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Occupational Safety and Health of Foreign-Born, Latinx Dairy Workers in Colorado

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Abstract

Objective—The US dairy industry, which employs foreign-born, primarily Latinx workers, has a two-fold higher injury rate than the national average. Little research has been conducted to understand the factors associated with the occupational safety and health (OSH) among foreign-born, Latinx dairy workers.

Methods—Structured interviews were conducted with 55 workers to assess a variety of OSH variables, including training experiences, health outcomes, and the psychosocial environment of the dairy.

Results—Participants reported a high number of work-related injuries, limited awareness of the risks inherent in dairy work, and the perception that work-related injuries are unpreventable. The psychosocial environment of the dairy was found to have a significant influence on OSH outcomes.

Conclusion—In addition to implementing culturally congruent OSH training for all workers, it is imperative to promote strong leadership and communication skills among dairy managers.

Keywords

dairy industry; foreign-born workers; Latinx; safety and health

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Introduction

The US dairy industry provides over 14% of the total world milk supply 1 and relies heavily on a foreign-born, primarily Latinx workforce.2 A survey of US dairies indicated that 47% employ foreign-born workers, a percentage that is projected to continue growing.2

The dairy industry is unarguably a dangerous one, with diverse risks that affect worker health and safety. Some of the more common occupational risks include those related to large animal handling, operating dangerous equipment and machinery, exposure to hazardous substances, ergonomic hazards (eg, repetitive motions, awkward postures), and fatigue due to the long hours and physical demands inherent in dairy work.3–6 Compared with the national average across all industries, dairy workers experience a two-fold higher rate of occupational injuries (3.3 and 6.6 per 100 full-time workers, respectively).7

Although data specific to foreign-born workers in the dairy industry are not available, foreign-born workers across industries have historically suffered a greater burden of fatal and nonfatal injuries, illnesses, and fatalities than native workers.8,9 This disparity is still true when comparing foreign-born and native workers within the same industry and job category.10 In an analysis of work-related, nonfatal injuries among a sample of 402,667 workers across various industries from the US National Health Interview Survey, Zhang et al 11 found that foreign-born workers may suffer from more severe injuries than native workers. These findings are unsurprising given that many foreign-born workers are young, inexperienced, and have limited formal education and English language proficiency,12 all of which may influence their awareness of and ability to learn about work-related hazards and protective measures.

Aside from a handful of predominantly qualitative studies,13–15 there has been little research on the occupational safety and health (OSH) of foreign-born, Latinx dairy workers in the US. In order to develop and implement effective policies, procedures, and programming to promote OSH in this high-risk industry, it is necessary to understand the experiences of and factors associated with work-related injuries and illnesses among this vulnerable and growing segment of the workforce. To address this gap, investigators of the current study conducted structured interviews with foreign-born, Latinx workers from eight Colorado dairies to better understand their OSH training experiences; experiences of work-related injuries and illnesses and other health and well-being outcomes; OSH knowledge, attitudes, and behaviors; and perceptions of the psychosocial environment of their respective dairies.

METHODS

Procedures

Structured interviews using a survey instrument were conducted with 55 foreign-born, Latinx dairy workers from eight large, industrialized dairies (~750 to 4000 cows per dairy) in Colorado. A convenience sample of dairy operations was obtained by contacting producers via phone and e-mail through the existing network of the last author who is a Doctor of Veterinary Medicine and Professor in the Department of Animal Sciences and

Dairy Extension Specialist at Colorado State University. Upon dairy producer consent, members of the research team visited the dairy operation and solicited worker participation. The interviews were conducted one-on-one, on-site, in a private room, before or after work shifts or during lunch breaks. The interviews took approximately 45 minutes to complete. Interviews were conducted in Spanish by one of three bilingual members of the research team: a Caucasian male and two Latinas. With participant permission, all interviews were audio recorded. Confidentiality was assured and written consent was obtained from all participants before starting the interviews. Participants were compensated $35 for their time.

Responses to open-ended questions were transcribed in Spanish and translated into English. All materials and procedures were approved by the Colorado State University Institutional Review Board before initiation of the study.

