

Covid-19 disease burden, vaccine uptake, and workplace disease prevention efforts in temporary agricultural workers in the US

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Abstract

Objective. To compare Covid-19 risk factors, self-reported Covid-19 testing and infection, and Covid-19 vaccination among H-2A workers and agricultural workers without H-2A visas. **Materials and methods.** Farmworkers completed surveys at randomly selected sites in five U.S. states from March – August 2022. Descriptive statistics and bivariate analyses were conducted for key characteristics and outcomes. **Results.** A total of 532 H-2A workers and 748 non-H-2A workers participated in the surveys. H-2A workers had significantly higher Covid-19 primary vaccine series uptake than non-H-2A workers (94.7 vs. 65.9%). More than one in four H-2A workers (29.6%) continued working while ill or positive with Covid-19. Fewer H-2A than non-H-2A workers reported receiving a Covid-19 test (51.5 vs. 59.2%, respectively) and a positive test result for Covid-19 (24.5 vs. 44.9% among those tested). **Conclusions.** Although H-2A workers had a lower self-reported prevalence of Covid-19 and higher Covid-19 primary vaccine series uptake than non-H-2A workers, findings such as reporting to work while ill or positive for Covid-19 indicate areas for improvement by binational public health leaders.

Keywords: pandemic; vaccinations; migrant workers; Covid-19; indigenous

Resumen

Objetivo. Comparar los factores de riesgo de Covid-19, las pruebas e infecciones de Covid-19 autoinformadas y la vacunación de Covid-19 entre trabajadores H-2A y trabajadores agrícolas sin visas H-2A. **Material y métodos.** Los trabajadores agrícolas completaron encuestas en sitios seleccionados al azar en cinco estados de EE. UU. de marzo a agosto de 2022. Se realizaron estadísticas descriptivas y análisis bivariados para características y resultados clave. **Resultados.** Un total de 532 trabajadores H-2A y 748 trabajadores que no son H-2A participaron en las encuestas. Los trabajadores H-2A tuvieron una aceptación de la serie primaria de vacunas contra Covid-19 significativamente mayor que los trabajadores que no son H-2A (94.7 vs. 65.9%). Más de uno de cada cuatro trabajadores H-2A (29.6%) continuó trabajando mientras estaba enfermo o positivo con Covid-19. Menos trabajadores H-2A que no H-2A informaron haber recibido una prueba de Covid-19 (51.5 vs. 59.2%) y un resultado positivo de la prueba de Covid-19 (24.5 vs. 44.9% entre los evaluados). **Conclusiones.** Aunque los trabajadores H-2A tuvieron una menor prevalencia autoinformada de Covid-19 y una mayor aceptación de la serie de vacunas primarias contra Covid-19 que los trabajadores sin visa H-2A, los hallazgos, como presentarse al trabajo mientras estaban enfermos o positivos para Covid-19, indican áreas de mejora por parte de los líderes binacionales de salud pública.

Palabras claves: pandemia; vacunas; trabajadores migrantes; Covid-19; indígena

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The H-2A temporary agricultural worker program is a complex and rapidly expanding visa program that allows U.S. agricultural employers who anticipate a shortage of local workers to bring foreign nationals to work for up to 10 months on U.S. farms.¹ The number of H-2A jobs approved by the U.S. Department of Labor has more than tripled in the past ten years, with over 317 000 jobs approved in fiscal year 2021.² Workers with an H-2A visa (H-2A workers) originated from 38 countries in fiscal year 2021, the majority (93%) from Mexico.³

There is limited published information about the sociodemographic characteristics and health, including Covid-19, of H-2A workers. This may partly be due to challenges in reaching H-2A workers and to their exclusion from the National Agricultural Workers Survey,⁴ a key data source on farmworkers in the U.S. However, H-2A workers have been considered at higher risk for Covid-19 because the majority share employer-provided housing and transportation while in the U.S., and most travel long-distance by land to their final U.S. destination.^{5,6} Public transportation carries an increased risk of contracting Covid-19 due to prolonged exposure to others, and H-2A workers from different parts of Mexico may spend hours or even days together on a bus or van, without testing or quarantine procedures observed before departure.^{3,7} Many H-2A workers reside in group housing such as dormitories or barracks, where a large number of individuals share a bedroom, kitchen, or bathroom, which may increase the risk of Covid transmission if masking, sanitation, and isolation procedures are not implemented and followed.⁸ Multiple outbreaks and deaths due to Covid-19 among H-2A workers while working in the U.S. have been reported in journalistic media and scientific literature.^{6,9,10}

During 2022, the National Center for Farmworker Health (NCFH) conducted Farmworker Covid-19 Community Assessments (FCCA) in five communities across the U.S. The objectives of this paper are to describe and compare the sociodemographic characteristics, household and occupational characteristics, self-reported Covid-19 testing and infection, and vaccination uptake among H-2A workers and agricultural workers who do not have an H-2A visa (referred to as non-H-2A workers in this paper). This information may be useful for the design and implementation of Covid-19 outreach and vaccination programs for H-2A workers.

