



The relations of workplace safety, perceived occupational stress, and adjustment among Latino/a immigrant cattle feedyard workers in the United States

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ARTICLE INFO

Keywords:

Agriculture
Farmworkers
Latino/Hispanic
Work stress
Occupational safety and health

ABSTRACT

Immigrant workers face significant occupational health and safety concerns and are often employed in dangerous, dirty, and demanding (3-D) jobs such as agriculture. To foster improvements in immigrant farm-worker health, integrative research that explores workplace safety, stress, and health and safety outcomes is needed. Therefore, the present study was designed to examine workplace safety characteristics and perceived stressors as predictors of Latino/a immigrant cattle feedyard workers' psychosocial adjustment. Data were from the "Health and Safety among Immigrant Cattle Feedyard Workers in the Central States Region" project, and participants included 243 Latino/a immigrant cattle feedyard workers from Kansas and Nebraska (M age = 37.68, SD = 10.10; 91.2% male). A path model including direct and indirect relations among the number of personal protective equipment and training types, safety climate, occupational stress, and adjustment outcomes (depression, anxiety, need for recovery, and life satisfaction) was examined. We found that the number of types of personal protective equipment and training positively predicted safety climate, which negatively predicted occupational stress. In turn, occupational stress was positively associated with depression, anxiety, and need for recovery, and negatively associated with life satisfaction. The present findings support the notion that workplace safety is directly associated with the health and well-being of immigrant workers and delineates the mechanisms by which workplace safety characteristics relate to workers' adjustment. This study yields supportive evidence for an *ecological stress-based model of immigrant worker health and safety* in U.S. Latino/a cattle feedyard workers. Implications for theory, research, and practice are discussed.

1. Introduction

Globally, each year nearly 164 million people migrate to find work (International Labour Organization, 2018). In the United States (U.S.), there are 28.4 million foreign-born workers, comprising 17.4% of the total workforce. Hispanic/Latino individuals accounted for almost half of the foreign-born labor force. On average, foreign-born workers tend to have lower levels of educational attainment and earn less money compared to their native-born counterparts (U.S. Bureau of Labor Statistics, 2020).

Immigrant workers face significant occupational health and safety concerns. They are often employed in dangerous, dirty, and demanding (3-D) jobs such as agriculture. Indeed, foreign-born workers comprise

more 75% of those that work in crop production (Hernandez & Gabbard, 2018) and more than a third of those who work in livestock production (e.g., cattle, hogs, and horses) (U.S. Department of Agriculture [USDA], 2019). Immigrants and foreign-born workers are considered vulnerable by the National Occupational Research Agenda (NORA)'s Agriculture, Forestry, and Fishing Sector Council (NORA, 2018). These workers have fewer protections than other workers. They may be fearful to raise concerns about unsafe working conditions, discrimination or harassment, and pay (Moyce and Schenker, 2018; Ramos et al., 2021a; Yanar et al., 2018). This is particularly true for workers who lack proper authorization to work (i.e., undocumented workers) as they may risk not only losing their job, but also being reported to immigration authorities and being deported. Immigrant workers may also have little access to

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<https://doi.org/10.1016/j.ssci.2021.105262>

Received 30 June 2020; Received in revised form 27 February 2021; Accepted 12 March 2021

Available online 5 April 2021

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job-related training and personal protective equipment (PPE) (Moyce and Schenker, 2018; Ramos et al., 2016b). Limited English proficiency and cultural differences may present challenges to health and safety information and training and influence perceptions of risk (García-Arroyo and Osca Segovia, 2020; Ramos et al., 2016b). Further, immigrant workers may have less access to healthcare and be more likely to be uninsured (Moyce and Schenker, 2018; Ornelas et al., 2020). The present study was designed to examine workplace safety characteristics and perceived stressors as predictors of Latino/a immigrant cattle feedyard workers' psychosocial adjustment.

1.1. Cattle feedyards

Cattle feedyards are part of the beef production cycle. A feedyard is a physical space where beef cattle typically spend between three and six months and are fed a specific ration to help them gain weight – adding muscle and fat (USDA, 2011). Cattle feeding operations are concentrated in the Midwestern part of the U.S., with approximately half of all feedyards and feedyard workers in the country being in the Central States region consisting of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota (Ramos et al., submitted for publication-a).