Measures

The survey instrument included 48 items designed to assess demographic and job characteristics; OSH training experiences; work-related injury and illness experiences in the last 12 months and other health and well-being outcomes; OSH knowledge, attitudes, and behaviors; the psychosocial environment of the dairy; and what respondents would change about their job to make it better. Additional open-ended items were asked depending on response patterns. Approximately one-third of the survey items were from the NIOSH Quality of Work-Life (QWL) Survey,16 some of which were slightly modified to make them relevant to the dairy context and/or to simplify the language for a low-literacy population. The rest of the survey items were newly created on the basis of themes identified in focus group research that was previously conducted with foreign-born, Latinx dairy workers.15 Two bilingual members of the research team with extensive experience conducting research on animal and human health and well-being in the US dairy industry translated the interview guide into Spanish. Following is a description of the questions used to assess each construct.

Demographic and Job Characteristics

Participants were asked to indicate their sex; age; years of education; country of origin; native language; English proficiency; years working in the US dairy industry; years working at their current dairy; current position; years working in their current position; work shift; average number of hours worked per week; if they had another job in addition to their job at the dairy; and the types of nondairy jobs they held in the past.

Training Experiences

Participants were asked to indicate if they had received any safety or health (ie, infectious and zoonotic diseases) training since working at the dairy. If yes, they were asked to indicate the frequency, format, language, and type of instructor.

Work-Related Injuries and Illnesses and Other Health and Well-Being Outcomes

Participants were asked to indicate if they had experienced a work-related injury or illness at their current dairy in the previous 12 months. If yes, they were asked a series of additional questions. For instance, if a participant reported experiencing a work-related injury, they were asked to describe the type of injury and body part/s affected; if they told their

supervisor, continued working, and/or required first aid; and ways in which the injury could have been prevented. Workers were allowed to indicate and answer follow-up questions regarding more than one injury experienced in the last 12 months. They were also asked if they knew of at least one coworker who had experienced a work-related injury or illness at their current dairy in the previous 12 months.

The other health and well-being outcomes assessed included overall health, perceived job stress, job satisfaction, and work-life balance. Overall health was assessed with a single-item on a 5-point Likert scale ranging from 1 (Poor) to 5 (Excellent). Perceived job stress was assessed with a single item asking participants to indicate how often they found their job stressful on a 5-point Likert scale ranging from 1 (Never) to 5 (Very often). Level of job satisfaction was assessed with a single item asking participants to rate how satisfied they are with their job on a 4-point Likert scale ranging from 1 (Not at all satisfied) to 4 (Very satisfied). Finally, work-life balance was assessed with two items asking how often work and family/personal life interfere with one another on a 4-point Likert scale ranging from 1 (Never) to 4 (Often).

OSH Knowledge, Attitudes, and Behaviors

To assess OSH knowledge, attitudes, and behaviors, participants were asked a series of questions related to if and how they believed dairy work could affect worker safety and health; the perceived risk of being injured or acquiring an infection at work associated with nine work tasks (ie, milking, hospital, calving management, cow housing maintenance, calf rearing, feeding, manure management, equipment operations, and moving/pushing cows) on a scale ranging from 0 (Low risk) to 10 (High risk); whether their dairy had a first aid kit; knowledge of disease transmission between humans and farm animals; and what they do to prevent getting sick. Participants were also asked if they had told their doctor they work with farm animals and, if so, what recommendations their doctor made to prevent illnesses or injuries related to exposure to farm animals.

Psychosocial Environment

The survey assessed five aspects of the psychosocial environment of the dairy: management treatment/relations, performance conditions, perceived workload, quality of communication with dairy management, and supervisor concern regarding workers' work-related illness and safety. Management treatment/relations, which focused on workers' perceptions of their relationship with and treatment by dairy managers, was assessed with five items. Performance conditions, which focused on conditions of the job that support or inhibit performance, was assessed with seven items. Perceived workload and supervisor concern were each assessed with a single item, and quality of communication with management was assessed with three items. See Table 1 for item language and response options. The two items that were assessed on a 5-point Likert scale were converted to a 4-point Likert scale to match the rest of the management treatment/relations and quality of communication with management items.

Suggestions

Participants were asked an open-ended question: “If you could change something about your job to make it better, what would it be?” and were allowed to indicate more than one desired change.

DATA ANALYSIS

All analyses were conducted using SPSS Version 21.0 (IBM Corp, Armonk, NY). Scales scores were calculated for management treatment/relations, performance conditions, and quality of communication with dairy management after reverse coding items as needed so that a high score represents a high amount of the construct. On the basis of Cronbach alpha, internal consistency was found to be adequate-management treatment/relations ([alpha] = 0.841), performance conditions ([alpha] = 0.756), and quality of communication with management ([alpha] = 0.629).