Materials and methods

The FCCA are a series of rapid community assessments (RCA) conducted during the Covid-19 pandemic in 10 farmworker communities in the U.S.: five in Phase 1 (August-December 2021) and another five in Phase 2 (March-

August 2022).¹¹ The objective was to assess farmworkers' attitudes, knowledge and practices concerning Covid-19 prevention, disease incidence, and vaccination uptake. The methods of the FCCA were adapted from the U.S. Centers for Disease Control and Prevention (CDC) RCA mixed methods guide, and included analysis of existing data, a site-based random sample survey of farmworkers, and key informant interviews.¹² The FCCAs were funded by the CDC as part of a multi-year national Covid-19 outreach project focused on farmworkers and led by NCFH. The methods, questionnaire, and qualitative interview guides were based on input from farmworkers, staff of farmworker-serving organizations, researchers, and CDC staff. This paper uses survey data from Phase 2 because it included most participating H-2A workers across the FCCAs. Key informant interviews were also conducted but are not included in this article.

Communities and recruitment

The five Phase 2 FCCA communities were: Colquitt County, Georgia; Sampson County, North Carolina; Weld County, Colorado; Atlantic and Cumberland Counties, New Jersey; and Yakima County, Washington. Atlantic and Cumberland Counties were considered one community because they share an agricultural labor force and similar crops are grown in the two counties. Communities were selected based on having a high number of farmworkers, diversity in agricultural sub-industries, and in geographic location.

Participants were recruited at housing sites, work sites, and community sites (e.g., supermarkets, grocery stores, check cashing stores, international remittance businesses, restaurants, labor bus stops, laundromats). There was a goal of visiting 10-30 sites in each community. If more than 30 sites were identified in a community, a stratified random sample of housing, work, and community sites was selected from a sampling list created with information from key informant interviews, data from registered farm labor housing and H-2A worksites and housing, and a listing of farms with five or more employees in the AtoZ private business database.¹³ The target sample size per community was 300 surveys. At each selected location, interviewers were instructed to recruit every n^{th} person (depending on the number of potential participants and desired number of interviews) in a group or the first ones encountered.

Eligibility criteria

All participants had to be 18 years of age or older and work or reside in the selected five communities. Survey participants had to have worked in agriculture (North

American Industrial Classification System codes 111, 1111, 112, 1121)¹¹ for at least one day or more since March 15, 2020 and they could not employ other workers as employees or subcontractors. Prison farm laborers were also excluded.

Data collection

Surveys were orally administered face-to-face by trained data collection staff from NCFH and local farmworker-serving organizations. Surveys were administered in English, Spanish, Haitian Creole, or Mixteco. Infrequently, surveys were administered with an *ad-hoc* adult

interpreter for participants who spoke other languages and were not fluent in Spanish or English. Participant responses were entered into an offline electronic data collection form built using Kobo Toolbox.¹⁴ All survey participants received a pre-activated 30 USD gift card upon completion of the survey.

Measurement of variables

Sociodemographic variables are listed in table I.¹⁵ All information was self-reported. Participants were categorized as Indigenous if they spoke an Indigenous language as a child or as an adult or identified their

Table I
SOCIODEMOGRAPHICS OF FARMWORKERS WITH AND WITHOUT H-2A TEMPORARY WORK VISAS SURVEYED DURING FARMWORKER COVID-19 COMMUNITY ASSESSMENTS, IN SELECTED COUNTIES IN U.S. STATES OF COLORADO, GEORGIA, NORTH CAROLINA, NEW JERSEY, AND WASHINGTON. MARCH-AUGUST 2022

