleasure in doing things	12.5%	9.3%	14.5%	12.6%	13.8%
N=	1181	505	649	691	471
Feeling down, depressed, or hopeless	13.7%	9.5%	17.0%	13.3%	14.1%
N=	1179	505	647	690	470

Table 40. Healthcare Provider Diagnosed Mental Illnesses

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Depression	6.8%	3.7%	9.0%	5.3%	8.4%
N=	962	408	542	544	415
Anxiety	9.5%	7.1%	11.4%	9.0%	10.0%
N=	957	409	537	542	412

The quality of sleep has a significant impact on the physical and mental wellbeing of an individual. As can be seen in Table 41, while 38 percent of survey respondents reported having average quality sleep, 13.3 percent workers reported having restless or very restless sleep. Among male workers 37.6 percent reported having average quality sleep while 9.9 percent workers reported having restless or very restless sleep. Among female workers 39.0 percent reported having average quality sleep while 15.4 percent reported having restless or very restless sleep. Among workers between 18 to 44 years of age 34.7 percent reported having

average quality sleep while 11.3 percent reported having restless or very restless sleep. Among workers 45 years of age or above, 41 percent reported having average quality sleep while 15 percent reported having restless or very restless sleep.

Table 41. Self-Reported Quality of Sleep

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Very sound or restful	17.5%	18.9%	16.2%	20.3%	15.0%
Sound or restful	31.2%	33.7%	29.3%	33.8%	29.0%
Average quality	38.0%	37.6%	39.0%	34.7%	41.0%
Restless	10.6%	7.5%	12.4%	8.6%	12.3%
Very restless	2.7%	2.4%	3.0%	2.7%	2.7%
N=	1194	508	659	557	634

Table 42 below depicts the patterns of utilization of mental health services among the survey respondents. Overall, 5.8 percent of workers reported the need to seek professional help with female workers (7.9%) reporting higher need than male workers (3.0%). There were 5.1 percent of workers aged 45 years or older who reported seeking professional help compared to 6.7 percent of workers between 18 to 44 years of age. Approximately 5 percent of workers reported seeking professional help from their primary care provider for their mental health issues with 4.4 percent among male and 5.7 percent among female workers reported seeking help. There were 6.8 percent of workers aged 45 years or older and 3.6 percent of workers between 18 to 44 years of age seeking help from their primary care provider. Among the survey respondents 3.1 percent reported seeking care from a psychiatrist or counselor or social worker for their mental health issues with 4.5 percent among female and 1.6 percent among male workers reporting they tried to utilize these services. The utilization of these services was higher among workers between 18 to 44 years of age (3.8%) compared to workers aged 45 years or older (2.4%).

Table 42. Patterns of Utilization of Mental Healthcare Services

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Needing professional help	5.8%	3.0%	7.9%	6.7%	5.1.%
N=	1192	506	659	555	634
Seeking professional help (PCP)	5.1%	4.4%	5.7%	3.6%	6.8%
N=	1022	434	561	551	468
Seeking professional help (Psychiatrist/counselor/social worker)	3.1%	1.6%	4.5%	3.8%	2.4%
N=	1025	436	562	555	467

Farmworkers are known to work under conditions of high stress. The findings of the study show that while 19.4 percent of workers reported feeling anxious, only 9.5 percent reported being diagnosed with anxiety and while 13.7 percent of workers reported feeling depressed, only 6.8 percent reported being diagnosed with depression. Less than 6 percent of the workers reported feeling the need for professional help and between 3 percent to 5 percent of workers utilized any type of mental healthcare services. Female workers and those between 18 to 45 years of age reported higher likelihood of feeling anxious or depressed but still nearly half of them did not report being diagnosed by a healthcare provider and less than 6 percent reported seeking any type of mental health services. These findings highlight high levels of under diagnosis and underutilization of mental health resources.

Results: Future Health

Preventive Health Services

Farmworkers have traditionally had lower levels of health insurance coverage and healthcare utilization compared to the general population of the U.S. (NAWS 2021, Hernandez and Gabbard, 2022). A significant proportion of the workforce lacks legal immigration status and is ineligible for health insurance coverage under the ACA (Shaw et al, 2014). This has led to delays in obtaining needed healthcare services and prescriptions and worse health outcomes which can be avoided through early detection and treatment (Guild et al, 2016). This section provides a brief description of the utilization of preventive care services by farmworkers in California.

Table 43 provides an overview of self-reported health care utilization by the surveyed agricultural workers in the past 12 months. Overall, 22.5 percent of workers reported having utilized the ER, 11.7 percent reported being admitted to the hospital, 43.2 percent reported having visited a doctor's clinic, 35 percent reported being seen by the dentist, 24.1 percent had a vision checkup and 17.4 percent had their hearing checked in the last 12 months. Among male workers, 18.7 percent reported having utilized the ER, 8.4 percent reported being admitted to the hospital, 36.5 percent reported having visited a doctor's clinic, 26 percent reported being seen by the dentist, 19.9 percent had a vision checkup and 14.7 percent had their hearing checked in the last 12 months.

Among female workers, 25.1 percent reported having utilized the ER, 14.1 percent reported being admitted to the hospital, 48.6 percent reported having visited a doctor's clinic, 42 percent reported being seen by the dentist, 27.8 percent had a vision checkup and 19.5 percent had their hearing checked in the last 12 months. Among workers between 18-44 years of age, 20.9 percent reported having utilized the ER, 10.5 percent reported being admitted to the hospital, 41.9 percent reported having visited a doctor's clinic, 37.8 percent reported being seen by the dentist, 19.6 percent had a vision checkup and 13.1 percent had their hearing checked in the last 12 months. Among workers aged 45 years or older, 23.8 percent reported having utilized the ER, 12.6 percent reported being admitted to the hospital, 44 percent

reported having visited a doctor's clinic, 32.2 percent reported being seen by the dentist, 27.7 percent had a vision checkup and 20 percent had their hearing checked in the last 12 months.

The patterns of utilization of routine preventive screening tests are depicted in Tables 44, 45 and 46. As seen in Table 44, among the total survey respondents only 20.7 percent reported ever being screened for colorectal cancer with 19 percent male and 20.9 percent female workers reported ever being screened. The rates of screening were higher for workers aged 45 years and above (25.5%) compared to those between 18 to 44 years of age (13.8%). Among the survey respondents, only 15.5 percent reported ever being screened for skin cancer with 13.9 percent male and 16.9 percent female workers reported ever being screened. The rates of screening were higher for workers aged 45 years and above (17.5%) compared to those between 18 to 44 years of age (13.1%). Among the survey respondents, 75.5 percent reported having routine blood tests with 71.3 percent male and 78.8 percent female workers reporting having received them. The rates were higher for workers aged 45 years and above (79.7%) compared to those between 18 to 44 years of age (70.7%).

Table 43. Patterns of Healthcare Utilization

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Go to Emergency Room	22.5%	18.7%	25.1%	20.9%	23.8%
N=	1067	450	594	493	572
Admitted to Hospital	11.7%	8.4%	14.1%	10.5%	12.6%
N=	1069	451	596	494	573
Go to Doctor's clinic	43.2%	36.5%	48.6%	41.9%	44.0%
N=	1182	501	655	554	625
Go to Dentist	35.0%	26.0%	42.0%	37.8%	32.2%
N=	1176	496	654	553	621
Vison checkup	24.1%	19.9%	27.8%	19.6%	27.7%
N=	1179	502	651	552	624
Hearing checkup	17.4%	14.7%	19.5%	13.1%	20.0%
N=	1175	497	652	550	622

Table 44. Patterns of Utilization of Routine Preventive Screening Tests

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Colorectal cancer screening	20.7%	19.0%	20.9%	13.8%	25.5%
N=	1176	500	650	550	623
Skin cancer screening	15.5%	13.9%	16.9%	13.1%	17.5%
N=	1176	498	652	549	624
Routine blood tests	75.5%	71.3%	78.8%	70.7%	79.7%
N=	1177	501	650	549	625

Table 45. Patterns of Utilizations of Preventive Screening Tests Among Males

	Overall	Age 18 to 44	Age 45 plus
Testicular examination	31.0%	28.8%	32.8%
N=	484	212	271
Prostate examination	25.1%	17.4%	31.2%
N=	474	207	266

Table 46. Patterns of Utilizations of Preventive Screening Tests Among Females

Type of preventive screening	Overall	18-44 years	45 years and above
Pap smear	88.3%	87.8%	88.7%
N=	649	329	319
Breast exam	71.3%	59.0%	83.8%
N=	654	332	321

Table 45 depicts the rates of screening for preventive examinations among male agricultural workers. As can be seen in Table 45 above, 31 percent of the surveyed male agricultural workers reported having ever received a testicular examination with 32.8 percent workers aged 45 years or above and 28.8 percent of workers between 18 to 44 years of age reporting ever being screened. Approximately 25 percent of the surveyed male workers reported having ever

received a prostate examination with 31.2 percent workers aged 45 years or above and 17.4 percent of workers between 18 to 44 years of age reporting ever being screened.

Table 46 depicts the rates of screening for preventive examinations among female agricultural workers. As can be seen in Table 46 above, 88.3 percent of the surveyed female agricultural workers reported having ever received a Pap smear with 88.7 percent workers aged 45 years or above and 87.8 percent of workers between 18 to 44 years of age reporting ever being screened. Approximately 71 percent of the surveyed female workers reported having ever received a breast examination with 83.8 percent workers aged 45 years or above and 59 percent of workers between 18 to 44 years of age reporting ever being screened.

