Employer, Use of Personal Protective Equipment, and Work Safety Climate: Latino Poultry Processing Workers

Thomas A. Arcury, PhD,[1,2]* Joseph G. Grzywacz, PhD,[1,2] Andrea M. Anderson, MS,[3] Dana C. Mora, MPH,[4] Lourdes Carrillo,[4] Haiying Chen, MD, PhD,[3] and Sara A. Quandt, PhD[4,2]

Background *This analysis describes the work safety climate of Latino poultry processing workers and notes differences by worker personal characteristics and employer; describes the use of common personal protective equipment (PPE) among workers; and examines the associations of work safety climate with use of common PPE.*

Methods *Data are from a cross-sectional study of 403 Latino poultry processing workers in western North Carolina.*

Results *Work safety climate differed little by personal characteristics, but it did differ consistently by employer. Provision of PPE varied; for example, 27.2% of participants were provide with eye protection at no cost, 57.0% were provided with hand protection at no cost, and 84.7% were provided with protective clothing at no cost. PPE use varied by type. Provision of PPE at no cost was associated with lower work safety climate; this result was counter-intuitive. Consistent use of PPE was associated with higher work safety climate.*

Conclusions *Work safety climate is important for improving workplace safety for immigrant workers. Research among immigrant workers should document work safety climate for different employers and industries, and delineate how work safety climate affects safety behavior and injuries.* Am. J. Ind. Med. 56:180–188, 2013.

KEY WORDS: immigrant workers; organization of work; minority health; health disparities

INTRODUCTION

Poultry farming and processing have expanded in the southeastern US over the past several decades [Striffler, 2005]. This expansion has been most significant in rural communities, as poultry processers have moved closer to the source of their raw materials [Griffith, 1990; Grey, 1999]. Poultry processing results in substantial occupational injury [Lipscomb et al., 2005, 2007a, 2008; Quandt et al., 2006; McPhee & Lipscomb, 2009; Cartwright et al., 2012]. Safety practices in poultry processing plants are often questioned [Lipscomb et al., 2007b; Marín et al., 2009].

[1]Department of Family and Community Medicine, Wake Forest School of Medicine, North Carolina

[2]Center for Worker Health, Wake Forest School of Medicine, North Carolina

[3]Division of Public Health Sciences, Department of Biostatistical Sciences, Wake Forest School of Medicine, North Carolina

[4]Division of Public Health Sciences, Department of Epidemiology and Prevention, Wake Forest School of Medicine, North Carolina

Contract grant sponsor: National Institute for Occupational Safety and Health; Contract grant number: R01-OH009251.

Disclosure Statement: The authors report no conflicts of interests.

*Correspondence to: Thomas A. Arcury, PhD, Department of Family and Community Medicine, Wake Forest School of Medicine, Winston-Salem, NC 27157.
E-mail: tarcury@wakehealth.edu

Accepted 3 July 2012

DOI 10.1002/ajim.22101. Published online 27 July 2012 in Wiley Online Library (wileyonlinelibrary.com).

Few rural communities have sufficient native-born labor needed by the poultry processing industry [Stull, 1994; Griffith et al., 1995; Fink, 1998; Stull & Broadway, 2004; Striffler, 2005]. As in other meat processing industries, the demand for this labor has been satisfied by immigrant Latino labor [Grey, 1999; Quandt et al., 2006]. Latino workers employed in poultry processing are vulnerable and marginal. Many more have migrated to the rural communities than there are jobs. These immigrant workers experience high rates of underemployment and unemployment. Many of these workers are not documented, and they are working using purchased documents. They are fearful of discovery, loss of employment, and potential deportation. Although demanding and dangerous, poultry processing jobs are considered to be ''good jobs'' as they provide reliable and long-term income [Grzywacz et al., 2007a]. For many men from Latin American countries it is unseemly for them to complain about the lack of safety or uncomfortable conditions [Quandt et al., 1998; Hunt et al., 1999; Menzel and Gutierrez, 2010; Arcury et al., 2012a]. Therefore, Latino poultry processing workers have low expectations for workplace safety, and they are not likely to make safety requests of their managers.