Cattle feedyards are risky environments with high rates of occupational injuries and illnesses. In 2018, the beef cattle ranching and farming, including the feedlot sector [NAICS code 11211] reported 8.5 injuries per 100 workers, which is significantly higher than the 'all industries' rate of 3.1 injuries per 100 workers (U.S. Bureau of Labor Statistics, 2018). Feedyard work is typically divided into departments such as cowboy/pen rider (e.g., people who check the health and safety of cattle in their pens), processing (e.g., people who manage cattle entering and exiting the feedyard), hospital or sick pen (e.g., people who check and care for sick animals), feed mill (e.g., people who grind feed stuffs into appropriate rations for the cattle), feed delivery (e.g., people who deliver the feed to the cattle's feed bunks), yard maintenance (e.g., people who maintain feedyard facilities, equipment, and machinery), administration (e.g., office staff and management), and security (e.g., people who ensure the physical security of the premises). Feedyard workers have a number of work-related exposures. For example, they may experience extreme weather conditions, particularly since most work is outdoors and have long hours with few days off. Workers may also be exposed to dust, noise, and heavy machinery as well as have contact with veterinary pharmaceuticals, chemicals, and pesticides. Some departments such as cowboy/pen riders, processing, and hospital or sick pen also have direct contact with the cattle, and in the case of cowboys and pen riders, sometimes they have contact with horses as well. Direct contact and handling of large animals is a serious risk factor for occupational injury (Swanton et al., 2016), but may also contribute to job satisfaction (Muri et al., 2020). Many workers may not have had feedyard-specific safety training to be able to identify risks or understand proper prevention and mitigation strategies (Ramos et al., 2018). Additionally, it is unclear to what extent PPE is provided to workers and used regularly across the industry.

1.2. Theoretical framework

To investigate the relations among workplace safety characteristics, perceived stress, and Latino/a immigrant cattle feedyard workers' adjustment, previous theoretical frameworks were adapted to create an

ecological stress-based model of immigrant worker health and safety (see Fig. 1). The first framework draws from social ecology theory (Bronfenbrenner, 1979), which posits various factors of the ecology including the characteristics of the work context (e.g., safety training, safety equipment, safety climate) influence psychosocial adjustment (Boss, 2002; Laosa, 1990). Multiple levels of influence affect how an individual worker processes information (Bronfenbrenner, 1979; Lee et al., 2017). As such, subjective perceptions and interpretations may be more important than objective assessments of the environment (Neal and Griffin, 2004; Xia et al., 2017). Risk perception is both rational and emotional. As an individual perceives risks, they may become more safety compliant (e.g., use of safety equipment) and engage in participatory behaviors (e.g., safety training) to mitigate their risks (Xia et al., 2017). Stress frameworks propose that exposure to risk characteristics lead to perceived stress (Berry and Kim, 1988; Lazarus and Folkman, 1984), which in turn, can undermine psychosocial health and well-being. For present purposes, we identified several adjustment indicators (i.e., depression, anxiety, need for recovery, life satisfaction) that are commonly linked to stress and risk factors and have been researched in prior work on work stress and health (e.g., Arcury et al., 2012; Hiott et al., 2006; Van Veldhoven and Broersen, 2003). Together, these theoretical frameworks suggest that immigrant workers' health and adjustment are contingent upon workplace safety characteristics via perceived risk and stress perceptions. Our model aligns with the National Institute of Occupational Safety and Health's *Total Worker Health* concept, which highlights that efforts to advance worker well-being must integrate work-related health and safety practices with health promotion beyond the worksite (Schill et al., 2019).

Based on our model, workplace safety characteristics create environments that can reduce workers' stress, risks, and injuries. Work safety climate refers to the shared perceptions regarding safety policies, procedures, and practices (Zohar, 2008) and the relative priority of safety in relation to other competing priorities (Zohar, 2010). It is an important construct because it represents a "key intersection between organizational and psychological processes" and their relationship with safety performance and outcomes (Neal and Griffin, 2004). Work safety climate is a leading indicator of organizational safety (Zohar, 2010), with specific first order factors including management values, safety communication, safety practices, safety training, and safety equipment (Griffin and Neal, 2000). Work safety climate can positively affect worker health and safety directly through workers' attitudes and group norms (Fogarty and Shaw, 2010). For example, Alruqi et al. (2018) identified that management commitment to safety, supervisor's safety role, safety rules and procedures, training, and individual responsibility for safety were predictors of occupational injury (Alruqi et al., 2018). Work safety climate may also have a spillover effect on workers' behaviors outside of work (Ramos et al., 2019b).

Work safety climate has been conceptualized in a variety of ways. On the one hand, it has been viewed as an antecedent to safety outcomes, a relationship that is mediated by safety knowledge, skills, and motivations (Griffin and Neal, 2000). On the other hand, work safety climate has been viewed as both an outcome as well as a mediator between behaviors and safety and satisfaction outcomes (Bunner et al., 2018; Nielsen et al., 2011). For example, those that perceived higher work-related risks had lower job satisfaction, but the effect was diminished by a positive safety climate (Nielsen et al., 2011).

Safety training and safety equipment are antecedents of safety

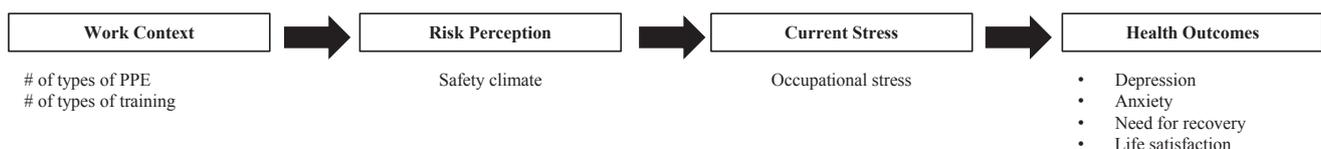


Fig. 1. Adapted Ecological Stress-Based Model of Immigrant Worker Health and Safety.

climate (Griffin and Neal, 2000). Both job-related training and access to and consistent use of PPE have been associated with a stronger work safety climate among farmworkers (Arcury et al., 2015b). Poor work safety climate has been associated with poor health outcomes, occupational injuries, and increased safety risks such as working while injured (Arcury et al., 2012, 2015a; Ramos et al., 2021b).