The findings of the study indicate that less than half of the surveyed agricultural workers had visited a doctor's office for any reason in the past 12 months with females and workers aged 45 years or above being more likely to visit the doctor's office compared to males and workers between 18 to 44 years of age. Only 35 percent of workers had visited the dentist in the past year with females and workers aged 45 years or above being more likely to visit the dentist compared to males and workers between 18 to 44 years of age. Less than 25 percent of workers had vision checkup in the past year with females and workers aged 45 years or above being more likely to get a checkup compared to males and workers between 18 to 44 years of age. Less than 18 percent of workers had hearing checkup in the past year with females and workers aged 45 years or above being more likely to get a checkup compared to males and workers between 18 to 44 years of age.

The study showed very low levels of screening for both colorectal cancer (20.7%) and skin cancer (15.5%) despite agricultural workers having high levels of exposure to toxic chemicals such as pesticides and prolonged exposure to direct sunlight while being engaged in hard physical labor making them highly vulnerable to the development of both colorectal cancer and skin cancer.⁵ Similar patterns were observed for male preventive screening exams with only 31 percent of workers reporting having ever received a testicular exam and 25.1 percent having ever received a prostate exam in their life. Female workers in contrast showed high rates of receiving preventive screening tests such as Pap smear (88.3%) and breast exam (71.3%). These findings indicate low levels of utilization of preventive care services by male agricultural

workers. There is an urgent need to improve access to and utilization of preventive care services by these workers to promote early detection and treatment of disease.

Health Behaviors

Agricultural workers in the United States face multiple occupational hazards including ergonomic hazards, exposure to high temperatures, pesticides, wildfire smoke and contagious diseases such as COVID-19. Many of them are undocumented and are hesitant in reporting injuries and illnesses to government agencies due to fears of being deported (Guild et al, 2016). This creates conditions of high stress which can lead to elevated levels of substance use (Negi 2011). Previous studies have documented elevated levels of binge drinking among Latino farm workers (Worby and Organizta, 2007). Their dietary patterns and inability to access nutritious foods is associated with an increased incidence of obesity and chronic diseases (Lopez-Cevallos et al, 2019). This section of the report provides a brief description of the health-related behaviors among agricultural workers in California including substance use, weight perception and attempts to lose weight.

As seen in Table 47, 9.8 percent of workers reported using tobacco with 19.1 percent male and 3.1 percent female workers reporting the use of such products. The percentages were higher for workers above 45 years of age (12.0%) compared to workers between 18 to 44 years of age (7.3%). Overall, 0.9 percent of workers reported using vaping products with 1 percent male and 0.9 percent female workers reporting such usage. The percentages were higher for workers between 18-44 years of age (1.6%) compared to workers 45 of age years or above (0.3%). Overall, 2.1 percent of workers reported using marijuana with 3 percent male and 1.5 percent female workers reporting such usage. The percentages were higher for workers between 18-44 years of age (3.5%) compared to workers 45 years of age or above (1.0%). Approximately 16 percent of workers reported having consumed 4 or more drinks in a single day in the past 30 days with 28.7 percent of male workers and 6.1 percent of female workers reporting such usage. The percentages were higher for workers between 18-44 years of age (17.8%) compared to those who were 45 years of age or above (14.5%).

Overall, 32.5 percent of workers reported having used prescription drugs with 27.1 percent male workers and 36.9 percent female workers reporting such usage. Workers aged 45 years or above had slightly lower levels of usage (33.1%) compared to workers between 18 to 44 years of age (32%). Overall, 1.4 percent of workers reported having used methamphetamine with 0.6 percent male workers and 2.2 percent female workers reporting such usage. Workers aged 45 years or above had higher levels of usage (1.8%) compared to workers between 18 to 44 years of age (1%). The frequency of use of these substances among agricultural workers has been provided in the appendix.

Table 47. Self-Reported Substance

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Tobacco usage	9.8%	19.1%	3.1%	7.3%	12.0%
N=	1094	430	638	522	569
Vaping usage	0.9%	1.0%	0.9%	1.6%	0.3%
N=	1185	500	658	552	630
Marijuana usage	2.1%	3.0%	1.5%	3.5%	1.0%
N=	1178	494	657	546	629
Alcohol*	16.1%	28.7%	6.1%	17.8%	14.5%
N=	1193	568	726	556	634
Prescription medication usage	32.5%	27.1%	36.9%	32.0%	33.1%
N=	1188	505	657	551	634
Methamphetamine usage	1.4%	0.6%	2.2%	1.0%	1.8%
N=	1176	500	650	542	631

* 4 or more for women, 5 or more for men

The self-perception of weight, levels of diagnosis of obesity and agricultural workers attempts to lose weight are displayed in Table 48. Approximately 53 percent of workers perceived themselves to be at the right weight while 31.3 percent considered themselves slightly overweight and 9.6 percent considered themselves very overweight. Among male workers, 57.4 percent considered themselves to be at the right weight while 29.9 percent considered themselves to be slightly overweight and 5.5 percent considered themselves to be very overweight. Among female workers, 49 percent considered themselves to be at the right

weight while 32.7 percent considered themselves to be slightly overweight and 12.4 percent considered themselves to be very overweight.

Among workers between 18 to 44 years of age, 52.3 percent considered themselves to be at the right weight while 34 percent considered themselves to be slightly overweight and 8.3 percent considered themselves to be very overweight. Among workers 45 years of age or above, 52.9 percent considered themselves to be at the right weight while 29.1 percent considered themselves to be slightly overweight and 10.7 percent considered themselves to be very overweight. Overall, 37.3 percent were diagnosed by a physician with obesity with 29.9 percent male workers, 43 percent female workers, 34 percent workers between 18 to 44 years of age and 40.3 percent of workers aged 45 years of above being diagnosed as obese. Among the survey respondents, 44.6 percent of workers were trying to lose weight with 38.3 percent male workers and 48.8 percent female workers, 38.5 percent of workers between 18 to 44 years of age and 49.9 percent of workers aged 45 years of above reporting they were making efforts to lose weight.

Table 48. Obesity Levels and Attempts to Lose Weight

	Overall	Men	Women	Age 18 to 44	Age 45 plus
Self-reported view of weight					
Very underweight	1.8%	2.0%	1.5%	2.2%	1.4%
Slightly underweight	4.7%	5.3%	4.3%	3.1%	6.0%
Right weight	52.7%	57.4%	49.0%	52.3%	52.9%
Slightly overweight	31.3%	29.9%	32.7%	34.0%	29.1%
Very overweight	9.6%	5.5%	12.4%	8.3%	10.7%
N=	1173	495	651	541	629
Told was overweight by physician	37.3%	29.9%	43.0%	34.0%	40.3%
N=	1179	499	653	550	626
Percentage of individuals trying to lose weight	44.6%	38.3%	48.8%	38.5%	49.9%
N=	1180	501	652	548	629

Percentage trying to lose weight among those diagnosed as overweight or obese only	66.6%	67.5%	68.0%	64.5%	72.2%
N=	479	260	325	296	295
Percent getting 30 minutes or more of exercise	48.3%	50.6%	46.5%	42.6%	53.0%
N=	1189	504	658	556	630

Among the survey respondents who were diagnosed as being overweight or obese, 66.6 percent of workers were trying to lose weight with 67.5 percent male workers and 68 percent female workers, 64.5 percent workers between 18 to 44 years of age and 72.2 percent of workers aged 45 years of above reporting they were making efforts to lose weight.

Approximately 48 percent of the survey respondents, reported that on the days they are not working they usually get 30 or more minutes of exercise with 50.6 percent among male workers, 46.5 percent among female workers, 42.6 percent among workers between 18 to 44 years of age, and 53 percent among workers aged 45 years or above reporting such patterns of exercise.

These findings indicate high levels of tobacco, alcohol, and prescription drug usage with low levels of vaping and marijuana usage among agricultural workers in California. These results also support findings from previous studies which report high levels of obesity among agricultural workers. However, the findings suggest that majority of the workers diagnosed as obese by a healthcare provider were actively making efforts to lose weight and become healthy.

Health Insurance

For farmworkers to access healthcare, it must be affordable, readily available, and delivered in a manner that is appropriate to their needs and culture. Traditionally, the lack of health insurance has been the most significant barrier to accessing healthcare in the United States, particularly prevention and other types of non-essential services (Glied et al 2020). But the other barriers to accessing health care can also be significant, especially for vulnerable populations such as farmworkers.

As shown in Table 49, the results from the FWHS suggest that 48.6 percent of the farmworkers were without health insurance at some point in the previous 12 months, with the percentage without health insurance tending to be higher among workers who are employed by contractors (50.9%) as opposed to growers (39.4%).

For those with health insurance, the majority (40.8%) had Medi-Cal or Medi-Cal with another type of insurance. The percentage with only employer insurance was only 7.3 percent. For those without health insurance, the most commonly cited reasons were they were not eligible for Medi-Cal or that it was too expensive (Table 50).