Recognition of the importance of the organization of work for occupational health and safety is increasing, including for the poultry processing industry [Sauter et al., 2002; Grzywacz et al., 2007b]. Work safety climate is one component of the organization of work [Zohar, 1980, 2010]. Work safety climate is workers' perception of their supervisors' value of safety over production. Work safety climate is often associated with occupational safety performance and reduced occupational injuries [Neal & Griffin, 2002; Zohar, 2010]. Given the vulnerability and marginality of Latino workers in poultry processing, their perception of the safety climate where they work is particularly important for their occupational safety [Quandt et al., 2006; Grzywacz et al., 2007b].

Little documentation of work safety climate among Latino workers in the poultry processing industry is available. Quandt et al. [2006] found among 200 poultry processing worker that measures of work safety climate and the provision of personal protective equipment (PPE) differed by employer. However, no further research has confirmed these findings. Using data from a large study of poultry processing workers in western North Carolina, this analysis has three aims. First, it describes the work safety climate of Latino poultry processing workers and notes differences in work safety climate by worker personal characteristics (gender, language, age, years worked in poultry processing) and employer. Second, it describes the use of common PPE among Latino poultry processing workers. Finally, it examines the associations of work safety climate and use of common PPE among Latino poultry processing workers.

METHODS

Data are from a cross-sectional study of Latino poultry processing workers residing in Burke, Surry, Wilkes, and Yadkin Counties in western North Carolina. These are rural counties with new settlement Latino communities [Kochhar et al., 2005]. The 2010 Latino population of the four counties was 19,310, 7.1% of their total population [US Bureau of the Census]. Three different poultry processing companies operate plants in the counties.

Sample Design

The research team did not have access to participants in the workplace. No list of Latinos in the counties exists. Therefore, a community-based approach to sampling was used to assure that a representative sample would be selected [Arcury & Quandt, 1999]. A sample frame was developed of dwellings where Latinos lived in the study area. The study team and a community-based organization partnered to map areas mostly populated by Latino residents (enclaves). The research team also surveyed other areas of the counties to identify other dispersed dwellings that were likely inhabited by Latino residents. To identify such dwellings, surveyors looked for cultural or behavioral indicators known to characterize Latino residents (e.g. car decals, bicycles, particular satellite dishes). The lists of enclave and dispersed dwellings contained 4,376 possible Latino dwellings, with about two-thirds in residential enclaves. The lists were randomized, and assigned proportionately to recruit two-thirds from enclaves and one-third from dispersed dwellings.

Recruitment

Well-known members of the local Latino communities were hired as recruiters, with two to four recruiters for each county. Recruiters visited randomly selected dwellings in order. If no one was home, recruiters returned at different times and on different days. Residents for this analysis were screened for inclusion criteria: self-identified as being Latino or Hispanic, worked 35 hr or more per week in a manual labor job in a poultry processing plant, and were 18 years or older. Manual labor in poultry processing was defined as any type of non-supervisory work in a poultry processing plant with job categories from receiving through sanitation. Employees of poultry production farms were excluded. More than one resident per dwelling could be recruited, if eligible. Of 1,681 dwellings selected, 965 were screened, for a screening rate of 57%. Of those eligible, 403 (78%) poultry processing workers were interviewed.

Data Collection

Interviewers completed a 1-day training session that addressed interview techniques, questionnaire contents, human subject protection, and ethics. Each interviewer was required to conduct practice interviews that were evaluated by field supervisors prior to beginning data collection. Participants completed face-to-face interviews in their homes. All interviews were conducted in Spanish. Interviews took approximately 60 min to complete and included information on work history, work environment, symptoms and disability, and psychosocial characteristics. The interviewers explained the purpose, procedures, risks, and benefits of the study; answered questions; and obtained written informed consent. The respondents were given a $10 incentive as appreciation for their participation. All procedures were approved by the Wake Forest Health Sciences Institutional Review Board. Study supervisors met with each interviewer at least weekly to collect and review completed questionnaires to ensure data quality.

Measures

Work safety climate was the primary measure for this analysis. Participants were asked to evaluate their current poultry processing employer with the 10 item Perceived Safety Climate Scale [Gillen et al., 2002]. Nine of the items in the scale used a four-point Likert format (strongly agree, agree, disagree, strongly disagree). The 10th item included three response categories. After an analysis of internal consistency was performed, one of the nine four-point Likert format items was discarded due to lack of fit within the scale. This item had a correlation with the total scale that was close to zero, indicating that it was not measuring the same construct as the remaining scale items. A total Work Safety Climate was calculated by summing the remaining nine items ($\alpha = 0.73$). Values for the scale ranged from 9 to 35, with higher values indicating better work safety climate.