There have been few studies that have explored the connection between PPE, job-related training, and occupational stress. A study among hospital staff during an outbreak found that safety measures were reported to reduce stress and were a strong motivator for continuing work despite the stressful, dangerous conditions (Khalid et al., 2016). Another recent study further demonstrated that PPE compliance was indirectly negatively associated with work stress (Smith et al., 2018). Additionally, limited research has addressed the relationship between PPE, job-related training, and mental health outcomes. However, a study of Thai rice farmers found that using PPE was a protective factor and was negatively associated with depression (Hanklang et al., 2016).

Clearly, there is a connection between the work-related risk characteristics and mental health. Numerous studies have shown that immigrant farmworkers have high levels of stress, anxiety, and depression (Furgurson and Quandt, 2020; Hovey and Magaña, 2000; Ramos et al., 2016a, 2015). Farmworkers face both structural and situational stressors such as discrimination, acculturation, poverty, immigration legal status, family separation, social isolation, and the high demands and low control experienced in the work environment (Arcury et al., 2015b; Furgurson and Quandt, 2020; Grzywacz et al., 2014; Hiott et al., 2006). Due to nature of agricultural work (i.e., long hours, unpredictable schedules, high demands), farmworkers may have a strong need for recovery, which is a short-term emotional state indicating excessive effort and reflecting a need to regulate work-related activities (Ramos et al., 2021c). Farmworkers may engage in negative coping strategies such as heavy drinking to deal with high levels of stress (Arcury et al., 2016; Furgurson and Quandt, 2020; Ramos et al., 2019b).

Among Latino farmworkers, both depression and anxiety are likely to be underdiagnosed (Furgurson and Quandt, 2020), but research has documented that farmworkers who are stressed are much more likely to also report depression (Chaney and Torres, 2017). Specific stressors such as those related to economics, logistics, and health have been identified as main contributors to reporting depression (Ramos et al., 2015). Harsh working conditions may also exacerbate negative mental health outcomes (Andrews et al., 2019). Stronger safety climate has been associated with less depression (Katz et al., 2019).

Most published studies of immigrant workers have focused on risk factors and negative adjustment outcomes, but the lack of poor adjustment does not necessarily indicate optimal adjustment. Limited studies have explored protective factors and positive adjustment outcomes. Recently, a few studies have explored life satisfaction. One found that stronger work safety climate was associated with greater life satisfaction among manufacturing workers in the U.S. (Katz et al., 2019). Another study documented that life satisfaction among rural Hispanic/Latino immigrant residents was associated with perceived safety, sense of community, and the characteristics of the community where individuals lived such as co-ethnic density (Ramos et al., 2020). To foster improvements in farmworker health and well-being, integrative research that explores workplace safety characteristics, occupational stress, and both positive and negative adjustment outcomes among this worker population is needed.

1.3. Purpose of present study

Studies of immigrant livestock workers are sparse, and little is known about the specific risk and protective factors that affect the health and well-being of these workers. Although some studies have addressed immigrant dairy farmworkers (Adcock et al., 2015; Menger et al., 2016; Schenker and Gunderson, 2013), few have explored any issues related to immigrant cattle feedyard workers. The studies that have addressed the

cattle feedyard worker population have been mainly descriptive, focusing on safety training (including both employer and worker preferences) and the use of social media to reach vulnerable Spanish-speaking workers during the COVID-19 pandemic (Ramos et al., 2018, 2021b, 2019a). One other study explored relations between physical and mental fatigue, job characteristics, health, and sociodemographic characteristics of workers. The authors concluded that job characteristics, job demands, and decision latitude can directly and indirectly impact fatigue and the need for recovery (Ramos et al., 2021c).

The present study was designed to examine workplace safety characteristics and perceived stressors as predictors of Latino/a immigrant cattle feedyard workers' adjustment and test an ecological stress-based model of immigrant worker health and safety. Based on theory and prior research, we hypothesized that inadequate safety training and equipment would be positively linked to lower perceived safety climate, which in turn, would be positively related to perceived work stress and subsequently to higher maladjustment (higher depression, anxiety, and need for recovery, and lower life satisfaction).