Table 49. Health Insurance Coverage

Coverage	Overall	Male	Female	18-44	45+	Contractor	Grower
None	48.6%	50.7%	47.1%	40.1%	56.4%	50.9%	39.4%
Yes	51.4%	49.3%	52.9%	59.9%	43.6%	49.1%	60.6%
N=	1199	509	663	561	635	960	236
IF YES:							
Medi-Cal and other	21.9%	18.9%	24.3%	26.9%	17.2%	21.5%	23.7%
Medi-Cal	14.9%	8.6%	19.8%	17.1%	12.9%	15.5%	12.3%
Employer	7.3%	13.4%	2.4%	7.3%	7.4%	4.7%	17.8%
Other	2.4%	3.1%	1.2%	2.5%	2.4%	2.7%	3.0%
Medi-Cal and employer	2.2%	2.2%	2.3%	2.3%	2.1%	2.3%	1.7%
Medi-Cal, employer and other	1.8%	2.2%	1.5%	2.5%	1.3%	1.9%	1.7%
Employer and other	0.8%	1.0%	0.8%	1.3%	0.5%	0.9%	0.4%
N=	1199	509	663	561	635	960	236

Table 50. Most Common Reasons for Not Having Health Insurance

For those with no health insurance, reasons	Overall	Male	Female	18-44	45+	Contractor	Grower
Not eligible (immigration status)	35.5%	38.8%	35.8%	34.5%	36.9%	37.5%	27.0%
Too expensive	28.2%	32.7%	22.6%	30.3%	25.2%	26.5%	37.8%
Not eligible (work status)	12.2%	10.2%	13.1%	9.9%	15.5%	13.0%	8.1%
N=	245	98	137	142	103	208	37

Unlike most other workers, the seasonality of much farm work and the potential need to travel to other locations (migrant workers) creates additional challenges for farmworkers in getting and maintaining healthcare coverage. As seen in Table 51, 50 percent of the farmworkers reported they do not have health insurance in the months when they are not working. The vulnerabilities caused by the nature of the work are not mitigated by having spouses with health insurance, as only 43.6 percent reported having a spouse who has access to health insurance. And more worrisome, the insurance coverage for children is only 73.6 percent, despite their being programs that provide coverage to children regardless of immigration or employment status.

To assess the impact of not having health insurance, the participants were asked whether they have a usual source of care (and, if so, who provided the care) and whether they had delayed seeking needed medical care in the past year (and, if so, why). Both questions are indicators of having needed medical care, as people without a usual source of healthcare tend to have lower utilization of preventive health services and early detection of disease, while those who delay seeking needed medical care risk complications and more significant illness that can lead to poorer health outcomes and even death.

The results (Table 52) suggest that 21.6 percent of the respondents reported not having a usual source of care. The numbers were slightly higher for men than women, and for younger compared with older farmworkers. For those with a usual source of care, the majority (58.2%) reported a Community Health Center or a Migrant Clinic as being their care provider and 28.5 percent reported seeing a doctor in their own clinic. Seven percent reported the hospital or ER as being their usual source of care, which implies that they were less likely to receive preventive and early diagnosis.

As shown in Table 53, 23 percent of the participants reported delaying medical care at some point in the previous 12 months. The numbers were slightly higher for women than men but were essentially equal across the age groups. For those who reported delaying care, 66.3 percent cited cost or lack of insurance as a significant barrier. Approximately half (47%) of those who delayed seeking care eventually received care for their treatment, meaning that the others have never received what they perceived as needed care.

Table 51. Health Insurance Coverage During Year, for Spouse, and for Children

	Overall	Male	Female	18-44	45+	Contractor	Grower
Percent with health insurance in months not working	50.0%	47.1%	52.6%	49.3%	50.4%	49.2%	52.7%
N=	1015	437	553	558	454	811	201
Percent with spouse who has health insurance	43.6%	49.0%	39.6%	41.3%	46.0%	39.3%	58.5%
N=	799	347	434	458	339	626	171
Percent with children with health insurance	73.6%	62.8%	80.8%	83.0%	61.9%	72.7%	76.9%
N=	840	325	494	460	378	669	169

Table 52. Percent with a Usual Source of Healthcare

Usual source of care	Overall	Men	Women	18-44	45+
None	21.6%	24.2%	20.0%	27.5%	16.3%
Yes	78.4%	75.8%	80.0%	72.5%	83.7%
N=	1192	505	661	529	630
IF YES:					
CHC/ Migrant clinic	58.2%	55.1%	60.2%	56.9%	59.0%
Doctor	28.5%	32.0%	26.9%	32.3%	25.8%
Hospital/ER	7.0%	7.8%	6.7%	7.4%	6.7%
Other	5.2%	3.6%	5.7%	3.0%	6.9%
Traditional medicine	0.9%	1.3%	0.4%	0.3%	1.3%
Pharmacist	0.3%	0.3%	0.2%	0.3%	0.4%
N=	932	385	525	406	524

Table 53. Delayed Needed Medical Care in the Past 12 Months

	Overall	Men	Women	18-44	45+
No	77.0%	79.1%	76.0%	77.0%	76.9%
Yes	23.0%	20.9%	24.0%	23.0%	23.1%
N=	1192	508	658	559	630
IF YES:					
Percent citing cost or lack of insurance as a reason	66.3%	60.4%	69.4%	57.5%	74.0%
N=	273	106	157	134	139
Percent who eventually sought care	47.0%	44.2%	49.0%	45.2%	49.1%
N=	666	267	386	341	324

Health literacy is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions” (U.S. Department of Health and Human Services, 2010). Table 54 reports the average score (out of 20) that participants scored on a health literacy assessment. The results suggest that scores were relatively higher for women than men. Thirty-nine percent of the participants reported needing an interpreter for a medical treatment, with 90 percent of those reporting receiving support. This was due in part to the high number of providers in farming regions who speak Spanish (the dominant language of non-English speakers in the sample), though rates tend to be lower for specialty and tertiary care than for primary or emergency care.

Table 54. Health Literacy and Need for an Interpreter

	Overall	Men	Women	18-44	45+
Health literacy score*	10.82	10.51	11.03	10.89	10.76
N=	1182	500	655	554	625
Percent needing an interpreter	39.0%	35.6%	41.6%	37.3%	40.4%
N=	1153	481	647	534	616
IF YES					
Percent getting an interpreter	90.1%	88.9%	91.3%	87.3%	92.3%
N=	444	171	263	197	247
Percent knowing that CA requires interpreter	70.8%	68.7%	72.7%	69.3%	72.1%
N=	1190	505	659	560	627

* Mean score out of 20 total

Conclusion

The findings from the Farmworker Health Study (FWHS) are a call to action for public engagement and policy development to improve farmworker health. We outline the study's implications and recommend areas for lifting farmwork standards and expanding healthcare access.

The most critical fact for understanding the organization of agricultural work and its implications for farmworker health is that many farmworkers have diminished social and economic rights. Farmworkers have fewer rights than most other workers, due to their exemption from the 1935 Wagner Act, and this is reflected in farmworker economic disadvantage. In 2019, the median of California farmworkers' wages was \$21,915—among the lowest of any occupational group. And since the 1970s, when several movements expanded the rights of farmworkers and native-born Latinos, farmwork has become increasingly dominated by migrants lacking the same rights as US citizens or legal residents. In our survey, two-thirds (67%) expressed the highest level of fear of family separation due to deportation—indicating that they or their family members did not have a right to legal residence in the US.

Limited social and economic rights have implications for the rights that farmworkers do have. Lack of immigration status and the persistent fear of retaliation, including job loss and deportation, hampers efforts to improve the health and well-being of farmworkers. Our survey suggested that farmworkers feared exercising the workplace rights they did have. More than one in three (36%) said they would be unwilling to file a report against an employer if their rights had been violated, and among those who said they would be unwilling to file a report, two-thirds (64%) said they would be unwilling to file due to fear of retaliation or job loss.

Unsurprising given their limited rights and fear of exercising rights, many farmworkers reported high rates of non-compliance with wage and hour and health and safety standards. Nearly one in five (19%) reported experiencing, at one point or another, not being paid wages they earned by an employer. Nearly one in six farmworkers (15%) did not receive the minimum number of 10-minute rest breaks under state law. Nearly half (43%) reported that their employer “never” provided a heat illness prevention plan as mandated under law. And more than ten percent of workers lacked regular access to clean drinking water at work. Such non-compliance with rest breaks, heat illness plans, and access to clean drinking water, pose major health hazards considering the industry’s high rates of acute heat illness injury and death, and the long-term health consequences of heat stress (e.g. kidney failure). Our survey also suggested that farmworker women experienced three different adverse pregnancy outcomes (low birth weight, pre-term birth, and birth defects) at twice the rate as the general population—outcomes associated with exposure to elevated temperatures during pregnancy.

Farmwork was also associated with social and economic challenges at home that posed major health hazards. More than one in three (37%) reported a “taste of water at home” that was either very bad (24%) or bad (13%)—an indicator of poor water quality and possibly health risks. Almost half (42%) reported low or very low food security. And at the same time that a large majority were renters (92%), many farmworkers encountered household problems such as cockroaches (29%), rodents (17%), rotting wood (16%), mold (14%), water damage (13%), and

water leaks (12%). Such living and working conditions also undoubtedly contributed to the high levels of anxiety and depression reported in this study.

In regards to the specific health profile of California farmworkers, our study suggests that California farmworkers may have lower rates of chronic health conditions than the state's general Latino population—but that there is reason to be concerned. Most farmworkers are immigrants, and, on the whole, immigrants have historically been healthier than native-born Latinos, due to the “Latino Health Paradox” (e.g. Markides and Coreil 1986; Markides and Eschbach 2005; Saenz and Garcia 2021) and the physical demands of farmwork (e.g. those with poor health tend to drop out of the workforce). That said, our results are limited by the low rates of healthcare insurance, utilization, and screening for chronic conditions—and rates of chronic conditions may be higher than reported. In addition, results indicate there should be concern about farmworkers' future health, given their high levels of obesity and the associated risk of heart disease, stroke, and diabetes. These problems are likely to be exacerbated by a lack of access to health insurance and thus less use of preventive and early diagnostic services.

