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Upper Body Musculoskeletal Symptoms of Latino Poultry Processing Workers and a Comparison Group of Latino Manual Workers

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Background *Upper body musculoskeletal injuries are often attributed to rapid work pace and repetitive motions. These job features are common in poultry processing, an industry that relies on Latino immigrants. Few studies document the symptom burden of immigrant Latinos employed in poultry processing or other manual jobs.*
Methods *Latino poultry processing workers (n = 403) and a comparison population of 339 Latino manual workers reported symptoms for six upper body sites during interviews. We tabulated symptoms and explored factors associated with symptom counts.*
Results *Back symptoms and wrist/hand symptoms lasting more than 1-day were reported by over 35% of workers. Poultry processing workers reported more symptoms than comparison workers, especially wrist and elbow symptoms. The number of sites at which workers reported symptoms was elevated for overtime workers and workers who spoke an indigenous language during childhood.*
Conclusion *Workplace conditions facing poultry processing and indigenous language speaking workers deserve further exploration.* Am. J. Ind. Med. 56:197–205, 2013.

KEY WORDS: musculoskeletal symptoms; poultry processing; upper extremity disorders; immigrant workers; occupational health and safety; work-related

INTRODUCTION

Upper body musculoskeletal injuries are often attributed to rapid work pace and repetitive motion patterns, insufficient recovery time, heavy lifting, and forceful manual exertions, non-neutral body postures, mechanical pressure concentrations, partial or whole-body vibration, and local or whole-body exposure to cold [National Research Council, 1998, 2001; Punnett and Wegman, 2004; van Rijn et al., 2010]. Many of these job features

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are common in the poultry processing industry [Armstrong et al., 1982; OSHA, 1993, 2004; Campbell, 1999].

The poultry processing industry has been repeatedly identified as one with a high proportion of jobs involving a limited number of tasks performed repetitively that result in ergonomic strain to the upper body and particularly, the upper extremities [Armstrong et al., 1982; Hall, 1989; Campbell, 1999; Nowell, 2000; Government Accountability Office, 2005; Lipscomb et al., 2005, 2007, 2008; Quandt et al., 2006]. The birds are taken from their transport cages, hung by their feet on hooks and stunned on an overhead moving belt. They are killed, plucked, eviscerated, butchered, often de-boned, and packaged—all at a speed of more than one bird per worker every 2 s [The Humane Society of the United States, 2007]. This efficiency can only be accomplished by workers who work at high rates of speed for long periods without breaks. Working in awkward positions and repeating the same movements, workers risk musculoskeletal injuries [Government Accountability Office, 2005].

In the final decades of the 20th century, the poultry processing industry in the United States grew rapidly, became increasingly centered in non-metropolitan areas of the South and came to be reliant on an ethnic minority and immigrant workforce [Fink, 1998; Grey and Woodrick, 2002; Government Accountability Office, 2005]. After peaking at 246,000 in 2002, employment in poultry processing has been more stable with the most recent employment estimate being 227,000 for 2010. [US Department of Labor, 2012]. Poultry processing operations are rooted in southern states, in part because of their large low-wage workforce and ''right-to-work'' status, which undermines strong unions, reduces labor costs, and allows operations to exist on thin economic margins [Fink, 2003]. Mexico and Guatemala are the source of the majority of the industry's immigrant workers [Government Accountability Office, 2005]. The increased number of immigrant workers from Mexico and Guatemala working in poultry processing has been reported in rural western North Carolina, the location of this study [Fink, 2003; Quandt et al., 2005, 2006].

The physical stress of poultry processing work is often exacerbated by supervisors who push to keep the line moving at the desired speed. Frequently, supervisors do not speak the same language as the immigrant Latino workers; they intimidate these workers and treat them with disrespect [Marin et al., 2009]. Additionally, there are important differences among the immigrant Latino workers. Many from Guatemala and southern Mexico were raised in communities in which an indigenous language (e.g. Aguacateco, Quiche, Ajobal, Accomogual) was the primary language [Fink, 1998, 2003], while most of the immigrants from central and northern Mexico were raised speaking Spanish.