2. Materials and methods

2.1. Participants

Data for this study are from the "Health and Safety among Immigrant Cattle Feedyard Workers in the Central States Region" project that was conducted between May 2017 and February 2020. Study inclusion criteria included: (1) identifying as a Hispanic/Latino immigrant, (2) being currently employed on a cattle feedyard in Kansas or Nebraska at the time of data collection, and (3) being at least the age of majority in the state where the data were collected (i.e., Kansas ≥ 18 or Nebraska ≥ 19). A total of 243 Latino/a immigrant cattle feedyard workers participated in this study. Participants were mainly males (91.2%) who were from Mexico (69.5%) or Guatemala (17.3%). The mean age of study participants was 37.68 years old.

2.2. Procedures

Feedyard workers were recruited to participate in this study through a variety of mechanisms including word-of-mouth, feedyard employers, Facebook advertising, and flyers in community locations. If feedyard workers met the inclusion criteria and were interested in participating, then a member of the research team would schedule an interview. Research team members would travel to the participant's location to conduct the interview face-to-face. Most interviews were conducted at community locations (e.g., library or restaurant) or in participants' homes after working hours; however, 20 interviews were conducted at feedyards where the participants were employed during working hours. Prior to starting the interview, the research team member answered any questions that the participant had and obtained informed consent. A structured questionnaire was used for all interviews, and questions were related to the work context, general health, stress and emotional health, social well-being, and demographics. Interviews lasted between 60 and 75 min and no personally identifiable information was recorded. All field research team members who conducted the interviews were bilingual in English and Spanish so that interviews could be conducted in the preferred language of the participant. For completing the interview, participants were given a \$25 or \$30 gift card. Participant compensation was increased during the study period to improve recruitment. This study was approved by the Institutional Review Board at the University of Nebraska Medical Center.

2.3. Measures

All measures used in this analysis are described in detail below.

Safety climate. Safety climate was assessed using a modified version of Gillen's Safety Climate Measure (Gillen et al., 2002), which consisted

of 10 items that addressed management's perceived commitment to safety and workers' engagement in safety. Sample items included, "Workers are regularly made aware of dangerous working practices or conditions," "Proper safety equipment is always available at your workplace, and "Workers have almost total control over personal safety." Eight items were scored on a Likert-type scale from strongly disagree (0) to strongly agree (3). The remaining two questions assessed perceptions about supervisor concern and injury risk over the next year. These two items were scored on a Likert-type scale with lower scores (0) reflecting less supervisor concern and higher perceived injury risk, and higher scores (2) reflecting more supervisor concern and less perceived injury risk. Total scores may range from 0 to 30, and a higher score indicated a perceived safer work environment. The scale had good reliability in this sample, Cronbach's $\alpha = 0.82$.

Number of personal protective equipment (PPE). A measure of PPE was created by summing the "yes" responses to the questions regarding the provision of specific PPE by the employer: sunscreen, sunglasses, goggles, long sleeve shirt, gloves, long pants, boots, and respirator. Thus, scores could range from "0" (no PPE equipment provided by employer) to "8" (eight PPE items provided by employer).

Number of training types. A measure of training types was created by summing the "yes" responses to questions regarding the types of training offered to employees: in-person training (e.g., workshop), videos, shadowing/watching other workers, hands-on training (e.g., supervised practice), and written materials (e.g., handbook). Thus, scores could range from "0" (no training provided by employer) to "5" (five different types of training provided by employer).

Occupational stress. Stress was assessed using six items based on the Hispanic Stress Inventory (HSI), immigrant version (Cervantes et al., 1991). Participants were asked if they have experienced each situation within the last three months. If they responded positively, then they were asked how much stress the situation had caused them. Response options ranged from not at all stressful (1) to extremely stressful (5). Sample items included, "Because I am Latino I have been expected to work harder" and "Because I am Latino it has been hard to get promotions or salary raises." The levels of stress reported by participants for each item were summed to obtain a total scale score. Higher scores indicated higher levels of stress. The scale had good reliability in this sample, Cronbach's $\alpha = 0.88$.

Depression. The Center for Epidemiologic Studies Depression Scale (CESD-10) was used to assess depressive symptomatology among participants (Radloff, 1977). The scale consists of 10 items which measured how often a person reported symptoms associated with depression (e.g., sad, lonely, or had restless sleep) over the past week. Response options included rarely or none of the time (less than 1 day) (0), some or a little of the time (1-2 days) (1), occasionally or a moderate amount of time (3-4 days) (2), or all of the time (5-7 days) (3). Two items representing a positive mood were reverse coded. A total score was calculated by summing all the items. If two or more items were missing, then the scale was not scored. The scale had acceptable reliability in this sample, Cronbach's $\alpha = 0.72$.

Anxiety. The Generalized Anxiety Disorder 7-item scale (GAD-7) was used to assess anxiety. Items related to the criteria for generalized anxiety disorder in the DSM-IV (e.g., not being able to stop or control worrying, having trouble relaxing, being nervous) (Spitzer et al., 2006). Participants were asked to respond based on the past two weeks, and response options included not at all (0), several days (1), over half the days (2), or nearly every day (3). All items were summed to calculate a scale score. The scale had acceptable reliability in this sample, Cronbach's $\alpha = 0.78$.