The findings on farmworkers' social and economic organization—their lack of rights, the challenges they face, and their health profile—also highlight the implications of major public disasters on the farmworking community. The COVID-19 pandemic had the greatest impact on industries with frontline and essential work, particularly those with a high percentage of workers who were immigrant and did not have access to unemployment benefits (Flores et al. 2022). In our survey, 41 percent of farmworkers said they would qualify for unemployment benefits, 26 percent said they were unaware of COVID-19 emergency paid sick leave, and among those who had ever received a positive test 13 percent said they were denied paid sick leave. This suggests a need for greater workers' rights education, expanded access to an economic and healthcare safety net, and greater protection of worker rights—not just to address public emergencies like COVID-19 but also rapidly emerging environmental crises.

In California, summers are hotter than a century ago, heat waves are more frequent, and occurrences of extreme fire weather days have doubled since the 1980s (Goss et al 2020). In this context, the findings of this survey related to lack of compliance with workplace health and safety standards should be reason for concern. In addition to the above-mentioned findings (on lack of breaks, heat illness plans, and access to clean drinking water), our survey also found that one in seven farmworkers reported that smoke made it difficult to breathe either often (8%) or very often (7%), while one-third (32%) claimed respirators were lacking but “always” needed when working in agriculture. Moreover, more than one in three respondents experienced problems keeping a house cool (39%), issues that will only increase their risk of heat-related illnesses as climate change exacerbates temperature extremes.

Findings related to climate change and the environment are particularly relevant for inland regions of the state where farmworkers concentrate—areas such as the San Joaquin Valley, Imperial Valley, Coachella Valley, and Sacramento Valley—where temperatures can exceed 110 degrees Fahrenheit. Such excessive heat may affect indoor agricultural workers, such as those in working in packing houses (11% of our sample), not currently protected by the Cal/OSHA heat standard. Lastly, not only are inland, agricultural regions prone to the increasing risks of heat and wildfire smoke, but heat-trapping may contribute to increased particulate matter and ground-level ozone—harmful pollutants from gas emissions with long-term health consequences.

In light of the social, economic and environmental challenges facing farmworkers, we recommend public engagement and policy development aimed at lifting farmwork standards and expanding healthcare access. Our recommendations are as follow:

1. Invest public resources in agricultural development that raises industry work standards.

There is an increasing need to lift workplace health and safety standards in the agricultural industry. In turn, the state should invest public resources in businesses and models that raise agricultural workplace health and safety standards. The state might subsidize trade associations

and growers that invest in and participate in new certification programs that ensure protection of workplace health and safety standards. The state might also subsidize agricultural technological development done in collaboration with farmworker organizations that specialize in workplace health and safety; or in collaboration with the National Institute for Occupational Safety & Health, the Centers for Agricultural Safety and Health, and public health researchers working on improved PPE (e.g. heat deflecting clothing, etc). The implications of technological development on pace of work are critical for understanding how to mitigate the increasing risk that heat stress will play in the future of farmwork.

2. Continue to invest public resources in protecting workers' rights. The substantial non-compliance with labor laws—especially worker health and safety standards and wage and hour requirements—point to the need for stronger monitoring and enforcement of these standards by relevant agencies. Recent innovations in this field include the Los Angeles County Public Health Council model (which encouraged worker participation in workplace health and safety education and enforcement). Public education is key; the high vaccination rate (81%) reported in this study—much higher than in many other communities in California—is partly an artifact of the public resources dedicated to farmworker-serving organizations who collaborated with our study to conduct data collection (i.e. the Community Advisory Board and two farmworker-serving clinics). The state should continue to invest in workers' rights education and training, particularly among those organizations that have been most effective.

3. Expand access to the economic safety net. Farmworkers are on the frontlines of economic and environmental crises, yet many lack access to the economic safety net. Nearly two-thirds (62%) reported difficulty paying for food or bills since the pandemic. Creating an economic safety net (e.g. state-funded unemployment benefits) would reduce anxiety and depression among the 40 percent of farmworkers lacking access to the federal Unemployment Insurance system—particularly during major disasters—and make the state's economy more resilient.

4. Expand access to the healthcare safety net. Several factors contribute to much lower levels of insurance among farmworkers than the general population, including the lack of employer-provided health insurance, high cost of insurance, seasonal nature of farm work, and lack of portability of insurance across county lines. In addition, many farmworkers lack legal residence and have household incomes that do not allow them to be eligible for Medi-Cal. We recommend closing loopholes in access to the state-funded healthcare safety net system for farmworkers who are undocumented, lack employer-based coverage, and earn too much to be eligible for Medi-Cal.

5. Expand healthcare access. Most farmworkers live in Medically Underserved Areas, which are “areas or populations designated... as having too few primary care providers, high infant mortality, high poverty or a high elderly population.” As a result, in addition to an expansion of health care insurance, it is also necessary to explore additional avenues for providing care. Virtually integrated health plans that utilize community organizations and community healthcare workers improve the coordination of care, and help to reduce the risk that farmworkers and their families do not fall through gaps in the health care system.

6. Build capacity for innovating community healthcare worker co-ops. The community healthcare worker (e.g. promotores) model has been held up by advocates as expanding healthcare access among immigrant populations (such as farmworkers)—particularly because the work of connecting vulnerable populations to healthcare was done by those same populations. Following the passage of California AB5, many promotores who were previously misclassified as independent contractors will now be classified as employees—but those who are undocumented lack work authorization and will be unable to work. One solution for community healthcare workers lacking work authorization is to form employee-owned co-ops. We recommend public investment in community organizations to build capacity for creating community healthcare worker co-ops to meet the demands of the healthcare sector, and for such co-ops to create pathways for skills development, credentialing, and career advancement.

References

- American Lung Association. 2022. "State of the Air 2022." American Lung Association. 2022. <https://www.lung.org/getmedia/74b3d3d3-88d1-4335-95d8-c4e47d0282c1/sota-2022.pdf>.
- Batalova J, Fix M, and Greenberg M. 2018. Chilling Effects: The Expected Public Charge Rule and Its Impact on Legal Immigrant Families' Public Benefits Use. Migration Policy Institute.
- Becot F, Inwood S, Bendixsen C, Henning-Smith, C. 2020. Health care and health insurance access for farm families in the United States during COVID: essential workers without essential resources?. *Journal of agromedicine*, 25(4), 374-377.
- Beeson T, Kress J, Wylie J, Wood SF. (2019). Pregnancy Intention, Ambivalence, and Contraceptive use in Community Health Center (CHC) Populations. *Spotlight on Public Health Research*.
- Bestall JC, Paul EA, Garrod R, Garnham R, Jones PW, Wedzicha JA. 1999. Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. *Thorax* 54:58. doi: 10.1136/thx.54.7.581. PMID: 10377201; PMCID: PMC1745516
- Blane, D. 1995. "Editorial: Social Determinants of Health—Socioeconomic Status, Social Class, and Ethnicity." *American Journal of Public Health* 85(7):903-905.
- Brown, B. 2021. Scorching heat is killing workers. Some states are stepping in. <https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2021/08/23/scorching-heat-is-killing-workers-some-states-are-stepping-in>
- Burdick, G. 2022. Oregon OSHA proposes heat, wildfire smoke rules. <https://ehsdailyadvisor.blr.com/2022/02/oregon-oshaproposes-heat-wildfire-smoke-rules/>
- California Health Care Foundation. 2022. Trump public charge rule no longer in effect. <https://www.chcf.org/collection/proposed-changes-to-public-charge-rule/>.
- Calvert GM, Jennifer Karnik, Louise Mehler, John Beckman, Barbara Morrissey, Jennifer Sievert, Rosanna Barrett, Michelle Lackovic, Laura Mabee, Abby Schwartz, Yvette Mitchell, Stephanie Moraga-McHaley. 2008. "Acute pesticide poisoning among agricultural workers in the United States, 1998-2005." *American Journal of Industrial Medicine* 51:883–98.
- Cameron L, Carroll P, Hamilton WK. 2018. Evaluation of an intervention promoting emotion regulation skills for adults with persisting distress due to adverse childhood experiences. *Child Abuse & Neglect* 79:423

- Carrasquillo O. 1970. Health Care Utilization. SpringerLink.
https://link.springer.com/referenceworkentry/10.1007/978-1-4419-1005-9_885.
- Centers for Disease Control and Prevention. 2008. Heat-Related Deaths Among Crop Workers —United States, 1992—2006. Morbidity and Mortality Weekly Report 57(4): 649-653. Retrieved on August 1, 2022 online from:
<https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5724a1.htm>
- Centers for Disease Control and Prevention. 2019. "Social Determinants of Health." CDC. 2019.
<https://www.cdc.gov/nchhstp/socialdeterminants/index.html>.
- Centers for Disease Control and Prevention. 2021. Agricultural Safety. The National Institute for Occupational Safety and Health. Washington, DC: Centers for Disease Control and Prevention. Retrieved on August 1, 2022 online from:
<https://www.cdc.gov/niosh/topics/aginjury/default.html>.
- Centers for Disease Control and Prevention. 2022. 'Trends in number of COVID-19 cases and deaths in the US reported to CDC by state-territory. California. https://COVID-19.cdc.gov/COVID-19-data-tracker/#trends_dailycases.
- California Department of Public Health. 2021. "California Birth Defects Monitoring Program." Www.cdph.ca.gov. August 2, 2021.
<https://www.cdph.ca.gov/Programs/CFH/DGDS/Pages/cbdmp/default.aspx>.
- Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wessely S, Wright D, Wallace EP. 1993. Development of a fatigue scale. *J Psychosom Res.* 37:147. doi: 10.1016/0022-3999(93)90081-p. PMID: 8463991
- Chow A, Leo Y-S. 2017. Surveillance of disease: Overview. Measles surveillance.
<https://www.sciencedirect.com/topics/medicine-and-dentistry/basic-reproduction-number>
- Curl CL, Spivak M, Phinney R, Montrose L. 2020. Synthetic pesticides and health in vulnerable populations: Agricultural workers. Current Environmental Health Reports. 7(1):13-29. doi:10.1007/s40572-020-00266-5
- Du Bois WEB. 1901. "The Negro Landholder in Georgia." Bulletin of the Department of Labor 6(35):647–777.
- Du Bois WEB. 1904. "The Negro Farmer." Bulletin of the Department of Labor 8:69–98.
- Du Bois WEB. 2003[1906]. "The Health and Physique of the Negro American." Voices from the Past. American Journal of Public Health 93(2):272-275.

