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## On-Farm Health Screening Needs of Immigrant Dairy Workers in the Texas Panhandle and South Plains

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### ABSTRACT

The objective of this pilot study was to determine the health needs of dairy farm workers and the feasibility of on-farm health risk screenings in the Texas Panhandle and South Plains. A cross-sectional study design was used to collect survey responses concerning health needs, occupational, and economic characteristics among 300 dairy workers between April 2020 and July 2021. Participants were predominantly immigrant Hispanic (88.8%) males (83.0%) of approximately 34.4 (SD 9.9) years of age, worked 6.0 (SD 0.4; Range 3–7) days a week and 9.9 (SD 1.5; Range 6–13) hours a day, earning a mean hourly rate of \$13.40 (SD \$2.80). Participants reported interest in attending on-farm health risk screenings (93.8%) as well as receiving a COVID-19 vaccine if it became available (86.4%). Health service categories were ranked from: (1st “most important”) preventative care (Mean Rank 2.3), (2nd) laboratory and diagnostic care (Mean Rank 2.6), (3rd) nutritional and physical fitness support (Mean Rank 2.8), (4th) mental health care (Mean Rank 3.4), and (5th) workplace interventions (Mean Rank 3.6). Participants reported obtaining health information predominantly from internet searches (32.0%) and social media (17.7%). Findings suggest there is need and interest for on-farm health risk screenings and education among immigrant dairy workers in the Texas Panhandle-South Plains region. Addressing known barriers to health should be paramount to the organization of on-farm health risk screenings.

### KEYWORDS

Hispanic; workplace interventions; health barriers; COVID-19; education

### Introduction

Immigrant agricultural workers in the United States (U.S.), including dairy farm workers, often have limited access to health care services.<sup>1</sup> Barriers to health care access include cost, transportation, communication challenges, absence of health insurance, cultural differences, limited knowledge of health centers and locations, conflicting work schedules, lack of childcare, unavailability of specialty health services, transient or migratory lifestyle, and fear of law and immigration enforcement.<sup>1–10</sup> These barriers often lead to an increase in self-reliant attitudes as well as increased dependence on home remedies<sup>11</sup> and self-prescription therapies.<sup>12</sup> These alternative medicinal practices, in addition to delayed health care, can lead to chronic illnesses and exacerbate disease severity.<sup>2</sup>

Few studies have considered the health status, needs, and barriers to health care services among immigrant dairy workers in the U.S.<sup>1,3,4</sup> Of the studies reported, the majority of Hispanic dairy workers have diabetes, hypertension, musculoskeletal (MS) pain, dental and oral hygiene problems, undiagnosed and untreated mental health disorders, cultural and linguistic isolation in the U.S. as well as a poor understanding of workers' compensation programs when injured.<sup>1,3,4</sup> A larger body of literature was found for a demographically similar workforce – U.S. seasonal and non-seasonal farmworkers. Studies reported Hispanic farmworkers also experienced MS pain, skin diseases, pesticide side-effects, chemical exposures, dental problems, mental health issues, infectious diseases (e.g., tuberculosis), and sexually transmitted diseases.<sup>2,6,12–14</sup>

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However, dairy workers and farmworkers work in different environments and may be exposed to different health, safety, and well-being hazards.<sup>15</sup> The modern U.S. dairy farm is a highly integrated agricultural system.<sup>16</sup> Whereas crop harvest is seasonal, dairy production is year round, producing milk 24-hours a day, 7 days a week, and 365 days a year.<sup>17</sup> In 2021, the U.S. Bureau of Labor Statistics (BLS) reported an incidence rate of 4.3 injuries and illnesses per 100 full-time equivalent employees (FTEs) and a total of 31 fatalities among dairy cattle and milk production workers – double the national industry rate. However, BLS data only captures workplace fatal and nonfatal injuries and illnesses. Dairy worker general health status and well-being are not surveilled and, therefore, often unaccounted.<sup>1</sup>

The National Institute for Occupational Safety and Health (NIOSH) created the Total Worker Health® (TWH) program to combine worker health and safety policies, programs, and practices with preventative measures to enhance worker health and well-being. TWH recognizes work as a social determinant of health.<sup>18</sup> There is a *need* to characterize occupational profiles, living and economic conditions, and determine specific health needs and feasibility of on-farm health risk screenings among dairy workers. These data can help inform which point-of-care testing to include for on-farm health screening interventions. The primary objective of this pilot project was to determine the health needs of dairy workers and the feasibility of on-farm health risk screenings on Texas Panhandle and South Plains dairy farms.