Descriptive statistics (ie, ranges, means, standard deviations, and frequencies) were calculated to summarize the results for all quantitative constructs. Open-ended responses were translated into English by a bilingual member of the research, then categorized and quantified by the first author. Predictive models were specified to explore the relationships between 11 predictor variables, including various demographic and job characteristics (English proficiency, current position, shift, average hours worked per week); frequency of safety and health training; all measured aspects of the psychosocial environment of the dairy (management treatment/relations, performance conditions, perceived workload, quality of communication with management, and supervisor concern regarding work-related illness and safety); and six outcome variables: experience of a work-related injury in the last 12 months; whether they told their doctor they work with farm animals; overall health ratings; perceived job stress; job satisfaction; and work-life balance. Logistic regression models were specified to examine predictors of binary outcomes (experience of a work-related injury in the last 12 months and whether they told their doctor they work with farm animals), and multiple linear regression models were used to examine predictors of continuous outcomes (overall health ratings, perceived job stress, job satisfaction, and work-life balance). All 11 predictor variables were examined in the models for overall health ratings, perceived job stress, and job satisfaction. For the other three outcome variables (ie, experience of a work-related injury in the last 12 months, whether they told their doctor they work with farm animals, and work-life balance), some of the predictor variables were excluded because they were not applicable to the outcome variable. Specifically, for experience of a work-related injury in the last 12 months, frequency of health training was excluded; for whether they told their doctor they work with farm animals, average hours worked per week, performance conditions, and perceived workload were excluded; and for work-life balance, frequency of safety and health training were excluded. Age, sex, years of schooling, and years in the US dairy industry were included in all models as control variables. A Bonferroni correction was applied to account for multiple comparisons.

RESULTS

Descriptive Statistics

Demographics and Job Characteristics—A total of 55 workers participated in an interview. Eighty percent of the participants were male, and, on average, participants were 35 years old and had completed 9 years of schooling. A majority of the participants were from Mexico (69.1%) and identified Spanish as their native language (94.5%). When asked to describe their English proficiency, the most commonly selected response was "I understand it well, but have trouble speaking it" (46.3%), followed by "None" (35.2%). Participants had been working in the US dairy industry between one-and-a-half months and 23 years (Median = 5 years), at their current dairy between one-and-a-half months and 14 years (Median = 10.33 years), and in their current position between 1 month and 13 years (Median = 1.08 years). Participants held a variety of positions on the dairy; the two most common were milking and moving/pushing cows (40%) and maternity and calf management (21.8%). A majority (67.3%) worked the day/morning shift. Participants reported working between 35 and 72 hours per week (Mean = 55.81, SD = 8.44). Only three participants (5.5%) reported having another job in addition to their current job at the dairy. Of the 43 participants who specified the types of jobs held before working in the dairy industry, the most common responses were in construction/carpentry (39.5%), cleaning (25.6%), food service (25.6%), agriculture (20.9%), factory/warehousing (18.6%), and landscaping (11.6%; participants were allowed to indicate multiple types of jobs held in the past).

OSH Training—Thirty-eight participants (69.1%) reported receiving safety training and 22 participants (40%) reported receiving health training (ie, related to zoonotic and infectious diseases) at least once while working at their current dairy. Seventeen participants (30.9%) reported receiving no safety or health training while working at their current dairy, and these participants reported working at their current dairy between 2 months and 13.33 years (Median = 4.5 years). The average frequency of safety and health training was between twice a year (score of 3) and monthly (score of 4) for both safety and health training; one respondent did not indicate frequency of safety training and three respondents did not indicate frequency of health training (see Table 2 for additional descriptive statistics regarding frequency of safety and health training). The most common format of safety and health training was video (75.7% and 61.1%, respectively); one participant did not indicate the format of safety training, and four participants did not indicate the format of health training. The most common language of safety and health training was Spanish (94.6% and 94.4%, respectively); one participant did not indicate the language of safety training, and four participants did not indicate the language of health training. Dairy managers provided a majority of safety and health training (85.7% and 76.5%, respectively), and the remaining was provided by outside trainers; three participants did not indicate the type of instructor for safety training, and five participants did not indicate the type of instructor for health training.