These differences in childhood language and place of birth among Latino immigrant workers might be expected to correlate with symptoms on two accounts. First, new immigrants who speak an indigenous language often face discrimination and limited access to culturally appropriate occupational safety and health information and training [Farquhar et al., 2008]. Second, on average, new immigrants raised in indigenous communities of Guatemala and southern Mexico are of smaller stature [Bogin et al., 1992; Bogin and Rios, 2003; Smith et al., 2003] than most Latino immigrants due to a variety of factors including poverty-associated nutrition and infectious disease insults during development. An elevated prevalence of musculoskeletal symptoms might be expected among indigenous-speaking immigrant workers if employers do not allow for accommodations in the work process or design of work tasks to fit their smaller average stature [Pheasant, 1991].

Although the industry is recognized as hazardous, data on prevalence of upper body musculoskeletal symptoms among poultry processing workers is sparse, especially for Latinos and Latinos speaking indigenous languages [Quandt et al., 2006; Lipscomb et al., 2007]. In an earlier study of Latino poultry workers in western North Carolina, 46% reported pain, stiffness, cramps, or weakness in arms or hands within the previous 30 days, and 36% reported similar symptoms in the neck or back [Quandt et al., 2006]. A study of black female poultry processing workers in Eastern North Carolina found the prevalence of upper extremity and neck symptoms to be more than 2 times higher among the poultry workers than in those of similar economic status employed in other jobs in the same region [Lipscomb et al., 2007]. Comparative estimates of the prevalence of upper body symptoms among Latino workers in other manual occupations are also sparse. The aims of this paper are to (1) describe the prevalence of upper body musculoskeletal symptoms reported at six specific body sites by Latino poultry processing workers and a comparison population of Latino manual workers in western North Carolina; and (2) identify occupational and demographic factors associated with the number of upper body sites for which Latino workers report symptoms.

METHODS

Study Design, Sampling, and Recruitment

During 2009 and 2010, we conducted a cross-sectional study of Latino poultry workers and other Latino manual workers living in communities surrounding three poultry processing plants in western North Carolina. Potential participants were recruited in person by Spanish-speaking study personnel who visited housing units that

were randomly selected from a comprehensive list of housing units with Spanish-speaking residents developed by community-based and study personnel. One-thousand five hundred and 26 adults were screened for eligibility; 957 of the individuals screened were eligible for participation.

Potential participants were eligible for inclusion if they were adults who self-identified as Latino or Hispanic and were working $\geq$35 hr/week at the time of recruitment in poultry processing or other manual labor jobs. Poultry processing work was defined as work other than supervision or quality control in a poultry processing plant. The comparison sample of Latino manual workers was recruited from the same communities. To be included in the comparison sample, a worker had to be employed for pay in a manual job, excluding jobs in poultry processing or poultry production. Chicken catchers were excluded from both groups.

Data Collection

Of the 957 individuals who screened eligible for the study, trained data collectors enrolled 742 (78%) individuals who completed face-to-face, interviewer-administered questionnaires. The face-to-face interviews were conducted in Spanish by native Spanish-speaking interviewers. The interview took approximately 60 min to complete and included information on work history, work environment, symptoms and disability, and demographic characteristics. Interview techniques, questionnaire contents, human subject protection, and ethics were covered at a 1-day training session. Each interviewer was required to conduct a practice interview prior to beginning data collection. The interviewers explained the purpose, procedures, risks, and benefits of the study; answered questions; and obtained written informed consent. Respondents were given a $10 incentive for their participation. All procedures were approved by the Wake Forest University Health Sciences Institutional Review Board. To ensure data quality, study staff met with each interviewer at least weekly to collect and review completed questionnaires. Cartwright et al. [2012] and Mirabelli et al. [2012] describe additional details about the implemented data collection, sampling, and recruitment procedures.

Measures

Upper body musculoskeletal symptoms potentially related to manual work and particularly poultry processing work were the focus of this study. Six upper body sites—(1) neck, (2) upper and/or lower back, (3) forearms, (4) wrist/hands, (5) shoulders, and (6) elbows—were assessed by interviewer administered questionnaire. For each body site, the primary question was, ''Have you at any time during the last 12 months had an ache, pain, discomfort, or numbness.'' To identify workers experiencing more chronic pain, each worker who reported ''yes'' for symptoms during the past 12 months for a particular body site was asked whether they experienced an ache, pain, discomfort, or numbness at that body site in the past 12 months that lasted longer than 1-day. To measure the extent of a worker's upper body musculosketal symptoms we counted the number of sites for which (s)he reported symptoms lasting longer than 1-day. The resulting count variable was categorized into three ordered levels (no upper body sites with symptoms, one to three upper body sites with symptoms, and four to six upper body sites with symptoms).