County	H-2A workers N=532 41.6%	Non-H-2A workers N=748 58.4%	P-Value
	% (95% confidence interval)	% (95% confidence interval)	
Weld County, Colorado	13.0 (10.2, 16.1)	20.3 (17.5, 23.4)	<0.0001
Colquitt County, Georgia	30.5 (26.6, 34.6)	12.6 (10.3, 15.2)	
Sampson County, North Carolina	33.3 (29.3, 37.5)	20.9 (18.0, 24.0)	
Atlantic and Cumberland Counties, New Jersey	11.8 (9.2, 14.9)	19.0 (16.2, 22.0)	
Yakima County, Washington	11.5 (8.9, 14.5)	27.3 (24.1, 30.6)	
Sex			<0.0001
Female	1.9 (0.9, 3.4)	35.8 (32.4, 39.4)	
Male	98.1 (96.6, 99.1)	64.2 (60.6, 67.6)	
Age			<0.0001
18-25	23.1 (19.5, 27.0)	14.1 (11.6, 16.9)	
26-54	72.6 (68.5, 76.4)	70.9 (67.4, 74.2)	
55+	4.3 (2.7, 6.5)	15.0 (12.4, 17.8)	
Ethnicity			0.3107
Hispanic/Latine	95.7 (93.6, 97.2)	93.7 (91.7, 95.3)	
Not Hispanic/Latine	4.1 (2.6, 6.2)	6.0 (4.4, 8.0)	
Other	0.2 (0.0, 1.0)	0.3 (0.0, 1.0)	
Racially or linguistically Indigenous			<0.0001
Yes	26.1 (22.3, 30.3)	45.5 (41.3, 49.8)	
No	73.9 (69.7, 77.7)	54.5 (50.2, 58.7)	
Birth place			<0.0001
Mexico	99.8 (99.0, 100.0)	79.4 (76.1, 82.3)	
Central America	0.00	7.1 (5.3, 9.3)	
United States	0.00	7.1 (5.3, 9.3)	
Other	0.2 (0.00, 1.1)	6.5 (4.8, 8.6)	
Languages spoken			
Spanish	98.7 (97.3, 99.5)	98.1 (96.9, 99.0)	0.4404
English	7.5 (5.4, 10.1)	22.7 (19.8, 25.9)	<0.0001

(continues...)

(continuation)			
Mesoamerican Indigenous language	6.6 (4.6, 9.0)	13.9 (11.5, 16.6)	<0.0001
Haitian Creole/Patois	0.2 (0.0, 1.0)	1.9 (1.0, 3.1)	0.0058
Other language	3.0 (1.7, 4.8)	2.9 (1.9, 4.4)	0.9451
Type of housing			<0.0001
Trailer/mobile home	20.9 (17.5, 24.6)	36.2 (32.8, 39.8)	
Apartment	3.6 (2.2, 5.5)	16.7 (14.1, 19.6)	
Dormitories/barracks	48.5 (44.2, 52.8)	13.5 (11.1, 16.2)	
Garage/outbuilding/shed	0.2 (0.0, 1.0)	0.5 (0.2, 1.4)	
Hotels	5.8 (4.0, 8.2)	1.1 (0.5, 2.1)	
House	20.3 (17.0, 24.0)	31.6 (28.2, 35.0)	
Other	0.8 (0.2, 1.9)	0.4 (0.1, 1.2)	
Overcrowded housing*			0.0007
Yes	80.8 (77.1, 84.0)	72.5 (69.1, 75.7)	
No	19.3 (16.0, 22.9)	27.5 (24.3, 30.9)	
Transport to work			<0.0001
Bus/truck/van of the boss or labor bus	80.5 (76.8, 83.8)	12.4 (10.1, 15.0)	
Drive a car	4.2 (2.6, 6.3)	52.8 (49.1, 56.4)	
Ride in the car of a relative, coworker, or friend	5.1 (3.4, 7.4)	9.5 (7.4, 11.8)	
Walk or ride a bicycle	2.7 (1.5, 4.4)	2.7 (1.7, 4.1)	
With a <i>ratero</i> ‡	7.6 (5.5, 10.2)	22.7 (19.7, 25.9)	
Transport to work with non-household members			0.2544
Yes	53.8 (49.4, 58.1)	50.5 (46.9, 54.2)	
No	46.2 (41.9, 50.6)	49.5 (45.8, 53.1)	

* The definition of an overcrowded household follows the U.S. Census definition, which is a ratio of greater than one for the ratio of persons per room (excluding bathrooms, laundry rooms and garages).

‡ Popular term derived from "ride," is the Spanish word commonly used for a person who charges a fee for providing a ride to work. Most commonly used by low-wage workers.¹⁵

race as Indigenous/Alaskan Native/American Indian.¹² Languages spoken as a child and as an adult were both captured as some Indigenous Mesoamerican persons stop speaking their native language in adulthood. Participants that had moved away from their home within the last year for work in agriculture were categorized as migratory workers. Immigration status was categorized as H-2A visa, U.S. citizen, legal permanent resident, other type of visa (e.g., H-2B temporary nonagricultural worker visas, nonimmigrant NAFTA Professional [TN] visa), and no U.S. work authorization, based on the immigration status the participant reported at the time of the interview. For analysis purposes, immigration status was dichotomized into H-2A workers and non-H-2A workers (all other workers).