## Methods

### Study design

A cross-sectional study design was used to collect survey responses concerning health care needs, occupational, and economic characteristics among dairy workers in the Texas Panhandle and South Plains (northwest Texas). This region has 150 licensed dairy farms (representing 268,800 cows) which employ an estimated 2,688 workers.<sup>19</sup> Employing the help of dairy extension and previously established relationships, dairy farm owners of 24 farms were personally called,

visited, and invited to participate in this study. A convenience sample of 300 dairy workers, across all milking shifts, was recruited from 22 large-herd dairy farms between April 2020 and July 2021. Two dairy farm owners declined to participate due to silage season – a historically busy time on farms. This study was approved by the University of Texas Health Science Center at Houston Committee of the Protection of Human Subjects (CPHS) (HSC-SPH-19-0094).

### Eligibility criteria

A total of 300 consenting dairy workers participated. A power analysis for an appropriate sample size was not warranted for this hypothesis-generating pilot study. Participant eligibility criteria include being ≥18 years of age and employed on a dairy farm.

### Consent

Bilingual research personnel (English and Spanish) explained the project objectives and obtained participant consent prior to survey administration. Participants were asked to verbally consent via phone or consent in-person on an electronic informed consent form.

### COVID-19 and field data collection

The field data collection for this pilot study was scheduled to begin April 2020. Due to the COVID-19 pandemic and the subsequent lockdown starting mid-March 2020, alternative survey administration methods were adopted in response to pandemic CDC guidelines. Therefore, the study survey was administered via phone from April 2020 through mid-March 2021 as well as in-person from late-March 2021 to August 2021—following lifted institutional travel restrictions.

### Data collection

The survey included 20 sociodemographic, occupational, and economic status questions, and 13 health care need assessment questions. Survey questions were adopted from the National Agricultural Workers Survey (NAWS)<sup>20</sup> and the NIOSH Well-Being Questionnaire.<sup>21</sup> Survey questions, available in

English and Spanish, were placed on the offline survey platform Qualtrics Mobile Survey Software® and uploaded to mobile tablet devices. Trained bilingual research personnel used these tablets to read questions to participants and log responses which were saved and subsequently uploaded to a secured institutional cloud storage. Participants received a \$10 gift card and a gift bag with personal protective equipment (PPE).

### **Data analyses**

Basic descriptive statistics of all sociodemographic characteristics, occupational and economic profiles, and self-reported health assessment results were estimated and reported. Percent densities of U.S. dairy worker originating states or departments were used for heat maps and rank statistics were used to categorize ranked health care service categories. All statistical analyses were performed using StataSE 17.0 software.<sup>22</sup>

## **Results**

### **Sociodemographic characteristics**

The mean age of participants was 34.4 (SD 9.9), with a range of 18 to 79 years-of-age, and 83.0% of workers were male (Table 1). Most workers had an elementary/middle school education (39.8%).

### **Nationality, language, and U.S. residency**

The majority of dairy workers were Hispanic (88.8%) immigrants. Mexican nationals (Supplemental Figure 1) were predominantly from the states of Chihuahua (18.1%), Hidalgo (13.6%), and Tamaulipas (7.7%); and, Guatemalan nationals (Supplemental Figure S2) were predominantly from the departments of Quiché (52.2%), Huehuetenango (13.0%), and Totonicapán (13.0%). On average, workers had 10.2 (SD 10.4) years residing in the U.S., with a range of 5 days to 44 years. The majority of surveyed workers reported no second language adopted (56.0%).

### **Living conditions**

Most survey workers were married (59.1%) with an average of 2.7 (SD 1.4) children. Living accommodations varied from owning a home (32.2%), renting (32.7%), or employer provided housing (10.7%). Co-habitants were diverse with most workers living with their spouses and children (32.6%) and co-workers (28.3%) followed by multigenerational-homes (12.0%). The average household residents were 4.4 (SD 2.2) individuals with a range of one to twelve residents, including self.