The primary occupational exposure of interest was work in the poultry processing industry and the comparison group was manual work in other industries. Additionally, study investigators categorized participating workers into eight major Standard Occupation Classification (SOC) groups based on the primary job reported by the worker. Because of small numbers in several of the eight major SOCs, the occupational groups were collapsed into three broad groups for analysis: production; occupations more likely to include outdoor work (Farming, Fishing, and Forestry; Construction and Extraction; Building and Grounds Cleaning and Maintenance; and Transportation and Material Moving); and occupations less likely to include outdoor work (Food Preparation and Serving Related; Personal Care and Service; Installation, Maintenance, and Repair; and Other). To measure the length of a worker's usual work week, we asked, ''How many hours per week do you usually work on all jobs?'' The range of responses was 18–65 hr/week. The interviews occurred as much as several weeks after participants consented to participate in the study, and our research group decided not to exclude workers whose usual work week decreased slightly between consenting to participate and the interview. At the interview, four workers (0.54%) reported usually working between 18 and 28 hr/week and 18 workers (2.44%) reported usually working 30–33 hr/week. Consequently, the responses were categorized into three groups ($<$40, 40, and $>$40 hr/week).

Age was reported in years and categorized into three groups (18–29, 30–39, and $\geq$40), and education was reported as the highest grade of school completed and categorized into two groups (0–6 and $\geq$7), which reflects whether participants completed a primary level of education. Interviewers classified workers as male or female by observation. The language(s) spoken in the household when the worker was a child was assessed as a measure of national and ethnic heritage and was categorized into two groups (indigenous and non-indigenous). If a worker identified an indigenous language (e.g. Quiche, Aguacateco) as a household language, (s)he was placed into the

indigenous group. Workers reporting the use of either English or Spanish in the household during childhood were placed into the non-indigenous group.

Data Analysis

All the statistical analyses took account of our stratified cluster sampling design. Descriptive statistics were used to describe the overall sample. Bivariate associations between work type (poultry vs. non-poultry) and various demographics were examined using Rao–Scott Chi-square tests. Since the number of body parts that experienced pain was categorized into three ordered levels (0, 1–3, and 4–6), we first attempted to fit ordinal logistic regression models to examine the association between work type and body pain. However, Scores tests indicated that the proportional odds ratios assumption did not hold. Therefore, nominal logistic regression models were used instead to allow the association between predictors and outcome to differ across outcome levels. Finally, following the example of Messing et al. [2009], we stratified by gender and ran separate models for men and women. All analyses were performed using SAS 9.2 (Cary, NC) and a *P*-value of <0.05 was considered statistically significant.

RESULTS

The sample included 403 poultry workers and 339 manual workers not employed in poultry processing (Table I). The workers were young, had completed limited formal education and included almost as many women as men. Over 16% of the sample regularly worked more than 40 hr/week, and nearly one-quarter reported than an indigenous language was spoken in their childhood home. The poultry workers differed significantly from non-poultry workers in the following characteristics: they had completed less formal education, were older, and worked more hr/week. The vast majority of the poultry workers were classified into the broad SOC of production workers, whereas non-poultry workers were more evenly dispersed among broad SOCs. Based on the job tasks they performed, the best broad SOC for one poultry processing worker was ''Installation, Maintenance, and Repair Occupations'' and the best broad SOC for three other poultry processing workers was ''Transportation and Material Moving Occupations.''

Among all workers, the back, and wrists/hands were the sites with the highest prevalence of reported upper body musculoskeletal symptoms (Table II). Prevalence of symptoms at these sites was 5 times the prevalence of elbow symptoms, and the difference in symptoms by upper body site was highly significant. For each body site, poultry processing workers reported greater prevalence of symptoms than other manual workers. Elevated prevalence of symptoms for poultry workers was most pronounced for the wrist/hands and elbow.