Participants were asked how many family members and how many non-family members lived in their home or in the building they lived in; these numbers were summed for a total number of persons in the household and divided by the number of rooms in the household,

excluding bathrooms, laundry rooms, and garages. Overcrowded housing was defined as having more than one person in the household per room.¹⁶

Variables related to Covid-19 vaccination, illness, and testing are listed in tables II and III. Participants were asked to report if they knew or suspected they ever had Covid-19, if they had received a Covid-19 test and if that test result was positive. Percent positivity among H-2A and non-H-2A workers was calculated by dividing the number of individuals who reported a positive test result by the number of participants who reported receiving a Covid-19 test. Participants were not asked to distinguish if they had Covid-19 or were tested in the U.S. or in their country of origin. Completion of the primary Covid-19 series was defined as receiving the number of doses recommended by the manufacturer. That is, one dose of the Janssen/Johnson & Johnson or CanSino vaccine or two doses of another World Health Organization or U.S. Food and Drug Administration approved vaccine. Reception of

Table II
COVID-19 DISEASE, TESTING, AND ISOLATION MEASURES AND COVID-19 VACCINATION UPTAKE REPORTED BY FARMWORKERS WITH AND WITHOUT H-2A TEMPORARY WORK VISAS SURVEYED DURING FARMWORKER COVID-19 COMMUNITY ASSESSMENTS, IN SELECTED COUNTIES IN U.S. STATES OF COLORADO, GEORGIA, NORTH CAROLINA, NEW JERSEY, AND WASHINGTON. MARCH-AUGUST 2022

	H-2A workers N=532 41.6%	Non-H-2A workers N=748 58.4%	P-Value
Knew or thought they had Covid-19 disease	% (95% confidence interval)		<0.0001
Yes	25.8 (22.1, 29.8)	36.7 (33.1, 40.3)	
No	74.2 (70.2, 78.0)	63.4 (59.7, 66.9)	
Received test for Covid-19			0.0068
Yes	51.5 (47.2, 55.9)	59.2 (55.5, 62.7)	
No	48.5 (44.2, 52.8)	40.8 (37.3, 44.5)	
Tested positive for Covid-19*	24.5 (19.5, 30.1)	44.9 (40.2, 49.8)	<0.0001
Actions taken while positive or symptomatic with Covid-19‡			
Isolated from family and/or roommates	69.2 (60.0, 77.4)	72.5 (66.5, 77.9)	0.5165
Wore a mask or face covering	92.3 (85.9, 96.4)	91.0 (86.8, 94.2)	0.6793
Participated in social gatherings	7.8 (3.6, 14.3)	6.7 (4.0, 10.5)	0.6936
Sought medical care	43.9 (34.6, 53.5)	47.5 (41.2, 53.8)	0.5199
Continued working	29.6 (21.4, 38.8)	14.9 (10.8, 19.9)	0.0010
Covid-19 vaccine primary series			<0.0001
Completed [§]	94.7 (92.5, 96.5)	65.9 (62.4, 69.3)	
Partially completed	4.1 (2.6, 6.2)	5.1 (3.6, 6.9)	
Not completed	1.1 (0.4, 2.4)	29.0 (25.8, 32.4)	
Covid-19 vaccine booster [#]			0.0476
Yes	51.7 (47.1, 56.2)	45.0 (40.1, 50.0)	
No	48.3 (43.8, 52.9)	55.0 (50.0, 59.9)	
Covid-19 vaccination location [#]			
At the work site in the U.S.	43.0 (38.7, 47.4)	15.0 (12.0, 18.4)	<0.0001
At a migrant/community health center in the U.S.	9.6 (7.2, 12.5)	32.5 (28.5, 36.7)	<0.0001
At another type of clinic in the U.S.	5.00 (3.3, 7.2)	11.0 (8.4, 14.0)	0.0004
At a pharmacy in the U.S.	1.7 (0.8, 3.3)	13.1 (10.3, 16.3)	<0.0001
In another country	26.9 (23.1, 30.9)	8.1 (5.9, 10.8)	<0.0001
At a community event in the U.S.	9.0 (6.7, 11.8)	17.5 (14.3, 21.0)	<0.0001
At some other location in the U.S.	4.2 (2.7, 6.3)	2.5 (1.3, 4.2)	0.1231

* Among those who reported being tested for Covid-19 (N=711; H-2A workers=272, Non-H-2A workers=439).

‡ Among those who suspected they had Covid-19 or had received a positive Covid-19 test result (N=398; H-2A workers= 133, Non-H-2A workers=265). Categories are not mutually exclusive; percentages may not sum to 100.

§ Completed series includes respondents who received one dose of the Janssen/Johnson and Johnson vaccine or CanSino vaccine, or two doses of any Covid-19 vaccine approved by the U.S. Food and Drug Administration or the World Health Organization.

Among those who indicated vaccination for Covid-19 (N=1,057; H-2A workers=526, Non-H-2A workers=531).

a booster vaccine was based on the number of doses the participant reported receiving and which type(s) of vaccines they received.