Work-Related Injuries and Illnesses and Other Health and Well-Being Outcomes—Sixteen (29.1%%) participants reported experiencing at least one work-related injury at their current dairy in the last 12 months. Of these, the most commonly reported types of injuries were animal-related (64.3%), equipment/machinery-related

(28.6%), and musculoskeletal pain (21.4%); two participants did not indicate the type of injury. The most frequently mentioned affected body parts were the hands/arms (40%), back (20%), and legs/feet (20%); one participant did not indicate the affected body part. Ten (66.7%) participants told their supervisor about the injury (one participant did not respond). The five workers who did not tell their supervisor had been pushed, stepped on, or kicked by cows; suffered from back pain; injured their hand/s while pulling calves; experienced falls; and/or were hit by a machine. When asked to explain why they did not report these injuries to their supervisors, three said it was because they felt the injury was minor/not serious, one said they did not know why, and one did not respond. A majority (93.3%) reported that they continued working after the injury occurred (one participant did not respond). Two workers who continued working after the injury felt they needed time off to recover but were not allowed to take it. Another worker was given the option to switch tasks (ie, work in the corrals instead of milking) for the rest of the day. Over one-third (38.5%) said the injury required first aid (three did not respond), and only three (20%) received medical attention (one worker did not respond). When asked how the injury could have been prevented, the most common response was to use more precaution (35.7%), and the next most common response was that the injury was unpreventable (28.6%; two participants did not respond). See Table 3 for additional descriptive statistics regarding injury type, body part affected, and perceptions regarding how the injury could have been prevented. Three (5.5%) participants reported experiencing a work-related illness in the last 12 months. Given the low prevalence of this outcome, predictive models were not explored.

Thirty-eight (70.4%) participants reported knowing of at least one coworker who had been injured at work in the last 12 months; one participant did not respond. The most common type of coworker injury was animal-related (61.8%), followed by equipment-related (23.5%); four participants did not indicate the type of coworker injury. See Table 3 for additional descriptive statistics regarding coworker injury type. Thirteen (23.6%) workers said that they knew of at least one coworker experiencing a work-related illness in the last 12 months.

In terms of other health and well-being outcomes, average overall health ratings were between good (score of 3) and very good (score of 4; Mean = 3.71, SD = 0.96). Descriptive statistics for perceived job stress, perceived job satisfaction, and work-life balance are reported in Table 2.

OSH Knowledge, Attitudes, and Behaviors—Just over half (54.5%) of participants perceived working on a dairy as potentially unsafe. When asked to rate the risk of being injured associated with various tasks on a scale ranging from 0 (no risk) to 10 (extremely high risk), participants reported calving management and hospital tasks as having the highest level of risk (Mean = 6.83, SD = 3.38 and Mean = 6.62, SD = 3.27, respectively) and moving/pushing cows and cow housing maintenance as having the lowest level of risk (Mean = 5.00, SD = 2.74 and Mean = 5.07, SD = 3.25, respectively); one participant did not rate the level of injury risk associated with calving management and milking.

Approximately one-third (34.5%) of participants believed working on a dairy could affect worker health, most commonly through biological exposures such as bacteria (52.9%) and

environmental exposures such as dust (47.1%; participants were allowed to indicate multiple aspects of dairy work that could affect health); two participants did not specify aspects of dairy work that can affect health. When asked about the level of risk of acquiring an infection associated with various tasks on a scale from 0 (no risk) to 10 (extremely high risk), participants reported hospital tasks and manure management as having the highest level of risk (Mean = 7.60, SD = 2.69 and Mean = 6.98, SD = 3.09, respectively) and equipment operations and cow housing maintenance as having the lowest level of risk (Mean = 4.02, SD = 3.51 and Mean = 4.74, SD = 3.31, respectively).

When asked whether the dairy had a first aid kit, a majority (74.5%) indicated yes, four (7.3%) indicated no, and 10 (18.2%) said they did not know. Over half (53.8%) of the participants who indicated the location of the first aid kit said that it was found in the dairy's office, and 10 (25.6%) said that the dairy had first aid kits in multiple locations. Nearly three quarters of the participants (75.9%) reported having knowledge of disease transmission between humans and farm animals; one participant did not respond. Those who reporting having this knowledge were asked to list diseases that can be transmitted between humans and farm animals. About half (51.2%) reported knowledge of specific diseases, most commonly Escherichia coli and Salmonella, and the rest either said they did not know (34.1%) or did not respond (14.6%). When asked how to describe the ways in which they prevent getting sick, the most common responses were related to hygiene (37.7%), heat/cold protection (35.8%), diet/nutrition (34%), and using personal protective equipment (26.4%); two participants did not respond.