### **Occupational profile**

Participants were predominantly employed as milkers (22.0%) working 8.5 (SD 1.2) hour milking shifts (Table 2). On average, participants worked 6.0 (SD 0.4; Range 3–7) days a week and 9.9 (SD 1.5; Range 6–13) hours a day – for an estimated average of 60-hour work weeks. Workers had 7.2 (SD 8.5) years of experience working in the dairy industry ranging from 1 week of experience minimum to 56 years of experience maximum. Most dairy workers had a 15.1 (SD 9.4) minute commute from home-to-farm while using their personal car (79.9%) or in carpool (12.6%) with 2.4 (SD 0.9) additional coworker passengers, despite social distancing guidelines.

### **Economic status**

Both hourly rate (in USD) and individual annual gross income were assessed. Hourly rate ranged from \$8.10 to \$30.00 with a mean hourly rate of \$13.40 (SD \$2.80). Individual annual gross income also varied from “Do not know” (30.3%) to half (49.3%) of dairy workers surveyed earning less than \$39,999. Further analyses found that participants who reported they “Do not know” their individual annual gross income had a mean hourly rate of \$12.04 (SD \$1.07)—an hourly rate indicative of an income categorized between \$10,000–\$19,999 (assuming full-time employment). Based on our analyses, our data suggests 80.0% of participants earned less than \$39,999 on an annual basis.

**Table 1.** Sociodemographic characteristics of dairy farm workers in the Texas Panhandle-South Plains region ( $n = 300$ ).

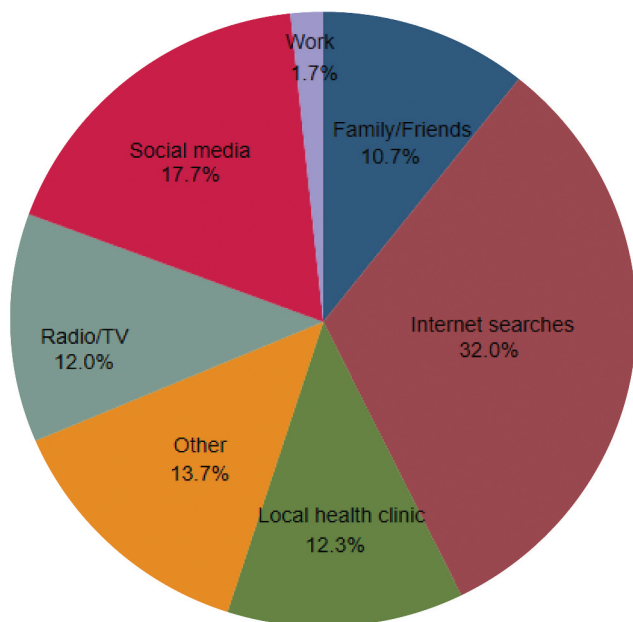
Characteristics	All ( $n = 300$ ) Mean (SD) or n (%)
<b>Age</b> (Range 18–79)	34.6 (9.9)
<b>Male</b>	249 (83.00)
<b>Nationality</b>	
United States	33 (11.2)
Mexico	230 (78.0)
Guatemala	23 (7.8)
Other*	14 (3.0)
<b>Primary language</b>	
English	29 (9.7)
Spanish	261 (87.3)
K'iche'	6 (2.0)
<b>Secondary language</b>	
English	94 (31.33)
Spanish	30 (10.0)
No secondary language	168 (56.0)
<b>Years living in the U.S.</b> (Range 0–44)	10.2 (10.4)
<b>Education</b>	
No formal	3 (1.0)
Elementary	51 (17.5)
Middle school	65 (22.3)
High school	64 (21.9)
College/Graduate/Professional	107 (36.6)
<b>Marital status</b>	
Single	103 (34.8)
Married	175 (59.1)
Divorced/Separated/Widowed	16 (5.4)
<b>Children</b>	167 (74.2)
Number of children (Range 1–10)	2.7 (1.4)
<b>Living accommodations</b>	
Own home	94 (32.3)
Rent home/apartment	95 (32.7)
Employer provided housing	97 (10.7)
<b>Living company</b>	
Alone	23 (7.7)
Multigenerational	36 (12.0)
Spouse only	23 (7.7)
Spouse and children	98 (32.6)
Children only	20 (6.7)
No. children living at home (Range 1–7)	2.6 (1.1)
Co-workers	85 (28.3)
No. of co-workers (Range 1–12)	4.4 (2.7)
Other	15 (5.0)
<b>Household residents</b> (Range 1–12)	4.4 (2.2)