Need for recovery. Four items from the Need for Recovery Scale were used (Van Veldhoven and Broersen, 2003). Because need for recovery refers to excessive effort and reflects a need to regulate work-related activities, items included: "I find it difficult to relax at the end of a working day", "By the end of the working day, I feel really worn out", "Often, after a day's work I feel so tired that I cannot get involved

in other activities", and "When I get home from work, I need to be left in peace for a while." For each statement, participants were asked to indicate how they felt during the past month, and response options included not at all (1), a little (2), moderately (3), quite a bit (4), or extremely (5). A total score for the scale was calculated by summing the scores for each of the items. This scale had good reliability in this sample, Cronbach's $\alpha = 0.82$.

Life satisfaction. The Satisfaction With Life Scale (SWLS) was used to assess satisfaction with life as a whole (Diener et al., 1985). The scale measures the judgmental component of subjective well-being and consists of five items (e.g., "In most ways my life is close to my ideal"; "The conditions of my life are excellent"; "I am satisfied with my life"; "So far I have gotten the important things I want in life"; and "If I could live my life over, I would change almost nothing.") measured on a Likert-type scale from 1 (strongly disagree) to 7 (strongly agree). Total scores may range from 5 to 35, and there was acceptable reliability in this sample with Cronbach's $\alpha = 0.77$.

Demographic covariates. Participants were asked a series of demographic questions including gender (male or female), job(s) at the feedyard, English proficiency, and tenure with their current employer (years). Participants were provided a list of typical feedyard jobs including cowboy/pen rider, hospital or sick pen, cattle processing, feed mill, feed delivery, yard maintenance, administration, security, or other. If a participant responded "other", then they were asked to describe the type of work that they did at the feedyard. Workers could choose more than one type of job if they engaged in multiple jobs on the feedyard. Jobs were categorized into animal handling (including cowboy/pen rider, hospital or sick pen, or cattle processing) and non-animal handling jobs (all other jobs) because occupational stressors and risks are different between those who directly handle livestock and those who do not. Additionally, those who have direct contact with livestock may have different types of PPE and training. For the analysis, the number of animal handling jobs that a worker engaged in were summed to create a continuous variable. English proficiency was assessed through the question, "How well do you speak English?" Response options included well, somewhat, a little, and not at all.

2.4. Data analysis plan

Using Mplus 8.0 (Muthén & Muthén, 1998-2017), a path model including direct and indirect relations among the main study variables was examined. Anxiety, depression, need for recovery, and life satisfaction were regressed onto occupational stress. Occupational stress was regressed onto safety climate. Finally, safety climate was regressed onto the number of PPE types and number of training types offered by the employer. All variables were regressed onto four control variables including gender, animal handling (number of job types involving animal handling), English proficiency, and years with current employer.

Full information maximum likelihood estimator was implemented in order to estimate any missing data. The bootstrap procedure ($N = 5000$) was implemented in order to determine whether the indirect effects in the model were statistically significant. An indirect effect was significant if the 95% confidence interval for the standard error estimate fell outside of zero for that particular indirect effect (MacKinnon et al., 2002). Since we tested a fully saturated model (i.e., a model that provides exact fit of the data), we did not report model fit indices.

3. Results

3.1. Preliminary analyses: Univariate statistics and correlations

Univariate statistics for the main study variables can be found in Table 1. Occupational stress, depression, anxiety, and need for recovery displayed high skewness (i.e., greater than 1) with values between 1.44 and 2.05. Thus, a square-root transformation was applied, reducing the skewness of these variables (values ranged between 0.06 and 1.00).

Table 1
Univariate Statistics for the Main Study Variables.

Variable				
Gender	Men	n = 218 (91.2%)		
	Women	n = 21 (8.8%)		
English Proficiency	Not at all	n = 47 (19.7%)		
	A Little	n = 116 (48.5%)		
	Somewhat	n = 53 (22.2%)		
	Well	n = 23 (9.6%)		
Animal Handling	M = 1.52	SD = 1.06	Skewness = 0.05	
Years Working for Current Employer	M = 3.27	SD = 4.37	Skewness = 2.93	
Number of PPE Types	M = 3.78	SD = 1.89	Skewness = 0.92	
Number of Job Training Types	M = 1.81	SD = 1.45	Skewness = 0.36	
Safety Climate	M = 1.58	SD = 0.49	Skewness = -0.02	
Occupational Stress	M = 0.81	SD = 0.33	Skewness = 1.46	
Depression	M = 0.38	SD = 0.36	Skewness = 1.69	
Anxiety	M = 0.25	SD = 0.35	Skewness = 2.05	
Need for Recovery	M = 1.71	SD = 0.72	Skewness = 1.44	
Life Satisfaction	M = 5.47	SD = 0.88	Skewness = -0.67	

Years with current employer, however, had a skewness value of 2.93. Since the square root transformation only reduced the skewness of this variable to 1.56, a log10 transformation was applied, reducing the skewness to -0.06. Bivariate correlations among main study variables, using these transformed variables, can be found in Table 2.