Twenty-eight participants (51.9%) reported telling their doctor they work with farm animals; one participant did not respond. When asked to specify recommendations made by doctors, a majority (60%) said their doctor offered no recommendations; three participants did not respond. Among the participants who specified doctor recommendations, the most common recommendations were to use personal protective equipment (24%) and practice good hygiene (16%; participants were allowed to indicate more than one recommendation).

Psychosocial Environment—Descriptive statistics for management treatment/relations, performance conditions, perceived workload, quality of communication with management, and supervisor concern regarding work-related illness and safety are reported in Table 2.

Suggestions—When asked what they would change about their job to make it better, the most common response was to hire more/better workers (25.5%), followed by nothing (19.1%), more recognition for good work performance (14.9%), better pay and/or pay for overtime (12.8%), fewer hours and/or work days (12.8%), better communication/ relationships with dairy management (10.6%), new and better equipment (6.4%), and more/ longer breaks (6.4%); eight participants did not respond.

Predictive Models—None of the 10 variables examined as predictors of experiencing a work-related injury in the last 12 months were significant. Of the eight variables examined as predictors of whether participants told their doctor they work with farm animals, frequency of safety training and frequency of health training were significant, but only frequency of safety training remained significant after applying the Bonferroni correction (P

= 0.05/8 = 0.006). Of the 11 variables examined as predictors of overall health ratings, management treatment/relations, performance conditions, and supervisor concern regarding work-related illness and injury were significant; as scores on these predictors increased, so did overall health ratings. The effect of performance conditions remained significant after applying the Bonferroni correction (P = 0.05/11 = 0.005). Five of the 11 variables examined as predictors of perceived job stress were significant (average hours worked per week, management treatment/relations, performance conditions, perceived workload, and quality of communication with management). As average hours worked per week and perceived workload increased, perceived job stress increased, while as management treatment/relations, performance conditions, and quality of communication with management increased, perceived job stress decreased. Perceived workload and quality of communication with management remained as significant predictors of perceived job stress after applying the Bonferroni correction (P = 0.005). Management treatment/relations and supervisor concern regarding work-related illness and safety were the only significant predictors of job satisfaction out of the 11 predictors examined, such that as management treatment/relations and supervisor concern ratings increased, so did job satisfaction. Both of these predictors remained significant after applying the Bonferroni correction (P = 0.005). Finally, three of the nine variables examined as predictors of work-life balance (management treatment/relations, performance conditions, and quality of communication with management) were significant. All predictors showed a positive relationship in that an increase in the predictor was associated with an increase in work-life balance. Performance conditions and quality of communication with management remained as significant predictors of work-life balance after applying the Bonferroni correction (P = 0.05/9 = 0.006). See Table 4 for a summary of results from significant logistic and multiple linear regression models for all outcome variables.

DISCUSSION

This study fills an important research gap regarding the OSH of foreign-born, Latinx dairy workers in the US. Nearly one-third of the participants reported experiencing at least one work-related injury in the last 12 months, most commonly animal-related injuries to the hand/arm or back. Notably, over one quarter of the participants perceived the injury as unpreventable, and approximately one-third did not report the injury to their supervisor. This finding is aligned with other studies in the dairy industry. For instance, Liebman et al 13 found that immigrant, dairy workers underreport work-related injuries out of fear of job loss, deportation, and other repercussions. Workers should be encouraged to report all injuries and near-misses so their supervisor can determine the need for first aid and/or medical attention beyond first aid. For instance, two workers who did not report their injuries to their supervisors had been experiencing back pain, which could indicate a musculoskeletal disorder that could worsen over time. It is also important for supervisors to be made aware of all injuries and near-misses so they can determine if there are additional controls that can be put into place and/or training that can be provided to workers to prevent such injuries from occurring in the future. Almost two-thirds of participants reported knowing of at least one coworker who had been injured in the last 12 months. Although only three participants reported experiencing a work-related illness in the last 12 months, 13 reported knowing of at

least one coworker who had experienced a work-related illness in the same time period. These findings stress the fact that dairy production continues to be a dangerous industry due to factors inherent in its environment and required daily tasks.