Statistical analysis

This analysis was limited to farmworkers who had reported their immigration status during the interview. Survey data was cross-tabulated by immigration status (H-2A and non-H-2A workers). The proportions from these cross-tabulations are reported here, along with Clopper-Pearson (exact) binomial confidence intervals. Chi square tests were used to test associations. Their *p*-values are reported and were interpreted using a significance level of 0.05. In the text of this article, we refer to these differences as “significant”. When necessary, we include language stating that there were no significant differences between the groups being compared. For variables where a skip pattern was used in the ques-

tionnaire, proportions have been calculated using only the sub-sample of workers to whom the question was asked. These denominators are denoted below each table, as applicable.

To better understand the impact of workers without authorization to work on vaccination statistics, a sub-analysis was conducted using a three-category immigration status variable: workers with H-2A visas, workers without authorization to work in the U.S., and other workers without H-2A visas. This three-category variable was cross-tabulated by vaccination variables.

All analyses were conducted using SAS version 9.4 (SAS Institute Inc).

Human subjects considerations

All surveys and interviews were completely anonymous. Participants were provided with a verbal informed consent that gave an overview of the type of data collected

Table III
COVID-19 VACCINATION AND OTHER PREVENTIVE MEASURES REPORTED BY FARMWORKERS WITH AND WITHOUT H-2A TEMPORARY WORK VISAS SURVEYED DURING FARMWORKER COVID-19 COMMUNITY ASSESSMENTS (WORKERS WITHOUT WORK AUTHORIZATION BROKEN OUT), IN SELECTED COUNTIES IN U.S. STATES OF COLORADO, GEORGIA, NORTH CAROLINA, NEW JERSEY, AND WASHINGTON. MARCH-AUGUST 2022

	H-2A workers N=532 41.6%	Workers without work authorization N=510 39.8%	Non-H-2A workers with other type of work authorization N=238 18.6%	P-Value
	% (95% confidence interval)	% (95% confidence interval)	% (95% confidence interval)	
Covid-19 primary series				<0.0001
Completed*	94.7 (92.5, 96.5)	59.0 (54.6, 63.3)	80.7 (75.1, 85.5)	
Partially completed	4.1 (2.6, 6.2)	6.5 (4.5, 9.0)	2.1 (0.7, 4.8)	
Not completed	1.1 (0.4, 2.4)	34.5 (30.4, 38.8)	17.2 (12.7, 22.6)	
Covid-19 booster [‡]				<0.0001
Yes	51.7 (47.1, 56.2)	33.5 (27.8, 39.4)	66.9 (58.5, 74.6)	
No	48.3 (43.8, 52.9)	66.5 (60.6, 72.2)	33.1 (25.4, 41.5)	
Covid-19 vaccination location [‡]				
At work in the U.S.	43.0 (38.7, 47.4)	14.0 (10.4, 18.2)	16.8 (11.8, 22.8)	<0.0001
At a migrant/community health center in the U.S.	9.6 (7.2, 12.5)	31.9 (26.9, 37.3)	33.5 (26.9, 40.7)	<0.0001
At another type of clinic in the U.S.	5.0 (3.3, 7.2)	10.6 (7.5, 14.5)	11.5 (7.4, 16.9)	0.0017
At a pharmacy in the U.S.	1.7 (0.8, 3.3)	11.9 (8.6, 15.9)	15.2 (10.4, 21.1)	<0.0001
In another country	26.9 (23.1, 30.9)	7.6 (5.0, 11.0)	8.9 (5.3, 13.9)	<0.0001
At a community event in the U.S.	9.0 (6.7, 11.8)	19.5 (15.3, 24.2)	14.1 (9.5, 19.9)	<0.0001
At some other location in the U.S.	4.2 (2.7, 6.3)	4.0 (2.1, 6.7)	0.00	0.0167

* Completed series includes respondents who received one dose of the Janssen/Johnson and Johnson vaccine or CanSino vaccine, or two doses of any Covid-19 vaccine approved by the U.S. Food and Drug Administration or the World Health Organization.

[‡] Among those who indicated vaccination for Covid-19 (N= 1 057; H-2A workers= 526, workers without work authorization= 334, non-H-2A workers with other type of work authorization= 197).

and how it would be used, how the incentive would be provided, and that they could stop the survey at any time or skip any questions they did not wish to answer. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.

Results

Sociodemographic characteristics (table I)

In Phase 2 of the FCCA, a total of 1 384 farmworkers (532 or 38.4% with H-2A visas and 852 or 61.6% without H-2A visas) were surveyed. The percentage of invited workers who declined to participate ranged from 9.8% in Weld County, Colorado to 14.5% in Yakima County, Washington, with an average refusal percentage of 12.8%. Surveys were conducted on a total of 181 different sites in the five communities (78 housing sites, 66 community sites, and 37 work sites). Eight percent of workers surveyed (N=104) declined to share their immigration status and were excluded from further analysis, leaving 1 280 farmworkers (532 or 41.6% H-2A workers and 748 or 58.4% non-H-2A workers) for analysis (table I).