PPE that should be used by poultry processing workers depends on the tasks performed. Participants were asked about 10 specific types of PPE. Four of these were included in the analysis by Quandt et al. [2006]: eye protection (e.g. safety goggles, glasses), hand protection, special footwear (e.g. non-slip, steel toed), and protective clothing (e.g. overalls, jackets). These are general types of PPE that should be used in poultry processing plants. The other six types of PPE included: hearing protection (e.g. ear plugs, ear muffs), dust masks, shoe insoles, specialized hand tools, special material handling tools, and head protection (e.g. hard hat, plastic helmets). Finally, participants reported if they used any other PPE. Measures for each type of PPE included: (1) whether it was provided; (2) whether it was provided at no cost; and (3) if it was used, with the values less than all of the time versus all of the time.

Personal and work characteristics considered in the analysis are gender, age, years working in poultry, employer, and language. Language has the values of Spanish and indigenous indicating the language spoken in their home when they were children. Employer is a three level categorical variable. Age and years working in poultry processing are continuous measures.

Statistical Analysis

Data were summarized using means and standard deviations (SDs) for continuous variables, frequencies, and percents for categorical variables. All analyses accounted for the sampling structure of the data, clustering on county of residence and dwelling unit. Associations of work safety climate components with gender, language, and employer were explored using Rao–Scott Chi-square tests, and the associations of the work safety climate total score with gender, language, and employer were assessed with ANOVA tests. The relationships of age and years working in poultry processing with work safety climate components were examined using simple linear regression. Associations between the work safety climate total score and PPE provision and use were explored with ANOVA tests. All analyses were completed using SAS version 9.2 (SAS Institute, Inc, Cary, NC). A *P*-value of 0.05 or less was considered statistically significant.

RESULTS

Personal and Work Characteristics

Most (57.1%) of the participants were male (Table I). Spanish was spoken in the homes of 73.4% of the participants when they were children, while 26.6% reported that an indigenous language was spoken in their childhood homes. The mean age of participants was 35.0 years (SD 10.8 years). Participants had an average of 4.9 years working in poultry processing (SD 4.2). About one-third of participants worked for each of the three employers.

Work Safety Climate

The majority of the participants agreed with each of the first nine-work safety climate items, indicating that they felt that work safety was important where they worked (Table II). About 90% of the participants indicated that workers' safety was important to management, workers were regularly made aware of dangerous practices or conditions, workers received instructions on safety when hired, and that proper safety equipment was always available.

TABLE I. Personal Characteristics and Employers of Poultry Processing Workers, Western North Carolina, 2010 (n = 403)

Personal characteristics and employers	n	%	Mean	SD
Gender				
Female	173	42.9		
Male	230	57.1		
Language				
Spanish	293	73.4		
Indigenous	106	26.6		
Age			35.0	10.8
Years working in poultry processing			4.9	4.2
Employer				
Employer 1	139	35.1		
Employer 2	121	30.6		
Employer 3	136	34.3		

Most also agreed that workers attend regular safety meetings (82.7%), and that workers have control over personal safety (84.9%). Half of the participants stated that workers are regularly praised for safe conduct, and almost two-thirds stated that taking risks was not part of their jobs. However, half also stated that supervisors were only interested in doing the job fast and cheap, as opposed to one-quarter who indicated that supervisors do as much as possible to make the job safe, and another quarter who indicated that supervisors could do more to make the job safe. The mean total work safety climate score was 24.8 of a possible 35 (SD 3.2).

Few differences in the work safety climate items or score were apparent by worker gender, language, age, or years working in poultry process. For gender, more males (55.5%) than females (43.0%) reported that workers were regularly praised for safe conduct ($P = 0.01$). For language, more Spanish (87.6%) than indigenous speakers (77.5%) ($P = 0.01$) reported that workers had almost total control over personal safety, and that taking risks was not part of the job (72.2% vs. 41.6%; $P < 0.01$). A greater percent of indigenous (66.0%) versus Spanish speakers (43.7%) reported that supervisors were only interested in doing the job fast and cheap ($P < 0.01$). Workers who agreed or strongly agreed that taking risks was not part of the job were older (36.8 vs. 31.7 years; $P < 0.01$) and had worked in poultry processing longer (5.6 vs. 3.6 years; $P < 0.01$) than those who disagreed or strongly disagreed.