Considering the high number of work-related injuries reported, it is surprising that nearly half of the participants did not perceive working on a dairy as potentially unsafe, and approximately two-thirds did not believe working on a dairy could affect worker health. The limited awareness of OSH risks in the dairy industry may be attributed to a lack of adequate OSH training. Nearly one-third of the participants reported they had not received any safety or health training since starting their job on the dairy. These findings are consistent with previous studies examining OSH training in the dairy industry.13–15

The most commonly reported format of training was videos; however, a meta-analysis examining the effectiveness of different OSH training methodologies indicates that less engaging training modalities, such as videos, are less effective compared with more engaging training modalities.17 In addition to using more engaging training modalities, it is also imperative that OSH training is optimally tailored to its target audience. See Menger et al 18 for a review of promising strategies for how to effectively tailor health and safety training for foreign-born, Latinx dairy workers, and Juarez-Carrillo et al 19 for an example of an OSH curriculum designed to increase knowledge, encourage safe behavior, and reduce worker communication inequalities among Hispanic immigrant dairy workers.

The findings also revealed a need for providing more OSH education and training to health care providers. In order to provide comprehensive care, it is important for physicians and other health care providers to ask their patients about the type of work they do and to discuss the relationship between work and health with their patients. Of the 28 participants who told their doctor they work with farm animals, over half said their doctor did not make any recommendations for how to stay healthy and safe at work, suggesting a need for OSH training for physicians and other healthcare providers. The lack of consistent and culturally congruent training for dairy workers, paired with the lack of recommendations by health care providers, could play a significant role in the vulnerability of foreign-born, Latinx dairy workers to work-related injuries and illnesses. Both workers and physicians and other health care providers should be informed of the importance of discussing work-related health and safety issues with one another to ensure these conversations take place. Additional research is needed to better understand the contexts in which workers visit physicians and other health care providers in order to inform the tailoring of training for both workers and physicians and other health care providers.

In terms of other health and well-being outcomes, participants rated their overall health, job satisfaction, and work-life balance as high, and their level of perceived job stress as moderate. On average, participants rated management treatment/relations and performance conditions more positively than the quality of communication with management and level of supervisor concern regarding workers work-related illness and safety.

Despite the small sample size, regression models revealed some significant predictors of the six outcome variables, even after applying Bonferroni corrections to account for multiple

comparisons. Whether or not participants told their doctor they work with farm animals was significantly associated with frequency of safety training; as training increased, so did the likelihood that participants had told their doctor they work with farm animals. Overall health ratings were significantly associated with performance conditions; as ratings of conditions increased so did overall health ratings. Perceived job stress was significantly associated with quality of communication with management; as quality increased, job stress decreased. Unsurprisingly, perceived workload was another significant predictor of perceived job stress-as perceived workload increased so did perceived job stress. Job satisfaction was significantly predicted by management relations/treatment and supervisor concern regarding work-related illness and safety. Finally, quality of communication with management and performance conditions significantly predicted work-life balance; as both predictors increased, work-life balance also improved. In a qualitative study of OSH among foreign-born, Latinx workers in the dairy industry, Menger et al 15 also identified management relations/treatment, quality of communication with management, and supervisor concern regarding worker work-related illness and safety as influential factors that affect worker health and well-being.

These findings suggest the psychosocial environment of the dairy may have a greater influence on OSH outcomes than demographic and job characteristics or the frequency of OSH training. Future research is needed to develop and disseminate effective interventions to improve the psychosocial environment of US dairy farms and, in turn, improve the health and well-being of foreign-born, Latinx dairy workers.

Of course, it is important to consider the limitations of this study-such as the small sample size, cross-sectional nature of the data, and the fact that a majority of the participants were from the morning/day shift, with less representation from other shifts-when interpreting the findings from this study. It is likely that a larger study with greater statistical power would be able to identify additional significant predictors of work-related injuries and illnesses among foreign-born, Latinx dairy workers. The use of Likert scales with a population with limited formal education and cultural unfamiliarity with such concepts may have also influenced the results. Although beyond the scope of this study, future studies should validate the use of such scales with this population. Another limitation is the fact that participants were recruited via their dairies with the permission of the owners or managers. Although efforts were made to assure participants that their responses would be kept confidential and not shared with dairy management, this still may have biased their responses. Future research should attempt to recruit participants through other avenues, such as churches or other community settings to avoid such biases.

CONCLUSION

With the increasing prevalence of foreign-born, Latinx workers in the US dairy industry, it is essential to develop OSH programs, policies, and procedures to meet the unique needs of this growing segment of the US workforce. Overall, the findings from this study suggest that in addition to investing in more comprehensive, frequent, and tailored OSH training for workers, dairy operations should also invest in programs to develop strong leadership and communication skills among middle and top dairy managers. Additional research is needed

to better understand and foster more supportive psychosocial environments within the US dairy industry.