- Du Bois WEB. 2014[1899]. *The Philadelphia Negro: A Social Study*. New York: Oxford University Press.
- El Khayat M, Halwani DA, Hneiny L, Alameddine I, Haidar MA, Habib RR. Impacts of climate change and heat stress on farmworkers' health: A scoping review. *Frontiers in Public Health*. 2022;10. doi:10.3389/fpubh.2022.782811
- Environmental Protection Agency. 2021. <https://www.epa.gov/wildfire-smoke-course/which-populations-experience-greater-risks-adverse-health-effects-resulting>
- Environmental Protection Agency. 2021. <https://www.epa.gov/climate-indicators/climate-change-indicators-drought>
- Eskenazi B, Marks AR, Bradman A, Harley K, Barr DB, Johnson C, Morga N, and Jewell NP. 2007. "Organophosphate pesticide exposure and neurodevelopment in young Mexican-american children." *Environmental Health Perspectives* 115(5):792-798. doi:10.1289/ehp.9828
- Farmworker Justice. 2016. "Hunger amidst Plenty: Food Assistance in Farmworker Communities – Farmworker Justice." Farmworker Justice. July 12, 2016. <https://www.farmworkerjustice.org/blog-post/hunger-amidst-plenty-food-assistance-in-farmworker-communities/>.
- Food and Drug Administration. 2022. COVID testing 2022. <https://www.fda.gov/medical-devices/coronavirus-disease-2019-COVID-19-emergency-use-authorizations-medical-devices/eua-authorized-serology-test-performance>.
- Finch BK, Frank R, Vega WA. 2004. "Acculturation and acculturation stress: A social-epidemiological approach to Mexican migrant farmworkers' health." *International Migration Review* 38(1):236-262. doi:10.1111/j.1747-7379.2004.tb00195.x
- Flores EO, Padilla A. 2020. "Hidden Threat: California COVID-19 Surges and Worker Distress." UC Merced Community and Labor Center Policy Brief. July 2020. Merced, CA: University of California Merced.
- Flores EO, Padilla A, Alatraste-Diaz R, Juarez K. 2022. *Essential Fairness: The Case for Unemployment Benefits for California's Undocumented Immigrant Workers*. UC Merced Community and Labor Center Policy Report. March 2022. Merced, CA: University of California Merced.
- Fujimoto I. 1977. "The Communities of the San Joaquin Valley: The Relation Between Scale of Farming, Water Use, and Quality of Life." Hearings before the Subcommittee on Family Farms, Rural Development and Special Studies of the Committee on Agriculture, 95th Congress, first session. Washington, DC: U.S. Government Printing Office.

- Galarza E. *Strangers in Our Fields*. Washington, DC: Joint United States-Mexico Trade Union Committee, 1957.
- Glied SA, Collins SR, Lin S. (2020). Did The ACA Lower Americans' Financial Barriers To Health Care? A review of evidence to determine whether the Affordable Care Act was effective in lowering cost barriers to health insurance coverage and health care. *Health Affairs*, 39(3), 379-386.
- Goldschmidt W. 1978. "Large-scale Farming and the Rural Social Structure." *Rural Sociology* 43(3):362-366.
- Gubernot DM, Anderson GB, Hunting KL. (2015). Characterizing occupational heat-related mortality in the United States, 2000-2010: an analysis using the Census of Fatal Occupational Injuries database. *American Journal of Industrial Medicine*, 58(2), 203–211. <https://doi.org/10.1002/ajim.22381>
- Guild A, Richards C, Ruiz V. 2016. Out of Sight, Out of Mind: The Implementation and Impact of the Affordable Care Act in U.S. Farmworker Communities. *J Health Care Poor Underserved*. 27(4A):73-82. doi:10.1353/hpu.2016.0183
- Handal AJ, Iglesias-Ríos L, Fleming PJ, Valentín-Cortés MA, O'Neill MS. "Essential" but Expendable: Farmworkers During the COVID-19 Pandemic-The Michigan Farmworker Project. *Am J Public Health*. 2020;110(12):1760-1762.
- Hernandez T, Gabbard S. Findings from the National Agricultural Workers Survey ... <https://www.dol.gov/agencies/eta/national-agricultural-workers-survey/research>. https://www.dol.gov/sites/dolgov/files/ETA/naws/pdfs/NAWS_Research_Report_13.pdf.
- Hobbs M, Cooper M. 2017. "The changing gender diversity of the California vineyard labor force and the implications for grape production." *Catalyst Discovery into Practice*. 1:99-102.
- Jimenez AM. 2021. "The Legal Violence of Care: Navigating the US Health Care System While Undocumented and Illegible." *Social Science & Medicine* (1982) 270:113676–113676. doi: 10.1016/j.socscimed.2021.113676.
- Kasner EJ, Keralis JM, Mehler L, Beckman J, Bonnar-Prado J, Lee SJ, Diebolt-Brown B, Mulay P, Lackovic M, Justin Waltz, Schwartz A, Mitchell Y, Moraga-McHaley S, Roisman R, Gergely R, Calvert GM. 2012. "Gender differences in acute pesticide-related illnesses and injuries among farmworkers in the United States, 1998–2007." *American Journal of Industrial Medicine* 55:571–83.
- Katz MH, Chokshi DA. 2018. "The 'Public Charge' Proposal and Public Health: Implications for Patients and Clinicians." *JAMA*. 320(20):2075-2076. doi:10.1001/jama.2018.16391

- Katz MJ, Wang C, Nester CO, et al. 2021. A valid telephone screen for cognitive impairment in diverse community samples. Alzheimer's Dementia 13:e12144.
<https://doi.org/10.1002/dad2.12144>
- Katznelson I. 2013. *Fear Itself: The New Deal and the Origins of Our Time*. New York: Liveright.
- Keifer M, Salazar MK, Connon C. An exploration of Hispanic Workers' perspectives about risks and hazards associated with Orchard Work. *Family & Community Health*. 2009;32(1):34-47. doi:10.1097/01.fch.0000342815.49649.46
- Kerr C. 1983. "Preface" in *On the Ground in the Thirties* by Paul S. Taylor. Salt Lake City, UT: Petergrine Smith.
- Kidsdata News. 2016. "Infants Born at Low Birthweight." Kidsdata.org. 2016.
<https://www.kidsdata.org/topic/301/low-birthweight/table#fmt=91&loc=2>.
- Kroenke K, Spitzer RL, and Williams JB. 2003. The Patient Health Questionnaire-2: Validity of a Two-Item Depression Screener. Medical Care 41:1284.
- Liew Z, von Ehrenstein OS, Ling C, Yuan Y, Meng Q, Cui X, Park AS, Uldall P, Olsen J, Cockburn M, and Ritz B. 2020. "Ambient Exposure to Agricultural Pesticides during Pregnancy and Risk of Cerebral Palsy: A Population-Based Study in California" *Toxics* 8(3):52.
<https://doi.org/10.3390/toxics8030052>
- Light I. 2006. *Deflecting Immigration: Networks, Markets, and Regulation in Los Angeles*. New York: Russell Sage Foundation.
- Lighthall D. 2001. "The Poor Health of Farm Workers." *Western Journal of Medicine* 175 (4): 223–24. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071557/>.
- Lin S, Lin Z, Yanqiu O, Soim A, Srishti S, Lu Y, Sheridan S, Luben TJ, Fitzgerald E, Bell E, Shaw GM, Reefhuis J, Langlois PH, Romitti P, Feldkamp ML, Malik S, Pantea C, Nayak S, Hwang SA, Browne M. 2018. "Maternal ambient heat exposure during early pregnancy in summer and spring and congenital heart defects - A large US population-based, case-control study." *Environment International* September 2018(118):211-221. doi: 10.1016/j.envint.2018.04.043.
- López-Cevallos DF, Escutia G, González-Peña Y, Garside LI. Cardiovascular disease risk factors among Latino farmworkers in Oregon. *Annals of Epidemiology*. 2019;40.
doi:10.1016/j.annepidem.2019.10.002
- Lumley SF, Wei J, O'Donnell D, Stoesser NE, Mathews PC, Howarth A, Hetch SB, Maredon BD, Cox S, James T, Peck LJ, Ritter TG, de Toledo A, Cornell RJ, Jones EY, Stuart DI, Screatton G, Ebner D, Hoosdally S, Crook DW, Conton CP, Pouwels KB, Walker AS, Peto TEA, Walker TM,