Other countries include: Colombia, El Salvador, Honduras, Nicaragua, Puerto Rico, Philippines, and Netherlands.

### Self-reported health needs assessment

The health needs survey included a self-reported assessment section (Table 3). The majority of workers described their general health as “Very Good” (38.5%), and “Good” (33.8%). Most workers were *not* current smokers (83.6%); however, on average, participants drank 5.8 (SD 6.4) alcoholic drinks per week (assessed as 1 unit = 1 beer = 1 glass of wine).

Dairy workers reported sleeping 6.9 (SD 1.2) hours per night (or day if on night shift) ranging from 3 hours to 12. Half of the participants had health insurance (55.7%)—most employer-provided (85.6%)—with 5.9 (SD 8.5) years of coverage and a range of 1 month to 45 years. A quarter of participants reported having a primary care provider with 37.7% reporting attending an annual health visit.



**Figure 1.** Diverse sources of health information among immigrant dairy farm workers in the Texas Panhandle-South Plains region ( $n = 300$ ).

### Healthcare service interest

Participants were asked to rank the most valued health care service categories from 1 to 5 (1 being “most important and 5 being “least important”). Service categories were ranked as: (1<sup>st</sup>) preventative care (Mean Rank 2.3), (2<sup>nd</sup>) laboratory and diagnostic care (Mean Rank 2.6), (3<sup>rd</sup>) nutritional and physical fitness support (Mean Rank 2.8), (4<sup>th</sup>) mental health care (Mean Rank 3.4), and (5<sup>th</sup>) workplace interventions (Mean Rank 3.6). More specifically, under each category, participants were asked to rank specific health care services, screenings, examinations, and programs of most value to their health and well-being (Table 4). Under each of these categories, participants ranked specific health risk screenings such as chronic disease management, blood pressure check, blood glucose check, cardiovascular disease (CVD), nutrition and weight management, anxiety, depression, and stress treatment as well as workplace health and safety training.

### On-farm health risk screenings

Participants were surveyed on interest and perceived benefits of on-farm health risk screenings and programs. Over 93.0% of participants reported

interest in attending health risk screenings if offered on their dairy farm of employment. Similarly, almost 90.0% of participants reported interest in attending health risk screenings with their family members, if offered at their farm. Over 93% of participants perceived on-farm health risk screenings offered on their farm would be a reason to continue working for their current farm employer.

### Health information resources

Participants reported obtaining health information (Figure 1) predominantly from internet searches (32.0%) and social media (17.7%).

### COVID-19 pandemic and vaccine

Due to the proximity of our data collection start date and the pandemic, we were able to add four COVID-19 experience questions at the end of March of 2020. Almost all surveyed workers (98.6%) were aware of the current COVID-19 pandemic with 88.7% knowing COVID-19 symptoms and 95.7% knowing how to minimize the risk of transmission. The majority of participants (86.4%) expressed interest in receiving a COVID-19 vaccine if it became available.