Differences for each of the work safety climate items and the total score were significant by employer (Table II). A greater percentage of participants working for Employer 2 gave positive responses to the items than did participants working for Employer 1 or Employer 3. For example, 99.2% of participants working for Employer 2 agreed that ''workers' safety practices are important to management,'' while 90.6% of participants working for Employer 1 and 78.1% of those working for Employer 3 agreed with this statement. Among Employer 2

TABLE II. Differences by Employer in Work Safety Climate and Total Score, Poultry Processing Workers, Western North Carolina, 2010 (n = 403)

	Total sample		Employer						
			1		2		3		
Agree or strongly agree with work safety climate item	n	%	n	%	n	%	n	%	*P*-value[a]
Workers' safety practices are very important to management	356	89.1	125	90.6	120	99.2	100	78.1	<0.01
Workers are regularly made aware of dangerous work practices or conditions	364	90.6	125	90.6	117	96.7	115	84.6	<.01
Workers are regularly praised for safe conduct	201	50.1	32	23.2	85	70.3	80	59.3	<0.01
Workers receive instructions on safety when hired	351	87.5	121	88.3	115	95.0	108	79.4	<0.01
Workers attend regular safety meetings	329	82.7	96	71.1	116	95.9	110	81.5	<0.01
Proper safety equipment is always available	345	89.6	119	87.5	116	95.9	112	85.5	0.02
Workers have almost total control over personal safety	337	84.9	114	83.2	119	98.4	98	74.2	<.01
Taking risks is not a part of my job	256	64.7	97	70.8	113	93.4	41	31.3	<0.01
Overall safety climate assessment									<0.01
Supervisors do as much as possible to make my job safe	95	24.2	30	22.6	53	43.8	8	6.1	
Supervisors could do more to make my job safe	102	26.0	25	18.8	51	42.2	25	19.1	
Supervisors are only interested in doing the job fast and cheap	195	49.7	78	58.6	17	14.0	98	74.8	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	*P*[b]
Total score[a]	24.8	3.2	24.2	2.4	26.2	2.3	24.2	4.2	<0.01

[a]Chi-square.
[b]ANOVA.

participants, 70.3% agreed that ''workers are regularly praised for safe conduct,'' while 23.2% of participants working for Employer 1 and 59.3% of those working for Employer 3 agreed with this statement. Among Employer 2 participants, 93.4% agreed that ''taking risks is not a part of my job,'' while 70.8% of participants working for Employer 1 and 31.3% of those working for Employer 3 agreed with this statement. Finally, 14.0% of participants working for Employer 2 felt that ''supervisors are only interested in doing the job fast and cheap,'' while 58.6% of participants working for Employer 1 and 74.8% of those working for Employer 3 felt that this statement most accurately reflected the overall safety climate.

Personal Protective Equipment

Provision and use of PPE varied by type of equipment (Table III). About one-third (32.7%) of participants reported that they were provided with eye protection, with 27.2% reporting they received it at no cost. Only 16.0% reported using eye protection all of the time. Most (80.4%) participants reported receiving hand protection, with 57.0% reporting they received it at no cost. Most (83.0%) reported using hand protection all of the time. About half of the participants reported being provided with special footwear, with 24.6% reported receiving this footwear at no cost. Almost three-quarters (72.8%) of the participants reported wearing special footwear all of the time. Most (94.8%) participants reported receiving protective clothing, and most (84.7%) reported being provided protective clothing at no cost, and most (92.0%) reported wearing protective clothing all of the time. Most participants reported being provided hearing protection (98.8%) and using it all of the time (96.5%), but 22.4% reported not receiving it at no cost. Dust masks were seldom provided by employers (18.2%) or used all the time (11.1%). Shoe insoles were seldom provided by employers (10.0%) or used all the time (35.3%). About one-third (35.4%) of participants reported being provided with specialized hand tools, and they were generally provided these at no cost (32.9%) and used them all of the time (23.4%). About one-quarter (22.3%) of the participants reported being provided with specialized material handling tools, and they were generally provided these at no cost (20.3%), but they were not used all of the time (4.8%). Finally, most (74.4%) participants reported being provided with head protection, and it was generally provided at no cost (67.2%) and used all the time (65.9%).