The largest share of H-2A workers were surveyed in Sampson County, North Carolina (33.3%), followed by Colquitt County, Georgia (30.5%). In comparison, the largest share of non-H-2A workers were surveyed in Yakima County, Washington (27.3%), followed by Sampson County (20.9%). Among non-H-2A workers, 68.2% did not have authorization to work in the United States, 16.3% were permanent residents, 11.4% were U.S. citizens, and 4.1% had another type of visa or a temporary protected status. All H-2A workers were classified as migratory, while 17.8% of non-H-2A workers migrated for work in the past year.

Most H-2A workers were male (98.1%) and born in Mexico (99.8%), while among non-H-2A workers, 64.2% were male and 79.4% born in Mexico. There were no significant differences in Spanish language use - nearly all workers in both groups reported speaking Spanish. A significantly lower percentage (7.5%) of H-2A workers reported that they spoke English, compared with 22.7% of non-H-2A workers. Significant differences between H-2A and non-H-2A workers were also observed for Mesoamerican Indigenous languages (6.6 vs. 13.9%, respectively) and Haitian Creole/Patois.

The top three forms of housing for H-2A workers were dormitories or barracks (48.5%), followed by trailers or mobile homes (20.9%) and houses (20.3%). These forms of housing differed significantly from those of non-H-2A workers, whose top three forms of housing were trailers and mobile homes (36.2%), houses (31.6%),

and apartments (16.7%). Eighty-one percent of H-2A workers lived in overcrowded housing, compared with a significantly lower 72.5% of non-H-2A workers.

Eighty-one percent of H-2A workers relied on an employer's vehicle or labor bus for transport to work, a significantly higher proportion than the 12.4% of non-H-2A workers who did the same. In contrast, 4.2% of H-2A workers drove themselves to work in a car, compared with 52.8% of non-H-2A workers. There were no significant differences between H-2A and non-H-2A workers when it came to traveling to work with non-household members - more than half of both groups did so.

Employer Covid-19 prevention interventions (table IV)

Twenty-seven percent of H-2A workers and 33.2% of non-H-2A workers reported not receiving trainings from their employers on physical distancing, face masks, Covid-19 self-quarantine, and handwashing, a significant difference. Five percent of H-2A and non-H-2A workers reported having received these trainings, but in a language other than their preferred one. Significantly higher percentages of H-2A workers than non-H-2A workers worked for employers who implemented temperature checks (56.0 vs. 50.4%), distributed face masks (72.7 vs. 60.6%), and provided handwashing facilities (88.9 vs. 84.0%).

Covid-19 vaccination, disease, testing, and isolation measures (tables II and III)

Ninety-five percent of H-2A workers completed their primary Covid-19 vaccination series, compared with a significantly lower 65.9% of non-H-2A workers (table II). Of H-2A workers, 51.7% also received booster doses compared with 45.0% of non-H-2A workers, a significant difference. Among non-H-2A workers, significantly smaller percentages of those without work authorization reported having completed the primary series compared to workers with U.S. citizenship, residency, or another visa (59.0 vs. 80.7%) and having received a booster (33.5 vs. 66.9%) (table III). The greatest share of H-2A workers were vaccinated at work in the U.S. (43.0%), followed by locations in another country (26.9%). These vaccination locations differed significantly from those of non-H-2A workers, of whom 15.0% were vaccinated at work in the U.S. and 8.1% in another country. Among non-H-2A workers, the largest proportion were vaccinated at a Community/Migrant Health Center in the U.S. (32.5%), followed by community events in the U.S. (17.5%). By comparison, 9.6% of H-2A workers were vaccinated at a Community/Migrant Health Center and 9.0% were

Table IV
EMPLOYER FACILITATED COVID-19 TRAININGS AND EMPLOYER DISEASE PREVENTION EFFORTS REPORTED BY FARMWORKERS WITH AND WITHOUT H-2A TEMPORARY WORK VISAS SURVEYED DURING FARMWORKER COVID-19 COMMUNITY ASSESSMENTS, IN SELECTED COUNTIES IN U.S. STATES OF COLORADO, GEORGIA, NORTH CAROLINA, NEW JERSEY, AND WASHINGTON. MARCH-AUGUST 2022