### Discussion

Immigration status in the U.S. is a historical barrier to health<sup>23</sup> and a strong predictor of morbidity and mortality.<sup>24</sup> Immigration status is also a social determinant of health rooted in public health, economic, and political inequities.<sup>25</sup> Participants in our study were predominantly immigrants from Mexican states along the U.S.-Mexico border and indigenous departments of Guatemala. Most sociodemographic characteristics of participants in our project were consistent with previous research studies conducted in the Texas-Eastern New Mexico dairy region,<sup>26–29</sup> for the exception of a much smaller Guatemalan workforce (7.8%). Compared to our previous studies conducted in this region, 22.7% (reported in 2017)<sup>30</sup> and 41.8% (reported in 2019)<sup>29</sup> of dairy workers surveyed identified Guatemala as their country of origin. These demographic discrepancies could be due to

**Table 2.** Occupational profile of dairy farm workers in the Texas Panhandle-South Plains region ( $n = 300$ ).

Characteristics	All ( $n = 300$ ) Mean (SD) or $n$ (%)
<b>Job position</b>	
Milker	66 (22.0)
Parlor parallel configuration	34 (53.1)
Both day and night shifts	57 (86.4)
Milking shift duration ( <i>Range 8–12</i> )	8.5 (1.2)
Tractor/Feeder	40 (13.3)
Maternity	32 (10.7)
Supervisor/Manager	25 (8.3)
Calf caretaker	22 (7.3)
Hospital	19 (6.3)
Breeder/Al	16 (5.3)
Other*	80 (26.8)
<b>Years of dairy experience</b> ( <i>Range 0–56</i> )	7.2 (8.5)
<b>Work days per week</b> ( <i>Range 3–7</i> )	6.0 (0.4)
<b>Work hours per day</b> ( <i>Range 6–13</i> )	9.9 (1.5)
<b>Work along relatives</b>	104 (35.6)
<b>Mode of work transportation</b>	
Personal car	234 (79.9)
Carpool	37 (12.6)
No. of passengers	2.4 (0.9)
Work vehicle	17 (5.8)
Walk	5 (1.7)
<b>Home to work distance</b> ( <i>miles</i> )	13.1 (10.9)
<b>Commute time</b> ( <i>minutes</i> )	15.1 (9.4)
<b>Smart phone</b>	288 (98.3)
Android	164 (57.1)
iPhone	107 (37.3)
Other	16 (5.6)
<b>Hourly rate</b> ( <i>USD</i> ) ( <i>Range \$8.10–\$30.00</i> )	13.4 (2.8)
<b>Individual annual income</b>	
Less than \$10,000	16 (5.3)
\$10,000–\$19,999	28 (9.3)
\$20,000–\$29,999	35 (11.7)
\$30,000–\$39,999	69 (23.0)
\$40,000–\$49,999	27 (9.0)
\$50,000–\$59,999	16 (5.3)
More than \$60,000	18 (6.1)
Do not know	91 (30.3)
<b>Paid overtime</b>	30 (25.2)
<b>Performance bonuses</b>	96 (33.0)
<b>Paid sick time</b>	93 (31.7)
<b>Paid vacation time</b>	259 (88.1)

Other job positions include: Cleaning services, Hoof trimmer, Maintenance, Mechanic/Shop, Office staff, Owner, Pusher, Ranch/Crop operations, and Veterinarian.

high industry turnover rates,<sup>26,31</sup> migratory lifestyles,<sup>1</sup> and hasty COVID-19 pandemic economic, housing, and childcare changes in 2020 and 2021.<sup>32</sup>

Long before the pandemic, the dairy industry had been consistently challenged with employment recruitment and retention strategies – many related to immigration documentation status.<sup>33–35</sup> Historically, the H-2A seasonal visa program has not been a viable option or common human resources practice for the U.S. dairy industry.

However, given the significant labor shortages, high turnover rates, and global pre-recession economy, dairy leadership have had to start relying on alternative methods for recruitment and retention of employment.<sup>36</sup> While all other visa issuances decreased from –34.0% to –69.0% during the pandemic, H-2A guest worker visa issuances increased by 4% between 2019 and 2020. The majority of H-2A guest worker visas (93.0%) were issued to Mexican nationals in 2020.<sup>37</sup> In Texas, anecdotal evidence of a new hiring trend warrants continued

**Table 3.** Self-reported health assessment among dairy farm workers in the Texas Panhandle-South Plains region ( $n = 300$ ).