Work Safety Climate and Personal Protective Equipment

Work safety climate was associated with various aspects of PPE provision and use (Table IV). Those who were provided with eye protection at no cost had a lower mean work safety climate score than those who had to pay for eye protection (24.8 vs. 27.0; $P < 0.01$). Work safety climate was not associated with the use of eye protection. Those who were provided with hand protection at no cost had lower mean work safety climate scores than those who were provided hand protection at a cost (24.2 vs. 26.1; $P < 0.01$). Those who used hand protection all of the time trended toward having greater work safety climate than those who did not (25.0% vs. 24.2; $P = 0.06$). Those who were provided special footwear trended to having a lower mean work safety climate than those who were not provided with special footwear (24.5% vs. 25.2; $P = 0.05$). Those who were provided with special

TABLE III. Use of Personal Protective Equipment by Poultry Processing Workers, Western North Carolina, 2010 (n = 403)

						Used			
	Provided		Provided at no cost			Less than all of the time		All of the time	
Personal protective equipment	n	%	n	% of total	% of provided	n	%	n	%
Eye protection	131	32.7	109	27.2	83.9	335	83.9	64	16.0
Hand protection	323	80.4	228	57.0	71.3	68	17.0	332	83.0
Special footwear	204	50.8	99	24.6	48.5	109	27.2	292	72.8
Protective clothing	382	94.8	337	84.7	89.4	32	7.9	369	92.0
Hearing protection	397	98.8	312	77.8	79.0	14	3.4	389	96.5
Dust masks	72	18.2	62	15.9	87.3	352	88.9	44	11.1
Shoe insoles	39	10.0	31	7.8	81.6	249	64.7	136	35.3
Specialized hand tools	142	35.4	132	32.8	93.0	302	76.7	92	23.4
Specialized material handling tools	89	22.3	81	20.2	93.1	377	95.2	19	4.8
Head protection	300	74.4	271	67.4	90.6	137	34.1	265	65.9
Other	30	7.5	8	2.0	27.6	3	9.7	28	90.3

TABLE IV. Safety Climate Scores by Personal Protection Equipment Provided, Provided at No Cost, and Used for Total Sample, Poultry Processing Workers, Western North Carolina, 2010

	Mean work safety climate score					
Personal protective equipment	**Provided by employer**		**Provided by employed at no cost[a]**		**Used**	
	No	**Yes**	**No**	**Yes**	**Less than all of the time**	**All of the time**
Eye protection						
Mean	24.7	25.1	27.0	24.8	24.9	24.6
n	269	128	21	106	334	60
P-value		0.19		<0.01		0.49
Hand protection						
Mean	25.0	24.8	26.1	24.2	24.2	25.0
n	79	319	92	224	67	328
P-value		0.41		<0.01		0.06
Special footwear						
Mean	25.2	24.5	25.1	23.9	24.0	25.1
n	197	201	105	96	108	288
P-value		0.05		0.03		<0.01
Protective clothing						
Mean	25.8	24.8	25.1	24.7	24.0	24.9
n	21	377	39	332	32	364
P-value		0.23		0.49		0.20
Hearing protection						
Mean	25.2	24.8	25.8	24.5	25.8	24.8
n	5	393	88	308	14	384
P-value		0.42		<0.01		0.24
Dust masks						
Mean	24.8	24.8	24.8	24.8	24.8	24.8
n	323	69	332	60	351	40
P-value		0.98		0.96		0.98
Shoe insoles						
Mean	24.9	24.8	24.8	24.8	24.3	25.9
n	349	39	363	31	248	136
P-value		0.82		0.99		<0.01
Specialized hand tools						
Mean	24.8	25.0	24.8	24.9	24.8	25.1
n	259	138	270	128	302	89
P-value		0.51		0.82		0.36
Specialized material handling tools						
Mean	24.8	24.9	24.8	24.7	24.8	25.9
n	310	87	316	79	374	19
P-value		0.74		0.82		0.08
Head protection						
Mean	25.0	24.8	25.1	24.7	24.7	24.9
n	103	295	131	266	137	260
P-value		0.49		0.30		0.54

[a]Based on the subset for whom the PPE is provided by the employer.

footwear at no cost had a lower mean work safety climate scores than those who were provided special footwear at a cost (23.9 vs. 25.1; $P = 0.03$). Those who used special footwear all of the time had greater work safety climate than those who did not (25.1 vs. 24.0; $P < 0.01$).