- Jeffery K, Eyre DW. 2021. The duration, dynamics, and determinants of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibody responses in individual healthcare workers. Clinical Infectious Diseases 73:e699.
- Lusk JL, Chandra, R. 2021. Farmer and farm worker illnesses and deaths from COVID-19 and impacts on agricultural output. *Plos one*, 16(4), e0250621.
- March of Dimes. 2022. "Preterm Birth: California, 2017-2020 Average." March of Dimes | PeriStats. January 2022.
<https://www.marchofdimes.org/peristats/data?reg=99&top=3&stop=60&lev=1&slev=4&obj=18&cmp=99&sreg=06>.
- Markides KS, Coreil, J. 1986. The Health of Hispanics in the Southwestern United States: An Epidemiological Paradox. Washington, DC: Public Health Reports 101(3):253-265.
- Markides KS, Eschbach, K. 2005. "Aging, Migration, and Mortality: Current Status of Research on the Hispanic Paradox." *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* 60(2):68-75
- Marrow HB, and Joseph TD. 2015. "Excluded and Frozen Out: Unauthorised Immigrants' (Non)Access to Care after US Health Care Reform," *Journal of Ethnic and Migration Studies* 41(14):2253-2273.
- Mora AM, Lewnard, JA, Kogut K, Rauch, S. A., Hernandez, S., Wong, M. P., ... & CHAMACOS-Project-19 Study Team. 2021. Risk factors associated with SARS-CoV-2 infection among farmworkers in Monterey County, California. *JAMA network open*, 4(9), e2124116-e2124116
- Mora AM, Lewnard, JA, Rauch S, Kogut K, Jewell N, Cuevas M, Eskenazi, B. 2022. Impact of COVID pandemic on California farmworkers' mental health and food security. *Journal of Agromedicine*, 1-12.
- Morris A. 2015. *The Scholar Denied: W.E.B. Du Bois and the Birth of Modern Sociology*. Berkeley, CA: University of California Press.
- Morris CE, Gonzales RG, Hodgson MJ, Tustin AW (2019). Actual and simulated weather data to evaluate wet bulb globe temperature and heat index as alerts for occupational heat-related illness. *Journal of occupational and environmental hygiene*, 16(1), 54–65.
<https://doi.org/10.1080/15459624.2018.1532574>
- Moyce S, Mitchell D, Armitage T, Tancredi D, Joseph J, Schenker, M. Heat strain, volume depletion and kidney function in California agricultural workers *Occupational and Environmental Medicine* 2017;74:402-409.

- Nakano Glenn E. 2003. *Unequal Freedom: How Race and Gender Shaped American Citizenship and Labor*. Cambridge, MA: Harvard University Press.
- Negi, NJ. 2011. Identifying Psychosocial Stressors of Well-Being and Factors Related to Substance Use Among Latino Day Laborers. *J Immigrant Minority Health* 13, 748–755.
- NICHD. 2017. “What Are Menstrual Irregularities?” <https://www.nichd.nih.gov/>. January 31, 2017.
<https://www.nichd.nih.gov/health/topics/menstruation/conditioninfo/irregularities#:~:text=For%20most%20women%2C%20a%20normal.>
- NAWS, 2021. Findings from the National Agricultural Workers Survey (NAWS) 2017–2018 ...
[https://wdr.doleta.gov/research/fulltext_documents/etaop2021-22%20naws%20research%20report%2014%20\(2017-2018\)_508%20compliant.pdf](https://wdr.doleta.gov/research/fulltext_documents/etaop2021-22%20naws%20research%20report%2014%20(2017-2018)_508%20compliant.pdf)
- Nodín Valdés, D. 1994. "Machine Politics in California Agriculture, 1945-1990s." *Pacific Historical Review* 63(2):203-224.
- O'Connell D, Peters SJ. 2021. *In the Struggle: Scholars and the Fight Against Industrial Agribusiness in California*. New York: New Village Press.
- Office of Disease Prevention and Health Promotion. 2022. “Social Determinants of Health - Healthy People 2030.” Health.gov. 2022. <https://health.gov/healthypeople/priority-areas/social-determinants-health>.
- Ortega AN, McKenna RM, Kemmick Pintor J, et al. 2018. Health Care Access and physical and behavioral health among undocumented Latinos in California. *Medical Care*. 56(11):919-926. doi:10.1097/mlr.0000000000000985
- Quandt SA, Brooke C, Fagan K, Howe A, Thornburg TK, Mccurdy SA. 2015. “Farmworker Housing in the United States and Its Impact on Health.” *New Solutions : A Journal of Environmental and Occupational Health Policy : NS* 25 (3): 263–86.
<https://doi.org/10.1177/1048291115601053>.
- Quintyne KI, Sheridan, A, Kenny, P, O'Dwyer, M. (2020). Air Quality and Its Association with Cardiovascular and Respiratory Hospital Admissions in Ireland. *Irish medical journal*, 113(6), 92.
- Rawal S, Hoffman HJ, Honda M, Huedo-Medin TB, Duffy VB. 2015. The Taste and Smell Protocol in the 2011-2014 US National Health and Nutrition Examination Survey (NHANES): Test-Retest Reliability and Validity Testing. *Chemosens Percept*. 8:138. doi: 10.1007/s12078-015-9194-7. Epub 2015 Aug 7. PMID: 27833669; PMCID: PMC5100746

- Reid A, Schenker MB. 2016. "Hired farmworkers in the US: Demographics, work organisation, and services." *American Journal of Industrial Medicine* 59(8):644–655.
- Riley AR, Chen YH, Matthay EC, Glymour MM, Torres JM, Fernandez A, and Bibbins-Domingo K. 2021. "Excess mortality among Latino people in California during the COVID-19 pandemic." *SSM - Population Health*, Volume 15, 100860, ISSN 2352-8273, <https://doi.org/10.1016/j.ssmph.2021.100860>.
- Rural Health Information Hub. 2018. "Ecological Models - Rural Health Promotion and Disease Prevention Toolkit." Ruralhealthinfo.org. 2018. <https://www.ruralhealthinfo.org/toolkits/health-promotion/2/theories-and-models/ecological>.
- Saenz R, Garcia MA. 2021. "The Disproportionate Impact of COVID on Older Latino Mortality: The Rapidly Diminishing Latino Paradox." *The Journals of Gerontology* 76(3):e81-e87.
- Shaw FE, Asomugha CN, Conway PH, Rein AS. The Patient Protection and Affordable Care Act: Opportunities for Prevention and Public Health. *The Lancet*. 2014;384(9937):75-82. doi:10.1016/s0140-6736(14)60259
- Taningco MT. 2007. "Revisiting the Latino Health Paradox." Policy Brief. Tomas Rivera Policy Institute. Los Angeles, CA: University of Southern California.
- Taylor PS. 1983. *On the Ground in the Thirties*. Salt Lake City, UT: Peregrine Smith.
- Thomas MD, Matthay EC, Duchowny KA, Riley RA, Khela H, Chen YH, Bibbins-Domingo K, and Glymour MM. 2022. "A descriptive analysis of 2020 California Occupational Safety and Health Administration COVID-19-related complaints." *SSM - Population Health*, Volume 17, 101016, ISSN 2352-8273, <https://doi.org/10.1016/j.ssmph.2021.101016>.
- Tigchelaar M. et al 2020 Work adaptations insufficient to address growing heat risk for U.S. agricultural workers. *Environ. Res. Lett.* 15 094035.
- Tonelli S. 2016. Musculoskeletal Symptoms Among Iowa Farmers and Farmworkers. Dissertation Thesis. University of Iowa. <https://doi.org/10.17077/etd.03vkfy1y>
- United States Environmental Protection Agency. 2009. Integrated Science Assessment (ISA) for Particulate Matter. Final Report EPA/600/R-08/139F, 2009. Washington DC: US Environmental Protection Agency.
- United States Department of Labor. (2021). Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings Rulemaking. <https://www.osha.gov/heat-exposure/rulemaking>

- U.S. Bureau of Labor Statistics. 2020a. Nonfatal occupational injuries and illnesses data by industry. Retrieved on August 1, 2022 online from: https://www.bls.gov/iif/oshwc/osh/os/19summ1_06.xlsx
- U.S. Bureau of Labor Statistics. 2020b. Fatal occupational injuries in California. Retrieved on August 1, 2022 online from: <https://www.bls.gov/iif/oshwc/cfoi/tgs/2019/iiffw06.htm>
- Van Natta M. 2019. "First Do No Harm: Medical Legal Violence and Immigrant Health in Coral County, USA." *Social Science & Medicine* (1982) 235:112411–112411. doi: 10.1016/j.socscimed.2019.112411.
- Van Natta M, Burke, NJ., Yen, IH, Fleming, MD., Hanssmann, CL, Rasidjan, MP, and Shim, JK. 2019. "Stratified Citizenship, Stratified Health: examining Latinx legal status in the U.S. healthcare safety net." *Social Science & Medicine*. Doi: <https://doi.org/10.1016/j.socscimed.2018.10.024>
- Von Ehrenstein OS, Ling C, Cui X, Cockburn M, Park AS, Yu F, Wu J, Ritz B. 2019. "Prenatal and infant exposure to ambient pesticides and autism spectrum disorder in children: population based case-control study." *BMJ* Mar 20:364:l962. doi: 10.1136/bmj.l962
- Ware Jr JE, Kosinski M, and Keller SD. 1996. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care* 34: 220.
- Worby PA, Organista KC. Alcohol Use and Problem Drinking Among Male Mexican and Central American Im/migrant Laborers: A Review of the Literature. *Hispanic Journal of Behavioral Sciences*. 2007;29(4):413-455. doi:10.1177/0739986307308765
- Zambrana R, Carter-Pokras O. 2010. "Role of Acculturation Research in Advancing Science and Practice in Reducing Health Care Disparities Among Latinos." *American Journal of Public Health* 100(1):18-23.
- Zúñiga V, Hernández-León R. 2005. *New Destinations: Mexican Immigration in the United States*. New York: Russell Sage Foundation.

Appendix

APPENDIX A: Defining Agricultural Workers

One important aspect of a study of agricultural workers is accounting for the various forms of labor that agricultural workers participate in. In this section we discuss our definition of agricultural workers, as well as recent historical changes that may be reducing the number of agricultural workers.