Characteristics	All ( $n = 300$ ) Mean (SD) or n (%)
<b>General Health</b>	
Excellent	69 (23.1)
Very Good	115 (38.5)
Good	101 (33.8)
Fair	13 (4.3)
Poor	1 (0.3)
<b>Current smoker</b>	
Alcoholic drinks per week (Range 1–35)	5.8 (6.4)
Sleep per night (hours) (Range 3–12)	6.9 (1.2)
Amount of sleep <i>not</i> enough	83 (28.6)
Sleep affects job performance	81 (28.1)
<b>Health insurance</b>	
Coverage (years) (Range 1 mo – 45 yrs)	5.9 (8.5)
Source of coverage	
Employer	137 (85.6)
Personal	21 (13.1)
<b>Primary care provider</b>	
Never	9 (13.0)
Once a year	26 (37.7)
2–3 times a year	27 (39.1)
>4 times a year	7 (10.2)
<b>Attend on-farm health risk screening</b>	255 (93.8)

monitoring of the H-2A visa program utilization route in the industry. Despite the program's complicated application process, expensive fees, requirements such as housing and transportation, seasonality of visa as well as re-application logistics, productivity benefits outweigh the significant labor shortages and turnover rates experienced by the dairy industry.<sup>38</sup>

Another recruitment and retention strategy at hand for the industry is on-farm health screenings. Study participants were interested and perceived benefit from on-farm health risk screenings which would make them want to stay employed on their dairy farm of employment. Increasing dairy worker health and well-being is an industry and public health investment and strategic imperative overdue.<sup>39</sup> Immigrant dairy workers often live in rural and isolated regions of the U.S. Obtaining culturally, linguistically, and literacy appropriate health information in health deserts can be a challenge. Participants reported obtaining health information predominantly from internet searches (32.0%) and social media (17.7%). In 2021, a systematic review measured health information on various social media platforms and found that posts with misinformation on topics concerning non-

communicable diseases, pandemics, vaccines, and medical treatments reached up to 87% in various studies.<sup>40</sup> Health information resources can also add to self-reliant attitudes and delayed health care among immigrant dairy workers. Alternative health practices, in addition to delayed healthcare, can lead to the progression of chronic illnesses and increased disease severity.<sup>2</sup> Consequently, increased severity of chronic illnesses leads to increased presenteeism (*physically present at work but sick, stressed, or tired*)<sup>41</sup> and absenteeism (*time absent from work*).<sup>42</sup> Over time, increased presenteeism and absenteeism can lead to business productivity losses and increased risk of preventable workplace injuries and fatalities.<sup>41,42</sup> On-farm health risk screenings can overcome barriers to health care associated with transportation, limited knowledge of health centers and locations, conflicting work schedules, lack of childcare, and fear of law and immigration enforcement.

Most participants described their general health as "Excellent" (23.1%) and "Very Good" (38.5%). These data differed from the most updated Texas Behavioral Risk Factor Surveillance Survey (BRFSS) reporting surveyed Texans described their general health as

**Table 4.** Top five specific health care services ranked by importance: 1 being “most important” and 5 being “least important” among dairy farm workers in the Texas Panhandle-South Plains region ( $n = 300$ ).

Service Category	Top 5 Specific Services (Mean Rank)
<i>Preventative Care</i>	All (1) Vision (2.1) (2) Dental (2.4) (3) Cardiovascular exam (2.7) (4) Chronic disease management (2.7) (5) Vaccinations (2.9)
Males	Females
1. Vision (2.1) 2. Dental (2.4) 3. Cardiovascular exam (2.7) 4. Chronic disease management (2.8) 5. Vaccinations (2.8)	(1) Vision (1.8) (2) Mammogram (2.2) (3) Dental (2.3) (4) Pap smear (2.4) (5) Chronic disease management (2.5)
<i>Laboratory &amp; Diagnostic Care</i>	(1) Blood pressure check (1.9) (2) Blood glucose check (2.11) (3) Cholesterol check (2.8) (4) Tuberculosis test (3.1) (5) HIV/AIDS status screening (3.6)
<i>Nutritional &amp; Physical Fitness Support</i>	(1) Nutrition classes (1.9) (2) Weight management (2.7) (3) Healthy cooking classes (2.7) (4) Gym membership (2.7) (5) Workout equipment at work (3.1)
<i>Mental Health Care</i>	(1) Anxiety treatment (2.4) (2) Depression treatment (2.7) (3) Stress management (2.6) (4) Controlling anger/emotions therapy (3.0) (5) Substance abuse therapy (3.8)
<i>Workplace Interventions</i>	(1) Workplace health & safety training (1.6) (2) Workplace hazard control (2.2) (3) Job stress management (2.9) (4) Workplace violence and bullying prevention (3.0) (5) Workplace visiting health care nurses (3.3)