Workers who were provided with hearing protection at no cost had lower mean work safety climate scores than those who were provided hearing protection at a cost (24.5 vs. 25.8; $P < 0.01$). Those who used shoe insoles all of the time had higher mean work safety climate scores than those who did not (25.9 vs. 24.3; $P < 0.01$). Those who used specialized material handling tools all the time trended toward higher mean work safety climate scores than those who did not (25.9 vs. 24.8; $P = 0.08$). Work safety climate was not associated with the provision or use of several types of PPE, including protective clothing, dusk masks, specialized hand tools, or head protection.

DISCUSSION

Work safety climate varied by employer among these Latino poultry processing workers. Reflecting the results reported by Zohar [2000] that employees within units were homogenous in their perceptions of work safety climate, participants in this study working for Employer 1 and Employer 3 had significantly lower total work safety climate scores than those working for Employer 2. The percentages of workers agreeing with the individual work safety climate items included in the work safety climate scale were significantly different for the three employers. More Employer 2 workers than Employer 1 and 3 workers agreed with each of the items, and they had the most positive evaluation of work safety climate. Employer 3 workers had the least agreement with each of the work safety items, and they had the worse evaluation of work safety climate. Work safety climate differed little by worker characteristics, including gender, language, age, and years worked in poultry processing.

The use and provision of some types of PPE, such as hand protection, protective clothing, and hearing protection, to these Latino poultry processing workers was almost universal. The provision of other types of PPE, such as eye protection, dust masks, shoe insoles, and specialized hand tools, was far less frequent. PPE should be provided at no cost to workers, but many of these workers reported that they paid for PPE. The use of PPE among these poultry processing workers reflected whether it was provided, and whether it was provided at no cost. For example, hearing protection and protective clothing were generally provided at no cost, and they were used by almost all of the workers all of the time. Other types of PPE, such as eye protection and dust masks were seldom provided, and few workers used them all of the time. That workers were required to purchase the PPE is a violation of Occupational Safety and Health Administration PPE standards [Occupational Safety and Health Administration, 2011]. Employers charging workers for PPE indicates that the safety climate in the plants may not be as good as the workers themselves perceive.

Work safety climate was associated with the provision and use of some PPE. However, this association raises questions. Only four of the nine work safety climate items were associated with the provision of PPE at no cost, and these associations, while not large, were inverse. Those who were provided eye protection, hand protection, special footwear, and hearing protection at no cost had lower work safety climate scores than those who had a cost associated with the provision of the PPE. This is counter intuitive. At the same time, those who used hand protection, special footwear, shoe insoles, and specialized materials handling tools all of the time have greater work safety climate than those who do not use this PPE all of the time. The counter intuitive situation in which workers who are provided with PPE at no cost perceive their work safety climate to be lower suggests several possible explanations. For example, only one item in the work safety climate scale refers specifically to provision of PPE; therefore, the construct that the scale is measuring may be different than the issue of provision of PPE by the employer. Another explanation for this pattern is that those for whom PPE is provided at no cost understand that they have dangerous jobs. Alternatively, perhaps employers have created a sufficiently strong safety climate that the workers using PPE do not object to purchasing these items themselves. Perhaps, employers provided the PPE as no cost as a way of ignoring engineering and administrative controls or poor training. Additional research should explore these possibilities.

Little research has examined work safety climate among manufacturing workers. Similar to the results of this study, other research has shown an association of work safety climate with unsafe behavior, but not with the occurrence of injury [Cooper & Phillips, 2004; Clarke, 2006]. These studies do not compare the work safety climate reported for employers in the same industry, such as poultry processing. Smith et al. [2006] compare work safety climate and injury rate across employers in multiple industries and find that work safety climate is associated with injury claims. However, employers in the same industry are not compared. This research documents that work safety climate for manufacturing workers can vary by employer in the same industry, even when those employers are in the same area. This indicates that work safety climate can be modified when an employer works to promote safety, even in a hazardous industry such as poultry processing.

Few studies have considered work safety climate among Latino immigrant workers. Menzel and Gutierrez

[2010] identified perceived risks among Latino construction workers in southern Nevada using qualitative methods. Arcury et al. [2012a, b] found that level of work safety climate was directly associated with the use of PPE among immigrant Latino construction workers. Work safety climate in this study was different from that reported for immigrant agricultural workers and construction workers [Arcury et al., 2012a, b]. Using the same work safety climate scale [Gillen et al., 2002], among immigrant agricultural workers, the mean work safety climate score was 26.6, while among immigrant construction workers it was 23.2, compared to the 24.8 among participants in this study. Among immigrant agricultural workers, work safety climate was lower among those reporting musculoskeletal pain and working when injured. Level of work safety climate was directly associated with the use of PPE among immigrant Latino construction workers. These differences by industry indicate that work safety climate is not a constant among immigrant workers; rather it is influenced by the environment in which they are working [Zohar, 2010].