Percent of upper body sites with musculoskeletal symptoms by possible explanatory variables are displayed in Table III. Workers who reported upper body musculoskeletal symptoms tended to report symptoms at several sites. One hundred and 23 workers (16.6%) reported symptoms at four to six upper body sites, 304 workers (41.0%) reported symptoms at one to three upper body sites, and 315 (42.4%) did not report upper body symptoms at a single upper body site. Workers in the poultry processing industry, those who usually worked >40 hr/week, those with less formal education, those in production occupations and workers addressed by adults in an indigenous language as a child, reported symptoms at more sites than the respective comparison groups.

In the multinomial logistic regression model, the strongest predictors of the number of symptoms reported were hours worked per week and the childhood language (Table IV). The odds of reporting symptoms increased monotonically with increasing hours of work. Workers who usually worked >40 hr/week had greater odds (OR = 7.5, 95% CI: 3.1, 17.5) of reporting upper body symptoms at four to six sites than no sites relative to their counterparts who usually worked <40 hr/week. Workers who reported an indigenous language as a child had greater odds (OR = 3.7, 95% CI: 2.1, 6.6) of reporting upper body symptoms at four to six sites versus none than other workers. Work in the poultry processing industry was positively associated with reporting upper body symptoms at four to six sites versus none (OR = 1.8; 95% CI: 0.8, 4.0), but the strength of the association was moderate and not significant. Work in the group of broad SOCs that included Farming, Fishing, and Forestry was positively and significantly associated with reporting symptoms at four to six sites, however, even after combining broad SOC groups to achieve larger cell counts, the confidence intervals surrounding the odds ratios for the SOC groups were wide.

Sex-specific models (data not shown) revealed results similar to those in Table IV. The biggest difference between the female and male sex-specific models was with regard to formal education. The negative association between more years of formal education and symptoms at four to six sites shown in Table IV was stronger and still statistically significant in the female-specific model, while in the male-specific model this association was weaker and not statistically significant, although still negative.

DISCUSSION

These results demonstrate a high prevalence of upper body musculoskeletal symptoms among Latino manual workers in western North Carolina. The symptoms and the

TABLE I. Description of Latino Poultry and Non-Poultry Manual Workers, Western North Carolina*

	Total sample, n (percent)	Poultry workers, n (percent)	Non-poultry workers, n (percent)	*P*-value
Female	319 (43.0)	173 (42.9)	146 (43.1)	0.97
Indigenous spoken language[a]	180 (24.5)	106 (26.6)	74 (22.0)	0.16
Education, 0–6 years	428 (57.8)	253 (62.9)	175 (51.6)	0.003
Age				
<30 years	293 (39.5)	148 (36.8)	145 (42.8)	
30–39 years.	254 (34.3)	125 (31.1)	129 (38.0)	
40+ years	194 (25.2)	129 (32.1)	65 (19.2)	0.0001
Hours worked/week				
<40 hr	109 (14.8)	34 (8.4)	75 (22.4)	
40 hr	507 (68.7)	292 (72.5)	215 (64.2)	
>40 hr	122 (16.5)	77 (19.1)	45 (13.4)	0.0001
SOC[b] category				
Food Preparation and Serving Related; Personal Care and Service; Installation, Maintenance, and Repair; and Other[c]	122 (16.4)	1 (0.3)	121 (35.7)	
Farming, Fishing, and Forestry; Construction and Extraction; Building and Grounds Cleaning and Maintenance; and Transportation and Material Moving	132 (17.8)	3 (0.7)	89 (26.3)	0.0001
Production	488 (65.8)	399 (99.0)	129 (38.0)	

*The total sample of 742 workers included 403 poultry workers and 339 non-poultry workers.
[a]Language in which adults spoke to the worker when she or he was a child.
[b]Standard Occupational Classification.
[c]Arts, Design, Entertainment, Sports, and Media Occupations; Sales and Related Occupations.

six body sites at which they are reported are associated with occupational injuries and illnesses commonly reported in the poultry processing industry [OSHA Poultry Processing Industry eTool, 2012]. Over 35% of workers reported symptoms of ache, pain, discomfort, or numbness at their upper and/or lower back in the past year that lasted greater than 1-day and a similar percent reported these symptoms at their wrists/hands. More than 25% of workers reported these symptoms at the shoulders and at the forearms. At all six sites, the prevalence of symptoms was somewhat greater among poultry workers than among other manual workers. Usually working >40 hr/week was the strongest predictor of reporting symptoms at one or more sites compared to none in our multinomial logistic regression model which adjusted for industry (poultry, other), broad occupations, age, gender, education, and childhood language. Workers who reported working >40 hr/week as compared to <40 hr/week had 7.5 times greater odds of reporting symptoms at four to six sites.