Agricultural production is comprised of different activities, from tractor operators that prepare soil, plant, and weed, to farmworkers that work in nurseries or harvest various crops (e.g., berries, fruits, and vegetables). After harvesting, sorting, and processing, some crops require additional labor. In fruit and vegetable production, packing may be based on crops or industry practices to sell crops off by skipping packing during harvesting. Large producers may own their own packing houses, while smaller producers rely on independent packing houses.

We define agricultural work based on definitions provided by the North American Industrial Classification System (NAICS). The NAICS defines farm work as consisting of codes 111 (Crop Production), 112 (Animal Production), and 115 (Support Activities for Agriculture and Forestry).¹ In this definition, crop production includes not just farming outdoors, but also working in nurseries producing crops. Support Activities include sectors such as sorting, grading, cleaning, packing, and packaging fruits and vegetables. However, our definition of an agricultural worker excludes code 112 (Animal Production). We nonetheless use the term “farmworker” interchangeably with “agricultural worker” in this report.

We estimate the California agricultural worker population at 255,707. These estimates are derived from American Community Survey (ACS) 2019, Public Use Microdata Series (PUMS). The ACS provides data on one of every 100 American households every year and is the nation’s

¹ Excluding codes 1125 (Aquaculture), 1152 (Support Activities for Animal Production), and 1153 (Support Activities for Forestry).

most representative annual survey on demographics, living and working conditions at the local and state level. Our estimates include workers who worked in the NAICS industry codes above, specifically in three occupation codes related to fieldwork: 6005 (First Line Supervisors), 6040 (Graders and Sorters), and 6050 (Agricultural Workers).

Two other data sources with smaller sample sizes and different methodologies provide estimates on California's farmworker population: the Quarterly Census of Employment and Wages (QCEW), and the Employment Development Department (EDD). While not representative of workers, we present these figures for added context in the appendices.

Various historical trends have contributed to a shrinking farmworker population, however. Mexico-U.S. migration, a major source of agricultural labor, has been in decline nationally over the past four decades. In part due to soaring housing costs, many migrants living in California have been relocating to other states in recent decades (Light 2006), particularly those within rural areas (Zúñiga and Hernández-León 2005).

Climate change has also led to agricultural industry-wide job loss in California. California's stretch of short-term droughts, from 2000 to the present, have triggered water allocation cutbacks. In addition, the ongoing implementation of the 2014 Sustainable Groundwater Management Act (SGMA) will regulate California's groundwater, agriculture's last source of water, for the first time in the state's history. This may also lead to reductions in industrial farming and jobs.

APPENDIX B: California Agricultural Worker Estimates

The QCEW provides employer-reported data on farmworker employment and wages. The 2015 QCEW estimated the agricultural workers at 421,300. This data was based on the number of jobs, however, not the number of workers. In addition, the 2015 QCEW data provides the estimated annual earnings of average full-time employees in California agriculture. By dividing total wages by average employment, the QCEW estimated that annual earnings of an average full-time employee in California agriculture were \$30,300 (EPI Report). However, based on their data collection method and employee criteria, QCEW undercounts workers and thus overstates average wages.

An analysis of 829,000 social security numbers reported to 2014 farm employers estimated a ratio of about two workers for every year-round farm job (Martin et al. 2017). In 2014, such estimates suggested annual earnings for a full-time worker in agriculture was \$19,000, \$16,500 for primary farmworkers, and \$12,719 for crop support workers (Martin et. Al, 2017). Under this method, aggregating three NAICS codes 1112 (Vegetable and Melon Farming), 1113 (Fruit and Tree Nut Farming), and 1151 (Support Activities for Crop Production), produces an estimate of 590,588 agricultural workers.

The 2020 Employment Development Department (EDD), like the QCEW, estimates annual average job positions, not people. In 2020, the EDD estimated total employment in agriculture at 405,800; of this, total production was 186,400, and total crop production was 158,400.

APPENDIX C: Defining Agricultural Employers

Most California agricultural workers work on large industrial farms (whether family-owned or not), and most often this is through third-party farm labor contractors. However, there are several terms used to refer to agricultural employers and farms, and we use some of these terms interchangeably. In this section we explain these distinctions.

The term “grower,” refers to a farm owner who engages exclusively in crop production, whereas the term “farmer” refers to one who engages in animal, dairy and/or crop production. We use these terms interchangeably, as agricultural workers may work for either farmers or growers. Yet, most agricultural workers are not directly employed by farmers/growers but by third-party FLCs.

In March 2021, the United States Department of Labor reported 5,357 licensed FLCs in California.² Farm owners’ contract with FLCs to offload risk, such as managing labor-management costs and worker liability. In turn, FLCs recruit, hire, manage and pay workers on contract to perform agriculture-related work on farms. The complex arrangement is not to the benefit of workers, however. In 2014, workers hired by FLCs had lower average earnings (\$12.55 per hour) compared with those directly employed by farmers (\$14.00 per hour) (EPI, Phil Martin).

Lastly, we also refer to the term “large industrial farms” in our study. We use this term to denote large farms (with over \$250,000 in annual gross revenues) engaged in commercial business, regardless of whether they are a family farm or non-family farm. The United States Department of Agriculture (USDA) Census of Agriculture, an official federal agency, excludes nonfamily corporations, cooperatives, or farms with hired managers (such as FLCs) from their definition of family farms.³ The USDA estimates that small (with gross revenue under \$250,000)

² See <https://www.dol.gov/agencies/whd/agriculture/mspa/farm-labor-contractors> for the full list of currently licensed FLCs in the US, last updated on March 2021.

³ See USDA National Institute of Food and Agriculture (2022) for definitions of size of farms and estimates of large farms’ share of industry production. <https://www.nifa.usda.gov/family-farms>

family farms account for 72 percent of 70,000 California farms. (The California Farm Bureau, a private business association, suggests a higher percentage of farmers see themselves as small family farmers, though these estimates are unofficial.)

APPENDIX D: Community-Engaged Research

The UC Merced Community and Labor Center’s mission is to conduct research, education and public service that builds capacity among community and labor organizations serving the most disadvantaged workers in the San Joaquin Valley and beyond. We use the term “community-engaged research” to describe our methodological approach, but fundamentally our approach was rooted in capacity-building more than research. The practices we most closely followed derive from American civic traditions in the fields of community and labor (which intersect with the major disciplines in the background of the study’s principal investigators: public health, sociology, and community studies), and our approach was to treat this study as an opportunity to build civic capacity and provide a public good to the region.

We dedicated time and effort to communicating with partnering organizations—always “moving at the speed of trust.” We recognized from the beginning the deep disadvantage that farmworkers experience, and the vital role that farmworker-centered organizations play in their lives. We sought to engage farmworker organizations for this reason, through every facet of the research process—not simply data collection.

In the following, we describe in greater detail our engagement with the CAB around the major phases in the development of the study: interviewer training, ongoing input into the survey, creation of the survey platform, study recruitment, data collection, and dissemination.

Interviewer Training

Implementing the FWHS during COVID-19 presented both challenges and opportunities. Community engagement was a key strategy in the FWHS. To uphold COVID-19 safety protocols, five tailored trainings with community interviewers were conducted over Zoom in June 2021 in

English and Spanish. The training set the foundation for organizations to begin recruitment and survey implementation. The day-long training included the following topics: the purpose of FWHS, social science research ethics (informed consent), interviewing techniques, data quality, COVID-19 protocols, research recruitment, survey instrument, interview protocol, and survey logistics. Study questions were also piloted during this time. In addition to practical and ethical considerations in survey research, attention to data quality was also explicitly and implicitly embedded in training in various ways. Based on community feedback, by July 2021, as the COVID-19 restrictions lowered, twelve (12) in-person survey trainings were conducted in eleven (11) communities using all the safety measures set by the California Department of Public Health and Centers for Disease Control (CDC) of distancing and masking. The list of locations the surveys that CBOs conducted are noted in Table A1 below.

Table A1: List of Where Surveys Were Conducted by Organization

Community-based Organization	Where Surveys Were Conducted	Survey Count
Californians for Pesticide Reform (CAPS)	Lindsay	129
Campesinas Unidas Del Valle De San Joaquin	Poplar	130
Central California Environmental Justice Network (CCEJN)	Fresno	122
Central Coast Alliance United for a Sustainable Economy (CAUSE)	Ventura	66
Central Valley Empowerment Alliance, Inc. (CVEA)	Poplar	83
Centro Binacional para el Desarrollo Indígena Oaxaqueño (CBDIO)	Sonoma	65
Lideres Campesinas	Sonoma	82
Training Occupational Development Educating Communities (TODEC) Legal Center	Coachella	115
United Farm Workers of America (UFW)	Salinas	61
Vo Neighborhood Medical Clinic	El Centro	127
Valley Voices	Hanford	57
Salinas Valley (UCB CERCH & CSVS)	Salinas	205

To complement in-person training and ensure that the study, and surveyors, followed the Institutional Review Board (IRB) protocols for working with human-subject research, surveyors completed online training by Collaborative Institutional Training Initiative (CITI). Online training was available in Spanish, and community organizations provided space and computer access to ensure surveyors could complete training. Once training was completed, surveyors were provided with a certificate of completion. Surveyors reported that the training was interesting and valuable. We also spent two months with the CAB staff and two clinics, conducting multiple trainings in English and Spanish on social science interviewing. Each interviewer took part in two half-day trainings over zoom, and a one-day training in person. Some zoom trainings involved multiple organizations, while our staff traveled to organizations' offices to conduct in-person trainings.