	H-2A workers N=532 41.6%	Non-H-2A workers N=748 58.4%	P-Value
Employer provided instructions or trainings on physical distancing, face masks, Covid-19 self-quarantine, and handwashing	% (95% confidence interval)	% (95% confidence interval)	0.0455
Yes, in preferred language	68.2 (64.1, 72.2)	61.6 (58.0, 65.1)	
Yes, in a non-preferred language	4.9 (3.2, 7.1)	5.2 (3.7, 7.1)	
No	26.9 (23.2, 30.9)	33.2 (29.8, 36.7)	
Employer regularly implemented hygiene and sanitation measures*			
Temperature checks	56.0 (51.7, 60.3)	50.4 (46.8, 54.0)	0.0474
Provision of face masks	72.7 (68.8, 76.5)	60.6 (57.0, 64.1)	<0.0001
Provision of hand washing facilities	88.9 (85.9, 91.5)	84.0 (81.1, 86.5)	0.0118

* Categories are not mutually exclusive; percentages may not sum to 100.

vaccinated at community events in the U.S. Among non-H-2A workers, there were no significant differences between workers without work authorization and other non-H-2A workers in the locations where they reportedly received Covid-19 vaccines.

In terms of Covid-19 testing and prevalence, a significantly lower proportion of H-2A workers (25.8%) than non-H-2A workers (36.7%) reported suspecting or knowing that they had Covid-19 at some point during the pandemic. A significantly smaller percentage (51.5%) of H-2A workers reported having been tested for Covid-19, compared with 59.2% of non-H-2A workers. Among workers tested for Covid-19, a significantly lower percentage of H-2A workers (24.5%) reported receiving a positive test result than did non-H-2A workers (44.9%). Among H-2A workers who at some point knew or suspected they had Covid-19, 29.6% reported that they continued to work while symptomatic or positive, compared with 14.9% of non-H-2A workers, a significant difference. There were no significant differences in the proportions of H-2A and non-H-2A workers who reported isolating themselves from family and/or roommates (69.2 and 72.5%, respectively) or participating in social gatherings (7.8 and 6.7%, respectively) while positive or symptomatic with Covid-19.

Discussion

These survey findings describe significant differences in self-reported Covid-19 vaccination uptake, testing, and disease incidence between H-2A workers and non-H-

2A workers, and in their demographics, housing, and transportation conditions. Examining these differences is important for public health and labor officials in both the U.S. and Mexico given the increasing share of H-2A workers in the U.S. agricultural workforce, and that the majority originate from Mexico. Most H-2A workers reported having completed the Covid-19 primary series with an FDA- or WHO-approved vaccine, with vaccination coverage significantly higher than non-H-2A workers, especially compared to workers without work authorization in the U.S. Primary series vaccination coverage was also higher among H-2A workers in our survey (26.2-54.1% higher, as of August 3, 2022) than among general populations of the counties where survey participants were employed.¹⁷ These observed differences in primary series uptake may be a result of U.S. policies requiring that individuals traveling to the U.S. present proof of full vaccination with one of the accepted vaccines (beginning in April of 2022), identifying farmworkers as essential workers, and therefore a priority for Covid-19 vaccination, and making the vaccine available to all in the U.S. irrespective of immigration and health insurance status.^{18,19} There were also major outreach efforts on the parts of vaccine providers, community-based organizations, employers, other community members, and farmworkers themselves to increase Covid-19 vaccine uptake. More than half of vaccinated H-2A workers reported having received their vaccinations in the U.S. These workers were likely vaccinated prior to the implementation of the vaccination requirement for international travelers, while in the U.S.

H-2A workers reported greater access to Covid-19 vaccines in their workplaces (43.0%) compared to non-H-2A workers (15.0%). About half of H-2A workers reported having received a booster dose, with a small percentage advantage over non-H-2A workers, indicating an opportunity to focus on to increase booster coverage.

Covid-19 testing, and self-reported disease incidence also differed significantly between H-2A and non-H-2A workers. A significantly smaller percentage (8.3% difference) of H-2A workers, compared to non-H-2A workers, reported having been tested for Covid-19 at some point during the pandemic. Although testing for Covid-19 was free for everyone in the U.S., some populations such as farmworkers may have experienced a multitude of factors which resulted in less accessibility to testing.¹⁸ Further investigation into these factors is needed. Among workers reporting a Covid-19 test, fewer H-2A workers reported a positive test result than non-H-2A workers (24.5 vs. 44.9%). Overall, fewer H-2A workers (one in four) reported that they knew or suspected they have had Covid-19 sometime during the pandemic, compared to more than one in three non-H-2A workers. This is a finding that was contradictory to our hypothesis, due to the fact that H-2A workers live in group housing and experience other risk factors for Covid-19 transmission that are less common among non-H-2A workers. There are several possible factors, although further research is needed to draw conclusions. It is possible that because H-2A workers live in environments largely controlled by their employer, many H-2A workers were isolated from outbreaks occurring in the community. This isolation from the community can play a role in other issues H-2A workers experience, such as human trafficking and forced labor,^{20,21} but it is possible it played a protective role in Covid transmission. It is also possible that some H-2A participants in the survey had a greater fear of disclosing if they had Covid because of concerns about forced isolation or deportation by the employer, both of which have been reported to occur during the pandemic.²²