Although direct comparisons cannot be made because of differences in the way that symptoms were reported, two earlier studies that examined symptoms among

TABLE II. Prevalence (Percent) and Crude Prevalence Ratios of Musculoskeletal Symptoms* by Site in Poultry Workers and Non-Poultry Workers

Site	Total sample (n = 742); prevalence (n)	Poultry workers (n = 403); prevalence (n)	Non-poultry workers (n = 339); prevalence (n)	Crude ratio[a]
Neck	15.9 (118)	17.4 (70)	14.2 (48)	1.2
Upper and/or lower back	36.3 (269)	36.8 (148)	35.7 (121)	1.0
Forearms	27.6 (205)	30.0 (121)	24.8 (84)	1.2
Wrists/Hands	35.2 (261)	40.4 (162)	29.4 (99)	1.4
Shoulders	29.4 (218)	30.8 (124)	27.7 (94)	1.1
Elbows	7.3 (54)	9.4 (38)	4.7 (16)	2.0

*Musculoskeletal symptoms in the past 12 months that lasted >1 day.
[a]Prevalence among poultry workers/prevalence among non-poultry workers.

TABLE III. Number and Percent of Upper Body Sites With Musculoskeletal Symptoms by Possible Explanatory Variables

	Body sites with symptoms; n (percent) n = # of cases			
	0 (total = 315)	One to three (total = 304)	Four to six (total = 123)	*P*-value
Industry				
Poultry	157 (39.0)	166 (41.2)	80 (19.8)	
Non-poultry	158 (46.6)	138 (40.7)	43 (12.7)	0.024
Age in years				
<30	119 (40.6)	121 (41.3)	53 (18.1)	
30–39	119 (46.8)	102 (40.2)	33 (13.0)	
40+	77 (39.7)	80 (41.2)	37 (19.1)	0.32
Gender				
Female	132 (41.4)	135 (42.3)	52 (16.3)	
Male	183 (43.3)	169 (39.9)	71 (16.8)	0.80
Language[a]				
Non-indigenous	269 (48.4)	214 (38.5)	73 (13.1)	
Indigenous	42 (23.3)	89 (49.5)	49 (27.2)	<0.0001
Education				
0–6 years	166 (38.8)	172 (40.2)	90 (21.0)	
7+ years	149 (47.6)	131 (41.9)	33 (10.5)	0.0003
Work hours per week				
<40 hr/week	58 (53.2)	40 (36.7)	11 (10.1)	
40 hr/week	227 (44.8)	210 (41.4)	70 (13.8)	
>40 hr/week	28 (23.0)	53 (43.4)	41 (33.6)	<0.0001
SOC[b] category				
Food Preparation and Serving Related; Personal Care and Service; Installation, Maintenance, and Repair; and Other[c]	67 (54.9)	43 (35.3)	12 (9.84)	
Farming, Fishing, and Forestry; Construction and Extraction; Building and Grounds Cleaning and Maintenance; and Transportation and Material Moving	55 (41.7)	56 (42.4)	21 (15.9)	
Production	193 (39.6)	205 (42.0)	90 (18.4)	0.003

[a]Language in which adults spoke to the worker when she or he was a child.
[b]Standard Occupational Classification.
[c]Arts, Design, Entertainment, Sports and Media Occupations; Sales and Related Occupations.

poultry workers in North Carolina reported elevated levels of musculoskeletal symptoms similar to those reported in the current study. Regarding upper extremities (UEs), 46% of workers reported pain, stiffness, cramps, or weakness in arms or hands in the past 30 days in the seminal occupational illness and injury study in Latino poultry processing workers in western North Carolina [Quandt et al., 2006]. Greater than 35% of the Black female poultry workers in Eastern North Carolina surveyed by Lipscomb et al. [2007] reported hand/wrist symptoms (pain, aching, stiffness, burning, numbness, or tingling) in the past year that lasted at least a week or occurred on more than three occasions. Regarding back symptoms, >20% of black female workers reported low back symptoms in the past year [Lipscomb et al., 2007], while 36% of Latinos reported symptoms in the neck or back in the past 30 days [Quandt et al., 2006].