3.2. Overall path model results

As discussed above, Mplus 8.0 was used to examine a path model including the direct and indirect relations among the number of PPE and training types, safety climate, occupational stress, and mental health and adjustment outcomes (depression, anxiety, need for recovery, and life satisfaction). The aforementioned transformed variables and control variables were included in the final model. The overall model (see Fig. 2) fit the data perfectly as we examined the saturated model. The R² values for anxiety (0.20), need for recovery (0.23), and life satisfaction (0.12)

Table 2
Correlations for the Main Study Variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Depression ^a	-											
2. Anxiety ^a	0.43**	-										
3. Need for Recovery ^a	0.33**	0.49**	-									
4. Life Satisfaction	-0.32**	-0.21**	-0.30**	-								
5. Occupational Stress ^a	0.16*	-0.37**	0.41**	-0.31*	-							
6. Safety Climate ^a	-0.06	-0.13*	-0.25**	0.19**	-0.35**	-						
7. # of PPE Types	-0.17**	-0.13	-0.18**	0.10	-0.09	0.38**	-					
8. # of Training Types	-0.13*	-0.12	-0.11	0.11	-0.07	0.30**	0.28**	-				
9. Gender ^b	-0.01	-0.07	0.03	0.15*	-0.17**	0.08	-0.06	-0.08	-			
10. Animal Handling	-0.00	0.00	0.01	0.05	-0.08	0.02	-0.05	-0.10	-0.04	-		
11. English Proficiency	-0.03	0.17**	0.12	0.04	-0.10	0.02	0.03	0.03	0.06	0.17**	-	
12. Years with Current Employer ^c	0.03	0.06	0.03	-0.03	-0.01	-0.13*	0.07	-0.11	0.02	0.02	0.10	-

* p < .05,

** p < .01.

^a Square-root transformation applied.

^b Gender is coded as 0 = Men, 1 = Women.

^c Log10 transformation applied.

were statistically significant (p's < 0.01). The R² for depression (0.06) approached statistical significance (p = .07).

Except for the correlation between anxiety and life satisfaction, the correlations among all outcome variables were statistically significant and in the expected directions. The number of PPE types and the number of training types were positively and significantly correlated, and both positively and significantly predicted safety climate. Safety climate negatively and significantly predicted occupational stress. Occupational stress significantly and positively predicted depression, anxiety, and the need for recovery, and significantly and negatively predicted life satisfaction. The only other significant direct effect in the model was the negative path between the number of PPE types and depression.

Table 3 summarizes the tests of the indirect effects. Except for the path among number of training types, safety climate, occupational stress, and depression, the 95% confidence interval for the standard error estimate of all other indirect effects fell outside of zero. Thus, the relations between number of PPE types and training types and the psychosocial adjustment outcomes were generally mediated by perception of safety climate and occupational stress.

4. Discussion

This study used principles of Total Worker Health to examine the relations between workplace safety characteristics, stress, and adjustment among Latino/a immigrant cattle feedyard workers. Overall, the study yielded evidence consistent with an ecological stress-based model of immigrant worker health and safety, highlighting that the relations between workplace safety and Latino/a cattle feedyard workers' adjustment are accounted for by both perceived safety climate and occupational stress. Specifically, the number of types of PPE and training positively predicted safety climate, which negatively predicted occupational stress. In turn, occupational stress was positively associated with depression, anxiety, and the need for recovery, and negatively associated with life satisfaction. These findings were significant in a model statistically controlling for gender, type of job, years working with the current employer, and English language proficiency. The present findings support the notion that workplace safety is associated with the health and well-being of immigrant workers and delineates the mechanisms by which workplace safety characteristics relate to worker adjustment. The discussion focuses on the implications for theories, future research, and practical application.

The mediating effects of safety climate and occupational stress in the relations between workplace safety characteristics and Latino/a immigrant cattle feedyard workers' adjustment were as expected. These findings yielded supportive evidence that workplace safety training and appropriate PPE are important predictors of adjustment among Latino/a