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Table 1

Psychosocial Environment Items and Response Options

Item	Scale
Management treatment/Relations ($\alpha = 0.841$)	
At the place where I work, I am treated with respect.	1 (Strongly Disagree) to 4 (Strongly Agree)
In general, how would you describe relations in your workplace between management and employees?	1 (Very bad) to 5 (Very good)
I trust the management at the place where I work.	1 (Strongly Disagree) to 4 (Strongly Agree)
Promotions are handled fairly.	1 (Strongly Disagree) to 4 (Strongly Agree)
My supervisor treats me fairly.	1 (Strongly Disagree) to 4 (Strongly Agree)
Performance conditions ($\alpha = 0.756$)	
On my job, I know exactly what is expected of me.	1 (Strongly Disagree) to 4 (Strongly Agree)
Conditions on my job allow me to be as productive as I could be.	1 (Strongly Disagree) to 4 (Strongly Agree)
The place where I work is run in a smooth and effective manner.	1 (Strongly Disagree) to 4 (Strongly Agree)
At work, there are enough people or staff to get all the work done.	1 (Strongly Disagree) to 4 (Strongly Agree)
I receive enough help to get the job done.	1 (Strongly Disagree) to 4 (Strongly Agree)
I have access to equipment to get the job done.	1 (Strongly Disagree) to 4 (Strongly Agree)
I have received enough training to get my job done.	1 (Strongly Disagree) to 4 (Strongly Agree)
Perceived workload	
I have too much workload to do to perform well at my job.	1 (Strongly Disagree) to 4 (Strongly Agree)
Quality of communication with management ($\alpha = 0.629$)	
How would you describe communication between your manager/supervisor and his/her employees?	1 (Very bad) to 5 (Very good)
Language differences negatively affect communication between management and employees. (Reverse-coded)	1 (Strongly Disagree) to 4 (Strongly Agree)
Cultural differences negatively affect communication between management and employees. (Reverse-coded)	1 (Strongly Disagree) to 4 (Strongly Agree)
Supervisor concern	
How much is your supervisor/manager concerned about dairy work-related illness and safety?	0 (not concerned at all) to 10 (extremely concerned)

Table 2

Descriptive statistics for all variables included in the logistic and multiple regression models

Controls	*N* (%)/Range	Mean	SD
Age	19–64	35.05	9.64
Sex (Male)	44 (80)		
Year of schooling	1–20	8.89	3.97
Years in US dairy industry	0.17–23	6.04	5.41
Predictors	***N* (%)/Range**	**Mean**	**SD**
Demographic and Job Characteristics			
Country of origin			
Mexico	38 (69.1)		
Central America	14 (25.5)		
South America	3 (5.5)		
English proficiency (1)			
I speak it very well	6 (11.1)		
I understand it well but have trouble speaking it	25 (46.3)		
I do not understand it very well	4 (7.4)		
None	19 (35.2)		
Current position			
Milking and moving/pushing cows	20 (36.4)		
Maternity and calf management	9 (16.4)		
Feeding management	5 (9.1)		
Reproductive and health management	7 (12.7)		
Maintenance	3 (5.5)		
Management	2 (3.6)		
Multiple positions	9 (16.4)		
Shift (6)			
Day/morning	37 (67.3)		
Afternoon	6 (10.9)		
Night	4 (7.3)		
Irregular/on call/relief/rotating	8 (14.5)		
Average hours worked per week (1)	35–72	55.81	8.44
Training	**Range**	**Mean**	**SD**
Frequency of safety training (1)	1–4	3.59	0.95
Frequency of health training (3)	1–5	3.08	1.36
Psychosocial Environment	**Range**	**Mean**	**SD**
Management treatment/relations	1.35–4	3.48	0.62
Performance conditions	1.86–4	3.41	0.53
Perceived workload	1–4	2.16	1.03
Quality of communication with management	1.25–4	2.75	0.75
Supervisor concern	0–10	7.15	3.05
Outcomes	***N* (%)/Range**	**Mean**	**SD**
Work-related injury in last 12 months	16 (29.1)		
Told doctor work with farm animals (1)	28 (51.9)		
Overall health rating	2–5	3.71	0.96
Perceived job stress	1–5	2.71	1.27
Job satisfaction	2–4	3.69	0.51
Work-life balance	1–4	3.11	0.71

Number of missing responses are in parentheses. Percentages were calculated on the basis of number of responses and may not add to 100 due to rounding. For all variables, a higher value reflects a greater amount of the construct.