A strength of this study is the comparison of symptom prevalence of Latino poultry processing workers to that of Latino manual workers in other industries. In our initial cross tabulation, work in poultry processing was significantly associated with reporting symptoms at more upper body sites. However, this association was no longer significant after adjustment for hours worked per week, broad occupations, age, gender, education, and childhood language. The precarious and relatively unsafe nature of the jobs that Latino manual workers are able to obtain outside of poultry processing may be part of the explanation. Other reports have noted that Latino immigrants are concentrated in jobs with precarious employment arrangements and industries such as agriculture and construction with elevated injury rates [Quinlan et al., 2001; Pransky et al., 2002; Dong and Platner, 2004; Arcury and Quandt, 2007; Dong et al., 2010]. Our comparison group of Latino

TABLE IV. Possible Explanatory Variables Associated With Number of Upper Extremity Sites With Musculoskeletal Symptoms Reported by Latino Manual Workers in Western North Carolina; Adjusted Odds Ratios From Multinomial Logistic Regression Model*

	One to three sites, adjusted odds ratio (95% CI)	Four to six sites, adjusted odds ratio (95% CI)	Overall *P*-value
Industry			
Poultry	0.99 (0.6, 1.7)	1.8 (0.8, 4.0)	0.26
Non-poultry			
Age (in years)			
40+	1.3 (0.9, 2.1)	1.5 (0.8, 2.8)	0.22
30–39	0.95 (0.6, 1.4)	0.7 (0.4, 1.3)	
<30	1	1	
Gender			
Male	0.7 (0.5, 1.0)	0.6 (0.4, 0.97)	0.07
Female	1	1	
Language[a]			
Indigenous	2.8 (1.8, 4.3)	3.7 (2.1, 6.6)	<0.0001
Non-indigenous	1	1	
Education			
7+ years	1.1 (0.8, 1.5)	0.6 (0.4, 0.98)	0.053
0–6 years	1	1	
Work hours per week			
>40 hr/week	2.7 (1.4, 5.3)	7.5 (3.1, 17.8)	<0.0001
40 hr/week	1.4 (0.8, 2.2)	1.6 (0.8, 3.3)	
<40 hr/week	1	1	
SOC[b] category			
Production	1.5 (0.8, 3.0)	1.5 (0.5, 4.2)	0.04
Farming, Fishing, and Forestry; Construction and Extraction; Building and Grounds Cleaning and Maintenance; and Transportation and Material Moving	1.9 (0.99, 3.5)	3.4 (1.4, 8.1)	
Food Preparation and Serving Related; Personal Care and Service; Installation, Maintenance, and Repair; and Other[c]	1	1	

*All of the variables included in the model are included in the table.
[a]Language in which adults spoke to the worker when she or he was a child.
[b]Standard Occupational Classification.
[c]Arts, Design, Entertainment, Sports and Media Occupations; Sales and Related Occupations.

manual workers were representative of their community, and a substantial portion were employed in construction and agriculture. Nevertheless, at each individual upper body site, we found the prevalence of symptoms was higher in Latino poultry processing workers than in the comparison Latino manual workers; and the difference was most pronounced for the wrist/hands and the elbows. The elevated prevalence of wrist/hand symptoms in poultry processing workers reported in this study is congruent with the elevated prevalence of carpal tunnel syndrome in Latino poultry processing workers reported by Cartwright et al. [2012] in his analysis of a sub-set of the population included in our analysis.

Overtime work (>40 hr/week) remained a significant positive predictor of the number of sites at which symptoms were reported in our final model. In its discussion of the length of the work week, the National Research Council report on musculoskeletal disorders and the workplace [National Research Council, 2001] noted that, particularly for manual work, long working hours can lead to fatigue and greater exposure to risk factors for musculoskeletal disorders. In their study comparing black women poultry processing workers and a community comparison group, Lipscomb et al. [2007] reported a significant crude association between overtime work and upper extremity musculoskeletal symptoms, but the association did not remain significant in their final model. The Latino poultry processing workers in our study were significantly more likely to work >40 hr/week than the comparison group of Latino manual workers.