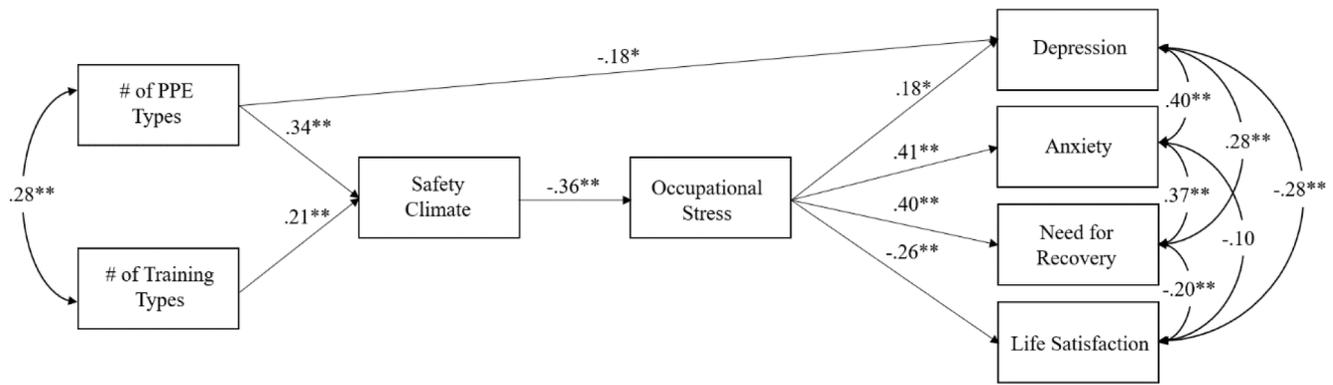


Fig. 2. Path model results (standardized) for the overall model examining the direct and indirect relations among number of PPE types, number of training types, safety climate, occupational stress, and adjustment outcomes. *Note.* Standardized coefficients are presented. Direct effects that were not significant were excluded from the model for parsimony. All variables were regressed onto the four control variables (gender, English proficiency, years with current employer, and animal handling). Individuals who reported greater English proficiency had significantly higher need for recovery and anxiety scores. Compared to men, women were significantly higher on life satisfaction and safety climate, and significantly lower occupational stress. No other relations among control and main study variables reached statistical significance. * $p < .05$, ** $p < .01$.

Table 3
Summary of the (unstandardized) model indirect effects.

Indirect Effect	Effect	Standard Error	95% Confidence Interval
# PPE Types → Safety Climate → Occupational Stress → Depression	-0.004*	0.002	-0.007, -0.001
# PPE Types → Safety Climate → Occupational Stress → Anxiety	-0.009**	0.003	-0.015, -0.005
# PPE Types → Safety Climate → Occupational Stress → Need for Recovery	-0.007**	0.002	-0.011, -0.003
# PPE Types → Safety Climate → Occupational Stress → Life Satisfaction	0.003**	0.001	0.001, 0.005
# Training Types → Safety Climate → Occupational Stress → Depression	-0.003 ⁺	0.002	-0.007, 0.000
# Training Types → Safety Climate → Occupational Stress → Anxiety	-0.007**	0.003	-0.014, -0.003
# Training Types → Safety Climate → Occupational Stress → Need for Recovery	-0.005*	0.002	-0.010, -0.002
# Training Types → Safety Climate → Occupational Stress → Life Satisfaction	0.002*	0.001	0.001, 0.005

⁺ $p < .10$,
* $p < .05$,
** $p < .01$

immigrant cattle feedyard workers. However, their effects are via workers' perceptions of safety climate and occupational stress. This is consistent with an ecological stress-based model of immigrant worker health and safety that asserts that workplace characteristics are processed and interpreted via workers' subjective perceptions, which subsequently predicts their psychosocial adjustment. That is, workplace characteristics, in and of themselves, do not necessarily predict adjustment in workers but rather can do so through workers' evaluations of those characteristics. This implies that workers should have easy access to those workplace resources that address safety issues. This notion is consistent with the broader literature on stress and coping that delineates the central role of subjective perceptions of stress as a determinant of adjustment (Lazarus and Folkman, 1984).

Of particular interest, the findings yield evidence that workplace safety characteristics and perceived occupational stress were significantly associated with both positive and negative indicators of adjustment. However, number of PPE only had a direct relation to depressive symptoms, but not other adjustment indicators. Therefore, other

positive and negative indicators of adjustment were predicted indirectly by workplace characteristics, perceived work safety climate, and occupational stress. These patterns of relations suggest that these adjustment indicators are distinct and that there can be specific predictive mechanisms. Importantly, workers' depressive symptoms were associated with multiple pathways (both direct and indirect), suggesting that such symptoms are particularly vulnerable to work safety characteristics (i.e., PPE and training), work safety climate, and occupational stress mechanisms.

The findings for the direct paths were generally as expected. Both number of PPE and training types were associated with higher levels of reported safety climate suggesting that workers were responsive to safety-related workplace resources. Interestingly, number of PPE types directly predicted fewer depressive symptoms though there were no other direct paths to other psychosocial adjustment indicators. Perhaps number of PPE types has a direct significant effect as compared to number of training types because availability to such resources is a daily (rather than intermittent) reminder of workplace safety. Training may be seen more as an administrative requirement, rather than a preventive safety behavior. Relatedly, depressive symptoms, as compared to life satisfaction, need for recovery, and anxiety, might be more susceptible to daily influences such as number of available types of PPE. Further research is needed to replicate these findings and to better understand the direct link between PPE and depressive symptoms in Latino/a immigrant cattle feedyard workers in the U.S.