“Excellent” (18.5%) and “Very Good” (28.6%).<sup>43</sup> These differences can be due to the healthy worker effect (HWE) which refers to the idea that employed individuals are generally healthier than individuals not employed.<sup>44</sup> On the contrary, barriers to health services often lead to an increase in self-reliant attitudes and increased dependence on home remedies<sup>11</sup> and self-prescription therapies.<sup>12</sup> On-farm health education in collaboration with local rural health and non-health community partners can help inform dairy workers of health amenities, services, and care options available locally.

Participants were predominantly employed as milkers (22.0%). One of the most hazardous tasks

on a dairy farm is milking.<sup>45</sup> The most common injuries during milking operations involve cow kicks, and slips, trips, or falls in a milking parlor.<sup>45</sup> Self-reported musculoskeletal symptoms (MSSs) among large-herd Hispanic milkers suggest the upper extremities, specifically the shoulders and wrists/hand were the most problematic.<sup>46</sup> However, these are self-reported MSSs and not clinically diagnosed musculoskeletal disorders (MSDs). On-farm health risk screenings can include physical screenings which can detect MS abnormalities and, subsequently, identify the need to refer workers to local health clinics that can provide a more conclusive diagnosis and appropriate therapy.

Most crucial to highlight and consider, the majority of participants earned less than \$39,999 annually. This is less than the median Texas income in 2020 of \$68,093 and below the Texas Panhandle income in 2020 of \$44,215.<sup>47</sup> Participants earned close to the poverty threshold for 2020 (\$31,417 for a family of five).<sup>48</sup> This pilot did not collect data on combined income, location of spouse and children, or international money transfers outside the U.S. for family members. However, most participants were married (59.1%) with a range of one to ten children. In addition, low individual income levels reported may be indicative of lower health insurance coverage compared to the general U.S. population. Half of participants had health insurance (55.7%) compared to 92.0% of the U.S. general population in 2019.<sup>49</sup> On-farm health risk screenings can overcome significant barriers to health care associated with cost and lack of health insurance.

### Limitations

Study limitations include recall bias of self-reported data. One-to-one surveys can be culturally unconventional and conceptually new among dairy workers, which can potentially lead to either underestimations or overestimations of personal and health information.<sup>50</sup> However, most socio-demographic characteristics collected in this study were consistent with previous research studies conducted in this region.<sup>26–29</sup> In addition, the methods of this pilot ensured interviewer bias remained low. The survey had a detailed<sup>28</sup> script (English and Spanish) to guide research personnel and establish administration quality and consistency. Last, study findings can be generalized to the Texas – New Mexico dairy region, but not the Western U.S. dairy industry.

### Conclusions

Our primary objective was to collect preliminary data that would inform the development, delivery, and evaluation of on-farm health services on U.S. dairy farms. Our findings suggest dairy workers in the Texas Panhandle and South Plains are young immigrant males living close to the poverty threshold and in need for health

risk screenings and health education. This pilot study did not determine the health status of dairy workers using direct measurements. Findings from this study can be used for evidence-based practice (EBP) planning for improving the health and well-being of dairy workers. Future research and outreach efforts should consider: (1) health risk screenings will require strong collaborations between local public health departments, community partners, academic institutions, and dairy farm leadership; (2) on-farm health risk screenings should include point-of-care testing for diabetes, hypertension, CVD, kidney function, MS health, COVID-19 experiences and long-term side effects, as well as, anxiety, depression, and stress assessments; (3) linguistically and culturally appropriate personnel; and, (4) screenings should be organized with the intention of referring workers with abnormal results to local health clinics that can provide health education, a more conclusive diagnosis, and appropriate therapy. Addressing known barriers to health should be paramount to the organization of on-farm health risk screenings.

### Acknowledgments

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### Disclosure statement

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