One of the most notable results of these analyses is the variation by childhood language in number of upper body sites for which symptoms were reported. An indigenous language was the primary childhood language for nearly a quarter of our sample while Spanish was the childhood language of the remainder. Less than a quarter of workers with an indigenous childhood language reported symptoms at no upper body sites, whereas nearly half of those whose childhood language was Spanish reported symptoms at no sites. After adjusting for work in poultry, broad occupational group, age, education, and gender, those with an indigenous childhood language had nearly 3 times greater odds of reporting symptoms at one to three sites and nearly 4 times greater odds at four to six sites. While new immigrants workers from Latin America are often portrayed as similar and grouped together in descriptive analyses [Mosisa, 2002; Toossi, 2002], these results suggest that occupational health conditions may be substantially worse for Latino manual workers of indigenous ethnic and national heritage. Qualitative data have documented that indigenous farmworkers in Oregon face disrespect and discrimination based on their language and culture as well as a lack of occupational safety information and equipment [Farquhar et al., 2008]. Further analyses are warranted to investigate whether indigenous poultry workers face similar obstacles. Additionally, ergonomics is an important determinant of occupational health for manual workers especially those in fast-paced repetitive work environments such as poultry processing [OSHA Poultry Processing Industry eTool, 2012]. A key principle of ergonomics is fitting the job to the worker [Pheasant, 1991]. Employers not taking account of the unique physical stature of indigenous workers from Latin America in the design of poultry processing and other manual work may be another contributor of the elevated prevalence of symptoms among indigenous Latino manual workers in this study.

This study has several limitations that bear consideration when interpreting the findings. First, the survey relied on retrospective self-reports of symptoms rather than physical examinations. Because our sample was asked to recall symptoms in the past year, some memory lapses are to be expected and, the prevalence of upper body symptoms reported here are likely underestimates. A subgroup of the workers in this study completed a physical examination and the high prevalence of carpal tunnel syndrome seen in the subgroup of poultry processing workers who completed the physical exam corroborates the upper body musculoskeletal symptoms reported here [Cartwright et al., 2012]. Second, inherent in the cross-sectional data is an inability to define clearly temporality in the relationships we identified. For example, we do not know if the long hours of work reported preceded or followed the onset of upper body musculoskeletal symptoms. Third, the information we have on the industries and occupations of the manual workers in our sample is somewhat limited. We were forced to rely on worker self-reports for this information because the closed nature of the poultry processing industry foreclosed the traditional approach of sampling from worksites and incorporating employer records of job assignments. Fourth, we were not able to explore the relationship between job tasks and upper body musculoskeletal symptoms. The broad range of industries in which our Latino manual worker comparison sample worked made it impractical to inquire about job tasks for workers outside of poultry processing. However, Cartwright et al. [2012] identified some associations between job tasks and the prevalence of carpal tunnel syndrome in the subgroup of poultry processing workers who completed a physical exam.

In spite of these limitations, this study describes a community sample of Latino poultry processing and other manual workers with high prevalence of musculoskeletal symptoms at six upper body sites. Besides corroborating earlier and concurrent studies that have implicated poultry processing as an industry in which workers face elevated prevalence of upper body musculoskeletal morbidity [Quandt et al., 2006; Lipscomb et al., 2007; Cartwright et al., 2012], this work presents similar results for Latino manual workers in other industries. Indigenous ethnic and national heritage and hours of work beyond the ''regular'' 40 hr/week are identified as factors strongly associated with the upper body musculoskeletal symptoms.

These data strengthen the call for more attention to the occupational health concerns of Latino manual workers in poultry processing and other industries and especially those of indigenous ethnic and national heritage by quantifying the musculoskeletal symptoms they experience. Some further research is also indicated. Systematic prospective assessments of occupational injuries and illnesses to the back and neck should be conducted to confirm the self-reported levels of such health conditions and investigate etiology. Reasons for the elevated prevalence of upper body musculoskeletal symptoms in Latino manual workers of indigenous ethnic and national heritage even relative to other Latino manual workers should be further investigated.

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