Moreover, a better perceived work safety climate was related to lower levels of occupational stress. These findings suggest that workers' subjective evaluations of the safety of their work environment relates to their perceived occupational stress. These subjective evaluations are important because workers' attitudes and behaviors are likely to differ as a function of how safe they perceive their work environment to be. This means that workers should be informed about efforts to improve safety to ensure their awareness and to positively impact their evaluations of such efforts. Transparency in these efforts on behalf of the feedyard employer can promote workers' acknowledgement of management's commitment to safety and workers' own engagement in safety, both of which are core components of work safety climate. Interventions to improve work safety climate may also have positive spillover effects on workers' well-being and their lives outside of the work environment (Ramos et al., 2019b). Finally, occupational stress was positively related to depression, anxiety and the need for recovery, and negatively related to life satisfaction. These latter findings suggest occupational stress relates to psychological symptoms (i.e., depression, anxiety), emotional (i.e., need for recovery), and dispositional (i.e., life satisfaction) adjustment indices. Workplace safety environment and

occupational stress are linked to these relatively varied adjustment indices adding credence to the importance of work-related stress and environmental characteristics.

Our findings suggest a connection among work-related factors and adjustment outcomes in this worker population. Therefore, there are some practical recommendations that follow from this study. First, safety must be priority for feedyard employers, and feedyards should ensure that workers have the proper safety equipment for their job. Employers may consider providing reimbursement or stipends to purchase safety equipment and PPE such as steel-toed boots, all-weather coveralls, and safety vests. Second, all workers should be provided job-related safety training throughout their tenure of employment. Employers may need to use multiple training and information dissemination methods that are culturally, linguistically, and literacy appropriate to the worker population and develop processes to ensure that workers have received and understood the information. By educating workers, they will be more aware of the risks in the work environment, which will allow for the development of mitigation strategies and may ultimately improve safety on the feedyard. Training and PPE are at lower levels of the hierarchy of controls and should be used to supplement, not replace, other safety measures such as eliminating, reducing, or engineering out hazards from the operation. Finally, safety must be a core value, a key part of the culture of the operation. Feedyard management should try to reduce the work-related stressors by allocating appropriate resources, both human resources to improve staffing ratios and financial resources to improve wages and provide professional development opportunities to current workers.

Despite the strengths of the present study, there are also some limitations to note. First, the study is a cross-sectional, correlational design, which mitigates strong inferences regarding causality and direction of causal effects. We note that when longitudinal data are not available, MacKinnon et al. (2012) argue that researchers can use theory to support the temporal relations tested in the model. Still, future research using longitudinal and experimental (such as interventions) designs is needed to better infer causality. Second, the study relies of self-reports from workers on the various constructs. This raises concerns about shared method variance and possible self-presentational demands. Research using multiple methods (e.g., multiple reporters, observations) can address these concerns. Third, the sample is not likely fully representative of U.S. cattle feedyard workers and consists of predominantly men. It is possible that these relations might differ in different subsamples of cattle feedyard workers, such as among workers of different ethnicities or between native and foreign-born workers, those from different regions of the U.S., and between male and female workers. Future research will be needed to reexamine these relations with more broadly representative samples of cattle feedyard workers.

5. Conclusions and contributions

This is the first study to examine the influence of the safety environment on safety climate perceptions and their resulting effects on stress and Latino/a immigrant agricultural workers' psychosocial adjustment. The present findings yield supportive evidence for a proposed ecological stress-based model of immigrant worker health and safety in Latino/a immigrant cattle feedyard workers in the U.S. This evidence provides promise for the efficacy of ecological stress-based models and their use in future research aimed at understanding immigrant workers' health and adjustment. Importantly, the findings showed evidence that workplace safety characteristics are associated with perceptions of work safety climate, which in turn, are related to perceived occupational stress and to subsequent psychological, emotional, and dispositional adjustment. These findings support the central roles of the workplace safety environment and job-related stress as predictors of workers' adjustment. Future interventions and policy programs could benefit from a greater emphasis on increasing safety training and providing greater access to PPE to improve workplace safety, reduce

occupational stress, and promote health and well-being among Latino/a immigrant cattle feedyard workers. Such comprehensive efforts that target improving the health and well-being of the cattle feedyard workforce could ultimately result in improvements in the quality of life for farmworkers and in increased workplace productivity for employers.

Work can have spillover effects on a person's life outside of the work environment. Such effects are not just related to physical injuries or illnesses, but they are also related to psychosocial indicators such as mental health, the need for recovery, and life satisfaction. As such, it is imperative that all workers have the appropriate PPE needed for their job and receive necessary job-related training at the time of hire and at regular intervals throughout their employment, particularly since safety standards within agriculture vary greatly across countries. These simple safety measures can reduce perceived occupational stress and improve psychological, emotional, and dispositional adjustment outcomes. Our ecological stress-based model of immigrant worker health and safety has promise for strengthening research on the relations between contextual factors such as the work environment, intrapersonal processes, and health and safety outcomes among immigrant workers.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank all the farmworkers who participated in this study. We also acknowledge members of the research team Axel Fuentes, Rodrigo Gamboa, Marcela Carvajal-Suarez, Natalia Trinidad, Sophia Quintero, Dr. Casper Bendixsen, and Dr. Kathleen Grant, for their valuable contributions to this study.

Funding

This research was funded by the National Institute for Occupational Safety and Health (NIOSH) grant number U54 OH010162 through the Central States Center for Agricultural Safety & Health.

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