These results should be considered within the study's limitations. Participants were recruited from one area of North Carolina, limiting generalizability to other areas. The study had a cross-sectional design which does not allow for determination of causation between provision and use of PPE and work safety climate. Other characteristics of the three employers not considered in the analysis may account for the differences in use of PPE and work safety climate. The provision and use of PPE is based on self-report, and participants may have wanted to provide socially acceptable responses. The lack of information about engineering or administrative controls available to the investigators is a limitation of the study that could contribute to explaining some of the counter-intuitive findings. However, the strengths of the study are also important. The sample was large and participants worked for three different poultry processing companies. The sample design attempted to recruit participants randomly. The study used a standard measure of work safety climate [Gillen et al., 2002], which has been used in other analyses of immigrant Latino workers [Quandt et al., 2006; Grzywacz et al., 2007b; Arcury et al., 2012a].

Latino poultry processing workers are a vulnerable population. This analysis shows that work safety climate varies greatly by employer. PPE is not always available to these workers. The association of work safety climate to provision and use of PPE is not clear, in that work safety climate is lower for those to whom PPE is provided at no cost, but it is higher for those who use PPE all of the time. Understanding work safety climate for immigrant workers has the potential for directing policy for improving workplace health and safety. Further research on work safety climate among immigrant workers is needed to document the levels of work safety for different employers and different industries, and to delineate how works safety climate may contribute to safety behavior and fewer workplace injuries.

REFERENCES

Arcury TA, Quandt SA. 1999. Participant recruitment for qualitative research: A site-based approach to community research in complex societies. Hum Organ 58:128–133.

Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA. 2012a. Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. Am J Public Health 102:S272–S278.

Arcury TA, Mills T, Marín AJ, Summers P, Quandt SA, Rushing J, Lang W, Grzywacz JG. 2012b. Work safety climate and safety practices among immigrant Latino residential construction workers. Am J Ind Med 2012b Apr 27 [Epub ahead of print].

Cartwright MS, Walker FO, Blocker JN, Schulz MR, Arcury TA, Grzywacz JG, Mora D, Chen H, Marín AJ, Quandt SA. 2012. The prevalence of carpal tunnel syndrome in Latino poultry processing workers and other Latino manual workers. J Occup Environ Med 54:198–201.

Clarke S. 2006. Safety climate in an automobile manufacturing plant: The effects of work environment, job communication, and safety attitudes on accidents and unsafe behaviour. Personnel Rev 35:413–430.

Cooper MD, Phillips RA. 2004. Exploratory analysis of the safety climate and safety behavior relationship. J Safety Res 35:97–512.

Fink D. 1998. Cutting into the meatpacking line: Workers and change in the rural midwest. Chapel Hill: University of North Carolina Press, 235 p.

Gillen M, Baltz D, Gassel M, Kirsch L, Vaccaro D. 2002. Perceived safety climate, job demands, and coworker support among union and non-union injured construction workers. J Safety Res 33:33–51.

Grey MA. 1999. Immigrants, migration, and worker turnover at the hog pride pork packing plant. Hum Organ 58:16–27.

Griffith D, Broadway MJ, Stull DD. 1995. Introduction: Making meat. In: Stull DD, Broadway MJ, Griffith D, editors. Any way you cut it: Meat processing and small-town America. Lawrence: University Press of Kansas, pp. 1–15.

Griffith D. 1990. Consequences of immigration reform for low-wage workers in the Southeastern US the case of the poultry industry Urban Anthropol 19:155–184.

Grzywacz JG, Arcury TA, Marín A, Carrillo L, Burke B, Coates ML, Quandt SA. 2007a. Work-family conflict: experiences, causes, and health implications among immigrant Latinos. J Appl Psychol 92:1119–1130.

Grzywacz JG, Arcury TA, Marín A, Carrillo L, Coates ML, Burke B, Quandt SA. 2007b. The organization of work: Implications for injury and illness among immigrant Latinos in poultry processing. Arch Environ Occup Health 62:9–26.