The COVID-19 pandemic was underway during the training for the study. As a result, we received Institutional Review Board approval for human subject's research, as well as university approval for in-person human subject's research. All in-person trainings followed university, local and state public health guidance. Center trainings with CAB staff focused on data collection, but also following COVID-19 safe protocols and all relevant standards.

Ongoing Input into the Survey

Creating opportunities for community feedback was critical to ensure mutual understanding. Language support was key. UC Merced Community and Labor Center staff leading trainings spoke Spanish in order to center the CAB staff. In addition, to ensure data reliability and surveyor proficiency, participants were asked to pilot the survey instrument in Spanish and English during training. By implementing an iterative research process to research, feedback on the survey instrument was elicited from participants based on their direct and indirect experience with farmworkers to increase data validity.

Two cases illustrate how cultural sensitivity and language access increased data validity in our study. First, there are regional variations and colloquialisms in Spanish to workplace terms, such

as type of work, equipment, and health and safety protective gear. Based on community expertise and attention to worker safety, we received feedback that improved data validity for workplace safety questions and the survey instrument in multiple ways (for example, terms about protective materials that were not familiar).

Based on feedback, the research team integrated pictures of workplace equipment, including personal protective equipment, into the survey to clarify important differences such as face coverings, masks, and bandanas and critical equipment like coveralls. Lastly, feedback from organizations that work with Indigenous farmworkers informed the study on essential expanded questions such as women's reproductive health and appropriate methods for conducting interviews in non-written Indigenous languages such as Mixteco and Triqui. The survey was translated in written format in two different languages, Spanish, and Ilocano. These were the preferred languages identified by the interviewers and ensured our study sample was representative of the total farmworker population and comprehensive.

Creation of the Survey Platform

The survey instrument was created and administered using Qualtrics Survey Software. Qualtrics Feature of this survey platform was utilized to ensure accurate data collection. Skip logic and display logic were used to verify if participants were qualified to answer a question based upon their sex, COVID-19 history, or response to a previous question. A question was included at the midpoint of the survey to allow interviewers to finish the second half of the survey at another time due to the length of time required to complete the survey. Interviewers were also provided the option to use the Offline Survey tool that allows for a downloaded version of the survey that can be administered using the Qualtrics Offline App without an internet connection and uploaded to the Qualtrics platform at a later time. Interviewers who opted to utilize this feature were provided with encrypted devices to use the offline features.

Study Recruitment

By mid-2021, the eleven (11) contracted organizations highly experienced working with farmworkers and Indigenous communities fully embarked on the survey recruitment and implementation. Contracted organizations had to be creative and pivot as information on COVID-19 was changing daily, which inevitably prolonged the completion of the survey from a few weeks to months. Community organizations faced many challenges navigating recruitment while functioning above their capacity to support their communities during the COVID-19 pandemic. Reaching this population was challenging as farmworkers worked long hours, commuted to work, took care of children at home, or lost contact. However, the most effective recruitment techniques were word-of-mouth, including: 1) having interviewers who are farmworkers or community members to share about the opportunity to participate in the study, 2) reach out in familiar environments such as local swap meets, COVID-19 vaccine pop-up clinics, worksites and 3) distributing an outreach flyer in English and Spanish, phone calls and referrals.

Interviewers were equipped with tablets and the option to complete the survey in paper form if Wi-fi was not available. Additionally, scale cards with Likert scales, yes/no, and images were provided to help participants answer closed ended questions. After completing the survey, all participants received a \$50.00 gift card (non-digital) to thank them for their participation and time. Based on feedback from the Community Advisory Board, digital gift cards were particularly challenging for rural residents and faced a technology literacy challenge (e.g., access to Wi-fi, email, smartphone, laptop/computer).

Data Collection

The FWHS community-based and participatory approach utilized input and participation from farmworker organizations. Activities included tracking recruitment, surveys with participants, and weekly check-in meetings with organizations.

Community-based organizations involved in data collection met regularly via weekly Zoom meetings that served as a “check-in”, drop in “office hours”. A total of 98 check-in meetings (30-60 minutes) and 44 office hours (2-hour gap periods) were held. The average time of completion for the survey was 1 hour and 24 minutes. All issues with Qualtrics features, survey administration, and participant recruitment were discussed and resolved during weekly meetings with the community-based organizations. The study team members met with interviewers during these meetings to establish rapport and address any questions, concerns, or suggestions regarding the survey tool and overall study. Feedback was noted and presented to the entire study team later for the final decision. The Data Manager presented concerns with data collected from each organization to ensure the quality of the data. Surveys that were split into two parts were matched by the Data Manager and verified during engagement with the community-based organizations. Study team members provided ongoing training for Qualtrics survey software during these meetings and reviewed participant recruitment logs to ensure the quality of the data. All suggestions from the community-based organizations for the survey tool were noted and presented to the study team weekly, and any resulting edits that were made to the survey wording, skip/display logic, or question order were clearly communicated to all participating organizations via their preferred method of communication.

Dissemination

The FWHS also included developing a dissemination workplan that engaged the CAB, as well as health providers and other key stakeholders. As part of this next step, we asked the CAB about their thoughts on dissemination in April of 2022. The objective was to begin discussing issues that members were most interested in, which would help to plan, develop, and implement the most effective community dissemination strategy to share survey findings.

A preliminary dissemination workplan has been drafted with key objectives, strategies, deliverables, and timeframe for completion. Some specific strategies include developing a priority contact list with local, state, and federal agencies, boards, committees and

commissions; scheduling presentations, and meetings with public officials and with leaders who have some influencing power to positively impact the health and working and living conditions; conducting a series of webinars; presenting findings at large state conferences, and at public events such as townhalls, and at other smaller events with targeted groups. The FWHS provides a significant opportunity for UC Merced to advance its public-serving mission, by building civic capacity among one of the state's most disadvantaged workforces. Many of the participants described the importance of the research project. One respondent stated, "I hope there is change towards the workers because there is a lot of abuse, discrimination, and fear." The goal of the study is to inform the development of local, state, and federal health policies that would improve the lives of farmworkers in California's communities and beyond.

APPENDIX E: Members of the Advisory Committee

Name	Organization Name
Van Do-Reynoso (Chair)	Santa Barbara County Department of Public Health
Yissel Barajas	Reiter Affiliated Companies
Catrina Taylor	California Department of Public Health
Joel Diringer	Diringer and Associates
Jeffrey Gilger	University of California Merced
Omar Guzman	Kaweah Delta Medical Center
Mario Martinez	Kaweah Delta Medical Center
Barbara Materna	California Department of Public Health
Jessica Nunez de Ybarra	California Department of Public Health
Cindy Quezada	Sierra Health Foundation
Noe Paramo	California Rural Legal Assistance Foundation
Diana Ramos	California Department of Public Health
Annalisa Robles	The California Endowment
Salvador Sandoval	Merced County Department of Public Health
Marion Standish	The California Endowment
Diana Tellefson Torres	United Farm Workers of America
Samuel Traina	University of California Merced
Ellen Widess	Former Chief of California Division of Occupational Safety and Health
Marjorie Zatz	University of California Merced

APPENDIX F: Community Advisory Board Organizations

Organization Name
Alianza Coachella Valley
California Rural Legal Assistance
California Rural Legal Assistance Foundation
Californians for Pesticide Reform
Campesinas Unidas del Valle de San Joaquin
Central Coast Alliance United for a Sustainable Economy
Centro Binacional para el Desarrollo Indígena Oaxaqueño
Central California Environmental Justice Network
Center for Farmworker Families
Central Valley Empowerment Alliance
Central Valley Immigrant Integration Collaborative
Cultiva La Salud – Fresno
Cultiva La Salud – Merced
Dolores Huerta Foundation
Fresno Asian Business Institute & Resource Center
Lideres Campesinas
Mixteco Indigena Community Organizing Project/Proyecto Mixteco Indigena
The Center on Race, Poverty & the Environment
Training Occupational Development Educating Communities Legal Center
United Farm Workers of America
United Farm Workers Foundation
Valley Voices
Vision y Compromiso
West Modesto Community Collaborative
Westside Family Preservation Services Network
Women’s Farmworker Association

A special mention to Dolores Huerta & Lali Moheno.

APPENDIX G: Farmworkers Research Team

Principal Investigators	
Paul Brown	Public Health, UC Merced
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Rodrigo Alatraste-Diaz	UC Merced Community and Labor Center
Keila Luna Monterrey	UC Merced Community and Labor Center
Reyna Villalobos	UC Merced Community and Labor Center
Sara Patino	UC Merced Community and Labor Center
Karina Juarez	UC Merced Community and Labor Center
Angelica Cardenas	Research Assistant, UC Merced
Anai Murillo-Gonzalez	Research Assistant, UC Merced
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Joel Diringer	Diringer and Associates, Health Sciences Research Institute
Mechelle Perea-Ryan	California State University, Stanislaus
Sandie Ha	Public Health, UC Merced
Katie Kogat	UC Berkeley
Brenda Eskenazi	UC Berkeley
Ana Mora	UC Berkeley
Research Advisory Committee	
Christy Getz	UC Berkeley
Ron Storchlic	UC ANR
Ignacio Abel Santana, Jr.	UCSF
Chris Patty	Kaweah Delta Health Center
Omar Guzman	Kaweah Delta Medical Center
Mario Martinez	Kaweah Delta Medical Center
Alma Torres-Nguyen	Kaweah Delta Medical Center
Ricardo Cisneros	Public Health, UC Merced
Meredith Van Natta	Sociology, UC Merced
Andrea Polonijo	Sociology, UC Merced
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APPENDIX H: Data Files