A main finding was that among H-2A workers who knew or suspected they had Covid-19, more than one in four (29.6%) indicated that they continued working while symptomatic or positive, a significantly higher proportion than non-H-2A workers (14.9%). Based on the literature, potential reasons could include H-2A workers' limited access and barriers to paid sick leave, greater employer pressure to continue working to meet production demands, fear of employer retaliation or being sent back home for being ill or taking time off work, or having a more limited understanding of their rights in the workplace while ill with Covid-19.^{8,23} This issue should be further investigated to determine appropriate

interventions to prevent the spread of infectious diseases at the work site.

The CDC and the Occupational Safety and Health Administration (OSHA) each published guidance to assist employers in implementing workplace Covid-19 prevention measures, including provision of face coverings, facilitating of vaccination of employees, symptom screening, and Covid-19 education at the workplace.^{24,25} Our study found that, although many employers of H-2A workers reportedly took proactive measures to protect the health of their employees, not all implemented these prevention strategies. Furthermore, although access to handwashing facilities in the workplace is required under Title 21 of the Code of Federal Regulations,²⁶ 11.1% of H-2A workers and 16.0% of non-H-2A workers reported not having access to such facilities at work. More than one quarter of both H-2A workers and non-H-2A workers reported that they had not received a training from their employer on physical distancing, using face coverings, proper hand washing, and quarantining since the start of the pandemic, and 5% more had received the training but not in their preferred language. Implementation of such trainings may be more effective through collaboration between employers, health and safety professionals, community-based organizations, public health departments, and health care providers. Previous studies suggest the importance of considering the increasing cultural and linguistic diversity of farmworkers when conducting health education with this population, particularly when outreaching Indigenous Mesoamerican workers.^{15,27,28} The impact of Covid-19 has not been felt equally, exacerbating existing inequalities and disproportionately impacting a number of populations. Covid-19 has created unprecedented challenges in relation to health communication, with the need to reach disadvantaged populations. This analysis highlights this diversity, as more than one in four H-2A workers and nearly half of non-H-2A workers self-identified as Indigenous, higher than the one in ten reported in the U.S. National Agricultural Workers Survey.²⁹

The data in this report has several strengths. At the time of writing, this was the largest health-focused survey of H-2A workers employed in multiple counties across the U.S. and had a high participation rate (87%). Data were collected following best cultural and linguistic practices in data collection with farmworkers, such as hiring interviewers from local community-based organizations, providing interpretation, and conducting surveys in convenient places for workers not with a supervisor or employer present, allowing participants to feel more secure in providing honest responses. However, our analysis has several limitations. Although site selection

was randomized, survey respondents were not randomly sampled. Survey respondents should not necessarily be viewed as a representative sample of all H-2A or other farmworkers in the county or nationally, but rather as a sample of diverse farmworker populations in the selected communities. Additionally, this analysis did not employ methods to adjust for recruitment site clustering, such as incorporation of random effects or use of generalized estimating equations. All survey data are self-reported and thus subject to bias. The topic of immigration status, in particular, is sensitive; 8% of workers surveyed declined to share their immigration status and were excluded from the analysis, which may constitute in-selection bias. The data in this assessment are cross-sectional and data collection occurred during the peak season of agriculture work in each community, so some groups of off-peak workers may have been missed due to the timing of the survey. The survey was only available in English, Spanish, Haitian Creole, and Mixteco, and some participants may have responded in a non-preferred language. There was untrained non-professional interpretation for eight participants who spoke Haitian Creole or Indigenous languages, which may have caused barriers in adequately capturing their responses.

This analysis provides unique insights into the experience of H-2A workers during the pandemic. Although H-2A workers had a lower self-reported prevalence of Covid-19 and a higher uptake of the primary Covid-19 vaccine series than non-H-2A workers, other findings suggest room for improvement, such as continuing to work while symptomatic or positive for Covid-19, gaps in Covid-19 training and language access, lack of disease prevention and control measures in workplaces, and low uptake of booster vaccinations. Efforts to address these challenges may benefit from partnerships between public health officials, community-based organizations, employers, and health care providers, such as the collaboration between CDC and NCFH, to enhance capacity and coordination for vaccination and outreach to all farmworkers.³⁰ Collaboration among U.S. public health and labor officials and the governments in the countries of origin for H-2A workers is also essential to the success of such initiatives. These efforts could help address ongoing needs during the Covid-19 pandemic, help to be better prepared for future public health emergencies and confront health disparities among farmworkers, an underserved population considered essential to the function of the food supply chain in the U.S.

Declaration of conflict of interests. The authors declare that they have no conflict of interests.

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