Hunt LM, Tinoco-Ojanguren R, Schwartz N, Halperin D. 1999. Balancing risks and resources: Applying pesticides without using protective equipment in southern Mexico. In: Hahn RA, editor. Anthropology in public health: bridging differences in culture and society. New York: Oxford University Press, pp. 235–254.

Kochhar R, Suro R, Tafoya SM, Center PH. 2005. The new Latino south the context and consequences of rapid population growth. Washington DC: Pew Hispanic Center, 85 p.

Lipscomb HJ, Argue R, McDonald MA, Dement JM, Epling CA, James T, Wing S, Loomis D. 2005. Exploration of work and health disparities among black women employed in poultry processing in the rural South. Environ Health Perspect 113:1833–1840.

Lipscomb HJ, Epling CA, Pompeii LA, Dement JM. 2007a. Musculoskeletal symptoms among poultry processing workers and a community comparison group: Black women in low-wage jobs in the rural South. Am J Ind Med 50:327–338.

Lipscomb HJ, Dement JM, Epling CA, McDonald MA, Schoenfisch AL. 2007b. Are we failing vulnerable workers? The case of black women in poultry processing in rural North Carolina. New Solut 17:17–40.

Lipscomb HJ, Kucera K, Epling C, Dement J. 2008. Upper extremity musculoskeletal symptoms and disorders among a cohort of women employed in poultry processing. Am J Ind Med 51:24–36.

Marín AJ, Grzywacz JG, Arcury TA, Carrillo L, Coates ML, Quandt SA. 2009. Evidence of organizational injustice in poultry processing plants: Possible effects on occupational health and safety among Latino workers in North Carolina. Am J Ind Med 52:37–48.

McPhee CS, Lipscomb HJ. 2009. Upper-extremity musculoskeletal symptoms and physical health related quality of life among women employed in poultry processing and other low-wage jobs in northeastern North Carolina. Am J Ind Med 52:31–40.

Menzel NN, Gutierrez AP. 2010. Latino worker perceptions of construction risks. Am J Ind Med 53:179–187.

Neal A, Griffin M. 2002. Safety climate and safety behaviour. Aust J Managt 27(1 Suppl.):67–76.

Occupational Safety and Health Administration. 2011. OSHA Instruction 29 CFR Part 1910, Subpart I, Enforcement Guidance for Personal Protective Equipment in General Industry. Directive Number CPL02-01-050. http://www.osha.gov/OshDoc/Directive_pdf/CPL_02-01-050. pdf. Accessed 2 July 2012.

Quandt SA, Arcury TA, Austin CK, Saavedra RM. 1998. Farmworker and farmer perceptions of farmworker agricultural chemical exposure in North Carolina. Hum Organ 57:359–368.

Quandt SA, Grzywacz JG, Marín A, Carrillo L, Coates ML, Burke B, Arcury TA. 2006. Illnesses and injuries reported by Latino poultry workers in western North Carolina. Am J Ind Med 49:343–351.

Sauter SL, Brightwell WS, Colligan MJ, Hurrell JJ, Katz TM, LeGrande DE, Lessin N, Lippin RA, Lipscomb JA, Murphy LR, Peters RH, Keita GP, Robertson SR, Stellman JM, Swanson NG, Tetrick LE. 2002. The Changing Organization of Work and the Safety and Health of Working People. Report No DHHS (NIOSH) No. 2002-116. Cincinnati OH: Department of Health and Human Services. 43p.

Smith GS, Huang YH, Ho M, Chen PY. 2006. The relationship between safety climate and injury rates across industries: The need to adjust for injury hazards. Accid Anal Prev 38:556–562.

Striffler S. 2005. Chicken: The Dangerous Transformation of America's Favorite Food. New Haven, CT: Yale University Press, 195 p.

Stull DD, Broadway MJ. 2004. Slaughterhouse Blues: The meat and poultry industry in North America. Belmont, CA: Wadsworth/Thomson, 192 p.

Stull DD. 1994. Meat and (wo)men: Meatpacking's consequences for communities. Kansas J Law Public Policy 3:112–118.

Zohar D. 1980. Safety climate in industrial organizations: Theoretical and applied implications. J Appl Psychol 65:96–102.

Zohar D. 2000. A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. J Appl Psychol 85:587–596.

Zohar D. 2010. Thirty years of safety climate research: Reflections and future directions. Accid Anal Prev 42:1517–1522.