Table 3

Summary of Work-Related Injuries in Last 12 Months

Response (No. Missing)	*N*	%
Self Injuries	16	29.1
Injury type (2)		
Animal-related	9	64.3
Equipment/tools/machinery-related	4	28.6
Musculoskeletal	3	21.4
Slips/trips/falls	2	14.3
Chemical	1	7.1
Burn	1	7.1
Body part affected (1)		
Back	3	20
Hand/arm	6	40
Head/face	2	13.3
Leg/foot	3	20
Chest	1	6.7
Testicles	1	6.7
Told supervisor (1)	10	66.7
Continued working (1)	14	93.3
How it could have been prevented (2)		
Improved communication	2	14.3
More precaution	5	35.7
More workers	2	14.3
PPE	2	14.3
Use other tool	1	7.1
Do not know	1	7.1
Nothing	4	28.6
Coworker Injuries (1)	38	70.4
Injury type (4)		
Animal-related	21	61.8
Equipment/tools/machinery-related	8	23.5
Slips/trips/falls	2	5.9
Chemical	1	2.9
Burn	1	2.9
Unknown	2	5.9

Number of missing responses are in parentheses. Percentages were calculated on the basis of number of responses. Percentages for type of injury, body part affected, and how the injury could have been prevented add up to more than 100 because some participants provided more than one response.

Table 4

Significant Logistic and Multiple Linear Regression Models for All Outcome Variables

Outcome	Adj. R^2 (P)	b (SE)	OR	P	95% CI (b or OR)
Told doctor					
Frequency of health training		0.53 (0.22)	1.70	0.015	1.11–2.60
Frequency of safety training		**0.61 (0.21)**	**1.85**	**0.003**	**1.23–2.78**
Overall health					
Management treatment/relations	0.23 (0.003)	0.46 (0.19)		0.018	0.08–0.84
Sex		0.88 (0.29)		0.004	0.30–1.46
Performance conditions	**0.28 (0.001)**	**0.66 (0.21)**		**0.003**	**0.24–1.08**
Sex		0.91 (0.28)		0.002	0.35–1.47
Supervisor concern	0.25 (0.001)	0.10 (0.04)		0.008	0.03–0.18
Sex		0.83 (0.28)		0.005	0.26–1.39
Perceived job stress					
Average work hours per week	0.25 (0.002)	0.05 (0.02)		0.008	0.01–0.09
Age		−0.04 (0.02)		0.032	−0.07 to −0.01
Years in US dairy industry		0.07 (0.03)		0.030	0.01–13
Management treatment/relations	0.26 (0.001)	−0.72 (0.25)		0.006	−1.21 to −0.22
Years of schooling		0.09 (0.04)		0.020	0.02–0.17
Years in US dairy industry		0.07 (0.03)		0.022	0.01–0.13
Performance conditions	0.25 (0.002)	−0.76 (0.29)		0.010	−1.34 to −0.19
Years of schooling		0.09 (0.04)		0.021	0.01–0.17
Years in US dairy industry		0.08 (0.03)		0.009	0.02–0.14
Perceived workload	**0.36 (<0.001)**	**0.58 (0.14)**		**<0.001**	**0.30–0.85**
Years of schooling		0.11 (0.04)		0.003	0.04–0.19
Time in US dairy industry		0.08 (0.03)		0.006	0.02–0.13
Quality of communication with management	**0.27 (0.001)**	**−0.59 (0.20)**		**0.005**	**−0.99 to −0.19**
Years of schooling		0.09–0.04		0.024	0.01–0.16
Years in the US dairy industry		0.07–0.03		0.023	0.01–0.13
Job satisfaction					
Management treatment/relations	**0.16 (0.018)**	**0.39 (0.10)**		**0.001**	**0.18–0.60**
Supervisor concern	**0.17 (0.013)**	**0.08 (0.02)**		**<0.001**	**0.04–0.12**
Work-life balance					
Management treatment/relations	0.14 (0.031)	0.41 (0.15)		0.007	0.12–0.71
Performance conditions	**0.22 (0.004)**	**0.60 (0.16)**		**0.001**	**0.27–0.92**
Quality of communication with management	**0.15 (0.023)**	**0.35 (0.12)**		**0.005**	**0.11–0.59**

Only significant control variables are reported. R^2 only reported for multiple regression models (not logistic regression models). The 95% CI is for the OR for logistic regression models and for the b for multiple regression models. Models that remained significant after applying the Bonferroni correction are in bold.
CI, confidence interval; OR, odds ratio.